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Import Competition and Household Debt

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ABSTRACT

We analyze the effect of import competition on household balance sheets using individual data on consumer finances. We exploit variation in local industry exposure to foreign competition to study households' response to the income shock triggered by China's accession to the World Trade Organization. We show that household debt increases significantly in regions where manufacturing industries are more exposed to import competition. The effects are driven by home equity extraction and are concentrated in areas with strong house price growth. Our results highlight the role played by mortgage markets in absorbing displacement shocks triggered by globalization.

TWO PHENOMENA IMPACTED THE U.S. economy in the years preceding the Great Recession. One is the dramatic rise in household debt from 2000 to 2007.[1] The other is an unprecedented increase in import competition

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[1] See Mian and Sufi (2009), Mian and Sufi (2014), among others.

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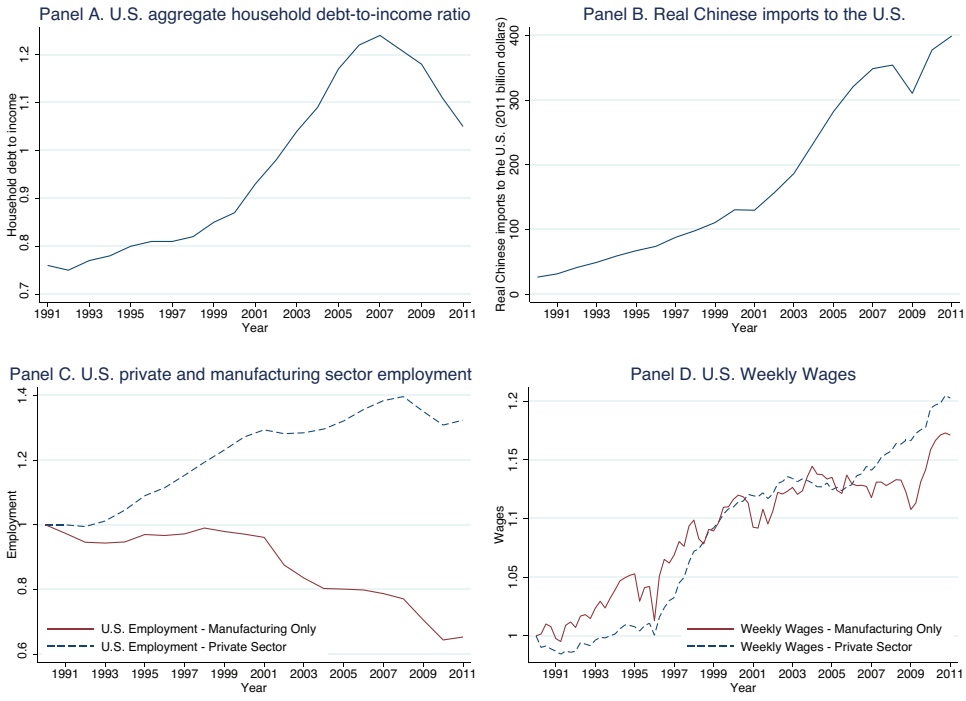

Figure 1. Aggregate U.S. household debt-to-income ratio, Chinese net imports to the United States, U.S. manufacturing employment, and U.S. weekly wages. This figure presents the time series of the U.S. aggregate household debt-to-income ratio from 1991 to 2011 (Panel A) obtained from the Enhanced Financial Accounts maintained by the Federal Reserve Board, real Chinese imports to the U.S. over the same period (Panel B), total employment for the U.S. private sector and manufacturing sector both normalized to one in 1990 (Panel C), and weekly wages for the U.S. private sector and manufacturing sectors only both normalized to one in 1990 (Panel D). (Color figure can be viewed at wileyonlinelibrary.com)

triggered by the expansion of China and other low-wage countries in global markets, with substantial labor market consequences.[2] The coincidence of these two events is illustrated in Figure 1, which displays a dramatic acceleration in both aggregate U.S. household leverage and Chinese imports to the United States in the decade before the crisis, together with a strong decline in aggregate employment in manufacturing sectors.

We hypothesize that these two occurrences are linked, in particular, that the adverse impact of import competition on labor markets stimulated household debt expansion in the 2000s. More precisely, we argue that the displacement of domestic production by imports fueled credit demand in impacted areas. We examine our hypothesis using a large, nationally representative panel data set of anonymous consumer credit records, namely, the Federal Reserve Bank

[2] See Pierce and Schott (2016), Autor, Dorn, and Hanson (2013), Acemoglu et al. (2016), and Autor et al. (2014), among others.

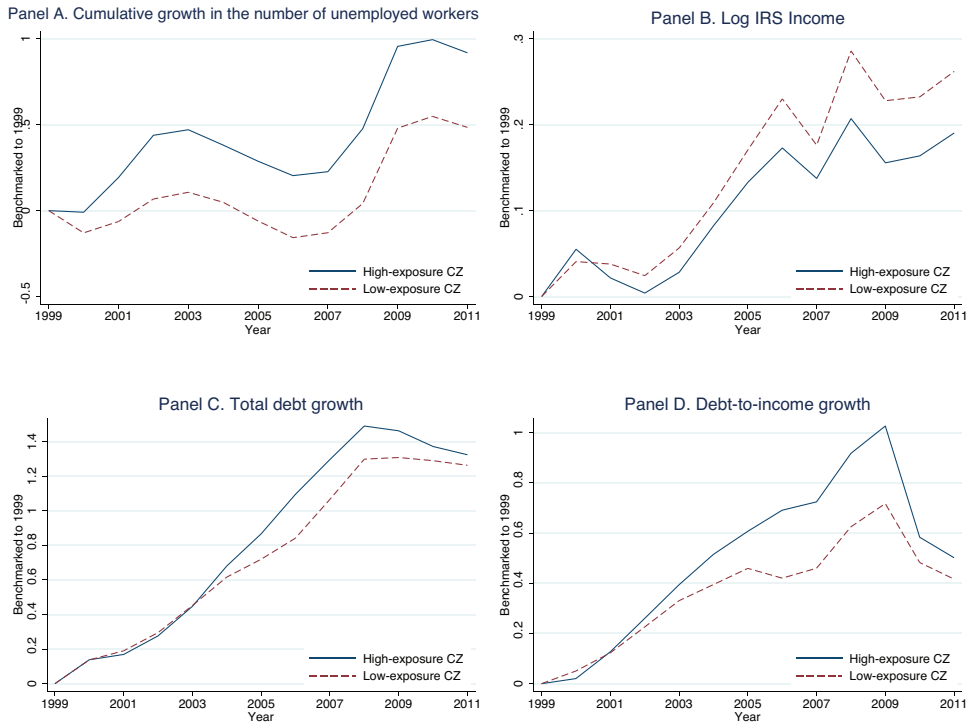

Figure 2. Labor market outcomes and household debt across high and low exposure areas. This figure presents the log change in unemployed workers (Panel A), the log change in income (Panel B), cumulative debt growth (Panel C), and debt-to-income (Panel D) for commuting zones (CZs) in the top (low-exposure) and bottom (high-exposure) quintiles of shipping costs (SC) measured in 1998. Information from the County Business Patterns data sets on the structure of employment across six-digit NAICS industries by CZ is used to compute SC at the CZ level. (Color figure can be viewed at wileyonlinelibrary.com)

of New York's Consumer Credit Panel/Equifax Data (CCP). We exploit cross-regional variation in exposure to import competition to study the impact of import penetration on household balance sheets.

Figure 2 illustrates our main finding. We trace out both changes in local labor market outcomes and the growth in total household debt across regions with high and low exposure to import competition, relative to their 1999 level.

While debt increases by more than 100% in both groups between 1999 and 2007, it grows by an additional 20 percentage points for areas with high exposure to import competition, which experienced larger growth in the number of unemployed workers and weaker income growth over the same period. This correlation suggests a link between regional exposure to import penetration and the boom, and subsequent bust, in household credit.

To properly identify the causal link between import penetration and household balance sheets, we use variation in exposure to international trade driven

by the historical industry composition of employment at the commuting zone (CZ) level. We measure the exposure of an industry to import competition, with physical shipping costs (SCs) obtained from import data.[3] SCs strongly predict an increase in import penetration and its adverse effects on U.S. output and employment: exposed CZs experience a large and significant drop in domestic output and value-added, as well as higher unemployment and lower income, from 1999 to 2007.

We next test whether CZ exposure to low-SC industries causes an increase in household leverage. We find that a one-standard-deviation decrease in SC is associated with a 2- to 4-percentage-point increase in aggregate household debt, which amounts to between 12% and 24% of the cross-CZ variation in household debt growth from 1999 to 2007. We obtain similar results when we consider debt-to-income (DTI) ratios and check that our results are robust to using alternative measures of industry exposure to Chinese competition in the literature and alternative methods of computing SCs. Most of the increase in household debt is driven by mortgages, the largest category of household borrowing. Using individual microdata from the CCP, we confirm that our main findings are not the by-product of migration patterns across differentially exposed areas and that they hold after controlling for individual-level risk profiles ex-ante. Importantly, we show that most of the effect comes from the intensive margin, specifically, from growing mortgage balances rather than new mortgages. We further show that the increase in leverage is due to households extracting equity from their homes in response to the income shock triggered by import competition.

The extent to which households can extract equity via a mortgage product is highly related to local house price dynamics. In Figure 3, we show that house prices soared in the 1999 to 2007 period, allowing households to borrow against the appreciating value of their homes. We test this formally and show that the response of household debt growth and equity extraction to import competition is concentrated in areas that experienced high price appreciation over the period. We also show that when house prices dropped in the wake of the Great Recession, the relation between import competition and household debt vanishes despite continuing Chinese import growth. In this subsequent period, we show that households in most affected areas that levered up experience higher probabilities of a reduction in credit score, of mortgages becoming delinquent, and of foreclosure. Taken together, we find that when house prices allow, equity extraction serves as an important albeit risky channel for consumption smoothing in response to adverse labor income shocks.

We confirm our main findings using the Panel Study of Income Dynamics (PSID), a longitudinal survey that collects both labor outcomes and household debt, thus allowing us to directly connect them at the individual level, albeit in a smaller sample. We also show that our results are consistent with

[3] Industry-level SCs are computed from trade data as the markup of Cost-Insurance-Freight over the price paid by the importer; see Bernard, Jensen, and Schott (2006b) and Barrot, Loualiche, and Sauvagnat (2019) for other examples of the use of SC to account for exposure to imports.

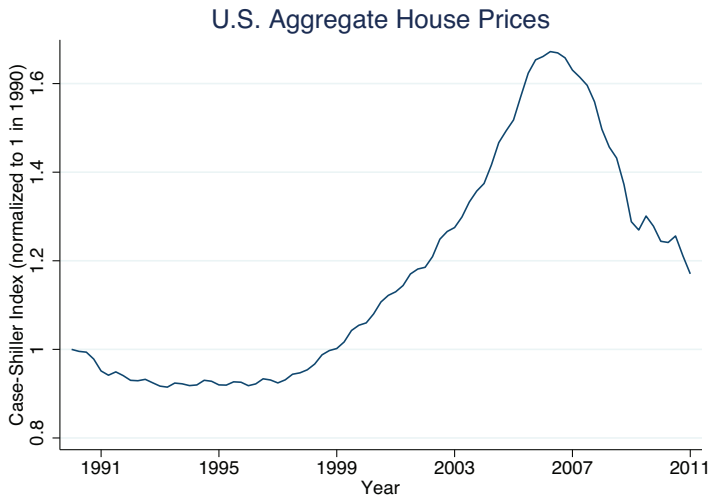

Figure 3. U.S. aggregate house prices. The figure shows the national Case-Shiller index deflated by the GDP price index, normalized to one in 1990. (Color figure can be viewed at wileyonlinelibrary.com)

the permanent income hypothesis (PIH). The textbook version of the life-cycle consumer theory predicts agents smooth consumption using debt when income shocks are transitory (Friedman (1957)). We first find that household debt responds less than one-for-one to the drop in income, consistent with the PIH. We then show that the increase in leverage is associated with shocks perceived as transitory rather than permanent. Although the displacement effect of import penetration has been long-lasting in hindsight, at the time it could have initially been perceived as transitory, leading affected workers to borrow to smooth consumption.[4] We use individual expectations data from the Health and Retirement Study (HRS) survey and show that households in affected areas systematically underestimate the persistence of unemployment spells caused by import competition.

The main contribution of this paper is to empirically document the insurance role of mortgage markets. A number of recent studies focus on the effect of credit availability on labor supply[5] and demand.[6] We consider the other direction of the relationship, that is, how households use their balance sheet to

[4] It could also be the case that credit demand is driven by ratchet effects in consumption, whereby affected households increase their credit demand to maintain consumption levels, even if the shock is perceived as being long-lasting. Yet, another interpretation is that affected households lever up to invest in human or physical capital in response to the shock rather than to smooth consumption.

[5] See, for instance, Benmelech, Bergman, and Seru (2011), Chodorow-Reich (2014), or Barrot and Nanda (2020).

[6] See, for instance, Mondragon (2014) Ganong and Noel (2019), Donaldson, Piacentino, and Thakor (2019), Herkenhoff, Phillips, and Cohen-Cole (2021), Bos, Breza, and Liberman (2018), or Bernstein (2016).

insure themselves against labor income shocks. In doing so, we relate to early work on the role of consumption smoothing motives for mortgage refinancing and home equity extraction as in Hurst and Stafford (2004). A few studies estimate the credit card debt response to income shocks[7] or automobile debt.[8] Compared to these papers, ours is among the first to focus broadly on household debt.

Our findings relate to prior work studying the dramatic rise in leverage in the 2000s and its consequences. Mian and Sufi (2009) and Mian and Sufi (2011) show that the advent of securitization allowed low-income or subprime borrowers to take on more mortgage debt. Subsequent work demonstrates how the outward shift in credit supply fueled the increase in debt. Adelino, Schoar, and Severino (2016a) and Adelino, Schoar, and Severino (2016b) present evidence consistent with an expectations-based view where both home buyers and lenders believed that home values would increase but experienced defaults when prices dropped. Building on these findings, we document that part of the increase in credit from 1999 to 2007 in regions with exposure to trade is a consequence of higher credit demand associated with adverse labor market shocks. We also illustrate the idea in Rajan (2011) and Kumhof, Rancière, and Winant (2015) that the rise in inequality is a long-run determinant of leverage.[9] We further find our effects to be stronger where house prices appreciated the most, namely, where relaxation of households' borrowing constraints made it easier for them to lever up (Mian and Sufi (2011), Cooper (2013), Chen, Michaux, and Roussanov (2020)).

Our paper also bridges the literature on the displacement effects of international trade and the literature on the causes and consequences of the rise in household leverage in the 2000s. The findings first shed light on the distributive consequences of the increase of import competition in the United States in the past decade. We add to a recent stream of studies considering the effect on labor markets of the acceleration of Chinese import penetration (Autor, Dorn, and Hanson (2013), Autor et al. (2014), Dix-Carneiro (2014), Krishna and Senses (2014), Caliendo and Parro (2015), Acemoglu et al. (2016), Hakobyan and McLaren (2016), Pierce and Schott (2016)), or of trade shocks more generally (Bernard, Jensen, and Schott (2006a), Bernard, Jensen, and Schott (2006b), Artuç, Chaudhuri, and McLaren (2010), Ebenstein et al. (2014)). Hsieh and Ossa (2016) and di Giovanni, Levchenko, and Zhang (2014) analyze the welfare effect of China's trade integration. Liebersohn (2017) investigates the link between industry composition and house prices. Our contribution relative to these papers is our analysis of household balance sheets' response to an increase in import competition and our finding that the mortgage market serves as a mechanism to smooth these shocks. More generally, our work illustrates the distributive effects of globalization (see Goldberg and

[7] See, for instance, Gross and Souleles (2002), Agarwal, Chunlin, and Souleles (2007), or Agarwal and Qian (2014).

[8] See, for instance, Aaronson, Agarwal, and French (2012).

[9] Coibion et al. (2020) measure inequality directly and find that it hurts the availability of credit.

Pavcnik (2007) for a review), and its impact on inequality (Helpman, Itskhoki, and Redding (2010), Antras, de Gortari, and Itskhoki (2017)).

In the remainder of the paper, we discuss our empirical strategy in Section I, present the results in Section II, and discuss interpretation of the inresults in Section III. Section IV concludes.

I. Data and Empirical Strategy

In the first part of this section, we present the household debt data. In the second part, we describe the construction of our measure of import competition exposure.

A. Household Debt

To study household leverage decisions, we use CCC data, an anonymized nationally representative sample of 5% of all individuals with a credit record and a valid Social Security Number, available from the first quarter of 1999.[10] The CCP tracks individuals over time at a quarterly frequency and collects data on their debt holdings, payment history, credit scores, and geographic location. Debt holdings are broken down into mortgages, junior liens such as home equity lines of credit (HELOC), auto loans, credit card debt, and other types of loans.[11] The CCP also includes information on the status of the loan being delinquent or in a foreclosure process.

Our data set presents two caveats. First, the CCP includes limited demographic information on each individual: age, credit score, and ZIP code. We therefore construct a variety of demographic controls at the ZIP code level from the 2000 Census and the Internal Revenue Service (IRS) to proxy for individual demographic characteristics, namely, the vacancy rate, percent white, percent black, share of the population without high school education, share with high school diploma only, poverty rate, and percent urban. Second, the CCP does not allow us to directly measure home equity extraction, that is, the propensity of individuals to borrow against the value of their home. We get around this constraint by borrowing the methodology of Bhutta and Keys (2016) and measuring equity extractions including, but not necessarily limited to, HELOC and second liens.

To complement the measure of equity extraction from Bhutta and Keys (2016), we use data from the Home Mortgage Disclosure Act (HMDA), which requires mortgage lenders to report mortgage applications and originations. The benefit of the HMDA data set is its large coverage of over 90% of all mortgages. For each application, HMDA collects location, loan amount (but not the interest rate), loan type (refinancing or home purchase), the applicant's income, and whether the loan was ultimately approved or denied by the lender.

[10] See Lee and van der Klaauw (2010) for a description of the CCP data.

[11] Due to the inconsistent collection of student debt data over the period of interest, we exclude student debt from our analysis.

In the analysis presented below, we aggregate HMDA data at the CZ level according to the location of the purchased property. We thus observe for each year from 1991 to 2011 the number (as well as total value) of applications, originations, and share of denied applications, separately for both refinancing and home purchase loans. Given that the CCP is available only from 1999, we also use HMDA to measure the long-run change in household debt before 1999 to control for prior trends in our specification presented below.

Another limitation of the CCP is that we cannot directly link an individual's leverage decisions and its labor market outcomes. To do so, we use the PSID, which allows us to estimate the elasticity of debt to import penetration at the level of each individual's industry of occupation. The PSID contains information on a sample of 5,000 individuals since 1968, but it is biannual since 1999. We use the PSID Core Sample and we follow Blundell, Pistaferri, and Preston (2008) to filter the data (see Appendix A for a detailed description of the sample construction).

Finally, to account for the change in mortgages due to new house purchases, we use the Building Permits Survey (BPS) from the Census. The survey provides data on the number of new housing units authorized by building permits at an annual frequency by county since 1980.

B. Exposure to Import Competition

This subsection presents our proxy for industry exposure to import competition based on SC. We detail our procedure to aggregate SC at the CZ level to measure local labor market exposure to import competition. We provide evidence that SCs are a strong predictor of the increase in Chinese imports to the United States across industries in the 2000s, as well as of the associated increase in domestic output and employment. Finally, we discuss potential threats to our identification strategy.

B.1. Shipping Costs

To account for exposure to import competition, we build on prior work (Bernard, Jensen, and Schott (2006b), Barrot, Loualiche, and Sauvagnat (2019)) and use industry-level SC. More precisely, we exploit product-level U.S. import data and compute the costs associated with shipments, called Cost-Insurance-Freight, as a percentage of the price paid by the importer. We obtain these data at the six-digit NAICS level from the U.S. Census through Peter Schott's website.[12] SCs are a structural characteristic rooted in the type of output produced by any given industry.[13] According to Hummels (2007), SCs essentially depend on the weight-to-value ratio: the markup is larger for

[12] The data are available at https://sompks4.github.io/sub_data.html.

[13] The main limitation of SC is that it does not take into account unobserved costs of shipping, for instance, time to ship (Hummels and Schaur (2013)), information barriers, contract enforcement costs, holding costs for the goods in transit, inventory costs due buffering, variability of delivery dates, or preparation costs associated with shipment size (Anderson and van Wincoop

goods that are heavy relative to their value because they are more expensive to transport.[14]

We verify that SCs are widely dispersed across industries, are persistent, and are indeed related to trade flows. We find substantial heterogeneity in SC across industries. In our industry, sample that covers 379 unique manufacturing industries (at the six-digit NAICS industry level), we find that SCs in 1998 represent 4.2% of the price of shipments on average, with a 1st percentile of 0.6% and a 99th percentile of 20%.[15] The distribution of SC is stable over time: the average SC in 2007 accounts for 4.8% of the price of shipments, with a 1st percentile of 0.4% and a 99th percentile of 17%. To check whether SCs are indeed strongly persistent, we estimate $\text{SC}_{i,2007} = \beta \text{SC}_{i,1998} + u_i$, over the 379 six-digit NAICS industries indexed by i and obtain $\hat{\beta} = 0.91$ and $R^2 = 0.62$.

B.2. Import Competition

Chinese import growth accounts for the bulk of import penetration in the United States over the 2000s. Internet Appendix[16] Figure IA.1 presents the change in U.S. import penetration (Panel A) and net import penetration (Panel B), measured, respectively, as imports and imports minus exports divided by domestic expenditures, where expenditures are the sum of domestic shipments (domestic output) plus imports less exports. Import and net import penetration increase by approximately 3.5 percentage points between 1999 and 2007. Decomposing this increase across countries of origin, we find that high-income countries' contribution to this change is virtually zero.[17] The deepening of the trade deficit is driven entirely by the contribution of low-income countries, itself dominated by the contribution of China.

A variety of reasons rooted in Chinese contemporary history explain the surge in exports in the 2000s. Zhu (2012) shows that the country's annual aggregate productivity growth was 2.45% between 1988 and 1998 and jumped

(2004)). Unless these costs are correlated in systematic ways with SC, they are likely to introduce noise in our measure of the sectoral exposure to import competition, which should generate an attenuation bias in our results. For recent contributions to the literature that adopts a structural approach to measure trade costs and estimate their effect on trade, see Hummels and Skiba (2004), Das, Roberts, and Tybout (2007), or Irarrazabal, Moxnes, and Opromolla (2015), among others.

[14] Our findings are quantitatively and qualitatively similar if we use weight-to-value ratios rather than our measure of SC.

[15] The distribution of SC across three-digit NAICS industries is presented in Internet Appendix Table IA.I.

[16] The Internet Appendix is available in the online version of this article on *The Journal of Finance* website.

[17] We define low-income based on the World Bank definition in 1989. These countries are Afghanistan, Albania, Angola, Armenia, Azerbaijan, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Burma, Cambodia, Central African Republic, Chad, China, Comoros, Republic of the Congo, Equatorial Guinea, Eritrea, Ethiopia, Gambia, Georgia, Ghana, Guinea, Guinea-Bissau, Guyana, Haiti, India, Kenya, Laos, Lesotho, Madagascar, Maldives, Mali, Malawi, Mauritania, Moldova, Mozambique, Nepal, Niger, Pakistan, Rwanda, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Sierra Leone, Somalia, Sri Lanka, Sudan, Togo, Uganda, Vietnam, and Yemen.

up to 4.68% between 1998 and 2007—with productivity growth in manufacturing reaching 13.4% per year. This acceleration can be tied to a series of political decisions in the late 1990s that stimulated the exit of the least productive incumbents. In 1995, the Chinese government reduced its commitment to stable employment in the State sector, allowing the least efficient state-owned firms to exit. In 1997, the 15th Congress of the Chinese Communist Party legalized the development of private enterprises. Finally, the lead-up to China's accession to the World Trade Organization (WTO) in 2001 was associated with tariff cuts and a broadening of trade rights.[18]

Given that China accounts for virtually all of the U.S. trade deficit, we focus on the effect of SC on Chinese imports. We check whether industries with lower SC were indeed those that experienced the highest penetration by Chinese imports. To do so, we sort manufacturing industries into terciles of SC measured in 1998. Then, for each SC tercile, we compute the cumulative change in Chinese import and net import penetration, defined as imports or net imports scaled by U.S. total expenditures measured as output (domestic shipments) plus net imports. We present the time series in Figure 4. Between 1999 and 2007, Chinese import penetration increased by 6, 4, and 2 percentage points in low-SC, medium-SC, and high-SC industries, respectively. These results confirm that SCs are indeed a good proxy for industry exposure to the surge in Chinese exports to the United States in the 2000s.

C. Effects of Shipping Costs on Import Competition and Income

We next formally document the causal effect of SC on import penetration and labor market outcomes at the CZ level.

C.1. Commuting Zone Exposure

Throughout the paper, we consider CZs as the main geographical unit of analysis. Developed by Tolbert and Sizer (1996) using county-level commuting data from the 1990 Census data, CZs are defined as clusters of counties that are characterized by strong within-cluster and weak between-cluster commuting ties and therefore represent local labor markets. They cover the entire land area of the United States.

To measure any given CZ's exposure to import competition, we exploit its historical industry composition measured in 1998, using employment data from the Census' County Business Patterns (CBP). Consider a CZ indexed by J. Its industry composition expressed in terms of industry labor shares is $\{\ell_J^h\}_h$. To assess the impact of the rise of import penetration across regions, we interact SC in industry h, θ_h, with industry composition in the region, expressed in

[18] Additionally, the end of the Multifiber Arrangement (MFA) textile and clothing quotas in 2002 and 2005 fueled the surge of Chinese exports even further.

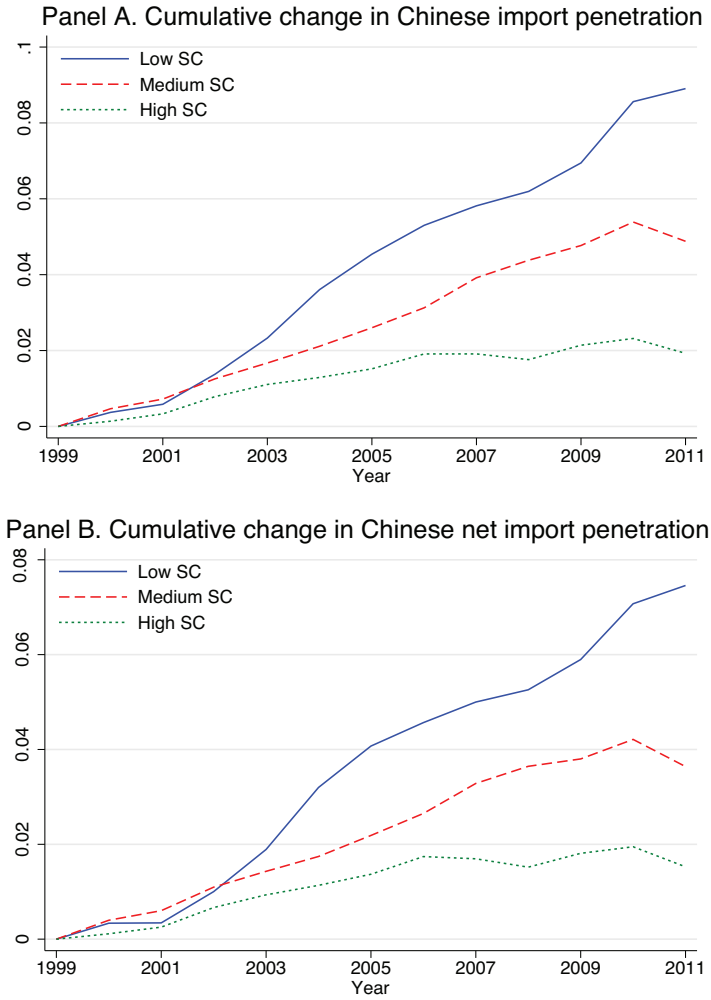

Figure 4. Change in Chinese import penetration. This figure presents the contribution of high-, medium-, and low-shipping-cost (SC) industries to U.S. import penetration (Panel A) and net import penetration (Panel B) from China. The contribution to import penetration is defined as imports divided by total U.S. expenditures, themselves measured as domestic shipments plus net imports. (Color figure can be viewed at wileyonlinelibrary.com)

labor share:

$$\mathrm{SC}_J = \sum_h \ell_J^h \theta_h. \tag{1}$$

We find substantial heterogeneity in employment-weighted SC across CZs. As shown in Table I, the average SC across CZs is 5.0%, with a median of 4.4%

Table I
Summary Statistics

This table presents summary statistics for the two samples used in this paper. Panel A presents statistics for 732 commuting zones (CZs) covering the United States. Information from the County Business Patterns data set on the structure of employment across six-digit NAICS industries by CZs is used to compute *Shipping Costs*, and *Chinese Import Penetration*, at the CZ level. Information on Debt at the CZ level is based on the aggregation of individual data from FRBNY CCP/Equifax. Changes in house prices between 1999 and 2007 are from the most granular index available from CoreLogic. *Chinese Import Penetration* is defined as U.S. imports from China normalized by U.S. expenditures measured as domestic shipments plus net imports. $\Delta_{91,99}$ *Log Loan Origination* is the log change in the total dollar value of loan origination between 1991 and 1999, and $\Delta_{91,99}$ *Log Loan Applications* is the log change in the dollar value of loan applications between 2000 and 2007, separately for home purchase loans and refinancing loans, all constructed from HMDA data. The expected and realized probabilities of moving out of unemployment are drawn from the HRS, a longitudinal survey conducted every two years. "Expected" is the average perceived probability of finding a job after becoming unemployed, computed across participants in the HRS waves of 2000, 2002, and 2004. "Realized" is the probability of an individual employed in year 2000 (according to HRS) but not in 2002 finding a job in 2004. Panel B presents statistics for the individual-level sample obtained from the CCP. Equity extraction in a given year is identified as in Bhutta and Keys (2016) using an indicator for equity extraction in at least one calendar year between 2000 and 2007, inclusive.

	Observations	Mean	Median	Std. dev.
Panel A: Commuting Zone Level				
Shipping Costs	732	0.050	0.044	0.023
Δ_{99-07} Chinese Import Penetration	732	0.037	0.033	0.030
Δ_{99-07} Net Chinese Import Penetration	732	0.032	0.028	0.029
Δ_{91-99} Chinese Import Penetration	732	0.012	0.009	0.014
Log Debt	732	3.080	3.060	0.407
Log Income	732	3.559	3.549	0.203
DTI	732	0.613	0.594	0.167
Δ_{99-07} Log Debt	732	0.656	0.641	0.168
Δ_{99-07} DTI	732	0.427	0.402	0.209
Δ_{99-07} Log Unemployed	732	0.066	0.095	0.366
$\sum$ IRS Income 2000 to 2007/IRS Income 1999	732	8.800	8.739	0.418
$\Delta_{99,07}$ Log All Mortgage	732	0.813	0.795	0.273
Δ_{99-07} Log HELOC	732	1.593	1.645	1.167
Δ_{99-07} Log Credit Card Debt	732	0.345	0.347	0.152
Δ_{99-07} Log Auto Debt	732	0.735	0.736	0.239
Δ_{99-07} HPI	732	0.412	0.368	0.181
Δ_{91-99} HMDA Loan Origination	732	2.996	2.702	1.839
Δ_{99-07} Log Loan Applications (Home Purchase)	732	−0.150	−0.101	0.390
Δ_{99-07} Log Loan Applications (Refinancing)	732	0.225	0.222	0.307
Probability of exiting unemployment (Expected, HRS)	106	0.50	0.49	0.14
Probability of exiting unemployment (Realized, HRS)	106	0.39	0.40	0.30
Expectation error (HRS)	106	0.11	0.11	0.34
Panel B: Individual Level				
Δ_{99-07} Log(Debt + 1)	5,098,995	0.638	0.414	4.414
Δ_{99-07} Log(Debt)	4,010,038	0.825	0.575	2.350
Δ_{99-07} DTI	5,020,862	0.694	0.029	2.077

(*Continued*)

Table I—*Continued*

Panel B: Individual Level				
Extract Flag	3,043,037	0.474	0.000	0.499
Extract Value	3,043,037	45,552	0.000	119,086
Δ_{07-11} Credit Score	4,630,796	9.059	10.000	67.456
Mtg. Delinq.$_{07-11}$	4,630,796	0.115	0.000	0.319
Foreclosure$_{07-11}$	4,630,796	0.039	0.000	0.194
Shipping Costs	5,098,995	0.042	0.040	0.010

and a standard deviation of 2.3%. Figure 5 presents the distribution of SC for each CZ across the U.S. territory.

C.2. Shipping Costs and Import Competition

We confirm that SCs are indeed a good proxy for CZ-level exposure to import competition, even after controlling for sector-level characteristics. In Table II, we consider the change in imports from China, as well as net imports from China (defined as imports from China minus exports to China), scaled by U.S. total expenditures measured as output (domestic shipments) plus net imports, between 1999 and 2007. We compute imports and exports using U.S. data obtained from Peter Schott's website, and shipments using the NBER-CES Manufacturing Industry Database. We aggregate imports and net imports at the CZ level as we do for SC.

We perform the following cross-sectional regression at the CZ level:

$$Y_J = \beta\ \mathrm{SC}_J + \delta' \mathbf{X}_J + u_J, \tag{2}$$

where Y_J is the 1999 to 2007 change in Chinese imports, and net Chinese imports, and $\mathbf{X}_J$ is a vector of controls measured at the CZ level including total employment, and the share of manufacturing employment, both from the CBP, and total income, from the IRS; all of these control variables are measured as of 1998. We also control for the logarithm of total debt in 1999 (using data from the CCP), the 1991 to 1999 change in loan originations, and the 1991 to 1999 change in net Chinese import penetration, as well as quintiles of the change in house prices between 1999 and 2007 and State fixed effects in some specifications.[19] All regressions are weighted by CZ adult population. The coefficient of interest, β, measures the effect of SC exposure on the outcome variable of interest. We find that SCs, measured in 1998, strongly predict the increase in Chinese import penetration and net import penetration. More precisely, in the most conservative specification, a one-standard-deviation increase in SC leads to a 0.7-percentage-point decrease in import penetration from China between 1999 and 2007—which amounts to 22% of the cross-sectional standard

[19] We obtain house price indices from CoreLogic. When house prices from CoreLogic are not available at the county level, we use house price data at the State level. We have county-level data on house prices for geographical areas covering 95% of the U.S. total population. For CZs overlapping several states, we consider the State with the largest share of each CZ's population.

Table II

Shipping Costs and Chinese Import Penetration

This table presents cross-sectional regressions of the change in *Chinese Import Penetration* in Panel A, and *Net Chinese Import Penetration* in Panel B, between 1999 and 2007 on *Shipping Costs* (SC), at the commuting zone (CZ) level. *Chinese Import Penetration* is defined as U.S. imports from China, normalized by U.S. expenditures measured as domestic shipments plus net imports. *Chinese Net Import Penetration* is defined as U.S. imports from China minus U.S. exports to China, normalized by U.S. expenditures measured as domestic shipments plus net imports. Information from the County Business Patterns data set on the structure of employment across six-digit NAICS industries by CZs is used to compute SC and import penetration at the CZ level, as well as *Log Employment* and the share of *Employment in Manufacturing* at the CZ level. *Log Income* comes from IRS data. *Log Debt* is based on the aggregation of individual data from FRBNY CCP/Equifax. Changes in house prices between 1999 and 2007 are from the most granular index available from CoreLogic. Δ_{91-99} *HMDA Loan Origination* is the log change in the total dollar value of loan origination between 1991 and 1999, from HMDA data. Census controls come from the 2000 Census and include the vacancy rate, percent white, percent black, share of the population without high school education, share with high school diploma only, poverty rate, and percent urban, measured at the CZ level. Regressions are weighted by adult population in each CZ as of 2000. *Magnitude SC* is the effect of a one-standard-deviation increase in SC on the dependent variable. Standard errors clustered at the state level are reported in parentheses. *, **, and *** indicate statistically different from zero at the 10%, 5%, and 1% level of significance, respectively.

	Panel A: Δ_{99-07} Chinese Import Penetration				Panel B: Δ_{99-07} Net Chinese Import Penetration			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Shipping Costs	-0.519^{***}	-0.224^{***}	-0.233^{***}	-0.280^{***}	-0.453^{***}	-0.205^{**}	-0.209^{***}	-0.255^{***}
	(0.138)	(0.080)	(0.077)	(0.073)	(0.113)	(0.077)	(0.075)	(0.072)
Log Employment		−0.001	−0.001	−0.001		0.001	0.001	0.001
		(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
Employment in Manufacturing (%)		0.059^{***}	0.067^{***}	0.075^{***}		0.044^{***}	0.052^{***}	0.054^{***}
		(0.021)	(0.021)	(0.021)		(0.015)	(0.015)	(0.015)
Log Income		-0.033^{**}	-0.031^{**}	−0.019		-0.033^{*}	-0.031^{*}	−0.026
		(0.015)	(0.015)	(0.018)		(0.017)	(0.016)	(0.022)
Log Debt		0.002	−0.001	0.008		0.002	−0.000	0.007
		(0.006)	(0.008)	(0.009)		(0.007)	(0.008)	(0.008)

(*Continued*)

Table II
(Continued)

This table presents cross-sectional regressions of the change in *Chinese Import Penetration* in Panel A, and *Net Chinese Import Penetration* in Panel B, between 1999 and 2007 on *Shipping Costs* (SC), at the commuting zone (CZ) level. *Chinese Import Penetration* is defined as U.S. imports from China, normalized by U.S. expenditures measured as domestic shipments plus net imports. *Chinese Net Import Penetration* is defined as U.S. imports from China minus U.S. exports to China, normalized by U.S. expenditures measured as domestic shipments plus net imports. Information from the County Business Patterns data set on the structure of employment across six-digit NAICS industries by CZs is used to compute SC and import penetration at the CZ level, as well as *Log Employment* and the share of *Employment in Manufacturing* at the CZ level. *Log Income* comes from IRS data. *Log Debt* is based on the aggregation of individual data from FRBNY CCP/Equifax. Changes in house prices between 1999 and 2007 are from the most granular index available from CoreLogic. Δ_{91-99} *HMDA Loan Origination* is the log change in the total dollar value of loan origination between 1991 and 1999, from HMDA data. Census controls come from the 2000 Census and include the vacancy rate, percent white, percent black, share of the population without high school education, share with high school diploma only, poverty rate, and percent urban, measured at the CZ level. Regressions are weighted by adult population in each CZ as of 2000. *Magnitude SC* is the effect of a one-standard-deviation increase in SC on the dependent variable. Standard errors clustered at the state level are reported in parentheses. *, **, and *** indicate statistically different from zero at the 10%, 5%, and 1% level of significance, respectively.

	Panel A: Δ_{99-07} Chinese Import Penetration				Panel B: Δ_{99-07} Net Chinese Import Penetration			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ_{91-99} HMDA loan origination		−0.002*	−0.001	−0.001		−0.001	−0.001	−0.001
		(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
Δ_{91-99} Net Chinese Import Penetration		0.827***	0.801***	0.775***		0.736***	0.719***	0.724***
		(0.205)	(0.212)	(0.220)		(0.180)	(0.184)	(0.214)
Census controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Quintiles HP Growth	No	No	Yes	Yes	No	No	Yes	Yes
Weights	Pop.	Pop.	Pop.	Pop.	Pop.	Pop.	Pop.	Pop.
State FE	No	No	No	Yes	No	No	No	Yes
Observations	732	732	732	732	732	732	732	732
R^2	0.093	0.397	0.404	0.525	0.081	0.347	0.353	0.477
Magnitude SC	−0.012	−0.005	−0.005	−0.007	−0.011	−0.005	−0.005	−0.006
% dep. var. cross-CZ s.d.	−0.410	−0.177	−0.184	−0.221	−0.361	−0.163	−0.167	−0.203

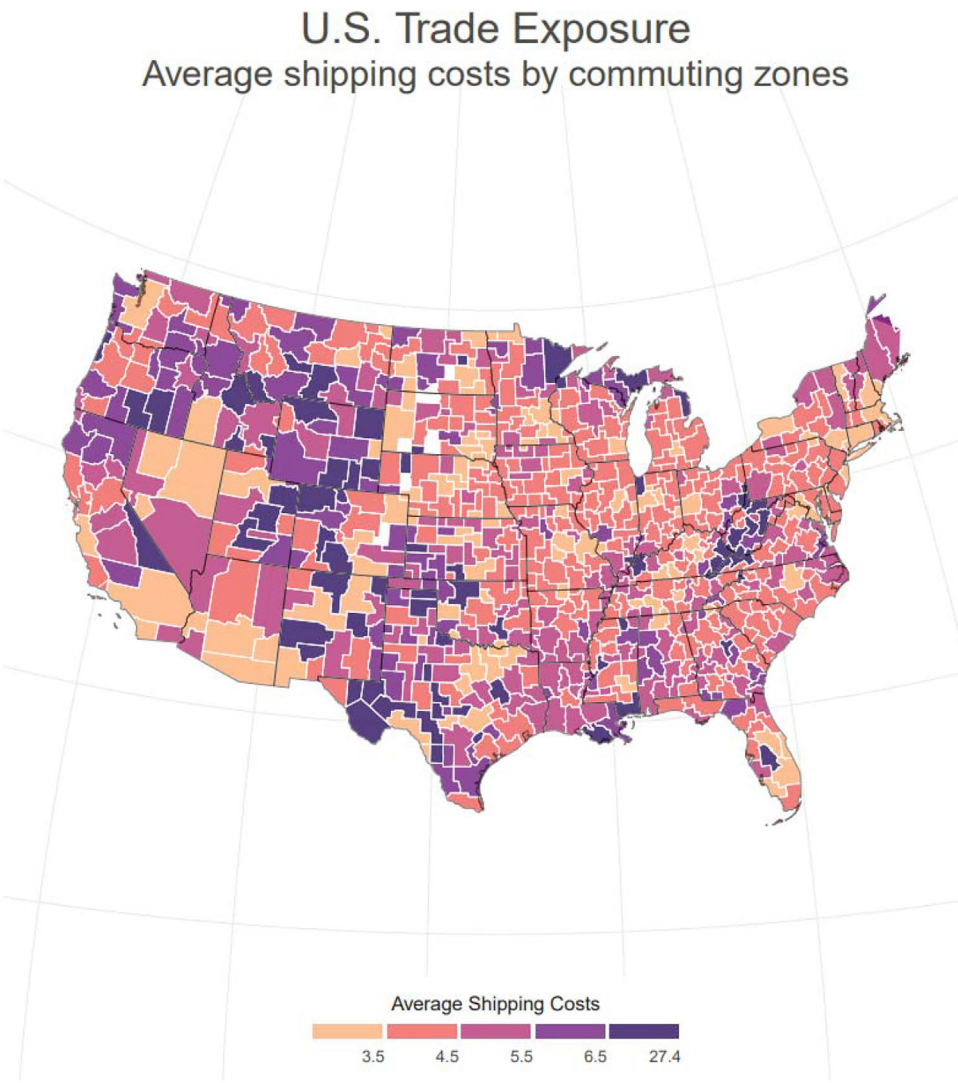

Figure 5. Average shipping costs by commuting zones. This figure presents the distribution of shipping costs (SC, %) across commuting zones (CZs) measured in 1998. Information from the County Business Patterns data sets on the structure of employment across six-digit NAICS industries by CZ is used to compute SCs at the CZ level. (Color figure can be viewed at wileyonlinelibrary.com)

deviation of import penetration. The effects are similar when we consider net import penetration. Since we control for net import growth from 1991 to 1999, this variable would absorb most of the effect if SCs were spuriously correlated with declining industries.

If low-SC areas are subject to greater import competition, one would expect their output to drop over the period. In Table IA.II, we consider the effect of SC on the 1999 to 2007 growth in output and value-added, obtained from the NBER-CES Manufacturing Industry Database and aggregated at the CZ level. We run the same cross-sectional specification as that presented in Table II. We find that a one-standard-deviation increase in SC is associated with 1.0 and 2.1 percentage point higher value-added and output growth, respectively, which amounts to 27% and 38% of the cross-CZ standard deviation of these two variables. These results confirm that the higher exposure to import competition in low-SC areas leads to lower output growth.

C.3. Shipping Costs and Income

We now turn to the effect of import competition on employment and income. We consider the effect of SC on labor market outcomes measured at the CZ level. In columns (1) to (4) of Table III, we examine changes in the number of unemployed aggregated at the CZ level from county-level data of the Bureau of Labor Statistics. In columns (5) to (8), we estimate the effect of cumulative income losses measured using income data from the IRS described above. Using the same cross-sectional estimation equation (2), we show that a decrease in SC leads to higher unemployment and lower income. The effect on employment is substantial: an increase in the exposure to import competition through a one-standard-deviation decrease in SC leads to a 12% increase in the number of unemployed (with estimates ranging from 5% to 20% across specifications). The effect on income is also statistically and economically significant. A one-standard-deviation change in import exposure translates to a drop in income of 6% over the period, which amounts to around 15% of its cross-CZ standard deviation. Moreover, given the average baseline level of income in 1999 of $37,500 across CZs, in dollar terms, this decline corresponds to a cumulative income loss of around $2,100 between 2000 and 2007.

C.4. Identification

Our empirical strategy is akin to a difference-in-difference estimation where areas are differentially exposed to the surge in Chinese imports based on their historical industry composition. It rests on the identifying assumption that SC exposure affects household debt's response only through increased import competition. In particular, CZ-level exposure to high- and low-SC industries needs to be orthogonal to local demand shocks for imports or local productivity shocks.

A first identification threat is that low-productivity industries in the United States might have lower SC on average. Consider declining industries irrespective of their exposure to China's import competition. Workers in these industries might be more likely to become unemployed, and could also take on more debt to sustain their consumption. Import penetration might also coincidentally increase in these declining industries, without being the main force driving unemployment and household leverage patterns. If for some reason,

Table III

Import Competition and Labor Market Outcomes, CZ Level

This table presents cross-sectional regressions of the change in the log number of unemployed workers from 1999 to 2007 in Panel A, and cumulative income in Panel B, on *Shipping Costs* (SC) at the commuting zone (CZ) level. Information from the County Business Patterns data set on the structure of employment across six-digit NAICS industries by CZ is used to compute SC at the CZ level, as well as *Log Employment* and the share of *Employment in Manufacturing* at the CZ level. *Log Income* comes from IRS data. *Log Debt* is based on the aggregation of individual data from FRBNY CCP/Equifax. Changes in house prices between 1999 and 2007 are from the most granular index available from CoreLogic. *Net Chinese Import Penetration* is defined as U.S. imports from China minus U.S. exports to China, normalized by U.S. expenditures measured as domestic shipments plus net imports. Δ_{91-99} *HMDA Loan Origination* is the log change in the total dollar value of loan origination between 1991 and 1999, from HMDA data. Census controls come from the 2000 Census and include the vacancy rate, percent white, percent black, share of the population without high school education, share with high school diploma only, poverty rate, and percent urban, measured at the CZ level. Regressions are weighted by adult population in each CZ as of 2000. *Magnitude SC* is the effect of a one-standard-deviation increase in SC on the dependent variable. Standard errors clustered at the state level are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	Panel A: Δ_{99-07} Log Unemployed				Panel B: $\sum$ IRS Income 2000 to 2007/IRS Income 1999			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Shipping Costs	−8.704***	−5.365***	−5.276***	−2.044**	7.457***	2.540**	2.649**	2.292**
	(1.669)	(1.392)	(1.170)	(0.887)	(1.702)	(1.205)	(1.167)	(1.137)
Log Employment		0.007	0.000	−0.005		−0.037	−0.031	−0.012
		(0.028)	(0.022)	(0.018)		(0.026)	(0.024)	(0.020)
Employment in Manufacturing (%)		0.036	−0.441	−0.541**		−2.006***	−1.690***	−1.439***
		(0.366)	(0.325)	(0.239)		(0.339)	(0.371)	(0.340)
Log Income		−0.271	−0.287	−0.063		−1.382***	−1.382***	−1.432***
		(0.324)	(0.257)	(0.225)		(0.330)	(0.281)	(0.337)
Log Debt		0.277*	0.460***	0.393***		0.349**	0.256*	0.460***
		(0.161)	(0.158)	(0.095)		(0.144)	(0.146)	(0.157)
Δ_{91-99} HMDA Loan Origination		0.007	−0.009	0.006		−0.046***	−0.034**	−0.019
		(0.023)	(0.021)	(0.019)		(0.017)	(0.017)	(0.013)
Δ_{91-99} Net Chinese Import Penetration		0.679	2.060	1.566**		1.279	0.488	−1.091
		(1.916)	(1.587)	(0.740)		(2.135)	(2.383)	(1.204)

(*Continued*)

Table III—*Continued*

	Panel A: Δ_{99-07} Log Unemployed				Panel B: $\sum$ IRS Income 2000 to 2007/IRS Income 1999			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Census controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Quintiles HP Growth	No	No	Yes	Yes	No	No	Yes	Yes
Weights	Pop.	Pop.	Pop.	Pop.	Pop.	Pop.	Pop.	Pop.
State FE	No	No	No	Yes	No	No	No	Yes
Observations	732	732	732	732	732	732	732	732
R^2	0.115	0.388	0.483	0.777	0.094	0.452	0.500	0.691
Magnitude SC	−0.204	−0.126	−0.124	−0.048	0.175	0.059	0.062	0.054
% dep. var. cross-CZ s.d.	−0.557	−0.343	−0.337	−0.131	0.417	0.142	0.148	0.128

SCs are lower in these declining industries, the relation we emphasize in this paper might be spurious. Reassuringly, we check and find in column 3 of the Internet Appendix Table IA.II that SCs are uncorrelated with productivity growth.

A related concern is that the United might have experienced a negative aggregate productivity shock over this period. This hypothesis does not invalidate our econometric methodology. It does, however, affect the interpretation of our results as coming from higher productivity in China (push factor) or lower productivity in the United States (pull factor). The differential pass-through across industries with high and low SC could also lead to higher import penetration in the most affected areas. However, if a negative aggregate shock in the United States was driving the results, we would observe imports increasing from all countries. The fact that we see an increase in net imports only from China over the period (see Figure IA.1), and that this coincides with the surge in Chinese productivity growth and its entry into the WTO, largely mitigates this concern.

Last, one might be worried that house prices are endogenous to SC, and that their effect on household debt might be spurious. As we show in Table IA.XI, SCs do not correlate with the growth in house prices over the period. This largely mitigates the concern that the higher debt growth in low-SC areas might be driven by higher house price growth caused by import competition. This does not necessarily mean that the effect of SC on household debt needs to be the same in high- and low-price growth areas, and thus, we include quintiles of house price growth fixed effects in our specifications.

C.5. Alternative Measures of the Exposure to Import Competition

Earlier work uses alternative instruments for exposure to import competition. In particular, Autor, Dorn, and Hanson (2013) (ADH) instrument for growth in Chinese imports to the United States using the contemporaneous composition and growth of Chinese imports in eight other high-income countries.[20] They show that rising imports between 1990 and 2007 caused higher unemployment, lower labor force participation, and reduced wages in local labor markets that are home to import-competing manufacturing industries. However, ADH focuses on the overall 1990 to 2007 period, and the instrument lacks power in the 2000 to 2007 period. Our paper is centered specifically on the 2000 to 2007 period during which household debt grew significantly in the United States. In this subperiod, ADH's instrument is only weakly related to the growth in unemployment, income, or welfare benefits. Since our aim is to related household debt growth and Chinese import competition through its effect on the labor market between 1999 and 2007, we use SC. That being said, in Appendix B, we show that SC and ADH yield comparable magnitudes in explaining the cross-sectional variation in the change in income between 1999 and 2007.

[20] Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland.

Two other prominent studies use alternative proxies for import competition: (i) the normal trade relations (NTRs) gap, that is, the difference between the non-NTR rates applied to nonmarket economies and the NTR tariff rates in Pierce and Schott (2016), and (ii) the change in industry-level Chinese import exposure over the 1999 to 2007 period in Acemoglu et al. (2016). Again, in Appendix B, we show that these instruments yield estimates for the effect of import competition on income that are comparable to our own.

II. Results

We now turn to our empirical analysis of the sensitivity of household debt growth to import competition. First, we investigate the role of import competition for household debt growth over the period 1999 to 2007 at the CZ level. Next, we zoom in to the individual level and analyze the role of house price dynamics.

A. Household Debt at the Commuting-Zone Level

A.1. Baseline Findings

We estimate a cross-sectional specification similar to (2) with household debt growth as the dependent variable:

$$\Delta D_J = \beta \, \mathrm{SC}_J + \delta' \mathbf{X}_J + u_J. \tag{3}$$

We first consider the log-change in total debt over the 1999 to 2007 period in Panel A of Table IV. In columns (1) to (3), the coefficients are highly statistically significant and are only mildly affected by the introduction of controls. When we introduce State fixed effects (in column (4)), the coefficient goes down by one-third but remains statistically significant. A one-standard-deviation increase in SC is associated with 2 to 4 percentage point lower debt growth over the period, which amounts to between 12% and 24% of the cross-sectional standard deviation of the log change in total debt over the sample period. The economic magnitude is significant: given the average level of debt across CZ in 1999 of $23,500, a one-standard-deviation drop in SC translates into an increase in total debt from $470 to $950.

A concern with debt growth is that it could be driven mechanically by changes in income. Accordingly, we consider the effect of SC on changes in DTI ratios in Panel B. Here again, we find the coefficients to be statistically and economically significant across specifications. Their magnitudes are similar to those obtained for the response of total debt.

To directly estimate the effect of Chinese import penetration on household debt growth, we perform a formal instrumental variable (IV) analysis, where the 1999 to 2007 change in net Chinese import penetration is instrumented with SC, and present the results in Table IA.III. The results reported in columns (1) to (4) indicate that an increase in Chinese net imports by

Table IV

Import Competition and Household Debt Growth, CZ Level

This table presents cross-sectional regressions of debt growth from 1999Q4 to 2007Q4 on *Shipping Costs* (SC), at the commuting zone (CZ) level. We consider the log change in debt in Panel A and the change in debt-to-income ratio (DTI) in Panel B. Information from the County Business Patterns data set on the structure of employment across six-digit NAICS industries by CZ is used to compute SC at the CZ level, as well as *Log Employment* and the share of *Employment in Manufacturing* at the CZ level. *Log Income* comes from IRS data. *Log Debt* is based on the aggregation of individual data from FRBNY CCP/Equifax. Changes in house prices between 1999 and 2007 are from the most granular index available from CoreLogic. *Net Chinese Import Penetration* is defined as U.S. imports from China minus U.S. exports to China, normalized by U.S. expenditures measured as domestic shipments plus net imports. Δ_{91-99} *HMDA Loan Origination* is the log change in the total dollar value of loan origination between 1991 and 1999, from HMDA data. Census controls come from the 2000 Census and include the vacancy rate, percent white, percent black, share of the population without high school education, share with high school diploma only, poverty rate, and percent urban, measured at the CZ level. Regressions are weighted by adult population in each CZ as of 2000. *Magnitude SC* is the effect of a one-standard-deviation increase in SC on the dependent variable. Standard errors clustered at the state level are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	Panel A: Δ_{99-07} Log Debt				Panel B: Δ_{99-07} DTI			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Shipping Costs	-1.726^{***}	-1.595^{***}	-1.430^{***}	-0.892^{**}	-5.792^{***}	-2.431^{***}	-2.093^{***}	-1.193^{**}
	(0.521)	(0.510)	(0.390)	(0.424)	(1.824)	(0.742)	(0.589)	(0.467)
Log Employment		−0.014	−0.010	−0.003		−0.009	−0.003	0.005
		(0.014)	(0.012)	(0.011)		(0.033)	(0.028)	(0.017)
Employment in Manufacturing (%)		-0.723^{***}	-0.416^{***}	-0.541^{***}		−0.348	0.002	-0.353^{**}
		(0.196)	(0.135)	(0.126)		(0.293)	(0.226)	(0.146)
Log Income		−0.106	−0.083	0.150		0.285	0.165	0.089
		(0.140)	(0.082)	(0.102)		(0.264)	(0.195)	(0.141)
Log Debt		0.210^{**}	0.093	-0.096^{*}				
		(0.093)	(0.075)	(0.050)				
DTI						1.073^{***}	0.884^{***}	0.313^{***}
						(0.157)	(0.122)	(0.090)
Δ_{91-99} HMDA Loan Origination		0.012	0.020^{*}	0.015^{**}		0.012	0.021	0.022^{***}
		(0.012)	(0.010)	(0.006)		(0.019)	(0.016)	(0.007)
Δ_{91-99} Net Chinese Import Penetration		−0.234	−0.704	0.465		−0.492	−0.946	0.758
		(0.469)	(0.499)	(0.435)		(0.752)	(0.701)	(0.484)

(*Continued*)

Table IV—*Continued*

	Panel A: Δ_{99-07} Log Debt				Panel B: Δ_{99-07} DTI			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Census controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Quintiles HP Growth	No	No	Yes	Yes	No	No	Yes	Yes
Weights	Pop.	Pop.	Pop.	Pop.	Pop.	Pop.	Pop.	Pop.
State FE	No	No	No	Yes	No	No	No	Yes
Observations	732	732	732	732	732	732	732	732
R^2	0.026	0.367	0.513	0.764	0.078	0.672	0.731	0.906
Magnitude SC	−0.040	−0.037	−0.033	−0.021	−0.136	−0.048	−0.041	−0.026
% dep. var. cross-CZ s.d.	−0.241	−0.222	−0.200	−0.124	−0.650	−0.273	−0.235	−0.134

1 percentage point leads to 4 to 7 percentage point higher household debt growth. This finding confirms that the strong relationship we document between SC and household debt is directly related to import competition.

We next break down the total debt into its various components. In Table V, we consider the three main categories of debt: mortgages, auto loans, and credit cards. We also subdivide mortgage debt into mortgage loans and home equity lines of credit (HELOC). In 1999, the average household balance sheet consisted of 78% mortgage debt, 7% automobile debt, 8% credit card debt, and 7% other debt. In columns (1) to (3), we find that mortgage debt growth, in particular HELOC growth, is more sensitive to SC than other categories. For credit card debt and auto debt, the coefficient is also negative but not statistically significant. We conclude that most of the cross-sectional variation in overall debt growth is explained by differences in mortgage borrowing.

A.2. Robustness of the Results

We present a series of robustness tests for the findings above in the Internet Appendix. In the Internet Appendix Table IA.IV, we use the weight-to-value ratio instead of SC to proxy for CZ exposure to import competition and find similar results. In Panel A of Table IA.V, we consider different measures of exposure to import competition from the literature such as the NTR gap from Pierce and Schott (2016), the Acemoglu et al. (2016) instrument for the change in exposure to Chinese imports, a measure of industry trade costs estimated from industry-level gravity equations, as well as the employment share of textile. The results confirm that household debt increases in areas with higher exposure to import competition.[21]

Panel B of Table IA.V presents several variations of our baseline specification. We start by controlling for the percentage of employment in routine occupations and the average offshorability index of occupations defined at the CZ level and available on David Dorn's website (column (1)). We next introduce industry controls (column (2)).[22] We compute SC using only Chinese imports (column (3)). To assess whether the results are driven by a spurious correlation with California and its (low-SC) computer industry, we exclude the computer industry from the computation of SC in column (4), and we exclude California from the sample in column (5). We then include a dummy for coastal regions in column (6), and a dummy for California, Florida, Nevada, and Arizona in column (7). In column (8), we add industry-level tariffs to SC in our measure of exposure to import competition. In column (9), we weight regressions by the employment share of tradable industries rather than by adult population.

Our baseline estimate of the effect of SC on household debt is 1.4, with a standard error of 0.4. This corresponds to a range of 14% to 26% around our

[21] The relationship between the ADH instrument and household debt growth is positive but statistically insignificant. However, this does not come as a surprise, given that ADH has no predictive power for labor market outcomes over the 2000 to 2007 subperiod.

[22] Those include value-added over total output, payroll over total output, total factor productivity (TFP), and TFP growth, all computed at the CZ level using 1998 labor shares as weights.

Table V

Import Competition and Household Debt Growth by Debt Type, CZ Level

This table presents cross-sectional regressions of debt growth from 1999Q4 to 2007Q4 on Shipping Costs, at the commuting zone level, separately for each type of debt (mortgage loans, HELOC—home equity lines of credit—credit card debt and auto debt). Information from the County Business Patterns data set on the structure of employment across six-digit NAICS industries by CZ is used to compute SC at the CZ level, as well as *Log Employment* and the share of *Employment in Manufacturing* at the CZ level. *Log Income* comes from IRS data. *Log Debt* is based on the aggregation of individual data from FRBNY CCP/Equifax. Changes in house prices between 1999 and 2007 are from the most granular index available from CoreLogic. *Net Chinese Import Penetration* is defined as U.S. imports from China minus U.S. exports to China, normalized by U.S. expenditures measured as domestic shipments plus net imports. Δ_{91-99} *HMDA Loan Origination* is the log change in the total dollar value of loan origination between 1991 and 1999, from HMDA data. Census controls come from the 2000 Census and include the vacancy rate, percent white, percent black, share of the population without high school education, share with high school diploma only, poverty rate, and percent urban, measured at the CZ level. Regressions are weighted by adult population in each CZ as of 2000. *Magnitude SC* is the effect of a one-standard-deviation increase in SC on the dependent variable. Standard errors clustered at the state level are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	Δ_{99-07} Log debt				
	All Mortgages (1)	Mortgage Loans (2)	HELOC (3)	Credit Card (4)	Auto (5)
Shipping Costs	−1.896***	−2.004***	−4.468*	−0.234	−1.496
	(0.534)	(0.537)	(2.561)	(0.306)	(1.031)
Log Employment	−0.014	−0.022	−0.041	0.004	−0.032
	(0.015)	(0.016)	(0.060)	(0.007)	(0.024)
Employment in Manufacturing (%)	−0.519***	−0.499***	−1.976***	−0.090	−0.858***
	(0.169)	(0.163)	(0.698)	(0.082)	(0.266)
Log Income	−0.066	−0.097	0.269	−0.095	−0.445*
	(0.104)	(0.098)	(0.609)	(0.085)	(0.260)
Log Debt	0.108	0.079	0.391	0.053	0.152
	(0.095)	(0.100)	(0.357)	(0.040)	(0.097)
Δ_{91-99} HMDA Loan Origination	0.043***	0.045***	0.112***	0.003	−0.004
	(0.013)	(0.013)	(0.041)	(0.005)	(0.016)
Δ_{91-99} Net Chinese Import Penetration	−0.676	−0.715	−0.738	0.364	−0.939
	(0.645)	(0.717)	(2.708)	(0.394)	(1.248)
Census controls	Yes	Yes	Yes	Yes	Yes
Quintiles HP Growth	Yes	Yes	Yes	Yes	Yes
Weights	Pop.	Pop.	Pop.	Pop.	Pop.
Observations	732	732	732	732	732
R^2	0.398	0.393	0.156	0.392	0.312
Magnitude SC	−0.044	−0.047	−0.105	−0.005	−0.035
% dep. var. cross-CZ s.d.	−0.163	−0.157	−0.090	−0.036	−0.147

baseline, finding that the standard deviation of SC explains 20% of the cross-sectional standard deviation of household debt.

The estimates in Panel B of Table IA.V account for 9% to 26% of the cross-sectional variation in household debt depending on the specification and therefore fall within this range.

To check that our results do not simply reflect differences across CZs in their sensitivity to the business cycle, we reestimate our baseline regression with local betas as additional controls, where local betas are estimated as the sensitivity of employment in each CZ to aggregate U.S. employment over the period from 1991 to 1999. We show in Table IA.VI that the coefficient on SC—although slightly weaker—remains statistically significant.

We finally check whether business debt responds to import competition. In Table IA.VII, we find no effect of SC on the growth in small business loans based on Community Reinvestment Act (CRA) data. This is reassuring evidence that the increase in leverage is specific to households. Using the Quarterly Workforce Indicators (QWI) data, we also fail to find any relationship between SC and the employment share of start-up businesses, which suggests that household debt is not used to start new businesses.

Taken together, these results indicate that Chinese import growth in the 2000s significantly affected household debt, primarily via mortgages.

B. Household Debt at the Individual Level

Next, we zoom in at the individual level to better control for demographics and borrower risk profiles, as well as to identify the channels through which import penetration affects household debt.

B.1. Baseline Findings

The CCP is instrumental to study the link between import penetration and the rise in household leverage for several reasons. First, CZ-level findings could be driven by migration, for instance, if individuals with higher debt systematically leave high-SC areas. We can rule out this concern by running our tests at the individual level, thereby controlling for household movement. Second, the CCP provides greater details on the source of the increase in debt, which allows us to isolate equity extraction. Third, the richness of the data set allows for tighter controls, in particular, individuals' age and credit score, other demographics at the zip code level, and house prices at the most granular level available from CoreLogic. Fourth, the granularity of the CCP allows us to consider heterogeneity in households' response to import competition (see Section III).

We merge the individual-level data from the CCP with shipping costs data at the CZ level. We run the following cross-sectional OLS specification at the individual level:

$$\Delta D_{i,J} = \beta\ \mathrm{SC}_J + \delta' \mathbf{X}_J + \gamma' \mathbf{Z}_i + u_{i,J}, \tag{4}$$

where $\Delta D_{i,J}$ is the 1999 to 2007 growth in measures of household credit over the sample period for individual i in CZ J, and $\mathbf{X}_J$ and $\mathbf{Z}_i$ are vectors of CZ- and individual-level covariates, respectively.[23] We restrict the sample to individuals who do not move from the CZ in which they lived in 1999.

We present the results in Table VI. In Panel A, we consider the change in the log of total debt plus one.[24] Across specifications, the coefficient on SC is negative, significant, and similar to the results at the CZ level, which confirms that the increase in debt is significantly higher in CZs in which industries are more exposed to import competition. Although the introduction of individual-level controls for age and credit score attenuates the coefficient slightly, the results remain significant. Similarly, in Panel B, we find that individuals in CZs with low exposure to import competition experience lower growth in their DTI ratio.

We next consider the intensive and extensive margins of household debt growth. In Table VII, we separately analyze the effect of SC exposure on the propensity to take out a new loan at any point in time between 1999 and 2007 (Panel A), on the 1999 to 2007 growth in the stock of existing debt (Panel B). We find that all of the effect is coming from the intensive margin: import competition affects the leverage of existing borrowers. One likely reason for this is that these borrowers might refinance their debt. We discuss this possibility next.

B.2. Home Equity Extraction

If households are levering in response to the increase in import competition, it is likely they would do so using the collateral value embedded in their homes. We thus explore the role of home equity in explaining the response of household debt to import competition. To do so, we follow Bhutta and Keys (2016) and construct a measure of home equity extraction using the CCP. We consider two variables: an extraction indicator for equity extraction during the sample period and the value of the equity extracted. We present the results in Table VIII. In Panel A, the coefficients are negative and highly statistically significant. A one-standard-deviation increase in SC is associated with a 0.4-percentage-point increase in the propensity to extract home equity. In Panel B, where we consider the log of the extracted amount plus one, a one-standard-deviation increase in SC is associated with a 5-percentage-point increase. Taken together, these findings indicate that import competition is associated with both a higher propensity to extract home equity and higher extracted amounts.

To complement these findings, we examine refinancing activity from a different perspective using the HMDA loan-level database. We estimate the effect of CZ-level SC exposure on the change in applications separately for home purchase loans and refinancing loans after controlling for a variety of average CZ-level loan characteristics including denial rate, application income, loan

[23] Some controls, for instance, income, are defined at the zip code level. Formally, they are included in $\mathbf{Z}_i$.

[24] This measure includes growth along the intensive margin and the extensive margin.

Table VI

Import Competition and Household Debt Growth, Individual Level

This table presents cross-sectional regressions of debt growth from 1999Q4 to 2007Q4 on *Shipping Costs* (SC), at the individual level. We consider the log change in debt in Panel A (where we add one to all balances) and the change in debt-to-income (DTI) ratio in Panel B (where debt is measured at the individual level and income is the average IRS income from an individual's zip code). Individual-level data come from the FRBNY CCP/Equifax Data, while SC, *Log Employment* and the share of *Employment in Manufacturing* are measured at the commuting zone (CZ) level. Changes in house prices between 1999 and 2007 are from the most granular index available from CoreLogic. In some regressions, we also include quantile indicators variables for five percentile bins of age and credit score. Census controls are zip-code-level variables for the vacancy rate, percent white, percent black, share of the population without high school education, share with high school diploma only, poverty rate, and percent urban, all from the 2000 census. We restrict attention to individuals between 15 and 57 in 1999 that do not change CZ during the observation period. Standard errors are clustered at the CZ level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	Panel A: Δ_{99-07} Log (Debt+1)					Panel B: Δ_{99-07} DTI				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Shipping Costs	-1.900^{**}	-2.414^{***}	-1.612^{**}	-1.783^{**}	-1.638^{**}	-3.361^{***}	-1.946^{***}	-2.091^{***}	-2.208^{***}	-2.033^{***}
	(0.899)	(0.742)	(0.750)	(0.739)	(0.738)	(0.745)	(0.617)	(0.649)	(0.643)	(0.634)
Log Employment		0.006	0.004	−0.004	−0.004		0.024^{***}	0.023^{***}	0.018^{*}	0.017^{*}
		(0.007)	(0.009)	(0.009)	(0.008)		(0.009)	(0.009)	(0.009)	(0.009)
Employment in Manufacturing (%)		-0.851^{***}	-1.234^{***}	-1.199^{***}	-1.137^{***}		-0.550^{***}	-0.645^{***}	-0.636^{***}	-0.496^{***}
		(0.139)	(0.155)	(0.149)	(0.149)		(0.151)	(0.152)	(0.150)	(0.132)
Log Income		-0.289^{***}	0.110^{***}	0.165^{***}	0.158^{***}		−0.007	-0.082^{***}	-0.052^{*}	-0.067^{**}
		(0.026)	(0.026)	(0.028)	(0.027)		(0.034)	(0.031)	(0.030)	(0.029)
Log (Debt+1)			-0.604^{***}	-0.619^{***}	-0.619^{***}					
			(0.002)	(0.003)	(0.003)					
DTI								-0.199^{***}	-0.207^{***}	-0.207^{***}
								(0.015)	(0.017)	(0.017)
Δ_{91-99} HMDA Loan Origination		0.018^{**}	0.001	−0.008	−0.012		0.033^{***}	0.032^{***}	0.026^{***}	0.019^{***}
		(0.009)	(0.009)	(0.009)	(0.009)		(0.007)	(0.008)	(0.007)	(0.006)
Δ_{91-99} Net Chinese Import Penetration		2.084	2.810^{*}	2.425	2.315		4.109^{**}	4.760^{**}	4.542^{**}	4.279^{**}
		(1.468)	(1.583)	(1.547)	(1.455)		(1.863)	(1.896)	(1.841)	(1.709)

(*Continued*)

Table VI—*Continued*

	Panel A: Δ_{99-07} Log (Debt+1)					Panel B: Δ_{99-07} DTI				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Credit Score			0.007***					0.001***		
			(0.000)					(0.000)		
Age			−0.053***					−0.031***		
			(0.001)					(0.001)		
Quintiles HP Growth	No	No	No	No	Yes	No	No	No	No	Yes
Risk Bins	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Age Bins	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Census controls	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,098,995	5,098,995	5,098,995	5,098,995	5,098,995	5,020,862	5,020,862	5,020,862	5,020,862	5,020,862
R^2	0.002	0.003	0.283	0.294	0.294	0.014	0.015	0.074	0.093	0.093

Table VII

Import Competition and Household Debt Growth by Debt Type, Individual Level

This table presents cross-sectional regressions of debt growth from 1999Q4 to 2007Q4 on *Shipping Costs* (SC), at the individual level. For extensive-margin analysis (Panel A), we run logistic regressions at the individual level in which the dependent variable is an indicator for having a positive debt balance in 2007Q4. Logit marginal coefficients are reported. For intensive-margin analysis (Panel B), changes in debt are calculated as changes in log debt from 1999Q4 to 2007Q4, without adding one to zero balances, so that individuals with zero balances in 1999Q4 or 2007Q4 are excluded from this regression specification. Individual-level data come from the FRBNY CCP/Equifax Data, while SC, *Log Employment*, and the share of *Employment in Manufacturing* are measured at the commuting zone (CZ) level. Changes in house prices are from the most granular index available from CoreLogic. In some regressions, controls for individual age and credit score in 1999 are replaced by quantile indicators variables for five percentile bins. Census controls are zip-code-level variables for the vacancy rate, percent white, percent black, share of the population without high school education, share with high school diploma only, poverty rate, and percent urban, all from the 2000 census. Standard errors are clustered at the CZ level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	Panel A: Extensive Margin (Debt Dummy$_{07}$)					Panel B: Intensive Margin (Δ_{99-07} Log Debt)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Shipping Costs	−0.186*	0.069	0.112	0.095	0.086	−1.986***	−2.020***	−2.629***	−2.739***	−2.518***
	(0.097)	(0.099)	(0.097)	(0.094)	(0.096)	(0.624)	(0.517)	(0.542)	(0.550)	(0.515)
Log Employment		0.002	−0.000	−0.001	−0.001		0.030***	0.030***	0.026***	0.025***
		(0.002)	(0.002)	(0.002)	(0.002)		(0.006)	(0.006)	(0.006)	(0.006)
Employment in Manufacturing (%)		−0.027	−0.033	−0.030	−0.041*		−0.571***	−0.733***	−0.730***	−0.579***
		(0.024)	(0.025)	(0.024)	(0.023)		(0.125)	(0.129)	(0.130)	(0.103)
Log Income		−0.014***	−0.008**	−0.003	−0.002		−0.268***	−0.419***	−0.390***	−0.406***
		(0.003)	(0.003)	(0.004)	(0.003)		(0.029)	(0.038)	(0.036)	(0.033)
Log (Debt+1)			−0.004***	−0.005***	−0.005***					
			(0.000)	(0.000)	(0.000)					
DTI								−0.335***	−0.328***	−0.329***
								(0.027)	(0.028)	(0.028)
Δ_{91-99} HMDA Loan Origination		−0.002*	−0.004***	−0.004***	−0.004***		0.026***	0.022***	0.019**	0.011**
		(0.001)	(0.001)	(0.001)	(0.001)		(0.007)	(0.007)	(0.007)	(0.005)
Δ_{91-99} Net Chinese Import Penetration		0.123	0.056	0.018	0.018		1.955	3.179**	3.097**	2.962**
		(0.191)	(0.201)	(0.198)	(0.197)		(1.289)	(1.329)	(1.276)	(1.169)

(*Continued*)

Table VII—*Continued*

	Panel A: Extensive Margin (Debt Dummy$_{07}$)					Panel B: Intensive Margin (Δ_{99-07} Log Debt)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Credit Score			0.001***					0.001***		
			(0.000)					(0.000)		
Age			−0.006***					−0.049***		
			(0.000)					(0.001)		
Quintiles HP Growth	No	No	No	No	Yes	No	No	No	No	Yes
Risk Bins	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age Bins	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Census	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,098,995	5,098,995	5,098,995	5,098,995	5,098,995	4,010,038	4,010,038	4,010,038	4,010,038	4,010,038
R^2						0.004	0.006	0.140	0.152	0.152
Pseudo-R^2	0.001	0.004	0.019	0.025	0.025					

Table VIII

Import Competition and Home Equity Extraction, Individual Level

This table presents cross-sectional regressions of proxies for home equity extraction from 1999Q4 to 2007Q4 on *Shipping Costs* (SC), at the individual level. Equity extraction in a given year is identified as in Bhutta and Keys (2016), with an extract indicator for equity extraction in at least one calendar year between 2000 and 2007, inclusive. This indicator is used as the dependent variable in a logistic regression, while the log translated *value* extracted is used as the dependent variable in an OLS specification. Marginal effects are reported in logit specifications. Individual level data come from the FRBNY CCP/Equifax Data, while SC, *Log Employment*, and the share of *Employment in Manufacturing* are measured at the commuting zone (CZ) level. Changes in house prices are from the most granular index available from CoreLogic. In some regressions, controls for individual age and credit score in 1999 are replaced by quantile indicators variables for five percentile bins. Census controls are zip-code-level variables for the vacancy rate, percent white, percent black, share of the population without high school education, share with high school diploma only, poverty rate, and percent urban, all from the 2000 census. Standard errors are clustered at the CZ level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	Panel A: Extract Flag					Panel B: Log(Extract Amount + 1)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Shipping Costs	−1.329***	−0.453***	−0.426***	−0.447***	−0.416***	−18.412***	−6.320***	−5.165***	−5.465***	−4.987***
	(0.179)	(0.159)	(0.156)	(0.152)	(0.149)	(2.220)	(1.828)	(1.782)	(1.739)	(1.707)
Log Employment		0.004**	0.004**	0.004*	0.003*		0.073***	0.044*	0.040	0.038
		(0.002)	(0.002)	(0.002)	(0.002)		(0.024)	(0.023)	(0.024)	(0.023)
Employment in Manufacturing (%)		−0.124***	−0.117***	−0.112***	−0.089***		−1.804***	−1.655***	−1.613***	−1.272***
		(0.032)	(0.032)	(0.031)	(0.029)		(0.396)	(0.387)	(0.386)	(0.350)
Log Income		0.039***	0.023***	0.029***	0.026***		0.641***	0.979***	1.016***	0.977***
		(0.006)	(0.005)	(0.005)	(0.005)		(0.069)	(0.072)	(0.071)	(0.071)
Log (Debt+1)			0.023***	0.021***	0.021***					
			(0.001)	(0.000)	(0.000)					
DTI								0.373***	0.349***	0.348***
								(0.039)	(0.036)	(0.036)
Δ_{91-99} HMDA Loan Origination		−0.004***	−0.004**	−0.005***	−0.006***		−0.015	−0.023	−0.031*	−0.049***
		(0.002)	(0.002)	(0.002)	(0.002)		(0.021)	(0.019)	(0.019)	(0.017)
Δ_{91-99} Net Chinese Import Penetration		0.545	0.494	0.482	0.426		8.304**	6.009	5.985	5.246
		(0.342)	(0.340)	(0.331)	(0.313)		(4.207)	(4.026)	(3.936)	(3.669)

(*Continued*)

Table VIII—*Continued*

	Panel A: Extract Flag					Panel B: Log(Extract Amount + 1)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Credit Score			0.000					−0.000		
			(0.000)					(0.000)		
Age			−0.001***					−0.005***		
			(0.000)					(0.001)		
Quintiles HP Growth	No	No	No	No	Yes	No	No	No	No	Yes
Risk Bins	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Age Bins	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Census controls	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,043,037	3,043,037	3,043,037	3,043,037	3,043,037	3,043,037	3,043,037	3,043,037	3,043,037	3,043,037
R^2						0.030	0.038	0.057	0.072	0.072
Pseudo-R^2	0.017	0.021	0.033	0.043	0.044					

amount, and application volume, in addition to the our baseline controls. We present the results in Table IA.VIII. Across specifications, we find that the demand for refinancing is higher in areas with higher exposure to import competition (columns (3) and (4)). The surge in demand for refinancing contrasts with the demand for home purchases, which shows no significant differences across areas (columns (1) and (2)). We find similar effects when we focus on originations rather than applications (Table IA.IX) and when we focus on denial rates (Table IA.X), which are higher for refinancing loans in areas with greater exposure to import competition. We further confirm that the increase in mortgage debt is not related to the construction of new housing using the Building Permit Survey: Table IA.XI shows no significant variation in the growth of new permits or in construction employment in more exposed areas.

The results above together suggest that Chinese import growth after its accession to the WTO led to a sharp increase in household debt through home equity extraction. This finding points to the role of rising house prices in the first half of the 2000s in explaining our findings. We explore this question next.

C. The Role of House Prices

As Bhutta and Keys (2016) pointed out, equity extraction is more likely to occur in areas with high house price appreciation, where households "cash-in" the capital gains of their investment. The sharp increase in house prices between 1999 and 2007 illustrated in Figure 3 may therefore play an important role in the relationship between import competition and household debt that we find in the data.[25]

To check whether this is the case, we go back to our CZ-level sample and double sort CZs into top (low-exposure) and bottom (high-exposure) quintiles of SC and into top-half and bottom-half house price appreciation between 1999 and 2007 as measured by CoreLogic. Figure 6 presents the cumulative 1999 to 2007 household debt and DTI growth in each subsample. In CZs that experienced low house price appreciation, total debt and DTI growth are only marginally larger in low-SC (more exposed) areas. In contrast, CZs that experienced high house price appreciation display strong differences across high and low exposure areas: total debt and DTI growth are much larger in CZs exposed to import competition.

We next formally test these differences in the individual-level CCP data set. We split our individual-level sample into areas with high versus low house price appreciation and estimate OLS regressions of the change in log debt, DTI, the extract indicator, and the log of the extracted amount plus one on our measure of exposure to import competition in each subsample. Panel A of Table IX shows that the increase in household debt is concentrated in areas with high house price appreciation. In particular, there is no effect of SC on either DTI or home equity extraction in areas with low house price appreciation.

[25] Note that SC and house price growth in the 2000s are not correlated, as shown in Table IA.XI.

Table IX

Import Competition and Household Debt: Interaction with House Prices

This table presents cross-sectional regressions of debt growth and home equity extraction from 1999Q4 to 2007Q4 on *Shipping Costs* (SC), at the individual level. The specifications are the same as in, respectively, column (9) of Table VII, column (9) of Table VI, column (4) of Table VIII, and column (9) of Table VIII, and are performed separately for areas with low (below-median) and high (above-median) house price appreciation over the period 1999 to 2007 in Panel A, and separately for areas with low (below-median) and high (above-median) housing supply elasticity in Panel B. The elasticity of housing supply is obtained from Saiz (2010). Standard errors are clustered at the CZ level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. We present the *p*-value for the difference in SC between low and high house price appreciation in Panel A, and between low and high housing supply in Panel B.

	Panel A: House Price Appreciation							
	Δ Log (debt)		Δ DTI		Extract Flag		Log(Extract Value + 1)	
	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)	Low (7)	High (8)
Shipping Costs	−1.654***	−3.908***	−0.447	−5.259***	−0.161	−0.968***	−1.924	−13.383***
	(0.390)	(0.986)	(0.357)	(1.301)	(0.129)	(0.234)	(1.439)	(2.956)
Risk Bins	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age Bins	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CZ controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Census controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,040,044	1,969,994	2,673,472	2,347,435	1,577,907	1,465,130	1,577,907	1,465,130
R^2	0.369	0.357	0.067	0.069	0.057	0.047	0.065	0.057
p-value (High-Low)		0.031		0.000		0.004		0.001

(*Continued*)

Table IX—*Continued*

	Panel B: Housing Supply Elasticity							
	Δ Log (debt)		Δ DTI		Extract Flag		Log(Extract Value + 1)	
	Low	High	Low	High	Low	High	Low	High
Shipping Costs	−8.666***	−4.245***	−9.938***	−3.147**	−1.418***	0.136	−22.749***	−0.864
	(2.244)	(1.170)	(2.141)	(1.411)	(0.367)	(0.364)	(4.974)	(4.465)
Risk Bins	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age Bins	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CZ controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Census controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,448,863	1,450,131	1,720,550	1,734,660	1,068,658	1,142,785	1,068,662	1,142,785
R^2	0.355	0.376	0.070	0.073	0.044	0.063	0.052	0.073
p-Value (High-Low)		0.080		0.009		0.003		0.001

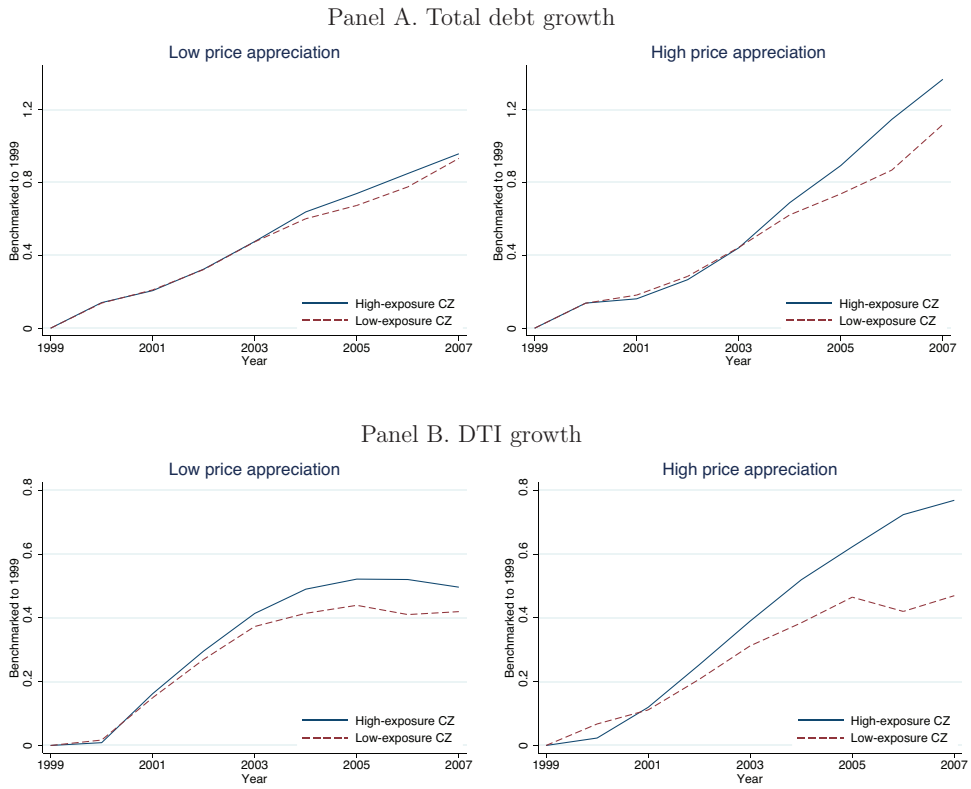

Figure 6. Household debt across high- and low-exposure areas interacted with house price appreciation. This figure presents the cumulative debt growth for commuting zones (CZs) in the top (low-exposure) and bottom (high-exposure) quintiles of shipping costs (SC) measured in 1998. Information from the County Business Patterns data sets on the structure of employment across six-digit NAICS industries by CZ is used to compute SC at the CZ level. (Color figure can be viewed at wileyonlinelibrary.com)

We test for the difference between the coefficients in each sample and confirm that it is statistically significant at conventional levels.

We next replicate this analysis by splitting areas based on the instrumented elasticity of housing supply obtained from Saiz (2010) instead of on house price appreciation itself. We find similar results: the effect of SC on household debt is concentrated in areas with low housing supply elasticity areas, while equity extraction is insensitive to SC in areas with high elasticity. These findings confirm that the increase in import competition led to a sharp increase in household debt through home equity extraction, due to the rise in house prices over the period 1999 to 2007. In what follows, we discuss whether the decline in house prices in the wake of the financial crisis illustrated in Figure 3 might have prevented households from borrowing against the value of their homes.

D. Evidence from before 1999 and after 2007

D.1. Pre-1999 period

We first explore the relationship between SC and household debt in the 1990s. As evidenced in Panel A of Figure 1, the household DTI ratio grows only moderately in this period, before increasing sharply in the 2000s. In Table IA.XI, we replicate the specifications from Table II in the 1991 to 1999 subperiod. More precisely, we run CZ-level cross-sectional regressions of the 1991 to 1999 change in Chinese import penetration on SC measured in 1990. In Panel A, we find that the effect of SC on Chinese import penetration is negative and significant, but the coefficients are weaker than those obtained in Table II for the 1999 to 2007 subperiod. Furthermore, the effect of SC on net Chinese import penetration is insignificant, which suggests that the negative effect of SC on exports to China offsets their positive effect on imports from China in the 1990s.

In Table IA.XIV, we go a step further and run our baseline CZ-level specification for each year between 1991 and 1999. We fail to find any relationship between SC and net Chinese import penetration, unemployment, and income. The main reason for this may be that Chinese import growth was overall much weaker in the 1990s than in the 2000s, after China's accession to the WTO. Panel B of Figure 1 presents aggregate Chinese imports to the United States, in 2011 dollars. While imports grew by almost $300bn from 1999 to 2007, they grew by only $100bn between 1991 and 1999.

A potential solution might be to use an alternative instrument, such as that introduced by ADH, for changes in Chinese import penetration in the 1990s. However, as shown in Table IA.XIII, when we replicate their specifications separately for the 1990s, the instrument is unable to predict unemployment and income. All coefficients but one are insignificant, and most have the wrong sign, and thus, we cannot use the ADH instrument in the pre-2000 period. This lack of employment response to Chinese import growth in the 1990s is consistent with evidence in Figure 1 that manufacturing employment was relatively stable in the 1990s.

It could be the case that workers experiencing income losses in the 1990s smoothed the shock by extracting equity from their home. This cannot be captured in cross-sectional CZ-level specifications using our instrument or the ADH instrument due to the lack of power. Yet, the mechanism that we outline in the paper is unlikely to have substantial aggregate effects, due to house price dynamics. The house price increase in the 1990 to 1999 period was not as strong as it was in the 2000 to 2007 period. Figure 3 shows the evolution of the Case-Shiller price index since 1991. Accounting for inflation (using the GDP deflator), we find that real house prices were almost flat during the 1990s while they rose by 55% between 2000 and 2007.

Despite the weakness of the relationship between SC and labor market outcomes in the 1990s, we check whether SCs have any predictive power for household debt in the 1990s. Since the CCP starts in 1999, we rely on HMDA data and use the change in the log number of loan applications and originations

between 1991 and 1999 as proxies for changes in household debt. We present the results in Panels D and E of Table IA.XIV. As expected, we fail to find any effect of SC on household debt in the cross-section of CZs throughout the 1990s.

D.2. Post-2007 Period

We next explore what happens post-2007. As shown in Panel A of Figure 1, the household DTI ratio drops sharply in the wake of the financial crisis. In Table IA.XV, we run our baseline CZ-level specification for each year between 1999 and 2011. We find that the relationship between SC and labor market outcomes still holds post-2007: as can be seen in the last column of Table IA.XIV, net Chinese import competition keeps building up faster in low-SC areas, and the negative impact on income remains strong. However, household debt levels off and declines after 2007. This is likely the result of the decrease in house prices illustrated in Figure 3 that makes it harder for households to borrow against their homes, and that confirms that house prices play an important role in explaining our baseline findings.

To understand the consequences of the increase in household debt for low-SC borrowers in the wake of the financial crisis, we estimate the effect of import competition exposure on the change in credit scores, as well as on the probability of mortgage delinquencies and foreclosure during the Great Recession from 2007 to 2011 in the individual-level CCP data. In Table X, we find that exposure to import competition has significant negative effects on individual credit scores (columns (1) and (2)), on the probability that mortgages become delinquent, and on foreclosures. In Table IA.XVI, we find that the decrease in credit scores and the increase in delinquencies and foreclosures between 2007 and 2011 in low SC areas are larger in areas with low housing supply elasticity. Thus, CZs in which we find the largest increase in debt and equity extraction—those with high exposure to import competition and a larger increase in house prices over the period 1999 to 2007—also experience the worst outcomes in the wake of the financial crisis.

E. Evidence from the Panel Study of Income Dynamics

A limitation of the CCP is that we assign treatment to individuals based on the industry composition of the CZ in which they live rather than on their industry itself. As a result, the effects that we detect may be unrelated to the labor outcomes in specific industries affected by import competition. While the sample size is small relative to the CCP, the PSID panel allows us to compute SC at the level of each individual's reported industry, rather than estimate their exposure using CZ-level SC. We provide details on the construction of the PSID panel in Appendix A and report summary statistics in Table IA.XVII.

In Panel A of Table XI, we confirm our earlier findings that higher exposure to import competition leads to higher unemployment, lower labor income, and higher household leverage. A one-standard-deviation increase in SC leads to a 12% decline in income growth in the 1999 to 2007 period. This decline

Table X

Import Competition, Delinquencies and Foreclosures (2007 to 2011)

This table analyzes mortgage delinquencies and foreclosures at the individual level. Logistic regressions are performed using indicators for these bad outcomes having occurred between 2007Q4 and 2011Q4. Logit marginal effects are reported. The analysis is restricted to individuals appearing in Equifax in 2007Q4 and 2011Q4. Individual-level data come from the FRBNY CCP/Equifax Data, while SC, *Log Employment*, and the share of *Employment in Manufacturing* are measured at the commuting zone (CZ) level. Changes in house prices are from the most granular index available from CoreLogic. In some regressions, controls for individual age and credit score in 1999 are replaced by quantile indicators variables for five percentile bins. Census controls are zip-code-level variables for the vacancy rate, percent white, percent black, share of the population without high school education, share with high school diploma only, poverty rate, and percent urban, all coming from the 2000 census. Standard errors are clustered at the CZ level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	(1) Δ Credit Score	(2) Bottom Credit Δ Decile	(3) Mortgage Delinquency	(4) Foreclosure
Shipping Costs	19.590**	−0.098**	−0.244***	−0.281***
	(8.797)	(0.047)	(0.078)	(0.075)
Log Employment	−0.583***	0.003***	0.002**	0.001*
	(0.100)	(0.001)	(0.001)	(0.001)
Employment in Manufacturing (%)	4.659***	−0.022***	−0.063***	−0.050***
	(1.453)	(0.008)	(0.019)	(0.015)
Log Income	−1.010***	0.006***	0.011***	0.007***
	(0.351)	(0.002)	(0.003)	(0.002)
Log (Debt+1)	−0.479***	0.002***	0.009***	0.002***
	(0.046)	(0.000)	(0.000)	(0.000)
Δ_{91-99} HMDA Loan Origination	−0.147	0.001	−0.002***	−0.002**
	(0.110)	(0.001)	(0.001)	(0.001)
Δ_{91-99} Net Chinese Import Penetration	−21.882	0.251**	0.161	0.022
	(18.054)	(0.109)	(0.197)	(0.148)
Quintiles HP Growth	Yes	Yes	Yes	Yes
Risk Bins	Yes	Yes	Yes	Yes
Age Bins	Yes	Yes	Yes	Yes
Census controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Observations	4,630,796	4,630,796	4,630,796	4,630,796
R^2	0.019			
Pseudo-R^2		0.041	0.101	0.098

Table XI

PSID: Import Competition, Labor Market Outcomes, and Debt Growth

This table presents reduced-form regressions of both labor outcomes and debt variables on the Shipping Costs (SC) of the industry of occupation of individuals in the PSID. Individual-unemployment is the number of unemployment spells experienced between 1999 and 2007 across the five biennial surveys. We measure the percent change in income over the sample period from all individual labor income revenues. The change in debt-to-income (DTI) is the difference between the ratio of total debt to income in 2007 and in 1999. The change in debt represents the percent change in the total value of all debt between 1999 and 2007. Panel B decomposes the percent change in debt across different categories from the PSID, mortgages, credit card, and auto loans. Individual level controls are the log of labor income, the log of the value of all debt, DTI, and the number of individuals in the household at the beginning of the period in 1999. We also include education, race, gender, and marital status fixed effects. Standard errors clustered at the state level are presented in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A. Employment, Income, and Debt: Change in 1999 to 2007

	Unemployment		Income		DTI		Debt	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Shipping Costs	−0.52	−0.50	4.00***	4.00 ***	−6.78**	−8.35**	−10.63**	−11.56**
	(0.32)	(0.38)	(1.20)	(1.31)	(2.85)	(3.46)	(4.59)	(5.07)
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	722	722	723	723	723	723	723	723
R^2	0.0425	0.0818	0.197	0.234	0.116	0.154	0.218	0.26

Panel B. Types of Debt: Change in 1999 to 2007

	Debt		Mortgage		Credit Card		Auto Loans	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Shipping Costs	−10.63**	−11.56**	−7.46**	−8.16**	−2.13**	−2.66***	0.22	0.15
	(4.59)	(5.07)	(3.26)	(4.04)	(0.84)	(1.00)	(0.19)	(0.22)
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	723	723	644	644	683	683	602	602
R^2	0.218	0.26	0.113	0.166	0.0402	0.0851	0.052	0.102

translates into a cumulative loss of $21,000 from 1999 to 2007. Debt increases by 33% in response to a one-standard-deviation increase in SC. This corresponds to an increase in debt balances from $8,600 to $15,500.[26]

In Panel B, we decompose the effect across various types of debt and confirm that the increase in debt is driven by mortgage debt and, to a smaller extent, credit card balances. In contrast, import competition leads to lower auto debt,

[26] In Table IA.XVIII, we perform two-stage least squares (2SLS) specifications and confirm that trade-related income shocks have induced households to borrow.

consistent with the idea that this durable consumption did not increase with the drop in income.

We also construct the measure of equity extraction of Bhutta and Keys (2016) (as in Section II.B.2 above) in the PSID. In Table IA.XIX, we confirm that higher exposure to import competition leads to higher equity extraction (columns (1) to (3)). In column (5), we show that the noninstrumented relationship between income and equity extraction is positive: household leverage typically increases with income. However, once income growth is instrumented with SC, the coefficient flips and becomes negative: households who experience a negative income shock tend to borrow more in response.

Taken together, not only do these findings confirm those obtained in the CCP sample, but they also provide direct evidence that the household debt response to import competition operates through individual-level exposure to the associated labor income shock.

III. Understanding the Channel

A. *Permanent Income Hypothesis*

Neoclassical consumption theory (Friedman (1957)) links income shocks and consumption smoothing motives. According to the PIH, consumption responds only to permanent shifts in income, not to transitory ones. As an immediate corollary of the PIH, debt responds only to transient fluctuations and not to permanent ones. To formalize this point, we go back to the textbook formulation of the PIH with quadratic utility in Appendix C. If labor follows an AR(1) process of the form $y_{t+1} = \bar{y} + \rho(y_t - \bar{y}) + \varepsilon_{t+1}$, under quadratic utility, the change in borrowing is given by

$$b_{t+1} - b_t = -\frac{1-\rho}{1-\beta\rho}(y_t - \bar{y}), \tag{5}$$

where β represents agents' subjective discount factor. Households increase their debt whenever their income falls below its average level, $\bar{y}$. The response of borrowing to labor income variation depends on the persistence of the labor income process. If shocks have no persistence ($\rho = 0$), debt responds one-for-one to deviations of labor income from its trend. When labor income is more persistent ($\rho \to 1$), the borrowing response is muted, going to zero in the limit.

Note that this stylized expression of the PIH assumes that households are not financially constrained. Instead, when they are constrained, because they cannot borrow against future earnings, the PIH predicts no response in borrowing to income shocks. However, if they have valuable collateral to borrow against, for example, equity in a home, then we would expect to see them to use this channel. Our results on equity extraction (see Section II.B.2 and Table VIII) underscore the importance of collateral.

In summary, the PIH delivers two main insights for our purpose: the debt should increase one-for-one with the drop in income, especially if households

have collateral to borrow against, but only if the shock is perceived as being transitory. We provide evidence along those lines in what follows.

B. Magnitude of Consumption Smoothing

We start by comparing the response of income and debt to import competition. In Section I.C.3, we use the CCP sample to show that a one-standard-deviation decrease in SC translates into a cumulative income loss of around $2,100 between 1999 and 2007. In Table IV, we find that the same standard-deviation decrease in SC corresponds to an increase in debt between 2% and 4%, depending on the specification. Given that the average level of debt across CZ in 1999 is $23,500, the effect of a one-standard-deviation drop in SC leads to a dollar increase in total debt of between $470 and $950. The debt response is sizeable but smaller than the drop in income, consistent with the PIH.

In Section II.E, we use the PSID and find that a one-standard-deviation decrease in SC translates into a 12% decline in income growth and a 33% increase in debt over the period. This translates into a cumulative loss of $18,000 in income, and into an increase of $8,500 in debt.[27] The relative magnitude of the increase in debt with respect to the cumulative drop in income is in line with our estimates at the CZ level, and fits into the standard response predicted by the PIH.[28]

Finally, we provide direct evidence of consumption smoothing. Using the PSID panel and its data on consumption, we show that household consumption does not respond to import competition, despite a significant drop in income. As shown in Table IA.XX, the effect of SC on consumption is small and statistically insignificant, consistent with our findings that households use debt to offset the drop in income they experience.

C. Permanent versus Transitory Shocks

According to the PIH, debt should increase only if the shock is considered transitory. The evidence presented in Artuç, Chaudhuri, and McLaren (2010) and Autor et al. (2014) indicates that the impact of import competition on labor income varies significantly across workers. Workers with higher levels of education and higher wages typically relocate into different industries after being

[27] For this computation, we use the same baseline income and debt levels in 1999 (from the IRS and the CCP) as in our analysis at the CZ level, respectively, $37,500 and $23,500. These statistics are similar to the 1999 income and debt level of the median household in the PSID: see Table IA.XVII. We compute the cumulative loss in income as $\sum_{t=1}^{t=8}(\exp(0.015 \times t) - 1) \times 23,500$, where $0.015 = 0.12/8$ is the annualized decline in income growth estimated in the PSID.

[28] The dollar values for the estimated drop in income and increase in debt are higher in the PSID than in the analysis at the CZ level. However, in the PSID, we directly link households to the SC of their industry of occupation across manufacturing industries only, whereas our analysis at the CZ level aggregates all households that reside in a given CZ. Accounting for the share of nonexposed households (in nonmanufacturing industries), the dollar values of the estimated decrease in income, and increase in debt, are around $2,800 and $1,350, respectively, in line with our estimates at the CZ level.

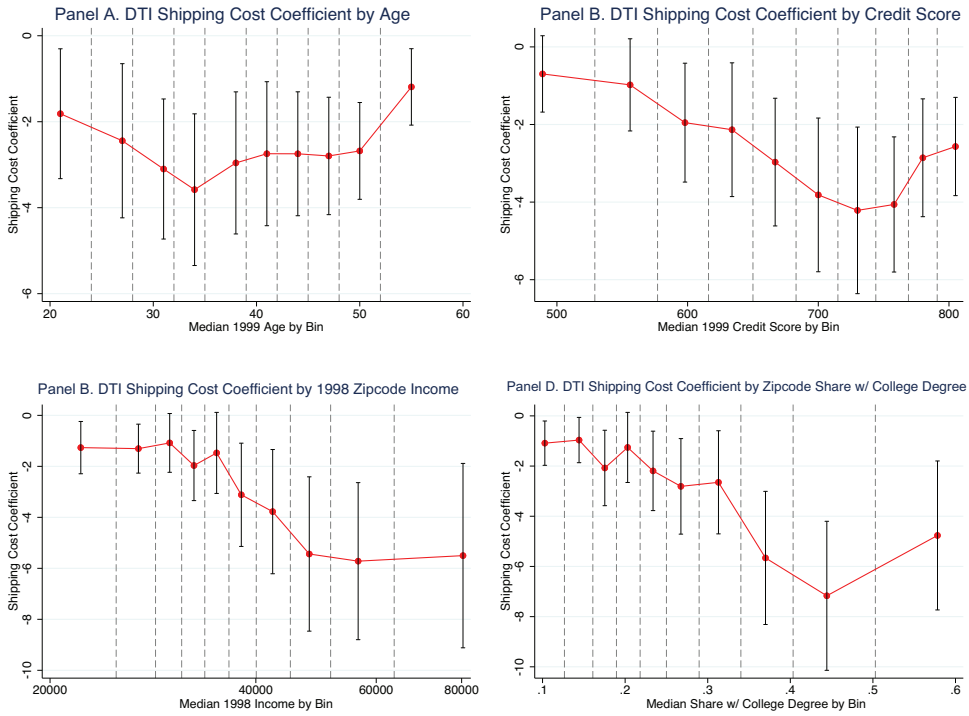

Figure 7. Heterogeneous treatment effects. This figure presents the point estimates and confidence intervals of cross-sectional regressions of the change in the debt-to-income ratio from 1999Q4 to 2007Q4 on shipping costs, our proxy for import competition, at the individual level. The specifications are similar to column (10) of Table VI and are run separately across deciles of (a) individual age, (b) individual credit score (b), (c) zip code income, and (d) zip code share of the population with at least college education. (Color figure can be viewed at wileyonlinelibrary.com)

hit by import competition, while low-skilled workers or workers with industry-specific capital are more permanently affected. Hence, in line with the PIH, it should be the case that households who increase borrowing the most are indeed those hit by a transitory shock because they can easily find another job. We test whether the increase in debt is stronger for higher income and more educated workers.

In Figure 7, we present the point estimates and confidence intervals of cross-sectional regressions of the change in the DTI ratio from 1999Q4 to 2007Q4 on our proxy for import competition at the individual level. The specifications are similar to column (10) of Table VI and are run separately across deciles of (a) individual age, (b) individual credit score, (c) income of a ZIP code, and (d) the share of the population with at least college education in a ZIP code. Although the differences across deciles are only weakly significant, the results suggest that the effects are concentrated among middle-aged individuals with relatively higher credit scores living in ZIP codes with higher income and education. Hence, in line with the PIH, the effect of import competition on debt

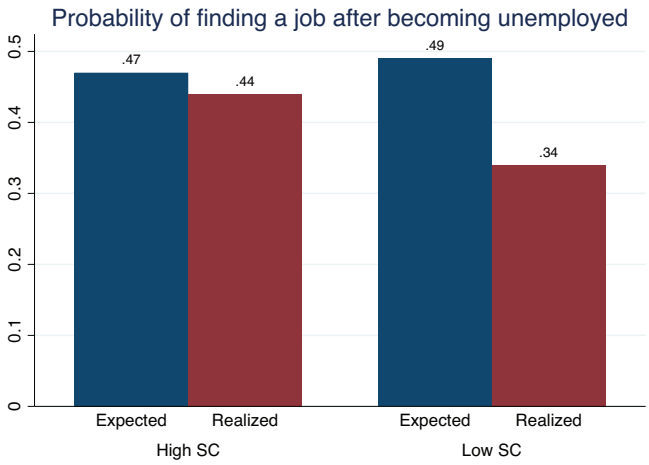

Figure 8. Realized and expected duration of unemployment spells. This figure presents realized and expected duration of unemployment spells. We draw from the Health and Retirement Study (HRS), a longitudinal survey conducted every two years. Individuals are asked about their current job status (employed, unemployed, retired) and their expectations of future labor outcome. In particular, they are asked: "Suppose you were to lose your job this month. What do you think are the chances that you could find an equally good job in the same line of work within the next few months?" Red bars present the average perceived probability to find a job after becoming unemployed, computed across participants in the HRS waves of 2000, 2002, and 2004. Blue bars present the probability of an individual employed in 2000 (according to HRS) but not in year 2002 finding a job in year 2004. High SC (Low SC) denote commuting zones that lie in the top tercile (bottom tercile) of the distribution of shipping costs (SC). Information from the County Business Patterns data sets on the structure of employment across six-digit NAICS industries by CZ is used to compute SC at the CZ level. (Color figure can be viewed at wileyonlinelibrary.com)

growth seems relatively stronger for individuals for whom prior research finds the shock to be shorter-lived.

We also explore how deviation from rational expectations may explain the household debt response to Chinese import growth. Workers who are permanently excluded from the labor market may have expected the shock to be transitory. In other words, even if the data-generating process for income is persistent ($\rho \sim 1$), households might perceive it to be $\rho \ll 1$ and make borrowing and consumption decisions based on these distorted expectations. To check whether this is the case, we analyze the realized and expected duration of unemployment spells across high- and low-SC areas. We draw from the HRS, a longitudinal survey conducted every two years. Individuals are asked about their current job status (employed, unemployed, retired) and about their expectations of future labor outcomes. In particular, they are asked what they think is the probability that they would find an equally good job within the next few months if they were to lose their job right now. In Figure 8, we plot the probability that an individual who was employed at time $t-2$ and not at time t finds a job at time $t+2$ (blue bars), and the average perceived probability of finding a job after becoming unemployed (red bars). Averages are

Table XII

Realized and Expected Duration of Unemployment Spells

This table presents the results of commuting zone (CZ)-level cross-sectional regressions of the realized and expected probability of moving out of unemployment on *Shipping Costs* (SC), at the CZ level. We draw from the Health and Retirement Study (HRS), a longitudinal survey conducted every two years. Individuals are asked about their current job status (employed, unemployed, retired) and about their expectations of future labor outcome. In particular, they are asked: "Suppose you were to lose your job this month. What do you think are the chances that you could find an equally good job in the same line of work within the next few months?" "Expected" is the average perceived probability of finding a job after becoming unemployed, computed across participants in the HRS waves of 2000, 2002, and 2004. "Realized" is the probability of an individual employed in 2000 (according to HRS) but not in 2002 finding a job in 2004. Information from the County Business Patterns data set on the structure of employment across six-digit NAICS industries by CZ is used to compute SC at the CZ level. CZ controls include log employment, the share of employment in manufacturing, log income, net Chinese import penetration between 1991 and 1999, and the log change in the total dollar value of loan origination between 1991 and 1999. Census controls come from the 2000 Census and include the vacancy rate, percent white, percent black, share of the population without high school education, share with high school diploma only, poverty rate, and percent urban, measured at the CZ level. Regressions are weighted by adult population in each CZ as of 2000. Robust standard errors are presented in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	Probability to Exit Unemployment after Becoming Unemployed		
	Expected (1)	Realized (2)	Error (Expected-Realized) (3)
Shipping Costs	−0.58	9.68*	−10.26*
	(1.54)	(5.31)	(5.51)
CZ controls	Yes	Yes	Yes
Census controls	Yes	Yes	Yes
Weights	Pop.	Pop.	Pop.
Observations	106	106	106
R^2	0.314	0.186	0.214

computed across participants in the HRS waves of 2000, 2002, and 2004. While the probability of exiting unemployment is 10 percentage points lower in low- than in high-SC areas, the expected probability is similar if not slightly higher in low-SC areas. Hence, individuals in low-SC areas seem to overestimate their ability to exit unemployment in the period. Table XII confirms that this holds in CZ-level cross-sectional regressions after including the full set of controls of our baseline specification.[29] Hence, households exposed to import competition might be taking more debt because they expect the shock to be more transitory than it ended up being.[30]

[29] HRS waves sample individuals located in 106 CZs. However, these 106 CZs cover 56 % of the U.S. total population.

[30] Our results may also be consistent with other hypotheses according to which individuals also borrow in the face of permanent shocks. Carroll (2000) models consumption decisions when consumers have utility functions featuring habits and show that the optimal consumption response

IV. Conclusion

We analyze the effect of import competition on household balance sheets using individual data on consumer finances. We exploit variation in local industry exposure to foreign competition to study households' response to the income shock triggered by China's accession to the WTO. We show that household debt increases significantly in regions in which manufacturing industries are more exposed to import competition. A one-standard-deviation increase in exposure to import competition explains around 20% of the cross-regional variation in household leverage growth between 1999 and 2007. The effects are driven by home equity extraction and are concentrated in areas with strong house price growth. Using data on individual expectations, we find that households in affected areas underestimate the persistence of income shocks and lever up to smooth consumption. Our results highlight the role played by mortgage markets in absorbing displacement shocks triggered by globalization.

While conditions during the early 2000s facilitated household borrowing, this is not a circumstance specific to our natural experiment nor does it imply that there are not broader economic lessons regarding household borrowing or financial stability. In particular, it is important to uncover the microeconomic conditions that contribute to households' credit cycles and thereby induce business cycles. Not only do households use the mortgage market to smooth consumption in response to income shocks, but severe consequences can obtain if their expectations turn out to be wrong. Our results also suggest that financial stability policies such as unemployment insurance or mortgage market regulations (e.g., LTV limits) could mitigate future crises.

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Appendix A: PSID Data Construction

We follow Blundell, Pistaferri, and Preston (2008) to construct the PSID panel. The full PSID sample from 1969 to 2017 has 827,384 observations,

to a negative permanent income shock will be weaker, potentially leading to borrowing to finance this excess consumption. In a similar vein, Bertrand and Morse (2016) look at the role of external habit on the consumption profile of households. Chetty and Szeidl (2016) show that households do not respond one to one to permanent shocks when they have "consumption commitments," that is, when they own goods such as housing that cannot be adjusted in response to fluctuations in income. The illiquidity of these goods creates excessive smoothness of consumption, leading to a dampened response of consumption to income shocks, permanent or transitory, and therefore to potentially higher borrowing. This might explain the finding in Pistaferri (2001) that the marginal propensity to save out of permanent shocks is significantly different from zero. We leave a proper quantification of this channel to future research.

including 20,516 observations in 1999. After imposing the filters from Blundell, Pistaferri, and Preston (2008) for geography (nonmissing), keeping only household heads who have been head for at least two years and with age between 20 and 65, we have 225,324 observations over the sample, including 5,411 observations in 1999. For our analysis, we need the industry of occupation from the PSID: After matching the PSID Census industry codes to SIC industries, we end up with a sample of 948 observations, 723 of which are available both in 1999 and 2007.

Appendix B: Comparison to the Literature

In what follows, we compare the magnitudes of our estimates on income with those of ADH, Pierce and Schott (2016), and Acemoglu et al. (2016). Summary statistics are presented in Table B.1 to ease exposition.

We start by plugging SC in ADH's main specification. In Panel A of Table B.2, we replicate ADH's analysis in the 2000 to 2007 subperiod using SC as the instrument for Chinese import growth instead of their own. The dependent variable is the 10-year equivalent percentage change in average and median annual household income or wage per working-age adult (in percentage points).[31] In columns (1) and (2), we find that a 1-percentage-point decrease in SC is associated with a 0.47% and 0.67% decline in average income and wages, respectively. Given the interquartile range of SC across CZs (1.6%), this translates into a 0.75% and 1.1% decrease in income and wages. Furthermore, given the cross-sectional standard deviation of the percent change in income is 10.8%, a one-standard-deviation change in SC (2.3%) accounts for 10% to 14% ($2.3\% \times [0.47, 0.66]/10.8\%$) of the cross-CZ variation in income and wages, respectively.

Comparison with ADH. In table 9 of ADH, a $1,000 increase in import penetration per worker is associated with a 10-year equivalent reduction in income of 1.5% and with a 2.15% reduction in wages. Given the interquartile range across CZ of $2,000 per worker, this translates into a 3% decrease in average income and a 4.3% decrease in average wages. In Panel B of Table B.2, we replicate ADH's analysis of the effect of import competition on income and wages for the 2000 to 2007 subperiod, which is the focus of our paper. The effect of import growth on income and wages is not statistically significant in this subperiod. Yet, for an increase in imports of $2,000 per worker (the interquartile range across CZ), the point estimates suggest a decline by 1% to 1.7% in average income and wages, respectively, and of 1.1% to 1.8% in median income and wages, respectively. Furthermore, given the cross-sectional standard deviation of income growth (10.8%), a one-standard-deviation-increase in their instrument (3.02%) explains $0.54 \times 3.02/10.8 = 15\%$ of the cross-CZ variation in income growth in the 2000 to 2007 subperiod. These estimates are very much in line with our findings in Panel A of Table B.2 using SC.

[31] All replication material can be found here: https://doi.org/10.1257/aer.103.6.2121.

Table B.1
Summary Statistics

Table B.1 presents summary statistics at the CZ level of our measure of import exposure, *Shipping Costs* (SC), and the measures of import exposure found in ADH, Pierce and Schott (2016), and Acemoglu et al. (2016). We also report statistics for the average change in income by CZ across both the 1990 to 2000 and the 2000 to 2007 subperiods. The change in income for the 2000 to 2007 period is adjusted to be comparable with a 10-year income change. SCs are calculated using industry shares and the SC of industries in 1998.

	N	Mean	Std. dev.	25th pct.	Median	75th pct.
Import Exposure						
Shipping Costs						
	715	0.0492	0.0233	0.0375	0.0441	0.053
NTR Gap: Pierce and Schott (2016)						
	715	0.256	0.0514	0.229	0.264	0.29
Acemoglu, Autor, Dorn, Hanson, and Price (2016)						
	715	1.07	1.06	0.333	0.776	1.5
(Δ imports from China to US)/worker (in 1000s of $): Autor, Dorn and Hanson (2013)						
Full Sample	1,444	1.91	2.58	0.434	1.18	2.49
1990 to 2000	722	1.18	1.78	0.261	0.746	1.41
2000 to 2007	722	2.64	3.02	0.879	1.94	3.44
Percent Change in Total Income (10-year equivalent change)						
Full Sample	1,444	11.8	12.4	1.9	12.6	20.8
1990 to 2000	722	19.8	7.84	15.3	19.6	24.1
2000 to 2007	722	3.73	10.8	−3.29	1.9	8.91
Percent Change in Wages Salary (10-year equivalent change)						
Full Sample	1,444	12.9	12.6	3.51	12.9	21.4
1990 to 2000	722	20.6	9.26	14.9	19.9	25.7
2000 to 2007	722	5.32	10.8	−2.07	4.11	11

Comparison with Pierce and Schott (2016). In Panel A of Table B.3, we replace ADH's instrument with Pierce and Schott (2016)'s instrument, the NTR gap, which we aggregate at the CZ level to make it comparable to SC and the ADH instrument. The interquartile range of the NTR gap is 0.06. Moving from the 25th to the 75th percentile of the NTR gap thus leads to a drop by 1.68% and 2.5% ($0.06 \times [28, 42]$) in average income and wages. The effects on median income and wages are smaller and boil down to a $19 \times 0.06 = 1.14\%$ decrease in median income and a $34 \times 0.06 = 2\%$ decrease in median wages. Furthermore, a one-standard-deviation increase in NTR (0.05) accounts for 13% and 20% of the cross-CZ variation in average income and wages ($0.05 \times [-28.1, -42.5]/10.8$). These estimates are in line with the estimates from Table B.2, Panel A.

Comparison with Acemoglu et al. (2016). In Panel B of Table B.3, we replace ADH's instrument with the industry-level change in import competition from Acemoglu et al. (2016), which we aggregate at the CZ level to make it comparable to SC and the ADH instrument. The estimates are not statistically different from zero, except for average wages (column (2)). The interquartile range of the instrument is 1.2, such that moving from the 25th to the 75th percentile

Table B.2

Change in Household Income and Wages, 2000 to 2007, Comparison with ADH

Table B.2 presents regressions of the change in household income on both *Shipping Costs* (SC) (Panel A) and instrumented imports from China (Panel B). The dependent variable is the 10-year equivalent percentage change in average and median annual household income per working-age adult (in percentage points). Per capita household income is defined as the sum of individual incomes of all working-age household members (age 16 to 64), divided by the number of household members of that age group. Total income comprises wage and salary income; self-employment, business, and investment income; social security and welfare income; and income from other nonspecified sources. All regressions include the following commuting zone (CZ)-level controls taken at the beginning of the period (1999): the percentage of employment in manufacturing, the percentage of college-educated population, the percentage of foreign-born population, the percentage of employment among women, the percentage of employment in routine occupations, the average offshorability index of occupations, and census division dummies. Details on the construction of these variables can be found in ADH. Models are weighted by beginning-of-period CZ share of national population. Robust standard errors in parentheses are clustered at the state level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A. Shipping Cost Instrument

	Average HH Income/Adult		Median HH Income/Adult	
	Total	Wage Salary	Total	Wage Salary
	(1)	(2)	(3)	(4)
Shipping Costs	47.303*	66.730***	52.930**	59.050*
	(24.766)	(24.467)	(25.587)	(32.060)
Observations	715	715	715	715
R^2	0.47	0.59	0.52	0.54

Panel B. Import Penetration—ADH Instrument

	Average HH income/adult		Median HH income/adult	
	Total	Wage-salary	Total	Wage-salary
	(1)	(2)	(3)	(4)
(Δ imports from China	−0.537	−0.862	−0.575	−0.934*
to US) / worker	(0.461)	(0.547)	(0.451)	(0.554)
Observations	722	722	722	722
R^2	0.44	0.56	0.50	0.50

leads to a percent reduction in average income and wages of 0.8% to 1.9% ($1.2 \times [0.7, 1.5] \simeq [0.8, 1.9]$). Furthermore, a one-standard-deviation increase in the instrument (1.06) accounts for $1.06 \times 0.7/10.8 = 7\%$ of the cross-CZ variation in average income and $1.06 \times 1.6/10.8 = 15\%$ of the cross-CZ variation in average wages. This is in line with the predictive power of SC for income and wage growth.

We conclude that the magnitude of the effect of SC on income is comparable with the extant literature.

Table B.3

Change in Household Income and Wages, 2000 to 2007, Comparison with Pierce and Schott (2016) and Acemoglu, Autor, Dorn, Hanson, and Price (2016)

Table B.3 presents regressions of the change in household income on both the NTR Gap from Pierce and Schott (2016) (Panel A) and imports from China from Acemoglu et al. (2016) (Panel B). The dependent variable is the 10-year equivalent percentage change in average and median annual household income per working-age adult (in percentage points). Per capita household income is defined as the sum of individual incomes of all working-age household members (age 16 to 64), divided by the number of household members of that age group. Total income comprises wage and salary income; self-employment, business, and investment income; social security and welfare income; and income from other nonspecified sources. All regressions include the following commuting zone (CZ)-level control taken at the beginning of the period (1999): the percentage of employment in manufacturing, the percentage of college-educated population, the percentage of foreign-born population, the percentage of employment amount women, the percentage of employment in routine occupations, the average offshorability index of occupations, and census division dummies. Details on the construction of these variables can be found in ADH. Models are weighted by beginning-of-period CZ share of national population. Robust standard errors in parentheses are clustered at the state level. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Panel A. Pierce and Schott (2016)

	Average HH Income/Adult		Median HH Income/Adult	
	Total (1)	Wage Salary (2)	Total (3)	Wage Salary (4)
NTR Gap	−28.123*	−42.514**	−19.370	−33.845*
	(14.898)	(16.480)	(13.779)	(18.011)
Observations	715	715	715	715
R^2	0.47	0.59	0.52	0.54

Panel B. Acemoglu, Autor, Dorn, Hanson, and Price (2016)

	Average HH income/adult		Median HH income/adult	
	Total (1)	Wage-salary (2)	Total (3)	Wage-salary (4)
(Δ imports from China	−0.709	−1.566*	−0.833	−1.436
to US) / initial absorption	(0.726)	(0.843)	(0.779)	(0.922)
Observations	715	715	715	715
R^2	0.47	0.59	0.52	0.54

Appendix C: Consumption Response to Income Shocks

We start solving a simple model of consumption insurance. We assume that an agent maximizes lifetime expected utility

$$U_0 = \sum_{h=0}^{\infty} \beta^h u(c_h),$$

subject to the budget constraint

$$b_t + c_t \leq R^{-1} b_{t+1} + y_t,$$

where b_t is agents' demand for a riskless bond with price R^{-1} and y_t is the labor income process.

To fix ideas, we assume that $\beta = R^{-1}$ and that utility is quadratic and follows $u(c_t) = -(c_t - \gamma)^2/2$. Under these assumptions, the Euler equation is $c_t = \mathbf{E}_t c_{t+1}$. Given a boundary condition, we are able to solve for the level of borrowing given current borrowing as follows:

$$b_{t+1} = b_t + (\beta^{-1} - 1) \sum_{k=0}^{\infty} \beta^k \mathbf{E}_t y_{t+k} - \beta^{-1} y_t.$$

Given that income follows an AR(1) process of the form

$$y_{t+1} = \bar{y} + \rho(y_t - \bar{y}) + \varepsilon_{t+1},$$

we are able to solve for the future level of borrowing using the law of iterated expectations:

$$b_{t+1} = b_t - \frac{1 - \rho}{1 - \beta\rho}(y_t - \bar{y}).$$

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Appendix S1: Internet Appendix.
Replication Code.