Cutting Back on Labor Intensive Goods? Implications for Fiscal Stimulus

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Abstract

I show that the effectiveness of fiscal stimulus as a tool for counter-cyclical stabilization depends not only on *how much* of changes in income households spend, but also on the *composition* of that expenditure. By combining expenditure and production data I measure the extent to which households cut back expenditure on labor-intensive goods upon unemployment. The result is quantitatively relevant because the labor share with which different final consumption goods are produced varies widely across the economy. I find that upon unemployment, a household reduces demand for other workers' labor by 6.5%, 15% more than what is implied when heterogeneity in production and expenditure is ignored. In the context of the Great Recession, the expenditure response to unemployment accounts for a fifth of the drop in labor compensation. Using a multi-good, multi-sector New-Keynesian model with heterogeneous agents, I show that my findings have significant implications for the targeting and evaluation of fiscal stimulus. First, the fiscal multiplier of government purchases of labor-intensive goods is almost five times larger than for purchases of capital-intensive goods. Second, the heterogeneity I document explains the lower effectiveness to stimulate the economy of capital-intensive military spending, as compared to highly labor-intensive general government spending. Third, I show that the decline of the labor share in the last decades has reduced the effectiveness of fiscal policy.

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1 Introduction

Many countries around the world responded to the Great Recession with fiscal stimulus. For example, in the United States, the American Recovery and Reinvestment Act of 2008, a package of $800 billion, included tax cuts, government purchases, and transfers. Fiscal stimulus packages such as this one succeed at raising output only if they increase aggregate demand for goods and only if this increased demand for goods leads to an increase in aggregate demand for labor. The first of these requirements – whether fiscal stimulus raises demand for goods – has been well-studied. For instance, it has been found that stimulus programs are most effective when targeting households with high marginal propensity to spend.[1] However, much less is known about the second requirement – whether this increased goods demand actually translates into an increased labor demand. While in a one-good model there is an immediate mapping from demand for goods to demand for labor, in reality different goods are produced with very different labor intensities and so, the extent to which higher demand for goods leads to higher demand for labor is an empirical question.

In this paper, I study empirically and theoretically whether fiscal stimulus can effectively raise labor demand. First, I document how households change the composition of their expenditure bundles upon becoming unemployed and relate it to the labor share with which those goods are produced. Second, I build a model that reproduces such heterogeneity in consumption and production to assess its implications for fiscal stimulus.

I show that households who become unemployed disproportionately cut back expenditures on labor-intensive goods. Upon unemployment, households barely change expenditures on goods with very low labor shares such as communications, utilities, housing, and food at home. However, they decrease expenditures on goods with high labor shares, such as food away from home, clothing, and domestic services, by more than 10%.

Quantitatively, the composition of the expenditure response to unemployment matters because different goods are produced with significantly different labor shares. The average labor share of Personal Consumer Expenditures is 0.53, indicating that 53 cents of every dollar spent by a consumer are paid out as compensation to workers. But the labor share

[1] Parker et al. (2013), Oh and Reis (2012), Kaplan and Violante (2014).

varies widely across the economy. While only 23 cents of every dollar spent on housing are paid out as labor compensation, 80 cents of every dollar spent on domestic services are received by workers.

The drop in aggregate labor demand due to the expenditure response to unemployment is large. When a household becomes unemployed, it decreases demand for other workers' labor by 6.5%, a seventh of which is explained by the composition of the expenditure bundle changing. Between 2007 and 2009, the expenditure response to unemployment accounted for a fifth of the drop in labor compensation.

To account for the varying degrees of labor intensity of the different industries involved in the production of each final good, I use the network-adjusted labor share.[2] The network-adjusted labor share measures how much of the value of the final good is paid out to workers along the entire supply chain, and not just by the final industry. For instance, when purchasing a muffin at a cafeteria, standard measures of the labor share would only count the compensation to workers involved in the production of the muffin in that cafeteria. Instead, the network-adjusted labor share also takes into account the compensation to workers producing and distributing the flour, sugar, and milk used to produce the muffin. My results are robust to using labor shares of the final industries and to defining labor intensity as labor requirement or output elasticity of labor demand.

I use a difference-in-difference strategy with household fixed effects to estimate responses of household expenditure to unemployment. My strategy exploits that the Consumer Expenditure Survey collects data on both expenditures and employment status twice for each household in the sample. In my estimation framework, household fixed effects capture any static characteristics such as household head's gender and education and, critically, household's preferences and socioeconomic status. Time fixed effects account for any long term trends and seasonality patterns affecting all households equally. Additionally, I include demographic controls to account for changes in the age of the household head and in the household composition.

[2] Baqaee (2015) computes the network-adjusted labor share by industry and for final aggregate components of the GDP. Valentinyi and Herrendorf (2008) compute the network-adjusted labor share for aggregate consumption and investment goods. I further disaggregate the network-adjusted labor share for fourteen different consumption goods. Horowitz and Planting (2009) refer to the network-adjusted labor share as the (labor) income requirements matrix.

The expenditure responses to employment and unemployment are fairly symmetric. I allow differential effects for households that move from unemployment to employment and for those that move from employment to unemployment. I find that total expenditure drops by 3% when the household head becomes unemployed and rises by 1.4% when he/she becomes employed, but the difference is not statistically significant. Furthermore, the expenditure responses on individual goods are also symmetric. Housing and food at home do not significantly vary with changes in employment status. But expenditures on food away from home, domestic services, recreation, and private transportation drop by more than 10% upon unemployment and rise by more than 10% upon employment.

The positive correlation between expenditure response to employment and labor share is driven by households reducing home production or purchasing work-related goods, rather than reacting to a change in permanent income. I use cross-sectional variation to decompose the expenditure response of individual goods into a response to total expenditure and a response to employment while keeping total expenditure constant. While the elasticity of expenditure on individual goods to total expenditure does not correlate with labor share, the elasticity to employment does. The correlation that I document is then not just explained by households cutting back on luxuries upon unemployment because of the associated drop in permanent income or borrowing constraints binding.

To evaluate the implications of heterogeneity in consumption and production for fiscal stimulus, I build and calibrate a model that matches the empirical evidence. On the production side of the economy, there are three sectors with different labor shares producing two consumption goods and one investment good. On the consumption side, households are heterogeneous on wealth, productivity, and employment status. Furthermore, unemployed households engage in home production, which induces a disproportionate reduction in their market demand for the labor-intensive good. Nominal rigidities in the price setting of final goods determine the strength of the aggregate demand externality in transitions outside the steady state.

On impact, the GDP multiplier of government purchases of labor-intensive consumption goods is almost five times larger than the one for purchases of capital-intensive goods. While a model without heterogeneity yields a fiscal multiplier of 0.43, in the model with heterogeneity the multiplier is 0.85 and 0.18 for labor-intensive and capital-intensive goods, respectively. To the old Keynesian notion that fiscal stimulus programs should target labor-intensive sectors, my model offers quantitative results on how different the effects of alternative policy instruments are. Furthermore, the recent decline on the labor share has reduced the effectiveness of fiscal policy and increase the difference among instruments.

Accounting for heterogeneity helps explain the different estimates for the size of the fiscal multiplier found in the literature. The fiscal multiplier has been estimated empirically using two alternative frameworks: (i) vector auto-regression models that assume government purchases do not affect the economy immediately and (ii) changes in military spending, which are assumed to be exogenous to economic conditions. Estimates of the fiscal multiplier using the latter approach have generally been lower. Consistent with my findings, the gap can be explained by the different labor shares of those government purchases. While military spending is fairly capital-intensive, regular government expenditures are very labor-intensive.

My paper contributes to several strands of literature. First, I contribute to the literature on the labor share (Baqaee, 2015; Valentinyi and Herrendorf, 2008; Karabarbounis and Neiman, 2014) by computing labor shares by final good (instead of by industry), by documenting the wide heterogeneity in labor shares across consumption goods, and by quantifying the impact of the decline in the labor share on fiscal multipliers. Second, I contribute to the literature on the expenditure response to unemployment (Gruber, 1997; Hendren, 2015; Ganong and Noel, 2015) by estimating the responses of expenditure on individual goods and finding significant heterogeneity consistent with explanations based on home-production and reductions on work-related expenses as in Aguiar and Hurst (2013). Third, I find a positive correlation between expenditure responses to employment and labor shares. This result complements recent work by Jaimovich, Rebelo, and Wong (2015) who find that in recessions expenditure on pricier, higher-quality, and relatively more labor-intensive goods falls disproportionately. Fourth, I contribute to the New-Keynesian literature (Christiano, Eichenbaum, and Evans, 2005; Kaplan, Moll, and Violante, 2016; McKay and Reis, 2016) by building a multi-good, multi-sector, heterogeneous agent model with home production and realistic expenditure responses to changes in employment. Fifth, I contribute to the empirical literature estimating the size of the fiscal multiplier (Blanchard and Perotti, 2002; Perotti, 2005; Barro and Redlick, 2011; Ramey and Shapiro, 1998) by showing that the lower effectiveness of military spending at stimulating the economy can be explained quantitatively by its relatively lower labor share.

The rest of the paper is structured as follows. In Section 2, I document that households disproportionately cut back expenditures on labor-intensive goods upon unemployment. In Section 3, I describe the framework that I use to quantify the effects of the mechanism. In Section 4, I discuss my calibration strategy and some steady state results. In Section 5, I explore the implications of my model for fiscal policy. Finally, Section 6 concludes.

2 Measuring the Labor Intensity of the Expenditure Response to Employment

Upon employment, households disproportionately increase their expenditures on goods and services that are very labor-intensive. In this section, I document these facts combining data from consumer surveys and national accounts.

2.1 Labor Share of Different Consumption Goods

Contrary to what is implied by standard one-sector models, the labor share varies widely across the economy. First, I discuss the computation of my preferred measure of labor intensity, the network-adjusted labor share. Then, I show that the network-adjusted labor share implies significant heterogeneity in the use of labor in the production of different consumption goods, a fact that is robust to alternative definitions of labor intensity.

2.1.1 Methodology

I use the network-adjusted labor share[3] to measure labor intensity for different final goods in the economy. Intuitively, the network-adjusted labor share captures the fraction of the value of the final good that is paid out as labor compensation across the good's entire supply chain, and not just by its final industry. For instance, 50% of the value of a burger bought

[3]Baqaee (2015). Horowitz and Planting (2009) refer to it as the labor income requirement matrix.

at a restaurant[4] is created at the restaurant,[5] 8% is created during the manufacturing of the bread and the beef,[6] 4% is added by the management of the company,[7] and so on. The network-adjusted labor share for that burger is then the average labor share of the different industries involved in its production, each weighted by the fraction of the value they add to the burger.

The network-adjusted labor share is computed using the Input-Output tables. Formally, the network-adjusted labor share of final good k, s_k, is given by:

$$s_k = \omega \, \Gamma \, y_k$$

where ω is the vector of labor compensation as a fraction of total output by industry and Γ is the Domestic Requirements Matrix,[8] a matrix indicating the amount of domestically produced output that each industry needs to deliver one dollar of commodity to final users. Vector y_k' maps the use of each commodity to final goods using the Personal Consumption Expenditures Bridge. I further aggregate consumption categories as indicated in Table A.1. Further details on the approach to Personal Consumer Expenditures data and on the computation of the labor share are presented in Appendices A.1 and A.2.

2.1.2 Results

Out of each dollar that a consumer spends on domestically produced goods and services, 53 cents are paid out as labor compensation to American workers. Personal Consumer Expenditures are less labor-intensive than the economy as a whole, which has an average labor share of 0.58. Exports have a similar labor share, 0.54. On the other hand, investment and government purchases are more labor-intensive, with labor shares of 0.62 and 0.71 respectively. My findings are consistent with Valentinyi and Herrendorf (2008), who also document

[4] Commodity: Purchased meals and beverages.

[5] Industry: Food services and drinking places.

[6] Industry: Food and beverage and tobacco products.

[7] Industry: Management of companies and enterprises.

[8] I differ from previous work on the network-adjusted labor share (Baqaee, 2015; Valentinyi and Herrendorf, 2008) by using Domestic Requirements instead of Total Requirements. The Domestic Requirements Matrix is computed after subtracting imports from the use table. My measure of the labor share then captures the fraction of value of each good that is received as compensation by American workers. Given that my focus is on fiscal stimulus of the domestic economy, the use of the domestic network-adjusted labor share is appropriate. The difference is nevertheless not large and not critical for my results.

that consumption goods are relatively less labor-intensive than investment goods.

There is wide heterogeneity in the labor share of different consumption goods (Figure 1). Using the Personal Consumer Expenditures Bridge, I compute the network-adjusted labor share for each category of final consumption. While housing has a labor share of only 0.23 and utilities and communications have labor shares slightly above 0.40, education and domestic services have labor shares greater than 0.75.

Goods that are produced with a high labor share also employ more workers per dollar of output. As an alternative measure of labor intensity, I define labor requirement as the number of employees required to produce a million dollars of each final consumption good.[9] I find that producing a million dollars of domestic services requires 19 workers, whereas a million dollars of housing, communications, or utilities requires less than 6 (Figure 2). On average, a million dollars of the consumption good requires 9 workers to be produced. These two measure of labor intensity, labor share and labor requirement, are strongly correlated (Figure 3).

I find similar heterogeneity using other common measures of labor intensity. The network-adjusted labor share is strongly correlated with two measures of the labor share that the literature has previously used and that do not use requirements matrices in their computation: the gross and value-added labor shares (Figure 4).[10] A more challenging concern relates to the fact that labor shares are averages, rather than marginal variables. The production of cars is relatively capital-intensive, but if the automobile industry responds to drops in demand mainly by firing workers, the labor share would not be a good metric of changes in labor compensation. In Appendix A.3, I address this concern by estimating the output elasticity of labor demand for different industries and comparing it to their labor requirements. I find that industries that hire more workers per million dollars of sales also show a more responsive labor demand to changes in output.

[9]Hugie Barello (2014) uses a similar measure but employing the Total Requirements Matrix instead of the Domestic Requirements Matrix in her calculations.

[10]To produce labor shares for goods, rather than for industries, I average the labor shares of the different industries producing a final good weighting them by their market share as implied by the make table.

2.2 Expenditure Response to Employment

In this subsection, I document that households who become employed disproportionately increase expenditures on goods that are very labor intensive. First, I discuss the data and identification strategy used to estimate the response of expenditure on individual goods to employment. Second, I show my baseline results. Third, I argue that the correlation between labor share and expenditure response to employment appears driven by changes in employment status, rather than by changes in permanent income. Fourth, I show that the response to employment and to unemployment are fairly symmetric.

2.2.1 Data Description

To explore how household's expenditures respond to employment I use the Interview component of the Consumer Expenditure Survey (CEX henceforth). The CEX collects extensive information on the consumption choices of American households and it has been deployed since 1980 with relatively minor methodological changes.[11] The survey interviews each household every 3 months for 5 quarters and it provides quarterly expenditure data for the last four interviews. Employment and income data are collected in the second and fifth interviews, which allows me to compare the change in a household's expenditure bundle after changes in employment status. For each household, I keep only the two interviews with employment data.[12] I use all waves between 1980 and 2014.

To connect production and expenditure data, I try to harmonize the categories of consumption goods in the CEX with those in the national accounts. I split household expenditures in the same fourteen categories as the previous subsection: clothing, communications, education, food at home, food away from home, health care, housing, recreation, utilities, domestic services, consumer durables, private transportation, public transportation, and other. Further details on the data construction are provided in Appendix A.4. Table 1 summarizes the expenditure shares of the households in my sample. Housing is the largest category, accounting for 30% of total expenditure on average. Private transportation and food at home

[11] Appendix A.4 describes minor corrections required to ensure comparability across the sample period.

[12] I refer to them as the first and second interview going forward, although they correspond to the second and fifth interviews in the CEX.

are also major expenditure categories, accounting for 15% and 13% of total expenditures on average, respectively.

2.2.2 Identification Strategy

I exploit within-household variation to identify the expenditure response to employment from the panel dimension of the CEX. Formally, I estimate the following regression separately for each good j:

$$y_{i,j,t} = \beta_j \text{ Employed}_{i,t} + \kappa_{i,j} + \tau_{j,t} + \gamma_j \, X_{i,t} + \epsilon_{i,j,t}$$

where $y_{i,j,t}$ is the expenditure share or log real expenditure on consumption good j in household i in quarter t, Employed$_{i,t}$ is a dummy equal to 1 if household i was employed in quarter t. $\kappa_{i,j}$ is a household fixed effect and $\tau_{j,t}$ is a time fixed effect for the month in which the interview was conducted. $X_{i,t}$ includes demographic controls: head's age, family size, and family type as defined by demographics of other members of the household (e.g. married couple only, married couple with oldest child under 6 years all, etc.).

My parameter of interest is β_j, the response of expenditure or expenditure share of good j to employment. The parameter is identified from households who move into and out of employment between interviews. When the dependent variable is the expenditure share, a positive value of β_j indicates that expenditure on good j grows as a fraction of total expenditure upon employment and decreases upon unemployment. On the other hand, when the dependent variable is the logarithm of expenditure on good j, β_j measures the semielasticity of expenditure on good j to employment, i.e. the percent change in expenditure of good j when the household moves from unemployed to employed.

My identification assumption is that changes in expenditure for households that became employed would have been the same than changes experienced by comparable households that remained unemployed absent the employment shock. A symmetric assumption is needed for households that moved from employment to unemployment. In my specification, household fixed effects control for any time-invariant household characteristics such as household's head education, preferences, and socioeconomic status. The month of the interview time fixed-effect flexibly controls for seasonality, business cycle variation, and long-term trends affecting expenditures patterns of all households equally. Finally, demographic controls isolate changes in expenditures resulting from predictable variations in household composition.

In my baseline specification, I define a household to be employed if the head of the household reports working a positive number of hours regularly. Because household heads tend to have a stable participation in the labor force, focus on their employment status alleviates concerns about an endogenous response of labor supply to shocks that are themselves affecting the expenditure patterns of the household. For instance, a high-school student graduating and joining the labor force simultaneously increases the household labor supply and decreases the share of education on the household expenditure bundle. But the negative correlation between employment status and expenditure share of education is not causal as it is driven by an omitted variable. Using the household head's employment status mitigates this endogeneity concern.

My results are robust to two alternative definitions for the employment status of the household. First, I restrict my sample to households with male heads, for whom the attachment to the labor force tends to be the most stable. Second, I base household employment status on the change in the number of earners between interviews. When the number of earners in the household drops, I say that the household has become unemployed. And when it rises, I identify the household as having become employed.

Finally, the estimated expenditure responses to employment are explained by unemployment, rather that by retirement. While I cannot differentiate unemployment from out of the labor force status from occupational questions in the CEX, I show that restricting the sample to households with heads younger than 50 does not affect my results.

2.2.3 Results

Total expenditure increases by 2.5% upon employment. Consistent with prior findings in the literature, I find that households increase total expenditure when they become employed and cut back when they become unemployed. My estimates of the drop in expenditure upon unemployment are slightly lower than what previous research has found. For instance, Saporta-Eksten (2014) finds a drop of 8% in total expenditure upon unemployment using the Panel Study of Income Dynamics, whereas Christelis, Georgarakos, and Jappelli (2014) estimate a decrease of 10% in the Internet Survey of the Health and Retirement Study. My lower point estimate of the expenditure response with respect to previous work likely follows from differential severity of the unemployment/employment spells studied. Because I am only able to capture relatively mild unemployment/employment spells in my research design by comparing households' employment status less than a year apart, my results are likely to be a lower bound on the effect of unemployment on expenditure.

However, there exists significant heterogeneity in the expenditure responses to employment of different goods (Figure 5). While expenditures on food at home, housing, communications, and utilities barely change upon employment; expenditures on food away from home, recreation, domestic services, private transportation, and other goods rise by more than 10%. As a consequence, housing decreases by a percentage point as a fraction of total expenditure when a household becomes employed. The results are consistent with households disproportionately raising their expenditures on work-related expenses (e.g. clothing, food away from home, transportation) and substitutes of home-produced goods (e.g. domestic services, recreation) upon joining the labor force.

The heterogeneity in the estimated expenditure response to employment is consistent with what has been documented in other settings before. Also using CEX data, Aguiar and Bils (2015) document that retired households reduce their expenditure on work-related goods and on goods that can be home-produced. Ganong and Noel (2015) use checking accounts data of unemployment insurance recipients and document a large drop on work-related expenses particularly at the onset of unemployment spells.

The expenditure response to employment across different goods is positively correlated with the labor share with which they are produced. The categories of expenditure in Figure 5 are sorted in ascending order by the network-adjusted labor share as documented in Figure 1. Goods whose expenditure barely change upon employment are produced with very low labor intensity (e.g. housing, utilities, communications, and food at home). On the other extreme, households increase their expenditure disproportionately on goods that are very labor intensity when they become employed (e.g. food away from home, clothing, domestic services).

My results are robust to a number of alternative specifications. I find that defining employment by the occupational status of the male household head (Figure 6) or by the change in the number of earners (Figure 7), and limiting the sample to young households as defined by the head's age (Figure 8) do not affect the heterogeneity in the expenditure response to unemployment. Housing, utilities, and food at home still fall as a fraction of total expenditure upon employment, whereas food away from home, domestic services, private transportation, and durables rise.

2.2.4 Decomposition Exercise

When a household becomes employed, it will adjust its expenditures for two reasons. First, upon employment, the household's permanent income will rise and its borrowing constraint will be relaxed. As a result, expenditure on normal goods will increase and expenditures on inferior goods will drop. Second, the household will have less time available for home production and will have to purchase some goods to go to work. In this subsection, I decompose the expenditure response to employment into these two major components. Formally, I estimate the following specification separately for each good j:

$$y_{i,j,t} = \beta_j \text{ Employed}_{i,t} + \eta_j \text{ Total Expenditure}_{i,t} + \tau_{j,s} + \gamma_j\, X_{i,t} + \epsilon_{i,j,t}$$

where $y_{i,j,t}$ is the log real expenditure on consumption good j in household i in quarter t, $\text{Employed}_{i,t}$ is a dummy equal to 1 if household i was employed in quarter t, $\text{Total Expenditure}_{i,t}$ is the household log total expenditure in period t, $\tau_{j,t}$ is a time fixed effect for the month in which the interview was conducted. $X_{i,t}$ includes household controls (family size and family type) and controls for the head of the household (age, marital status, race, gender, and education).

The parameters of interest are η_j, the response of individual goods to total expenditure, and β_j, the response of individual goods to employment that is orthogonal to changes in total expenditure. The specification corresponds to a log-linear approximation of the Engel curves. Previous work has mainly focused on the estimation of η_j, but I exploit the framework to also identify β_j. Together, η_j and β_j permit the decomposition of the expenditure response to employment into a permanent income or relaxed borrowing constraints component (η_j) and a home-production or work-related expenses component (β_j).

I estimate the coefficients η_j and β_j from the cross-section. Identifying η_j and β_j from within household variation is challenging given the strong correlation between employment and total expenditure documented previously. As such, I do not include household fixed effects for this decomposition exercise. Then, identification of β_j comes from comparing two households with similar demographics and level of total expenditure, but different employment status: one is employed and the other is unemployed. Identification of η_j comes from comparing two households with same the employment status and demographics, but different levels of total expenditure.

I address endogeneity concerns raised by measurement error by instrumenting total expenditure in the second interview with total expenditure in the first interview. Measurement error in the household expenditure of good j is captured by the residual but it is also accumulated in the household's total expenditure, biasing estimates of η_j. To deal with this concern, I follow Aguiar and Bils (2015) and I instrument total expenditure in the second interview with total expenditure in the first interview.[13] The relevance of the instrument comes from the strong correlation of total expenditure over time as expenditure follows a relatively stable permanent income. For this exercise, I only keep the final interview of each household.

The positive correlation between expenditure on individual goods and their labor shares is driven by the response to employment, rather than by the response to total expenditure. The responses of expenditure on individual goods to employment and total expenditure are shown in Figure 9. The estimated elasticities to total expenditures are in line with previous work (Aguiar and Bils, 2015). Housing presents a coefficient slightly greater than one, while utilities, communications, food at home, and public transportation all have a coefficient lower than one. Food away from home, domestic services, recreation, and clothing exhibit a more than proportional response to total expenditure, with a coefficient greater than one. The correlation between these responses to total expenditure and the labor share with which the goods are produced is 0.07. The estimated responses to employment are qualitative in line with my previous estimates using within-household variation. And the correlation between expenditure responses to employment and labor shares is 0.38, as households dis-

[13] I have also instrumented total expenditure with total income and the results are very similar.

proportionately respond to employment by increasing expenditure on very labor-intensive goods.

2.2.5 Symmetry of the Expenditure Response to Employment and Unemployment

In this subsection, I show that the expenditure response to employment changes is fairly symmetric. I separately estimate the change in expenditure for households who switch from employment to unemployment and for those who switch from unemployment to employment. The implicit assumption in my previous subsections that the drop in expenditure upon unemployment is the same than the increase in expenditure upon employment is not restrictive.

Formally, I restrict the sample to households that initially report being unemployed and estimate the following regression for each good j

$$y_{i,j,t} = \beta_j^{UE} \, \text{SwitchUE}_{i,t} + \kappa_{i,j} + \tau_{j,t} + \gamma_j \, X_{i,t} + \epsilon_{i,j,t}$$

And I estimate an analogous specification for households that initially report being employed

$$y_{i,j,t} = \beta_j^{EU} \, \text{SwitchEU}_{i,t} + \kappa_{i,j} + \tau_{j,t} + \gamma_j \, X_{i,t} + \epsilon_{i,j,t}$$

where $y_{i,j,t}$ is the expenditure share or log real expenditure on consumption good j in household i in quarter t, $\text{SwitchUE}_{i,t}$ is a dummy that takes the value of 1 if the head of household i was previously unemployed and has become employed in the second interview. Similarly, $\text{SwitchEU}_{i,t}$ is equal to 1 in the second interview if the household has become unemployed after reporting being employed in the first interview. Additionally, $\kappa_{i,j}$ is a household fixed effect, $\tau_{j,t}$ is a time fixed effect for the month in which the interview was conducted, and $X_{i,t}$ includes demographic controls: head's age, family size, and family type as described above. My parameters of interest in these specifications are β_j^{UE} and β_j^{EU}, which measure the response of expenditure on good j to the head becoming employed and becoming unemployed, respectively.

The expenditure response to employment and unemployment is fairly symmetric. Total expenditure drops by 3% when the head becomes unemployed and rises by 1.5% when he/she becomes employed (Figure 10). The difference is not statistically significant. Expenditures on housing and food at home decrease slightly upon unemployment and increase upon employment, but they are not significant from zero. On the other hand, expenditures on food away from home, recreation, domestic services, other, and private transportation drop by around 10% upon unemployment, and rise by a similar magnitude upon employment.

2.3 The Labor Intensity of the Expenditure Response to Employment

In this section, I combine my findings on the expenditure response to employment and the labor share of different goods to quantify the magnitude of the mechanism and assess its robustness.

Upon employment, households disproportionately increase their expenditures on goods whose production is very labor intensive. The correlation between the change in the expenditure share upon employment and the network-adjusted labor share is 0.76 (Figure 11). The correlation between the labor share and the expenditure response to employment is 0.61.

My results suggest a 6.5% drop in the household's demand for labor upon unemployment. In 2014, the average American household spent \$56 thousand, of which \$28 thousand[14] were received by American workers as labor compensation. Upon unemployment, the household reduces its expenditures on different goods at different rates, which decreases compensation to workers by 6.5% to \$26 thousand.[15] Furthermore, 15% of the drop is explained by the change in the composition of the expenditure bundle, rather than by the drop in total expenditure.

The decrease in the household's demand for other workers' labor upon unemployment explains a fifth of the drop in compensation to labor during the Great Recession. The

[14] I compute this figure by multiplying the amount spent on each good after excluding imports (using the expenditure weights of employed households) by its network-adjusted labor share.

[15] I compute this figure by applying the unemployment elasticities of expenditures estimated from Subsection 2.2 to the expenditure bundle of employed households and multiplying them by their network-adjusted labor share.

average unemployment rate in 2007 was 4.6%, but it rose to 9.3% in 2009.[16] The increase of unemployment (4.7 percentage points) multiplied by the estimated decrease in households' demand for other workers' labor upon unemployment (6.5%) implies a drop in the flow of expenditure towards workers of 0.3%. Between 2007 and 2009, labor compensation[17] decreased by 1.4%. Thus, the decrease in expenditure of unemployed workers explains 22% of the drop in labor compensation during the Great Recession.

The positive correlation between expenditure response to employment and labor share is a robust result. Using the network-adjusted labor shares from Subsection 2.1 and the expenditure responses to employment estimated in Subsection 2.2, I estimate the following regression:

$$\beta_j = \alpha_0 + \alpha_1 \text{Labor Share}_j + \epsilon_j$$

where β_j is the expenditure (or expenditure share) response to employment for good j and Labor Share_j is the network-adjusted labor share with which the good is produced. Table 2 presents the estimates for α_1 for alternative definitions of the labor share and the expenditure response. In my baseline specification, expenditure on goods with a 0.1 greater labor share increases by almost two percentage points upon employment. Across alternative specifications, the slope fluctuates between 0.14 and 0.33. In a similar way, the expenditure share of goods with a 0.1 greater labor share rises by a quarter of a percentage point upon employment. The result is stable across specifications.

3 A Model with Heterogeneous Goods in Consumption and Production

In this section, I propose a model to quantify the implications for fiscal stimulus of the heterogeneity in consumption and production documented in the previous section. The model features goods that are produced with different labor shares and whose demand depends on the employment status of consumers.

[16] The NBER dates the beginning of the Great Recession in December 2007 and its end in June 2009.

[17] As discussed in Appendix A.2, I compute labor compensation adjusting the compensation of employees by the ratio of total workers to employees to account for the labor component of entrepreneurial income.

3.1 Main Components

The model has no aggregate uncertainty, but individual agents are exposed to idiosyncratic shocks. Time is discrete. In the tradition of the Aiyagari-Bewley-Huggett models,[18] infinitely-lived households receive every period idiosyncratic productivity and employment shocks that cannot be insured away. Households are allowed to save only in risk-free savings accounts held with a competitive financial sector. The financial sector invests those savings in government bonds and productive capital. Households also own the firms and receive their profits.

The model features heterogeneity in both consumption and production. Heterogeneity in production is modeled with different industries having different labor shares. Heterogeneity in consumption responses upon unemployment is attained through the presence of home production. Heterogeneity in consumption could have been introduced in the model via non-homothetic preferences or adjustment costs. But based on the evidence on Subsection 2.2, a story of home-production appears more plausible.

Following the New-Keynesian literature,[19] I introduce nominal rigidities on prices to strengthen the aggregate demand channel. Firms are monopolistically competitive and pay an adjustment cost to change prices as in Rotemberg (1982). Every period, firms hire labor and capital, set their price, and pay back dividends to households. But fiscal stimulus programs have real effects in the economy even without nominal rigidities.

The model is completed by a government, a monetary authority, and labor unions. The government enacts fiscal policy via direct purchases, taxes on labor income, and unemployment insurance. The monetary authority sets the nominal interest rate using a Taylor rule. Labor unions prevent the labor market from clearing, introducing unemployment, and producing a positively-sloped labor supply. Labor unions in the model do not attempt to match the behavior of labor unions in the U.S. Instead, they are merely an abstraction to aggregate the discrete employment status of workers into a labor supply with a wage elasticity of one

[18] Aiyagari (1994), Bewley (1986), and Huggett (1996) are the foundational references in this literature. Brinca et al. (2016) offer a recent and related application by studying the impact of wealth inequality on the effectiveness of fiscal stimulus in the context of a life-cycle heterogeneous agent model.

[19] Clarida, Gali, and Gertler (2000), Smets and Wouters (2007), Christiano, Eichenbaum, and Evans (2005), Zubairy (2014) are representative agent models with nominal rigidities. Kaplan, Moll, and Violante (2016) and McKay and Reis (2016) are recent examples of heterogeneous agent New Keynesian models.

and no wealth effect.

3.2 Households

In the model, households are both consumers and workers. There is a continuum of households of measure one. An individual household starts period t with wealth level a_t, permanent productivity shock z_t^P, transitory productivity shock z_t^T, and employment status e_t, a 0 or 1 variable indicating whether the household is unemployed or employed, respectively. Households may differ in their degree of patience, β_h. Denote $\mu_t(\beta_h, a_t, z_t^P, z_t^T, e_t)$ the joint distribution of individual states at time t.

Households have preferences over consumption goods that are represented by the utility function

$$E_0 \sum_{t=1}^{\infty} \beta_h^t u(c_{1,t}, c_{2,t})$$

with

$$u(c_{1,t}, c_{2,t}) = \begin{cases} \dfrac{\left[c_{1,t}^{1-\nu}\ c_{2,t}^{\nu}\right]^{1-\gamma}}{1-\gamma} & \text{if } \gamma \neq 1 \\ (1-\nu)\ \ln c_{1,t} + \nu\ \ln c_{2,t} & \text{if } \gamma = 1 \end{cases}$$

$$c_{1,t} = x_{1,t}$$

$$c_{2,t} = \left[\psi\ x_{2,t}^{\rho} + (1-\psi)\ (1-e_t)^{\rho}\right]^{\frac{1}{\rho}}$$

where consumption of good 1 (c_1) is equal to market purchases of good 1 (x_1), but good 2 can be home produced if the household is not employed. The parameters ψ and ρ govern how the expenditure bundle of a household changes upon unemployment. In particular, if $\psi = 1$, there is no home production and the household always spends a share ν of total expenditure on good 2, regardless of its employment status. If $\psi < 1$, upon unemployment the household home-produces some of good 2 and so, its expenditure on the good drops disproportionately, biasing the expenditure bundle towards good 1.

Households are subject to permanent and transitory productivity shocks that determine their earnings. The permanent shock follows a discrete first-order Markov process given by matrix P. The transitory shock is independent and identically distributed over time. If employed in period t, earnings before tax are given by

$$z_t = e^{z_t^P + z_t^T}$$

Households do not choose their employment status. Instead they experience an exogenous employment shock every period. When $e_t = 0$, the household is unemployed and receives unemployment insurance. When $e_t = 1$, the household is employed and receives labor compensation. All unemployed households find jobs with probability $\delta_{ue,t}$ at the end of period t. Employed households lose their jobs in period t with probability $\delta_{eu,t}(z_t^p)$, which depends negatively on the level of their permanent productivity shock. These features of the model map to the evidence showing that low productivity workers have higher job destruction rates, but that job finding rates do not vary across productivity groups.[20]

I allow the discount factor β_h to be heterogeneous across households. In particular, I assume that households are either patient or impatient and I calibrate the discount factor of each group to simultaneously match the aggregate wealth in the economy and the average expenditure response to unemployment. This heterogeneity in the discount factor yields a better match to the wealth distribution and prevents some households from saving enough to perfectly self-insure against the drop in income associated to unemployment.[21] I choose to match the average expenditure response upon unemployment so that by comparing my baseline model with one without heterogeneity in consumption and production I can isolate the effect of the labor composition of the expenditure response to unemployment. Otherwise, such comparison would also capture a differential response on average expenditure.

Finally, households maximize utility subject to the budget constraint

$$P_{1,t}\, x_{1,t} + P_{2,t}\, x_{2,t} + a_{t+1} = W_t\, e_t(1-\tau_{w,t})z_t + ui_t W_t z_t(1-e_t) + \Pi_t - \tau_{LS,t} + (1+i_t)a_t$$

[20] Cairo and Cajner (2014) document that workers have very similar job finding rates regardless of their education level, but highly-educated workers have lower separation rates and so, lower unemployment rates.

[21] Heterogeneity in the discount factor has been used before to improve the match of the wealth distribution (e.g. Krusell and Smith, 1998; McKay and Reis, 2016).

where $P_{1,t}$ and $P_{2,t}$ are the prices of the consumption goods, W_t is the nominal wage rate per effective unit of labor, $\tau_{w,t}$ is a proportional tax on labor income, ui_t is the unemployment insurance replacement rate, $\tau_{LS,t}$ is a nominal lump-sum tax, and Π_t are firm profits. Households can save on a risk-free asset that pays a nominal interest i_t, but are not allowed to borrow (i.e. $a_{t+1} \geq 0$).

3.3 Firms

There are three productive sectors in the economy. Two sectors produce consumption goods and a third sector produces investment goods. Each sector has its own labor share and it is composed of a continuum (of measure one) of final and intermediate producers.

3.3.1 Final Goods Producers

Let i denote the productive sector with $i = 1, 2, I$. The first two sectors ($i = 1, 2$) produce consumption goods and the third sector ($i = I$) produces investment goods.

Each sector has a continuum of perfectly competitive final producers who purchase intermediate goods indexed by j and assemble final goods using the production function

$$Y_{i,t} = \left(\int \left(y_{i,t}^{j} \right)^{\frac{\epsilon - 1}{\epsilon}} dj \right)^{\frac{\epsilon}{\epsilon - 1}}$$

where ϵ is the elasticity of substitution across intermediate goods.

Let $p_{i,t}^{j}$ be the nominal price of intermediate good j in sector i at time t. Then, cost minimization yields a standard demand for intermediate good j

$$y_{i,t}^{j}(p_{i,t}^{j}) = \left(\frac{p_{i,t}^{j}}{P_{i,t}} \right)^{-\epsilon} Y_{i,t}$$

where

$$P_{i,t} = \left(\int \left(p_{i,t}^{j} \right)^{1-\epsilon} dj \right)^{\frac{1}{1-\epsilon}}$$

3.3.2 Intermediate Goods Producers

Monopolistically competitive firms in each sector hire labor (ℓ) and capital (k) to produce intermediate goods using a Cobb-Douglas technology

$$y_{i,t}^j = A \left(k_{i,t}^j\right)^{\alpha_i} \left(\ell_{i,t}^j\right)^{1-\alpha_i}$$

where α_i varies by sector.

Intermediate producers rent capital at a nominal rate R_t from a competitive financial sector and hire effective units of labor at a nominal rate W_t from a representative final labor union. There are no adjustment costs to capital nor labor at the firm level. Factors can move freely across sectors. The nominal average and marginal cost implied by cost minimization coincide because of constant returns to scale and are given by

$$AC_{i,t} = MC_{i,t} = \frac{1}{A}\left(\frac{R_t}{\alpha_i}\right)^{\alpha_i}\left(\frac{W_t}{1-\alpha_i}\right)^{1-\alpha_i}$$

Intermediate producers choose their prices to maximize profits

$$E_0 \sum_{t=1}^{\infty} \prod_{t_1=1}^{t} (1+i_{t_1}) \left[y_{i,t}^j(p_{i,t}^j - AC_{i,t}) - \Theta_{i,t}(p_{i,t+1}^j, p_{i,t}^j)\right]$$

with menu costs à la Rotemberg (1982)

$$\Theta_{i,t}(p_{i,t+1}^j, p_{i,t}^j) = \frac{\theta}{2}\left(\frac{p_{i,t+1}^j - p_{i,t}^j}{p_{i,t}^j}\right)^2 P_{i,t}Y_{i,t}$$

I assume that adjustment costs are paid as transfers to households and so, they do not take up real resources.

I focus only on symmetric equilibria. Then, individual demand for labor and capital equals the sectoral aggregate demand for labor and capital

$$\ell_{i,t}^j = L_{i,t}$$

$$k_{i,t}^j = K_{i,t}$$

3.4 Labor Unions

Labor unions intermediate households' supply of labor to firms. There are two types of labor unions in the model. A final, perfectly-competitive, representative labor union aggregates labor from a continuum of intermediate, monopolistically competitive labor unions (of measure one) and sells it to the firms.

The use of labor unions in the model is purely for analytic simplicity. In my model, unions do not experience nominal rigidities.[22] Instead, they aggregate households' discrete employment status into a labor supply with elasticity of one with respect to the wage rate. In general, New Keynesian models obtain a positively-sloped labor supply by allowing households to choose the intensive margin of employment (how many hours to work) or by having a continuum of households with different disutility of labor choosing along the extensive margin (whether to work or not). For my analysis, the former choice is undesirable because I want to target expenditure responses to changes in the employment status of the household along the extensive margin as documented in Section 2, whereas the latter complicates the solution of the model significantly because the wealth level would factor into the labor supply decision of the household as labor would affect both disutility of working and home production. Labor unions provide with a simple solution to deliver a positively-sloped labor supply.

3.4.1 Final Labor Union

The final labor union combines labor from intermediate unions indexed by m using a Dixit-Stiglitz aggregator

$$L_t = \left(\int (n_t^m)^{\frac{\epsilon_u - 1}{\epsilon_u}} \, dm \right)^{\frac{\epsilon_u}{\epsilon_u - 1}}$$

where ϵ_u is the elasticity of substitution across labor as provided by different intermediate unions and n_t^m is the amount of effective labor provided by intermediate union m in period t.

Let W_i^m be the nominal wage set by intermediate union m. Then, cost minimization for

[22]Some papers have used labor unions to introduce nominal rigidities in wages (e.g. Zubairy, 2014).

the final union yields the demand for labor from the intermediate union m

$$n_t^m(W_t^m) = \left(\frac{W_t^m}{W_t}\right)^{-\epsilon_u} L_t$$

where

$$W_t = \left(\int (W_t^m)^{1-\epsilon_u}\, dm\right)^{\frac{1}{1-\epsilon_u}}$$

3.4.2 Intermediate Labor Unions

Intermediate labor unions care about the real wage (net of taxes) and the employment rate of their members according to the objective function

$$\left[\alpha_w \left(\frac{W_t^m(1-\tau_{w,t})}{\omega P_{1,t} + (1-\omega)P_{2,t}}\right)^{\rho_u} + (1-\alpha_w)(n_t^m)^{\rho_u}\right]^{\frac{1}{\rho_u}}$$

where ω is the weight of average expenditure on good 1 in the expenditure bundle of consumers in steady state and n_t^m is the effective labor supply of the union members

$$n_t^m = \int z_t\, e_t\, I_m\, d\mu_t(\beta_h, a_t, z_t^P, z_t^T, e_t)$$

where I_m is an indicator function that takes the value of one for households that are members of labor union m. Regardless of their productivity and wealth levels, every household is equally likely to be associated to any labor union.

Intermediate labor unions choose every period their wage rate to maximize their objective function subject to the final union's demand for their members' labor. Imposing symmetry, this yields a labor supply with elasticity one with respect to the wage rate and with no wealth effects

$$L_t = \left(\frac{\alpha_w}{(1-\alpha_w)\epsilon_u}\right)^{\frac{1}{\rho_u}} \frac{(1-\tau_{w,t})W_t}{\omega P_{1,t} + (1-\omega)P_{2,t}}$$

3.5 Government

The government implements fiscal policy through taxes, transfers, and direct purchases of final goods. The government collects a tax on labor income and a lump sum tax. And it pays unemployment insurance to unemployed households.

Let B_t be the government debt at period t. Then, the government budget constraint is

$$P_{1,t}G_{1,t} + P_{2,t}G_{2,t} + P_{I,t}G_{I,t} + (1+i_t)B_t = B_{t+1} + W_t\, L_t\, \tau_{w,t} - ui_t\, W_t\, (\overline{L} - L_t) + \tau_{LS,t}$$

where $(\overline{L} - L_t)$ is the amount of effective labor unemployed because L_t is the amount of effective labor employed and $\overline{L}$ is the total amount of effective labor in the economy

$$\overline{L} = \int z_t\, d\mu_t(\beta_h, a_t, z_t^P, z_t^T, e_t)$$

Notice that $\overline{L}$ is not indexed by t because I assume productivities are drawn from their stationary distributions and so, aggregates are constant.

3.6 Monetary Authority

A monetary authority sets the nominal interest rate every period following a Taylor rule:

$$i_t = i^* + \psi_\pi \pi_t$$

where i^* is the noninflationary steady-state nominal interest rate. The inflation rate π_t is computed using a Consumer Price Index

$$1 + \pi_t = \frac{\omega\, P_{1,t} + (1-\omega)\, P_{2,t}}{\omega\, P_{1,t-1} + (1-\omega)\, P_{2,t-1}}$$

3.7 Financial Sector

There is a perfectly competitive financial sector that takes savings from households and invests on government bonds and productive capital.

Investment on productive capital is subject to an adjustment cost. In particular, I assume that investment is given by

$$I_t = \overline{K}_{t+1} - (1 - \delta_t)\,\overline{K}_t + \frac{\phi_K}{2}\left(\overline{K}_{t+1} - \overline{K}_t\right)^2$$

where the depreciation rate depends on the utilization of capital, which is also chosen by the financial sector. Following Baxter and Farr (2005) I assume that the depreciation rate depends on the utilization rate of capital ur_t according to the functional form

$$\delta_t = \delta + \frac{b}{1+\zeta}\, ur_t^{1+\zeta}$$

and effective capital is given by $K_t = ur_t \overline{K}_t$.

Because there is no aggregate uncertainty, profit maximization of the financial sector yields a no arbitrage condition. Government bonds and productive capital pay the same return at every point in time

$$(1 + i_{t+1})\,\frac{P_{I,t}}{P_{I,t+1}} = \frac{1 + \frac{R_{t+1}\, ur_{t+1}}{P_{I,t+1}} - \delta_{t+1} + \phi_K(\overline{K}_{t+2} - \overline{K}_{t+1})}{1 + \phi_K(\overline{K}_{t+1} - \overline{K}_t)}$$

Finally, perfect competition in the financial sector yields a zero-profit condition and so, at time t, households receive a nominal interest rate on their savings equal to i_t.

3.8 Market Clearing

A competitive equilibrium for this economy is defined as paths for prices $\{P_{1,t}, P_{2,t}, P_{I,t}, W_t, R_t, i_t\}_{t\geq 0}$, household policy functions $\{x_{1,t}(.), x_{2,t}(.), a_{t+1}(.)\}_{t\geq 0}$, government policies $\{G_{1,t}, G_{2,t}, G_{I,t}, \tau_{w,t}, \tau_{LS,t}, ui_t\}_{t\geq 0}$, quantities $\{Y_{1,t},\ Y_{2,t}, Y_{I,t}, L_t, L_{1,t}, L_{2,t}, L_{I,t}, K_t, K_{1,t}, K_{2,t}, K_{I,t}, \overline{K}_t\}_{t\geq 0}$, and a distribution of individual states over households $\{\mu_t(\beta_h, a_t, z_t^P, z_t^T, e_t)\}_{t\geq 0}$ such that in every period t:

1. Households maximize their utility given their budget constraint and borrowing limit taking as given equilibrium prices and government policies.

2. Firms maximize profits taking as given equilibrium prices and government policies.

3. Labor unions maximize their objective function taking as given equilibrium prices and government policies.

4. The financial sector maximizes profits taking as given equilibrium prices and government policies.

5. The government budget constraint holds.

6. The distribution of individual states for the following period is consistent with households optimal choices and transition probabilities of exogenous shocks.

7. All markets clear.

There are six markets in the economy: the two consumption goods markets, the investment good market, the asset market, the labor market, and the productive capital market.

The consumption goods markets clear when the amount produced of each good equals what consumers and the government want to buy

$$Y_{1,t} = \int x_{1,t}(\beta_h, a_t, z_t^P, z_t^T, e_t) d\mu_t(\beta_h, a_t, z_t^P, z_t^T, e_t) + G_{1,t}$$

$$Y_{2,t} = \int x_{2,t}(\beta_h, a_t, z_t^P, z_t^T, e_t) d\mu_t(\beta_h, a_t, z_t^P, z_t^T, e_t) + G_{2,t}$$

The investment good market clears when the amount produced equals investment and government purchases

$$Y_{I,t} = \overline{K}_{t+1} - (1-\delta)\overline{K}_t + \frac{\phi_K}{2}\left(\overline{K}_{t+1} - \overline{K}_t\right)^2 + G_{I,t}$$

The asset market clears when savings equal productive capital and government bonds

$$\int a_{t+1}(\beta_h, a_t, z_t^P, z_t^T, e_t) d\mu_t(\beta_h, a_t, z_t^P, z_t^T, e_t) = P_{I,t+1}\overline{K}_{t+1} + B_{t+1}$$

The labor market clears when labor demand from the three sectors equals labor supply from the final labor union

$$L_{1,t} + L_{2,t} + L_{I,t} = L_t$$

Finally, the productive capital market clears when capital demand from the three sectors equals the amount of effective capital available that period

$$K_{1,t} + K_{2,t} + K_{I,t} = K_t$$

4 Calibration and Steady State Results

In this section, I discuss my calibration strategy for the model to reproduce the expenditure responses to employment and the heterogeneity in production documented previously.

I set a period in the model to be a quarter.

Preferences. I set the intertemporal elasticity of substitution equal to 1 ($\gamma = 1$). I set ρ equal to 0.53 to obtain an elasticity of substitution between time and goods in home production of 2.13 as estimated by Aguiar and Hurst (2007) for all housework. The calibration of the remaining preference parameters (ν, ψ, and the two discount factors β_P and β_I) is discussed below.

Productivity and Employment Shocks. I calibrate the Markov process governing the permanent productivity shock to be a discrete approximation[23] to an autoregressive process of first order. I follow Guerrieri and Lorenzoni (2011) and set the persistence of the permanent productivity shock to 0.967 and its variance to 0.017 to match the evidence on the persistence and variance of the wage process as documented by Flodén and Lindé (2001). I also follow Guerrieri and Lorenzoni (2011) in setting the quarterly average transition probabilities from unemployment to employment and from employment to unemployment to 0.057 and 0.882, respectively to match aggregate labor market flows as estimated by Shimer (2005). The average unemployment rate in steady state is then 6%. I assume the job destruction rate by permanent productivity level adopts the following functional form

$$\delta_{eu}\left(z^P\right) = \delta_{eu}\, e^{\phi_{eu}\left(z^P - \bar{z}^P\right)} C_k$$

where C_k is a constant of integration for the weighted sum of the job destruction rate by productivity level to add up to the average job destruction rate. I set $\phi_{ue} = -0.395$, so

[23] I use the discretization method proposed by Rouwenhorst (1995) with eleven gridpoints.

that the ratio between the unemployment rates of the highest and lowest productivity types in steady state reproduces the ratio of unemployment rates between high-skilled workers (i.e. with bachelor's degree or more) and low-skilled workers (i.e. less than a high school diploma) in the data. Figure 12 presents the fit of the calibrated function to unemployment rates by education level. Finally, I assume that the distribution of the transitory shock is a discrete approximation[24] to a normal variable with zero mean and quarterly variance of 0.19 to reproduce an annual variance of 0.05 as in Kaplan and Violante (2014).

Technology. I map the different goods in the economy into the three productive sectors in the model as follows. First, I drop exports and focus only on goods produced and consumed locally. Second, I divide government expenditure into military spending and non military spending because their labor shares are significantly different (0.60 and 0.74, respectively). Third, I map investment and military spending into the investment good in the model because they have similar labor shares (0.60 and 0.62 respectively). Fourth, I compute the average labor share for the remaining goods (i.e. the fourteen categories of consumption studied in Section 2 and non-military government spending) and I allocate them to the labor-intensive or capital-intensive consumption goods in the model depending on whether their labor share is above or below the average. The resulting labor-intensive consumption good has a labor share of 0.70 and represents 48% of GDP, whereas the capital-intensive consumption good has a labor share of 0.38 and represents 29% of GDP. The investment good has a labor share of 0.61 and represents the remaining 23% of GDP. The mapping is summarized in Table 3. I set the elasticity of substitution across intermediate goods, ϵ, to 10 which in steady state yields a profit share on GDP of 10% and a markup of 11% as in Kaplan, Moll, and Violante (2016). The capital share for each of the production functions is then $\alpha_i = 1 - s_i\,\epsilon/(\epsilon-1)$ where s_i is the fraction of output that flows to workers. For the capital-intensive consumption good $\alpha_1 = 0.58$, for the labor-intensive consumption good $\alpha_2 = 0.23$, and for the investment good $\alpha_I = 0.32$. I normalize A to 1. I calibrate the parameter governing the adjustment cost to capital to match the magnitude of the adjustment cost to investment in Zubairy (2014) at a 4% deviation of investment from steady state.[25] I find

[24] I use five gridpoints.

[25] Standard deviation of the growth rate of quarterly gross investment between 1970 and 2015.

$\phi_K = 0.00004$. In the next section, I explore results for two alternative values for the menu cost parameter θ: 0 for the case of flexible prices and 100 for the case of sticky prices as in Kaplan, Moll, and Violante (2016).

Labor Union. I follow Zubairy (2014)[26] and I set the wage elasticity of demand ϵ_u to 21. I set the inverse of the elasticity of substitution between employment and real wages ρ_u to be 0.5. I calibrate the weight of real wages in the labor union objective function to be such that the unemployment rate in steady state is 6%, consistent with my calibration of the unemployment shock. This approach yields $\alpha_w = 0.94$.

Government. Consistent with the mapping in Table 3, I assume that the government does not purchase any of the capital-intensive consumption good in steady state ($G_1 = 0$) and I set G_2 and G_I so that they represent 5% and 17% of output, respectively. I follow Zubairy (2014) by setting the labor tax rate to 0.23 and calibrating the level of debt as a fraction of (annual) GDP to be 0.33. Following Shimer (2005) I set the unemployment insurance replacement rate to be 40%. Finally, the lump sum tax adjusts to guarantee that the government's budget constraint holds.

Monetary Authority. I follow Kaplan, Moll, and Violante (2016) and I set $\psi_\pi = 1.25$.

Financial Sector. I set the depreciation rate of capital to 10% annually in steady state as in Kaplan, Moll, and Violante (2016). I attain that 10% by normalizing the utilization rate in steady state to 1, choosing $\zeta = 2$, within the 95% confidence interval discussed in Baxter and Farr (2005), and setting b equal to 0.03.

Remaining Parameters. I calibrate the remaining parameters of the model using the Method of Simulated Moments so that the model in steady state[27] reproduces important moments of the data. I simultaneously search for the four parameters that minimize the distance between theoretical and empirical moments, but each parameter can be associated to one particular moment for ease of interpretation. I choose the discount factor of the patient households β_P to reproduce a ratio of capital to annual GDP of 2.31 as in Ríos-Rull and Santaeulàlia-Llopis (2010) which, added to the ratio of government debt to GDP of 0.33, yields a level of wealth to GDP of 2.64. I find $\beta_P = 0.990$. The average share of

[26] The model Zubairy (2014) has labor unions to introduce nominal rigidities on wages.

[27] I simulate an economy with 50,000 households for 10,000 periods. The economy reaches steady state much earlier than that.

household expenditure on the capital-intensive good, 0.48, identifies $1-\nu$, the share of the capital-intensive good in the utility function. I find $1-\nu=0.479$, which is slightly lower than 0.48 to compensate for the greater share of the capital-intensive good on the bundle of unemployed households. Finally, the discount factor of the impatient households β_I and the share of the market good on home-production ψ are identified from the expenditure responses to employment of the different goods. I find that $\beta_I = 0.976$ and $\psi = 0.958$ match increases in expenditure upon employment of 4.7% and 10.6% for the capital and labor-intensive goods, respectively, as documented in Subsection 2.2.

A Model without Heterogeneity. To evaluate the effects of heterogeneity in consumption and production, I calibrate an alternative version of the model where both channels are shut down. Heterogeneity in production is shut down by assuming that all three goods are produced with the same labor share, the average in the economy, 0.59. Heterogeneity in consumption is shut down by assuming that time does not factor into home-production, i.e. $\psi = 1$. I then calibrate the two discount factors and the share of the capital-intensive good in the utility function to match the ratio of capital to annual GDP (2.31), the average share of household expenditure on the capital-intensive good (0.48), and the average expenditure response to employment (0.06). The latter moment is twice as large as the average expenditure increase I documented in Subsection 2.2, because it is the weighted average of the expenditure changes in the labor and capital-intensive goods. I choose this target so that the comparison between the models is only about how households change the composition of their expenditure bundle upon employment, and not by how much they change total expenditure.

The model yields a wealth distribution with a significant share of hand-to-mouth households, consistent with empirical evidence[28] (Figure 13). Both with and without heterogeneity, about 20% of the households have assets for less than their current quarterly earnings. The median household has savings for 1.6 years of earnings in the model with heterogeneity, and 1.4 in the model without. The model also delivers very rich households, with the household

[28] Kaplan and Violante (2014) identify households as hand-to-mouth in the Survey of Consumer Finances if their level of liquid wealth is less than half of their earnings. Kaplan, Moll, and Violante (2016) document that 25% of the households are poor hand-to-mouth and an additional 20% are wealthy hand-to-mouth because they have positive illiquid assets, but very low liquid assets. My model abstracts from differences in the liquidity of assets.

at the 95th percentile of the wealth to earnings distribution having savings for 35 years of earnings.

The model successfully reproduces the disproportionate increase in expenditure on labor-intensive goods upon employment. In the model without heterogeneity, the expenditure response upon employment is the same for both goods (Figure 14). But in the model with heterogeneity, the increase in expenditure is much larger for the labor-intensive good than for the capital-intensive good. Even for rich households, expenditure on the-labor intensive good rises significantly upon employment.

5 Implications for Fiscal Stimulus Programs

In this section, I present the implications for fiscal stimulus of the heterogeneity in consumption and production. First, I compute the fiscal multipliers associated to different fiscal policies and discuss the quantitative importance of targeting. Second, I argue that my results can explain the difference in effectiveness of military and total expenditure found by the literature. Third, I show that the recent decline in the labor share has reduced the effectiveness of fiscal policy.

5.1 The Size of the Fiscal Multiplier and Implications for Fiscal Targeting

In this subsection, I explore how GDP responds on impact to a one-time fiscal stimulus program equivalent to 1% of quarterly GDP financed by lump sum taxes or debt. First, I discuss the case of flexible prices. Second, I present the results for the model with sticky prices.

I consider four types of fiscal stimulus programs: government purchases of the three goods in the model and increments in unemployment insurance benefits. I focus on the fiscal multiplier on impact. For government purchases of good i, I define the fiscal multiplier as

$$\text{Fiscal Multiplier of } G_i = \frac{\Delta GDP}{P_i^* \Delta G_i}$$

where P_i^* is the initial steady state price level of good i. For unemployment insurance, I define the multiplier as

$$\text{Fiscal Multiplier of UI} = \frac{\Delta GDP}{\Delta UI}$$

where UI is the total amount of unemployment insurance payments.

5.1.1 Building Intuition in the Case of Flexible Prices

To build intuition on how the model works, it is useful to first consider the case of flexible prices (i.e. $\theta = 0$) and constant capital utilization (i.e. $b = 0$). Later in this subsection, I discuss how the results change when allowing for variable capital utilization.

Absent variable capital utilization, fiscal stimulus can increase GDP only if it raises employment. If government debt is constant, in the short run the stock of capital is fixed. If capital utilization is constant, output will only increase if labor increases.

The demand for labor in each sector is the marginal revenue product of labor. With flexible prices, firms maximize profits every period choosing labor, capital, and price conditional on the demand they face. The demand for labor in sector i is then given by

$$L_{i,t} = \left[\frac{A\,(1-\alpha_i)(\epsilon-1)}{\epsilon}\right]^{\frac{1}{\epsilon}} \left(\frac{W_t}{P_{i,t}}\right)^{-\frac{1}{\alpha_i}} K_{i,t}$$

where $K_{i,t}$ is an endogenous variable that depends on the relative aggregate demand for the output of each sector.

In a model without heterogeneity in production, fiscal stimulus cannot increase employment. If the three sectors have the same labor intensity, $\alpha_i = \alpha$, the three goods will have the same price, $P_{i,t} = P_t$, and aggregate labor demand will depend only on the aggregate stock of capital

$$L_t = \sum_i L_{i,t} = \left[\frac{A\,(1-\alpha)(\epsilon-1)}{\epsilon}\right]^{\frac{1}{\epsilon}} \left(\frac{W_t}{P_t}\right)^{-\frac{1}{\alpha}} \sum_i K_{i,t} = \left[\frac{A\,(1-\alpha)(\epsilon-1)}{\epsilon}\right]^{\frac{1}{\epsilon}} \left(\frac{W_t}{P_t}\right)^{-\frac{1}{\alpha}} \overline{K}_t$$

Government purchases are inflationary, raising prices and labor demand. But labor supply drops by the same amount as higher prices contract the real wage. As a consequence, nominal wages and prices increase by the same amount and the real wage does not change. As shown in the left-hand size graphs of Figure 15, the level of employment does not vary.

But fiscal stimulus can increase employment in a model with heterogeneity in production if the government purchases labor-intensive goods. By purchasing labor-intensive consumption goods, the government redirects aggregate demand in the economy, inducing a reallocation of capital towards the labor-intensive sector and a larger increment in the demand for labor as shown in the right-hand side of Panel A in Figure 15. As a consequence, real wages, employment, and GDP rise.

Fiscal stimulus can decrease employment if the government purchases capital-intensive goods. In this case, the increase in labor demand is weaker than the contraction in labor supply associated to higher prices[29] because the government is shifting the production bundle of the economy towards goods for which the labor to capital ratio is low. Then, employment and the real wage drop as shown in the right-hand side of Panel B in Figure 15.

When allowing for variable capital utilization, fiscal stimulus can affect employment in the model without heterogeneity, but the effect is very small. A one-time increase in government purchases financed by a lump sum tax has a multiplier on GDP on impact of 0.001 (Panel A of Table 4), as higher prices induce the financial sector to increase utilization of capital, engineering a slightly larger expansion in labor demand. The fiscal stimulus program reduces employment if it is funded by debt because an increase in government debt forces a reduction in productive capital, given the initial amount of savings. But the response of output is again very small, with a multiplier of just -0.001 (Panel B of Table 4).

5.1.2 Results with Sticky Prices

The introduction of nominal rigidities yields a larger aggregate demand channel and so, larger multipliers, but their heterogeneity persists.

In a model with no heterogeneity in production and consumption, an increase in government purchases by one dollar raises output by 43 cents if it is financed by lump sum taxes. The presence of nominal rigidities prevents prices from rising too quickly, which induces a larger expansion of labor demand and a weaker contraction of labor supply. As a result, GDP and employment rise.

[29]Relative prices of final goods change in this case, but this effect is not quantitatively large.

The fiscal multiplier is almost five times larger for government purchases of the labor-intensive consumption good as compared to purchases of the capital-intensive consumption good. Government purchases of the labor-intensive good raise GDP by 85 cents on a dollar when they are financed by lump sum taxes. The effect of purchases of capital-intensive good is only 0.18. Thus, a model without heterogeneity overestimates the fiscal multiplier on purchases of capital-intensive goods by 130%, but underestimates the multiplier of purchases on labor-intensive goods by 50%.

With sticky prices, the fiscal multipliers are slightly larger when fiscal stimulus is financed with debt. Although there is a negative effect on the stock of capital because of the increase in government debt, increased utilization and slower changes in prices yield higher levels of employment and output. In the case of no heterogeneity, the fiscal multiplier is 0.443. In the case without heterogeneity, the multiplier is 0.881 and 0.189 for government purchases of the labor-intensive and capital-intensive consumption goods, respectively.

Unemployment insurance does not have large effects in my model. Despite the fact that unemployed households tend to be poor and so, are more likely to be hand-to-mouth, an increase in unemployment insurance benefits does not have large effects because there is relatively few of them and, as a fraction of total expenditures, they represent an even smaller share. Additionally, in the model with heterogeneity, their expenditure bundle is biased towards capital-intensive goods.

That fiscal stimulus should target labor-intensive sectors has long been conventional wisdom among policymakers,[30] but my exercise offers a quantitative evaluation of the effectiveness of different policies. In their review of the state of the literature on the fiscal multipliers, Batini et al. (2014) report that government investment and government consumption in the U.S. have multipliers of 0.6 and 0.35, respectively.[31] But the different size of those multipliers emerges from investment having positive supply side effects, rather than by acknowledging their different labor intensities.

[30]For instance, Goolsbee and Krueger (2015) discuss how the high capital intensity of the auto industry was taken into account by the Obama administration when considering bailouts for General Motors and Chrysler in 2009.

[31]Those multipliers are restated from Coenen et al. (2012).

5.2 Implications for the Empirical Assessment of Fiscal Multipliers

My results in the previous subsection suggest that it matters what the government is purchasing and not just how much it is purchasing. In this subsection, I document that indeed the empirical literature has found smaller multipliers for military spending, which is more capital-intensive.

The literature has empirically estimated the size of the fiscal multiplier using two alternative approaches on aggregate data. On the one hand, some work has measured the fiscal multiplier using structural vector autoregression (VAR) techniques on total government expenditure. In this strand of literature, identification is usually attained by assuming that government spending cannot respond to output shocks immediately, but that it lags for a quarter or a year (Blanchard and Perotti, 2002; Perotti, 2005). On the other hand, military spending has been used instead of total government spending because it is less likely to respond to output (Hall, 2009; Barro and Redlick, 2011) or by exploiting unanticipated war news in an event study approach (Ramey and Shapiro, 1998; Ramey, 2011).

The fiscal multiplier estimated for military spending is lower than the multiplier estimated for total spending. In Figure 16, I compile all the estimates of fiscal multipliers published in the top 30 economic journals in the last 20 years. Appendix A.5 provides details on the construction of the histogram. The average fiscal multiplier for military spending is 0.55, whereas it is 0.67 for total spending.

Military spending is more capital-intensive than nondefense spending. In 2007, while the network-adjusted labor share for military spending was 0.60, it was 0.74 for nondefense spending. Figure 17 confirms that military spending has been significantly more capital-intensive over the last four decades.[32]

The difference in effectiveness between military and nondefense spending can be explained in the context of my model.[33] The fiscal multiplier associated to government purchases of goods with labor-intensity similar to defense spending is 0.64. The remaining government

[32] The figure shows the network-adjusted labor share but without the adjustments for imports and self-employment because of data limitations for the period before 1997.

[33] This point is also made by Baqaee (2015), but without quantification and excluding heterogeneity in consumption.

purchases are very labor-intensive and so, have a fiscal multiplier of around 0.85. As a back-of-the-envelope calculation,[34] since military expenditures represent a fifth of government expenditures, the average multiplier of a dollar spent keeping that proportion is 0.80, sixteen cents higher than the multiplier for defense and roughly in line with the difference found in the empirical literature.

5.3 Implications of the Decline in the Labor Share for the Fiscal Multiplier

The labor share has declined significantly in the last decades. In this subsection I show that, as a consequence, fiscal stimulus has become less effective.

Consistent with results in the literature using alternative definitions of the labor share, I find that the network adjusted labor share has declined in the last 20 years (Table 5).[35] The drop has been particularly severe for goods that were already capital-intensive such as private transportation (-0.09), food at home (-0.08), and communications (-0.07). But almost all the goods produced and consumed domestically have experienced a drop in their labor share. The only exceptions are defense spending and food away from home, whose labor shares remained constant. The drop is in line with what Karabarbounis and Neiman (2014) find using the corporate labor share, what Rodriguez and Jayadev (2010) find using the labor compensation share, and what Baqaee (2015) finds using the network-adjusted labor share by industry (instead of by final goods).

I use the model in Section 3 to assess the implications of a decline in the labor share for fiscal stimulus. I calibrate two new versions of the model with the labor shares in 1998 and 2014 as displayed in Table 5. And I explore the implications of a one-time fiscal stimulus program financed by lump sum taxes under sticky prices. I report the resulting multipliers in Table 6.

The effectiveness of fiscal policy has declined with the labor share and the heterogeneity in multipliers has grown. The fiscal multiplier of government purchases of the labor-intensive

[34] It is only a rough approximation because changes in defense and nondefense expenditure exploited in empirical work do not need to be correlated.

[35] Although the decline in the labor share started in the mid-70's, early 80's, data limitations prevent me from computing the network-adjusted labor share by final good before 1998.

consumption good decreased from 0.862 to 0.845. The decline was greater for government purchases of the capital-intensive consumption good, from 0.200 to 0.167. As a consequence, the difference between multipliers in the two goods has grown. In 1998, government purchases of the labor-intensive good were 4.3 times more effective at raising output than purchases of the capital-intensive-good. In 2014, they were more than 5 times more effective.

6 Conclusions

In this paper, I have documented significant heterogeneity in consumption and production. I have shown that the labor share of final consumption aggregates such as Personal Consumer Expenditures hides a great deal of heterogeneity. The production of some goods is very capital-intensive (e.g. housing, communications, utilities), while for others is very labor-intensive (e.g. education, domestic services, health care). Using the Consumer Expenditure Survey, I have also shown that upon unemployment household disproportionately cut back expenditures on labor-intensive goods.

In the context of a heterogeneous agent New Keynesian model that matches this heterogeneity in consumption and production, I find that it matters a great deal for fiscal stimulus. From the point of view of fiscal targeting, I find that government purchases of the labor-intensive consumption good are almost five times more effective at raising GDP than purchases of the capital-intensive good. From the point of view of empirical assessment, I find that the difference in multipliers of defense and total government spending found by the literature can be explained quantitatively by my model. Finally, I show that the decline in the labor share over the last two decades has reduced the effectiveness of fiscal policy and has increased the difference between fiscal multipliers.

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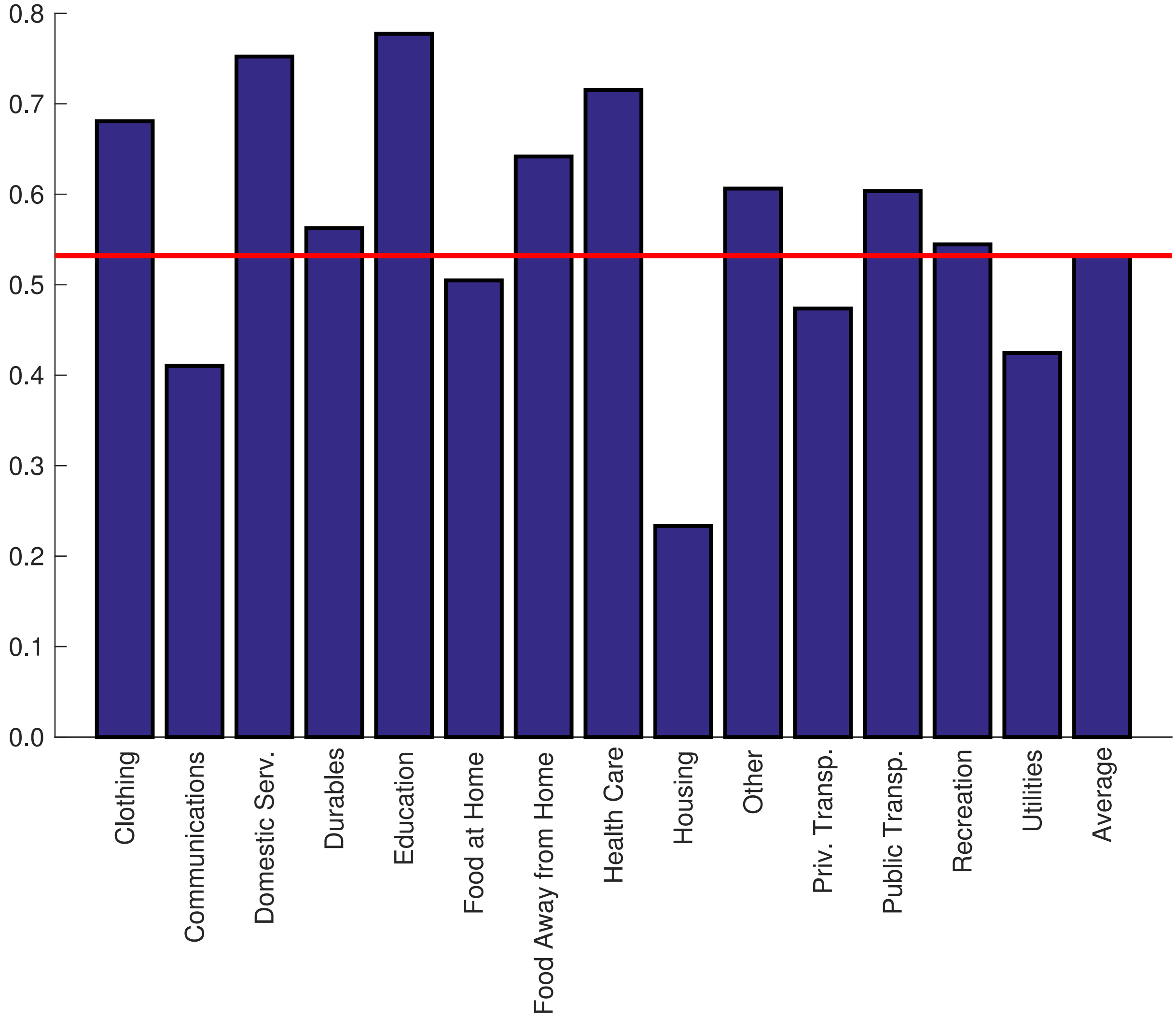
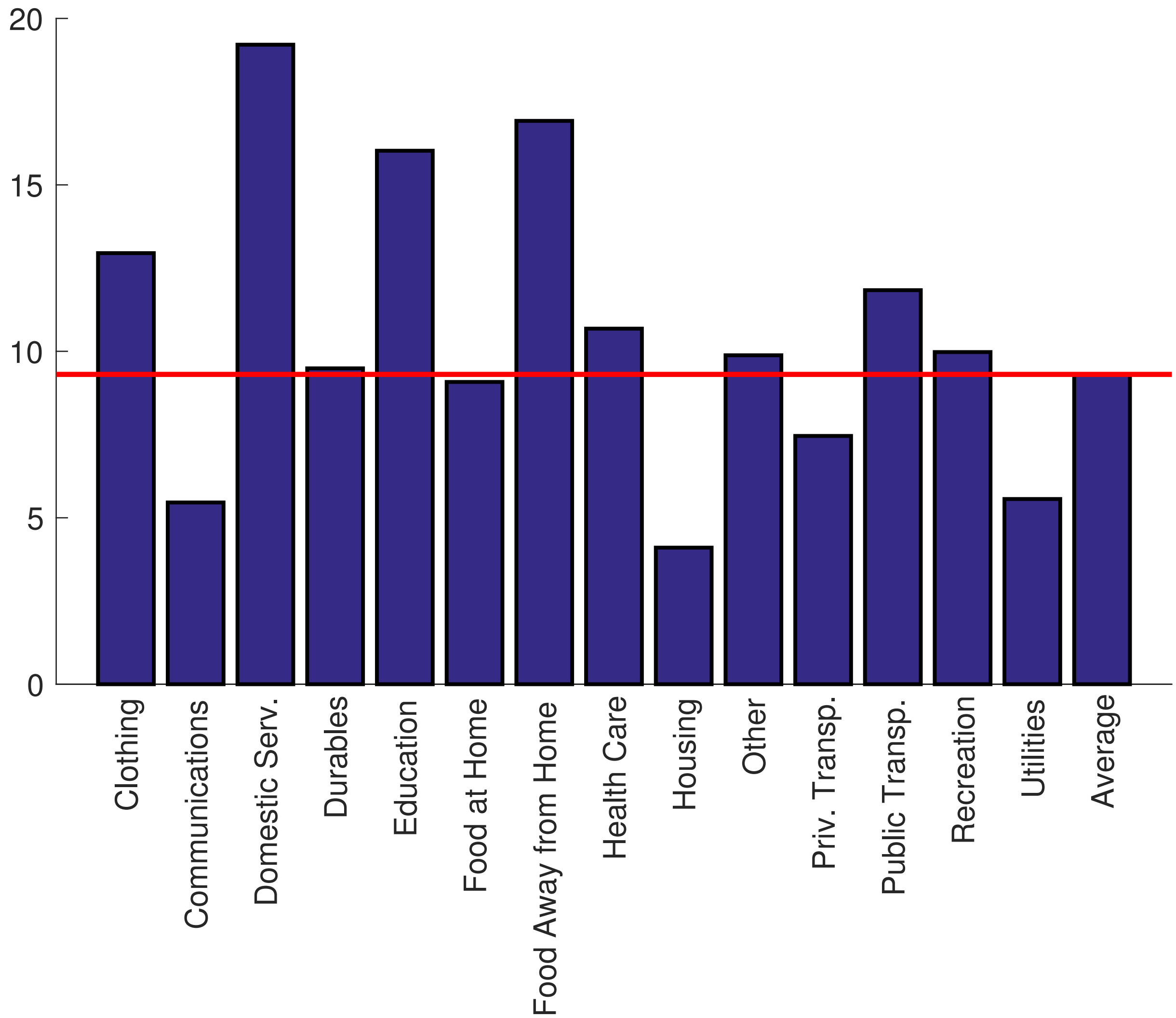
Figures

Figure 1: Labor Share of Different Consumption Goods



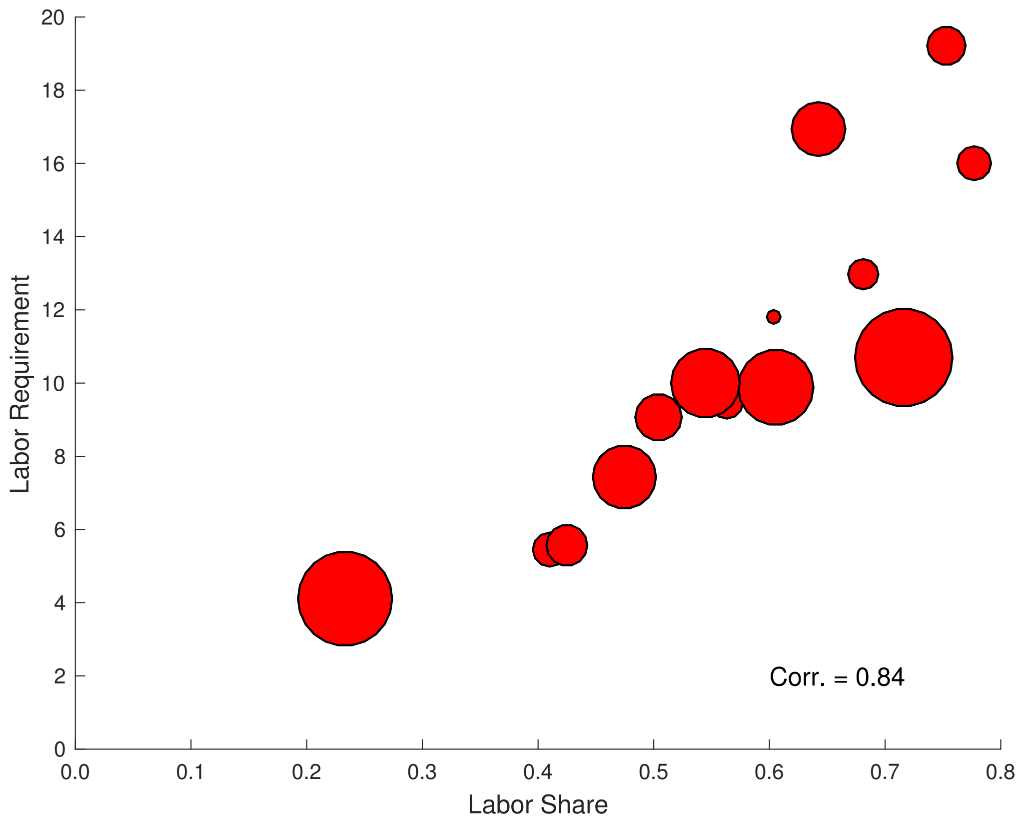
Significant heterogeneity in the labor share of final consumption goods
Network-adjusted labor share of different categories of final consumption in 2007. Refer to the main text and Appendices A.1 and A.2 for details on the calculations.

Figure 2: Labor Requirement of Different Consumption Goods



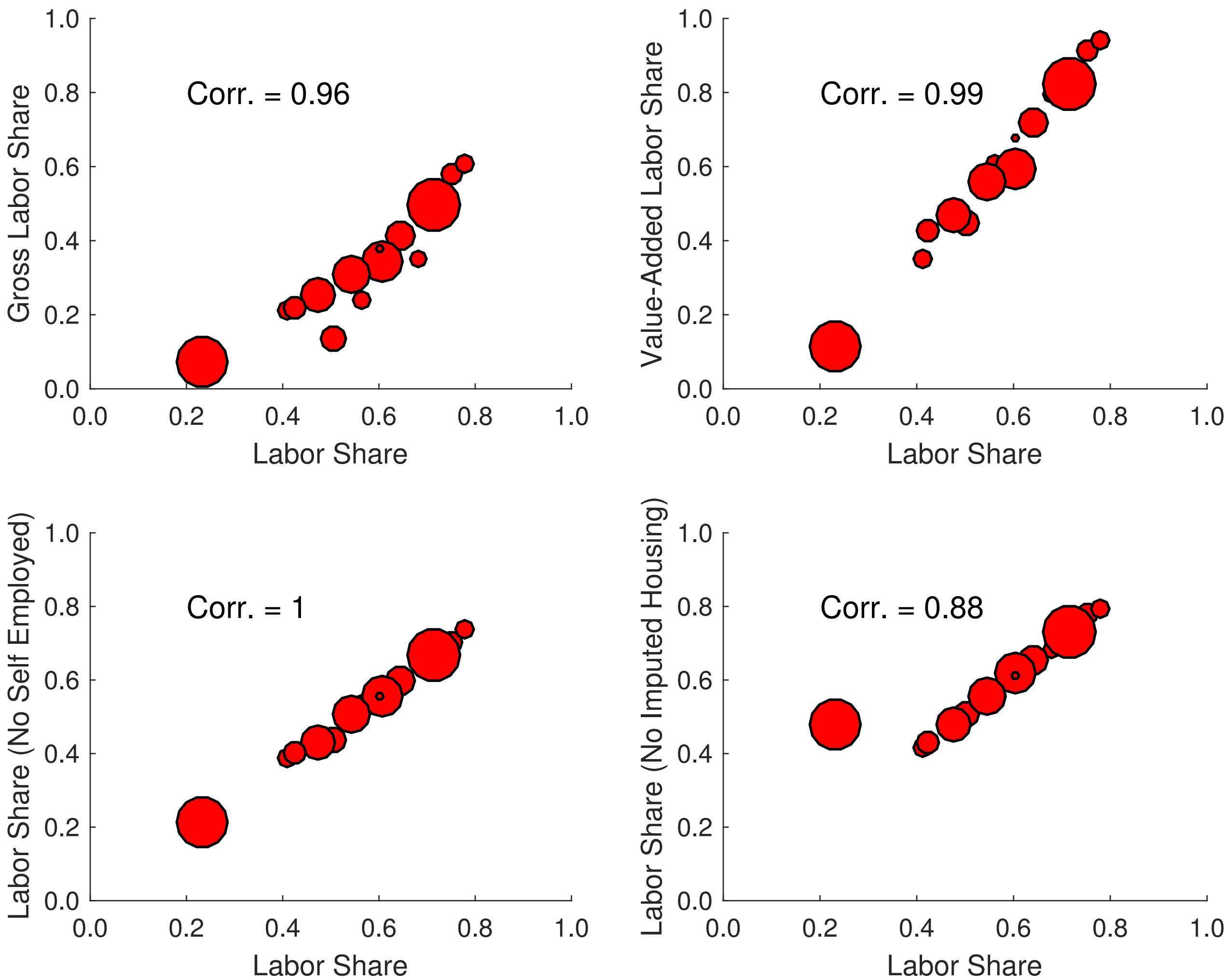
Significant heterogeneity in the labor requirements of final consumption goods Labor requirement is defined as the number of employees required to produce a million dollars of each final consumption good in 2007. Refer to the main text and Appendices A.1 and A.2 for details on the calculations.

Figure 3: Labor Share and Labor Requirement of Different Consumption Goods



Labor share and labor requirements are strongly correlated
Labor share is the network-adjusted labor share. Labor intensity is defined as the number of employees required to produce a million dollars of each final consumption good.
Each ball represents one of the final consumption goods in Figures 1 and 2. The size of each ball is proportional to the share of that final good on total consumption in 2007 according to the national accounts.
Corr. refers to the weighted correlation between labor share and labor requirement.
Refer to the main text and Appendices A.1 and A.2 for details on the calculations.

Figure 4: Alternative Definitions of the Labor Share



The network-adjusted labor share is strongly correlated with other measures of the labor share

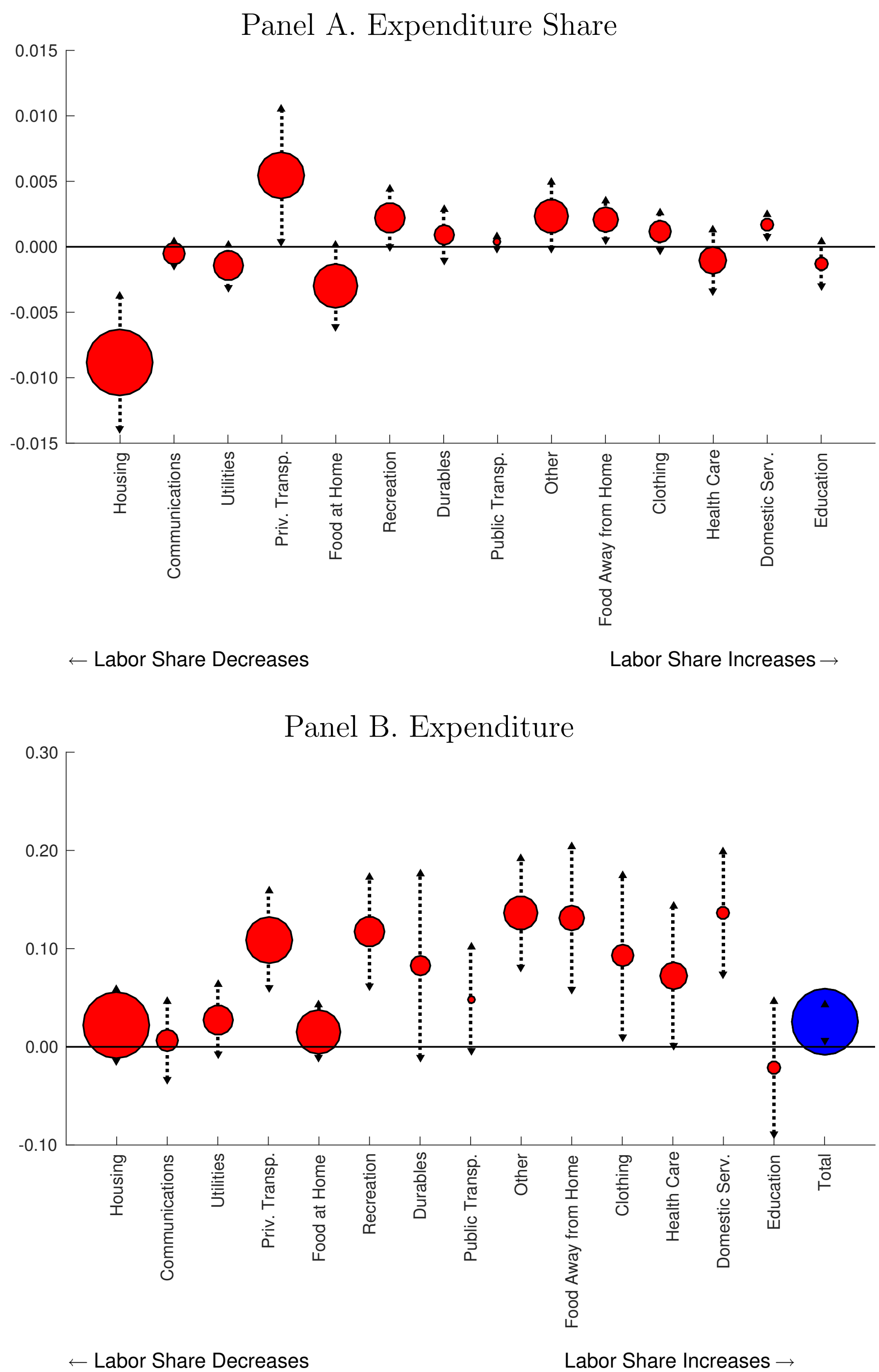
Labor share is the network-adjusted labor share. Gross labor share is the weighted average gross labor share (i.e. labor compensation divided by total industry output) of the different final industries that add value to each final consumption good without using the Domestic Requirements Matrix to account for linkages along the supply chain. Value-added labor share is the weighted average value-added labor share (i.e. labor compensation divided by total industry value-added) of the different final industries that add value to each final consumption good without using the Domestic Requirements Matrix to account for linkages along the supply chain. Labor Share (No Self Employed) refers to the network-adjusted labor share without adjusting compensation of employees for the share of self-employed workers in each industry. Labor Share (No Imputed Housing) is the network-adjusted labor share computed after excluding the imputed rental value of owner-occupied housing from GDP and from the output of the real estate industry.

Each ball represents one of the final consumption goods in Figure 1. The size of each ball is proportional to the share of that final good on total consumption in 2007 according to the national accounts.

Corr. refers to the weighted correlation between the variables in each panel.

Refer to the main text and Appendices A.1 and A.2 for details on the calculations.

Figure 5: Expenditure Response to Employment of Household Head



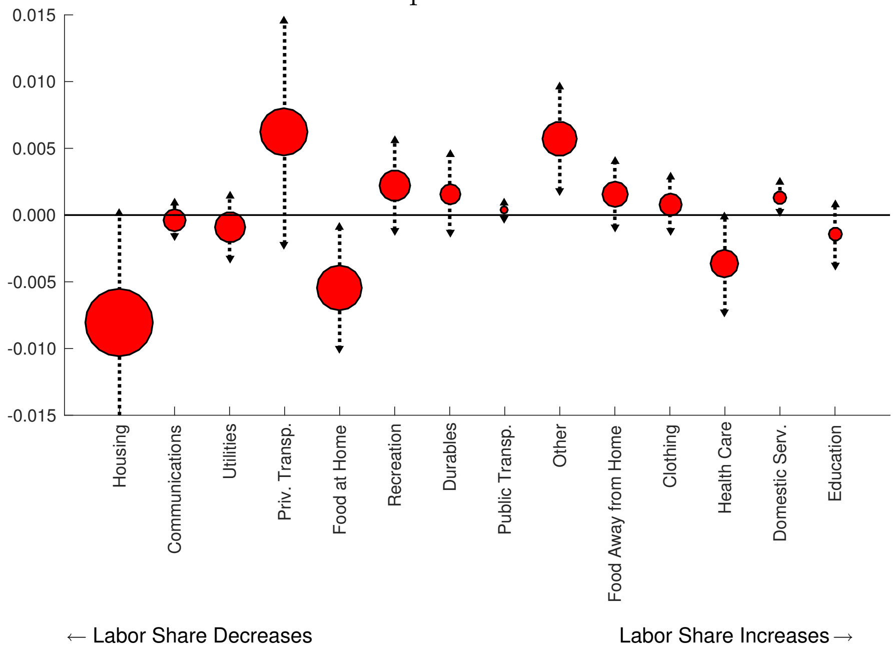
Upon employment, households spend disproportionately more on labor-intensive goods

Panel A shows the response of the expenditure share of each good to a change in the employment status of the household head. Panel B shows the elasticity of expenditure on each good to a change in the employment status of the household head.

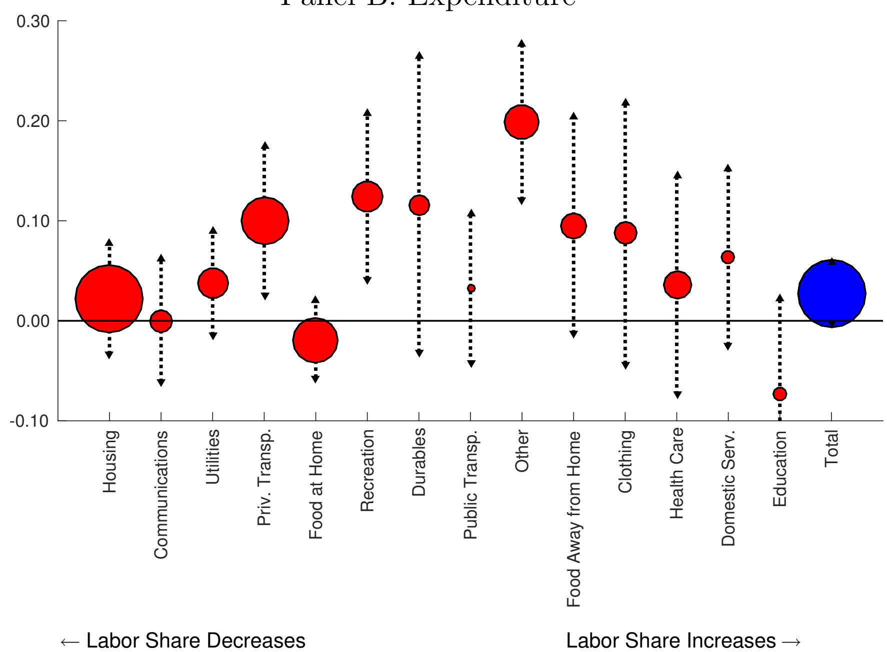
95% confidence intervals are shown with dotted lines. Standard errors are clustered at household level. Goods are sorted by their network-adjusted labor share in ascending order. The size of each ball is proportional to the share of that good on total consumption according to the CEX.

Figure 6: Expenditure Response to Employment of Household Head: Only Male Heads

Panel A. Expenditure Share



Panel B. Expenditure

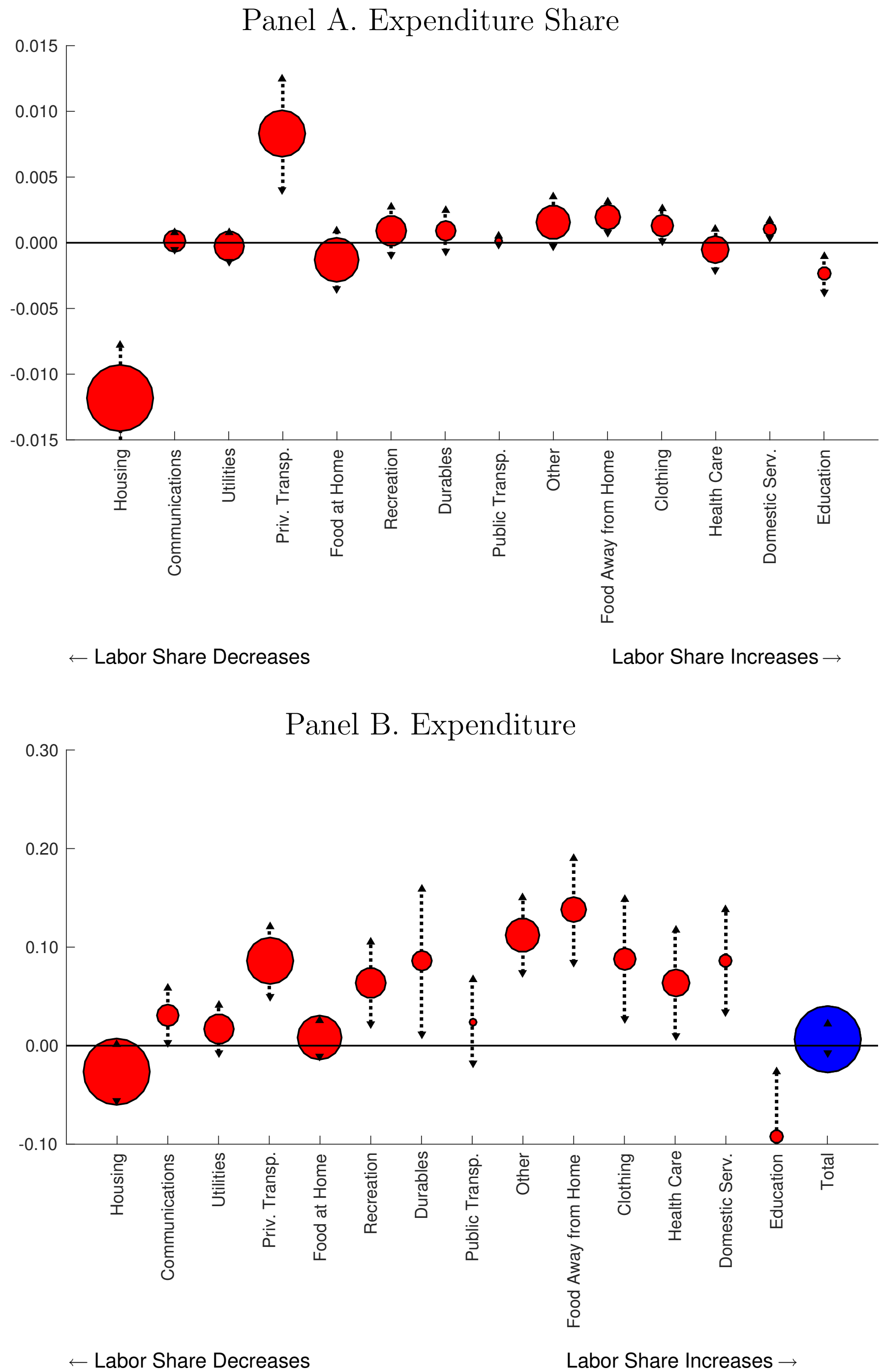


The disproportionate increase in labor-intensive goods upon employment is also evident for male heads

Panel A shows the response of the expenditure share of each good to a change in the employment status of the household head. Panel B shows the elasticity of expenditure on each good to a change in the employment status of the household head. Sample is restricted to male heads only.

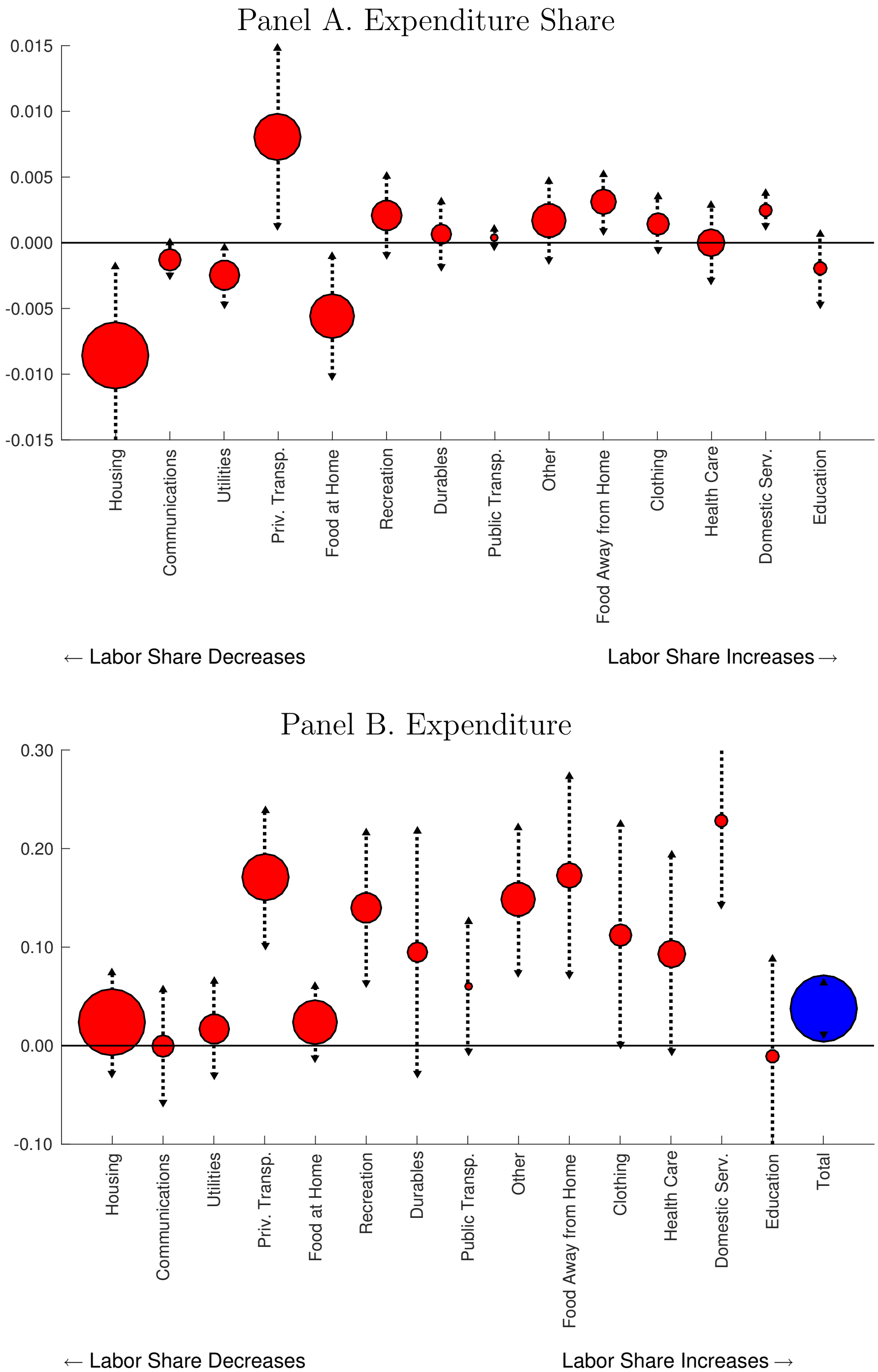
95% confidence intervals are shown with dotted lines. Standard errors are clustered at household level. Goods are sorted by their network-adjusted labor share in ascending order. The size of each ball is proportional to the share of that good on total consumption according to the CEX.

Figure 7: Expenditure Response to an Increase in the Number of Members Employed



When the number of members employed increases, households raise their expenditures disproportionately on labor-intensive goods
Panel A shows the response of the expenditure share of each good to an increase in the number of household members employed. Panel B shows the elasticity of expenditure on each good to an increase in the number of household members employed
95% confidence intervals are shown with dotted lines. Standard errors are clustered at household level. Goods are sorted by their network-adjusted labor share in ascending order. The size of each ball is proportional to the share of that good on total consumption according to the CEX.

Figure 8: Expenditure Response to Employment of Household Head: Only Heads Aged 25-50



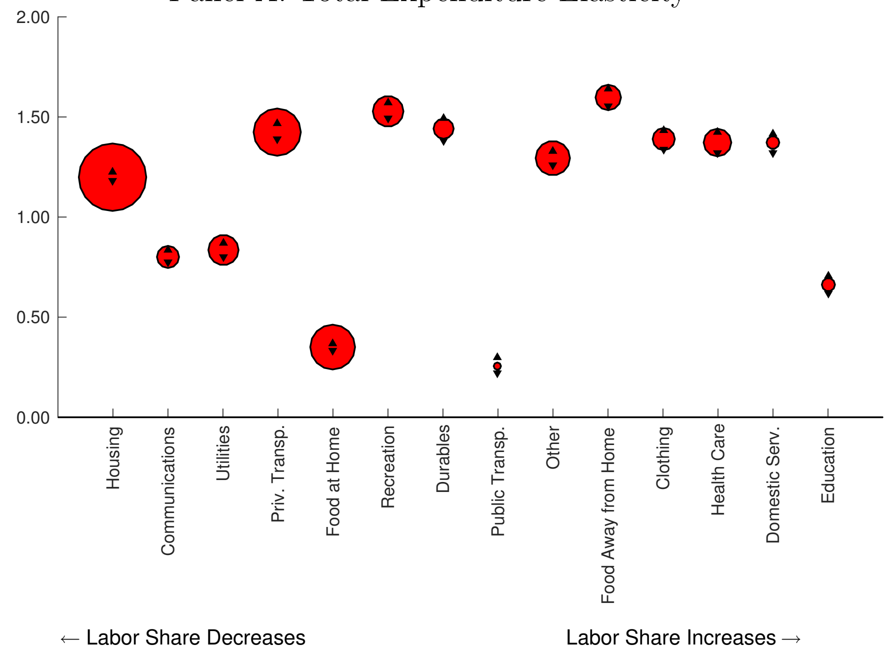
The heterogeneous expenditure response is driven by unemployment, rather than by retirement

Panel A shows the response of the expenditure share of each good to a change in the employment status of the household head. Panel B shows the elasticity of expenditure on each good to a change in the employment status of the household head. Sample is restricted to heads aged 25-50 only.

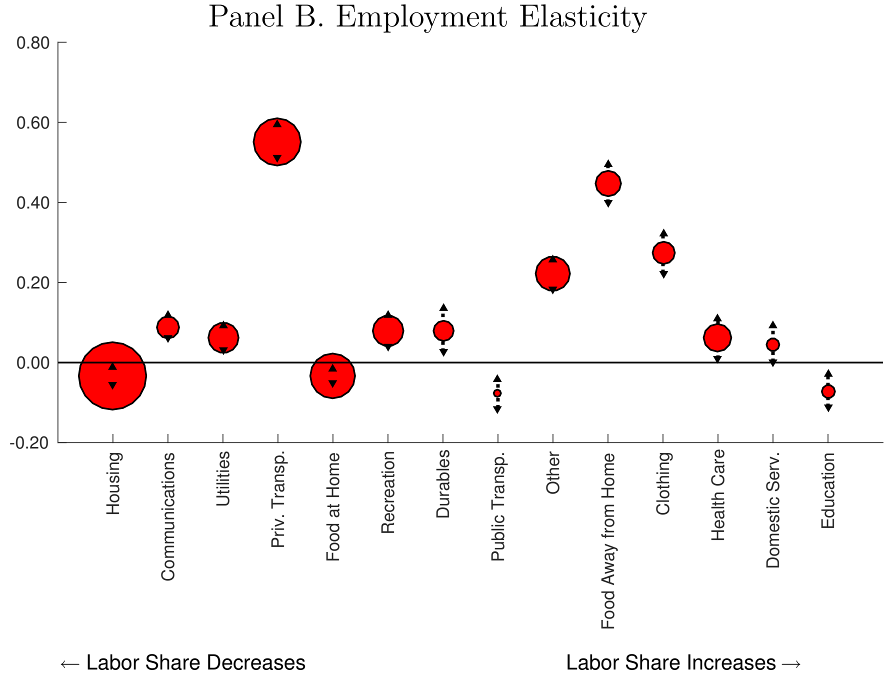
95% confidence intervals are shown with dotted lines. Standard errors are clustered at household level. Goods are sorted by their network-adjusted labor share in ascending order. The size of each ball is proportional to the share of that good on total consumption according to the CEX.

Figure 9: Total Expenditure and Employment Elasticities

Panel A. Total Expenditure Elasticity

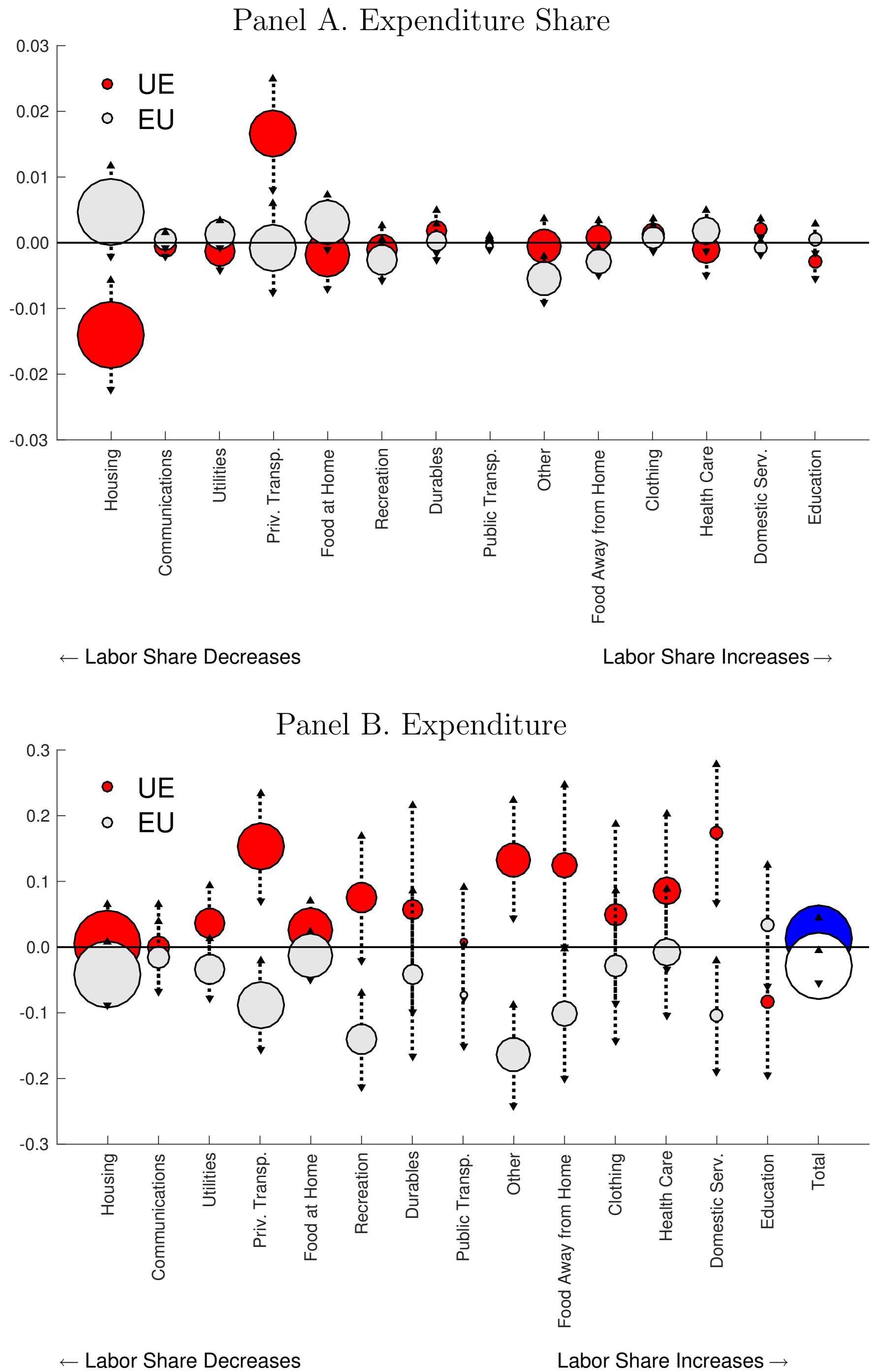


Panel B. Employment Elasticity



The positive correlation between labor share and expenditure is explained by the response to employment rather than to total expenditure
Panel A shows the elasticity of expenditure on each good to total expenditure. Panel B shows the response of expenditure by good to the employment status of the household head.
95% confidence intervals are shown with dotted lines. Robust standard errors used. Goods are sorted by their network-adjusted labor share in ascending order. The size of each ball is proportional to the share of that good on total consumption according to the CEX.

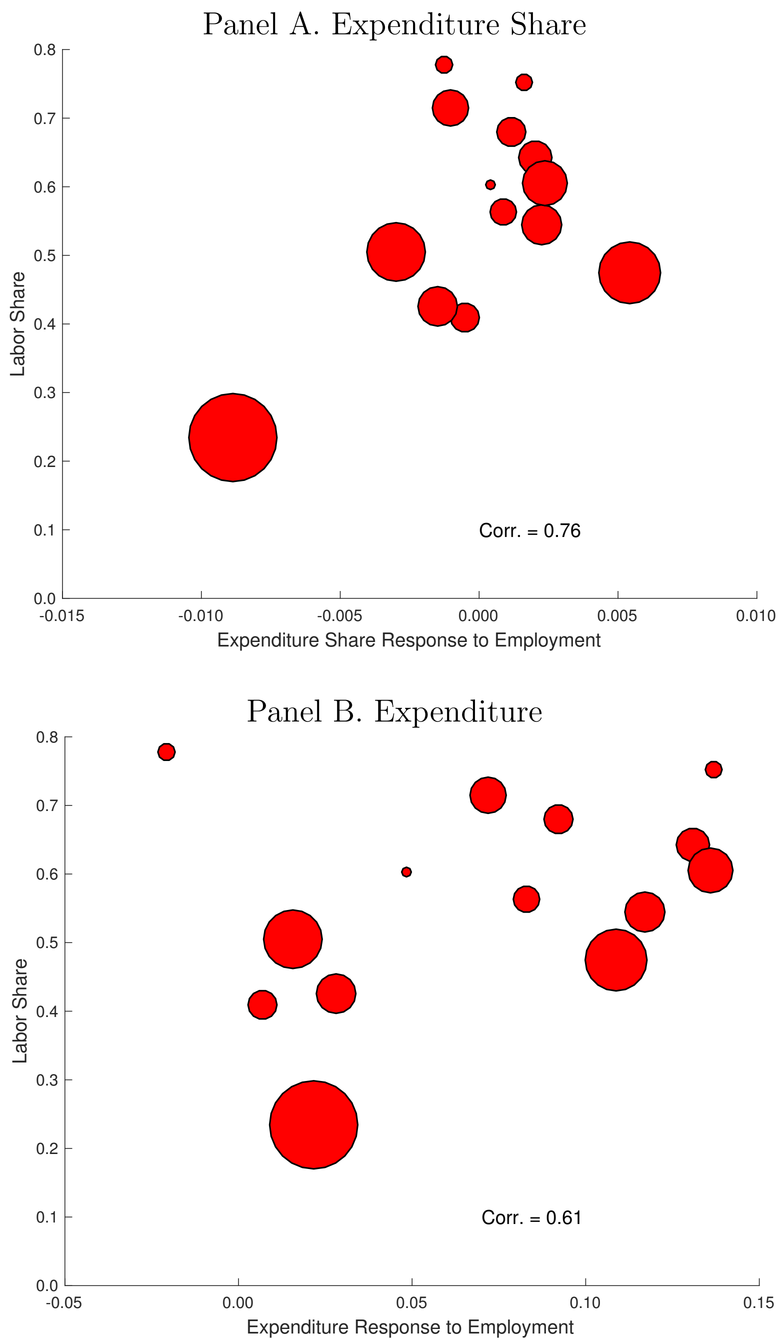
Figure 10: Expenditure Response to Employment of Household Head: Switchers



The expenditure response to employment and unemployment is fairly symmetric

Panel A shows the response of the expenditure share of each good when the household head becomes employed in red balls and when the head becomes unemployed in grey balls. Panel B shows the elasticity of expenditure of each good when the household head becomes employed in red/blue balls and when the head becomes unemployed in grey/white balls. Blue and white balls represent changes in total expenditure.
95% confidence intervals are shown with dotted lines. Standard errors are clustered at household level. Goods are sorted by their network-adjusted labor share in ascending order. The size of each ball is proportional to the share of that good on total consumption according to the CEX.

Figure 11: Expenditure Response to Employment and Labor Share

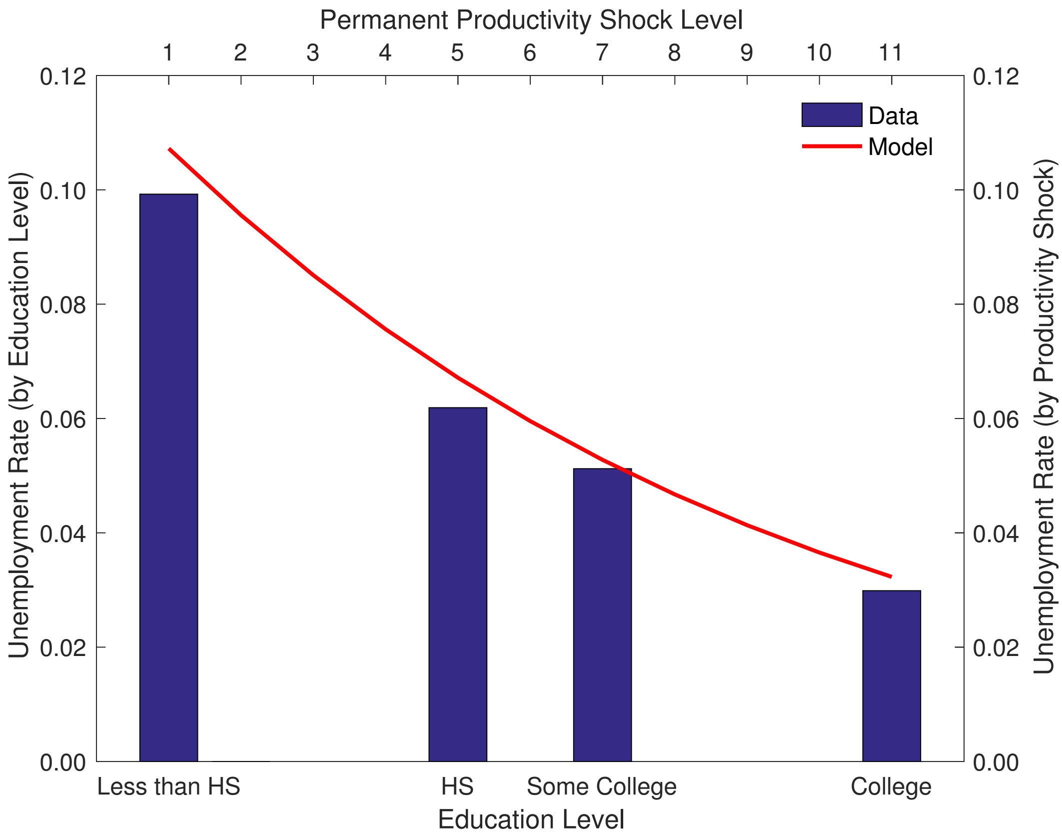


Strong correlation between labor share and expenditure response to employment

Each ball represents one of the fourteen final consumption goods. Expenditure responses to employment are as shown in Figure 5. Labor shares are as shown in Figure 1. The size of each ball is proportional to the share of that good on total consumption according to the CEX.

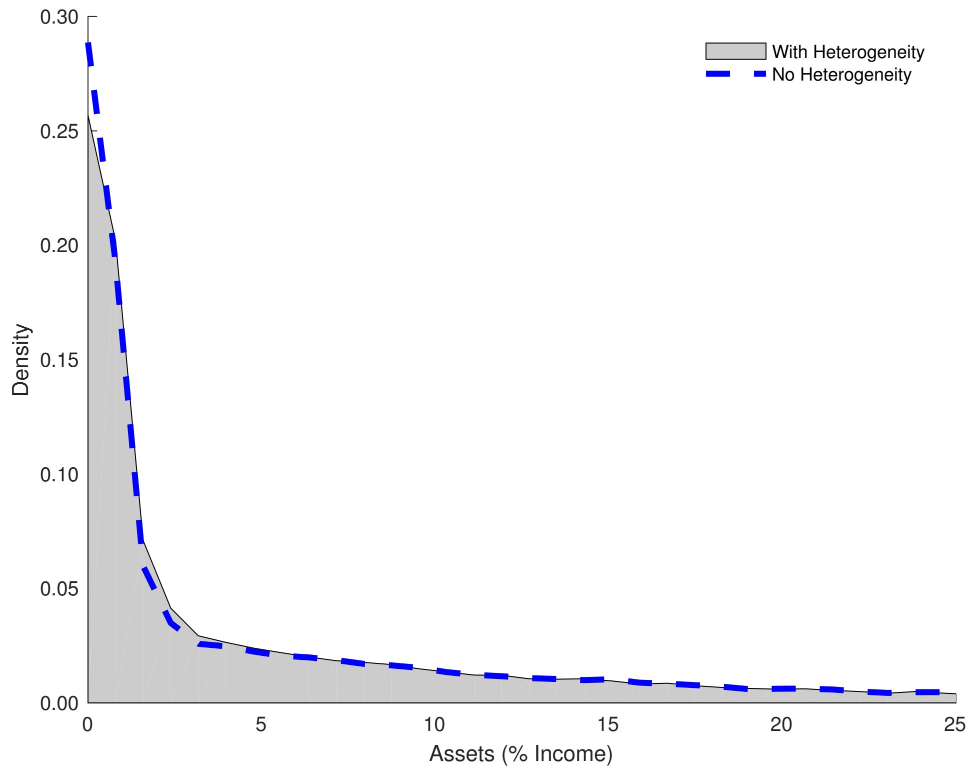
Corr. refers to the weighted correlation between the variables in each panel.

Figure 12: Unemployment Rates by Education Level (Data) and Permanent Shock Level (Model)



The model matches unemployment rates by skill level well
Data corresponds to the average of the monthly seasonally adjusted unemployment rates of workers aged 25 and older for different education levels between January 1992 and September 2016 as reported by the Bureau of Labor Statistics.
Less than HS refers to workers with less than a high school diploma. HS refers to high school graduates with no college. Some college refers to workers with some college or associate degree. College refers to workers with a bachelor's degree and higher.
Model refers to the unemployment rate in steady state for each level of permanent productivity. Refer to the main text for the functional form of the job destruction probabilities by permanent productivity level and details on its calibration.

Figure 13: Asset Distribution in the Model with and without Heterogeneity



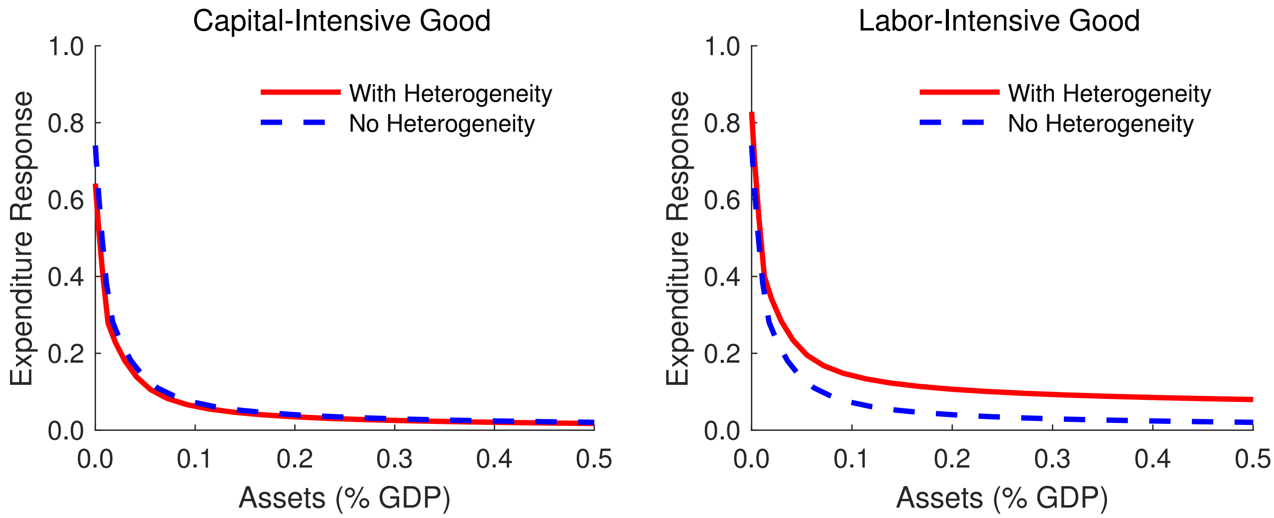
The asset distribution is very similar in the models with and without heterogeneity

Stationary distribution of assets as a fraction of household (annual) income in the models with and without heterogeneity. Model with heterogeneity refers to the model described in Section 3 and calibrated in Section 4. Model without heterogeneity refers to the model without home-production (i.e. $\psi = 1$) and with the same labor share in the production of the three goods.

The y-axes has been truncated to facilitate visualization.

The stationary distribution is found after simulating the economy described in Section 3 for 50,000 households and 10,000 periods.

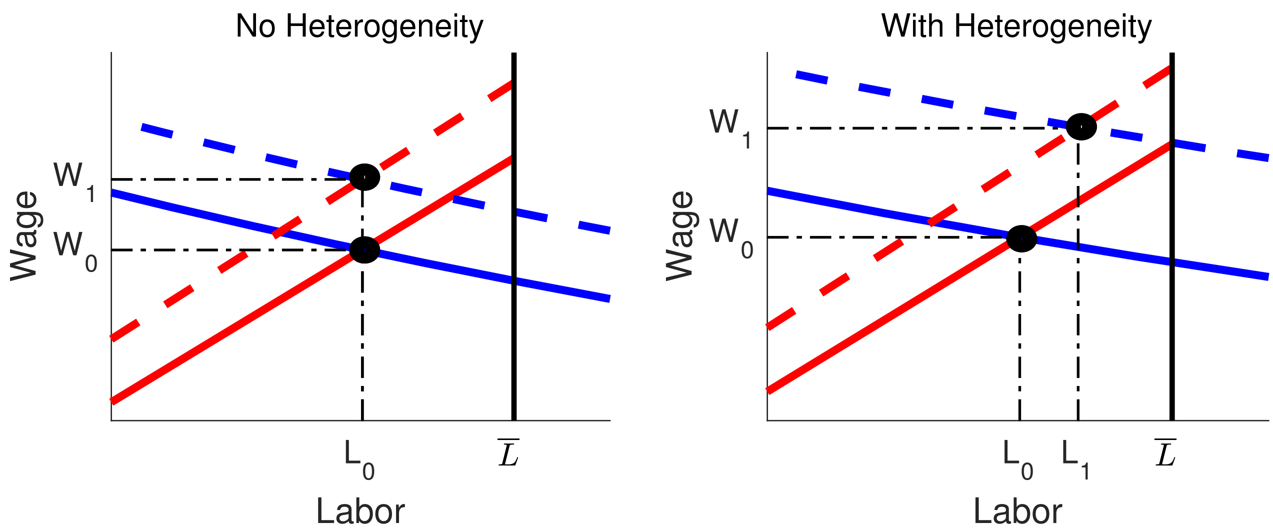
Figure 14: Expenditure Response to Employment by Type of Good



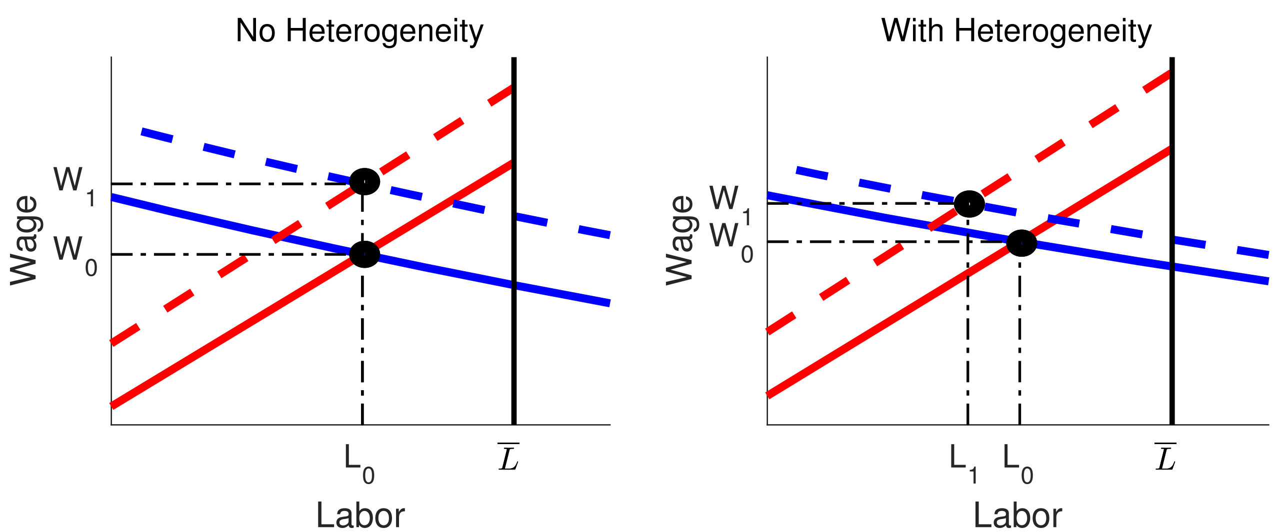
The model with heterogeneity reproduces the disproportionate increase in expenditure on labor-intensive goods upon employment
The expenditure response is expressed as a percentage with respect to the expenditure level of the household when unemployed (i.e. 0.2 means that upon employment a previously unemployed household increases expenditure by 20%).
Expenditure responses computed from the household policy functions evaluated at the average level of permanent and transitory shock for an impatient type (i.e. household with relatively low discount factor).
Asset level expressed as fraction of annual GDP in each model to facilitate comparison.

Figure 15: Effect of Fiscal Stimulus in the Labor Market with Flexible Prices

Panel A. Government Purchases of Labor-Intensive Good



Panel B. Government Purchases of Capital-Intensive Good

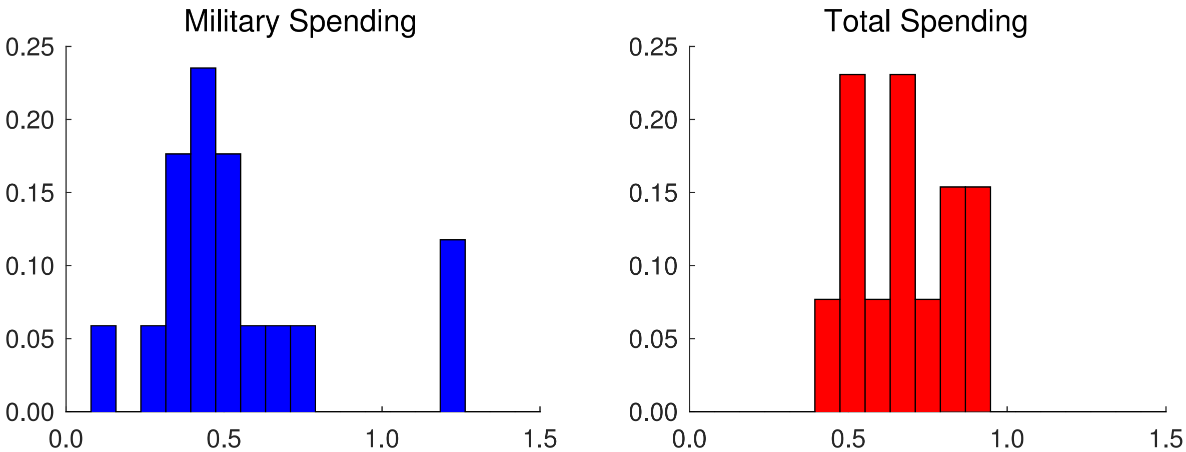


In a model with heterogeneity in production, fiscal stimulus has real effects even when prices are flexible

Panels A and B present the effects in the labor market of an increase in government purchases of labor-intensive and capital-intensive goods, respectively. The graphs in the left show the results in a model with no heterogeneity in production. The graphs in the right show the results in a model with heterogeneous labor shares in production.

Wage refers to the nominal wage. Labor refers to the level of employment. The upward-sloping red solid (dashed) line corresponds to the initial (final) labor supply. The downward-sloping blue solid (dashed) line corresponds to the initial (final) labor demand. Initial market equilibrium is denoted by the point (L_0, W_0). Final market equilibrium is denoted by the point (L_0, W_1) in the model with no heterogeneity in production and by the point (L_1, W_1) in the model with heterogeneity in production.

Figure 16: Impact Fiscal Multipliers Using Military and Total Government Spending

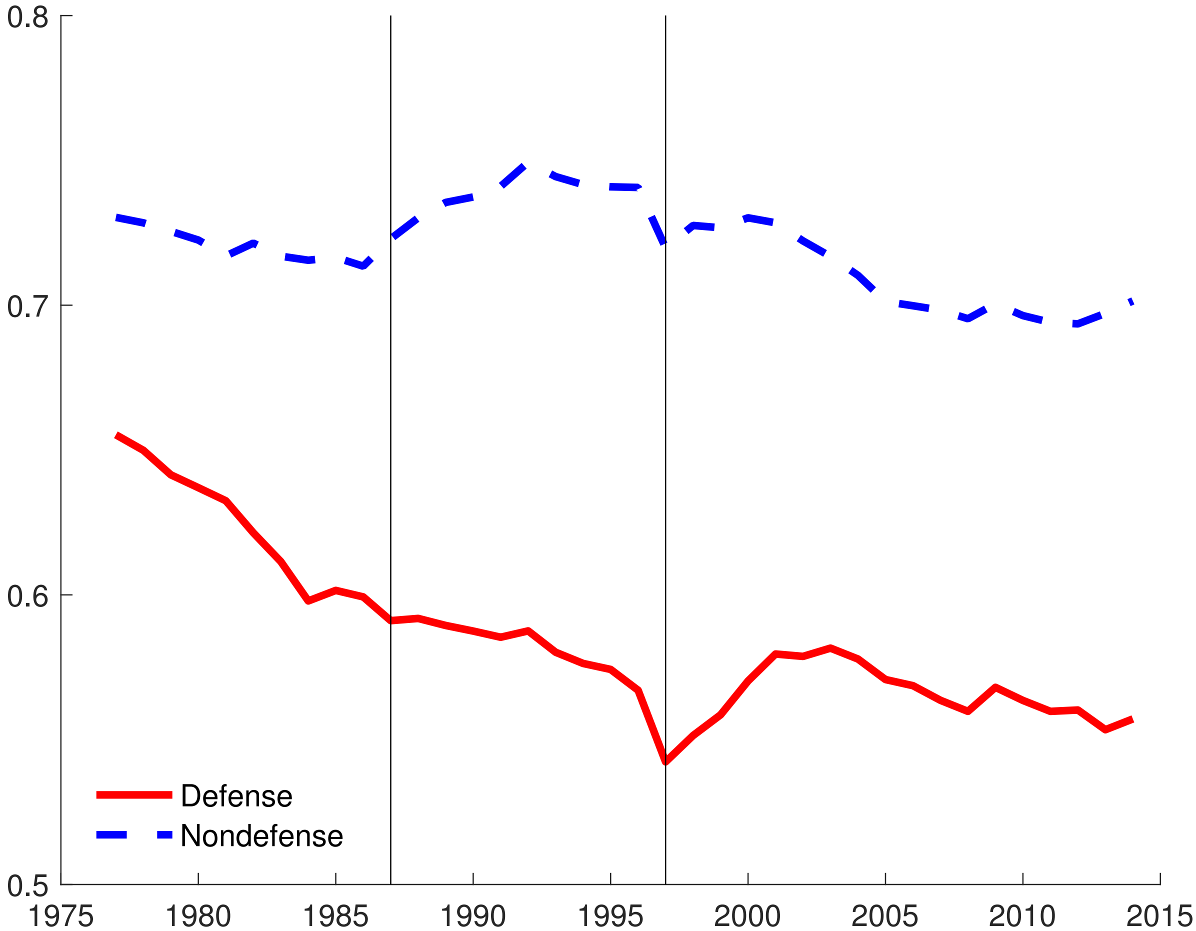


The fiscal multiplier estimated for military spending is lower than the multiplier for total spending

The histograms show the frequency with which different values of fiscal multipliers have been estimated in the last twenty years depending on whether the identification strategy exploited variation in military spending (left-hand side histogram) or in total spending (right-hand side figure).

Further details on the methodology for reviewing the literature and collecting these multipliers are presented in Appendix A.5.

Figure 17: Labor Compensation Share of Defense and Nondefense Spending



The labor share of defense spending is and has been significantly lower than the share of nondefense spending

Network-adjusted compensation share is equal to the network-adjusted labor share without the adjustment for self-employment described in Appendix A.2 because of data limitations. Also because of data limitations, the total requirements matrix is used instead of the domestic requirements matrix, and the use and make matrices are before-redefinitions, but still at producer prices.

The vertical lines represent the dates of two major changes in methodology: 1987 and 1997.

Tables

Table 1: Summary Statistics: 1980-2014

Expenditure Shares	Mean	P10	P50	P90	SD
Clothing	0.03	0.00	0.02	0.08	0.04
Communications	0.03	0.01	0.03	0.07	0.03
Education	0.01	0.00	0.00	0.02	0.05
Food at Home	0.13	0.04	0.11	0.25	0.09
Food Away from Home	0.04	0.00	0.03	0.10	0.05
Health Care	0.05	0.00	0.03	0.13	0.07
Housing	0.30	0.09	0.26	0.58	0.20
Recreation	0.06	0.00	0.04	0.14	0.07
Utilities	0.06	0.01	0.05	0.12	0.05
Domestic Services	0.01	0.00	0.00	0.03	0.03
Durables	0.03	0.00	0.01	0.08	0.05
Other	0.08	0.01	0.06	0.17	0.08
Private Transportation	0.15	0.02	0.11	0.29	0.14
Public Transportation	0.00	0.00	0.00	0.01	0.01
Number of households					84,655
Number of heads of households with employment change					5,379
Number of male heads of households with employment change					2,285
Number of heads of households aged 25-50 with employment change					3,064
Number of households with increase in the number of members employed					10,396

The CEX offers a reasonable sample size to study the expenditure response to employment
The top panel shows summary statistics of expenditures shares in different goods across households. Mean refers to the mean expenditure share in each good across households. P10, P50, and P90 refer to the 10th, 50th, and 90th percentile of the distribution of expenditure shares in each good. SD refers to the standard deviation in expenditure shares in each good. All summary statistics are computed using probability weights. The bottom panel shows the number of households in the sample and those who satisfy the different definitions of employment discussed in Subsection 2.2.
For details on the data construction, refer to the main text and Appendix A.4.

Table 2: Expenditure Response to Employment and Labor Share

Panel A. Expenditure Share

	(1)	(2)	(3)	(4)
Baseline	0.024***	0.021***	0.024***	0.031***
	(0.006)	(0.007)	(0.005)	(0.009)
1998	0.024***	0.022***	0.025***	0.032***
	(0.004)	(0.005)	(0.005)	(0.006)
2014	0.024***	0.022***	0.025***	0.032***
	(0.006)	(0.007)	(0.005)	(0.008)
Excl. Imputed Housing	0.019	0.016	0.019	0.019
	(0.016)	(0.018)	(0.017)	(0.023)
Total Requirements	0.024***	0.021***	0.024***	0.032***
	(0.006)	(0.007)	(0.006)	(0.009)

Panel B. Expenditure

	(1)	(2)	(3)	(4)
Baseline	0.177***	0.152*	0.239***	0.249***
	(0.044)	(0.078)	(0.052)	(0.052)
1998	0.167***	0.139*	0.237***	0.235***
	(0.040)	(0.064)	(0.055)	(0.042)
2014	0.183***	0.158*	0.251***	0.253***
	(0.043)	(0.075)	(0.053)	(0.052)
Excl. Imputed Housing	0.257*	0.217	0.327	0.292
	(0.132)	(0.186)	(0.184)	(0.168)
Total Requirements	0.180***	0.154*	0.245***	0.253***
	(0.044)	(0.077)	(0.052)	(0.052)

The positive correlation between labor share and expenditure response to employment is a robust result
Each coefficient in the tables above represents the slope of a linear regression of the expenditure response to employment on the labor share for the different consumption goods.
Columns present different specifications of the expenditure response to employment. (1) uses the employment status of the head of the household as in Figure 5. (2) restricts the sample to male heads as in Figure 6. (3) restricts the sample to heads aged 25-50 as in Figure 8. (4) defines a household becoming employed when the number of earners in the household increases as in Figure 7.
Rows present alternative specifications of the labor share. Baseline refers to the network-adjusted labor share in 2007 as in Figure 1. 1998 and 2014 refer to the labor share computed for years 1998 and 2014 as in Figure A.1. Excl. Imputed Housing refers to the labor share computed after excluding the imputed rental value of owner-occupied housing from GDP and from the output of the real estate industry as in Figure 4. Total Requirements refers to the labor share computed without excluding imports as in Figure A.1.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parenthesis.

Table 3: Mapping Goods in the Data to Goods in the Model

Good	Labor Share	Fraction of GDP
Capital-Intensive Consumption Good		
Housing	0.23	0.12
Communications	0.41	0.02
Utilities	0.42	0.02
Private Transportation	0.47	0.04
Food at Home	0.50	0.03
Recreation	0.54	0.05
Durables	0.56	0.01
Average	0.38	0.29
Labor-Intensive Consumption Good		
Public Transportation	0.60	0.00
Other	0.61	0.11
Food Away from Home	0.64	0.04
Clothing	0.68	0.00
Health Care	0.72	0.12
Nondefense Government Spending	0.74	0.17
Domestic Services	0.75	0.02
Education	0.78	0.01
Average	0.70	0.48
Investment Good		
Defense Government Spending	0.60	0.05
Investment	0.62	0.18
Average	0.61	0.23

The aggregation of goods in the data to feed into the model preserves heterogeneity
The table shows the mapping from categories of goods in the data to the three goods in the model (i.e. capital-intensive consumption good, labor-intensive consumption good, and investment good). Refer to the main text for further details.
Labor share refers to the network-adjusted labor share as computed in Subsection 2.1. Fraction of GDP refers to the expenditure on each good divided by GDP (excluding exports) in 2007.

Table 4: Fiscal Multipliers in the Model

Panel A. Tax-Financed Fiscal Stimulus

Policy	Baseline	No Heterogeneity
Flexible Prices ($\theta = 0$)		
Labor-Intensive Consumption Good	0.067	0.001
Investment Good	0.005	0.001
Capital-Intensive Consumption Good	-0.170	0.001
Unemployment Insurance	0.001	0.000
Sticky Prices ($\theta = 100$)		
Labor-Intensive Consumption Good	0.851	0.431
Investment Good	0.642	0.431
Capital-Intensive Consumption Good	0.180	0.431
Unemployment Insurance	0.002	0.002

Panel B. Debt-Financed Fiscal Stimulus

Policy	Baseline	No Heterogeneity
Flexible Prices ($\theta = 0$)		
Labor-Intensive Consumption Good	0.071	-0.001
Investment Good	0.006	-0.001
Capital-Intensive Consumption Good	-0.160	-0.001
Unemployment Insurance	0.001	0.000
Sticky Prices ($\theta = 100$)		
Labor-Intensive Consumption Good	0.881	0.443
Investment Good	0.663	0.443
Capital-Intensive Consumption Good	0.189	0.443
Unemployment Insurance	0.002	0.002

Heterogeneity in consumption and production has a large impact on the size of the fiscal multiplier
Figures in the table correspond to the GDP multiplier on impact of a one-time fiscal stimulus policy financed with a lump sum tax (Panel A) or with debt (Panel B). For government purchases of good i, the multiplier is $\frac{\Delta GDP}{P_i^* \Delta G_i}$ where P_i^* is the initial steady state price level of good i. For unemployment insurance, the multiplier is $\frac{\Delta GDP}{\Delta UI}$ where UI is the total unemployment insurance benefits.
Baseline refers to the model with heterogeneity in consumption and production described in Section 3 and calibrated in Section 4. No heterogeneity refers to a version of the model with the same labor shares in production of the three goods and no home production.

Table 5: Changes in the Labor Share between 1998 and 2014

Good	1998	2014	Change
Capital-Intensive Consumption Good			
Housing	0.22	0.21	-0.01
Communications	0.46	0.39	-0.07
Utilities	0.45	0.42	-0.03
Private Transportation	0.57	0.47	-0.09
Food at Home	0.54	0.47	-0.08
Recreation	0.58	0.53	-0.05
Durables	0.59	0.54	-0.05
Average	0.41	0.36	-0.05
Labor-Intensive Consumption Good			
Public Transportation	0.65	0.58	-0.06
Other	0.61	0.58	-0.03
Food Away from Home	0.63	0.64	0.00
Clothing	0.68	0.63	-0.05
Health Care	0.74	0.71	-0.03
Nondefense Government Spending	0.77	0.74	-0.03
Domestic Services	0.79	0.75	-0.04
Education	0.80	0.77	-0.03
Average	0.71	0.68	-0.02
Investment Good			
Defense Government Spending	0.58	0.58	0.00
Investment	0.65	0.61	-0.04
Average	0.64	0.61	-0.03

The labor share declined significantly between 1998 and 2014
Network-adjusted labor share computed as in Subsection 2.1 for the years 1998 and 2014, the first and last years for which employment and Input-Output tables are available under the NAICS framework.
Classification of goods in this table follows Table 3.

Table 6: Fiscal Multipliers in the Model Using Labor Shares in 1998 and 2014

Policy	1998	2014
Sticky Prices ($\theta = 100$)		
Labor Intensive Consumption Good	0.862	0.845
Investment Good	0.650	0.625
Capital Intensive Consumption Good	0.200	0.167
Unemployment Insurance	0.002	0.002

The effectiveness of fiscal policy has declined with the labor share
1998 refers to the model with heterogeneity in production and consumption calibrated using the labor shares in 1998 as shown in Table 5. 2014 refers to the model with heterogeneity in production and consumption calibrated using the labor shares in 2014 as shown in Table 5.
Fiscal multiplier are for the case with sticky prices ($\theta = 100$) and stimulus financed by lump sum taxes.

A Appendix

A.1 Methodological Approach to PCE Data

In this appendix, I discuss my approach to the data in the national accounts for Personal Consumer Expenditures.

I connect data on the production of commodities to its different uses by final consumers using the Personal Consumer Expenditures (henceforth PCE) Bridge. Table A.1 summarizes the mapping from categories of expenditure in the PCE to the ones defined for this project. I include Final consumption expenditures of nonprofit institutions serving households (NPISHs) as part of government expenses, rather than PCE.

As part of the robustness checks, I exclude "imputed rental of owner-occupied housing" and "rental value of farm dwellings" from PCE, from GDP, and from the output of the real estate. The exercise introduces an asymmetry in the production of housing services as houses then add value to the economy if they are rented, but not if they are occupied by their owners. Furthermore, if upon employment, a household were to buy a house and stop renting, excluding rental equivalence of the house owned would suggest that the household is now spending less on housing, whereas the actual change depends on how the rent paid on the previous house compares to the opportunity cost of the new one. As shown in Figure A.3 and Table 2, the positive correlation between labor share and changes in expenditure upon employment is robust to excluding rental equivalence.

A.2 Computation of the Labor Share

The computation of the network-adjusted labor share relies mainly on national accounts data. In this appendix, I discuss methodological choices to compute the labor share shown in this paper.

I compute the network-adjusted labor share using the Industry-by-Commodity Domestic Requirements Matrix.[36] The matrix has industries in the rows and commodities in the columns. The entry in row i and column j indicates the amount of domestically produced

[36] Refer to Horowitz and Planting (2009) for a very rich description of the methodology employed in the production of the Input-Output Tables.

output of industry i that is required to deliver one dollar of commodity j to final users. The Domestic Requirements Matrix is computed using the Domestic Input table, instead of the Use table. The Domestic Input table is obtained by subtracting the imports matrix from the use matrix, thus finding the use of domestically produced commodities by industry and final users. Previous work (Baqaee, 2015; Valentinyi and Herrendorf, 2008) has instead used the Total Requirements Matrix in the computation of the network-adjusted labor share. I show in Figure A.1 that the two definitions are strongly correlated.

In terms of disaggregation, I choose to work with the Input-Output tables at the summary level, which divides the economy into 71 industry groups. I choose the summary level because the detail level (389 industries) is only available for benchmark years and because the PCE Bridge maps to the commodities produced at the summary level. Following Valentinyi and Herrendorf (2008), I use the Producer Value tables After Redefinitions. The Producer Value tables treat transportation and trade margins as final goods rather than inputs in the production process of other industries.

For my analysis, I take 2007 as baseline because the most recent benchmark Input-Output tables were produced that year following the 2007 Economic Census. As shown in Table 5, the labor share has declined significantly over the last 20 years. The decline has been larger for capital-intensive goods and so, the labor share is still strongly correlated over time (Figure A.1). The choice of baseline year is then not critical for my results.

The computation of the labor share also requires disaggregating entrepreneurial income into labor and capital income. National accounts divide national income into compensation of employees, corporate profits, and proprietor's income. The literature has long understood that proprietor's income mixes both labor and capital income as entrepreneurs invest both their own work and physical resources on their projects (Johnson, 1954).

I account for the labor component in entrepreneurial income by multiplying the ratio of compensation of employees to output[37] by the ratio of number of workers (both employees and self-employed workers) to employees. The assumption behind this adjustment is that the annual compensation of employees is the same than the annual labor compensation

[37] Elsby, Hobijn, and Sahin (2013) refer to the ratio of compensation of employees as fraction of gross value added as "payroll share". Gollin (2002) refer to it as "employee compensation share". In the context of my analysis, the compensation share is defined as fraction of total output.

of self-employed workers. This approach follows Valentinyi and Herrendorf (2008) and is similar to the one employed by the Bureau of Labor Statistics in its headline measure of the labor share.[38] Because of data limitations, I compute the adjustment factor at the sector level (15 industry groups), rather than at the summary level. My results are robust to using compensation share (i.e. compensation of employees as fraction of industry output) to measure labor share (Figure 4).

The adjustment is far from perfect. As Elsby, Hobijn, and Sahin (2013) point out, the correction implied a labor income to entrepreneurs larger than the sum of all proprietor's income during the 1980s and, as a consequence, a negative return on capital for a decade, indicating a likely overstatement of the labor share. However, given that self-employment varies significantly across sectors in the economy and it is particularly relevant in the production of services, it is important to account for it.

Other strategies have been used in the literature to deal with the allocation problem, but they appear unsuitable for my project. As noted by Krueger (1999) a common response after Johnson (1954) was to allocate two-thirds of the proprietor's income to labor and one-third to capital. But the recent decline in the labor share makes the use of a constant fraction, across industries and over time, unappealing. Alternatively, Karabarbounis and Neiman (2014) argue for the use of the corporate labor share that gets around the problem. But corporations only produce 60% of the American GDP and different sectors have different levels of incorporation, particularly in the service industry.

A.3 Output Elasticity of Labor Demand

In this appendix, I provide evidence that industries hiring relatively more workers exhibit a labor demand more responsive to changes in output.

The labor demand of capital-intensive sectors may be very responsive to output in the presence of adjustment costs. For instance, the automobile industry could respond to drops in demand by firing workers, rather than by reducing capital stock or other inputs in the short run. In that case, my measure of the labor share would not capture how labor compensation

[38] The Bureau of Labor Statistics uses as adjustment factor the ratio of total hours worked (by both employed and self-employed workers) to the number of hours worked by employees. The assumption for that adjustment is that the average hourly compensation for employed and self-employed workers is the same.

reacts to demand shocks.

The ideal approach to address this concern would be to estimate the output elasticity of labor demand for each industry. Formally, I would like to estimate this regression for each industry j:

$$L_{i,j,t} = \beta_j Y_{i,j,t} + \gamma_j K_{i,j,t} + \delta_j A_{i,j,t} + \kappa_{i,j} + \tau_{t,j} + \epsilon_{i,j,t}$$

where $L_{i,j,t}$, $Y_{i,j,t}$, $K_{i,j,t}$, and $A_{i,j,t}$ are the log employment, log output, log capital, and productivity level of firm i in industry j at time t, respectively. Firm and industry-specific time fixed effects are represented by $\kappa_{i,j}$ and $\tau_{t,j}$. The specification could also include other inputs and higher order terms as in the trans-log functional form.

However, such specification is unfeasible because productivity shocks are unobservable and so, ignoring them, introduces severe omitted variable bias. The industrial organization literature (De Loecker, 2011, De Loecker and Warzynski, 2012) has responded to this challenge with a proxy for productivity inverted from the firm's demand for materials or other inputs not subject to adjustment costs. This approach requires rich levels of data and so, estimations have usually been performed at the plant level for the manufacturing sector. But, as shown in the main text, services compose the most interesting part of my story.

I deal with this endogeneity concern by instrumenting output by the levels and growth rates of the markets where the firm sells its products. I use Worldscope data on American public firms in the period 1980 to 2014. I sort firms into 17 different industries, mainly following the SIC divisions. The dataset includes annual (fiscal year) information on sales, employment, capital, and sales exposure to different geographic markets (i.e. fraction of sales in the domestic and international markets).[39] I use the sales exposure to different markets to construct instruments for firm sales:

$$Y^D_{i,j,t} = \omega_{i,j,t} GDP^{US}_t + (1 - \omega_{i,j,t}) GDP^{ROW}_t$$

[39]The dataset also includes compensation of employees for a small subset of firms because reporting it is not required in the United States. Because of data limitations, I use output and sales interchangeably in this appendix.

$$Y^G_{i,j,t} = \omega_{i,j,t} g^{US}_t + (1 - \omega_{i,j,t}) g^{ROW}_t$$

where $\omega_{i,j,t}$ is the fraction of firm sales to the domestic market, GDP^{US}_t and GDP^{ROW}_t are the levels of GDP in year t in the U.S. and the rest of the world, respectively, as obtained from the World Economic Outlook dataset. The growth rates of GDP in the U.S. and in the rest of the world are given by g^{US}_t and g^{ROW}_t.

For each industry j, I estimate the regression

$$L_{i,j,t} = \beta_j Y_{i,j,t} + \gamma_j K_{i,j,t} + \kappa_{i,j} + \tau_{t,j} + \epsilon_{i,j,t}$$

where $L_{i,j,t}$, $Y_{i,j,t}$, and $K_{i,j,t}$ are the log employment, log sales, and log capital of firm i in industry j and year t, respectively. I include firm fixed-effects ($\kappa_{i,j}$) and industry-specific time fixed effects ($\tau_{t,j}$). And I instrument log sales with the weighted average of the level and growth of the markets where the firm is active, $Y^D_{i,j,t}$ and $Y^G_{i,j,t}$.

The output elasticity of labor demand is positively correlated with labor requirements across industries (Figure A.2). In the context of this exercise, I define labor requirements as the number of employees required to produce a million dollars of sales in each industry. Thus, industries employing relatively more workers respond to changes in output with larger changes in labor demand.

A.4 Methodological Approach to CEX Data

In this appendix, I discuss my approach to the data in the Consumer Expenditure Survey.

I obtain the Consumer Expenditure Survey (henceforth CEX) microdata for all the waves between 1980 and 1995 from the Inter-university Consortium for Political and Social Research.[40] I obtain the microdata for the waves between 1996 and 2014 from the website of the Bureau of Labor Statistics.[41]

Since the purpose of this paper is to combine expenditure and production data, I define

[40] For instance, for 1992: U.S. Dept. of Labor, Bureau of Labor Statistics. CONSUMER EXPENDITURE SURVEY 1992: INTERVIEW SURVEY, DETAILED EXPENDITURE FILES. Washington, DC: U.S. Dept. of Commerce, Bureau of the Census [producer], 1994. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 1995. http://doi.org/10.3886/ICPSR06440.v1

[41] http://www.bls.gov/cex/pumd.htm

expenditure categories that match goods in the CEX and in the Personal Consumer Expenditures of the national accounts as closely as possible. This requires a number of minor adjustments. First, I include “phone services” as part of communications, which also includes internet access, rather than as utilities. Second, I include “lodging away from home” as recreation, not as shelter. Third, I include “nursing homes” as domestic services, instead of medical services, because the main purpose of those facilities tends to be residential accommodations rather than health care. Fourth, I include clothing services such as repairs and rental in the category other, with personal care services, rather than in clothing. Fifth, I count all parking expenses as private transportation. Sixth, I count motorcycles as recreational items, not as private transportation. Seventh, I include “air transportation” and “water transportation” as recreation, rather than as public transportation, when purchased bu households.

My main divergence with respect to the methodology in the CEX is in the treatment of shelter for homeowners. The CEX defines shelter for homeowners as the sum of out-of-pocket expenditures: maintenance expenditures, interest on mortgages, and property taxes; whereas the national accounts impute the rental equivalence of the home owned to account for the opportunity cost. For consistency with the national accounts, I define housing for homeowners as the sum of the rental equivalence, maintenance expenditures, property taxes, and net household insurance. I exclude interest on mortgages because it is associated to a saving decision, rather than to an expenditure choice. For vacation houses, the CEX started collecting data on rental equivalence only after 1999, so I follow Aguiar and Bils (2015) and use out-of-pocket expenditures for them. The CEX did not start collecting rental equivalence until the 1982-1983 wave. Following Aguiar and Bils (2015), I impute rental equivalence in the 1980-1981 wave by estimating a regression of rental equivalence on household income; marital status, age, race, education, and gender of the household head; family size; and number of earners using the 1982-1983 wave. For renters, I define housing as the sum of rent, net household insurance, and household maintenance. My results on the positive correlation between labor share and changes in expenditure upon employment are robust to using out-of-pockets expenditures as a measure of housing (Figure A.3).

Consistent with the CEX methodology, I only consider expenditures associated to consumption, not to saving or investment decisions. Thus, I exclude capital improvements, house purchases, and payments of principal on mortgages or home equity loans.

To ensure that the household head remains the same across interviews, I drop all household heads whose gender changed or whose age increased by more than two years. I also drop households with negative income and with negative expenditures on at least one category. Afterwards, I add 1 to every category of expenditure before taking logs when estimating a log-log specification. I do not implement that adjustment when estimating the effect on the expenditure share.

Following Aguiar and Bils (2015), I increase by 11% the value of food at home in the surveys between 1982 and 1987, as the wording of the question in those waves appears to have yielded abnormally low values. A similar correction is implemented by Krueger and Perri (2006).

I use the CEX-derived measure of after-tax income in the previous twelve months and I add the rental equivalence for homeowners. I deflate all nominal expenditures and total income using the aggregate Consumer Price Index for the three and twelve months before each interview, respectively. However, this adjustment is only relevant for interpretation purposes, because all regressions include time-fixed effects.

For my baseline specification, I keep only households whose heads are aged 25-65. For robustness exercises, I further restrict the sample to only those with male heads or with heads aged 25-50. The number of households used to identify the expenditure response to employment is shown in Table 1, which also includes summary statistics of the distribution of expenditure shares for each good.

In every regression, I use probability weights and I cluster standard errors at the household level.

A.5 Methological Approach to Assessment of Fiscal Multipliers Estimated in the Literature

In this appendix, I describe my methodology for reviewing the empirical literature on the size of the fiscal multiplier and producing the histogram in Figure 16.

I search for empirical estimates of the fiscal multiplier published recently in top-tier journals. Concretely, I search for the words *fiscal multiplier* in the field "full text" using the search engines on the websites of the top 30 journals in economics as listed by IDEAS/RePEc.[42] If the journal engine does not allow to search by full text, I use the Princeton University Library.[43] I limit attention to estimates for the U.S. that used aggregate data and were published between January 1996 and the present. I include papers with cross-country data only if they offered separate estimates for the U.S.

For comparability, I use only estimates for the fiscal multiplier on impact. When the results are displayed as impulse-responses functions, I use the response of GDP in the first period. If standard errors are shown, I include the estimates for all the specifications that are statistically significant from zero. If standard errors are not shown, I keep all the estimates. I restate elasticities into fiscal multipliers dividing them by 0.22 or 0.05 when they use total spending or only military spending, consistent with Table 3.

I categorize estimates into defense and total spending based on the variation exploited in the research design. Papers using structural vector autoregression (VAR) techniques on total government expenditure belong to the latter. Papers using military spending or war-related news are included in the former.

A small number of papers reports results for both defense and nondefense spending. Blanchard and Perotti (2002) find a multiplier of 2.67 for nondefense spending and 2.50 for defense spending under deterministic trend, but they do not report standard errors, nor the multipliers for their specification under stochastic trend. Auerbach and Gorodnichenko (2012) find that nondefense is more effective than defense in expansions, but the opposite result holds for recessions. Finally, Perotti (2007) concludes *"Thus, the evidence from the SVAR approach is that civilian government spending shocks appear to be associated with stronger responses of GDP and its components."*[44][45]

[42] IDEAS/RePEc Aggregate Rankings for Journals, All years.

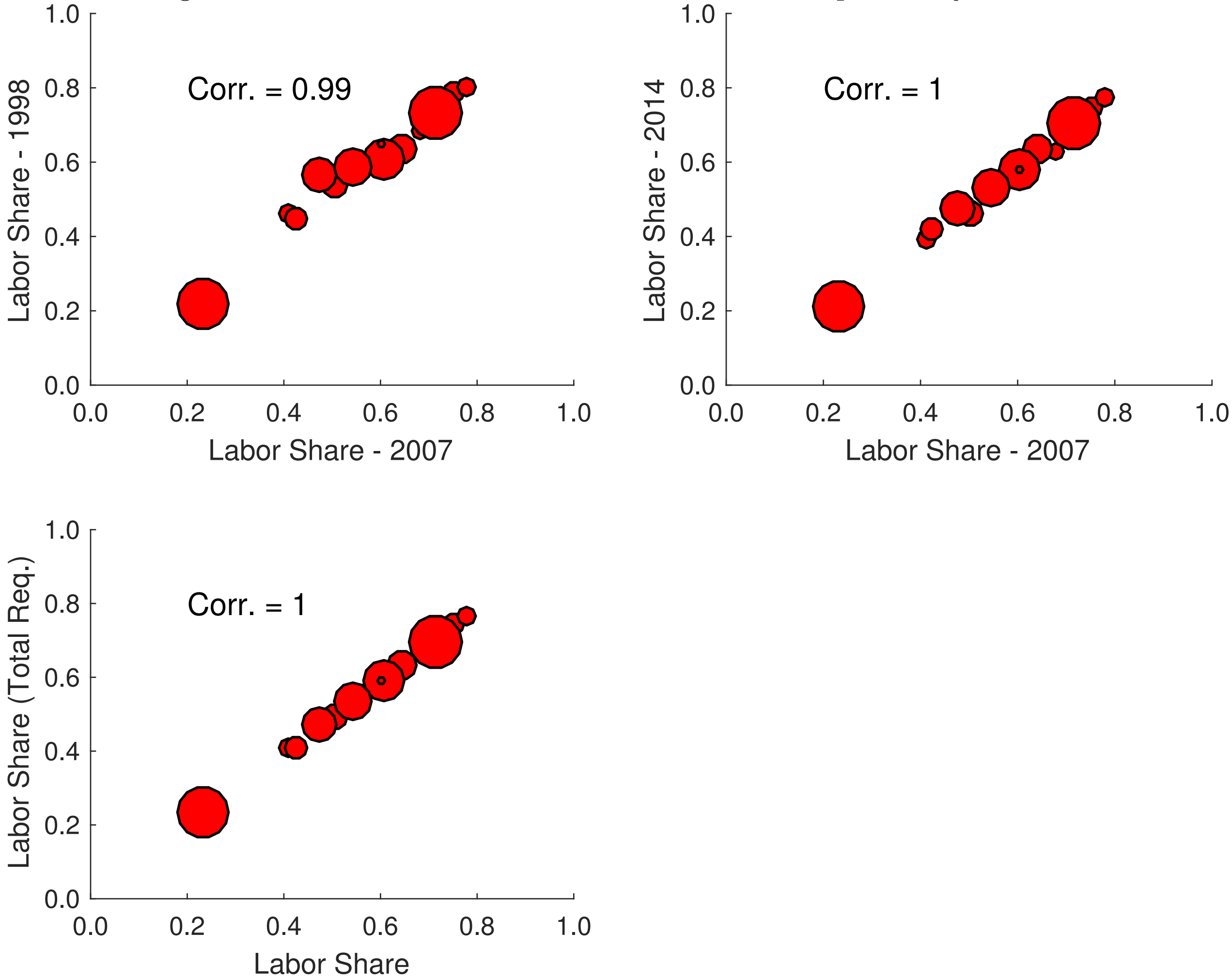
[43] http://library.princeton.edu

[44] But these results are not included in my sample because they are not published in a journal, but in a working paper.

[45] Gali, Lopez-Salido, and Valles (2007) do not report defense versus nondefense multipliers, but nondefense and total. They find that nondefense multiplier is greater than total spending multiplier in their larger VAR specification for the samples 1954-2003 and 1960-2003, but smaller in their small VAR. They do not report standard errors.

Figures

Figure A.1: Labor Share over Time and without Imports Adjustment



The labor share is strongly correlated over time and the adjustment for imports is not quantitatively very large

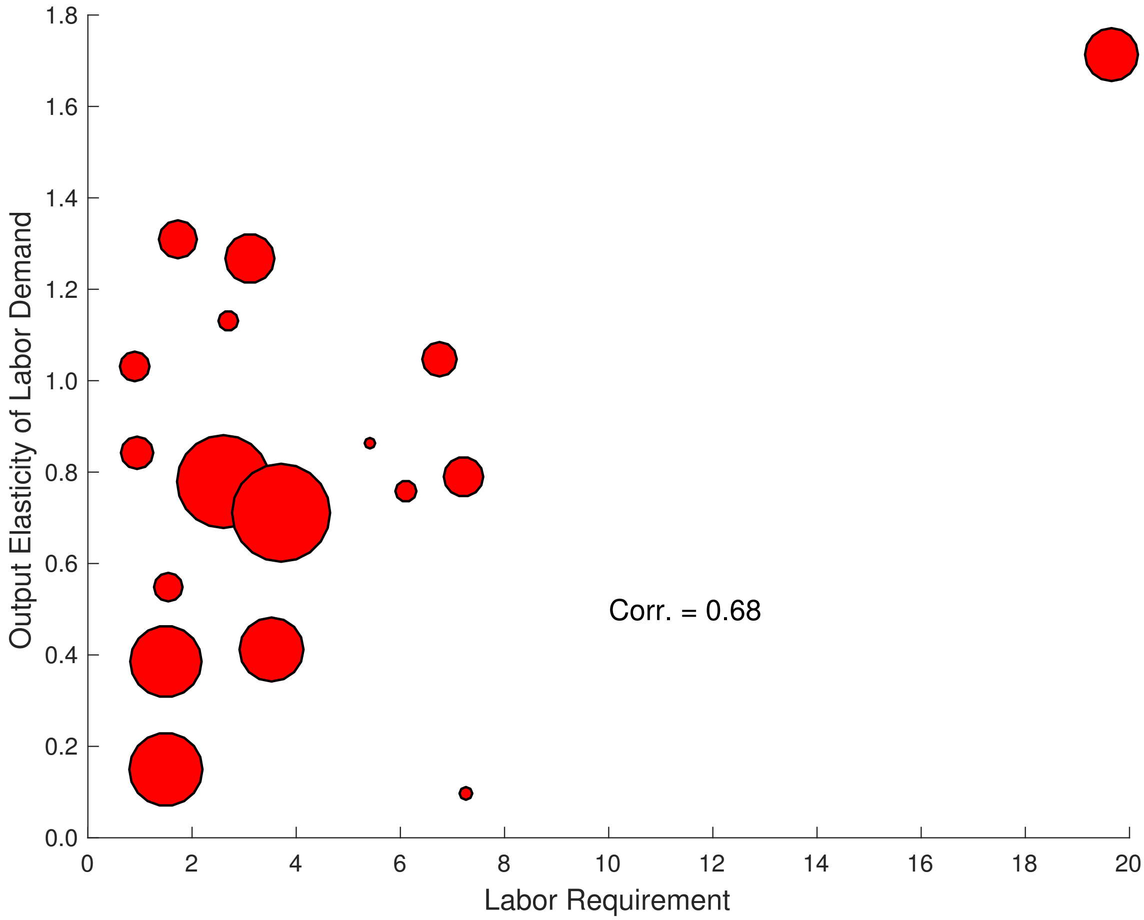
The top two panels present the network-adjusted labor share in 1998, 2007, and 2014. 1998 and 2014 are the first and last year for which employment and Input-Output tables are available under the NAICS framework, respectively. Labor share (Total Req.) refers to the network-adjusted labor share computed using the Total Requirements Matrix, instead of the Domestic Requirements Matrix.

Each ball represents one of the final consumption goods in Figure 1. The size of each ball is proportional to the share of that final good on total consumption in 2007 according to the national accounts.

Corr. refers to the weighted correlation between the variables in each figure.

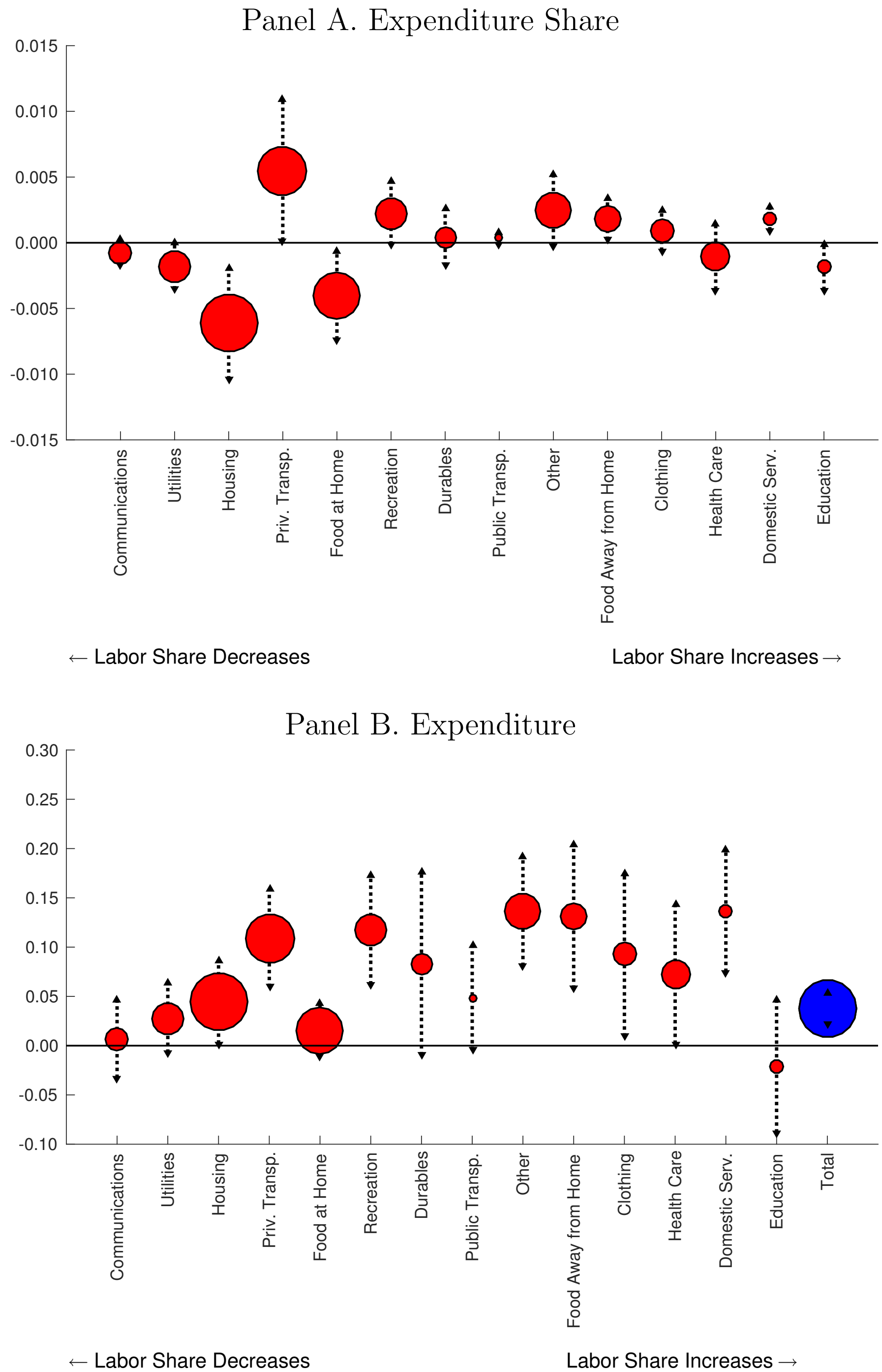
Refer to the main text and Appendix A.2 for details on the calculations.

Figure A.2: Output Elasticity of Labor Demand and Labor Requirements by Industry



Industries employing relatively more workers respond to changes in output with larger changes in labor demand
Labor requirement is the average number of employees per million dollars of sales in the industry in 2014. Output elasticity of labor demand is estimated using an instrumental variable approach as described in Appendix A.3.
The size of each ball is proportional to the amount of employment in the industry in 2014 according to Worldscope.
Corr. refers to the weighted correlation between labor requirement and output elasticity of labor demand.

Figure A.3: Results Excluding Rental Equivalence for Homeowners



The positive correlation between labor shares and expenditure responses to employment is robust to excluding imputed housing for homeowners
Panel A shows the response of the expenditure share of each good to a change in the employment status of the household head. Panel B shows the elasticity of expenditure on each good to a change in the employment status of the household head.
95% confidence intervals are shown with dotted lines. Standard errors are clustered at household level. Goods are sorted by their network-adjusted labor share in ascending order. Labor share is computed after excluding rental equivalence from PCE, GDP, and output of the real estate industry. Housing is defined as out-of-pocket expenditures only. The size of each ball is proportional to the share of that good on total consumption according to the CEX.

Tables

Table A.1: Mapping to PCE categories

Good	PCE Category
Clothing	Children's and infants' clothing; Jewelry and watches; Men's and boys' clothing; Other clothing materials and footwear; Women's and girls' clothing
Communications	Internet access; Postal and delivery services; Telecommunication services
Domestic Services	Nursing homes; Social services and religious activities
Durables	Furniture and furnishings; Glassware, tableware, and household utensils; Household appliances; Household supplies; Telephone and facsimile equipment; Tools and equipment for house and garden
Education	Commercial and vocational schools; Educational books; Higher education; Nursery, elementary, and secondary schools
Food at Home	Food and nonalcoholic beverages purchased for off-premises consumption; Food produced and consumed on farms
Food Away from Home	Food furnished to employees (including military); Purchased meals and beverages
Health Care	Dental services; Hospitals; Net health insurance; Paramedical services; Pharmaceutical and other medical products; Physician services; Therapeutic appliances and equipment
Housing	Imputed rental of owner-occupied nonfarm housing; Rental value of farm dwellings; Group housing; Net household insurance; Rental of tenant-occupied nonfarm housing; Household maintenance
Other	Alcoholic beverages purchased for off-premises consumption; Financial services furnished without payment; Financial service charges, fees, and commissions; Life insurance; Luggage and similar personal items; Personal care and clothing services; Personal care products; Professional and other services; Tobacco
Private Transportation	Motor vehicle fuels, lubricants, and fluids; Motor vehicle maintenance and repair; Motor vehicle parts and accessories; Net motor vehicle and other transportation insurance; Net purchases of used motor vehicles; New motor vehicles; Other motor vehicle services
Public Transportation	Ground transportation
Recreation	Accommodations; Air transportation; Audio-video, photographic, and information processing equipment services; Net foreign travel (Other services); Gambling; Magazines, newspapers, and stationery; Membership clubs, sports centers, parks, theaters, and museums; Musical instruments; Net expenditures abroad by U.S. residents (Other nondurable goods); Other recreational services; Recreational items; Recreational books; Sporting equipment, supplies, guns, and ammunition; Sports and recreational vehicles; Video, audio, photographic, and information processing equipment and media; Water transportation
Utilities	Electricity; Fuel oil and other fuels; Natural gas; Water supply and sanitation

Good refers to the categories of expenditure as defined in this paper. PCE Category refers to the classification of products used by the national accounts for Personal Consumer Expenditures (e.g. Table 2.4.5).