A Model of Labor Supply, Fixed Costs and Work Schedules*

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Abstract

To analyze labor supply allocations, we propose a three-dimensional labor supply framework that distinguishes between hours worked per day, days worked per week and workweeks. Individuals make labor supply choices given heterogeneous schedule-dependent fixed costs of work. The three margins are not perfect substitutes. Leisure on days not worked in a workweek has the largest weight in preferences, leisure on weeks off has the smallest weight. We use the model to analyze heterogeneous response to changes in fixed costs, schedule flexibility, and restrictions on weekly hours. Fixed costs of work affect response to each policy and determine associated losses.

1 Introduction

Labor supply theory emphasizes the distinction between the extensive margin and the intensive margin. At the intensive margin, individuals respond to wage fluctuations by varying their hours or the intensity of their work. At the extensive margin, individuals make participation choices, subject to individual constraints and comparative advantage considerations. The elasticity of labor supply at each margin reflects different aspects

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of individual behavior. For an extensive summary of this literature, see, for example, Hausman (1985), Pencavel (1986), and Blundell and MaCurdy (1999).

We extend the standard labor supply framework to account for detailed work schedules by incorporating three time dimensions: hours per day, days per week, and weeks per year. The three labor supply decisions are determined jointly and simultaneously. Agents maximize utility by choosing consumption and three types of leisure: leisure time in the workweek on days worked, leisure time in the workweek on days not worked and leisure time in the weeks not worked. The choice of the optimal labor schedule is subject to individual fixed costs of work at each time dimension and to a given hourly wage, which is a function of the total hours worked.[1] To obtain the parameters that govern the substitution between the three margins, we estimate the model empirically using individual-level data. We show that hours worked per day and days worked per week are not perfect substitutes.

The model is estimated using 2003–2015 Current Population Surveys, including the Food Security Supplements and American Time Use Surveys, and the 1996 Survey of Income and Program Participation, including the Work-Related Expenses and Work Schedule files. Our estimation strategy builds on the methodologies of MaCurdy (1981) and Altonji (1986) and develops two empirical specifications. Both methods use instruments for leisure variables that employ the exogenous variation in fixed costs of work and non-labor income, and yield similar results. We show that hours worked per day, days worked per week, and weeks worked per year are not perfect substitutes. Each type of leisure has a different weight in preferences, with leisure on days not worked during a workweek having the largest weight, and leisure on weeks off having the smallest weight.

The estimation results are in line with findings of earlier studies. For example, Hanoch (1976), Hanoch (1980), Blank (1988), Triest (1990), and Reilly (1994) show that weekly hours and annual weeks are not perfect substitutes and, therefore, should not be aggregated. Hamermesh (1996) empirically analyzes decisions on days worked per week and hours worked per day, and shows that the two margins should not be treated as a homogeneous unit.

We use the model to evaluate a number of policies. The individual intertemporal elasticity of labor supply is around 0.2, within the range of the existing estimates. The

[1] The fixed cost structure relates to Gronau (1974), Heckman (1974), Heckman (1979), and Cogan (1981). These studies use a two-dimensional labor supply framework to show that the response of the labor supply to wage fluctuations varies, not just with the overall cost of work, but also with the structure of fixed costs.

model produces a large range of elasticities for the same set of model parameters by varying work schedules and the degrees of attachment to the labor force. Among seemingly similar workers with the same weekly hours, those who work more compressed weeks have higher elasticity. Workers who are less attached or who are partially employed have a higher elasticity of labor supply. These findings are in line with the results reported in Rogerson and Rupert (1991), who find that individuals employed for 52 weeks per year have significantly lower labor supply elasticity than those not in the corner solution. Additionally, the proximity to a corner at any time dimension (i.e., hours, days, or weeks) reduces the elasticity of labor supply. We compute the aggregate, or "macro", elasticity of labor supply and find it to be around 1.6, within the range of the existing estimates.

Previous studies show that the elasticities at the extensive and intensive margins differ significantly by gender, age, and other individual characteristics (see, for example, Bishop, Heim, and Mihaly 2009, Blau and Kahn 2007, Diamond 1980, Eissa and Liebman 1996, Laroque 2005, Meyer and Rosenbaum 2001, Saez 2002). In our model, individual heterogeneity is driven by variation in the fixed costs of work and by individual productivity (and tax rates). Our results are in line with those in the existing literature.

We calibrate the model to analyze changes in labor supply in response to policies that generate changes in the fixed costs of work, affect schedule flexibility, and set restrictions on weekly hours. Policies designed to affect the common fixed costs of work, such as commuting and childcare costs, are widespread. For example, in many European countries, workers can deduct commuting expenses to reduce their income tax liability. In contrast, in the United States, commuting costs are not tax deductible. Childcare subsidies are available in many OECD countries, including the United States, where they are limited to low-income families.[2] We show that a 5% or 10% decrease (increase) in the daily fixed costs of work leads to a reduction (increase) in hours worked per day, has no effect on days worked per week, and results in a marginal decrease (increase) in weeks worked per year. There are large utility gains (losses) associated with such changes in fixed costs. Similar magnitude changes in weekly costs have small effects on time allocation. Most OECD countries also implement policies that may affect choices of working hours and schedule flexibility. These policies include restrictions on total hours worked per week, hours worked per day, number of rest days per week, and penalty rate systems for overtime

[2]See OECD (2017) for a survey of early childhood education and care policies. In the United States, some programs subsidize work-related childcare expenses only, but others have no employment requirement for the parents. See Blau (2007) for an extensive discussion of these policies in the United States.

work and for work on prescribed days of rest.[3] We conduct two experiments to analyze the effects schedule flexibility on labor supply and wellbeing. First, we compare outcomes in the benchmark allocation with outcomes in an environment that restricts working to five days per week. In the restrictive environment, there are only minor changes in the average weekly hours worked for those who remain employed. However, the dispersion of hours in this environment is higher, average utility is lower, and labor force participation decreases. Second, we analyze the effects of restrictions on weekly hours worked. Such restrictions mostly affect individuals with higher daily and weekly costs. Low-productivity workers at the higher end of the weekly and daily cost distributions are more likely to leave the labor force. Under such policies, constrained workers reduce their hours worked per day and days worked per week, and increase their weeks worked per year. There are large associated utility losses for constrained workers. Some of these losses are mitigated by fixing the wages of constrained workers to pre-policy levels.

The remainder of the paper is organized as follows. Section 2 builds the theoretical framework and outlines the empirical strategy. Section 3 describes the data, and in Section 4, we discuss the estimation methods and provide the results. Section 5 reports the individual and aggregate estimates of the intertemporal elasticity of labor supply. In Section 6, we analyze the effects of popular public policies on labor supply. Section 7 concludes the paper.

2 Theoretical Model

We develop a three-dimensional labor supply framework in which workers derive utility from consumption, c_{it}, and three types of leisure, leisure time on days worked in workweeks, l_{1it}, leisure time on days off in workweeks, l_{2it}, and leisure time on weeks off in year t , l_{3it}. Leisure variables are defined as follows:

[3] Policymakers justify such regulations in various ways, such as reducing unemployment and yielding a better division of labor, as well as improving the work–life balance and quality of life of workers. For example, in Belgium, overtime rates must be paid for all work in excess of eight hours per day or 39 hours per week, and every worker must be given at least one 24-hour rest period each week. Work time is normally limited to 11 hours per day and 50 hours per week. Then, according to the French labor market regulations, the standard working week is 35 hours, with a statutory requirement of one rest day per week (Sunday). However, the 35-hour limit can be extended to 48 hours at a premium wage rate.

$$l_{1it} = n_{it} d_{it} \left(\overline{h} - h_{it}\right), \tag{1a}$$

$$l_{2it} = n_{it} \overline{h} \left(\overline{d} - d_{it}\right), \tag{1b}$$

$$l_{3it} = \overline{dh} \left(\overline{n} - n_{it}\right), \tag{1c}$$

where h_{it} are hours worked per day on days worked, d_{it} are days worked per week on weeks worked and n_{it} are weeks worked per year. The values $\overline{h}$, $\overline{d}$ and $\overline{n}$ are maximum values of hours worked per day, days worked per week and annual weeks, respectively.[4]

Agent i maximizes his/her expected lifetime utility given by

$$U_i = E_0 \sum_{t=0}^{T} \beta^t \left[\varphi_{cit} \frac{c_{it}^{1-\gamma_c}}{1-\gamma_c} + \varphi_{lit} \left(\frac{[l_{1it} l_{2it}^{\rho_1} l_{3it}^{\rho_2}]^{1-\gamma_n}}{1-\gamma_n} \right) \right], \tag{2}$$

where β is a discount factor and T is the end of the planning horizon. Person specific preferences over consumption and leisure in period t are given by φ_{cit} and φ_{lit}, respectively. Parameters ρ_1 and ρ_2 summarize the differences in preferences over the three types of leisure, and together with $1 - \gamma_n$, determine the substitution between l_{1it}, l_{2it} and l_{3it}. Strict concavity of the utility function requires $\gamma_c, \gamma_n, \rho_1, \rho_2 > 0$, while $\gamma_n > 1$ implies that the three types of leisure are substitutes, (i.e. the marginal utility of week off or day off is lower the shorter the workday). The utility share of leisure on workdays, l_{1it}, is normalized to one. Expectations are conditioned upon the information set of the individual at time 0. The preference structure assumes separability of consumption and leisure, and a constant elasticity of substitution between the three dimensions of labor supply.

Firms may not be indifferent to the number of hours worked when there are fixed costs involved in hiring and retaining workers, as found in Lewis (1969) and Barzel (1973) and, more recently, in Keane and Wolpin (2001) and Aaronson and French (2004). Here, we follow Aaronson and French (2004) and assume the following structure for hourly earnings:

$$\ln w_{it}(H_{it}) = \alpha_{it} + \theta \ln H_{it}, \tag{3}$$

where $H_{it} = n_{it} d_{it} h_{it}$ is total hours worked in period t and α_{it} represents an individual's underlying productivity and summarizes the proportional tax rate (i.e., $\alpha_{it} = \widetilde{\alpha}_{it} + \ln(1 -$

[4] Cho, Merrigan, and Phaneuf (1998) use a similar definition of leisure in a two-dimensional labor supply model.

tax_t)).[5]

In every period t, the budget constraint is given by

$$w_{it}(H_{it})H_{it} - F(d_{it}, n_{it}) - c_{it} + (1+r)A_{it} - A_{it+1} = 0, \tag{4}$$

where A_{it} is wealth in period t, and r is the real interest rate. Individual work-related fixed costs in time t are summarized by $F\left(d_{it}, n_{it}\right)$. For simplicity of presentation, we assume that the fixed costs of work are constant within period t (i.e., in a given year, the daily fixed costs of work are the same for each day worked). Therefore, at the optimum, individuals choose to work the same number of hours on each workday, and the same number of days in each workweek. The fixed costs of work are defined as follows:

$$F(d_{it}, n_{it}) = n_{it}\left[f_{dit}d_{it} + f_{nit}\right] + f_{pit}I(n > 0), \tag{5}$$

where f_{dit} is the daily fixed cost of work, f_{nit} is the weekly fixed cost of work, and f_{pit} is a participation cost. The worker pays f_{dit} on each day worked, regardless of how many hours are worked that day; an example of such costs are commuting costs or the costs of making oneself presentable for work. Similar assumptions apply to f_{nit} and f_{pit}.[6]

2.1 First-Order Conditions

For simplicity of notation, the individual subscripts i are omitted.
Each individual chooses consumption and leisure to maximize the expected lifetime utility in equation (2) subject to the budget constraint (4). First-order conditions are given by

$$\beta^t \varphi_{ct} c_t^{-\gamma_c} = \lambda_t, \tag{6a}$$

$$\beta^t \varphi_{lt} \rho_2 l_{3t}^{\rho_2(1-\gamma_n)-1} l_{2t}^{\rho_1(1-\gamma_n)} {l_{1t}}^{1-\gamma_n} = \lambda_t \left\{ w_t(H_t)(1+\theta) - \frac{f_{dt}}{\bar{h}} - \frac{f_{nt}}{\overline{\overline{dh}}} \right\}, \tag{6b}$$

$$\beta^t \varphi_{lt} \rho_1 l_{3t}^{\rho_2(1-\gamma_n)} l_{2t}^{\rho_1(1-\gamma_n)-1} {l_{1t}}^{1-\gamma_n} = \lambda_t \left\{ w_t(H_t)(1+\theta) - \frac{f_{dt}}{\bar{h}} \right\}, \tag{6c}$$

$$\beta^t \varphi_{lt} l_{3t}^{\rho_2(1-\gamma_n)} l_{2t}^{\rho_1(1-\gamma_n)} {l_{1t}}^{-\gamma_n} = \lambda_t w_t(H_t)(1+\theta), \tag{6d}$$

$$\lambda_t = (1+r)E_t \lambda_{t+1}, \tag{6e}$$

[5] Aaronson and French's (2004) estimate of θ is 0.4. Keane and Wolpin's (2001) estimate is 0.2.

[6] The effect of hourly fixed costs is to shift down the slope of the wage rate, which does not change the nature of the labor supply decision. Therefore, hourly costs are not considered.

where λ_t is the marginal utility of wealth, which is a function of wealth, current and future preferences, and current and future wages. Equation (6e) determines the allocation of wealth across periods. We use the first-order conditions to estimate ρ_1, ρ_2, γ_n, and γ_c.

The first-order conditions yield the following demand functions for each type of leisure:

$$\ln l_{1t} = \kappa_1 \ln w_t(H_t) + \kappa_2 \ln \left[w_t(H_t)\,(1+\theta) - \tfrac{f_{dt}}{\overline{h}} \right] + \kappa_3 \ln \left[w_t(H_t)\,(1+\theta) - \tfrac{f_{dt}}{\overline{h}} - \tfrac{f_{nt}}{\overline{dh}} \right] + \ln \Gamma_t, \tag{7a}$$

$$\ln l_{2t} = (\kappa_1 + 1) \ln w_t(H_t) + (\kappa_2 - 1) \ln \left[w_t(H_t)\,(1+\theta) - \tfrac{f_{dt}}{\overline{h}} \right] + \kappa_3 \ln \left[w_t(H_t)\,(1+\theta) - \tfrac{f_{dt}}{\overline{h}} - \tfrac{f_{nt}}{\overline{dh}} \right] + \ln \Gamma_t + \ln \left[\rho_1\,(1+\theta) \right], \tag{7b}$$

$$\ln l_{3t} = (\kappa_1 + 1) \ln w_t(H_t) + \kappa_2 \ln \left[w_t(H_t)\,(1+\theta) - \tfrac{f_{dt}}{\overline{h}} \right] + (\kappa_3 - 1) \ln \left[w_t(H_t)\,(1+\theta) - \tfrac{f_{dt}}{\overline{h}} - \tfrac{f_{nt}}{\overline{dh}} \right] + \ln \Gamma_t + \ln \left[\rho_2\,(1+\theta) \right], \tag{7c}$$

where $\kappa_1 = \frac{1-(\rho_1+\rho_2)(1-\gamma_n)}{(\rho_1+\rho_2)(1-\gamma_n)-\gamma_n}$, $\kappa_2 = \frac{\rho_1(1-\gamma_n)}{(\rho_1+\rho_2)(1-\gamma_n)-\gamma_n}$ and $\kappa_3 = \frac{\rho_2(1-\gamma_n)}{(\rho_1+\rho_2)(1-\gamma_n)-\gamma_n}$ and $\Gamma_t = \frac{\beta^t \varphi_{lt}}{\lambda_t}\,(1+\theta)^{(\rho_1+\rho_2)(1-\gamma_n)-1}\,\rho_1^{\rho_1(1-\gamma_n)}\,\rho_2^{\rho_2(1-\gamma_n)}$.

2.2 Empirical specification

Rearranging equation (6d) and taking the first-differences yields the following:

$$\Delta \ln w_t(H_t) = -\gamma_n \Delta \ln l_{1t} + \rho_1\,(1-\gamma_n)\,\Delta \ln l_{2t} + \rho_2\,(1-\gamma_n)\,\Delta \ln l_{3t} - \ln \beta + \Delta \ln \varphi_{lt} + \Delta \ln \lambda_t, \tag{8}$$

Given the uncertainty in wages, λ_t is a random variable that is not realized until the start of period $t+1$. Then, $\Delta \ln \lambda_t$ is computed as follows. Backdating (6e) yields $\lambda_{t-1} = (1+r)E_{t-1}\lambda_t$ and, therefore, assuming rational expectations, $\lambda_t = 1/(1+r)\,(\lambda_{t-1} + e_{\lambda t})$, where $e_{\lambda t}$ is a mean-zero expectation error. Taking logs of both sides, and using the first-order linear approximation of $1/(1+r)\,(\lambda_{t-1} + e_{\lambda t})$ around $e_{\lambda t} = 0$ and ignoring higher-order terms, leads to $\ln \lambda_t = -\ln(1+r) + \ln \lambda_{t-1} + \xi_t$, or $\Delta \ln \lambda_t = -\ln(1+r) + \xi_t$, where $\xi_t = (1/\lambda_t)\,e_{\lambda t}$ is an approximation error.

Combining and rearranging equations (6a) and (6d) yields:

$$\ln c_t = \frac{\gamma_n}{\gamma_c} \ln l_{1t} - \frac{\rho_1\,(1-\gamma_n)}{\gamma_c} \ln l_{2t} - \frac{\rho_2\,(1-\gamma_n)}{\gamma_c} \ln l_{3t} + \frac{1}{\gamma_c} \ln w_t(H_t) + \frac{1}{\gamma_c} \ln \left(\frac{\varphi_{ct}}{\varphi_{lt}}(1+\theta) \right), \tag{9}$$

To construct $\ln l_{1t}$, $\ln l_{2t}$ and $\ln l_{3t}$, we set $\overline{h} = 16$, $\overline{d} = 7$ and $\overline{n} = 52$.

Equation (8) uses the lagged labor supply as a proxy for the lifetime wealth, and equation (9) uses consumption as a proxy for lifetime wealth.[7] We estimate these equations empirically, addressing endogeneity and potential measurement errors, and derive ρ_1, ρ_2, γ_n, and γ_c. Section 4 describes the empirical estimations in detail. Using these estimated parameters, we calculate the intertemporal elasticity of labor supply at each time dimension and perform a range of experiments. Sections 5 and 6 report these results.

3 Data

The first-differences equation (8) is estimated using the 1996 Survey of Income and Program Participation (1996 SIPP). The SIPP features a panel structure and has detailed monthly demographic and employment data for all persons in a household. The panel has 12 waves, collecting data for a continuous 48-month period. Detailed questions about work schedules were asked of a subsample of individuals during the 4th and 10th waves (Work Schedule supplements). Commuting data (miles driven to work per week) are reported in the 3rd, 6th, 9th, and 12th waves (Work-Related Expenses supplements). The wage rate variable, denoted by $\ln w_t^*$, is calculated as the log of weekly earnings divided by usual weekly hours worked.

The sample is restricted to working individuals between the ages of 21 and 60 years who are married, not disabled, not attending school, not in the military, and not retired. We use only married individuals because spousal information is used in the estimation procedure. The initial samples of men contain 11,189 and 9,409 observations in waves 4 and 10, respectively. The corresponding samples of women have 10,184 and 8,584 observations, respectively. We use information on individuals who were interviewed in both waves, which leaves 8,654 observations for men and 7,451 observations for women. Samples are merged with the work expenses data available in waves 3, 6, 9, and 12. We exclude individuals who report more than 80 hours of work per week and those who report changes in hours worked or in commuting miles greater than 300% or below -75%. The final sample contains 3,898 observations for men and 3,446 for women.

[7] The assumption of separability in consumption and leisure is maintained throughout the paper. Altonji (1986) shows that if measurement errors are small, the parameters of the model can still be estimated from the first-difference specification in equation (8). However, the log-level specification in equation (9) may result in biased estimates. We estimate the model using both specifications; the differences between the estimates are not large, and can be partially attributed to the bias associated with the separability assumption.

To estimate equation (9), we draw data from the 2003–2015 waves of the American Time Use Survey (ATUS) merged with the Current Population Survey, Food Security Supplements (CPS). The merged ATUS-CPS data contain detailed labor supply and food consumption information. Within each household that participates in the ATUS, one randomly selected member (age 15 and up) is asked to provide information about his/her daily activities over a randomly assigned 24-hour period. Each day of the week is represented equally in the survey.

We construct two wage rates: w_t^* is derived from weekly earnings divided by usual weekly hours; and w_t^{**} is the wage rate available for a subset of persons who were recorded as paid on an hourly basis. Hours worked per day are obtained from the time-use diary. Days worked per week are calculated by dividing usual hours worked per week by hours worked per day.[8] To minimize the potential correlation between measurement errors in the leisure variables and the wage rates, we draw information on usual weekly hours from different supplements: days worked per week is calculated using hours from the ATUS, and w_t^* is calculated using hours from the Food Security Supplements. Consumption, c_t^*, is taken from the Food Security Supplements, and is calculated as food expenditure per equivalent person.[9] We assume that measurement errors in consumption and other variables are not correlated because they come from independent questions or questionnaires. All nominal measures are adjusted using the CPI 2015. Weeks worked per year are obtained from the March CPS Supplements (also known as the Annual Social and Economic Supplements), which are available for a subset of the individuals in the ATUS–CPS sample.

We merge the ATUS, March Supplements, and Food Security Supplements, including only those individuals with valid food expenditure entries. The merged sample is limited to individuals between the ages of 21 and 60 years who are not disabled, not attending school, not in the military, and not retired. We also exclude individuals who were interviewed on a holiday. Given these specifications, the ATUS–CPS sample contains 22,380 observations for men and 28,195 for women. We exclude individuals who do not work, those who work less than one hour per week or more than 16 hours per day, those with missing data on key variables, those who have more than one employer, those who travel more than six hours per day, and those who report extreme hourly wages. Furthermore, we exclude individuals

[8] If the obtained variable is not an integer, it is rounded to the closest whole number. If the number of days worked exceeds 7, the observation is considered invalid.

[9] The equivalence scale is provided by the US Department of Commerce (1991, p. 132). The scale is as follows: 1 person = 1 unit, 2 people = 1.28, 3 = 1.57, 4 = 2.01, 5 = 2.37, 6 = 2.68, 7 = 3.04, and 8 = 3.40.

who report a weekly household food consumption that exceeds $1,000 or individual food consumption below $5. After these adjustments, the sample contains 6,667 observations for men and 6,804 for women. Weeks worked are not reported for every individual in this sample (only for those found in the March Supplements). Limiting the data to only those workers with valid weeks who work at least 10 weeks per year and who have at least 10 hours of each type of leisure reduces the sample to 3,024 observations for men and 3,132 for women. Finally, we do not include individuals with top-coded earnings. Our final samples include 2,856 observations for men and 3,075 observations for women. We also construct a subsample of women whose earnings are similar or higher than those of their spouses. This subsample is limited to women who have spousal information, and contains 946 observations.

The key variables of the SIPP and ATUS–CPS are summarized in the Online Appendix. Employed men supply 8.7–8.9 hours per day, 5.0–5.1 days per week, and work 49–51 weeks per year. For women, the corresponding statistics are 7.7–8.2 hours per day, 4.7–4.8 days per week, and 49–50 weeks per year. The fixed costs of work are measured by the presence of children and the commuting time or distance. In the ATUS–CPS, the average time spent on commuting is 0.82 and 0.62 hours per day for men and women, respectively. Time spent on childcare is 0.44 hours for men and 0.74 hours for women. In the SIPP, the average distance traveled to work per week is 109.8 and 80.9 miles for men and women, respectively.

4 Estimation

Using the proposed model, we derive two empirical specifications. Equation (8) uses the lagged labor supply as a proxy for the lifetime wealth, and is consistent with the methodology of MaCurdy (1981). Equation (9) uses consumption as a proxy for lifetime wealth, and builds on approach of Altonji (1986). We estimate these equations to obtain the parameters that govern work schedule choices and time allocation, ρ_1, ρ_2, γ_n, and γ_c. Our estimations address endogeneity and potential measurement errors. Measurement errors are particularly important in the first-differences specification because leisure variables do not move much over the two years. However, there can be a measurement error in every period, which would lead to a substantial attenuation bias in the estimated coefficients. The consumption estimation method in equation (9) is more prone to endogeneity issues than is the first-differences specification. The preference for consumption, summarized by

φ_{ct}, may affect both consumption and leisure, and is not fully observable in the data. On the other hand, it is plausible to assume that the change in φ_{lt} over a two-year period is small and, therefore, should not lead to important endogeneity issues in the estimation of equation (9). Instrumental variables are used to address potential measurement errors in variables and endogeneity issues. Using the demand functions in equations (7a)–(7c), we specify the set of instrumental variables for each specification. Policy experiments in Sections 5 and 6 use the estimated ρ_1, ρ_2, γ_n, and γ_c.

4.1 Using Past Labor Supply Variables to Proxy for λ

The first-differences specification in equation (8) uses data from the 4th and 10th waves of the 1996 SIPP. Wave 10 survey was administered about two years after wave 4. The available log leisure measures and log real wage rate, $\ln l^*_{1t}$, $\ln l^*_{2t}$, $\ln l^*_{3t}$, and $\ln w^*_t$, are assumed to equal $\ln l_{1t}$, $\ln l_{2t}$, $\ln l_{3t}$, and $\ln w_t$, respectively, plus the classical measurement errors ϵ_{1t}, ϵ_{2t}, ϵ_{3t}, and ϵ_{wt}, respectively. The variables are obtained using responses to independent corresponding questions. Therefore, $\Delta\epsilon_{1t}$, $\Delta\epsilon_{2t}$, and $\Delta\epsilon_{3t}$ should not be correlated with $\Delta\epsilon_{wt}$.

Taking into account the measurement errors, equation (8) is rewritten as:

$$\Delta \ln w^*_t = -\gamma_n \Delta \ln l^*_{1t} + \rho_1 (1-\gamma_n) \Delta \ln l^*_{2t} + \rho_2 (1-\gamma_n) \Delta \ln l^*_{3t} - \ln \beta(1+r) + \Delta \ln \varphi_{lt} + \upsilon_t, \tag{10}$$

where $\upsilon_t = \xi_t - \gamma_n \Delta\epsilon_{1t} + \rho_1 (1-\gamma_n) \Delta\epsilon_{2t} + \rho_2 (1-\gamma_n) \Delta\epsilon_{3t} + \Delta\epsilon_{wt}$.

Measurement errors present an important estimation issue in the first-differences specification. To address these errors, we utilize the leisure demand functions in equations (7a)–(7c) and instrument for $\Delta \ln l^*_{1t}$, $\Delta \ln l^*_{2t}$, and $\Delta \ln l^*_{3t}$ using proxies for the fixed costs and the marginal utility of wealth, λ. The instruments include changes in commuting distance, an indicator for childbirth between the two waves, changes in non-labor income, and changes in spousal hours worked. Note that the first-differences in equation (10) are computed over a two-year period, and it is plausible to assume that there were no changes in the preference parameter, $\ln \varphi_{lt}$, over this relatively short period. Additionally, because $\Delta \ln \varphi_{lt}$ might be related to age and the wage profile is also age dependent, all estimations include age as a control variable. Other included controls are education, race, and changes in job characteristics. We assume that the instruments are not correlated with the measurement errors, $\Delta\epsilon_{1t}$, $\Delta\epsilon_{2t}$, $\Delta\epsilon_{3t}$, and $\Delta\epsilon_{wt}$, and that the exclusion restriction holds. The SIPP weights are used to ensure the representativeness of the sample.[10]

The first-stage estimation results of equation (10) are reported in Table 1, columns (1)–(3). Around 85% of workers report working 52 weeks in both waves of the 1996 SIPP, which leads to low variation in $\Delta \ln l_{3t}^*$ and high standard errors in the first and second estimation stages. Thus, we propose estimating equation (10) using an alternative model specification, which abstracts from the choice of weeks worked. In the simplified model, the leisure variables are defined as $\widehat{l}_{1it} = d_{it}\left(\overline{h} - h_{it}\right)$ and $\widehat{l}_{2it} = \overline{h}\left(\overline{d} - d_{it}\right)$. The first-stage results of this simplified model using the entire sample and using a subsample of job-to-job movers are reported in columns (4)–(7) of Table 1. Table 2 reports the first-stage results of the simplified model for men and women.

The first-stage estimates are consistent across specifications, with some differences between men and women. Change in commuting distance, which is a proxy for the change in daily fixed costs of work, is negatively correlated with $\Delta \ln l_{1t}^*$ and $\Delta \ln l_{2t}^*$, and positively correlated with $\Delta \ln l_{3t}^*$. Childbirth between the two waves, which is a proxy for changing daily and weekly fixed costs of work, has a positive effect on $\ln l_{1t}^*$ and a negative effect on $\ln l_{2t}^*$, for both men and women. There is no correlation between childbirth and $\Delta \ln l_{3t}^*$. Non-labor income and spousal hours worked per week are proxies for wealth status. Higher spousal hours worked may reflect higher or lower wealth, whereas higher non-labor income may reflect wealth or substitution effects. Therefore, the coefficients of these instruments capture a mixture of effects. An increase in non-labor income positively affects $\ln l_{1t}^*$ and negatively affects $\ln l_{2t}^*$. An increase in spousal hours negatively affects $\ln l_{1t}^*$ and positively affects $\ln l_{2t}^*$. The estimates are not statistically significant for $\Delta \ln l_{3t}^*$.[11]

The second-stage estimates are reported in Table 3. The results for the full model are shown in column (1). The remaining columns present the results for the simplified model. The estimates of γ_n are in the range 1.9–3.5, and the estimates of ρ_1 are in the range 1.1–1.5. Using the full model, we estimate ρ_2 to be around 0.6.

[10] MaCurdy (1981) and Altonji (1986) estimate the Frisch intertemporal labor supply elasticity by regressing the difference of log-wages on the difference in log-hours worked, $\Delta \ln HOURS_t = constant + \gamma \Delta \ln WAGE_t + \epsilon_t$. To control for measurement errors, MaCurdy use year dummies and individual-specific information, such as age and education, as instruments for hourly wage. Altonji use two different wage series for each individual.

[11] The F-statistics of the excluded instruments in the full specification (see Table 1 columns (1)–(3)) are between 5.4 and 7.4. The Stock and Yogo (2005) critical values for the acceptable 5%–10% range of maximum IV bias are between 6.61 and 9.53. In the robustness and sensitivity analysis, the next subsection reports results using the alternative estimation methodology, which yields very similar parameter values.

4.2 Using Consumption to Proxy for λ

Equation (9) is estimated using the ATUS-CPS data. We assume that the available measures of leisure, consumption and real wage, $\ln l_{1t}^*$, $\ln l_{2t}^*$, $\ln l_{3t}^*$, $\ln c_t^*$, $\ln w_t^*$, equal $\ln l_{1t}$, $\ln l_{2t}$, $\ln l_{3t}$, $\ln c_t$, $\ln w_t$ plus additive measurement errors ϵ_{1t}, ϵ_{2t}, ϵ_{3t}, ϵ_{ct}, $\epsilon_{\omega t}$, respectively. Considering the measurement errors, equation (9) is rewritten as follows:

$$\ln c_t^* = \frac{\gamma_n}{\gamma_c} \ln l_{1t}^* - \frac{\rho_1 (1-\gamma_n)}{\gamma_c} \ln l_{2t}^* - \frac{\rho_2 (1-\gamma_n)}{\gamma_c} \ln l_{3t}^* + \frac{1}{\gamma_c} \ln w_t^* + \frac{1}{\gamma_c} \ln \frac{\varphi_{ct}(1+\theta)}{\varphi_{lt}} + \varepsilon_t, \quad (11)$$

where $\varepsilon_t = \frac{\gamma_n}{\gamma_c}\epsilon_{nt} + \frac{\rho_1(1-\gamma_n)}{\gamma_c}\epsilon_{dt} + \frac{\rho_2(1-\gamma_n)}{\gamma_c}\epsilon_{dt} - \epsilon_{ct} + \frac{1}{\gamma_c}\omega$.

The labor supply variables are measured with errors, and might also be correlated with preferences $\ln \varphi_{ct}$. Equation (11) is estimated using instruments for $\ln l_{1t}^*$, $\ln l_{2t}^*$ and $\ln l_{3t}^*$, which include proxies for the fixed costs of work and lifetime wealth. The instruments include time spent on commuting, number of children, time spent on childcare, calendar month of the ATUS interview, and an indicator for a weekend ATUS interview. Some specifications also include spousal earnings (using a subsample of individuals who have spousal data). To address the measurement error in the wage rate, we construct a predicted hourly rate, based on how $\ln w_t^{**}$ projects onto $\ln w_t^*$.

All estimations include age, education, race, marital status, and state variables to control for consumption preferences, labor supply preferences, and price differences across regions. As a robustness check, we use four IV specifications to estimate the coefficients for men, and two specifications for women. Each specification uses a different subset of instruments or a subsample of individuals with spousal information. In IV1, the the set of instruments includes the number of children, time spent on childcare, calendar month of the interview, and an indicator for a weekend interview; IV2 also includes time spent on commuting; the estimation of IV3 is limited to workers with spouses; and IV4 uses the subsample of workers with spouses and includes spousal earnings as an instrument and spousal hours as a control variable. ATUS person weights are used to ensure the representativeness of the sample.

Using the entire sample of women, we obtain estimates that differ significantly from the first-differences and men estimates, and most of them have the wrong sign. This result suggests that the consumption of working women is not a good proxy for their lifetime wealth, these results are reported in the Online Appendix. The utility parameters for women are estimated using a subsample of women whose earnings are similar or higher than those of their spouses, or women in the top 15% of the earnings distribution. For this subsample, consumption appears to be a better proxy for lifetime wealth than for the whole sample of women. This estimation is limited to women who have spousal information and who earn relatively high wages. Therefore, the number of observations is relatively low (946 observations).

Table 4 summarizes selected first-stage results for men and women. The number of children, time spent on work travel, and time spent on childcare reflect differences in the fixed costs of work and in time constraints, and produce mixed results.

Spousal earnings, controlling for working hours, measures permanent differences in spousal productivity, and is a proxy for wealth effects. Workers with higher earning spouses have shorter workweeks and work more weeks per year.

The F-statistics of the excluded instruments are reported in Table 5 . In the estimations that use the full sample of men (the IV1 and IV2 specifications) the F-statistics are between 5.8 and 10.9. For women, in the IV1 specification, the F-statistics are 9.50 and 7.00 for $\ln l^*_{1t}$ and $\ln l^*_{2t}$, respectively, and 2.44 for $\ln^*_{3t}$. The F-statistics in the estimations for men indicate that the maximum IV estimator bias is within the acceptable 5%-10% range in most cases.[12]

Table 5 reports the second-stage estimates for men and women. Columns (1) and (2) present the results for all men (IV1 and IV2 specifications). Columns (3) and (4) present results for men who have eligible spouse information (IV3 and IV4 specifications). The estimates for men in Table 5 are similar to those obtained using the first-differences estimation approach (see Table 3). The estimates of γ_n are in the range of 3.0–5.1, ρ_1 is between 1.8–2.1 and ρ_2 is around 0.7.

The estimates of γ_c are in the range of 2.6–3.5. Most of the coefficients for men are statistically significant at the 1%-5% levels. Columns (5) and (6) in Table 5 report the results for women. Due to the low number of observations some estimates in these specifications are not significant. This is mostly driven by the low variation in weeks worked; in this subsample 819 out of 946 women report working 52 weeks. The significant coefficients are very similar to those in the estimations for men.

We estimate the model to obtain the parameters that govern work schedule choices and time allocation, ρ_1, ρ_2, γ_n, and γ_c. We use two alternative methods and two datasets. Both methods use instruments for leisure variables employing the exogenous variation in

[12] To analyze the F-statistics, we use the Stock and Yogo (2005) critical value tables for TSLS, with multiple endogenous variables. These critical values, for the specification in column (1) of Table 5, are between 9.53 and 6.61.

the fixed costs of work and in non-labor income. From the estimates of ρ_1 and ρ_2 we derive which type of leisure has the largest weight and the smallest weight in the utility function. If $\rho_1 > 1-\phi_d/[\overline{h}(1+\theta)]$ (where ϕ_d represents the daily fixed cost as a fraction of the hourly wage), then leisure on days not worked during a workweek has a larger weight in the utility function than leisure on hours off on days worked. If $\rho_2 < 1-\phi_d/\overline{h}(1+\theta)-\phi_n/[\overline{dh}(1+\theta)]$ (where ϕ_n represents the weekly fixed cost as a fraction of the hourly wage), then leisure on weeks off has a smaller weight in the utility function than leisure on hours off on days worked. Our SIPP estimates of ρ_1 are 1.1–1.5, and the ATUS–CPS estimates are 1.8–2.1. The estimates of ρ_2 across samples are around 0.65. These results suggest that leisure on days not worked during a workweek has the largest weight in the utility function, and leisure on weeks off has the smallest weight.[13] In the next two sections, we use the estimated model parameters to examine a range of policy experiments.

5 Elasticity of Labor Supply

In this Section we recover the intertemporal elasticity of substitution of labor supply, and show how it varies with the fixed costs of work and with the work schedule. Our goal is to evaluate the differences in labor supply elasticity between workers who work different schedules.

Using the leisure demand functions in (7a)–(7c), we derive the following intertemporal elasticities for each type of leisure with respect to $w_t(H_t)$:

$$\eta_1 = \kappa_1 + \kappa_2 \frac{\widetilde{w_t(H_t)}(1+\theta)}{\widetilde{w_t(H_t)}(1+\theta)-\frac{\widetilde{f_{dt}}}{\overline{h}}} + \kappa_3 \frac{\widetilde{w_t(H_t)}(1+\theta)}{\widetilde{w_t(H_t)}(1+\theta)-\frac{\widetilde{f_{dt}}}{\overline{h}}-\frac{\widetilde{f_{nt}}}{\overline{dh}}}, \tag{12a}$$

$$\eta_2 = (\kappa_1+1) + (\kappa_2-1) \frac{\widetilde{w_t(H_t)}(1+\theta)}{\widetilde{w_t(H_t)}(1+\theta)-\frac{\widetilde{f_{dt}}}{\overline{h}}} + \kappa_3 \frac{\widetilde{w_t(H_t)}(1+\theta)}{\widetilde{w_t(H_t)}(1+\theta)-\frac{\widetilde{f_{dt}}}{\overline{h}}-\frac{\widetilde{f_{nt}}}{\overline{dh}}}, \tag{12b}$$

$$\eta_3 = (\kappa_1+1) + \kappa_2 \frac{\widetilde{w_t(H_t)}(1+\theta)}{\widetilde{w_t(H_t)}(1+\theta)-\frac{\widetilde{f_{dt}}}{\overline{h}}} + (\kappa_3-1) \frac{\widetilde{w_t(H_t)}(1+\theta)}{\widetilde{w_t(H_t)}(1+\theta)-\frac{\widetilde{f_{dt}}}{\overline{h}}-\frac{\widetilde{f_{nt}}}{\overline{dh}}}, \tag{12c}$$

where $\kappa_1 = \frac{1-(\rho_1+\rho_2)(1-\gamma_n)}{(\rho_1+\rho_2)(1-\gamma_n)-\gamma_n}$, $\kappa_2 = \frac{\rho_1(1-\gamma_n)}{(\rho_1+\rho_2)(1-\gamma_n)-\gamma_n}$ and $\kappa_3 = \frac{\rho_2(1-\gamma_n)}{(\rho_1+\rho_2)(1-\gamma_n)-\gamma_n}$. The "tildes" indicate the averages of the corresponding variables.[14]

[13] This conclusion holds for most conceivable values of daily and weekly fixed costs. For example, it holds when the daily fixed cost is less than five times the hourly wage and the weekly fixed cost is less than 10 times the hourly wage.

[14] We assume $\frac{\partial \ln \lambda_t}{\partial \ln w_t(H_t)} = 0$ and compute the λ-constant elasticities of intertemporal substitution. This assumption follows McLaughlin (1995), who argues that the short-run uncompensated labor elasticity is

The intertemporal elasticity for each labor supply margin is derived by taking the total derivatives of leisure functions (1a)–(1c). The elasticities are given by

$$\eta_n = -\eta_3 \tfrac{\overline{n}-\widetilde{n}}{\widetilde{n}}, \tag{13a}$$

$$\eta_d = (\eta_n - \eta_2) \tfrac{\overline{d}-\widetilde{d}}{\widetilde{d}}, \tag{13b}$$

$$\eta_h = (\eta_d + \eta_n - \eta_1) \tfrac{\overline{h}-\widetilde{h}}{\widetilde{h}}, \tag{13c}$$

and the intertemporal elasticity of the total labor supply is $\eta_H = \eta_h + \eta_d + \eta_n$.

It follows from equations (13a)–(13c) that individuals who work fewer hours, days, or weeks have a higher elasticity of labor supply. The elasticity of labor supply increases with the strength of the tie between hours worked and wages (i.e., θ). All computations use the Aaronson and French (2004) estimate, $\theta = 0.4$.

Table 6 reports the elasticity estimates. To obtain an estimate for the average fixed costs of work, we draw from a number of sources. The 1996 SIPP Work-Related Expenses Supplements provide data on daily work-related spending (commuting, parking, etc.), which is calculated to be around \$1 for men and \$0.9 for women, on average. ATUS provides daily time costs of work, commuting, and other work-related activities. These are measured as around 0.85 hours for men and 0.7 hours for women. Average childcare costs are estimated by Kimmel (1998) as \$10.5 per day. These calculations suggest that the average daily fixed costs equal to around one hourly wage. We assume that the weekly costs of work are the same as the daily costs of work.[15] The elasticity computations use $\widetilde{f_{dt}}, \widetilde{f_{nt}} \in \{\widetilde{w}, 3\widetilde{w}\}$.

Table 6 shows the results of the calculations using the ATUS–CPS and SIPP estimates. In all specifications, the margin of hours worked per day has the highest elasticity, whereas the margin of weeks worked is the least elastic. In the benchmark case (i.e., for $\widetilde{f_{dt}}, \widetilde{f_{nt}} = \widetilde{w}$), the elasticity of annual hours worked is around 0.18. The elasticity is decreasing with the fixed costs of work.[16] The computed elasticity is within the standard range of

likely to embed small wealth effects in an environment where the shocks are assumed to be temporary, the horizon is infinite, and the discounting is small. Thus, if the wage change captures unexpected temporary changes, then the income effect is negligible.

[15] Assuming the weekly costs of work to be above or below the daily costs does not change our main conclusions.

[16] Previous studies show that not accounting for human capital accumulation effects on labor supply leads to negatively biased elasticity estimates. In our model, we can account for human capital accumulation by incorporating an additional benefit for working more hours, days, or weeks by adjusting the fixed costs to be negative. Such a modification increases the elasticity of labor supply.

estimates that use individual-level data. Chetty (2012) summarizes the relevant literature, and shows that the estimated micro elasticity of the intensive margin of labor supply is in the range 0–0.25. For example, the estimates are 0.15 in MaCurdy (1981), 0.09 in Browning et al. (1985), 0.14 in Blundell et al. (1998), and 0.15 in Ziliak and Kniesner (1999).[17]

Table 7 reports the simulated elasticities for workers on different schedules. Column (1) shows that the elasticity is substantially higher, 0.54 compared to 0.19, for workers who work half the year (26 weeks). Columns (2) and (3) of Table 7 present the simulation results for part-time workers who supply 24 weekly hours for 49 weeks per year. We distinguish between those who work two days and three days per week. The elasticity of the part-time workers are 0.58 and 0.52, respectively, and substantially higher than the 0.19 benchmark estimate.

Columns (4)–(7) report the results for full-time workers who supply 40 hours per week, for 49 weeks per year, and who work between three and six days per week. The overall elasticity of annual hours decreases with the number of days. For more compressed schedules, the elasticity of the days margin is higher, whereas the elasticity of the hours margin is lower. This is an important example of how seemingly similar workers who work 40 hours per week respond differently to wage fluctuations.

5.1 Aggregate Elasticity of Labor Supply

Our estimate of the individual intertemporal elasticity of labor supply is around 0.2. Here, we measure the aggregate labor supply elasticity to understand how the aggregate labor supply responds to business cycles and government policies that affect wages.

There is an ongoing debate on the inconsistency between the small "micro elasticities", i.e., labor supply elasticities estimated in micro-studies, and the large "macro elasticities", i.e. labor supply elasticities used in macro-models to study aggregate outcomes. Our framework provides a clear and simple relationship between the "micro elasticity" and the "macro elastcity".

We derive the aggregate labor supply elasticity by including marginally attached workers in weighted calculations, $\eta_{AH} = \sum \mu_i \eta_{Hi}$, where μ_i is the weight of individual i, and

[17]None of these studies use the ATUS or CPS (or a combination of the two). To facilitate a comparison with a standard model, we use the ATUS–CPS data to estimate the Altonji (1986) cross-sectional specification. Using IV specifications, the elasticity is within the range of 0.12–0.17, whereas Altonji (1986) reports 0.17.

η_{Hi} is the individuals' labor supply elasticity. The data are taken from the 2003–2015 CPS, which provides the number of weeks worked in the previous year for those currently employed, as well as for those who are not employed, but are willing to work if they receive a job offer (these individuals can be unemployed or not part of the labor force at the time of the interview). Using this definition of marginally attached workers, we obtain that the fraction of workers who work 0 weeks is 6.79%. As demonstrated in Table 7, the elasticity varies with work schedules, and is higher for partially employed workers. Marginally attached workers have the highest elasticity of labor supply. Using equations (13a)–(13c), we compute that a worker who works one week per year, five days per week, and eight hours per day has an elasticity of around 19 (for both men and women, using the parameters in Table 6, columns 1 and 3). Using these elasticities for marginally attached workers, we measure the aggregate elasticity of labor supply to be 1.6, which is within the range of "macro" elasticities accepted in the literature. In their seminal paper, Lucas and Rapping (1969) estimate this elasticity to be 1.4. More recently, Chang and Kim (2006), assuming an individual elasticity of 0.4, find an aggregate elasticity of about 1. Rogerson and Wallenius (2009) assume an individual elasticity ranging from 0.05 to 1.25, and find that the corresponding macro elasticity is in the range 2.25–3. Fiorito and Zanella (2012) estimate the macro elasticity to be between 1.1 and 1.7. Erosa et al. (2016) estimate the aggregate elasticity to be 1.75, with the extensive margin elasticity of 1.08 and the intensive margin elasticity of 0.67. The concept introduced in these studies is similar to the outcomes of our model: labor is more elastic at the aggregate than it is at the individual level because marginal workers move in and out of employment in response to wage fluctuations.

6 Policy experiments

The model produces a large range of elasticities for the same set of model parameters by varying the work schedules. In this Section we calibrate the model and analyze the changes in labor supply in response to public policies that affect the fixed costs of work and schedule flexibility, and to policies that set restrictions on weekly hours.

6.1 Calibration and policy experiments

Period is set to equal to one year. Some parameters of the model are taken from our empirical estimations. The remaining parameters are calibrated to match moments of the data. The value of θ is fixed at 0.4, as in Aaronson and French (2004).

The parameters γ_c, γ_n, ρ_1, and ρ_2 are taken from our estimations. The value of γ_c is set at 2.78, γ_n is 3.28, ρ_1 is 1.52, and ρ_2 is 0.65.[18] To obtain α_{it} in the wage equation, $w_{it}(H_{it}) = \exp(\alpha_{it} + \theta \ln H_{it})$, we use the ATUS–CPS data to calculate the portion of the wage not explained by annual hours worked. These calculations use a residual wage, netting out the effects of education, experience, race, year, and state. The residual average hourly wage is \$8.26 and α_{it} is distributed over the range of $[-2, -0.5]$. In the model, agents draw a productivity parameter from a uniform distribution over the specified range.

The model is calibrated in a static environment, abstracting from the asset distribution. We match mean and variance of hours worked per day and days worked per week. Agents choose their work schedules from a menu of bundles of hours per day $[0, 16]$, days per week $[0, 7]$, and weeks per year $[0, 52]$. Columns (1) and (2) of Table 8 report the targeted data moments and their corresponding values in the calibrated model. The calibrated parameters are the daily and weekly fixed costs and the preference parameter φ_c, assuming that $\varphi_l = 1 - \varphi_c$.

The calibrated φ_c is 0.83. Daily fixed costs are calculated from the ATUS-CPS data using equations (7a) and (7b), such that $\rho_1 = \frac{1}{w(H)(1+\theta)} \frac{l_2}{l_1} \left(w(H)(1+\theta) - \frac{f_d}{h} \right)$. We project the calculated fixed cost on $x_i \in [0, 1]$, and obtain the following polynomial form: $f_{di} = a_d + b_d x_i + c_d x_i^2 + d_d x_i^3$. The coefficients b_d, c_d and d_d are from the data and a_d is calibrated. The polynomial $f_{ni} = a_n + b_n x$ constructs the weekly costs of work, where a_n and b_n are calibrated.[19]

Columns (1) and (2) in Table 8 show that the model performs well in capturing the means and standard deviations of the three dimensions of labor supply. The mean of weekly hours (not targeted in the calibration) is similar to the moment in the data. On the other hand, weeks worked in the model (not targeted in calibration) are lower than in the data. We consider this outcome not to be a concern because the weeks measure in the data seems to overstate the actual number of weeks worked. Taking into account that both datasets utilized in our empirical analysis report weeks with a job (including vacations and sick days), our measures of the means and standard deviations for weeks worked should not be far from the true moments in the data.

For 35% of individuals, our calibration delivers negative daily fixed costs. This outcome is consistent with a theory that argues that workers work longer workweeks (or

[18] We use average estimates from the CPS and SIPP data. See columns (1) and (4) in Table 6.

[19] Calibration results for the fixed costs are as follows: $f_{di} = -1.08 + 635.32x_i - 1232.4x_i^2 + 809.6x_i^3$, and $f_{ni} = -2.3 + 152.0x_i$.

annual hours), not only to earn a higher income, but also to acquire human capital or promotion opportunities. When analyzing the effects of changing fixed costs on labor supply allocations, focus on individuals with positive fixed costs.

In the model, 61% of workers work more than 40 hours per week, compared to 42% in the data, and 43% of workers work more than 45 hours per week, compared to 29% in the data. Our calibration matches well the mean of days worked, but generates a variance below the data estimate. In the model, 81% of workers work five days per week, 15% of workers work four days, 4% work six days, and 0% work seven days. The corresponding statistics in the data are 52%, 24%, 19%, and 5%, respectively. Our calibration does not target the labor force participation rate, which is around 81% in the data and 92% in the model.

The Online Appendix presents the distributions of hours worked per day, days worked per week, and weeks worked per year for the benchmark allocation and for the selected experiments.

6.1.1 Benefits from schedule flexibility

Using the model we examine the importance of schedule choice flexibility on time allocations, and the value of flexible choice of schedules. We compare a restricted 5-days workweek allocation to the benchmark scenario and also calculate the cost of this restriction in terms of consumption. This exercise aims to examine policies that put restrictions on choice of the workweek length. Such policies implement restrictions on the number of rest days per week or dictate wage penalties associated with weekend work.

The 5-days per week restriction leads to an overall utility loss. But the impact of the policy is moderated because of the large mass of workers who voluntarily choose a 5-day schedule. Workers who work less than 5 days per week are those with relatively low daily and weekly fixed costs of work. Forcing these workers to increase their days worked reduces their hours per day from 6.8 to 5.7, and the weeks worked from 44 to 43. Weekly hours remain fairly stable, 27 hours per week in the benchmark allocation and 28 hours per week after implementing the 5-days policy. Workers who work more than 5 days per week are those with high fixed costs of work. After the policy is implemented, they increase hours worked per day from 12.2 hours to 12.3 and decrease weeks worked from 44 to 43. The fraction of workers out of the labor force increases from 8.4% to 9.1%. Column (3) in Table 8 presents the aggregate labor supply allocations for this experiment. The average utility loss suffered by constrained workers is equivalent to 8.7%

of the annual consumption in the benchmark allocation. We discuss effects of this loss of schedule flexibility in conjunction with other policies in the following subsections.

6.1.2 Restricting hours worked per week

We analyze the effects of restrictions on weekly hours worked on the labor market. Our experiment uses the general lines of the French policy, which implements a strict 35-hour workweek, and was gradually introduced between 1982 and 2012. The French policy implements a list of regulations with regard to weekly hours, overtime restrictions, subsidies to firms, and changes in tax schemes. France is not the only economy that has legal restrictions on weekly hours. Other countries, some only for selected industries, implement similar regulations with various degrees of enforcement.[20]

Our experiment is simple; we restrict individuals to not work more than 45 or 40 hours per week, and then analyze changes in labor supply and labor market allocations in terms of the work schedule.

In the benchmark allocation, 43% work more than 45 hours per week. We show that constrained individuals reduce their average daily hours from 10.9 to 10.6, and their average days worked per week from 5.1 to 4.4. In addition, they increase their weeks worked per year from 44.3 to 46.6. The 45-hour per week restriction also leads to a decrease in labor force participation from 91.6% to 86.6%. The dropouts are low-productivity workers with high fixed costs who were working particularly long hours before the policy. Column (4) in Table 8 presents the aggregate labor supply allocations for this experiment. The average utility loss suffered by constrained workers (not including those who left the labor force) is equivalent to 27% of annual consumption.

Setting the maximum hours worked per week to 40 hours affects 61% of workers. Forcing these workers to reduce their weekly hours to 40 hours leads to a reduction in their hours worked per day from 10.3 to 9.6, and a reduction in their days worked per week from 5.1 to 4.3, on average. They increase their weeks worked per year from 44.2 to 46.5. The labor force participation drops to 82%. Column (5) in Table 8 presents the labor supply allocations for this experiment for the aggregate economy. The average utility loss suffered by constrained workers is equivalent to 20% of annual consumption (lower than in the 45-hour-week policy, because more workers drop out of the labor force).

Restrictions on weekly hours also imply reductions in wage rates for constrained work-

[20]Examples are Algeria, Bahamas, Belgium, Bulgaria, Chad, Chile, Czech Republic, Egypt, Italy, Mongolia, Morocco, Netherlands, Republic of Korea, Portugal, Rwanda and Slovenia.

ers. With the 45-hour-week restriction, the average wage rates of constrained workers drop from 6.0 to 5.7, and with the 40-hour-week policy, wages drop from 6.2 to 5.9 (workers who work more hours in the benchmark allocation are, on average, less productive). We also evaluate the allocations and utility losses for policies that restrict weekly hours, but that keep the wages of constrained workers at pre-policy levels (for those workers who choose the maximum weekly hours allowed after the policy is implemented). The aggregate allocations are reported in the Online Appendix. Implementing the 45-hour policy with a constant wage rate leads to a utility loss of 20% for constrained workers in terms of annual consumption in the benchmark economy. The 40-hour-week policy with a constant wage leads to an 19% utility loss for constrained workers (lower than in the 45-hour-week policy, because more workers drop out of the labor force).

The experiments show that restrictions on hours lead to decreases in labor force participation and in the utility of the remaining workers, even when wage rates are kept constant. The workers most affected are those with low productivity and high fixed costs, and who work longer hours to sustain consumption. Our results also show that restrictions on weekly hours reduce both hours per day and days per week, which may require significant adjustments by firms to transition to shorter workweeks.

Finally, implementing restrictions on weekly hours together with the 5-days per week policy leads to further reductions in labor force participation. The simulation results are reported in columns (6) and (7) of Table 8. In the case of the 45-hours and 5-days per week policy, 21% of workers end up out of the labor force, whereas in the case of the 40s-hour and 5-days per week policy, 24% are out of the labor force. When there is no 5-days restriction, these figures are 13% and 18%, respectively. Hours per day decrease and days per week increase when adding the 5-days restriction. The Online Appendix shows the statistics of these policies when keeping the wage constant.

6.1.3 Fixed costs and labor supply

We analyze how changes in the daily and weekly fixed costs of work affect labor supply allocations. These experiments aim to examine policies designed to affect commuting costs or childcare costs.

Table 9 summarizes the outcomes of the simulations. Columns (2) and (3) show the results for 5% and 10% decreases in the daily fixed costs. A 5% (10%) decrease in daily fixed costs reduces the number of hours worked per day from 8.88 to 8.81 (8.78). There is no change in days worked and there is a marginal decrease in weeks worked per year.

The average utility gain is equivalent to 2% (4%) of annual consumption.

Columns (4) and (5) show the results for 5% and 10% increases in daily fixed costs. The proportion of those out of the labor force increases to 9.0% (9.2%). Workers with high fixed costs, who work long hours in the benchmark allocation, are more likely to leave the labor force. The average hours worked per day do not change much after the increase in fixed costs, 8.83 (8.85) compared to 8.84 in the benchmark allocation, this is due to the compositional change of the labor force.[21] The cost of this policy is 4% (7%) of the annual consumption in the benchmark allocation.

Columns (6)–(9) show the simulation results for changes in the weekly costs of work. The 5% and 10% changes in weekly fixed costs of work do not generate significant movements in work schedules. A 5% (10%) decrease in weekly fixed costs leads to a utility gain equivalent to 3% (5%) of annual consumption in the benchmark allocation. The loss from an increase in the weekly costs by 5% (10%) is 3% (6%). The increase in costs increases the proportion of those out of the labor force to 8.6% (8.8%).

7 Conclusion

The standard implicit assumption in the labor supply framework is that hours worked per day and days worked per week are perfect substitutes and, therefore, can be aggregated into weekly hours. This study extends the standard framework and proposes a model of a three-dimensional labor supply. In the extended model, individuals choose their hours per day, days per week and weeks per year, subject to their daily and weekly fixed costs of work, while wage rates are tied to total hours worked.

We show that hours worked per day and days worked per week are not perfect substitutes. Each type of leisure (during the workweek on days worked, during the workweek on days not worked, and on the weeks not worked) has a distinct share in preferences. The leisure on days not worked during a workweek has the largest share, and leisure on weeks off has the smallest share.

We use the model to evaluate a number of policies. In our framework, the intertemporal elasticity of labor supply is around 0.2, which is within the standard range of the intensive margin elasticities. On average, hours worked per day is the most elastic margin of labor supply whereas weeks worked is the least elastic. We produce a large range of elasticities

[21] For example, in the benchmark allocation, the average hours worked per day of those who remain in the labor force after the 10% increase in the daily fixed cost is 8.81.

for the same set of model parameters by varying work schedules and degrees of attachment to the labor force. Less attached workers have a significantly higher elasticity of labor supply which can explain the differences between the "macro" and "micro" elasticities. Seemingly similar workers with the same weekly hours have different elasticities of labor supply if they allocate their time differently. Those who work fewer days have higher elasticity.

We calibrate the model to analyze changes in the labor supply in response to changes in daily and weekly fixed costs of work, restrictions on schedule choice flexibility, and restrictions on weekly hours. We show that when there is a relatively small decrease in daily fixed costs of work (costs that account for commuting, childcare, etc.), there is a reduction in hours worked per day, no change in days worked per week, and a marginal decrease in weeks worked per year. There are substantial utility gains and losses associated with small changes in daily fixed costs. Similar magnitude changes in weekly costs have small effects on time allocations. The cost of losing schedule flexibility is analyzed in an environment that restricts days worked to five days per week. This policy is associated with a significant utility cost, equivalent to 9% of annual consumption for constrained workers. We also evaluate policies that restrict weekly hours worked, such as the French 35-hour-week policy. Here, we analyze changes in time allocations, labor force participation, and utility losses associated with 40- and 45-hours restrictions, and find that these policies lead to large utility losses and decreases in labor force participation.

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Table 1: First stage, first-difference method, 1996 SIPP

	model 1			model 2			
	all			all		job movers	
	$\Delta \ln l1$	$\Delta \ln l2$	$\Delta \ln l3$	$\Delta \ln l1$	$\Delta \ln l2$	$\Delta \ln l1$	$\Delta \ln l2$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ ln sp. hours	0.0033	0.0385	-0.0396	-0.0091	0.0260	-0.0476	0.0772
	(0.0171)	(0.0199)	(0.0497)	(0.0140)	(0.0171)	(0.0280)	(0.0336)
Δ ln non-labor inc.	0.0011	-0.0061	0.0052	0.0023	-0.0049	0.0081	-0.0117
	(0.0025)	(0.0027)	(0.0072)	(0.0020)	(0.0024)	(0.0039)	(0.0044)
Δ work travel	-0.0274	-0.0194	0.0837	-0.0076	0.0004	-0.0071	-0.0001
	(0.0054)	(0.0064)	(0.0174)	(0.0044)	(0.0054)	(0.0083)	(0.0001)
childbirth {0.1}	0.0216	-0.0357	0.0185	0.0280	-0.0294	0.0129	-0.0461
	(0.0147)	(0.0159)	(0.0418)	(0.0122)	(0.0139)	(0.0248)	(0.0282)
education	-0.0004	0.0008	0.0034	-0.0002	0.0010	0.0026	-0.0018
	(0.0015)	(0.0018)	(0.0046)	(0.0012)	(0.0016)	(0.0026)	(0.0034)
age	0.0005	-0.0003	-0.0004	0.0003	-0.0004	0.0007	-0.0019
	(0.0005)	(0.0006)	(0.0016)	(0.0004)	(0.0005)	(0.0008)	(0.0010)
black	0.0335	0.0143	-0.1238	0.0114	-0.0078	0.0066	-0.0040
	(0.0144)	(0.0179)	(0.0501)	(0.0114)	(0.0161)	(0.0258)	(0.0332)
male	-0.0045	-0.0278	0.0359	0.0036	-0.0197	0.0014	-0.0133
	(0.0082)	(0.0090)	(0.0244)	(0.0068)	(0.0078)	(0.0147)	(0.0165)
job change	-0.0646	-0.0515	0.3926	-0.0080	0.0051		
	(0.0103)	(0.0112)	(0.0343)	(0.0081)	(0.0093)		
shift change	-0.0096	0.0133	-0.0202	-0.0139	0.0091	-0.0327	0.0081
	(0.0120)	(0.0132)	(0.0304)	(0.0105)	(0.0122)	(0.0198)	(0.0227)
cons	0.0038	0.0334	-0.1645	-0.0176	0.0119	-0.0695	0.1150
	(0.0308)	(0.0353)	(0.0946)	(0.0244)	(0.0312)	(0.0492)	(0.0648)
N	7344	7344	7344	7344	7344	2142	2142
R2 adj.	0.0117	0.0077	0.0355	0.0011	0.0016	0.0022	0.0051
F-stat excl. IV	7.39	5.41	6.06	2.57	2.62	1.71	4.12

Note: All estimations use 1996 SIPP weights. Model 1 refers to the full model, with three leisure variables. Model 2 refers to the simplified model, which does not consider weeks and uses two leisure variables. Job movers are workers who changed employers between the 4th and 10th waves of the survey. Spouse hours are usual hours worked per week. Work travel measures commuting distance which is specified in units of 100 miles. Coefficients and robust standard errors are presented.

Table 2: First-stage, first differences method, men and women, 1996 SIPP

	men				women			
	all		job movers		all		job movers	
	$\Delta \ln l1$	$\Delta \ln l2$	$\Delta \ln l1$	$\Delta \ln l2$	$\Delta \ln l1$	$\Delta \ln l2$	$\Delta \ln l1$	$\Delta \ln l2$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ ln sp. hours	-0.0256	0.0303	-0.0860	0.1194	0.0191	0.0185	0.0266	0.0000
	(0.0180)	(0.0221)	(0.0374)	(0.0441)	(0.0223)	(0.0267)	(0.0394)	(0.0515)
Δ ln non-labor inc.	0.0019	-0.0033	0.0096	-0.0144	0.0030	-0.0078	0.0071	-0.0089
	(0.0023)	(0.0030)	(0.0045)	(0.0058)	(0.0037)	(0.0039)	(0.0074)	(0.0067)
Δ work travel	-0.0053	-0.0023	-0.0009	-0.0176	-0.0104	0.0042	-0.0167	-0.0013
	(0.0050)	(0.0071)	(0.0100)	(0.0134)	(0.0081)	(0.0084)	(0.0142)	(0.0154)
childbirth {0,1}	0.0064	-0.0047	-0.0034	-0.0121	0.0562	-0.0609	0.0296	-0.0805
	(0.0133)	(0.0188)	(0.0303)	(0.0397)	(0.0222)	(0.0205)	(0.0405)	(0.0382)
education	0.0004	-0.0004	0.0029	-0.0025	-0.0015	0.0033	0.0014	-0.0010
	(0.0013)	(0.0021)	(0.0031)	(0.0045)	(0.0023)	(0.0025)	(0.0046)	(0.0052)
age	-0.0001	0.0001	0.0005	-0.0011	0.0009	-0.0010	0.0009	-0.0027
	(0.0005)	(0.0007)	(0.0010)	(0.0013)	(0.0007)	(0.0007)	(0.0013)	(0.0015)
black	0.0124	-0.0132	0.0043	-0.0261	0.0120	-0.0029	0.0082	0.0270
	(0.0156)	(0.0250)	(0.0356)	(0.0532)	(0.0167)	(0.0198)	(0.0377)	(0.0336)
job change	-0.0118	0.0120			-0.0033	-0.0026		
	(0.0100)	(0.0133)			(0.0129)	(0.0128)		
shift change	-0.0112	-0.0055	-0.0156	-0.0386	-0.0158	0.0246	-0.0500	0.0570
	(0.0127)	(0.0171)	(0.0254)	(0.0325)	(0.0171)	(0.0173)	(0.0308)	(0.0311)
cons	0.0000	-0.0138	-0.0667	0.0885	-0.0273	0.0075	-0.0560	0.1204
	(0.0273)	(0.0411)	(0.0590)	(0.0863)	(0.0445)	(0.0473)	(0.0848)	(0.0939)
N	3898	3898	1082	1082	3446	3446	1060	1060
R2 adj.	0.0004	-0.0009	0.0054	0.0107	0.0018	0.0035	-0.0002	0.0061
F-stat excl. IV	0.97	0.74	2.11	3.51	2.51	3.29	0.78	1.55

Note: All estimations use 1996 SIPP weights. Model 1 refers to the full model, with three leisure variables. Model 2 refers to the simplified model, which abstracts from the choice of weeks worked. "Job change" and "shift change" are $\{0, 1\}$ dummy variables, indicating the relevant changes between the waves. Job movers are workers who changed employers between the 4th and 10th waves of the survey. Spouse hours are usual hours worked per week. Work travel measures commuting distance which is specified in units of 100 miles. Coefficients and robust standard errors are presented.

Table 3: Second-stage, first-differences method, 1996 SIPP

	model 1	model 2					
				men		women	
	all	all	job movers	all	job movers	all	job movers
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta \ln l1$	-3.5234	-3.0386	-2.9629	-1.3317	-3.4535	-3.2670	-1.9228
	(5.0047)	(1.7108)	(1.8994)	(2.3740)	(2.7291)	(1.6232)	(1.8034)
$\Delta \ln l2$	-2.9464	-2.9343	-2.5658	-2.4127	-2.8614	-2.4569	-1.3349
	(3.6169)	(1.4503)	(1.0711)	(2.1578)	(1.7043)	(1.4703)	(1.2576)
$\Delta \ln l3$	-1.6040						
	(2.4764)						
N	7344	7344	2142	3898	1082	3446	1060
γ_n	3.52	3.04	2.96	1.33	3.45	3.27	1.92
	(5.00)	(1.71)	(1.90)	(2.37)	(2.73)	(1.62)	(1.80)
ρ_1	1.17	1.44	1.31	7.27	1.17	1.08	1.45
	(1.06)	(0.77)	(0.90)	(47.38)	(0.72)	(0.39)	(2.06)
ρ_2	0.64						
	(0.33)						

Note: All estimations use SIPP weights. Model 1 refers to the model with three leisure variables. Model 2 refers to the simplified model, which abstracts from the choice of weeks worked. The parameters γ_n, ρ_1, and ρ_2 are computed using the estimated coefficients of $\Delta \ln l1$, $\Delta \ln l2$, and $\Delta \ln l3$; see equation (8). The standard errors of ρ_1 and ρ_2 are calculated using the delta method. Coefficients and robust standard errors are presented.

Table 4: First-stage, consumption method, ATUS-CPS 2003-2015

	men						women		
	IV2			IV4			IV1		
	$\ln l1$	$\ln l2$	$\ln l3$	$\ln l1$	$\ln l2$	$\ln l3$	$\ln l1$	$\ln l2$	$\ln l3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
work travel	-0.0036	-0.0021	0.0029	-0.0009	-0.0096	0.0081			
	(0.0027)	(0.0021)	(0.0069)	(0.0037)	(0.0028)	(0.0084)			
children	-0.0420	-0.0140	0.0470	-0.0230	-0.0100	0.0080	-0.0620	0.0300	-0.0680
	(0.0130)	(0.0100)	(0.0260)	(0.0140)	(0.0120)	(0.0320)	(0.0240)	(0.0190)	(0.0550)
child care	0.0109	-0.0019	-0.0109	0.0075	-0.0022	-0.0046	0.0198	-0.0106	0.0027
	(0.0017)	(0.0015)	(0.0042)	(0.0022)	(0.0021)	(0.0058)	(0.0029)	(0.0021)	(0.0070)
April	-0.1090	0.0130	0.2470	-0.1150	0.0150	0.1640	-0.0820	0.1190	0.0750
	(0.0450)	(0.0370)	(0.1020)	(0.0680)	(0.0460)	(0.1150)	(0.1150)	(0.0720)	(0.1460)
May	-0.0100	-0.1030	0.2930	0.0500	-0.1400	0.3410	-0.0780	-0.0310	0.4450
	(0.0290)	(0.0260)	(0.0640)	(0.0410)	(0.0320)	(0.0750)	(0.0600)	(0.0540)	(0.1040)
June	-0.0580	-0.1060	0.3510	-0.0670	-0.1400	0.4300	-0.0190	0.0000	0.2810
	(0.0270)	(0.0230)	(0.0650)	(0.0410)	(0.0310)	(0.0770)	(0.0560)	(0.0500)	(0.0830)
weekend	0.0130	-0.0550	0.0070	-0.0770	-0.0140	-0.0300	0.3360	-0.2930	0.0260
	(0.0350)	(0.0320)	(0.0760)	(0.0560)	(0.0450)	(0.0900)	(0.0760)	(0.0540)	(0.1500)
sp. earn				0.0270	0.0390	-0.1370			
				(0.0230)	(0.0220)	(0.0520)			
age	0.0020	-0.0010	-0.0090	0.0030	-0.0050	0.0020	0.0020	-0.0060	-0.0040
	(0.0010)	(0.0010)	(0.0030)	(0.0020)	(0.0020)	(0.0040)	(0.0020)	(0.0020)	(0.0040)
black	-0.0430	0.0300	-0.0730	-0.1090	-0.0040	-0.1290	0.0380	-0.0330	-0.2050
	(0.0530)	(0.0400)	(0.0910)	(0.0840)	(0.0670)	(0.1150)	(0.0520)	(0.0440)	(0.0870)
married	-0.0150	-0.0170	0.0130	-0.0670	-0.0540	0.1130	0.1230	-0.0160	-0.0480
	(0.0270)	(0.0240)	(0.0620)	(0.0480)	(0.0450)	(0.1150)	(0.0690)	(0.0480)	(0.1520)
educ	0.0110	-0.0040	-0.0040	0.0110	-0.0070	0.0150	-0.0130	-0.0060	0.0370
	(0.0040)	(0.0040)	(0.0090)	(0.0060)	(0.0050)	(0.0120)	(0.0070)	(0.0060)	(0.0190)
sp. hours				0.0020	0.0000	-0.0040			
				(0.0020)	(0.0010)	(0.0030)			
cons	7.1810	7.9090	5.3190	6.9580	8.1360	4.9420	7.3930	8.1890	4.8150
	(0.1710)	(0.1510)	(0.3610)	(0.2770)	(0.2190)	(0.3730)	(0.2310)	(0.2210)	(0.4720)
N	2856	2856	2856	1545	1545	1545	946	946	946
R2 adj.	0.0870	0.0900	0.0640	0.1720	0.1680	0.1100	0.3290	0.2990	0.1210

Note: All estimations use ATUS weights. Work travel and childcare are specified in units of 10 minutes. The excluded calendar month is March. All estimations include year and state effects. Coefficients and robust standard errors are presented.

Table 5: Second-stage, consumption method, ATUS-CPS 2003-2015

	men				women	
	IV1	IV2	IV3	IV4	IV1	IV2
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln l1$	1.0951	1.2361	1.4811	1.4247	1.2397	1.1417
	(0.4388)	(0.4381)	(0.4543)	(0.4490)	(0.5057)	(0.4603)
$\ln l2$	1.3730	1.5574	2.4102	2.3544	1.6657	1.5074
	(0.5822)	(0.5789)	(0.7053)	(0.6844)	(0.7590)	(0.6977)
$\ln l3$	0.4945	0.5855	0.8664	0.8036	0.2483	0.2850
	(0.3092)	(0.3100)	(0.3418)	(0.3212)	(0.2843)	(0.2736)
$\ln wage$	0.3602	0.3840	0.2905	0.2841	0.3375	0.3652
	(0.0984)	(0.1024)	(0.1044)	(0.1023)	(0.1284)	(0.1162)
N	2856	2856	1545	1545	946	946
γ_c	2.78	2.60	3.44	3.52	2.97	2.74
	(0.76)	(0.69)	(1.24)	(1.27)	(1.13)	(0.87)
γ_n	3.04	3.22	5.09	5.02	3.68	3.13
	(0.81)	(0.78)	(1.83)	(1.78)	(2.44)	(1.88)
ρ_1	1.87	1.83	2.03	2.06	1.84	1.94
	(0.64)	(0.57)	(0.57)	(0.60)	(0.63)	(0.74)
ρ_2	0.67	0.69	0.73	0.70	0.27	0.37
	(0.22)	(0.20)	(0.22)	(0.22)	(0.32)	(0.36)
F-test $\ln l1$	10.85	9.06	5.32	4.70	9.50	7.77
F-test $\ln l2$	6.86	5.81	7.71	6.84	7.00	6.24
F-test $\ln l3$	8.40	6.99	7.69	6.74	2.44	2.29

Note: All estimations use ATUS weights. The parameters γ_c, γ_n, ρ_1, and ρ_2 are computed using the estimated coefficients of $\ln l1$, $\ln l2$, and $\ln l3$ (see equation (11)). The standard errors of ρ_1 and ρ_2 are calculated using the delta method. Other included controls are age, years of schooling, race, marital status, and state and year fixed effects. The included instruments in IV1 are number of children, time spent on childcare, calendar month of the interview, and an indicator for a weekend interview; IV2 adds commuting time; IV3 and IV4 are limited to workers with spouses; IV4 also includes spousal earnings as an instrument and spousal hours as a control. The estimations in columns (5)–(6) use a subsample of women whose earnings are similar or higher than those of their spouses. The F-tests statistics are from the first-stage estimations. Coefficients and robust standard errors are presented.

Table 6: Labor supply elasticity

	ATUS-CPS			SIPP	
	men, all	men, spouse present	women, spouse present	all	job-to-job movers
	(1)	(2)	(3)	(4)	(5)
Parameter values:					
γ_n	3.04	5.09	3.68	3.52	2.96
ρ_1	1.87	2.03	1.84	1.17	1.31
ρ_2	0.67	0.73	0.27	0.64	0.64
Mean values:					
wage	26.3	29.2	26.8	16.1	16.1
weeks	49.3	49.5	50.3	51.0	51.0
days	5.0	5.0	5.0	4.9	4.9
hours	8.9	8.9	8.7	8.3	8.3
Elasticities:					
	Fixed costs: $fd = w$, $fn = w$				
η_n	0.01	0.00	0.00	0.00	0.00
η_d	0.06	0.03	0.05	0.06	0.07
η_h	0.13	0.05	0.12	0.15	0.17
η_H	0.19	0.09	0.17	0.22	0.24
	Fixed costs: $fd = 3w$, $fn = 3w$				
η_n	0.01	0.01	0.01	0.00	0.00
η_d	0.08	0.04	0.07	0.08	0.09
η_h	0.08	0.00	0.08	0.11	0.12
η_H	0.17	0.05	0.16	0.19	0.22

Note: The elasticities are calculated using equations (13a)–(13c). The parameter values are from Tables 3 and 5. The parameters in columns (1)–(3) are from Table 5, columns (1), (3) and (5), respectively. The parameters in columns (4) and (5) are from Table 3, columns (1) and (3). The mean values of hourly wage, hours worked per day, days worked per week, and weeks worked are reported in the Online Appendix. The fixed costs are as specified.

Table 7: Labor supply elasticity and work schedule, simulations

	average schedule, part-year 26 weeks	24 weekly hours 2d/12h schedule	24 weekly hours 3d/8h schedule	40 hours per week, 3d/13.3h schedule	40 hours per week, 4d/10h schedule	40 hours per week, 5d/8h schedule	40 hours per week, 6d/6.7h schedule
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean values:							
wage	26.3	26.3	26.3	26.3	26.3	26.3	26.3
weeks	26.0	49.3	49.3	49.3	49.3	49.3	49.3
days	5.0	2.0	3.0	3.0	4.0	5.0	6.0
hours	8.9	12.0	8.0	13.3	10.0	8.0	6.7
Elasticities							
η_n	0.14	0.01	0.01	0.01	0.01	0.01	0.01
η_d	0.11	0.41	0.22	0.22	0.12	0.07	0.03
η_h	0.28	0.16	0.29	0.06	0.11	0.13	0.13
η_H	0.54	0.58	0.52	0.29	0.25	0.21	0.17

Note: The elasticities are estimated using equations (13a)–(13c). The values of γ_n, ρ_1, and ρ_2 are from Table 5, column (1). The mean values of hourly wage, hours worked per day, days worked per week, and weeks worked are reported in the Online Appendix. In these simulations, we assume $fd = w$ and $fn = w$.

Table 8: Policy experiments, restrictions on weekly hours and days worked

	Data	Benchmark	Days=5 (D5)	Hours=45 (H45)	Hours=40 (H40)	D5+H45	D5+H40
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
hours	8.88	8.84	8.74	8.59	8.28	7.70	7.19
	(1.74)	(2.32)	(2.56)	(2.44)	(2.26)	(1.69)	(1.40)
days	4.98	4.89	5.00	4.59	4.46	5.00	5.00
	(0.87)	(0.42)	(0.00)	(0.61)	(0.66)	(0.00)	(0.00)
weeks	49.27	44.01	43.92	44.89	45.30	44.66	45.12
	(7.77)	(0.54)	(0.73)	(1.81)	(2.04)	(1.99)	(2.26)
weekly hours	43.68	43.72	43.74	38.64	35.91	38.50	35.93
	(8.61)	(13.58)	(12.78)	(8.44)	(6.94)	(8.47)	(7.02)
wage	8.26	6.56	6.54	6.48	6.42	6.46	6.38
	(2.50)	(2.52)	(2.54)	(2.50)	(2.51)	(2.54)	(2.53)
fd		3.08	3.79	0.61	-1.38	-2.32	-3.87
		(28.77)	(27.73)	(26.95)	(25.64)	(22.06)	(20.88)
fn		74.45	75.02	71.37	68.57	67.40	64.96
		(37.83)	(37.44)	(36.50)	(35.26)	(33.51)	(32.25)
Utility loss % of benchmark consumption			8.7%	26.8%	20.4%	24.2%	30.7%
% OLF		8.4%	9.1%	13.4%	17.9%	20.6%	24.3%

Note: Data calculations are produced using the ATUS–CPS men sample. The wage used for calibration is a residual, controlling for education, experience, race, state, and year effects. D5 refers to the $days = 5$ policy experiment, and H40 and H45 refer to the restrictions on weekly hours of 40 and 45 hours, respectively. The utility loss is calculated as a consumption-equivalent, using constrained individuals in the labor force after policy implementation.

Table 9: Policy experiments, changes in daily and weekly fixed costs of work

	Benchmark	-5% in f_d	-10% in f_d	+5% in f_d	+10% in f_d	-5% in f_n	-10% in f_n	+5% in f_n	+10% in f_n
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
hours	8.84	8.81	8.78	8.83	8.85	8.80	8.76	8.86	8.89
	(2.32)	(2.29)	(2.26)	(2.32)	(2.34)	(2.30)	(2.29)	(2.32)	(2.33)
days	4.89	4.89	4.89	4.89	4.90	4.89	4.87	4.90	4.91
	(0.42)	(0.42)	(0.41)	(0.42)	(0.43)	(0.42)	(0.41)	(0.42)	(0.43)
weeks	44.01	44.01	44.00	44.00	44.02	44.01	44.01	44.00	44.01
	(0.54)	(0.53)	(0.53)	(0.53)	(0.53)	(0.53)	(0.52)	(0.52)	(0.54)
weekly hours	43.72	43.51	43.31	43.69	43.80	43.41	43.10	43.92	44.16
	(13.58)	(13.30)	(13.04)	(13.59)	(13.75)	(13.39)	(13.19)	(13.65)	(13.77)
wage	6.56	6.55	6.54	6.57	6.58	6.54	6.53	6.58	6.59
	(2.52)	(2.51)	(2.50)	(2.53)	(2.54)	(2.51)	(2.51)	(2.52)	(2.53)
fd	3.08	2.52	1.96	3.23	3.61	3.08	3.08	2.93	2.83
	(28.77)	(27.96)	(27.16)	(29.23)	(29.86)	(28.77)	(28.77)	(28.65)	(28.59)
fn	74.45	74.45	74.45	74.03	73.88	70.72	67.00	78.00	81.58
	(37.83)	(37.83)	(37.83)	(37.62)	(37.53)	(35.94)	(34.04)	(39.64)	(41.47)
Utility loss, % of benchmark consumption		-2.4%	-4.4%	3.5%	7.3%	-2.6%	-4.9%	2.8%	6.0%
% OLF	8.4%	8.4%	8.4%	9.0%	9.2%	8.4%	8.4%	8.6%	8.8%

Note: Utility loss is calculated as an annual consumption-equivalent, using constrained individuals in the labor force after policy implementation.