The Aggregate Labor Supply Curve at the Extensive Margin: A Reservation Wedge Approach*

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November 17, 2019

Abstract

We present a theoretically robust and empirically tractable representation of the aggregate labor supply curve at the extensive (employment) margin. First, we introduce the simple and basic concept of the reservation wedge: the hypothetical percent shift in an individual's potential earnings required to render her indifferent between employment and nonemployment. This concept generalizes reservation wages to the context of heterogeneity in earnings. For any given specific model, the reservation wedge serves as the sole scalar sufficient statistic for employment preferences. The CDF of the reservation wedges *is* the aggregate labor supply curve at the extensive margin. Second, we directly measure the wedge distribution in a representative household survey – thereby nonparametrically mapping out the global labor supply curve of the U.S. population. For small deviations, the empirical curve exhibits large Frisch elasticities above 3, hence locally consistent with business cycle evidence. Rather than constant, the empirical arc elasticities shrink towards 0.5 for larger, upward shifts, thereby potentially also reconciling large local elasticities with the small arc elasticities implied by recent quasi-experimental evidence from tax holidays. Third, in a model meta-analysis, existing models would fail to match the global shape of this empirical curve. Fourth, we engineer one model to fit the empirical curve. A business cycle accounting exercise reveals that this fitted model (under the assumption of efficient rationing) would help reconcile cyclical employment fluctuations with labor supply.

*We thank Chaoran Yu for excellent research assistance. For comments we thank Mark Bils, Gabriel Chodorow-Reich, Shigeru Fujita, Adam Guren, Greg Kaplan, Loukas Karabarbounis, Ellen McGrattan, Alisdair McKay, Luigi Pistaferri, Ayşegül Şahin, Sergio Salgado (discussant), and Gianluca Violante, and seminar and conference participants at the Federal Reserve Bank of Philadelphia, the NBER Dynamic Equilibrium Models meeting, the NBER Summer Institute 2019 (Micro Data and Macro Models), the Society of Economic Dynamics Annual Meeting, Stanford University/SIEPR, UC Berkeley, West Coast Matching Workshop (Federal Reserve Bank of San Francisco), and the University of Bonn. We also thank audiences of seminars covering the previous related paper "The Labor Supply Curve with Long-Term Jobs" (from which the paper at hand stems and large parts of which it replaces) at Columbia University, the Federal Reserve Bank of Minneapolis, the Federal Reserve Bank of New York, UC Davis, and UT Austin. For financial support of our custom survey, we thank SIEPR at Stanford, the Clausen Center and the Institute for Research on Labor and Employment at UC Berkeley, and for support with designing the survey, NORC at UChicago. The survey received IRB approval from UC Berkeley (protocol number 2019-02-11815).

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1 Introduction

The aggregate labor supply curve – the sum of individuals' desired labor supply as a function of wages – is a core feature of macroeconomic models. In market-clearing equilibrium models, it pins down the slope between wages and employment. In New Keynesian models with nominal frictions, it shapes the trade-off between wage-inflation pressure and output, and hence also the price Phillips curve. In models of wage bargaining and wage posting, the curve enters workers' reservation wages. The curve also determines the cyclical amplitude of potential labor market disequilibria and their welfare costs.

Despite their theoretical centrality, labor supply blocks in macroeconomic models commonly rely on ad-hoc abstractions. For example, labor supply may be modeled as a conventional intensive-margin hours choice, despite the empirical fact that aggregate labor hours primarily adjust along the extensive, i.e. employment, margin. Alternatively, models featuring extensive margins often appeal to abstractions such as employment assignments by a fictional utilitarian head of a large representative household with a pooled budget constraint. By contrast, more realistic, atomistic labor supply models often either lack an extensive margin. Or, if they do feature an extensive margin, labor supply arises from complex, interrelated heterogeneity, precluding a tangible and simple-to-parameterize aggregate labor supply curve that would be convenient for calibration and quantitative analysis.

We present a basic but theoretically robust and tractable framework characterizing the aggregate labor supply curve at the extensive margin. We begin with the individual-level extensive-margin employment preference, which we summarize in form of a micro *reservation (labor) wedge*: the hypothetical percent shift in an individual's potential labor earnings required to render her indifferent between employment and nonemployment. *Throughout, we use the term "wedge" as an abstract placeholder for tax-like proportionate shifters of potential labor earnings (rather than necessarily as a gap in an optimization condition).* In a wide class of spot labor market models, this reservation wedge is a *sufficient statistic* for each individual's extensive-margin labor supply preferences, and summarizes model-specific features and heterogeneity in, e.g., tastes for leisure or disutility from working, marginal utilities of consumption, hours constraints, potential wages, all of which follow directly or indirectly from a variety of functional form and parameter choices and as equilibrium outcomes. While we focus on the Frischian perspective in a spot labor market, the framework also accommodates uncompensated, or longer-run, settings with wealth effects, frictions, and extensions such as intensive margin choices.

Our concept of the reservation *wedge* generalizes the standard reservation *wage* to contexts with heterogeneity in potential earnings. For aggregate labor supply, we argue that reservation wages only sufficiently summarize employment preferences if potential earnings are homogeneous; otherwise they require as a second variable each individual's potential earnings. With heterogeneity in earnings, our reservation wedge concept is the only scalar statistic sufficient to rank individuals on an aggregate labor supply curve with respect to a homogeneous percent shifter of potential earnings. While basic, to our knowledge ours is the first explicit derivation, discussion and measurement of this concept.[1] We show that this refinement is consequential conceptually, empirically and quantitatively.

The cumulative distribution function of the individual reservation wedges fully characterizes – in fact, *is* – the extensive-margin aggregate labor supply curve. We define as its argument a generalized wage concept we call the *prevailing aggregate wedge*: a homogeneous percent shifter of potential earnings. It could stand in for specific experiments such as aggregate productivity fluctuations, linear tax reforms, labor demand shocks, or certain labor market frictions. This shifter therefore exactly accords with the general variation with respect to which the reservation wedge denotes an individual's indifference point in her employment choice. Shifts in this prevailing wedge sweep up *marginal workers* – those whose reservation wedges are around the original prevailing aggregate wedge and who thereby drive extensive margin adjustment. The aggregate extensive-margin elasticity is determined by the density of marginal workers around the prevailing aggregate wedge.[2]

Second, we measure the empirical reservation wedge distribution in a custom, representative survey of U.S. households. A single tailored question directly asks a respondent for her reservation wedge: what percent size of a transitory increase or decrease in her idiosyncratic potential earnings would render her indifferent between employment and nonemployment? Our survey implementation of the reservation wedge is new and differs from existing reservation wage surveys, chiefly in that it permits heterogeneity in potential earnings and in that it asks a representative cross-section of all labor force statuses, not just the small and selected portion of unemployed job seekers.[3]

The empirical wedge distribution exhibits a large mass around one – where the reservation wage is close to the individual's actual wage i.e. the location of marginal workers. This large mass of marginal workers implies a large *local* Frisch elasticity around and above 3. Business cycles feature small changes in wages (or productivity), so these local Frisch elasticities are allocative, and would in fact hit the high ranges implied by empirical business cycles read through the lens of equilibrium labor market models.

Such high elasticities have been challenged as they are an order of magnitude above emerging quasi-experimental estimates of specific arc elasticities, from realized employment adjustment to very large positive short-run net-wage changes as from income tax holidays (Bianchi, Gudmunds-

[1]For example, Chetty, Guren, Manoli, and Weber (2012) informally allude to aggregate labor supply in terms of reservation *wages*: "The size of the extensive margin responses depends on the density of the distribution of reservation *wages* around the economy's equilibrium" (our emphasis). Similarly, Chang and Kim (2006) plot model-implied reservation-*wage* graphs (separately by productivity type).

[2] At a broad methodological level, we express a given household's micro propensity to engage in a discrete choice as continuous "gap" from the adjustment threshold, and then derive aggregate responsiveness in this adjustment from its cross-sectional distribution. Methodologically related, Berger and Vavra (2015) study durable goods expenditure with fixed adjustment costs and derive the aggregate responsiveness to aggregate shocks. Related is also the role of the price gap distribution in sticky price models (e.g., Alvarez and Lippi, 2014). Our spot labor market with flow participation costs eliminates dynamic complications present in these contexts.

[3]Pistaferri (2003) measures intensive-margin intertemporal labor supply preferences in a household survey by comparing individual-level wage expectations with hours worked. Mas and Pallais (2019) obtain revealed preference estimates for intensive-margin hours labor supply curves.

son, and Zoega, 2001; Chetty et al., 2012; Martinez, Saez, and Siegenthaler, 2018; Sigurdsson, 2018). A priori, the framework can reconcile this tension as it flexibly permits nonconstant elasticities. In fact, the empirical curve does feature arc elasticities that are far from constant, falling below 1.0 towards 0.5 for large shifts, particularly upwards i.e. exactly the arc elasticity portion identified by the quasi-experimental estimates – all while masking large local Frisch elasticities.[4] In other words, the empirical reservation wedge distribution is widely dispersed, implying that the typical worker is inframarginal in that she derives considerable worker surplus, consistent with models of heterogeneity in job surplus (e.g., Mortensen and Pissarides, 1994; Bils, Chang, and Kim, 2012; Jäger, Schoefer, and Zweimüller, 2019) but – away from the mass of marginal workers – overall inconsistent with models of homogeneity (e.g., Hansen, 1985; Rogerson, 1988, or DMP models without heterogeneity).

Both empirically and conceptually, our nonparametric and model-independent sufficient statistic approach in form of the reservation wedge complements important work by Chang and Kim (2006, 2007); Gourio and Noual (2009); Park (2017), who also model employment adjustment as driven by marginal workers, albeit defined within a distribution of reservation *wages* rather than our wedge concept. They each structurally estimate one specific model relying on model-specific parametric and distributional assumptions.[5] Our nonparametric sufficient-statistics approach thereby similarly complements the large body of structural estimations of specific parametric micro labor supply models with participation margins (e.g., Heckman and MaCurdy, 1980; Blundell, Pistaferri, and Saporta-Eksten, 2016; Attanasio, Levell, Low, and Sánchez-Marcos, 2018; Beffy, Blundell, Bozio, Laroque, and To, 2018). Our approach also complements quasi-experimental studies of the effect of net wage changes on *realized* employment rates, such as from income tax holidays (Bianchi, Gudmundsson, and Zoega, 2001; Chetty, Guren, Manoli, and Weber, 2012; Martinez, Saez, and Siegenthaler, 2018; Sigurdsson, 2018). Such studies identify one particular arc labor supply elasticity per experiment. By contrast, we trace out the *global* aggregate labor supply curve, rather than the arc elasticity of labor supply at one given tax change. Moreover, by relying on realized employment rates, all aforementioned studies need not solely isolate preferences (which we attempt) but can additionally reflect frictions.[6]

Third, we conduct a quantitative exercise by comparing the empirical supply curve to the curves implied by specific calibrated models with an extensive margin labor supply. Here, the reservation wedge serves as a bridge and illuminates otherwise opaque aggregate labor supply curves and their

[4]This insight implies a trade-off between statistical power and overcoming adjustment costs (e.g., Chetty, 2012), and measuring the local elasticities relevant for smaller shocks (away from isoelasticity). Keane and Rogerson (2012, 2015) and Peterman (2016) discuss other factors potentially masking larger macro extensive-margin elasticities such as frictions, mismeasurement or heterogeneity.

[5]For example, Park (2017) assumes homogeneous labor supply disutility, and uses measured consumption, realized employment allocations combined with imputed wages and distributional assumptions to back out reservation wages. Gourio and Noual (2009) consider an empirical setting specified to normal distributions and derives estimating equations based on a social planner's large-household allocation.

[6] Such studies therefore provide calibration targets for a model's entire labor market structure net of frictions. Moreover, for many policy questions, the reduced-form realized employment effects may be the required input, such as for fiscal externalities (for UI applications, see, e.g., Chetty, 2006).

determinants. We find that no existing models' extensive margin labor supply blocks comes close to capturing the nonconstant and asymmetric arc elasticities of the empirical curve. We start with representative, full-insurance households, and then specialize it to feature isoelastic labor supply in aggregate hours, analogous to the intensive-margin isoelastic utility specification of MaCurdy (1981) and extended to the extensive margin in Galí (2011a,b); Galí, Smets, and Wouters (2012), and also indivisible labor with homogeneity (Hansen, 1985; Rogerson, 1988). We also integrate an intensive margin, studying the Rogerson and Wallenius (2008) lifecycle model. We finally introduce an extensive-margin choice into atomistic heterogeneous agent models with borrowing constraints (Bewley, 1986; Huggett, 1993; Aiyagari, 1994; Chang and Kim, 2006, 2007; Kaplan, Moll, and Violante, 2018).

Fourth, we assess the macroeconomic consequences of the empirical labor supply curve taken at face value. As a performance measure, we use the labor wedge in business cycle accounting (Chari, Kehoe, and McGrattan, 2007), the gap between the aggregate MPL and MRS time series (Shimer, 2009). To that end, we reverse-engineer one model to *precisely* match the empirical curve: a representative household consisting of members heterogeneous in labor disutility. We fit and provide a ready-to-use parametric polynomial approximation of the labor disutility function implied by the empirical reservation wedges, which we show is a naturally increasing and convex function of the employment rate directly identified by the empirical wedges.

Since the employment and wage fluctuations over business cycles fluctuations trace out local deviations, the business cycle accounting exercise exhibits a much less volatile labor wedge. The empirical labor supply curve therefore helps reconcile empirical employment fluctuations with labor supply preferences and labor market clearing. Overall, these results appear well approximated by a high (2.5) constant elasticity labor supply model. Importantly, this exercise assumes efficient rationing of labor supply i.e. assignment of workers into employment by their rank in the reservation wedge distribution, such that the marginal workers with the lowest employment surplus (highest reservation wedges) are the first to drop out in a recession.

We close by reiterating that the reservation wedges trace out the *desired* spot-market labor supply curve, i.e. underlying preferences over employment and nonemployment. By construction, the framework is decidedly agnostic and prior to potential real-world frictions such as search frictions or wage rigidities, which may detach desired from actual employment allocations. It most accurately captures spot-market jobs, thereby also likely side-stepping various real-world dynamic considerations. We thereby leave open the long-standing question in labor and macroeconomics about the degree to which empirical employment adjustment actually occurs along households' desired labor supply curve (see, e.g., Lucas and Rapping, 1969; Hall, 1980, 2009; Galí, 2011b; Galí, Smets, and Wouters, 2012; Schmitt-Grohé and Uribe, 2016; Krusell, Mukoyama, Rogerson, and Sahin, 2017; Mui and Schoefer, 2018; Jäger, Schoefer, and Zweimüller, 2019).[7] In fact, using the panel

[7]Relatedly, an interesting and important question beyond the scope of our paper is the treatment of the unemployed from the perspective of labor supply, in which they have wedges below one (i.e. they would like to work yet perhaps due to search frictions have yet to obtain an employment opportunity). Hence, their desired labor supply classifies them as similar to the employed rather than the out of the labor force (in contrast to the debate on the subcategories

dimensions of our custom US survey and additionally drawing on large German household surveys linked to administrative social security data, we provide some suggestive evidence that in the micro data, realized employment outcomes are only imperfectly correlated with reservation wedges. Moreover, studying empirical micro covariates of the wedges, reveals some but overall limited empirical correlates of the wedge, which, e.g., clearly do not map into a single specific model. Taken together, our findings leave considerable room for – and may provide a methodological handle on – rationed labor supply due to frictions (or alternatively the discrepancies may reflect measurement error or imperfect persistence in the empirical wedges).

In Section 2, we define the reservation wedge framework. In Section 3 we construct the empirical counterparts. In Section 4, we compare various models' distributions with the empirical one. In Section 5, we calibrate one model to precisely match the empirical curve, and study macro implications through business cycle accounting. Section 6 concludes.

2 Basic Framework

First, we formalize the extensive-margin aggregate labor supply curve as a function of a homogeneous labor-earnings shifter we call the *prevailing aggregate labor wedge*, which accommodates wage heterogeneity. **Throughout the paper, the term "wedge" will serve as a short-hand to denote an abstract placeholder for tax-like proportionate shifters of potential labor earnings.** Second, we summarize individual-level employment preferences by formalizing a sufficient statistic we call the idiosyncratic *reservation labor wedge*: the hypothetical level of the prevailing aggregate wedge that would render a given individual indifferent between employment and nonemployment. Equivalently, the reservation wedge corresponds to the percent shift (upward or downward) in an individual's potential earnings that would achieve this indifference point for her, and therefore also to an (inverse) measure of her (non-)employment surplus. Third, the aggregate labor supply curve is the CDF of the reservation wedge, tracing out the fraction of individuals desiring to work, as a function of the prevailing aggregate wedge. Fourth, we define extensive-margin arc elasticities. Fifth, we show robustness of this framework to a series of extensions.

2.1 The Aggregate Labor Earnings Shifter vs. Idiosyncratic Earnings

The extensive-margin aggregate labor supply curve traces out the response of aggregate desired employment to a wage concept we define as the *prevailing aggregate labor wedge* $1 - \Xi_t$: a homogeneous labor income shifter $1 - \Xi_t$ of individual-level baseline potential labor earnings y_{it}, so that realized labor earnings are $(1 - \Xi_t)y_{it}$ if working. This earnings shifter $1 - \Xi_t$ stands in for experiments such as aggregate wage fluctuations, changes in labor demand, or changes in labor taxes. This concept will operationalize the question: how much would aggregate labor supply change if all wages shifted by a proportionate amount given by wedge $1 - \Xi_t$?

of the nonemployed e.g. as in Flinn and Heckman, 1983). Krusell, Mukoyama, Rogerson, and Sahin (2017) and Cairo, Fujita, and Morales-Jimenez (2019) present models with three labor force statuses and notions of labor supply in settings of heterogeneous agents a representative household respectively. Hall (2009) presents a DMP matching model with a representative household featuring unemployment, with flexible labor supply along the intensive margin.

Importantly, by separating the homogeneous labor income shifter $1-\Xi_t$ from the individual-level baseline labor income y_{it}, $1-\Xi_t$, accommodates heterogeneity in wages. Individual labor earnings y_{it} are always *gross* of this aggregate wedge $1-\Xi_t$, and the individual's net-of-wedge potential earnings are $(1-\Xi_t)y_{it}$. Moreover, the specific joint definitions of idiosyncratic labor incomes y_{it} and aggregate earnings shifter $1-\Xi_t$ may depend on the particular experiment tracing out the labor supply curve. For example, if $1-\Xi_t$ denotes linear labor income taxes, y_{it} in turn denotes gross-of-tax earnings. Alternatively, one can define y_{it} as being net-of-tax earnings, and $1-\Xi_t$ in turn denotes an incremental linear tax. If $1-\Xi_t$ is to represent a shift in labor productivity and the model has workers be paid their marginal product, then individual-level earnings y_{it} will be baseline earnings gross of that shift. Similarly, and the most abstract concept useful to define the labor supply curve, if $1-\Xi_t$ is to represent a homogeneous shift in everyone's real wages, y_{it} will denote the baseline earnings level absent or before that shift.

2.2 Micro Labor Supply: Reservation Wedges

We now derive the individual-level reservation wedge for a benchmark spot labor market model.

Labor Supply Problem Consider an individual i with time-separable utility $u_i(c_{it}, h_{it})$ from consumption c_{it} and hours worked h_{it}, with budget Lagrange multiplier λ_{it}, and assets a_{it} earning interest rate r_{t-1}:

$$\max_{a_{it},h_{it},c_{it}} \mathbb{E}_t \sum_{s=t}^{t_i^{\max}} \beta^{s-t} u_i(h_{is}, c_{is}) \tag{1}$$

$$\text{s.t. } a_{is} + c_{is} \leq a_{i,s-1}(1+r_{s-1}) + (1-\Xi_s)y_{is}(h_{is}) + T_{is}(.) \quad \forall t_i^{\max} \geq s \geq t. \tag{2}$$

For now labor is indivisible, such that $h_{it} \in \{0, \widetilde{h}_{it}\}$; we permit intensive-margin hours choices below in Section 2.5. Pre-wedge earnings at a given hours choice are $y_{is}(h_{is})$. Crucially, net labor income is shifted by the prevailing labor wedge $1-\Xi_t$, which is not individual-specific and thereby links individual-level preferences to aggregate labor supply. $T_{it}(.)$ denotes other taxes and transfers (unrelated to labor income and employment status).

To derive the discrete employment choice, we define costs and benefits of working now, and put concrete structure on them while reviewing particular models in Section 4. On the labor disutility side, working rather than not comes at discrete cost $v_{it} = u_i(c_{it}^{e=1,\lambda_{it}}, \widetilde{h}) - u_i(c_{it}^{e=0,\lambda_{it}}, 0)$ (where hence consumption is respectively optimized against a constant λ, as we shall see below for the Frischian experiments and thereby also accommodating nonseparable preferences). Besides standard hours disutility, v_{it} may also include fixed participation costs (Cogan, 1981). On the benefit side, in the context of indivisible labor and extensive margin employment choices more broadly, it is useful to define *potential earnings* y_{it}, which here are $y_{it} = w_{it}\widetilde{h}_{it}$ (earnings are zero otherwise).

Labor supply assigns each individual i her desired hours $h_{it}^* \in \{\widetilde{h}_{it}, 0\}$, a binary discrete choice due to indivisible labor, according to a cutoff rule:

$$h^*_{it} = \begin{cases} 0 & \text{if} \quad (1-\Xi_t) w_{it} \widetilde{h}_{it} \lambda_{it} < v_{it} \\ \widetilde{h}_{it} & \text{if} \quad (1-\Xi_t) w_{it} \widetilde{h}_{it} \lambda_{it} \geq v_{it}. \end{cases} \tag{3}$$

Equivalently, due to labor indivisibility, individual desired extensive-margin labor supply (desired employment) $e^*_{it} \in \{0, 1\}$ is given by:

$$e^*_{it} = \begin{cases} 0 & \text{if} \quad (1-\Xi_t) y_{it} \lambda_{it} < v_{it} \\ 1 & \text{if} \quad (1-\Xi_t) y_{it} \lambda_{it} \geq v_{it}. \end{cases} \tag{4}$$

That is, an individual prefers employment if the utility benefits, $(1-\Xi_t) y_{it} \lambda_{it}$, outweigh the utility cost, v_{it} (such the net-of-wedge earnings exceed the extensive-margin MRS). For marginal – i.e. indifferent – individuals, the condition holds with equality.

Micro Reservation (Labor) Wedges We summarize an individual's extensive-margin labor supply preferences by defining as a micro sufficient statistic her idiosyncratic *reservation wedge* $1 - \xi^*_{it}$: the *hypothetical* aggregate prevailing labor wedge $1-\Xi_t$ that would, if prevailing transitorily, render her *marginal* in a Frischian (λ-constant) setting:

$$1 - \xi^*_{it} \equiv \frac{v_{it}}{y_{it} \lambda_{it}}. \tag{5}$$

We write the micro reservation wedge as a lower case letter to differentiate it from the aggregate prevailing wedge. The *-symbol denotes the indifference condition rather than a potential idiosyncratically prevailing micro wedge. It is the extensive-margin, discrete-choice analogue of the standard marginal rate of substitution at the intensive margin between labor disutility and consumption, divided by the wage/potential earnings concept.

The reservation wedge is a scalar sufficient statistic for an individual's employment preferences collapsing the three basic elements: potential labor earnings, budget multipliers, and labor disutility. In turn, these three components will capture rich model-specific sources of heterogeneity, such as wealth, borrowing constraints, skills, hours requirements, job amenities, time endowments, or tastes for leisure.

One can then write the individual labor supply preference as a cutoff rule pertaining to her reservation wedge and the prevailing aggregate wedge $1 - \Xi_t$:

$$e^*_{it} = \begin{cases} 0 & \text{if} \quad 1 - \xi^*_{it} > (1-\Xi_t) \\ 1 & \text{if} \quad 1 - \xi^*_{it} \leq (1-\Xi_t). \end{cases} \tag{6}$$

Reservation Wedges Vs. Reservation Wages Our reservation wedge concept is a generalization of the more standard reservation *wage* to the context of wage heterogeneity. Of course, when potential earnings $\bar{y}_t$ are homogeneous in our setting, reservation wages $y^r_{it} \equiv \frac{v_{it}}{\lambda_{it}}$ sufficiently characterize labor supply preferences at the extensive margin. In such a context, reservation wedges $1-\xi^*_{it} \equiv \frac{v_{it}}{\bar{y}_t\lambda_{it}} = \frac{y^r_{it}}{\bar{y}_t}$ in turn are simple scaled version of the homogeneous wage and the reservation wages. However, with heterogeneity in potential earnings y_{it}, reservation wages and similar concepts alone do not sufficiently characterize employment preferences without simultaneous reference to each individual's potential earnings. By contrast, our concept of the reservation wedge $1-\xi^*_{it} \equiv \frac{v_{it}}{y_{it}\lambda_{it}} = \frac{y^r_{it}}{y_{it}}$ then is the one-dimensional statistic sufficient to rank individuals on an aggregate labor supply curve with respect to a homogeneous shift in earnings such as in form of $1-\Xi_t$. We provide a more empirically focused discussion of the distinction in Section 3.1, where we measure the wedges in a custom survey.

2.3 The Aggregate Extensive-Margin Labor Supply Curve

The distribution of reservation wedges in period t, given by CDF $F_t(1-\xi^*)$, in turn fully characterizes the aggregate short-run labor supply curve as a function of transitory shifts in $1-\Xi_t$ (hence Frischian, λ-constant variation). Any two specific models will feature isomorphic labor supply curves if and only if they generate same reservation wedge distribution $F(\cdot)$, sufficiently summarizing all model-specific multi-dimensional heterogeneities relevant to extensive-margin aggregate labor supply.

The aggregate desired employment rate E_t equals the fraction of workers with $1-\xi^*_{it} \le 1-\Xi_t$, i.e. the mass of employed households (defined by index $i \in [0,1]$) through the marginal worker:

$$E_t(1-\Xi_t) = \int e^*_{it} di = \int_{-\infty}^{\infty} \mathbb{1}\left(1-\xi^* \le 1-\Xi_t\right) dF_t(1-\xi^*) \tag{7}$$

$$= F_t\left(1-\Xi_t\right). \tag{8}$$

Desired employment *adjustment*, e.g. to an increase in aggregate wedge from $(1-\Xi_t)$ to $(1-\Xi'_t)$, is driven by the mass of nearly-marginal workers, $F_t(1-\Xi'_t)-F_t(1-\Xi_t)$: those nonemployed in regime $1-\Xi_t$ but employed under $1-\Xi'_t > 1-\Xi_t$, i.e. with reservation wedges $1-\Xi_t < 1-\xi^*_{it} \le 1-\Xi'_t$.

2.4 The Aggregate Extensive-Margin Frisch Elasticity

Definition In the reservation wedge framework, the extensive-margin Frisch labor supply elasticity emerges as one local property. For discrete wedge changes, the arc elasticity is:

$$\epsilon_{E_t,(1-\Xi_t)\to(1-\Xi'_t)} = \frac{F_t\left(1-\Xi'_t\right) - F_t\left(1-\Xi_t\right)}{F_t\left(1-\Xi_t\right)} \Bigg/ \frac{(1-\Xi'_t)-(1-\Xi_t)}{1-\Xi_t}. \tag{9}$$

For infinitesimal changes in $(1-\Xi_t)$, the elasticity is:

$$\epsilon_{E_t,1-\Xi_t} = \frac{(1-\Xi_t)}{E_t}\frac{\partial E_t}{\partial(1-\Xi_t)} = \frac{(1-\Xi_t)f_t(1-\Xi_t)}{F_t(1-\Xi_t)}. \tag{10}$$

For a preexisting wedge normalized to $1 - \Xi_t = 1$, the elasticity is the reverse hazard rate (or inverse Mills ratio) at threshold 1, i.e. $f_t(1)/F_t(1)$ (any tax system can be subsumed as net wages w_{it} without loss of generality).

Constant Elasticity The framework permits any shape of the aggregate labor supply curve and hence the implied elasticites. A specific case is a *constant* extensive-margin Frisch elasticity. We now clarify the general conditions on the wedge distribution for this case because a constant elasticity is a property convenient for calibration and often assumed in modeling practice (two examples are in our model meta-analysis in Section 4). Additionally, empirical work often thinks of a single elasticity to be measured, hence taking isoelasticity as the implicit point of departure (see, e.g., the review of quasi-experimental estimates in Chetty, Guren, Manoli, and Weber, 2012). Specifically, we now clarify that a labor supply curve will be isoelastic if the reservation wedge distribution is power-law-like. Suppose $1 - \xi^*$ follows a distribution $G_{1-\xi^*}$ with shape parameter $\alpha_{1-\xi^*}$ and maximum $(1 - \xi^*)_{\max}$:[8]

$$G_{1-\xi^*}(1 - \xi^*) = \left(\frac{1 - \xi^*}{(1 - \xi^*)_{\max}}\right)^{\alpha_{1-\xi^*}}. \tag{12}$$

Using the basic definition of arc elasticities in Equation (9), the arc elasticities of the aggregate labor supply curve implied by this specific wedge distribution are then constant and equal to $\alpha_{1-\xi^*}$:

$$\epsilon_{E_t,1-\Xi_t} = \frac{(1 - \Xi_t)\frac{\alpha(1-\Xi_t)^{\alpha_{1-\xi^*}-1}}{(1-\xi^*)_{\max}^{\alpha_{1-\xi^*}}}}{\frac{(1-\Xi_t)^{\alpha_{1-\xi^*}}}{(1-\xi^*)_{\max}^{\alpha_{1-\xi^*}}}} = \alpha_{1-\xi^*}. \tag{13}$$

Of course, the constant elasticity will only hold within interior ranges of the employment rate, and mechanically shrink once a pertubation is large enough to cross full nonemployment or employment. Moreover, such a power-like wedge distribution can emerge as long as *any one* of wedge components $(v_{it}, 1/\lambda_{it}, 1/y_{it})$ is power-distributed conditional on the other two.[9]

[8]Specifically, the distributional assumptions specify a standard power law distribution $F(X) = P(x < X) = a \cdot (x/X_{\min})^{-\gamma+1}$ with shape parameter $\gamma > 0$. A comparison with our wedge-based power-law-like distribution (12) clarifies that we require the *inverse* of our wedge to follow a power distribution:

$$G_{1-\xi^*}(1 - \xi^*) = P(X < 1 - \xi^*) = \left(\frac{1 - \xi^*}{(1 - \xi^*)_{\max}}\right)^{\alpha_{1-\xi^*}} \Leftrightarrow P\left(\frac{1}{1 - \xi^*} < \frac{1}{X}\right) = \left(\frac{\frac{1}{1-\xi^*}}{\frac{1}{(1-\xi^*)_{\max}}}\right)^{-\alpha_{1-\xi^*}}, \tag{11}$$

which is a power-law distribution of $\frac{1}{1-\xi^*}$ with minimum $\frac{1}{(1-\xi^*)_{\max}}$, and shape parameter $\gamma = \alpha_{1-\xi^*} + 1$.

[9] For example, let v_{it} follow a power distribution with maximum $v_{\max}$ and shape parameter α_v, independent from $g(y, \lambda)$, the joint distribution of y_{it} and λ_{it}. The distribution of $1 - \xi^*_{it}$ is then:

$$F_t(1 - \Xi_t) = P\left(1 - \xi^*_{it} \leq 1 - \Xi_t\right) = P\left(v_{it} < (1 - \Xi_t)y_{it}\lambda_{it}\right) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} \min\left\{\left(\frac{(1 - \Xi_t)y\lambda}{v_{\max}}\right)^{\alpha_v}, 1\right\} g_t(y, \lambda)dyd\lambda. \tag{14}$$

2.5 Extensions Within the Spot Labor Market Benchmark

We now show that the basic reservation wedge framework continues to serve as the sufficient statistic for extensive-margin labor supply preferences when considering richer spot-labor market settings.

Job Menus and Intensive Margin Choices Even with intensive margin choices, the reservation wedge continues to encode the extensive-margin labor supply curve. We will discuss intensive margin choices in a very general way using a job menu framework. Rather than having one choice of a job (as in the original example with $h_{it} \in \{\widetilde{h}_{it}, 0\}$), suppose the individual's employment status additionally requires job choice j from a job menu $J_{it} = \{(y_{it,j}, v_{it,j})\}_j$, in which each job j is defined by its attributes $(y_{it,j}, v_{it,j})$ and hence may differ in earnings and disutility (or amenities). This general setting nests an intensive-margin hours choices.

Our solution proceeds in two steps. First in the "inner loop", for any given wedge $1 - \Xi_t$, we define the intensive-margin job choice – at which stage we therefore intentionally ignore the participation constraint i.e. the extensive-margin choice:

$$\max_{a_{it}, j_{it} \in J_{it}, c_{it}} \mathbb{E}_t \sum_{s=t}^{t_i^{\max}} \beta^{s-t} u(j_{is}, c_{is}) \tag{16}$$

$$\text{s.t. } a_{is} + c_{is} \leq a_{i,s-1}(1 + r_{s-1}) + (1 - \Xi_s) y_{is,j_{is}} + T_{is}(.) \;\; \forall t_i^{\max} \geq s \geq t, \tag{17}$$

where optimal job choice is defined as a discrete choice maximizing utility. This "inner loop" gives the best job choice conditional on working and conditional on the prevailing wedge $1 - \Xi_t$:

$$j^*(1 - \Xi_t) = \underset{j \in J_{it}}{\text{argmax}} \{(16) \text{ s.t. } (17) | 1 - \Xi_t\}. \tag{18}$$

Second, in the "outer loop", extensive-margin labor supply is given by an augmented cutoff rule, which with job menus is now defined with respect to the job choice respectively optimal at the

A powerful case is $\left(\frac{(1-\Xi_t) y_{it} \lambda_{it}}{v_{\max}}\right)^{\alpha_v} < 1$ for each (y, λ)-"type". Economically, this property implies positive nonemployment in each (y, λ)-type at $1 - \Xi_t$. Then the distribution becomes "cleanly" power-like:

$$\Rightarrow F_t(1 - \Xi_t) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \left(\frac{(1 - \Xi_t) w \lambda}{v_{\max}}\right)^{\alpha_v} g_t(y, \lambda) dy d\lambda = \left(\frac{1 - \Xi_t}{v_{\max}}\right)^{\alpha} \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} (y\lambda)^{\alpha_v} g_t(y, \lambda) dy d\lambda, \tag{15}$$

which itself is a power distribution with shape parameter α_v and maximum $1 - \xi_{\min}^v = \frac{v_{\max}}{\left[\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} (y\lambda)^{\alpha} g_t(y, \lambda) dy d\lambda\right]^{1/\alpha_v}}$. That is, we have indexed the population by (y, λ). *Within* each (y, λ)-type, the reservation wedge is power-distributed since v_{it} is. So each (y, λ)-type exhibits a constant elasticity α_v. The aggregate elasticity – the weighted average of (y, λ)-types' elasticities α_v – is hence also α_v. By contrast, if Ξ_t or $\xi_{\min}^v$ is low enough for full employment in some types, these types' labor supply will be locally inelastic, so the aggregate elasticity will be smaller than α_v, at $\alpha_v \cdot P((1 - \Xi_t) y \lambda < v_{\max})$.

given prevailing wedge $1 - \Xi_t$ defined in Equation (18):

$$\Rightarrow e^*_{it} = \begin{cases} 0 & \text{if} \quad (1-\Xi_t) y_{it,j^*(1-\Xi_t)} \lambda_{it} < v_{it,j^*(1-\Xi_t)} \\ 1 & \text{if} \quad (1-\Xi_t) y_{it,j^*(1-\Xi_t)} \lambda_{it} \geq v_{it,j^*(1-\Xi_t)}. \end{cases} \tag{19}$$

Here, the individual-level reservation wedge is an implicitly defined fixed point: it is the prevailing wedge that would render the individual indifferent between working and not working, *conditional on having (re-)optimized job choice*:

$$1 - \xi^*_{it} = \frac{v_{it,j^*(1-\xi^*_{it})}}{y_{it,j^*(1-\xi^*_{it})} \lambda_{it}}. \tag{20}$$

These results also formally clarify that the job/hours choice under a prevailing wedge $1 - \Xi_t$ need not be the hours choice relevant to the reservation wedge, since job switching and hours reoptimization may occur towards the marginal job $j^*(1 - \xi^*_{it})$.

Applying this framework to the intensive margin choice also illustrates why nonconvexities in labor costs are often needed to generate extensive margin movements. Consider the specific case in which jobs differ by hours only, so potential earnings from working h_{it} hours is $y_{it} = h_{it} w_{it}$. With perfectly unrestricted hours choice and no nonconvexities, such as with standard MaCurdy (1981) hours disutility specifications, the optimal intensive margin choice is ${h^*_{it}}^{1/\eta} = (1 - \Xi_t)\lambda_{it} w_{it}$; so the individual prefers employment at any positive prevailing wedge level, no matter how low while above zero (albeit at lower and lower hours). Intuitively, at zero hours of work, there is no first-order disutility of work but a first-order consumption gain – precluding a meaningful extensive margin. A version of this consideration will emerge in the Rogerson and Wallenius (2008) model, which we review in our model meta-analysis in Section 4.

Non-Frischian, Uncompensated Variation The paper focuses on Frischian, short-run labor supply. However, our framework generalizes to non-Frischian contexts where λ need not remain constant. Examples are longer-lived shifts that entail wealth effects, amplified by borrowing constraints or adjustment costs in asset liquidation.

To study non-Frischian settings, we extend the one-period wedge to an explicit horizon. Let $1 - \Xi_{t,t+\Delta}$ denote a wedge perturbation lasting for duration Δ (e.g. a discrete amount of periods, with $\Delta = 0$ denoting a one-period deviation). Special cases are, instantaneous and perfectly transitory shift $1 - \Xi_{t,t}$, and a permanent wedge $1 - \Xi_{t,t+\infty}$. Consider settings in which at least for the time interval of the perturbation Δ, the other parameters are stable. $\lambda_{it}(1 - \Xi_{t,t+\Delta})$ denotes the budget multiplier, which in this non-Frischian context may be $(1-\Xi_{t,t+\Delta})$-dependent. The decision rule for period-t employment then is:

$$e^*_{it} = \begin{cases} 0 & \text{if} \quad (1-\Xi_{t,t+\Delta}) y_{it} \lambda_{it}(1-\Xi_{t,t+\Delta}) < v_{it} \\ 1 & \text{if} \quad (1-\Xi_{t,t+\Delta}) y_{it} \lambda_{it}(1-\Xi_{t,t+\Delta}) \geq v_{it}. \end{cases} \tag{21}$$

The reservation wedge continues to be defined analogously to the Frischian wedge, yet now (as in the intensive-margin case), as as a fixed point $1 - \xi^*_{t,t+\Delta}$, implicitly defined as the hypothetical prevailing wedge $1 - \Xi_{t,t+\Delta}$ of duration Δ that would leave the worker indifferent between working for that time interval $[t, t+\Delta]$ and not working:

$$1 - \xi^*_{t,t+\Delta} = \frac{v_{it}}{y_{it} \cdot \lambda_{it}(1 - \xi^*_{t,t+\Delta})}. \tag{22}$$

Non-Frischian wedges $1 - \Xi_{t,t+\Delta}$ with $\Delta > 0$ capture two effects. First, the substitution effect going along the reservation wedge distribution holding λ constant. This is the Frischian setting we have so far studied by assuming the period Δ to be infinitesimal. Second, a wealth effect may also shift $\lambda_{it}(1 - \Xi_{t,t+\Delta})$, working into the opposite direction.[10] As a result, Frischian contexts may to some degree not provide accurate descriptions of the full labor supply adjustment. (In principle, even in the context of wealth effects, a Frischian variation can be induced in practice or theory by offsetting lump sum taxes or transfers T.)

We quantitatively evaluate the divergence between uncompensated and Frischian labor supply curves in three specific calibrated models (which we further study in Section 4): a representative household with a 2.5 Frisch labor supply isoelasticity, a finitely-lived atomistic household with also an intensive margin, and a heterogeneous agent model with uninsured potential-earnings shocks and borrowing constraints. Computational details for these uncompensated exercises are in Appendix B. In each exercise, we simulate an unexpected aggregate-wedge perturbation lasting for one quarter, a useful horizon for business-cycle frequencies.

Appendix Figure A1 plots the 3x2 aggregate labor supply curves. At least in these three models uncompensated curves are very close to their reservation-wedge-implied Frischian peer, even at a quarterly frequency. We suspect that larger income effects and hence divergence may arise with illiquid assets such as those studied in Kaplan, Violante, and Weidner (2014); Kaplan, Moll, and Violante (2018), where even some high-income and high-net-wealth individuals households act-liquidity constrained.

Net vs. Gross Earnings, Nonemployment Subsidies, and Home Production Monetary (nondisutility) opportunity costs of working, such as nonemployment-subsidizing programs such as unemployment insurance (for measurement of these average costs in the context of a representative household, across countries and the U.S. business cycle, see Prescott, 2004; Chodorow-Reich and

[10]Consider an application of our framework to the canonical example of balanced-growth (with $\sigma = 1$) preferences separable and isoelastic in consumption $u(c,h) = \frac{c^{1-\sigma}}{1-\sigma} + v(h)$, and labor earnings as the only source of income, and with amortized (hence smoothed as consumption) pre-wedge present value of earnings Y_{it}, for a permanent wedge $1 - \Xi_{t,t+\infty}$:

$$e^*_{it} = \begin{cases} 0 & \text{if} \quad (1 - \Xi_{t,t+\infty}) y_{it} (1 - \Xi_{t,t+\infty})^{-\sigma} \cdot Y_{it}^{-\sigma} < v_{it} \\ 1 & \text{if} \quad (1 - \Xi_{t,t+\infty}) y_{it} (1 - \Xi_{t,t+\infty})^{-\sigma} \cdot Y_{it}^{-\sigma} \geq v_{it}. \end{cases} \tag{23}$$

For $\sigma = 1$, the employment policy is independent of the wedge: the substitution effect, movement *along* the aggregate labor supply curve, is perfectly offset by the wealth effect, which shifts the curve towards the original employment level, generating the extensive-margin analogue of constant inelastic long-run labor supply.

Karabarbounis, 2016) or home production (Benhabib, Rogerson, and Wright, 1991; Aguiar, Hurst, and Karabarbounis, 2013), which we denote as b_{it}, affect labor supply by shaping the outside option to market work.[11] The wedge framework accommodates these features and clarifies that they act, on the extensive margin, by shifting the threshold of the marginal individual, and interact with wedge-shifts to the degree that they are themselves wedge-sensitive.[12]

Two cases are useful to consider. First, if such opportunity costs b_{it} is subject to the wedge (e.g., home production if shifting with TFP as the shifter), it can be folded into a richer *net* potential earnings concept: *net* potential earnings $\tilde{y}_{it} = y_{it} - b_{it}$ (gross earnings y_{it} minus b_{it}). The wedge logic then goes through:

$$1 - \xi_{it}^{*} = \frac{v_{it}}{(y_{it} - b_{it})\lambda_{it}} = \frac{v_{it}}{y_{it}\left(1 - \frac{b_{it}}{y_{it}}\right)\lambda_{it}} = \frac{v_{it}}{\tilde{y}_{it}\lambda_{it}}, \tag{24}$$

where $\frac{b_{it}}{y_i t}$ is a "replacement rate".

Second, if b_{it} is not marked up by the wedge (e.g., acyclical nonemployment subsidies), then b_{it}, marked up by λ_{it}, can (albeit at the cost of some obfuscation) fold into disutility of labor $\tilde{v}_{it} = v_{it} + b_{it}\lambda_{it}$:

$$1 - \xi_{it}^{*} = \frac{v_{it} + b_{it}\lambda_{it}}{y_{it}\lambda_{it}} = \frac{\tilde{v}_{it}}{y_{it}\lambda_{it}}. \tag{25}$$

Nonwage Job Amenities Nonwage job amenities (Mas and Pallais, 2017; Hall and Mueller, 2018) can simply be folded into the now *net* disutility of work v_{it}^{j} for each job j, then encompassing all nonmonetary flow benefits entering directly the utility function, and can also be incorporated into the aforementioned intensive-margin setting.

Multi-Member Households and Family Labor Supply Our framework studies single-member households comprised of individuals. However, in a Frischian setting, the same member-level expressions obtain with multi-member households, and intra-family interactions will show up solely through budget mutlipliers λ under the assumption of members' utility functions being separate (as in, e.g., Blundell, Pistaferri, and Saporta-Eksten, 2016; Beffy, Blundell, Bozio, Laroque, and To, 2018). Away from this assumption, as with general utility specifications in unitary household models or in collective models (Chiappori, 1992), an individual's reservation wedge may depend on other members' labor supply through shaping disutility of labor v_{it}. Still, we suspect that we can continue to order individuals by their reservation wedge and that household members' wedges then take into account the respective optimization of the other members' with respect to the hypothetical reservation level, somewhat akin to the fixed point arguments underlying the intensive-margin job menu choices above.

[11] Taxes $T(.)$, since taken as parametric in labor supply, do not capture such terms.

[12] For the extensive margin, this clarification therefore suggests another channel by which institutional arrangements can affect aggregate labor supply elasticities (Prescott, 2004; Schoefer, 2010), namely by simply shifting the baseline cutoff, which changes aggregate elasticities except in the knife-edge case of isoelastic wedge distributions.

2.6 Beyond the Spot Labor Market Benchmark

So far we have characterized desired labor supply in form of reservation wedges from the perspective of a spot labor market as well as "gross-of-frictions." We here briefly discuss potential deviations from the spot frictionless benchmark. First, long-term jobs may generate dynamic considerations in committing to a job. For example, in the model of labor-supply with long-term jobs in Mui and Schoefer (2018), a spot-like wage concept resembling the "user cost of labor" akin to that of Kudlyak (2014) for labor demand emerges. Second, under accumulation of human capital on the job, as in Imai and Keane (2004) and the related skill-loss perspective of Ljungqvist and Sargent (2006, 2008), the benefit of working also incorporates these dynamic considerations, generating a forward-looking investment incentive for labor supply today.

Third, in the presence of frictions, the "net-of-frictions" counterpart of the reservation wedge would take into account non-spot market structures, and frictions. To fix ideas, consider the discrete choice setup in which these costs are monetary as an ad-hoc adjustment lump-sum cost $\lambda_{it} \cdot c_{it} \cdot \mathbb{1}\left(e_{it} \neq e_{i,t-1}\right)$. This cost shrinks the set of individuals adjusting to a transitory wedge shift, specifically depending on the employment status quo: an employed worker may – gross of frictions – prefer to take off a month for a vacation in response to small wage changes, while net of the adjustment costs, she may prefer to stay put.

Fourth, by studying desired spot-market labor supply rather than realized employment allocations, a question is how to conceptualize gaps between desired and realized employment. For example, the unemployed in our setting are more similar to the employed rather than those out of the labor force (as the unemployed will have have wedges below one i.e. they would like to work yet perhaps due to search frictions have yet to obtain an employment opportunity). This classification contrasts with the focus on how to divide the nonemployed into the unemployed vs. out of the labor force as in (Flinn and Heckman, 1983). Dedicated treatments of labor supply notions in the context of search frictions are provided by Hall (2009), Krusell, Mukoyama, Rogerson, and Sahin (2017) and Cairo, Fujita, and Morales-Jimenez (2019).

Importantly, any such disconnects may therefore warrant caveats associated with the widely used spot labor market paradigm more generally.

3 Empirical Reservation Wedges

Having formulated the theoretical extensive-margin aggregate labor supply curves as the reservation wedge distribution, we now trace out the empirical counterpart of reservation wedges in a custom U.S. household survey. We follow three steps, mirroring the model steps from Section 2:

- E1 Elicit individual-level reservation wedges $1 - \widetilde{\xi}^*_{it}$.
- E2 Construct and plot CDF $F_t(1 - \widetilde{\xi}^*)$, the aggregate labor supply curve.
- E3 Compute extensive-margin labor supply arc elasticities from the CDF of the reservation wedges.

3.1 Eliciting Individual-Level Reservation Wedges

Our primary data set is a custom survey of U.S. households comprising all labor force segments (aged 18 and older), of which we ask a tailored question eliciting directly their idiosyncratic reservation wedges. We are to our knowledge the first to attempt to elicit any reservation wage concepts (let alone reservation wedges) from non-job-searchers.

Survey We implement this approach with a tailored survey questionnaire in a nationally representative U.S. survey of 2,000 respondents. Our survey was fielded by NORC (University of Chicago), in a sample drawn from the AmeriSpeak Omnibus survey program. We also obtain additional demographic variables permitting us to study the covariates of the wedges and to conduct subsample analyses.[13]

Ideal Measure of the Reservation Wedge To fix ideas, we start with the ideal survey question tightly mirroring the theoretical reservation wedge:

> You are currently [non]employed. Suppose the following thought experiment: you (and only you) receive an additional temporary linear incremental tax [or subsidy] on your take-home earnings (at whichever hours or job you may choose to work). At what incremental tax [or subsidy] rate would you be indifferent between working for this period and not (at whichever job would be your best choice at that tax [subsidy] rate)?

This approach invokes an additional tax [subsidy] on top of any potentially pre-existing taxes and frictions, thereby normalizing the marginal worker's reservation wedge to one i.e. $1 - \widetilde{\xi}^*_{it} = 1$. One therefore does not have to take a stance on the *level* of the already-prevailing aggregate labor wedge in the data. Formally, we would elicit this normalized wedge $1 - \widetilde{\xi}^*_{it}$ corresponding to:

$$v_{it} = (1 - \widetilde{\xi}^*_{it}) \left[(1 - \Xi_t) y_{it}\right] \lambda_{it} \tag{26}$$

$$\Leftrightarrow 1 - \widetilde{\xi}^*_{it} = \frac{v_{it}}{\left[(1 - \Xi_t) y_{it}\right] \lambda_{it}} = \frac{1 - \xi^*_{it}}{1 - \Xi_t}. \tag{27}$$

Comparison to Standard Reservation Wage Measures Our attempt to empirically measure the reservation wedge concept contrasts with more standard existing reservation wage measures in at least two important ways. First, as we theoretically described in Section 2, conceptually the reservation wedge measure is the sufficient statistic for employment preferences in the presence of wage heterogeneity, whereas a reservation wage only plays this role in the knife-edge case of wage homogeneity, an empirically (and in many of our models also theoretically) uninteresting case. (As we clarify in Section 2 and implement for a series of surveys of job seekers in Appendix C,

[13] Our survey was conducted in two waves conducted in March and April, 2019. NORC provides sample probability weights to match the American adult demographic. We rescale the weights in each wave to represent the proportion of the total sample obtained from each wave. The first wave, dated March 19th 2019, contributed 809 observations with non-missing wedge responses; the second wave, dated April 19th 2019, contributed 870 individuals with non-missing wedge responses. Then, we reweight the observations so that the weighted labor force status proportions precisely match the February 2019 BLS population shares for employment, labor force participation, and unemployment (although the raw sample was very close to the BLS targets).

one could in principle still construct reservation wedges by dividing reservation wages by proxies for potential earnings.) Rather than a wage *level*, the wedge corresponds to the individual-specific *percent change* in her potential earnings that would exactly entail her indifference point between employment and nonemployment.

Second and as importantly, existing reservation wages have only been measured in surveys of (mostly unemployed) job seekers, which make up a selected section of the population, thereby not providing a lever on the aggregate labor supply curve. By contrast, our concept and survey aims to capture a representative cross-section of the full population and thereby includes additionally the out of the labor force and the employed. Third and less fundamentally, we attempt to identify a Frischian variation rather than the kind of sequential-search job-specific wages the existing surveys would identify.

Actual Implementation of Reservation Wedge Measure in U.S. Household Survey The actual questions we implement are the result of piloting in online samples and iterations with survey administrators, leading us to formulate relatively concrete hypotheticals. While the ideal question formulation permits job switching and reoptimization (see Section 2.5), we in practice invoke a "job-constant" perspective yielding job-j-specific wedges $1 - \widetilde{\xi}^{*}_{it,j} \equiv \frac{v_{it,j}}{(1-\Xi_t)y_{it,j}\lambda_{it}}$. Throughout, we keep the frequency of the Frischian wage change constant at one month. We discuss caveats and trade-offs of the specific implementation in Section 3.4.

Below are our questions eliciting the reservation wedge from respondents in each of the three labor force statuses.[14]

Question for the Employed To keep the scenario sufficiently realistic, we allude to unpaid time off. To avoid capturing frictions associated with job mobility (an insight from piloting), we also guarantee the worker to be able to return to the original job in this specification:

> The following is a hypothetical situation we ask you to think about regarding your current job, so please read [listen] carefully and try to think about what you would do if presented with this choice.
>
> Suppose, for reasons unrelated to you, your employer offers you the following choice: Either you take unpaid time off from work for one month, or you stay in your job for that month and only receive a fraction of your regular salary. No matter what choice you take, after the month is over, your salary will return to normal.
>
> In this hypothetical scenario, you cannot take an additional job to make up for the lost income during that month.
>
> Assume this choice is real and you have to make it. At what point would the cut in your salary be just large enough that you would choose the unpaid month of time off over working for the month at that lower salary?

[14] We feature an additional variant of the question for the temporarily laid off that mirrors that of the employed (supposing the respondent is back at the previous job). We do not ask the self-employed, given the missing wage concept. We do not differentiate multiple-job holders.

> For example, an answer of 5% means that a 5% wage cut would be the point where you would choose to take unpaid time off for the month instead of working for 5% lower pay during that month. But if the wage cut was less than 5%, you would instead choose to work for that than take unpaid time off. Choose any percentage between 1% to 100%, where the cut wage cut is just large enough that you would prefer to not work at all for no pay than work at reduced pay for that month.

Question for the Unemployed While for the unemployed, reservation wage questions have been measured in empirical research, our challenge was to keep the answer comparable to the Frischian perspective presented to the other respondents groups. We therefore induce a scenario in which a prospective job permits a one-month earlier start date than regular, albeit at a wage reduction. The particular reason is left unspecified, although we clarify that this interim month is to be spent in nonemployment. By construction, the reservation wedges – which reflect *desired* employment status – of the unemployed will be at most one, as for the employed.

> The following is a hypothetical situation we ask you to think about a potential job you may be looking for, so please read [listen] carefully and try to think about what you would do if presented with this choice.
>
> Suppose you have found the kind of job you are looking for and the employer would like to hire you. The regular start date for the job is one month away. As an alternative, your employer offers you the option to start working immediately, rather than waiting a month.
>
> However, if you chose to start work immediately, for that first month, you will only receive a fraction of the regular salary. The job is otherwise exactly the same. No matter what choice you take, after the month is over, the salary will then resume at the regular salary.
>
> In this hypothetical scenario, you cannot take an additional job to make up for the lost income during that month.
>
> Assume this choice is real and you have to make it. At what point would the cut in your salary be just large enough that you would choose the waiting a month without working and without the salary over starting the job immediately for the first month at that lower salary?
>
> For example, an answer of 5% means that a 5% wage cut would be the point where you would choose to wait a month without working instead of working for % lower pay during that month. But if the wage cut was less than 5%, you would instead choose to work at that wage than wait a month without working. Choose any percentage between 1% to 100%, where the cut wage cut is just large enough that you would prefer to not work at all for no pay than work at reduced pay for that month.

Question for the Out of the Labor Force Those out of the labor force presented the most significant challenge in formulating our questions. This group is comprised of those least likely to consider taking up employment (including the disabled, the retired, or students), but also of some marginal workers (as evidenced by the high rate of transitions between employment and nonemployment).

For this group, we ask about the required wage *increase* to induce a respondent into employment, since by self-classification and revealed preference these individuals likely have reservation wages exceeding their expected potential wages. Crucially, for our Frischian perspective, this wage change is only supposed to occur for a single month. For concreteness and realism, we implement this scenario in the form of a sign-up bonus on top of the first-month salary. We also specify that the employment relationship is to last for at least (rather than exactly) one month:

> The following is a hypothetical situation that may not have anything to do with your actual situation, but please read [listen] carefully and try to think about what you would do if presented with this choice.
>
> Think of the range of jobs that you would realistically be offered if you searched for jobs (even if you currently are not looking for a job and may not accept any of these potential jobs).
>
> Suppose you had such job offers in hand. Currently you would likely not take such jobs, at least not at the usual salary. However, suppose the employer were nevertheless trying hard to recruit you, specifically by offering an additional sign-up bonus. The requirement to receive the bonus is that you will work for at least one month. The bonus comes as a raise of the first month's salary. This sign-up bonus will only be paid in the first month (on top of the regular salary that month), afterwards the salary returns to the regular salary.
>
> Assume this choice is real and you have to make it. We would like to learn whether there is a point at which the bonus in the first month is just high enough that you would take the job.
>
> 5% means you would take the job if your employer paid a bonus of just 5% of the regular salary in the first month. 100% means you would require a bonus as large as the regular salary. 500% would mean you require a bonus equal to five times as large as the regular salary.
>
> Choose any percentage bonus that would be just high enough that you would take the job. You can enter a very high number (e.g. 100,000%) if you think you would not take any job, even if it paid a lot.

3.2 Results: The Empirical Aggregate Labor Supply Curve

Distribution of the Reservation Wedge We present histograms of the empirical reservation wedges from the reported reservation wedges in the US survey data in Figure 1 Panel (a), where gray (white) [black] bars denote observations from the sample that are employed (unemployed) [out of the labor force]. We report the summary statistics of the distribution of the log reservation wedge in Table 1.

The empirical histogram of the wedge distribution exhibits a large mass around one – where the reservation wage is close to the individual's actual wage i.e. the location of marginal workers. Globally, the distribution is widely dispersed, implying that the typical worker is inframarginal in that she derives considerable worker surplus (or, in the case of the nonemployed, would suffer considerable net disutility) from employment with tremendous heterogeneity in worker surplus.

Aggregate Labor Supply Curves To trace out the aggregate extensive-margin labor supply curve, we aggregate the micro wedges into a cumulative distribution function. Figure 1 Panel (b) plots the CDF of the empirical distribution of the empirical reservation wedges, with the cumulative distribution function $F(1-\xi^*)$ on the y-axis, and a given wedge cutoff on the x-axis $1-\xi^*$. By setting the placeholder cutoff $1-\xi^* = 1-\Xi$, the curve will ask what the employment rate is as a function of any given prevailing wedge $1-\Xi$. (Our empirical wedges are measured as $1-\widetilde{\xi}^*$ defined in Equation (27) and hence correspond to the actual wedges simply normalized around 1.)

To facilitate visual inspection with regards to implied elasticities, we additionally take logs of both axes, thereby plotting changes in desired log employment against changes in $\log(1-\Xi)$. We do so in Figure 2 and 3 (which is simply Figure 2 zoomed into the local behavior).

Implied Arc Elasticities Complementing this interpretation, w report descriptive statistics and arc elasticities for various intervals in Tables 1 and 2 respectively. In Table 2, we illustrate the local behavior of the labor supply curve around marginal workers, reporting shares as well as *arc elasticities*. These elasticities are simply the share of the population in a given upward, downward or symmetric distance from the prevailing unit wedge, given by Equation (9) following the definition in Section 2.4, $\epsilon_{E,(1-\Xi)\to(1-\Xi')} = \frac{F(1-\Xi')-F(1-\Xi)}{F(1-\Xi)} \Big/ \frac{(1-\Xi')-(1-\Xi)}{1-\Xi}$, where here $1-\Xi = 1$ and $F(1)$ is the baseline employment rate. To detect potential nonconstant elasticities or asymmetries, we construct a set of arc elasticities using varying sizes of wedge deviations. We additionally plot a series of arc elasticities of the empirical labor supply curve as a function of the wedge deviation from the unit wedge and hence the employment baseline in Figure 4 (in solid curves with hollow circles; the figure additionally contains model analogues we develop in subsequent Section 4 and a fitted line we derive in Section 5).

Large Local Elasticities Inspecting the empirical curve, we find a *local* Frisch elasticity of desired extensive-margin labor supply of around 3 (even higher with very small pertubations). The underlying concentration of marginal workers mirrors, in an attenuated way, intuitions from models of homogeneity (Hansen, 1985). That is, on both sides, lots of individuals will respond by dropping out or in in response to small changes in potential earnings.

Nonconstancy: Smaller Arc Elasticities to Large (In Particular Upward) Deviations Nonlocal perturbations imply dramatically lower arc elasticities to large wedge changes than local ones. That is, while locally an increase in potential earnings crowds in nearly 2.26 percent of the employment rate around a 1% change in the wedge (implying an elasticity of $\frac{d(\text{Emp/Pop})}{\text{Emp/Pop}}/0.01 = \frac{0.0226}{0.631}/0.01 = 3.72$), the implied elasticity falls to 0.96 when considering a larger wedge pertubations of 10%. Downward, arc elasticities fall from 5.66 for the 1% interval to 1.68 for the 10% drop in potential earnings.

The nonconstant elasticities is salient in the arc elasticities plot in Figure 4. Arc elasticities are largest locally around the baseline prevailing wedge, and decrease in either direction of the curve. Taken at face value, Figure 4 suggests that constant elasticities do not provide a realistic description of the *global* aggregate extensive-margin labor supply curve.

This empirical pattern has two main implications for modeling and interpretation of empirical evidence on labor supply. First, when resorting to constant-elasticity setups nevertheless, a high elasticity may be warranted for small perturbations (as implied by marginal labor product shifts in labor-market-clearing business cycle models), than when studying, e.g., large temporary work subsidies or income tax holidays.

Second, small arc elasticities identified by large positive increases in potential earnings may mask large local elasticities. For example, Chetty, Guren, Manoli, and Weber (2012) infer Frischian extensive margin labor supply elasticities elasticities at the extensive margin with a tax holiday in Iceland, studied by Bianchi, Gudmundsson, and Zoega (2001), which reduced average tax rates from 14.5% to 0.0% for one year, in response to which positive employment effects implied an arc elasticity of 0.42.[15] In our framework, this experiment corresponds to an increase in $1 - \Xi_t$ from 1.00 to 1.17. Our survey-implied labor supply curve, taken at face value, indicates an arc elasticity of 0.60 for that large a pertubation, despite exhibiting much larger elasticities for smaller wedge changes. We illustrate how the nonconstancy plays out for macro, business cycle contexts in Section 5.

To some degree, the nonconstant elasticity is of course expected, as the employment rate cannot exceed 100%. A priori, the large macro elasticity benchmarks of around 2.5 cited by Chetty, Guren, Manoli, and Weber (2012) for cyclical macro contexts would, out of a baseline employment rate of 79.2% in their Icelandic example of a tax holiday, imply employment rates exceeding 100%, similarly for some of the other case studies with large net-of-tax wedge increases the authors discuss.[16]

Lastly, we note that the histogram exhibits some likely spurious mass points at 0.5 and 1.5, likely due to respondents' rounding and anchoring; our fitted line, in detail derived in Section 5, will smooth out those bunching points (which if spread out more evenly would distribute mass towards a locally more elastic and far-away less elastic curve, thereby further accentuating the asymmetries already present, we conjecture).

3.3 Covariates of the Reservation Wedges

We now ask which micro covariates are associated with between-worker variation in reservation wedges.[17] We regress the logged reservation wedge on covariates in Table 3. Appendix Table A1 additionally controls for labor force status and hence studies within-status variation.[18] We

[15]Another quasi-experiment reviewed in Chetty, Guren, Manoli, and Weber (2012) is the Self Sufficiency Program in Canada, studied by Card and Hyslop (2005), which raised average net of tax rates by dramatically more, from 0.25 to 0.83, for 36 months, with an implied employment elasticity of 0.38.

[16]Of course, in the case studies the empirical employment rates do not reach 100% in response to the subsidies, and therefore do not actually hit the full-employment constraint. By contrast, Martinez, Saez, and Siegenthaler (2018) also study a large tax holiday, in Switzerland, and find no treatment effects on employment rates, which therefore implies small elasticities across all intermediate arcs.

[17] Our analysis of covariates of employment surplus (reservation wedge) complements revealed-preference identification by Jäger, Schoefer, and Zweimüller (2019), who compare marginal and inframarginal workers' attributes in a complier analysis in the context of separations in response to nonemployment subsidies.

[18]The regression sample shrinks by a quarter due to missing covariates (in part retrieved from previous waves for these repeat respondents).

conduct covariate-by-covariate regressions (including baseline controls) and then one kitchen-sink multivariate regression in the last column. In Appendix Figure A2, we additionally portray some associations graphically in histograms of subgroups and age gradients.

To increase sample size, we have also supplemented our analysis with larger existing surveys of the German population, namely the German Socio-Economic Panel (GSOEP) and Panel Study Labour Market and Social Security (PASS), which elicit standard reservation *wages* from subpopulations. We proxy for an individual's reservation *wedges* as the ratio of reservation wages to lagged or expected earnings. We describe the surveys and the construction of these reservation wedge proxies in Appendix C.1, and report the associated regressions in Appendix Tables A3 (GSOEP) and A4 (PASS).

Overall, besides some systematic predictors of reservation wedges, we find largely find that (in particular stable) observables provide limited guidance in reserrvation wedge variation, suggesting that transitory or unobservable factors largely shape the preferences.

Age Life cycle models imply that marginal workers arise predominantly from the extremes of the age distribution, due to the triangle-shaped productivity profile and the resulting cutoff ages for labor force participation (as chiefly the Rogerson and Wallenius, 2008, model, reviewed in Section 4). Appendix Figure A2 (f) plots the wedge-age gradient, binning ages to the nearest multiple of five. Before age 60, the relationship is flat, then wedges increase after age 60. Perhaps the flat wedges among the younger reflects training on the job incentives, as in Imai and Keane (2004).[19]

Sex The regression analysis reveals a noisily estimated 10% higher reservation wage among the female population on average (which disappears once we control for labor force status in Appendix Table A1).[20]

Financials High net and gross asset to income ratio individuals (perhaps with a high λ and low y; only a handful of observations have zero household income) exhibit higher reservation wedges. By contrast, though noisily estimated, credit card debt (binned) (continuous amounts not provided) lead to lower wedges, perhaps indicating higher λ as in heterogeneous agent models with borrowing constraint (reviewed in Section 4).[21]

Education Worker surplus should increase in education (e.g., Oi, 1962). For the U.S. survey, we do find a noisily estimated but negative effect of college education on the wedge (omitted category: less than high school diploma).[22]

[19]Appendix Figure A2 Panel (e) plots the gradient for the GSOEP (unemployed). Here, the younger workers (aged 20 to 25) have higher wedges, consistent with lower productivity or higher-valued nonwork outside options such as schooling. Interestingly, *older* workers' reservation wedge proxies are nearly flat and finally fall – inconsistent with the prediction of the Rogerson and Wallenius (2008) lifecycle model.

[20]In GSOEP, while wedges of male and female workers are very similar, the histograms by sex in Figure A2 (a) reveals that female workers have a larger mass of "very inframarginal" workers on the employment side (left of 1), somewhat shifted from the mass right below 1. Our U.S. survey does not clearly echo this result in the associated histogram in Panel (b), perhaps because the GSOEP survey relies on the unemployed.

[21]In GSOEP, where we do not see financials, perhaps counterintuitively, satisfaction with income has a negative effect, while concern about ones' finances has a positive one.

[22]In Appendix Figure A3 Panel (f), we plot average reservation wedges by education level for GSOEP (the survey with the richest education information). The employment rate of highly-educated individuals is higher and the ratio of

3.4 Limitations and Trade-Offs

We here discuss a series of caveats to our empirical labor supply curve, the shape of which we will hereafter take at face value for the rest of the paper.

Micro Vs. Aggregate Pertubation First, we induce a scenario in which the variation in the wedge is at the micro level, as we aim to have an all-else-equal scenario that more directly maps into the baseline model. Yet, it is conceivable that due to shifts in stigma, leisure complementarities, frictions in labor supply adjustment that differ by idiosyncratic vs. coordinated adjustment, or wealth effects resulting in added worker effects, the micro responses may differ in response to an aggregate shock.

Spot Market Vs. Adjustment Frictions Second and more specifically, our formulation in particular for the employed evokes a spot-market scenario in which adjustment frictions are attenuated. For example, in the case of the employed, a post-nonemployment-spell return to work is permitted. This scenario may overstate employed workers' reservation wedges compared to a scenario in which such return is only not possible or would require costs, subsequent wage cuts, or job switching. Future work, theoretical or in form of variations in survey questions, may tease out how important such refinements are. These concerns may be less important for the other labor force statuses. We only briefly theoretically discussed those deviations from spot labor markets in Section 2.6.

Ultimately, we believe that such discomfort with these aspects of our questions should likely imply discomfort with models of spot labor markets more generally, perhaps in favor of approaches that implement labor supply in frictional settings (Hall, 2009; Krusell, Mukoyama, Rogerson, and Sahin, 2017).

That is and more broadly, frictions may detach desired from actual employment allocations. We relegate a tentative assessment of these issues into Appendix Section C.2, where we compare respondents' *realized* employment outcomes past, present and future (using the panel structure in the surveys and administrative data) with their idiosyncratic reservation wedge statements. We find some evidence that in the micro data, realized employment outcomes correlated – but far from perfectly so – with the predictions from the reservation wedge measures, perhaps suggesting either rationed labor supply due to frictions, or mismeasurement or imperfect persistence of the wedges across years.

Response Quality Third and relatedly, as with related survey measures of contingent valuation more generally, and most relatedly existing reservation wage measures among the unemployed, these survey measures may be of poor quality. Yet, in our setting, excess dispersion in form of noise would generate lower elasticities rather than higher local elasticities. The specific mismeasurement of concern to us is respondents overestimate the degree to which they are willing to change their employment status.

the reservation wages to lagged wages is lower. The GSOEP and PASS regressions reveal a significantly negative effect on the wedge of years of education.

Stationary Vs. Time-Dependent Distribution Fourth, our survey elicits the labor supply curve for one cross-section representative of the U.S. population only; in subsequent Section 5 we assume this economy to reflect a steady-state with a stationary Frischian distribution from which we study deviations throughout U.S. history.

Uncompensated Variation Fifth, in practice in the survey, we set the duration of the wage perturbation to one month to balance sufficient shortness to plausibly induce Frischian variation with sufficient length to denote a meaningful extensive-margin choice. An interesting extension would be to study wedges from longer durations, for example by instead invoking a quarter-long or even year-long temporary wedge. On the one hand, potential wealth effects will grow with longer duration. On the other hand, adjustment costs may be more easily overcome, working in the opposite direction.

In Section 2.5, we have discussed such wealth effects and shown that for the models discussed below in Section 4, the uncompensated and Frischian/wedge-based labor supply curves are extremely similar, even at the *quarterly* (as in the simulations) rather than monthly (as in our survey) frequency, reported in Appendix Figure A1.

4 Meta-Analysis of Existing Models, and Comparison to Data

We now compare the global empirical curve with those implied by various macroeconomic models' labor supply blocks, using the reservation wedge distribution as a unifying bridge. We find that none of these models would provide an accurate description of the global curve. Section 4.1 summarizes the results. Section 4.2 provides the derivations of the reservation wedges at the individual- and economy-wide levels model by model, discusses the model calibrations, and elaborates on model-specific details.

Our wedge approach traces out Frischian labor supply, but as we discussed in Section 2.5, these curves turn out to be extremely similar to uncompensated variants with wealth effects for the specific models we study here. We report these uncompensated variants in Appendix Figure A1.

4.1 Overview of Results

We plot the wedge distributions (as aggregate labor supply curves) of a series of models we review in detail in Section 4, along with the *empirical* curve from our survey for the U.S. population, in Figure 2 and 3 (which is simply Figure 2 zoomed into the local behavior). We parameterize each model so that its steady state employment rate (the employment to population ratio) is 60.7%, an empirical target that reflects the U.S. 16+ civilian employment population ratio in February 2019 from the BLS (FRED series EMRATIO), also reflected in our survey.[23] We plot the arc elasticities of each of the models' labor supply curves as a function of the wedge deviation in Figure 4. We report descriptive statistics and arc elasticities for various intervals in Tables 1 and 2 respectively. In each model, we normalize the prevailing aggregate wedge around 1, without loss of generality,

[23]Rather than restricting the sample to the prime working age population, we target a fuller population definition because our survey targets workers 18 and older without an upper age limit.

and study deviations from this baseline wedge (or any preexisting taxes). We extract the wedge distributions from the models' steady state equilibria.

Homogeneity (Hansen, 1985) Qualitatively, the empirical wedge distribution does mirror some intuitions of the homogeneity model of Hansen (1985); Rogerson (1988) (and also textbook DMP models without heterogeneity), as a large set of the workforce appears to be bunching around the prevailing wedge, generating the large local elasticities. However, as is evident from the histogram of reservation wedges in Figure 1 Panel (a), the empirical reservation wedges exhibit tremendous heterogeneity, consistent with models of heterogeneity in job surplus (Mortensen and Pissarides, 1994; Bils, Chang, and Kim, 2012; Jäger, Schoefer, and Zweimüller, 2019) and present in lifecycle models Rogerson and Wallenius (2008) or with heterogeneous disutility of labor supply (Galí, 2011a,b; Galí, Smets, and Wouters, 2012; Boppart and Krusell, 2016), or potential earnings (as in the heterogeneous agent model), i.e. models we review below.

Isoelasticities (MaCurdy, 1981) We include the 0.32 and 2.5 isoelasticity "MaCurdy (1981)" setups we present and microfound in Section 4. We follow Chetty, Guren, Manoli, and Weber (2012) in considering the 0.32 case to correspond to the average of quasi-experimental estimates of realized employment adjustment to short-run and large net-wage changes, whereas the 2.5 isoelasticity case is a "large elasticity" the authors associate with various macroeconomic calibrations in particular equilibrium business cycle models. Neither the low nor the high Frisch elasticity curves accurately describe the empirical *global* labor supply curve. Interestingly, around the baseline prevailing wedge, the local elasticity is closer to the large elasticity case. To the left, a high elasticity of around 3 may best describe the empirical curve. However, as one examines larger intervals in particular positive pertubations, the data exhibit smaller arc elasticities below 1.00, towards 0.50, closer to the 0.32 isoelasticity benchmark in this nonlocal region.

Heterogeneous Agent Model The extensive-margin labor supply curves become substantially less transparent in heterogeneous agents models with stochastic potential-earnings processes, in which individuals are differ across multiple, equilibrium dimensions. The reservation wedges and their distribution summarize this heterogeneity in labor supply preferences, providing an alternative way to characterize the curve rather than by brute force simulating the model for a series of shocks.

The heterogeneous agent model generates very small local labor supply elasticities (0.12–0.31) upward, but exhibits larger (up to 0.72) elasticities downward, albeit only briefly. Qualitatively, these asymmetries are in line with the empirical curve. But the amplitudes of the deviations are dramatically compressed, with the model implying too small of elasticities throughout. Interestingly, the model generates stable elasticities for larger pertubations and asymptotes strikingly tightly towards the 0.32 benchmark corresponding to the Chetty, Guren, Manoli, and Weber (2012) quasi-experimental estimates.

Rogerson and Wallenius (2008) This model features lifecycle dynamics in intensive and extensive margin labor supply, and overlapping generations. The calibrated economy exhibits a high local elasticity. In the upwards direction, it generates a nearly constant elasticity, mirroring the 2.5 isoelasticity line. Interestingly, the model generates some asymmetry, implying smaller elasticities upward than downward, qualitatively in line with our empirical benchmark. Quantitatively however, the model misses the steep decline in the elasticity in response to positive wedge shifts, where the empirical benchmark implies elasticities below one and towards 0.5, whereas the model-implied elasticities remain above 2.[24]

4.2 Full Derivation: Models Recast in Reservation Wedge Framework

We now present a detailed model-by-model meta-analysis applying the reservation-wedge approach as a unifying bridge between structurally different labor supply blocks, proceeding in three steps:

- M1 Construct the individual-level reservation wedge $1 - \xi^*_{it}$ in the model at hand.
- M2 Compute its (steady-state) equilibrium reservation-wedge distribution $F_t(1 - \xi^*_{it})$, and plot the implied aggregate labor supply curve.
- M3 Compute arc elasticities of extensive margin labor supply from the CDF of the reservation wedges $F_t(1 - \xi^*_{it})$.

The parameters for our calibrated models in this meta-analysis are in Table 4. Figure 5 plots additional model-specific wedge histograms and supplementary items.

4.2.1 Representative Household: Full Insurance and "Command" Labor Supply

A common specification of aggregate labor supply appeals to a large representative household, comprised of a unit mass of individual members, which we explicitly index by $i \in [0, 1]$. Micro utility $u_i(c_{it}) - e_{it}v_{it}$ is separable, where $e_{it} \in \{0, 1\}$ is an employment indicator. Potential earnings are y_{it}. There is potentially some uncertainty over the path of wages and interest rates. The large household has a *pooled* budget constraint and assigns consumption levels and employment statuses to its individual members:[25]

$$\max_{\{c_{it}, e_{it}\}_i, A_t} \mathbb{E}_t \sum_{s=t}^{\infty} \beta^{s-t} \int_0^1 \left[u_i(c_{is}) - e_{is}v_{is} \right] di \tag{28}$$

$$\text{s.t. } A_s + \int_0^1 c_{is} di \leq A_{s-1}(1 + r_{s-1}) + \int_0^1 (1 - \Xi_s) y_{is} e_{is} di + T_s \quad \forall s \geq t. \tag{29}$$

[24]Consistent with our global clarification, Chetty et al. (2012), who simulate large empirical wage increases in the model, find it to exhibit large Frisch elasticities.

[25] We take a perspective, as, e.g., Galí (2011a,b); Galí, Smets, and Wouters (2012), that the household head directly assigns allocations. Hansen (1985) and Rogerson (1988) present incentive-compatible lotteries. The Hansen (1985) set-up is equivalent to a representative household with utility function $U(c_t, E_t) = \log(c_t) - \overline{v}E_t$, with intratemporal first-order condition $\overline{\lambda}_t \overline{w}_t = \overline{v}$.

Full (cross-sectional) insurance implies that the marginal utility of consumption is optimally set homogeneous across households, equal to the multiplier on the pooled budget constraint,

$$\overline{\lambda}_t = \frac{\partial u_i(c_{it})}{\partial c_{it}} \ \ \forall\ i, \tag{30}$$

which eliminates λ_{it} as a source of cross-sectional variation in reservation wedges even with heterogeneity in consumption utility function $u_i(\cdot)$. Due to spot jobs, expectations and intertemporal aspects are subsumed in $\overline{\lambda_t}$. Going forward, $\overline{x}_t$ denotes idiosyncratic variables x_{it} that are homogeneous in the cross-section in a given model.

First, we define the allocative micro reservation wedge in this large-household structure, here rendering the household *head* indifferent between sending that marginal member i to employment rather than nonemployment, where we can index an individual i by her disutility-earnings type vy:

$$1 - \xi^*_{it} = \frac{v_{it}}{\overline{\lambda}_t y_{it}} \tag{31}$$

$$= 1 - \xi^*_{vyt}. \tag{32}$$

Optimal labor supply assigns each i employment status $e_{it} = e_{vyt} \in \{0, 1\}$ given by a wedge cutoff:

$$e^*_{vyt} = \begin{cases} 0 & \text{if} \quad 1 - \xi^*_{vyt} > 1 - \Xi_t \\ 1 & \text{if} \quad 1 - \xi^*_{vyt} \leq 1 - \Xi_t. \end{cases} \tag{33}$$

Second, we trace out the *aggregate* labor supply curve from the distribution of the reservation wedges, which in turn subsumes the detailed potential heterogeneity in wages and labor supply disutilities. Employment E_t is equal to the mass of workers with $1 - \xi^*_{it} \leq 1 - \Xi_t$:

$$E_t(1 - \Xi_t) = F_t(1 - \Xi_t) = P\left(1 - \xi_{it} \leq 1 - \Xi\right) = P\left(\frac{v_{it}}{y_{it}\overline{\lambda}_t} \leq 1 - \Xi_t\right) = P\left(\frac{v_{it}}{y_{it}} \leq (1 - \Xi_t)\overline{\lambda}_t\right) \tag{34}$$

$$= \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} \mathbb{1}\left[\frac{v}{y} \leq (1 - \Xi_t)\overline{\lambda}_t\right] dG_t(v, y), \tag{35}$$

where $G_t(v, y)$ is the CDF of the joint distribution of v and y.

Third, the arc elasticity properties then follow the definition in Equation (9) and depend on the joint distributions of v and y.

Below we review specific cases of this representative-household class of labor supply model block, to study more concrete curves.

Hansen (1985) The setup nests the model of indivisible labor and homogeneous households by Hansen (1985), where specifically $\overline{y}_t = \tilde{h}w_{it}$ and $v_{it} = \overline{v}\ \forall i$ (which in the original paper is $A\ln(1 - h_{it})$), with one exogenous hours option $h_{it} \in \{0, \widetilde{h} > 0\}$.

First, all individuals have the same wedge – i.e. all are exactly marginal:

$$1 - \xi^*_{it} = 1 - \overline{\xi}^*_t = \frac{\overline{v}}{\overline{\lambda}_t \overline{y}_t}. \tag{36}$$

Second, the wedge distribution, which we plot in Figure 5 (a), is degenerate.

Third, the Frisch elasticity is locally infinite at $1 - \Xi_t$. Interior solutions are obtained through λ_t (decreasing marginal utility from consumption).

Heterogeneity Only in Disutility of Labor We now maintain wage homogeneity, but disutility of labor v is distributed between individuals according to CDF $G^v_t(v)$. First, each individual i is now characterized by their type $v(i)$, and the household head maximizes:

$$\max_{\{c_{vt}, e_{vt}\}, A_t} \mathbb{E}_t \sum_{s=t}^{\infty} \beta^{s-t} \int \left[u(c_{vs}) - e_{vs} v_s\right] g(v) dv \tag{37}$$

$$\text{s.t. } A_s + \int c_{vs} g(v) dv \leq A_{s-1}(1 + r_{s-1}) + (1 - \Xi_s) y_s \int e_{vs} g(v) dv + T_s \quad \forall s \geq t. \tag{38}$$

First, we define the reservation wedge for each individual characterized by their type $v(i)$:

$$1 - \xi^*_{it} = \frac{v_{it}}{\overline{y}_t \overline{\lambda}_t} \tag{39}$$

$$= 1 - \xi^*_{vt}. \tag{40}$$

Second, aggregate labor supply curve, i.e. distribution of $1 - \xi^*_{it}$, will follow directly from $G^v_t(v)$ since consumption and wages are homogeneous. The household head sends off members with $1 - \xi^*_{it} < 1 - \Xi_t$ to employment, and all others to nonemployment:

$$E_t(1 - \Xi_t) = F_t(1 - \Xi_t) = P\left(1 - \xi^*_{it} \leq 1 - \Xi_t\right) = P\left(v_{it} \leq \frac{1 - \Xi_t}{\overline{y}_t \overline{\lambda}_t}\right) = G^v_t\left(\frac{1 - \Xi_t}{\overline{y}_t \overline{\lambda}_t}\right). \tag{41}$$

Alternatively, pointwise optimization would lead to a disutility cutoff rule $v^*_t = (1 - \Xi_t)\overline{y}_t \overline{\lambda}_t$: $v_{it} \geq v^*_t$ types work, $v_{it} < v^*_t$ types stay at home.

Third, the elasticity is given by $\left[(1 - \Xi_t) g^v_t\left(\frac{1-\Xi_t}{\overline{y}_t \overline{\lambda}_t}\right)\right] / \left[1 - G^v_t\left(\frac{1-\Xi_t}{\overline{y}_t \overline{\lambda}_t}\right)\right]$.

MaCurdy (1981) Isoelastic Preferences A common representative household setup (pooled budget constraint and homogeneous wages) applies the familiar isoelastic *intensive*-margin MaCurdy (1981) preferences to the extensive margin (we review as an example a New Keynesian application to wage stickiness as the subsequent model):

$$\frac{C_t^{1-\sigma}}{1-\sigma} - \Psi \frac{E_t^{1+1/\eta}}{1 + 1/\eta}. \tag{42}$$

We now *reverse-engineer* a distribution of disutility $G_t^v(v)$ that delivers this labor supply specification. The micro wedge is again given by (39). Suppose v follows a power distribution $G_t^v(v) = \left(\frac{v}{v_{\max}}\right)^{\alpha_v}$ with shape parameter α_v over support $[0, v_{\max}]$. Then, aggregate employment is (building on Section 2.4, assuming positive nonemployment by all types):

$$E_t(1-\Xi_t) = F_t(1-\Xi_t) = P\left(\frac{v_{it}}{\overline{y}_t\overline{\lambda}_t} \le 1-\Xi_t\right) = G_t^v\left((1-\Xi_t)\overline{y}_t\overline{\lambda}_t\right) = \left(\frac{(1-\Xi_t)\overline{y}_t\overline{\lambda}_t}{v_{\max}}\right)^{\alpha_v}. \tag{43}$$

The wedge distribution then too is a power distribution inheriting shape parameter α_v – giving the constant extensive margin Frisch elasticity:

$$\epsilon_{E_t,1-\Xi_t} = \frac{(1-\Xi_t)F_t(1-\Xi_t)}{F_t(1-\Xi_t)} = \frac{(1-\Xi_t)\alpha_v(1-\Xi_t)^{-1}\left(\frac{(1-\Xi_t)\overline{y}_t\overline{\lambda}_t}{v_{\max}}\right)^{\alpha_v}}{\left(\frac{(1-\Xi_t)\overline{y}_t\overline{\lambda}_t}{v_{\max}}\right)^{\alpha_v}} = \alpha_v. \tag{44}$$

To show that this household can be written as a representative household with a MaCurdy preference structure, consider a rearrangement the aggregate labor supply curve (43):

$$v_{\max}E_t^{\frac{1}{\alpha_v}} = (1-\Xi_t)\overline{y}_t\overline{\lambda}_t, \tag{45}$$

which is the first order condition of objective function (42) for $\eta = \alpha_v$ and $\Psi = v_{\max}$.[26]

In Figure 5 (b), we plot the density of reservation wedges for a MaCurdy model with potential earnings $\overline{y}$ and marginal utility of consumption $\overline{\lambda}$ are normalized to one, and the Frisch elasticity is 0.32. The maximum micro labor supply disutility is set to $0.607^{-1/0.32}$ for an equilibrium employment rate at 60.7%.

Heterogeneous (Sticky) Wages and Isoelasticity (Galí, 2011a,b; Galí, Smets, and Wouters, 2012) The New Keynesian model presented in Galí (2011a,b); Galí, Smets, and Wouters (2012) (which also microfound the isoelasticity) additionally features wage heterogeneity. Individuals are a unit square indexed by $(l, n) \in [0,1] \times [0,1]$. l denotes the type of labor, paid wage y_{lt}, which may diverge across types due to wage stickiness. n indexes labor disutility, $n^{1/\eta}$. The household head

[26]Alternatively, we can directly derive total disutility of labor $V(E_t)$ from employment rate $E_t \in [0,1]$, where the head optimally sorts the members by their disutility of labor up until $v = \mu(E_t)$, a threshold defined as the disutility of working of the marginal worker for total employment $E_t = G^v(\mu(E_t)) = \left(\frac{\mu(E_t)}{v_{\max}}\right)^{\alpha_v}$, which gives quantile function $\mu(E_t) = v_{\max}E_t^{1/\alpha_v}$, and hence:

$$V(E_t) = \int_0^{\mu(E_t)} v\,dG_t^v(v) = \frac{\alpha_v}{v_{\max}{}^{\alpha_v}}\int_0^{\mu(E_t)}(v)^{\alpha_v}dv = \frac{\alpha_v}{v_{\max}{}^{\alpha_v}}\frac{v^{1+\alpha_v}}{1+\alpha_v}\Bigg|_0^{\mu(E_t)} = v_{\max}\frac{E_t^{1+1/\alpha_v}}{1+1/\alpha_v}, \tag{46}$$

which again mirrors MaCurdy utility function (42) for $\eta = \alpha_v$ and $\Psi = \overline{v}$.

maximizes:

$$\max_{c_t,\{E_{lt}\}_l} \mathbb{E}_t \sum_{s=t}^{\infty} \beta^{s-t} \Big(\frac{c_s^{1-\sigma} - 1}{1-\sigma} - \Psi \int_0^1 \overbrace{\int_0^{E_{ln}} n^{1/\eta} \; dn}^{E_{lt}^{1+1/\eta}/(1+1/\eta)} dl \Big) \tag{47}$$

$$\text{s.t. } A_t + \int_0^1 c_{lt} dl \leq A_{t-1}(1 + r_{t-1}) + (1 - \Xi_t) y_{lt} E_{lt} + T_t \;\; \forall s \geq t, \tag{48}$$

where the l-specific employment rate is $E_{lt} = \int_0^1 e_{lt} dl$.

We now cast this setting into the reservation wedge framework. First, we define the micro reservation wedge, characterizing individual i by type nl:

$$1 - \xi^*_{nlt} = \frac{\Psi n^\eta}{y_{lt} \overline{\lambda}_t}. \tag{49}$$

Second, $1 - \xi^*_{nlt}$ follows (with *some* nonemployment within each *wage*-type l as in Section 2), a power distribution with maximum $\Psi \left(\left(\int_0^1 y_{lt}{}^{\eta} dl \right)^{1/\eta} \overline{\lambda}_t \right)$ and shape parameter η.[27] This implies the following aggregate labor supply curve:

$$E_t(1 - \Xi_t) = F_t(1 - \Xi_t) = P\left(\frac{\Psi s^{1/\eta}}{y_{lt}\overline{\lambda}_t} \leq 1 - \Xi_t \right) = \int_0^1 \left(\frac{(1 - \Xi_t) y_{lt} \overline{\lambda}_t}{1/\eta} \right)^\eta dl = \left(\frac{(1 - \Xi_t)}{\Psi \Big/ \left(\left(\int_0^1 y_{lt}^\eta dl \right)^{1/\eta} \overline{\lambda}_t \right)} \right)^\eta . \tag{51}$$

Third, again as in Section 2 the elasticity is again precisely η.

4.2.2 Heterogeneous Agent Models: Atomistic Households Without Risk Sharing

We now move to heterogeneous agent models, where atomistic households make labor supply and consumption decisions with separate budget constraints potentially facing incomplete markets. These class of models can feature heterogeneity in λ_{it}, which is determined in equilibrium.

A useful classification of heterogeneity is whether it is permanent or transitory.

[27] Intuitively, the distribution of the reservation wedge is power-distributed with the same parameter within each labor type. As a result, changes in $1 - \Xi_t$ elicit the same proportional employment changes from each labor type, and the aggregate employment elasticity inherits that homogeneous elasticity. Our expression holds for $1 - \Xi_t$ small enough that $1 - \xi^*_{nlt} > 1 - \Xi_t$ holds for some n within *all* labor types l, i.e. the aggregate wedge must be high enough that *some* workers in each labor type are nonemployed. Otherwise, there is full employment from some labor types, and the labor response from those labor types is zero, so the aggregate Frisch elasticity is lower than η, and the CDF (labor supply curve) is:

$$E_t(1 - \Xi_t) = F_t(1 - \Xi_t) = P\left(n \leq \left(\frac{(1 - \Xi_t) y_{lt} \overline{\lambda}_t}{\Psi} \right)^\eta \right) = \int_0^1 \min \left\{ \left(\frac{(1 - \Xi_t) y_{lt} \overline{\lambda}_t}{\Psi} \right)^\eta, 1 \right\} dl, \tag{50}$$

mirroring the expression in Equation (14). See also Footnote 9.

Permanent Heterogeneity With atomistic agents with separate budget constraints but *permanent* differences, a mass point of marginal workers endogenously emerges (mirroring intuitions from labor indivisibility with homogeneity as in Hansen, 1985). Specifically, in this setting individuals choose a lifetime fraction of working l_i, or equivalently a probability of working in a given period ϕ_{it} s.t. $\int_{t=0}^{\infty} \phi_{it} = l_i$, as in the time-averaging approach of Ljungqvist and Sargent (2006). Permanent heterogeneity in tastes, endowments or wages affects the average employment probability, yet at each given point in time, these "interior" households are exactly on the margin. This local mass of marginal actors makes up one minus the fraction of households that either never or always work – implying an empirically uninteresting case of the infinite local Frisch elasticity.[28]

We therefore next move to more realistic models with time-varying heterogeneity, starting with stochastic wages below, then moving to deterministically time-varying wage-age profile in Section 4.3

Time-Varying Heterogeneity: Stochastic Wages (Huggett, 1993) We now consider the popular case where the heterogeneity between households arises from stochastic productivity. Incomplete financial markets mean that income shocks pass through into budget constraints, and thence into consumption/savings policies, assets, consumption, and λ_{it}. To study this setting through the lens of the reservation wedge framework, we introduce indivisible labor into the Huggett (1993) model as in Chang and Kim (2006, 2007).

There is a continuum of infinitely lived individuals, in discrete time. Assets a_{it} earn or incur interest r_t. An individual chooses consumption c_{it} and indivisible labor supply $e_{it} \in \{0,1\}$. Potential earnings y_{it} follow an exogenous Markov process. She maximizes separable preferences, subject to budget constraint and borrowing limit $a_{\min} < 0$ (set so that positive consumption is always feasible if working even at the lowest earnings level and when at the borrowing constraint), with discount factor $\beta \leq 1$:

$$\max_{c_{it}, e_{it}, a_{it}} \mathbb{E}_t \sum_{s=t}^{\infty} \beta^{s-t} \left[\frac{c_{is}^{1-\sigma}}{1-\sigma} - \overline{v} e_{is} \right] \tag{52}$$

$$\text{s.t.} \quad a_{i,s} = (1 - \Xi_s) y_{is} e_{is} + (1 + r_s) a_{i,s-1} - c_{is} \quad \forall s \geq t \tag{53}$$

$$a_{is} \geq a_{\min} \quad \forall s \geq t. \tag{54}$$

[28] To see how permanent heterogeneity can generate trivial reservation wedge dispersion (in continuous time), consider a household (indexed by $i \in [0,1]$) characterized by disutility v_i, initial endowments a_{0i}, and wages w_i (and consumption tastes $u_i(c_{it})$), with stable interest rates $r = \rho$ and no borrowing constraint. So the household's problem is $\max_{c_{it}, e_{it}, a_{it}} \mathbb{E}_t \int_{s=t}^{\infty} e^{-\rho(s-t)} \left[u_i(c_{is}) - v_i e_{is} \right] ds$ subject to a lifecycle budget constraint $\dot{a}_{is} = (1-\Xi_s) y_i e_{is} + r a_{is} - c_{is} + \mathbb{1}(s = t) \cdot a_{it} \forall s \geq t \Leftrightarrow \int_{s=t}^{\infty} e^{-r(s-t)} c_{is} ds = \int_{s=t}^{\infty} e^{-r(s-t)} (1 - \Xi_s) y_i e_{is} ds + a_{it}$. First, labor supply is an employment policy e_{it}^* characterized by a constant-over-the-lifecycle reservation wedge $1 - \xi_{it}^* = \frac{v_i}{\lambda_i y_i} = 1 - \xi_i^*$. Second, the distribution of the wedges (labor supply curve) is $E_t(1 - \Xi_t) = F(1 - \Xi_t) = \int_i \mathbb{1}[1 - \xi_i^* \leq 1 - \Xi_t] di$. The constant wedge structure implies that for a given prevailing wedge $1 - \Xi_t$, there are three wedge regions. Two inframarginal regions denote workers that do not work even for (small) wedge increases, as well as those that always work even for small wedge declines. The third set is the set of marginal workers, who endogenously are *exactly* indifferent, and hence will *all* drop out of work for small wedge declines, and *all* move into employment for small wedge increases. Hence, if there is a mass point of these marginal individuals at the prevailing wedge, the labor supply curve will exhibit an infinite Frisch elasticity at the extensive margin.

First, we calculate the reservation wedge for each individual, indexed by a and y (since individuals of the same asset and productivity types face the same optimization problem):

$$1 - \xi^*_{ay} = \frac{\overline{v}}{\lambda_{ay} y}. \tag{55}$$

Second, we calculate the wedge distribution (CDF) from the joint distribution of assets and productivities, yielding the labor supply curve:

$$E_t(1 - \Xi_t) = F_t(1 - \Xi_t) = \sum_{y \in Y} \int_{a_{\min}}^{\infty} \mathbb{1}[1 - \xi^*_{ay} \leq 1 - \Xi] g_t(a, y) da, \tag{56}$$

where $g(a, y)$ is the density of agents with assets a and potential earnings y.

Third, the arc elasticities, following Equation (9), depend on the joint distributions of λ and y.

Below we assess these properties at the example of two concrete earnings processes. We solve for consumption and labor supply rules, as well as the joint distribution of assets and productivity states, for an exogenous and constant interest rate $r_s = r \;\; \forall s \geq t$.

Two-State Potential-Earnings Process We start by describing a simple economy with a two-state Markov process for potential earnings, jumping from y_1 to $y_2 > y_1$ (y_2 to y_1) with probability λ_{12} (λ_{21}). Our goal here is to convey intuitions, and to illustrate the complexity of aggregate labor supply already with only two wage states – and how reservation wedges can unveil and organize the obscure labor supply curve. The parameters are not picked to match any empirical moments, except for an equilibrium employment rate of 60.7% when $1 - \Xi_t = 1$. We plot the distribution of the wedges in Figure 5 Panel (c).

In the model, for both wage levels, $1 - \xi^*_{ay}$ is increasing in assets, since λ_{ay}, the individual's budget multiplier, is decreasing in assets. As expected, $1 - \xi^*_{ay_2} < 1 - \xi^*_{ay_1}$ for any given asset level a, since higher wages raise consumption and the opportunity cost of not working. For $1 - \Xi_t = 1$, all high earners work for any asset holdings in the asset grid (i.e. $1 - \xi^*_{ay_2} < 1 \; \forall a \in [a_{\min}, a_{\max}]$). Low earners work if assets (and consumption) are low, but above an asset threshold $a^*_{y_1}$ s.t. $1 - \xi^*_{a^*_{y_1} y_1} = 1$ prefer leisure.

The implied labor supply curve is plotted in Figure 5 Panel (d), and exhibits complex behavior even with only two wage types, due to the asset distribution. When the labor wedge is at $1 - \Xi_t = 1$, the marginal worker is a low-wage worker with a relatively high asset level. As $1 - \Xi_t$ falls, low-earners drop out of employment in descending order of their assets holdings, with lower and lower density. At some point, the marginal worker is a low-wage earner with assets at the borrowing limit. Since there is a *mass* of such individuals, the labor supply curve is locally infinitely elastic at that point (echoing locally the logic in the models of homogeneity of Hansen, 1985; Rogerson, 1988). As $1 - \Xi_t$ falls further, all low-wage individuals become nonemployed, and the marginal worker is now a high earner (and again the pecking order is given by asset holdings).

Realistic Earnings Process We now apply a realistic 33-state potential-earnings process, mimicking that in Kaplan, Moll, and Violante (2018) (whose model features only intensive-margin labor supply), which in turn approximates the empirical patterns documented in Guvenen, Karahan, Ozkan, and Song (2015). We detail the construction of variant in Appendix Section B.2.4. The computational details for the full model are again described in Appendix B.2, and the full set of parameters are in Table 4.

We plot the distribution of the wedges in Figure 5 Panel (e). To further illustrate the compositional sources of the reservation wedge distribution, Panel (f) plots the wedge distribution for three particular out of the 33 total values of potential-earnings states. High-potential-earnings individuals tend to have lower reservation wedges, as expected, but the states themselves are not completely informative without reference to the Markov process that guides expected earnings dynamics and equilibrium assets distributions, further highlighting the benefit of the wedge as the sufficient statistic.

Overall, in the heterogeneous agent model calibrated to a realistic earnings process, the reservation wedge distribution is widely dispersed. Specifically and as a result, the model generates a *small* local Frisch elasticity. For a 0.01 pertubation, the downward arc elasticity is 0.72 on the high side, but much smaller upwards (0.18). For large pertubations towards 0.10, the elasticities quickly settle in below 0.5. The equilibrium reservation wedge distribution and hence labor supply curve inherit the joint distribution of λ and y, so that the curve is particularly inelastic if low earnings realizations are offset by associated high λ values.

The Role of Incomplete Financial Markets We now decompose these two components in a simple exercise: we shut off the equilibrium heterogeneity in λ by instead ad-hoc setting a homogeneous $\overline{\lambda}_t$ (normalized to generate the same baseline employment rate). This experiment evokes complete markets, where y-state-contingent claims would neutralize the effects of stochastic potential earnings on λ, generating a wedge distribution that mimics a variant of the representative full-insurance household (here with constant v and λ), since $1 - \xi_y^* = \frac{\overline{v}}{\overline{\lambda} y}$. We plot the resulting wedge-implied labor supply curve reflecting solely heterogeneity in potential earnings y in Figure 5 Panel (g), in the solid line marked by stars where the subset of potential-earning states from the 33 total states are within the range of wedge deviations we plot.

The underlying sparse discrete Markov process renders the full-insurance curve choppy (so we do not plot it in our full Figures 2–4), in particular compared to the full model's incomplete-markets setting plotted also in form of a solid line without markers, where the smooth asset distribution serves to smooth out the wedge distribution. In reality, earnings levels are continuous and the sparse set of earnings levels is chosen for computational reasons, so we additionally plot one arising from *continuous* earnings (for the parametric process which Kaplan, Moll, and Violante (2018) discretize into the 33 states), which smooths out the earnings and hence wedge distribution even with homogeneous λ.[29] This line is plotted as a dashed line, and we also include this

[29]To construct this continuous earnings-process-only labor supply curve, we obtain the steady-state distribution of the underlying earnings process described in Appendix Section B.2.4, by simulating 10,000 realizations to the 2,000th

benchmark in the overview Figures 2–4.

The comparison highlights the *stabilizing* role of incomplete markets in extensive-margin labor supply in lowering elasticities. Aggregate labor supply implied by homogeneous λ is dramatically more elastic in the low end. This is because λ and y in the incomplete markets setup covary negatively: low productivity agents have higher shadow values of income than their better-earning peers. Full insurance eliminates this negative covariance, so the labor supply with full insurance is highly elastic. This intuition is specific to the extensive margin (and hence differs from intensive-margin-only life-cycle intuitions as in Domeij and Floden, 2006; Heathcote, Storesletten, and Violante, 2014).

This exercise also illustrates how the reservation wedge framework can serve as a diagnostic tool to study labor-supply implications also of richer asset market structures, such as with illiquid assets with which wealthy households can act constrained too, further shaping the joint distribution of λ and y (e.g., as in Kaplan, Violante, and Weidner, 2014; Kaplan, Moll, and Violante, 2018, which do not feature an extensive margin).

4.3 Intensive and Extensive Margins, and Lifecycle Dynamics: the Rogerson and Wallenius (2008) Model

As in the general intensive-margin case in Section 2.5, permitting hours choices preserves the reservation wedge logic. A leading model with both margins is that by Rogerson and Wallenius (2008), which also features lifecycle patterns (and the Frischian behavior of which Chetty, Guren, Manoli, and Weber, 2012, studied as a leading example of macro models with an extensive margin). We discuss our parameterization in Appendix Section B.3, largely following the paramaterization choices of Chetty, Guren, Manoli, and Weber (2012), but we change the tax rate and apply a 60.7% employment rate target for consistency with all our models and the survey, all hence matching our U.S. 2019 broad population benchmark.

The overlapping generations economy is set in continuous time and has a unit mass of individuals born at every instant, denoted by i, and each lives for a length of time equal to one. The individual's age at time t is denoted by $d_{it} \in (0,1)$. (In our calibration, we will set the discount rate to zero, and individuals can save and borrow at zero interest rate.) The individual freely chooses hours worked h_{it} and consumption c_{it} at some utility $u(c_{is})$, which is separable from disutility of hours, here following the MaCurdy isoelastic sturcture with $v(h_{it}) = \Gamma \frac{h_{it}^{1+1/\gamma}}{1+1/\gamma}$. Earnings $y_{is}(h_{is})$ depend on hours subject to a nonconvexity and age, as we discuss below. The optimization problem at time t for individual i of age d (with remaining lifetime $1-d_{it}$) is:

$$\max_{c_{it},h_{it}} \mathbb{E}_t \int_{s=t}^{t+(1-d_{it})} e^{-\rho(s-t)} \left[u(c_{is}) - v(h_{is})\right] ds \tag{57}$$

$$\text{s.t. } c_{is} + \dot{a}_{is} = r_s a_{is} + (1-\Xi_s) y_{is} \quad \forall t + (1-d_{it}) \geq s \geq t. \tag{58}$$

period. The labor supply curve is simply the CDF of this distribution, normalized in log changes around the 60.7% employment rate baseline.

Earnings $y_{is}(h_{is})$ are structured as follows. Hourly wages $w_{it} = w_{d_{it}}$ are a triangular, single-peaked function of age d, generating lifecycle aspects. Moreover, rather than $y = hw$, to generate an extensive margin, $y_{is}(h_{is})$ features a nonconvexity of earnings in hours, in form of fixed hours cost: labor hours are productive, and hence are paid wages w_d, only above hours threshold $\underline{h}$:

$$y_{it}(h_{it}) = w_{d_{it}} \cdot \max\{h_{it} - \underline{h}, 0\}. \tag{59}$$

Absent this fixed cost, the marginal disutility at $h = 0$ hours is zero, and so everyone works positive hours (provided positive wages) – eliminating the extensive margin, as in our intensive-margin example in Section 2.5.

First, in a given period t, heterogeneity in reservation wedges solely reflect heterogeneity in age d, so we can write wedges and choices indexed by age types d. Hours choices $h^*_{dt}(1 - \Xi_t)$ are given by $(1 - \Xi_t)w_d\lambda_{dt} = \Gamma[h^*_{dt}(1 - \Xi_t)]^{1/\gamma}$. Since our context features an intensive margin, this wedge is implicitly defined as a fixed point, as in our general job-choice case in Section 2.5:

$$1 - \xi^*_{dt} = \frac{v\left(h^*_{dt}(1 - \xi^*_{dt})\right)}{\lambda_{dt} y_{dt}(h^*_{dt}(1 - \xi^*_{dt}))} = \frac{\frac{\Gamma}{1+\frac{1}{\gamma}}\left(\frac{\lambda_{dt}(1-\xi^*_{dt})w_d}{\Gamma}\right)^{\gamma+1}}{\lambda_{dt} w_d\left(\left[\frac{\lambda_{dt}(1-\xi^*_{dt})w_d}{\Gamma}\right]^{\gamma} - \underline{h}\right)}. \tag{60}$$

That is, individuals work when the (hourly) wage is above some threshold w^*.[30] Also, setting $\underline{h} = 0$ nests the MaCurdy intensive-margin-only setting, with $1 - \xi^*_{dt} = 0$ for all workers and ages, as in our general intensive-margin job choice in Section 2.5.

Second, Figure 5 Panel (h) plots the histogram of the wedge distribution, which also gives the aggregate labor supply curve:

$$E_t(1 - \Xi_t) = F_t(1 - \Xi_t) = P\left(\frac{\Gamma\left(\underline{h}(1/\gamma + 1)\right)^{1/\gamma}}{\lambda_{dt} w_d} \leq 1 - \Xi_t\right) = P\left(\frac{1}{w_d} \leq \frac{1 - \Xi_t}{\Gamma\left(\underline{h}(1/\gamma + 1)\right)^{1/\gamma}/\lambda_{dt}}\right). \tag{61}$$

Since out of a nonstochastic steady state as the one we depict, λ_{dt} is homogeneous as we can reduce the budget constraint (58) into a lifecycle budget constraint, the distribution of the wedges solely inherits that of $1/w_d$, a feature we discuss in detail below.

Third, we compute the extensive-margin arc elasticities. The Frisch arc elasticities range from 2.60 to 3.20 in this particular calibration, with local elasticities (from 0.01 wedge pertubations) between 2.84 and 2.90.[31]

[30] In fact, without uncertainty and perfect capital markets and hence a lifetime budget constraint $\overline{\lambda}$, we could then solve for the age-specific reservation wedge explicitly as $1 - \xi^*_d = \frac{\Gamma(\underline{h}(1/\gamma+1))^{1/\gamma}}{\overline{\lambda} w_d}$, and therefore also solve for the reservation wage and hence marginal ages.

[31] In principle, we could obtain the elasticity analytically from the wedge distribution. Our method to measure the arc elasticities on the basis of the reservation wedge distribution complements the construction of the Frisch elasticity by Chetty, Guren, Manoli, and Weber (2012), who simulate a small, short-lived one percentage point tax change, which

The Role of the Intensive Margin To assess the importance of intensive margin reoptimization on extensive margin labor supply preferences, in Figures 2–4 we plot two labor supply curves for this model, first the baseline one allowing for hours choice reoptimization (solid line). This curve "envelopes" the second curve (dotted line), which shuts off such hours reoptimization and instead holds hours fixed at the optimal hours choice at "pre-experiment" $1 - \Xi = 1$ levels. That is, for noninfinitesimal wedge shifts, extensive margin adjustment is attenuated. Intuitively, intensive margin reoptimization weakly raises the return of work. As a result, the flexible-hours employment curve always is equal or exceeds the fixed-hours analogue.

The Role of the Wage-Age Profile Our framework highlights that the particular wage-age profile and the uniform age distribution underlie the shape of the reservation wedge distribution and labor supply curve: w_d is piece-wise linear in age (a single-peaked triangle), so the wage distribution is given by the age distribution, as clarified by Equation (61). This suggests the possibility that seemingly unrelated changes in the model structure, specifically in the wage-age gradient around the marginal ages (labor force entry and exit) may have dramatic effects on local elasticities. Our additional exploration thereby refines the study by Chetty, Guren, Manoli, and Weber (2012), who enlist the Rogerson and Wallenius (2008) model as a representative macro model example with indivisible labor featuring inherently large extensive-margin Frisch elasticities.[32]

To illustrate this flexibility, we recalibrate the model and now target a lower Frisch elasticity, by allowing a higher level of peak lifetime productivity and a steeper slope of the wage-age productivity gradient. The parameter choices and targets are in Table 4, and we additionally plot the labor supply curves (dotted-dashed line) in Figures 2–4. Under this paramaterization, the density around 1.0 is lower, and so the local elasticity falls. Quantitatively, the calibration implies a local Frisch elasticity (using an arc from 0.995 to 1.005) of only 1.6 – nearly half of the baseline 2.9 elasticity. More flexible nonlinear functional forms of the wage-age gradient would likely deliver even lower Frisch elasticities.

5 Potential Business Cycle Implications of the Empirical Curve

Our meta-analysis in Section 4 has revealed that no existing model generates a *global* empirical labor supply curve that comes close to the empirical example from our survey. We now take the empirical curve at face value, and reverse-engineer a model to *precisely* match the empirical curve. Our example draws on a representative household full-insurance setting with heterogeneous disutility of labor. We then assess the macroeconomic consequences for cyclical labor market fluctuations of this curve taken at face value, conducting a business cycle accounting labor wedge analysis, i.e. an assessment of the cyclical gap between the MRS and MPL of a representative agent

requires repeatedly solving the model for each generation, may include non-Frischian features, and only isolates one arc elasticity.

[32]That is, since the age distribution is uniform, the slope of w_d in d around the cutoff ages (young and old, i.e. "entering the labor force" or "retiring") determines the extensive-margin Frisch elasticities, with a steeper w_d at those points yielding a lower elasticity of labor supply. At least locally, one could engineer a wide range of extensive margin Frisch elasticities by retaining the calibrated productivity profile w_d (hence hitting lifetime labor supply calibration targets), but tilting the shape of w_d in an arbitrarily small region around the cutoff ages.

benchmark economy.

5.1 One Model Matching the Empirical Curve

Broadly, calibrating a given model's implied wedge distribution to match the empirical target, requires inverting the distributions of the model-specific heterogeneity sources. The easiest case features a single dimension of heterogeneity among the wedge-relevant components λ, y and v. Specificially, we discuss the case of a representative household whose members are heterogeneous in labor disutility and face homogeneous wages. Disutility of labor v is distributed according to CDF $G_t^v(v)$. As in Section 4.2.1, the household maximizes:

$$\max_{\overline{c}_t,\{e_{vt}\},A_t} \mathbb{E}_t \sum_{s=t}^{\infty} \beta^{s-t} \left[u(\overline{c}_s) - \int e_{vs} v dG_s^v(v) \right]$$
$$\text{s.t. } A_s + \overline{c}_s \leq A_{s-1}(1+r_{s-1}) + (1-\Xi_s) y_s \int e_{vs} dG_s^v(v) + T_s \quad \forall s \geq t.$$

The empirical wedge, $1-\widetilde{\xi}_{vt}$, corresponds to the theoretical wedge of type v:

$$1-\widetilde{\xi}_{vt} = \frac{1-\xi_{vt}}{1-\Xi_t} = \frac{v}{\left[(1-\Xi_t)\overline{y}_t\right]\overline{\lambda}_t} \tag{62}$$
$$\Leftrightarrow v = (1-\widetilde{\xi}_{vt}) \cdot \left[(1-\Xi_t)\overline{y}_t\right]\overline{\lambda}_t, \tag{63}$$

for some calibrated values of $\overline{y}_t$ and $\overline{\lambda}_t$. To match the empirical wedge distribution (here $1-\widetilde{\xi}_{vt}$), the v distribution corresponds to that of the empirical wedge adjusted by $(1-\Xi_t)\overline{y}_t\overline{\lambda}_t$. Let $\widetilde{f}(\cdot)$ denote the empirical density distribution of $1-\widetilde{\xi}_{vt}$. Because the multiplication $(1-\Xi_t)\overline{y}_t\overline{\lambda}_t$ is a positive monotone transformation, the density distribution of v, denoted as $g(v)$, can be written as a function of $\widetilde{f}(\cdot)$:

$$g(v) = \widetilde{f}\left(\frac{v}{(1-\Xi_t)\overline{y}_t\overline{\lambda}_t}\right)\frac{1}{(1-\Xi_t)\overline{y}_t\overline{\lambda}_t}. \tag{64}$$

We can thus discipline the theoretical disutility distribution by the empirically recovered wedge distribution for any calibrated values of $\overline{y}_t$ and $\overline{\lambda}_t$.

Specifying Aggregate Labor Supply Disutility $V(E)$ It is convenient to write aggregate labor supply disutility directly in terms of the employment rate E_t as function $V(E)$:

$$V(E) \equiv \int e_v v dG^v(v) = \int_{-\infty}^{\mu(E)} v dG^v(v), \tag{65}$$

where we define $\mu(E) \equiv (G^v)^{-1}(E)$ to be the quantile function of the disutility distribution. It is therefore easy to construct a representative household setup that is consistent with any given extensive-margin empirical aggregate labor supply curve by imposing the wedge-implied $V(E)$:

$$\max_{\overline{c}_t, E_t, A_t} \mathbb{E}_t \sum_{s=t}^{\infty} \beta^{s-t} \left[u(\overline{c}_s) - V(E_s)\right] \tag{66}$$

$$\text{s.t. } A_s + u(\overline{c}_s) \leq A_{s-1}(1 + r_{s-1}) + (1 - \Xi_s) y_s E_s + T_s \quad \forall s \geq t. \tag{67}$$

Theoretical Properties of $V(E)$ Aggregate labor supply disutility function $V(E)$ has intuitive and convenient properties. Its slope is the disutility of the marginal worker at the verge of (non)employment, at a given aggregate employment rate. Due to optimal rationing, $V'(E) > 0$ and convexity $V''(E) > 0$ are implied as the marginal worker has higher disutlity of labor than her inframarginal predecessor already at work. Formally, these properties follow from Leibniz's rule, the definition of $\mu(\cdot)$ and assuming smoothness of $G^v(\cdot)$. We can then write $V'(E) = \mu(E) g(\mu(E)) \mu'(E) = \mu(E) > 0$ over the support, as $\mu'(E) = \frac{1}{g(\mu(E))}$. It is immediate that $V''(E) = \frac{1}{g(\mu(E))} > 0$ over the support.

Analytical Approximation to $V(E)$: Fitted Polynomial We now construct a continuous and differentiable analytical function $V(E)$ by fitting a polynomial to the empirical curve. This procedures smooths out and interpolates the discrete empirical distribution to permit fine-grained labor supply levels in the model. Our procedure ultimately approximates the inverse empirical CDF of the reservation wedges. We start by exploiting the aforementioned property of $V(E)$ that its derivative, $V'(E) = \mu(E)$, is the disutility of the marginal person at a given E – hence corresponding to the empirical wedge $1 - \widetilde{\xi}$ (times a homogeneous factor $\overline{\lambda}(1 - \Xi)$). We finally apply a polynomial approximation to $V'(E) = v$ (rather than $V(E)$ directly) over the support of E.[33] We then analytically (anti-)differentiate the polynomial to recover $V''(E)$ and $V(E)$. We use an eighth-degree polynomial approximation to the inverse empirical CDF of the disutility distribution (corresponding to employment rate E), weighting to capture local curvatures and global asymmetries. We constrain the first derivative of the polynomial to be positive over the support $E \in [0, 1]$ to ensure an always-increasing marginal disutility of labor. Details of the polynomial approximation are in Appendix Section D.[34]

The fitted coefficients for $V'(E)$ are displayed in Table 5, along with those for the corresponding antiderivate $V(E)$ and for the derivative $V''(E)$. In Appendix Figure A5 Panel (a), we plot our fitted polynomial approximation (solid continuous line) against the empirically recovered disutilities $V'(E) = v$ (hollow circles). Panel (b) displays the analytical antiderivative against the numerical integral, and finally Panel (c) confirms that the second derivative of $V(E)$ is positive over the

[33] Fitting $V'(E)$ rather than $V(E)$ (e.g., through taking conditional expectations of v by E in the data) is appealing because $V(E)$ would nature be smooth and easily fitted, but its curvature determines elasticities, making $V'(E)$ a more informative target for our purposes.

[34] The weighting is performed through a weighted constrained polynomial regression of disutility v on polynomials of the employment rate (or the quantiles of each associated v). The weight is based on wedge deviation around the baseline wedge (and hence employment rate) of the form $\omega_x = [\left|(1 - \xi_x) - 1\right| + 0.01]^{-2}$, hence assigning more weight to local wedge (and hence employment) deviations e.g. relevant to business cycle fluctuations. We constrain the polynomials so that the disutility function is convex; that is, $V''(E) > 0$.

support.

In principle, the polynomial fit can be done in two ways. The first, which we choose, is to fit the extensive-margin MRS analogue to the employment rate, namely by fitting wedge levels to the CDF. This procedure minimizes the error between the model MRS and the empirical wedge at each given employment point, the most suitable approach for the goal of the labor wedge analysis in Section 5.2, which takes a given empirical employment rate and imputes the MRS. Moreover, putting a structure on the MRS as a function of the employment rate is the only way to provide a functional form for $V(E)$. A second option would be to fit the employment rate as a function of the wedge, hence providing a reduced-form labor supply curve (to our knowledge there is no feasible existing way to conduct a total least square fitting to a higher-degree polynomial that would provide a compromise of minimizing errors on both axes). Fortunately, our reverse implementation successfully closely matches the labor supply curve as well, in particular with respect to the arc elasticities.

We also include the associated fitted line in form of dashed line as labor supply curves in Figures 2 and 3, along with the associated arc elasticities in Figure 4.

5.2 Application: The Cyclical Business Cycle Accounting Labor Wedge Revisited

We illustrate the macroeconomic implications of the empirical labor supply curve by comparing its performance to a benchmark business cycle model with standard constant-elasticity labor supply specifications. Our performance measure is the business cycle accounting labor wedge (Hall, 1997; Mulligan, 2002; Chari, Kehoe, and McGrattan, 2007; Shimer, 2009), the tax-like gap between the marginal product of labor and the imputed marginal rate of substitution, going from a frictionless general equilibrium with representative agents.

Figure 6 presents results as time series and binned scatter plots for quarterly U.S. postwar data, with all time series logged, seasonally adjusted, and detrended using an HP filter with a smoothing parameter of 1,600.[35]

Representative Household Disutility We posit separable balanced growth preferences for the representative household, with log consumption utility:

$$U(C_t, E_t) = \ln C_t - V(E_t). \tag{68}$$

We consider three variants for the disutility of labor term $V(E_t)$. The first two are isoelastic curves $\Gamma E_t^{1+1/\eta}/(1+1/\eta)$, such that η denotes the constant Frisch elasticity, for $\eta \in \{0.32, 2.5\}$. Our third variant constructs $V(E_t)$ to perfectly match the wedge distribution fitted to the empirical curve as described in the previous section. Given that we only measure the labor supply curve at one point in time (in 2019) and hence around a particular prevailing employment rate, we center the model

[35] We use real personal consumption experience per capita (FRED series A794RX0Q048SBEA), the employment to population ratio for all persons aged 15 and over (LREMTTTTUSQ156S), and the nonfarm business sector real output per hour of all persons (OPHNFB). We have obtained similar results with real output per person, and with alternative consumption proxies including service flows from durables.

employment rate in the data-consistent $V(E)$ around a slow-moving trend (from an HP-filter with a smoothing parameter of 1,600 given the quarterly frequency our employment rate time series) and assume that the survey snapshot was taken during a point of employment at trend, and that the shape of the labor supply curve around the trend employment rate is stable during the sample period we study.

Fluctuations in the Marginal Disutility of Labor Figure 6 Panels (a) and (b) present the detrended log deviations of $V'(E_t)$, the employment disutility of the marginal worker. Since aggregate employment fluctuations have small amplitudes, this time series traces out the region where the empirical supply curve exhibits *high local* elasticities (see Figure 2). As a result, at business cycle frequencies, the empirically consistent $V'(E)$ resembles high isoelasticity benchmark.

The Business Cycle Accounting Labor Market Wedge The business cycle accounting labor wedge is the time-varying tax-like gap $1 - X_t$ between the MPL and the MRS in the empirical time series according to the conjectured benchmark model:

$$(1 - X_t)F_L(L_t, K_{t-1}) = \frac{-U_L(C_t, E_t)}{U_C(C_t, L_t)}. \tag{69}$$

Any gaps between the measured MPL and MRS, represented by deviations of $1 - X_t$ from 1, reflect omitted frictions, taxes, model misspecification or measurement error (Chari, Kehoe, and McGrattan, 2007; Shimer, 2009). Our interest lies in *cyclical* percent (log) deviations in this gap measure from its steady state or trend level (on which we accordingly do not take a stance).

The business-cycle-accounting labor wedge exercise imposes functional forms for the utility and production functions, and then feeds in empirical time series for C_t, E_t and MPL_t, to then back out the time series of the labor wedge $(1 - X_t)$ that leads condition (69) to hold with equality at each point. We follow Shimer (2009) in picking a Cobb-Douglas production function. The MPL time series then, once logged and HP-filtered, inherits that of average real output per hour. (We obtain similar wedges with average real output per worker rather than hour.)

We plot the labor wedge time series in Figure 6, for each $V(E)$ specification. As is well known, calibrating labor supply to a small Frisch elasticity generates a volatile and procyclical labor wedge, such that recessions are times when the gap between the MRS and the MPL widens. One possibility is that households are off their labor supply curves (Karabarbounis, 2014). Another reason is that the incidence of the market wedge is on firms (Bils, Klenow, and Malin, 2018; Mui and Schoefer, 2018). Yet the larger Frisch elasticity of 2.5 reduces the amplitude of the wedge series.

Setting $V(E)$ to the empirically consistent labor supply curve generates a low-amplitude wedge series – strikingly similar to the high-isoleasticity case. The binned scatter plots in Figure 6 Panel (b) and (d) illustrate this property. Panels (e) and (f) also present the labor wedge that set λ_t counterfactually to be acyclical – hence purely "Frischian". The amplitudes shrink very little, clarifying that the wedge is largely due to the fluctuations in $V'(E)$ in the MRS rather than λ_t.

Inducing Nonlocal Variation In Appendix Figure A6, we replicate Figure 6 but ad-hoc amplify the fluctuations in E_t only entering the $U_E = V'(E_t)$, while U_C and the MPL take the actual E_t time series. Then, the data-consistent nonisolastic labor supply curve finally generates a labor wedge in between the 0.32 and 2.5 isoelasticity benchmarks, particularly moving towards the low elasticity during upswings, but during recessions still tightly hugging the high elasticity case (reflecting the asymmetric arc elasticities discussed in Section 3).

In conclusion, the empirical labor supply curve from our survey of U.S. households, taken at face value, implies smooth labor wedges closer to a high elastic labor supply curve (although if taken to the global context, the isoelastic assumption would, unlike our variable-elasticity curve, not at the same time be capable of rationalizing the relatively small arc elasticities to, e.g., large tax holidays).

6 Conclusion

We close by reiterating that our framework and empirical implementation trace out *desired* spot-market labor supply, i.e. underlying preferences. The reservation wedge framework is decidedly agnostic and prior to potential real-world frictions such as search or wage rigidities, which may detach desired from actual employment allocations.

Our paper thereby leaves open the degree to which empirical employment adjustment actually occurs along households' desired labor supply curve. For example, our labor wedge analysis in Section 5.2 assumed efficient rationing: namely that employment adjustment occurs along the pecking order of individuals sorted by their reservation wedges – a perhaps courageous assumption only valid in the absence of labor market frictions and evoking a Walrasian auctioneer in the labor market. To attempt a suggestive empirical evaluation of this assumption in our setting, in Appendix Section C.2 we compare respondents' *realized* employment outcomes past, present and future (using the panel structure in the surveys and administrative data) with their stated reservation wedges, which determines her *rank in the aggregate labor supply curve*. We find some evidence that in the micro data, realized employment outcomes are correlated, but far from perfectly so, with desired labor supply implied by reservation wedges, perhaps suggesting either rationed labor supply due to frictions (or measurement error and imperfect persistence in the wedges).

By robustly capturing theoretical and empirical extensive-margin labor supply preferences in theory and in one empirical survey implementation, the reservation wedge framework may add one handle in a dedicated future study of this related long-standing question in labor and macroeconomics notoriously challenging to assess empirically.[36]

[36]For analyses of the efficiency of group-level employment cyclicalities and respectively employment adjustment at the separation margin, see Jäger, Schoefer, and Zweimüller (2019) and Bils, Chang, and Kim (2012). The broader macroeconomic debate includes Lucas and Rapping (1969); Hall (1980, 2009); Galí (2011b); Galí, Smets, and Wouters (2012); Schmitt-Grohé and Uribe (2016); Krusell, Mukoyama, Rogerson, and Sahin (2017); Mui and Schoefer (2018).

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Tables

Table 1: Reservation Wedge Distributions: Descriptive Statistics for U.S. Data (Survey) and Calibrated Models

Statistic	**Data**: U.S. Pop (Authors' Survey)	U.S. Pop (Fitted)	Hansen (Indiv. Labor)	MaCurdy (0.32)	MaCurdy (2.5)	Rogerson Wallenius	Heterogeneous Agent
Mean	1.06	1.06	1	1.16	0.87	0.96	1.02
Median	0.95	0.94	1	0.56	0.93	0.94	0.95
25 Pctile.	0.65	0.67	1	0.07	0.70	0.83	0.56
75 Pctile.	1.50	1.42	1	1.95	1.09	1.09	1.30
Variance	0.35	0.34	0	1.80	0.07	0.02	0.25
Skewness	0.42	0.49	-	1.10	-0.73	0.39	0.69
Kurtosis	5.14	-0.87	-	3.00	2.76	-1.01	3.06

Note: The table presents descriptive statistics of the reservation wedge distributions for the data (U.S. population survey discussed in Section 3), as well as for the models with an extensive margin of labor supply (presented in the model meta-analysis Section 4). The associated aggregate labor supply curves and arc elasticities are jointly plotted in Figures 2–4, and additional moments are provided in Table 2. For the survey data (and its polynomial fit), the mean, variance, skewness, and kurtosis were calculated according to Rimoldini (2014), truncating wedges above 2.0.

Table 2: Mass of Marginal Agents and Local Arc Elasticities: Reservation Wedge Distribution Around 1.00 for U.S. Data (Survey) and Calibrated Models

	+/-		+		-	
	$\frac{d\text{Emp}}{\text{Pop}} \times 100$	Elasticity	$\frac{d\text{Emp}}{\text{Pop}} \times 100$	Elasticity	$\frac{d\text{Emp}}{\text{Pop}} \times 100$	Elasticity
Panel A: **Wedge Interval: 0.01**						
U.S. **Data**	3.44#	5.66#	2.26	3.72	4.61	7.59
U.S. **Fitted**	2.85	4.69	1.93	3.19	3.75	6.18
Hansen	100.0	∞	100.0	∞	100.0	∞
MaCurdy (0.32)	0.20	0.32	0.20	0.32	0.20	0.32
MaCurdy (2.5)	1.52	2.50	1.53	2.52	1.51	2.48
Het. Agent	0.25	0.41	0.11	0.18	0.43	0.72
Rog.-Wall.	1.74	2.87	1.73	2.84	1.76	2.90
Panel B: **Wedge Interval: 0.03**						
U.S. **Data**	6.87	3.77	2.31	1.27	5.55	3.05
U.S. **Fitted**	8.97	4.37	3.88	2.13	8.77	4.81
Hansen	100.0	∞	100.0	∞	100.0	∞
MaCurdy (0.32)	0.59	0.32	0.58	0.32	0.59	0.32
MaCurdy (2.5)	4.55	2.50	4.66	2.56	4.45	2.44
Het. Agent	0.75	0.42	0.42	0.23	1.04	0.58
Rog.-Wall.	5.23	2.87	5.01	2.79	5.40	2.96
Panel C: **Wedge Interval: 0.05**						
U.S. **Data**	7.49	2.47	4.11	1.35	14.36	4.73
U.S. **Fitted**	11.3	3.72	5.05	1.66	12.07 3.98	
Hansen	100.0	∞	100.0	∞	100.0	∞
MaCurdy (0.32)	0.98	0.32	0.96	0.32	0.99	0.33
MaCurdy (2.5)	7.59	2.50	7.87	2.59	7.31	2.41
Het. Agent	1.34	0.45	0.93	0.31	1.52	0.51
Rog.-Wall.	8.72	2.87	8.30	2.74	9.18	3.02
Panel D: **Wedge Interval: 0.10**						
U.S. **Data**	18.47	3.04	5.81	0.96	22.35	3.68
U.S. **Fitted**	17.12	2.82	6.91	1.14	20.72	3.41
Hansen	100.0	∞	100.0	∞	100.0	∞
MaCurdy (0.32)	1.96	0.32	1.89	0.31	2.02	0.33
MaCurdy (2.5)	15.18	2.50	16.33	2.69	14.06	2.32
Het. Agent	2.46	0.41	1.39	0.23	2.70	0.45
Rog.-Wall.	17.48	2.88	15.85	2.61	19.37	3.19

Note: The table presents masses and local arc elasticities of the reservation wedge distributions for the data (U.S. population survey discussed in Section 3), as well as for the models with an extensive margin of labor supply (presented in the model meta-analysis Section 4). The associated aggregate labor supply curves and arc elasticities are jointly plotted in Figures 2–4, and additional descriptive statistics are provided in Table 1. For each model economy and the survey, in the left columns the table presents the mass of marginal agents (those with wedge levels around one) for various intervals around one, symmetrically ("+/−", e.g. between 0.995 and 1.005), above one, ("+", e.g., 1.00 and 1.01), and below one ("−", e.g., 0.99 and 1.00) The right columns present the implied local arc elasticities for each interval and economy. Superscript # denotes the approximation for the symmetric 0.01 interval in the survey ("U.S. Data"), where responses were restricted to percentage digits, hence this symmetric 0.01 interval is the average of the asymmetric intervals for this entry.

Table 3: Covariate Analysis: (Log) Reservation Wedge for U.S. Population (Authors' Survey)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age / 100	-2.255*	-2.129*	-2.305*	-2.017*	-2.000*	-1.950	-1.990	-2.485
	(0.925)	(0.907)	(0.935)	(0.943)	(0.944)	(1.583)	(1.569)	(1.534)
(Age / 100) Sq.	4.254***	4.174***	4.185***	3.952***	3.951***	4.441**	4.307**	4.657**
	(0.989)	(0.969)	(1.006)	(1.016)	(1.016)	(1.661)	(1.662)	(1.635)
Female	0.076	0.102	0.082	0.099	0.101	0.052	0.052	0.077
	(0.057)	(0.057)	(0.056)	(0.056)	(0.056)	(0.077)	(0.075)	(0.073)
H.S. Diploma	0.086	0.035	0.091	0.078	0.083	-0.048	-0.033	0.019
	(0.145)	(0.137)	(0.143)	(0.142)	(0.143)	(0.340)	(0.300)	(0.277)
Some College	-0.121	-0.147	-0.113	-0.114	-0.107	-0.034	-0.018	0.028
	(0.131)	(0.120)	(0.129)	(0.127)	(0.129)	(0.332)	(0.289)	(0.266)
College or Higher	-0.255	-0.265*	-0.252	-0.265	-0.247	-0.110	-0.099	-0.089
	(0.136)	(0.125)	(0.135)	(0.136)	(0.136)	(0.333)	(0.294)	(0.270)
Good Health		-0.387***						-0.150
		(0.115)						(0.143)
Partnered			0.017					0.123
			(0.057)					(0.079)
Any kids			-0.107					-0.030
			(0.058)					(0.074)
Assets / HH Income				0.050**				0.061*
				(0.018)				(0.030)
Debts / HH Income				0.013				-0.050
				(0.026)				(0.033)
Net. Assets / HH Income					0.037*		0.058*	
					(0.016)		(0.026)	
0 < $C.C.Debt$ <3.5k						-0.022	-0.012	-0.038
						(0.100)	(0.102)	(0.097)
C.C. Debt > 3.5k						-0.081	-0.029	-0.022
						(0.110)	(0.115)	(0.116)
Liquid Assets under 1000						0.075	0.139	0.146
						(0.089)	(0.093)	(0.099)
Constant	0.107	0.407	0.166	0.014	0.021	-0.191	-0.214	-0.048
	(0.216)	(0.236)	(0.213)	(0.210)	(0.211)	(0.454)	(0.438)	(0.498)
N	1624	1515	1624	1585	1585	875	867	825
R^2	0.18	0.20	0.18	0.19	0.18	0.23	0.24	0.24

Note: $*$: $p < 0.10$, $**$: $p < 0.05$, $***$: $p < 0.01$. Robust standard errors in parentheses. Construction of reservation wedges, survey and sample are described in Section 3. *Source:* Authors' questionnaire in NORC Amerispeak Omnibus Survey.

Table 4: Parameters of Macro Models with an Extensive Margin of Labor Supply

Parameter	Symbol	Value (by Variant)	
Panel A: Hansen (Indivisible Labor)			
Ext. Margin Labor supply disutility	$\overline{v}$	1.0	
Potential earnings	$\overline{y}$	1.0	
Marginal utility of consumption	$\overline{\lambda}$	1.0	
Panel B: MaCurdy (Isolesticity)			
		Low Frisch (0.32)	High Frisch (2.50)
CRRA consumption parameter	σ	1.00	"
Potential earnings	$\overline{y}$	1.00	"
Shape parameter of labor disutility dist.	α_v	0.32	2.50
Max. labor disutility	$v_{\max}$	4.759	1.221
Panel C: Heterogeneous Agent Model			
		Toy Model	HANK Earnings Process
Potential-earnings states		$[y_1, y_2] = [0.0797, 0.15]$	33-State Markov process from
Transition probabilities		$[\lambda_{12}, \lambda_{21}] = [0.1, 0.2]$	Kaplan, Moll, and Violante (2018)*
CRRA consumption parameter	γ	2.0	2.0
Interest rate	r	0.03	0.03
Discount rate	β	0.95	0.97
Labor disutility	$\overline{v}$	3.0	2.083×10^{-5}
Unemployment insurance benefit	b	0.06	0.00
Asset grid: Min. assets (& borrowing limit)	$a_{\min}$	-0.02	-1.775
Asset grid: Max. assets	$a_{\max}$	0.75	5,000,000
Panel D: Rogerson-Wallenius			
		Baseline	Low-Frisch Variant
Interest rate	r	0.0	"
CRRA consumption parameter	σ	1.0	"
Labor disutility shifter	Γ	42.492	40.000
Minimum hours	$\overline{h}$	0.258	0.272
Maximum labor productivity	$\hat{w}_0$	1.000	1.112
Slope of labor productivity	$\hat{w}_1$	0.851	1.320
Intensive-margin Frisch elasticity	γ	0.5	"
Tax rate	τ	26.0%	"

Note: The table presents the parameters for the models with an extensive margin of labor supply presented in the model meta-analysis Section 4, generating the calibrated aggregate labor supply curves plotted in Figures 2–4, with companion plots in Figure 5. *: We describe the 33-state earnings process in Appendix Section B.2.4.

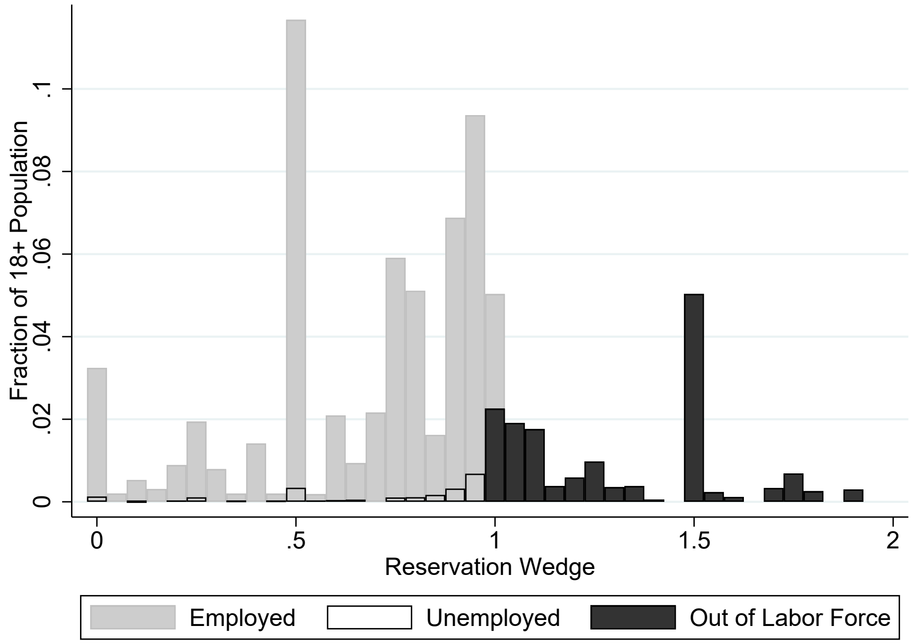
Table 5: Fitted Representative Household Labor Supply Disutility $V(E)$, $V'(E)$ and $V''(E)$ as a Function of the Aggregate Employment Rate $E \in [0,1]$: Coefficients of Polynomial Approximation

Coefficient	$f(E,\beta) = \sum_{i=0}^{\bar{i}} \beta_i^f E^i = \ldots$		
	$V'(E)$ (fitted, $\bar{i} = 8$)	$V(E)$ (analytical from $V'(E)$)	$V''(E)$ (analytical from $V'(E)$)
β_0^f	$1.03 \cdot 10^{-5}$	0^*	13.88
β_1^f	13.88	$1.03 \cdot 10^{-5}$	-478.41
β_2^f	-239.20	6.94	5889.42
β_3^f	1963.14	-79.74	-32581.88
β_4^f	-8145.47	490.79	93474.10
β_5^f	18694.82	-1629.09	-144600.69
β_6^f	-24100.11	3115.80	114099.61
β_7^f	16299.95	-3442.87	-35816.04
β_8^f	-4477.00	2037.49	
β_9^f		-497.45	

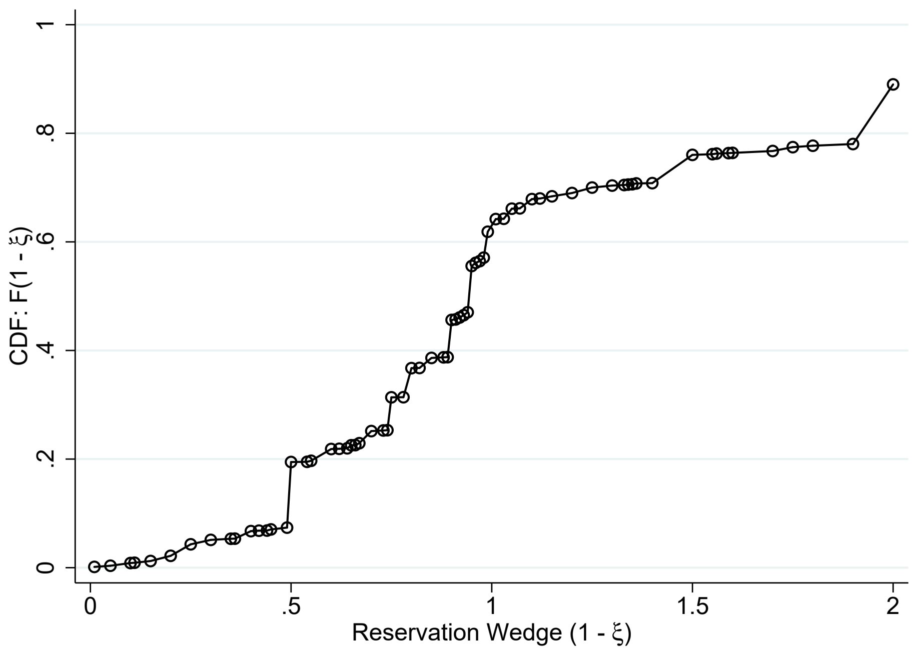
Note: The table reports the coefficients of the polynomial function fitted to match the empirical extensive-margin aggregate labor supply curve measured and discussed in Section 3. The function fitted here corresponds to a representative household's aggregate disutility of employment $V(E)$. We describe the fitting procedure in Section 5 with further details in Appendix D. $V'(E)$ is the eighth-degree polynomial fitted to the empirical labor supply curve, with $E \in [0,1]$ denoting the employment rate. The microfoundation is a full-insurance representative household in which household members are heterogeneous in the disutility of working, which acts as a fixed cost due to indivisible labor. As a result $V'(E)$ denotes the disutility of labor of the marginal household member at employment rate E. We obtain $V(E)$ as the analytical antiderivative of $V'(E)$ (with its constant, denoted by *, normalized s.t. $V(0) = 0$). $V''(E)$ is the analytical derivative of $V'(E)$. The properties of the functions in the range of interest $E \in [0,1]$ are $V(E) \geq 0$, $V'(E) > 0$ and $V''(E) > 0$. Along with raw empirical data points, these functions are plotted in Figure A5, and included in Figures 2–4.

Figures

Figure 1: Empirical Distribution of Reservation Wedge Proxy in U.S. Population



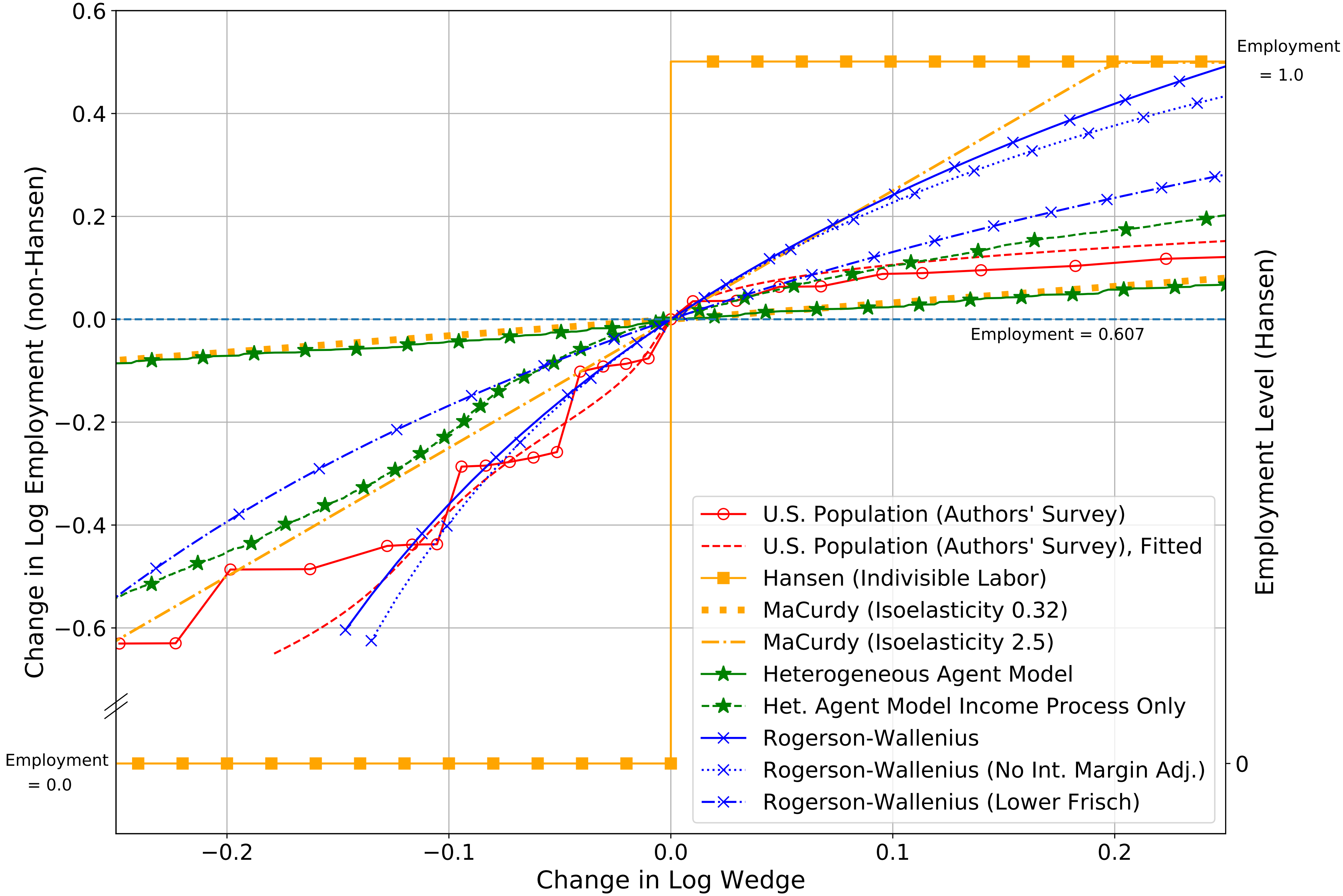
(a) Histogram



(b) Cumulative Distribution Function (Aggregate Labor Supply Curve of the U.S. Population)

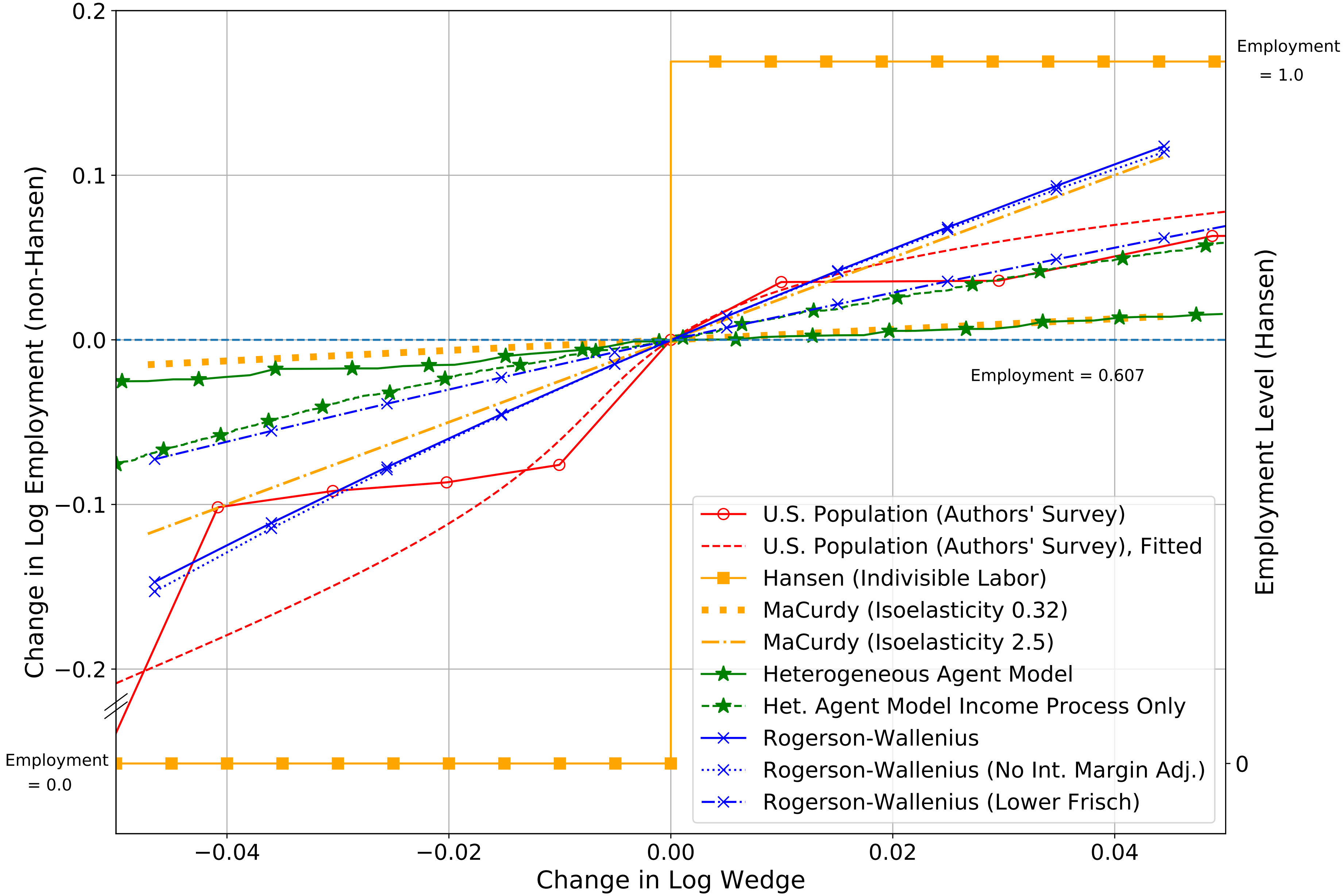
Note: The figure plots the empirical distribution of reservation wedges in a representative sample of the U.S. population. Panel (a) plots the histogram, separately by labor force status. Panel (b) plots the population-level CDF, with hollow circles denoting observations. This CDF is (when evaluated at the cutoff set to the prevailing aggregate wedge) the aggregate labor supply curve at the extensive margin. We truncate the distribution at 2.00 (so the CDF does not appear to reach 1). Section 3 describes the data source, wedge construction and interpretations. Additional moments and summary statistics are provided in Tables 1 and 2. Figures 2-3 and 4 plot the logged versions of Panel (b) and respectively arc elasticities around the unit wedge (along with model-implied curves). *Source:* Authors' questionnaire in NORC Amerispeak Omnibus Survey.

Figure 2: Comparing the Extensive-Margin Labor Supply Curves: Model-Implied vs. Data



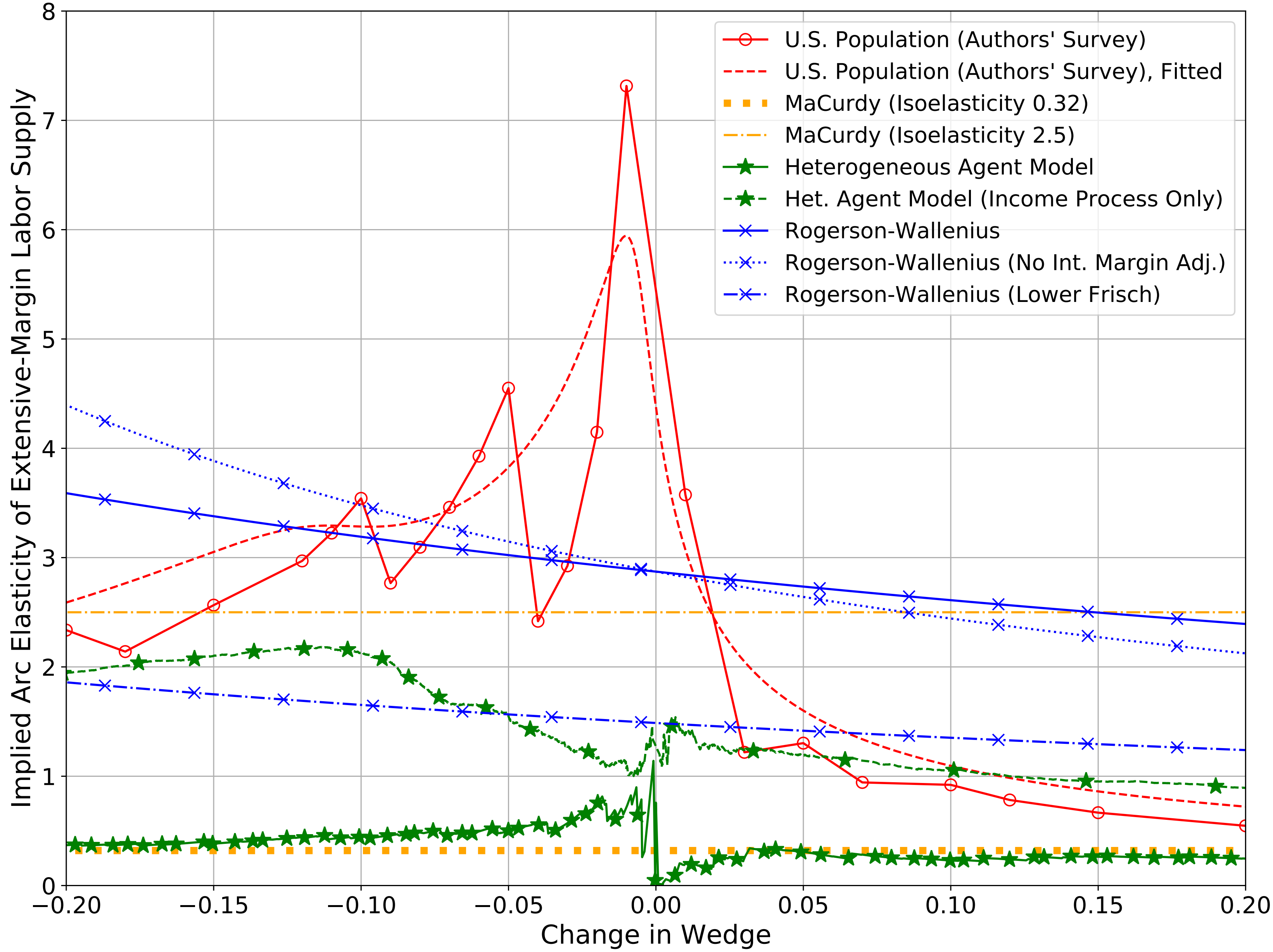
Note: The figure plots the empirical and model-implied short-run aggregate labor supply curves at the extensive margin building on our reservation wedge approach: the deviation in the log (desired) employment rate (y-axis) against deviations in the aggregate prevailing wedge (x-axis). The empirical labor supply curve is described in Section 3 and its fitted version in Section 5.1. The curves for a series of macro models with an extensive margin of labor supply are described and calibrated in the meta-analysis in Section 4. All curves go from the same baseline employment level of 0.607, and from a corresponding baseline wedge normalized to 1.0. The Hansen indivisible labor is plotted on a secondary y-axis denoting the employment level (rather than in log deviations). Figure 3 replicates the above figure but zooms into smaller wedge deviations to highlight the local properties of the aggregate labor supply curves.

Figure 3: Zoomed In: Comparing the Extensive-Margin Labor Supply Curves: Model-Implied vs. Data



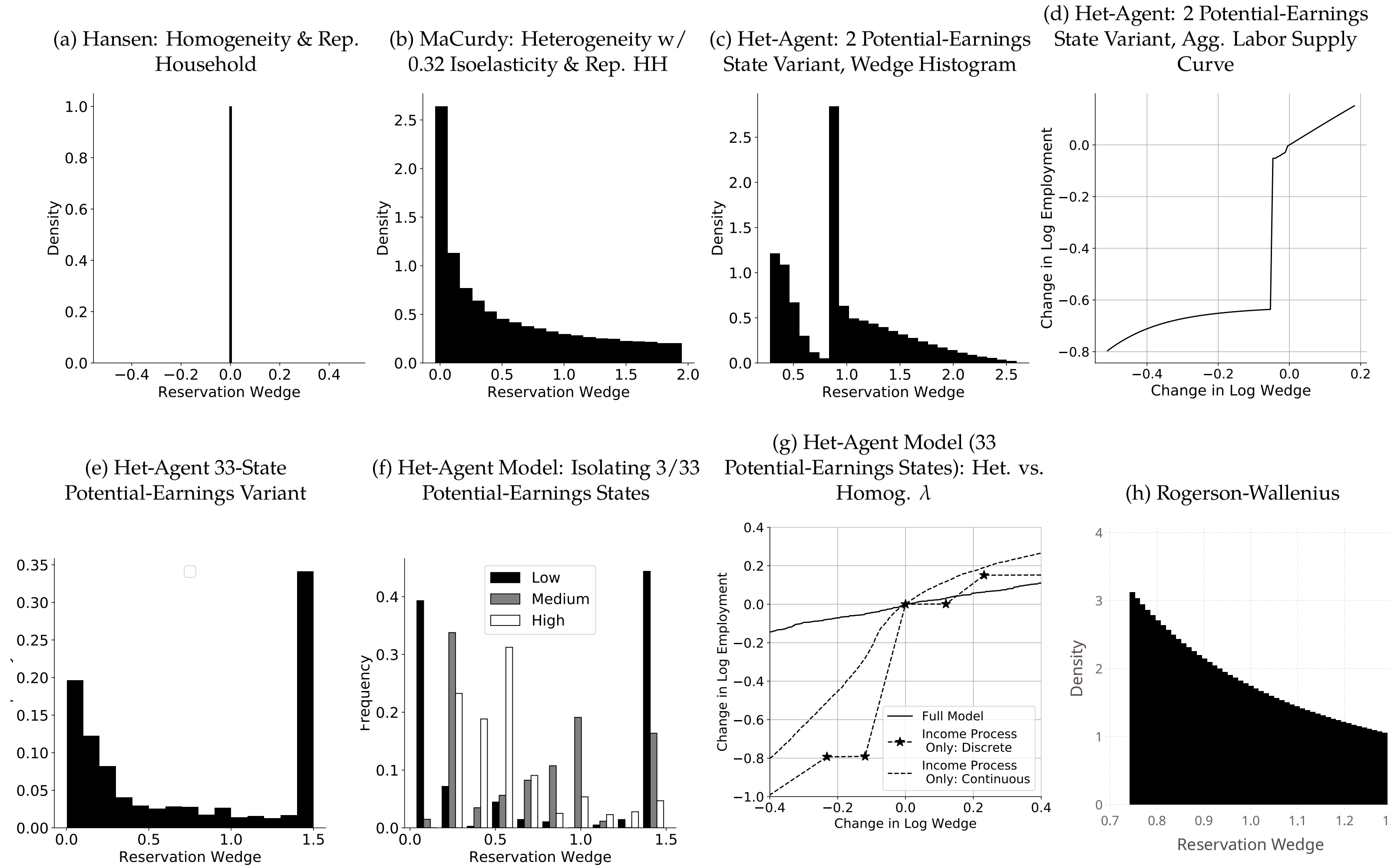
Note: The figure replicates Figure 2 but zooms into smaller wedge deviations to highlight the local properties of the aggregate labor supply curves. As companion Figure 2, the figure plots the empirical and model-implied short-run aggregate labor supply curves at the extensive margin building on our reservation wedge approach: the deviation in the log (desired) employment rate (y-axis) against deviations in the aggregate prevailing wedge (x-axis). The empirical labor supply curve is described in Section 3 and its fitted version in Section 5.1. The curves for a series of macro models with an extensive margin of labor supply are described and calibrated in the meta-analysis in Section 4. All curves go from the same baseline employment level of 0.607, and from a corresponding baseline wedge normalized to 1.0. The Hansen indivisible labor is plotted on a secondary y-axis denoting the employment level (rather than in log deviations).

Figure 4: Arc Elasticities of Extensive-Margin Labor Supply: Model-Implied vs. Data



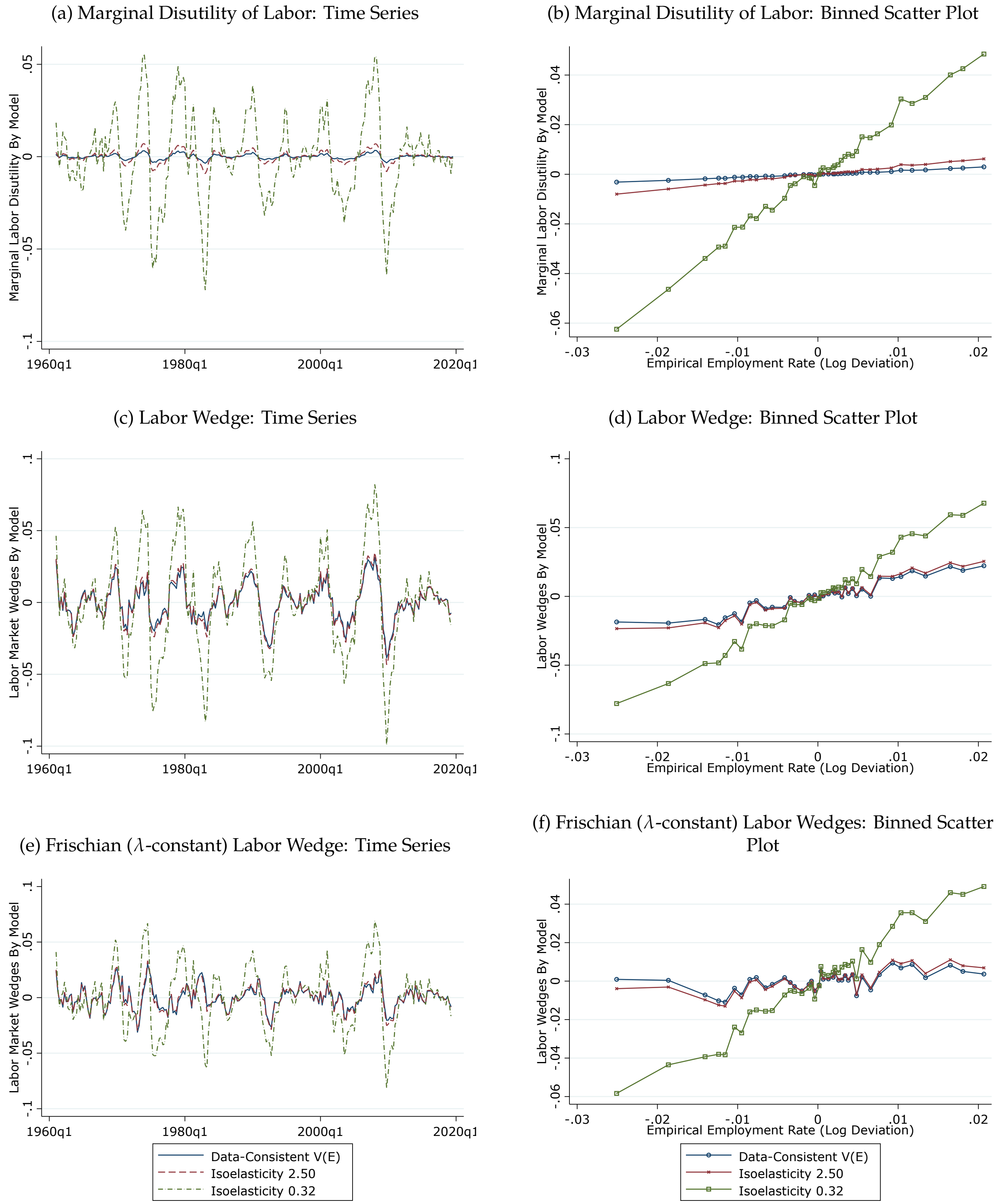
Note: The figure plots arc elasticities of the employment rate with respect to deviations of the aggregate prevailing wedge $1-\Xi$, for range of deviations of the wedge around the baseline level (the x-axis). The figure pools these arc elasticities for the empirical labor supply curve (described in Section 3) and for a series of macro models with an extensive margin of labor supply (with the model meta-analysis in Section 4). The arc elasticities are calculated as $\frac{d\text{Emp}}{\text{Emp}} / \frac{d(1-\Xi)}{1-\Xi}$, from the baseline employment level (harmonized across models by calibration) and from a corresponding baseline wedge normalized to 1.0.

Figure 5: Further Details on Model Reservation Wedges Distributions



Note: The figure plots additional simulated data from the models reviewed in the meta-analysis in Section 4. Panel (a) plots the histogram of the Hansen (1985) model's reservation wedges. Panel (b) plots the histogram of the reservation wedges that would emerge in an isoelastic representative household setting with an elasticity of 0.32. Panel (c) plots the reservation wedge histogram from the two potential-earnings states heterogeneous agent model; Panel (d) plots the associated aggregate labor supply curve. Panel (e) plots the histogram of reservation wedges in the 33 potential-earnings states heterogeneous agent model following the realistic earnings process. Panel (f) provides wedges for three earnings states; the low (1876.61), medium (24,489.68), and high (117,080.23) potential-earnings levels. The densities are normalized so that the total density by earnings level sums to one; however, there is 0.395, 0.164, and 0.033 of density for the low, medium, and high earnings levels that have reservation wedges above 1.5 (which we censor in this histogram). Panel (g) plots the original aggregate labor supply curve for the 33-state heterogeneous agent economy and heterogeneous borrowing constraint multiplier λ, but adds curves for two full-insurance models by setting the borrowing constraint multiplier λ homogeneous, for the original coarse discrete earnings process as well as a richer continuous-state version. It thereby highlights the role of the covariance of potential earnings and the shadow value of income in shaping the inelastic labor supply curve. Panel (h) plots the reservation wedge histogram for the calibrated Rogerson and Wallenius (2008) model.

Figure 6: Business Cycle Implications: Aggregate Marginal Labor Supply Disutility and Aggregate Labor Market Wedges (Log Deviations From Trend, U.S. Quarterly Data)



Note: The figure reports the results of the labor wedge analysis described in Section 5.2. Panels (a) (time series) and (b) (binned scatter plot of the model-specific marginal disutilities of labor $V'(E)$ against the employment rate for U.S. business cycles. Panels (c) and (d) follow the same structure but plot the aggregate labor wedges, the gap between the MPL and the MRS. Panels (e) and (f) finally plot the labor wedges that hold λ constant (by holding consumption constant under separable utility) i.e. only reflect shifts in the marginal disutility of labor $V'(E)$ against the marginal product of labor. Each panel plots these time series for three representative household models that only differ in their aggregate disutility of employment $V(E)$: MaCurdy (1981) Frisch isoelasticities of 0.32 and 2.50, and the data-consistent disutility curve $V(E)$, which we obtain by fitting a polynomial to the empirical reservation wedge distribution as described in Section 5.1 (the empirical curve is discussed in Section 3). Companion Appendix Figure A6 replicates this figure but ad-hoc amplifies the employment fluctuations entering the marginal disutility of labor $V'(E)$ by a factor of 10, to highlight that locally, the curve acts as a high-elasticity one and that only unrealistically large employment fluctuations reach the lower-elasticity regions. All time series are quarterly, and log deviations from trend using an HP filter with smoothing parameter of 1,600.

Appendix of:

The Aggregate Labor Supply Curve at the Extensive Margin: A Reservation Wedge Approach

Preston Mui and Benjamin Schoefer

A Additional Exhibits

A.1 Additional Tables

Table A1: Covariate Analysis: (Log) Reservation Wedge for U.S. Population (Authors' Survey) (Additionally Controlling for Labor Force Status)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Unemployed	0.082	0.053	0.088	0.106	0.106	0.047	0.028	0.029
	(0.059)	(0.070)	(0.060)	(0.060)	(0.060)	(0.121)	(0.120)	(0.136)
OOLF	1.299***	1.282***	1.299***	1.312***	1.314***	1.384***	1.369***	1.377***
	(0.074)	(0.075)	(0.076)	(0.080)	(0.078)	(0.099)	(0.097)	(0.101)
Age / 100	-0.519	-0.472	-0.643	-0.512	-0.508	-0.023	-0.057	0.001
	(0.765)	(0.747)	(0.766)	(0.778)	(0.778)	(1.221)	(1.217)	(1.114)
(Age / 100) Sq.	0.581	0.563	0.680	0.478	0.474	0.311	0.271	0.052
	(0.872)	(0.851)	(0.867)	(0.893)	(0.893)	(1.359)	(1.360)	(1.254)
Female	0.004	0.016	0.005	0.005	0.005	0.012	0.010	0.025
	(0.044)	(0.045)	(0.043)	(0.044)	(0.044)	(0.061)	(0.060)	(0.058)
H.S. Diploma	0.113	0.102	0.117	0.149	0.150	0.022	0.030	0.032
	(0.117)	(0.117)	(0.118)	(0.120)	(0.120)	(0.262)	(0.240)	(0.244)
Some College	0.040	0.025	0.044	0.068	0.069	-0.018	-0.010	-0.006
	(0.107)	(0.104)	(0.107)	(0.109)	(0.109)	(0.257)	(0.235)	(0.239)
College or Higher	-0.011	-0.021	-0.009	0.006	0.009	-0.012	-0.010	-0.021
	(0.111)	(0.107)	(0.112)	(0.117)	(0.114)	(0.257)	(0.237)	(0.239)
Good Health		-0.125						0.015
		(0.094)						(0.121)
Partnered			0.038					0.043
			(0.045)					(0.065)
Any kids			-0.016					-0.046
			(0.046)					(0.058)
Assets / HH Income				0.029				0.021
				(0.016)				(0.024)
Debts / HH Income				-0.021				-0.105**
				(0.024)				(0.034)
Net. Assets / HH Income					0.028*		0.033	
					(0.014)		(0.020)	
\$0 < C.C. Debt < \$3.5k						0.024	0.027	0.005
						(0.084)	(0.085)	(0.080)
C.C. Debt > \$3.5k						0.021	0.049	0.067
						(0.085)	(0.089)	(0.089)
Liquid Assets under \$1000						0.009	0.045	0.083
						(0.075)	(0.077)	(0.079)
Constant	-0.360	-0.258	-0.348	-0.379*	-0.379*	-0.550	-0.560	-0.533
	(0.184)	(0.201)	(0.188)	(0.186)	(0.186)	(0.348)	(0.344)	(0.413)
N	1624	1515	1624	1585	1585	875	867	825
R^2	0.46	0.47	0.46	0.47	0.47	0.50	0.50	0.51

Note: $*$: $p < 0.10$, $**$: $p < 0.05$, $***$: $p < 0.01$. The table replicates Table 3 but additionally includes a fixed effect for labor force status (employed, out of the labor force, unemployed) as a control variable in each specification. Robust standard errors in parentheses. Construction of reservation wedges, survey and sample are described in Section 3. *Source:* Authors' questionnaire in NORC Amerispeak Omnibus Survey.

Table A2: Descriptive Statistics of the Reservation Wedge Proxy from Reservation Wage Surveys of Unemployed Job Seekers: GSOEP, PASS and Pole emploi

Measure	Empirical Statistic		
	A. GSOEP	B. PASS	C. Pole Emploi
Mean	1.22	0.75	0.94
Median	0.83	0.84	0.93
25 Pctile.	0.64	0.75	0.83
75 Pctile.	1.2	≥ 1.0	1.01
Pct. < 1	61.0%	72.8%	70.5%
Pct. $= 1$	6.00%	-	-
Pct. ≥ 1	-	27.2%	-
Pct. > 1	33.0%	-	29.5%
Pct. > 2	11.3%	-	0.1%
Variance	2.05	0.19	0.31
Skewness	6.43	-1.45	6.43
Kurtosis	70.83	5.55	7.44

Note: The table reports summary statistics of the empirical reservation wedge proxies constructed as the individual-level ratio of reservation wage to potential wage (in turn proxied for with the previous wage (GSOEP, Pole Emploi) or expected wage (PASS)), with the construction and correspondence to the reservation wedge concept described in Appendix C.1. Some PASS entries are empty due to disclosure restriction and/or due to the censoring above 1.00 in the wedge. Associated histograms are presented in Figure A3. *Sources:* German Socio-Economic Panel (for GSOEP column); PASS-IAB linked data (for PASS columns); Le Barbanchon, Rathelot, and Roulet (2017) for the Pole Emploi columns.

Table A3: GSOEP Covariate Analysis: (Log) Reservation Wedge for German Job Seekers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age / 100	-4.860***	-3.980***	-5.039***	-4.731***	-5.251***	-5.133***	-4.572***
	(0.462)	(0.493)	(0.460)	(0.462)	(0.463)	(0.459)	(0.415)
$(\text{Age} / 100)^2$	4.871***	3.898***	5.038***	4.713***	5.381***	5.171***	4.567***
	(0.593)	(0.639)	(0.590)	(0.593)	(0.595)	(0.589)	(0.525)
Female	0.003	0.012	0.024	0.019	-0.004	0.012	0.033*
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Years Edu.	-0.029***	-0.029***	-0.024***	-0.029***	-0.029***	-0.024***	-0.023***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Partnered		-0.095***					-0.074***
		(0.014)					(0.014)
Any Children		-0.031*					-0.031*
		(0.015)					(0.015)
Satis. Income Medium			-0.117***				-0.072***
			(0.014)				(0.015)
Satis. Income High			-0.213***				-0.147***
			(0.019)				(0.020)
Satis. Housework Medium				-0.093***			-0.066***
				(0.015)			(0.015)
Satis. Housework High				-0.109***			-0.047**
				(0.017)			(0.017)
Satis. Leisure Medium					-0.103***		-0.095***
					(0.018)		(0.018)
Satis. Leisure High					-0.134***		-0.108***
					(0.017)		(0.017)
Concerned Finances (somewhat)						0.079***	0.049*
						(0.022)	(0.021)
Concerned Finances (very)						0.166***	0.094***
						(0.022)	(0.022)
Constant	1.309***	1.186***	1.368***	1.348***	1.475***	1.197***	1.326***
	(0.083)	(0.086)	(0.083)	(0.083)	(0.086)	(0.086)	(0.080)
N	9817	9817	9817	9817	9817	9817	9817
R^2	0.06	0.06	0.07	0.06	0.06	0.07	0.08

Note: The table reports coefficients from a regression of individual-level empirical reservation wage proxies on survey covariates for unemployed job seekers (constructed as the ratio of reservation wages to a proxy for a potential wage (e.g. the previous wage), with the construction and correspondence to the reservation wedge concept described in Appendix C.1). $*$: $p < 0.10$, $**$: $p < 0.05$, $***$: $p < 0.01$. Robust standard errors in parentheses. *Source:* German Socio-Economic Panel (GSOEP).

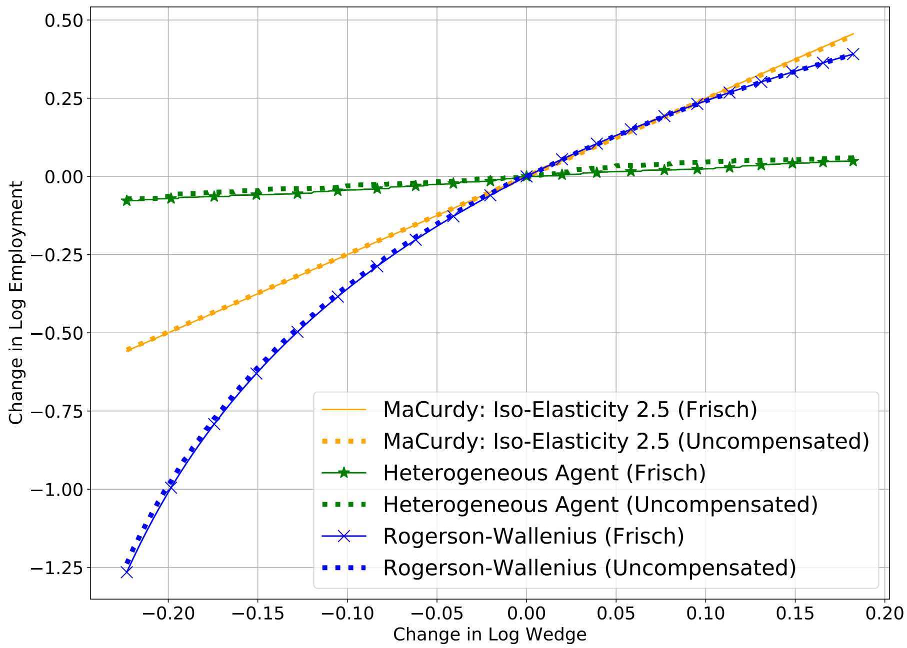
Table A4: PASS Covariate Analysis: Tobit Regression of (Log) Reservation Wedge Proxy for German Nonemployed (Right-Censored at 0 (Log(1))

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Searching for Work	0.022**	0.007*	0.020*	0.022**	0.019*	0.022**	0.019*
	(0.011)	(0.004)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Age / 100	0.458	0.547*	0.541*	0.509*	0.444	0.476*	0.585**
	(0.287)	(0.303)	(0.385)	(0.276)	(0.285)	(0.287)	(0.294)
Age / 100^2	-0.289	-0.397	-0.385	-0.345	-0.279	-0.311	-0.440
	(0.353)	(0.390)	(0.390)	(0.340)	(0.351)	(0.353)	(0.377)
Female	-0.055***	-0.051***	-0.050***	-0.054***	-0.053***	-0.056***	-0.049***
	(0.011)	(0.005)	(0.012)	(0.011)	(0.011)	(0.011)	(0.013)
Partnered		-0.011	-0.017				-0.015
		(0.014)	(0.018)				(0.018)
Kids		-0.003	-0.014				-0.016
		(0.018)	(0.022)				(0.022)
Partnered × Kids			0.016				0.018
			(0.025)				(0.026)
Log Years Education				-0.013			-0.006
				(0.038)			(0.029)
Life Satisfaction (Medium)					-0.011		-0.051
					(0.011)		(0.057)
Life Satisfaction (High)					-0.016		0.057
					(0.016)		(0.063)
Home Satisfaction (Medium)						-0.007	-0.081
						(0.013)	(0.055)
Home Satisfaction (High)						0.006	-0.016*
						(0.015)	(0.082)
Health Issues							0.034
							(0.123)
Constant	-0.269***	-0.271***	-0.278***	-0.018***	-0.258***	-0.271***	-0.288***
	0.055	0.022	0.056	0.088	0.056	0.058	0.091
N	25,964	25,964	25,964	25,915	25,955	25,964	25,899

Note: The table reports coefficients from a regression of individual-level empirical reservation wage proxies on survey covariates for unemployed job seekers (constructed as the ratio of reservation wages to a proxy for a potential wage (e.g. the previous wage), with the construction and correspondence to the reservation wedge concept described in Appendix C.1). $*$: $p < 0.10$, $**$: $p < 0.05$, $***$: $p < 0.01$. Robust standard errors in parentheses. R^2 is omitted for the Tobit regressions. *Source:* Panel Study Labour Market and Social Security (PASS) survey from the Institute for Employment Research (IAB).

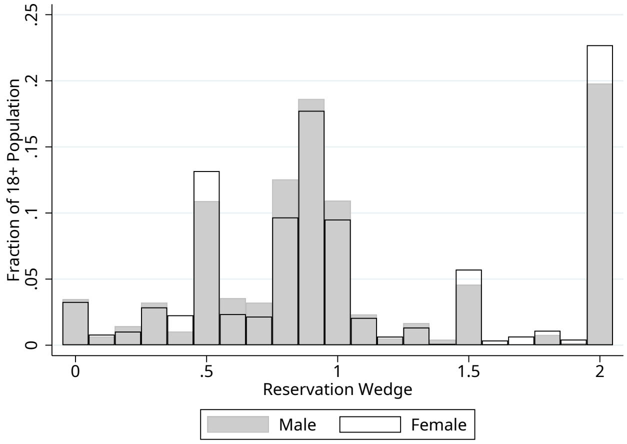
A.2 Additional Figures

Figure A1: Frischian vs. Uncompensated Quarter-Long Deviation in the Aggregate Prevailing Wedge: Extensive-Margin Aggregate Labor Supply Responses in Three Calibrated Models

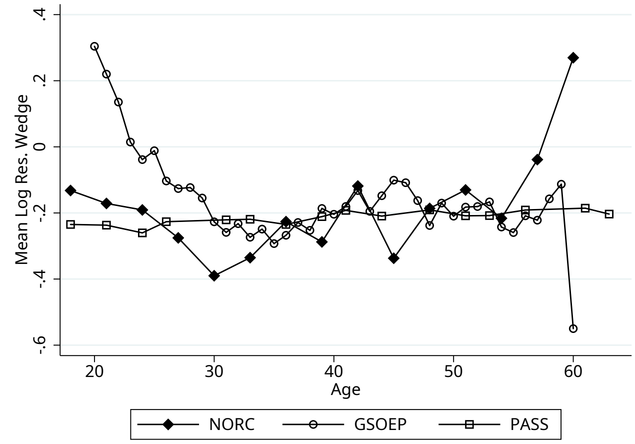


Note: The figure compares aggregate labor supply curves that are purely Frischian (from our reservation wedge distributions) and from non-Frischian, uncompensated pertubations in the aggregate prevailing wedge that are short-lived and last one quarter in each model. The three curves are output from simulating three of the models we discuss in detail in Section 4: a representative household model with an isoelasticity of 2.5, a heterogeneous agent mode with a realistic 33-state earnings process, and the Rorgerson-Wallenius model with lifecycle aspects and an intensive margin hours choice. The specific quantitative experiments are detailed in Appendix B for each model. Model parameters are in Table 4.

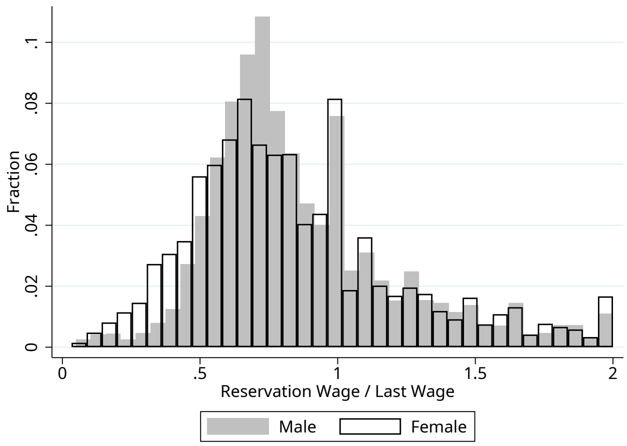
Figure A2: Distribution of Reservation Wedges



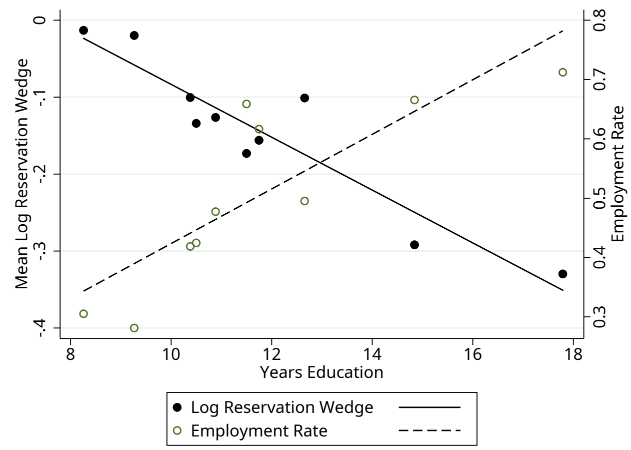
(a) U.S. Population (NORC): Distribution by Gender



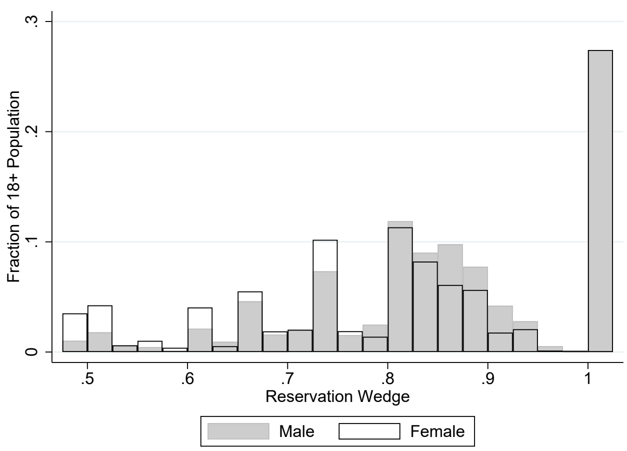
(d) Reservation Wedges by Age



(b) GSOEP: Distribution by Gender



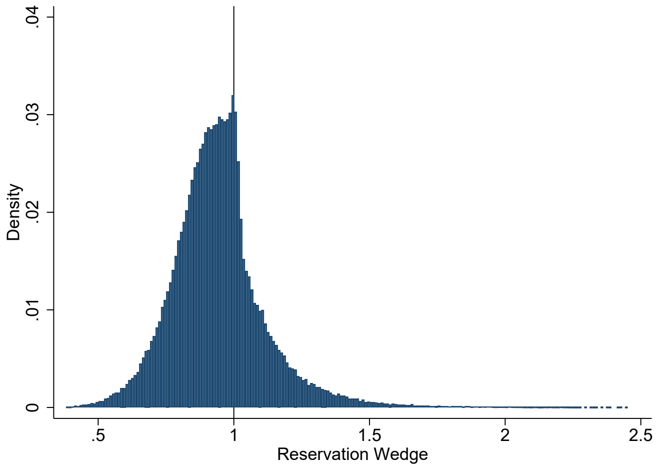
(e) GSOEP: Wedges by Years of Education



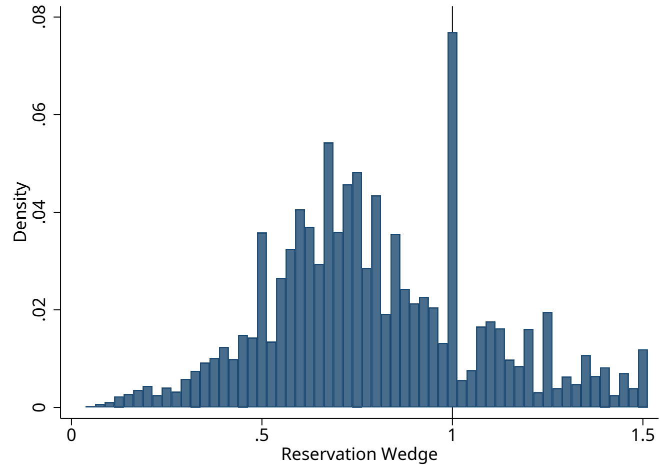
(c) PASS: Distribution by Gender

Note: The figure plots additional properties of the empirical reservation wedge distributions discussed in Section 3. Panels (a)-(c) plot histograms of reservation wedges by gender for three surveys: U.S. population (NORC, authors' survey), GSOEP and PASS. Panel (d) plots a binned scatter plot of the log reservation wedge against age bins (three-year averages for NORC; one-year for GSOEP; and unweighted three-year averages for PASS). Data for ages 66+ in NORC are binned together as one. PASS wedges are coefficients from a Tobit regression of the log reservation wedge on a saturated set of age dummies (age 18 omitted). Panel (e) plots, in the GSOEP, the gradients of employment rates and the mean wedge against years of education. The construction of the wedge proxies are detailed in the main text for NORC, and in Appendix C.1 for GSOEP and PASS. Wedges and wedge proxies for the NORC and GSOEP data are truncated at 2.0. Wedges for the PASS data are by construction truncated at 1.0 due to the survey question.

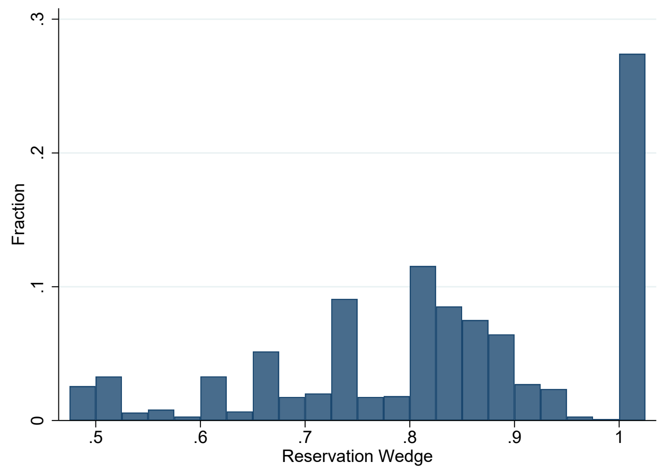
Figure A3: Distribution of Reservation Wedges from Three Reservation Wage Surveys of Unemployed Job Seekers: Pôle Emploi Administrative Survey, GSOEP Household Survey, PASS-IAB Admin-Linked Household Survey



(a) Pôle Emploi



(b) GSOEP

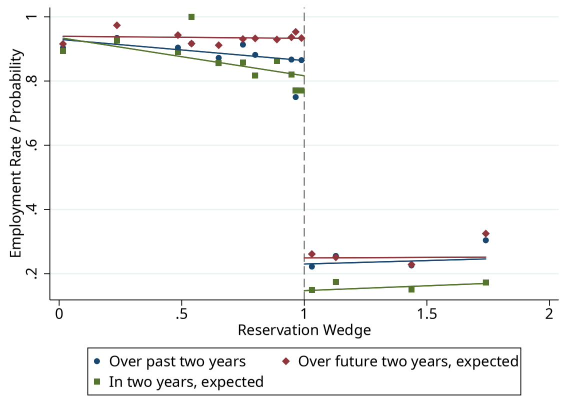


(c) PASS

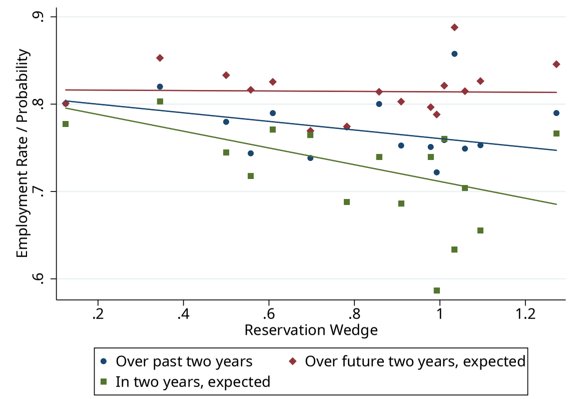
Note: The figure plots histograms of reservation proxies from sureys of (unemployed) job seekers (constructed as the ratio of reservation wages to a proxy for a potential wage (e.g. the previous wage for GSOEP and Pole Emploi and expected wage for PASS), with the construction and correspondence to the reservation wedge concept described in Appendix C.1). Associated summary statistics are reported in Table A2. PASS wedges less than 0.5 and greater than 1 are grouped in the left-most and right-most bars, due to data disclosure requirements. PASS includes unemployed and out of the labor force individuals reported to have ever searched (rather than current searchers only). *Sources:* German Socio-Economic Panel (GOSEP); PASS-IAB linked data; Pole Emploi French UI Agency data (provided by Le Barbanchon, Rathelot, and Roulet, 2017).

Figure A4: The Empirical Relationship Between Individual-Level Realized Employment Dynamics and Reservation Wedges

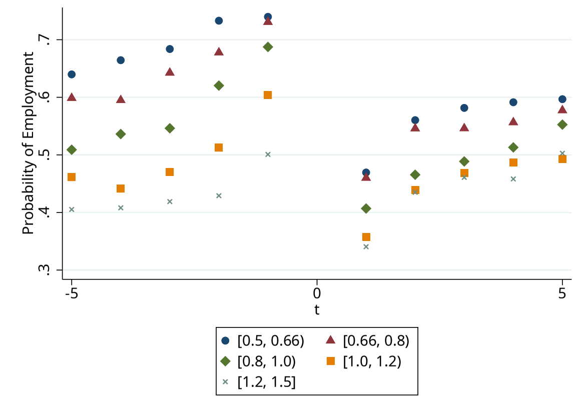
(a) US Survey: Pooling All Labor Force Statuses



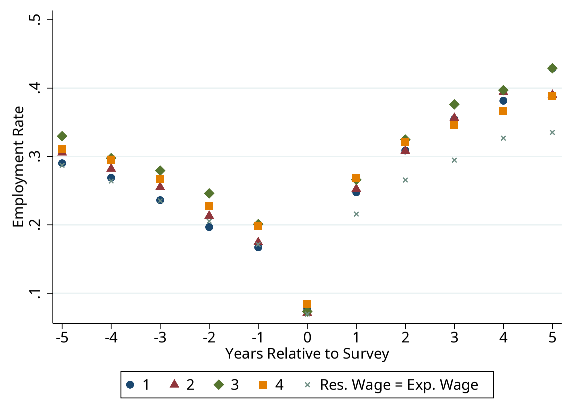
(b) US Survey: Controlling for Labor Force Status



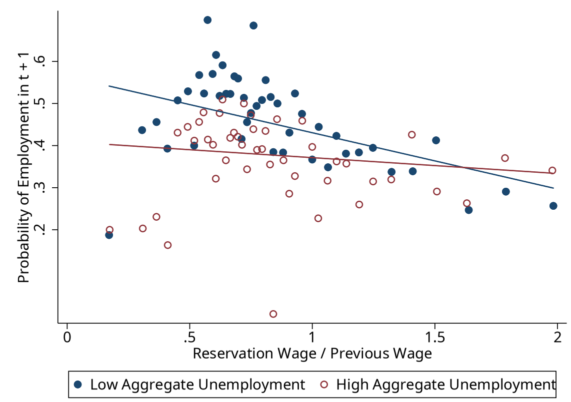
(c) GSOEP: Employment Dynamics by Reservation Wedges



(d) Administrative Data & PASS Merge: Future and Past Employment Rates by Reservation Wedge Proxy



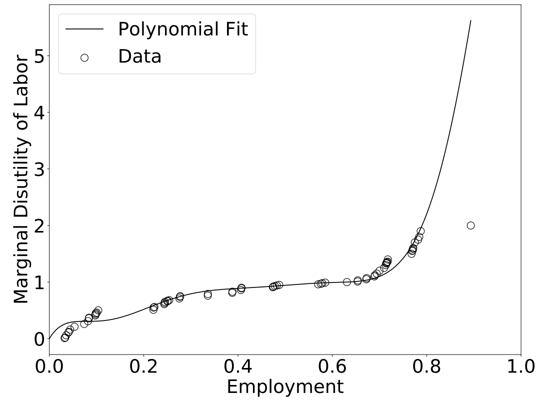
(e) GSOEP: Employment Dynamics by Reservation Wedge, by Aggregate Labor Market State



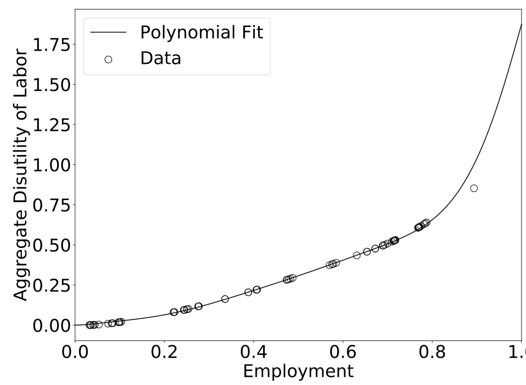
Notes: The figure shows individual-level realized or expected employment rates for individuals grouped by their reservation wedge proxy elicited at a given survey date. The construction of the proxies for PASS and GSOEP are in Appendix C, along with interpretation of all panels. Panels (a) and (b) are binned scatter plots of the U.S. survey, plotting on the y-axis three outcomes (survey questions printed in Section C.2) denoting (i) the share of months worked over the past 24 months, (ii) over the next 24 months, and (iii) the probability assessment of employment two years post-survey. On the x-axis, the graph bins respondents into quantiles by their reservation wedge, so that the y-axis reports the mean value of the given wedge bin. Panel (a) plots the raw data; the drop at one arises from employed and unemployed workers having wedges below one and are likely to work or have worked; wedges above one stem from the out of the labor force. Panel (b) residualizes both axes by a fixed effect for labor force status. Panel (c) plots the probability (share) of employment pre and post survey date (years on the x-axis) using the panel structure of the survey. Since in GSOEP, reservation wages are only elicited for unemployed job seekers, this outcome is by construction zero (and hence omitted) at the zero time period. Panel (d) uses a merged version of the PASS survey and the IAB German social security administrative data to plot employment rates (an admin. snapshot at the survey date and the same dates in the other years) and the wedge proxy. Due to disclosure requirements and sample sizes, PASS respondents are split by quartiles of the reservation wedge proxy, with a separate group for those whose wage is not lower than their expected wage (and only then is the reservation wage elicited in the survey). The PASS sample includes the unemployed and out of the labor force reported to have ever searched (rather than current searchers only), explaining why pre and post employment is below GSOEP; positive employment at point of survey reflects admin.-data-based employment. Panel (e) takes the GSOEP survey and plots the one-year-ahead outcome but splits up the sample by the unemployment rate, suggesting that the slope between employment and wedges appears steeper in tighter labor markets, perhaps reflecting more efficient rationing. (Specifically, we split the survey waves in half: a high-unemployment time before 2006 (steadily around 10%), and after 2006 when unemployment sharply declined to 7% and recently even lower.) Sources: GSOEP; PASS-IAB matched data set; authors' U.S. custom (NORC) survey.

Figure A5: Visualizing the Fitted Polynomial Approximation and Empirical Labor Supply Curve: Representative Household Labor Supply Disutility $V'(E)$, $V(E)$ and $V''(E)$ as a Function of Employment Rate $E \in [0,1]$:

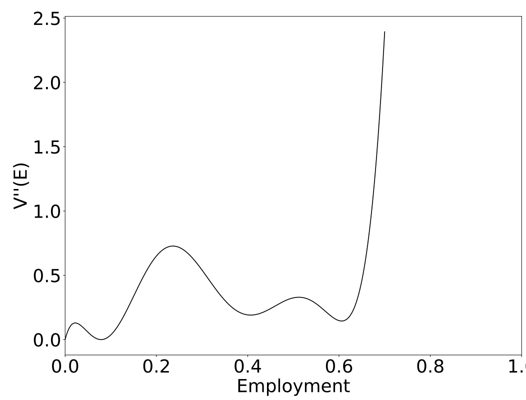
(a) Fit and Target of Marginal Aggregate Disutilty $V'(E) = v$ (Marginal Worker's Micro Disutility)



(b) Aggregate Disutility $V(E)$: Antiderivative of $V'(E)$



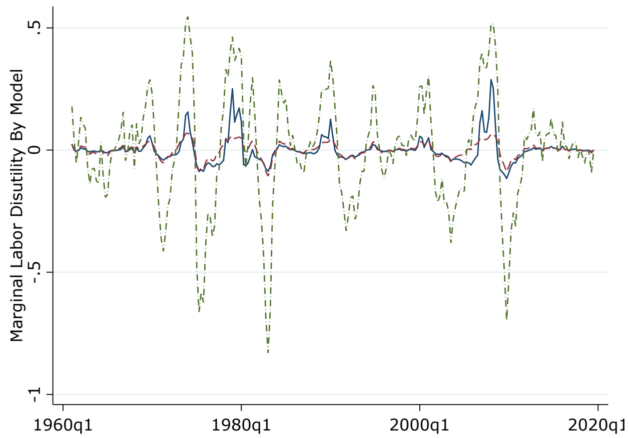
(c) Second Derivative: $V''(E)$



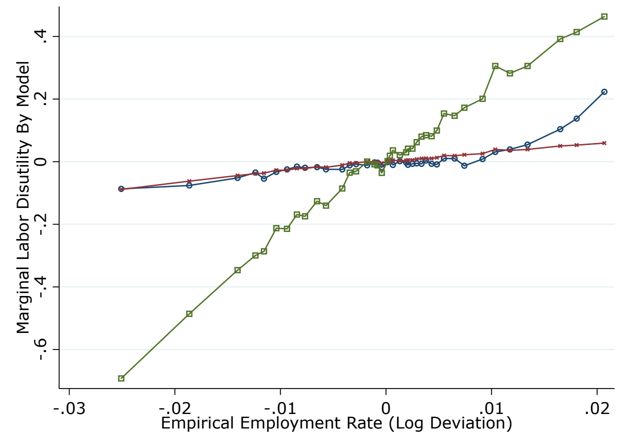
Note: The figures plots empirical and fitted properties of the extensive-margin labor supply curves implied by reservation wedges. The raw data points (hollow circles) along with the polynomial function (continuous line) fitted to match the empirical extensive-margin aggregate labor supply curve (which is measured and discussed in Section 3). We describe the fitting procedure in Section 5.1 with further details in Appendix D. The micro-foundation is a full-insurance representative household with aggregate disutility of employment $V(E)$ capturing household members' heterogeneous disutility of working with indivisible labor. As a result, $V'(E)$ denotes the disutility of labor of the marginal household member at employment rate E. $V'(E)$ is the eighth-degree polynomial $f(E,\beta) = \sum_{i=0}^{\bar{i}=8} \beta_i^f E^i$ fitted to the empirical labor supply curve, with $E \in [0,1]$ denoting the employment rate. Going from the fitted function for $V'(E)$ (plotted in Panel (a)), we obtain $V(E)$ (plotted in Panel (b)) as the analytical antiderivative (with its constant normalized s.t. $V(0) \approx 0$). $V''(E)$ (plotted in Panel (c)) is the analytical derivative of $V'(E)$. The properties of the functions in the range of interest $E \in [0,1]$ are $V(E) \geq 0$, $V'(E) > 0$ and $V''(E) > 0$. As in Figure 1, we do not include wedge observations above 2.0, which make up around 10% of our sample (and so our employment rate does not go to 100%). Due to large values towards an employment rate of 100%, we also cut off the plots at different points on the right to maintain readable y-axis ranges. Table 5 reports the coefficients, and the resulting fitted curve is included in Figures 2–4.

Figure A6: Business Cycle Implications: Aggregate Marginal Labor Supply Disutility and Aggregate Labor Market Wedges **With E_t Fluctuations Amplified Ten-Fold in $V'(E)$** (Log Deviations From Trend, U.S. Quarterly Data)

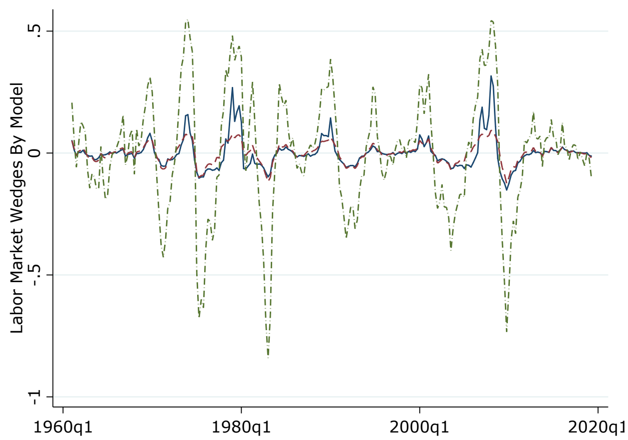
(a) Marginal Disutility of Labor: Time Series



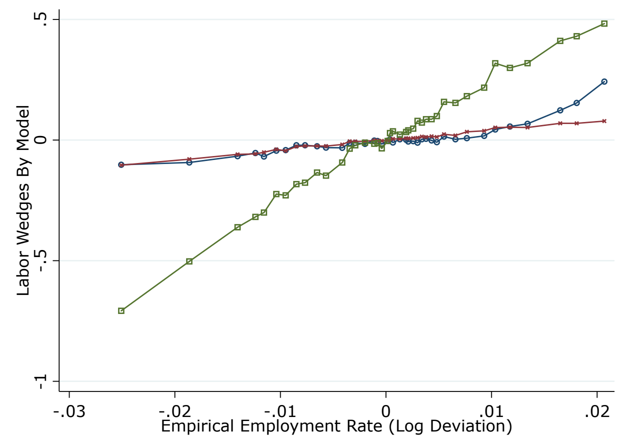
(b) Marginal Disutility of Labor: Binned Scatter Plot



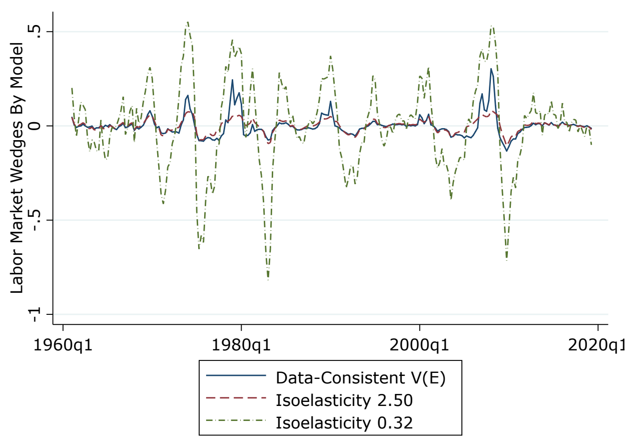
(c) Labor Wedge: Time Series



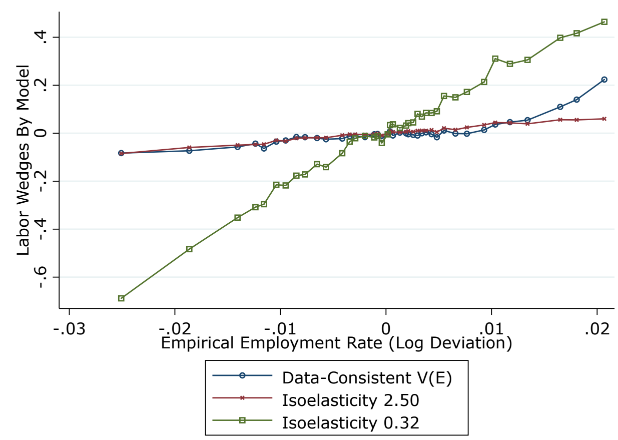
(d) Labor Wedge: Binned Scatter Plot



(e) Frischian (λ-constant) Labor Wedge: Time Series



(f) Frischian (λ-constant) Labor Wedges: Binned Scatter Plot



Note: The figure extends the labor wedge analysis described in Section 5.2. It replicates Figure 6 but ad-hoc amplifies the employment fluctuations entering the marginal disutility of labor $V'(E)$ ten-fold (while feeding the nonamplified empirical E_t into the other elements). It thereby highlights that locally, the curve acts as a high-elasticity ones and at the aggregate business cycle level, unrealistically large employment fluctuations are needed for the curve to reach the lower-elasticity region. As in baseline Figure 6, Panels (a) (time series) and (b) (binned scatter plot of the model-specific marginal disutilities of labor $V'(E)$ against the employment rate for U.S. business cycles. Panels (c) and (d) follow the same structure but plot the aggregate labor wedges, the gap between the MPL and the MRS. Panels (e) and (f) finally plot the labor wedges that hold λ constant (by holding consumption constant under separable utility) i.e. only reflect shifts in the marginal disutility of labor $V'(E)$ against the marginal product of labor. The plots reflect three representative household models that only differ only in aggregate disutility of employment $V(E)$: MaCurdy (1981) Frisch isoelasticities of 0.32 and 2.50, and the data-consistent disutility curve $V(E)$, as described in Section 5.1. All time series are HP-filtered log quarterly time series with smoothing parameter of 1,600.

B Model and Compuational Details

We describe additional details of the models discussed in Section 4.

B.1 The Representative Household Model: A Short-Lived, Uncompensated Shock

Here we describe how we model and quantify the uncompensated labor supply response of a representative household with MaCurdy-style convex labor supply disutility and shared consumption, depicted in Appendix Figure A1.

We consider a household that maximizes

$$\max_{C_s, E_s} \sum_{s=t}^{\infty} \beta^{s-t} \frac{C_s^{1-\sigma}}{1-\sigma} - \Psi \frac{E_s^{1-\eta}}{1-\eta} \tag{B1}$$

$$\text{s.t.} \sum_{s=t}^{\infty} \frac{1}{1+r} C_s \leq \sum_{s\geq t}^{\infty} \frac{1}{1+r} (1-\Xi_s) w_s E_s, \tag{B2}$$

so that wages are constant at $w_t = w \forall t$. We also consider the case were $\beta(1+r) = 1$ so that $C_t = C \forall t$. We also have assumed that initial assets A_0 are zero, which implies the largest wealth effect among the range of nonnegative initial asset holdings, thereby providing the largest difference between the Frischian and uncompensated setting (away from the representative household being borrowing-constrained, a setting covered by our heterogeneous agent model).

We study partial equilibrium, i.e. hold aggregate equilibrium variables (interest rates, net of aggregate prevailing wedge potential earnings/wages) fixed.

We first construct the employment baseline for the unperturbed setting. Denote $\bar{E}$ and $\bar{C}$ as the employment and consumption levels in a stable setting in which $1 - \Xi_t = 1 \forall t$. The intratemporal substitution condition and the budget constraint imply, respectively:

$$w\bar{C}^{-\sigma} = \Psi \bar{E}^{1/\eta} \tag{B3}$$

$$\bar{C} = w\bar{E}. \tag{B4}$$

Solving these conditions for $\bar{E}$ delivers $\bar{E} = \left[\frac{w^{1-\sigma}}{\Psi}\right]^{\frac{\eta}{1+\eta\sigma}}$.

Second, we turn to labor supply under a pertubation of the wedge of size $1-\Xi$ lasting T periods. In our uncompensated experiment, we set the baseline aggregate prevailing wedge $1 - \Xi_t = 1 - \Xi$ for $t = 1, \ldots, T$, potentially diverging at a constant level from the baseline wedge subsequently reset to unity at $1 - \Xi_t = 1$ for $t > T$. The labor response we plot is labor supply in period 1 under the initial wedge level $1 - \Xi_t = 1 - \Xi$.

Let E' and E'' denote labor supply when $1 - \Xi_t = 1 - \Xi$ and $1 - \Xi_t = 1$ respectively. Then, optimal intratemporal labor supply implies

$$wC^{-\sigma} = \Psi E''^{1/\eta} \tag{B5}$$

$$(1-\Xi)wC^{-\sigma} = \Psi E''^{1/\eta}. \tag{B6}$$

Therefore, initial labor supply is the eventual labor supply times the Frisch-elasticity-scaled wedge pertubation:

$$\implies E' = (1-\Xi)^{\eta} E''. \tag{B7}$$

The budget constraint then implies for consumption C in this wedge series (or for λ):

$$\sum_{t=T+1}^{\infty} \left(\frac{1}{1+r}\right)^t wE'' + \sum_{t=1}^{T} \left(\frac{1}{1+r}\right)^t (1-\Xi) wE' = \sum_{t=0}^{\infty} \left(\frac{1}{1+r}\right)^t C \tag{B8}$$

$$\sum_{t=T+1}^{\infty} \left(\frac{1}{1+r}\right)^t wE'' + \sum_{t=1}^{T} \left(\frac{1}{1+r}\right)^t (1-\Xi)^{1+\eta} wE'' = \frac{1+r}{r} C \tag{B9}$$

$$\frac{1+r}{r} wE'' - \sum_{t=1}^{T} \left(\frac{1}{1+r}\right)^t \left(1-(1-\Xi)^{1+\eta}\right) wE'' = \frac{1+r}{r} C \tag{B10}$$

$$wE'' - \frac{r}{1+r} \sum_{t=1}^{T} \left(\frac{1}{1+r}\right)^t \left(1-(1-\Xi)^{1+\eta}\right) wE'' = C \tag{B11}$$

$$\left[1 - \frac{r}{1+r} \sum_{t=1}^{T} \left(\frac{1}{1+r}\right)^t \left(1-(1-\Xi)^{1+\eta}\right)\right] wE'' = C. \tag{B12}$$

Let $m(T, 1-\Xi) \equiv \left[1 - \frac{r}{1+r} \sum_{t=1}^{T} \left(\frac{1}{1+r}\right)^t \left(1-(1-\Xi)^{1+\eta}\right)\right]$. Combining the above with the intratemporal substitution condition (B6), one can solve for L' in particular as a function of baseline employment level $\bar{E}$ in the unperturbed setting, duration of the pertubation T, and wedge deviation $1-\Xi$:

$$E' = \left[(1-\Xi)^{\eta} m(T, 1-\Xi)^{-\sigma\eta/(1+\sigma\eta)}\right] \left(\frac{w^{1-\sigma}}{\Psi}\right)^{\frac{\eta}{1+\sigma\eta}} = \left[(1-\Xi)^{\eta} m(T, 1-\Xi)^{-\sigma\eta/(1+\sigma\eta)}\right] \bar{E}. \tag{B13}$$

The model is calibrated so that the period length corresponds to one month, so this experiment simulates a one-quarter shift in the prevailing aggregate labor wedge by implementing a three-period duration of the shift. The quarterly interest rate is set to 0.764% (implying an annual discount factor of 0.97).

B.2 The Heterogeneous Agent Model with Extensive Margin Labor Supply

We describe the model the solution algorithm, and how we simulate the short-lived uncompensated shock. We also describe the 33-state potential-earnings process.

B.2.1 The Model

In this section we describe our modification to Huggett (1993), with endogenous labor supply, which occurs along the extensive margin only.

Individuals solve

$$\max_{c_{it}, e_{it} \in \{0,1\}, a_{it}} \mathbb{E}_t \sum_{s=t}^{\infty} \beta^{s-t} \left[\frac{c_{is}^{1-\sigma}}{1-\sigma} - \overline{v} e_{is} \right] \tag{B14}$$

$$\text{s.t.} \quad a_{i,s} = (1 - \Xi_s) y_{is} e_{is} + b(1 - e_{is}) + (1 + r_s) a_{i,s-1} - c_{is} \quad \forall s \geq t \tag{B15}$$

$$a_{is} \geq a_{\min} \quad \forall s \geq t, \tag{B16}$$

where $y_{i,t}$ follows the Markov process described in Appendix Section B.2.4 below. Households endogenously choose their labor supply e_{it}, which is restricted to 0 or 1. As described in the main text, since individuals within the same asset and productivity levels face the same problem, consumption and labor supply decisions (and hence reservation wedges) can be written as a function of assets and productivity.

The first-order condition on consumption is, as in the standard case,

$$u_c(c^*(a, y), e^*(a, y)) = V_a(a, y), \tag{B17}$$

where V is the value function for someone at asset level a and earnings state y. The optimality condition on labor supply is

$$e^*(a, w) = \begin{cases} 1 & \text{if } V_a(a, y) y > \overline{v} \\ 0 & \text{if } V_a(a, y) y < \overline{v}. \end{cases} \tag{B18}$$

A similar optimality condition should be used to solve the agent's problem at the binding constraint $a_{\min}$:

$$e^*(a_{\min}, y) = \begin{cases} 1 & \text{if } \frac{(y+ra)^{1-\sigma}}{1-\sigma} - v > \frac{(ra)^{1-\sigma}}{1-\sigma} \\ 0 & \text{otherwise .} \end{cases} \tag{B19}$$

If $a_{\min} < 0$, this implies that individuals at the borrowing constraint are always employed.

B.2.2 Solution Algorithm

We solve the model with parameters $\sigma = 2$, $r = 0.03$, $\beta = 0.97$, and unemployment insurance $b = 0$. We set the borrowing constraint at $a_{\min} = -z_1 r + 0.001$, so that positive consumption is possible at the lowest productivity and asset levels if the individual works. We choose the labor supply disutility shifter $\bar{v}$ to match the equilibrium employment rate 60.7%.

We use a grid of assets comprising a discrete set of asset levels A with minimum $a_{\min}$ and maximum $a_{\max} = 50000000$. We place fifty asset levels equally spaced between $a_{\min}$ and 0, 450 levels between 0 and 1000000, and 500 levels between 1000000 and 5000000. We solve the consumption and labor supply rules using value function iteration:

$$V^{n+1}(a,y) = \max_{a' \in A, e \in \{0,1\}} \left\{ u(ye + (1+r)a - a') + \beta \sum_{y'} T_{y,y'} V(a', y') \right\}, \tag{B20}$$

where $T_{y,y'}$ is the transition probability between productivity levels y and y'. Consumption is given by $c(a,y) = ye^*(a,y) + (1+r)a - a'^*(a,y)$, where e^* and a'^* are the solutions to the maximization problem in (B20) for an individual characterized by asset and productivity states (a,y).

Once we solve for the consumption and labor supply rules, we calculate the equilibrium joint distribution of assets and productivity $g(a,y)$ by solving the system of equations:

$$g(a,y) = \sum_{\tilde{y}} \sum_{\tilde{a} \text{ s.t. } a'^*(\tilde{a},\tilde{y}) = a} g(\tilde{a},\tilde{y}) T_{\tilde{y},y}. \tag{B21}$$

With the joint distribution of assets and productivity assets, value functions, and consumption choices, we can solve for the distribution of reservation wedges, and therefore the labor supply curve.

B.2.3 A Short-Lived, Uncompensated Shock

We describe how we obtain the uncompensated labor supply curve in response to a quarter-long wedge pertubation depicted in Appendix Figure A1. The purpose of this exercise is to simulate the aggregate extensive-margin labor supply response of a heterogeneous agent economy under an *uncompensated* (non-Frischian) one-period change in the benefit of working i.e. the prevailing aggregate labor supply wedge. We study partial equilibrium, i.e. hold aggregate equilibrium variables (interest rates, potential earnings) fixed.

Consider an individual with assets a and productivity y. That individual faces a temporary prevailing aggregate wedge $1 - \Xi_s = 1 - \Xi$ during some period s, which then returns to a wedge of level $1 - \Xi_t = 1$ for $t > s$. Then, that individual solves

$$\max_{c, e \in \{0,1\}} \left\{ u(c,e) + \beta \sum_{y'} T_{y,y'} V(a', y') \right\} \tag{B22}$$

$$\text{s.t. } a' = (1+r)a - c + ey, \tag{B23}$$

where

$$u(c, e) = \frac{c^{1-\sigma}}{1-\sigma} - \bar{v}e \tag{B24}$$

and where V is the value function from the solution to the equilibrium with the baseline unit wedge in all periods.

For a given prevailing labor supply wedge, the solution is easily found by maximizing the utility over a grid of consumption points under employment and nonemployment, since the problem is not recursive. We then measure the labor supply response as the difference in the measure of individuals who choose employment under the temporary first-period-only labor wedge $1 - \Xi$ versus the measure of individuals who choose employment in the baseline economy with the unit wedge.

The model is calibrated so that the period length corresponds to one quarter, so this experiment simulates a one-quarter shift in the prevailing aggregate labor wedge.

B.2.4 The Potential Earnings Process

We now apply a realistic 33-state potential-earnings process, mimicking that in Kaplan, Moll, and Violante (2018) (whose model features only intensive-margin labor supply), which in turn approximates the empirical patterns documented in Guvenen, Karahan, Ozkan, and Song (2015). Our Markov process represents an underlying process modeled as the sum of two independent components $\log y_{it} = \log y_{1,it} + \log y_{2,it}$, with the log of each component $y_{j,it}$ evolving according to a jump-drift process. Jumps arrive at a Poisson rate γ_j, and trigger new draws of the earnings component from a mean-zero normal distribution. Between jumps, the process drifts toward zero at rate β_j.[37] Kaplan, Moll, and Violante (2018) implement this process as two finite-state continuous time Markov processes for each independent component. In our application, we do so as a single discrete-time Markov process in which the income states are hence combinations of the states of the two income processes.[38] We discretize the continuous time transition rates between states by using the matrix exponential; i.e. the discrete time transition matrix for income component j is calculated as $T^{j,d} = \exp T^{j,c} = \sum_{k=0}^{\infty} \frac{1}{k!}\left(T^{j,d}\right)^k$, where $T^{j,c}$ is the continuous time transition matrix for component j. The continuous time transition rates are measured with quarters as the unit of time, so the discrete time transition matrix is also in quarters. Then, we collapse the discrete time transition matrices for the two components into a single transition matrix between one-dimensional income states. $T^d_{y,y'}$, the transition probability between the single-dimension income state y to y' for which $\log y = \log y_1 + \log y_2$ and $\log y' = \log y'_1 + \log y'_2$, is then equal to $T^{1,d}_{y_1,y'_1} T^{2,d}_{y_2,y'_2}$. (For this process and the income levels chosen, conveniently each y state is uniquely defined by one (y_1, y_2) combination.)

[37] Of course, in our model not all individuals will work; we do not estimate a latent potential earnings process such that the modeled realized earnings, taking into account labor supply decisions, would generate realized empirical earnings dynamics.

[38] Inconsequential for quantities, we normalize the earnings state levels so that the average steady-state potential earnings are equal to the 2015 U.S. average personal income.

B.3 The Rogerson and Wallenius (2008) Model

We describe the solution of the model variants, and how we simulate the short-lived uncompensated shock.

B.3.1 Parameterizing the Model

Baseline Model The original Rogerson and Wallenius (2008) distribution of the hourly wage w_d (labor efficiency) arises from a uniform age distribution and a triangular wage-age gradient (single-peaked at $d = 1/2$ with $w_{d=1/2} = \hat{w}_0$ as the maximum wage level, and generally $w(d) = \hat{w}_0 - \hat{w}_1|d - 0.5|$). We approximate the continuum of generations with 1,000,000 equally-spaced discrete generations, and solve the model following the Technical Appendix of Chetty, Guren, Manoli, and Weber (2012).

To paramaterize the Rogerson and Wallenius (2008) model, we choose the utility function parameters (Γ, the labor disutility shifter, γ, the labor supply intensive margin elasticity), effective labor supply parameters ($\overline{h}$, the minimum number of hours worked, and $\hat{w}_1$, the slope of the wage-age gradient) and the tax rate at which the model equilibrium is calculated. We assume CRRA log consumption utility ($\sigma = 1$).

We set the initial tax rate at 26%, which was the average net tax rate faced by an average single worker in 2017. We set the labor supply intensive margin elasticity to 2.0. From this point, we conduct two paramaterizations. In the first, we choose the remaining three parameters, Γ, $\overline{h}$, and $\hat{w}_1$, to match three equilibrium targets, as in Chetty, Guren, Manoli, and Weber (2012): the employment rate (60.7%, as in the other model exercises), the maximum intensive margin hours choice (0.45), and the ratio of the lowest wage to the highest wage received over the lifecycle (0.5). This paramaterization sets $\Gamma = 42.492$, $\overline{h} = 0.258$, and $\hat{w}_1 = 0.851$.

For each generation/age, indexed by d, we calculate hours at each age, h^*_d, and then calculate the wedges using $1 - \xi^*_d = \frac{(1-\tau)w_d(h^*_d - \overline{h})u'(c_d)}{v(h^*_d)}$. This formulation of the wedge is "normalized" so that the relevant wage is the after-tax wage, and so the indifferent worker is that of the age d such that $1 - \xi^*_d = 1$.

This, combined with the distribution of individuals along the age dimension (uniform), gives the distribution of reservation wedges, from which we can compute the arc elasticities.

Low-Frisch Elasticity Parameterization In the second paramaterization, we also choose the peak of the wage-age profile and target a lower extensive margin Frisch elasticity. This paramaterization sets $\Gamma = 40.000$, $\overline{h} = 0.248$, $\hat{w}_1 = 1.319$, and lifetime peak productivity at 1.110.

Shutting off the Intensive Margin In Figures 2–4 we also add a variant that shuts off intensive-margin reoptimization. We do so by simply solving for the optimal policies, extracting the reservation wedges, and then computing alternative reservation wedges that hold hours fixed at the corresponding unit wedge point, such that $1 - \xi_d = \frac{v(h^*_{d,1-\Xi=1})}{y_d(h^*_{d,1-\Xi=1})\lambda}$.

B.3.2 A Short-Lived, Uncompensated Shock

We describe how we obtain the uncompensated labor supply curve in response to a quarter-long wedge pertubation depicted in Appendix Figure A1.

We simulate the labor supply response of the economy under a temporary, short, but noninstantaneous (and therefore non-Frischian) change in the benefit of working in form of a shift in the prevailing aggregate wedge. As in the other models, we again study partial equilibrium, i.e. hold aggregate equilibrium variables (e.g., interest rates) fixed.

We suppress calendar time subscripts in what follows.

We continue to solve the model in continuous time, i.e. in the context of considering a time interval corresponding to a month-long duration, one could work for part of the period rather than having a period-long policy.

In our experiment, we suppose that households are subject to our aggregate prevailing labor wedge $1-\Xi$ for a time interval of duration m. After this interval, the wedge returns to unity. The introduction of the wedge is unanticipated, and once occurring, the households perfectly foresee that the wedge deviation will last exactly m time units before returning to unity. Upon realization of the shock, households will re-optimize their planned consumption and labor supply for the remainder of their lives.

Solving for Assets We first need to solve for household assets at age d before the wedge shock. Currently held assets are determined by past earnings, government transfers (which are equal to $\tau\bar{c}$, where $\bar{c}$, taken as parametric by the household, is the equilibrium consumption level in turn equal to average income and hence $\tau\bar{c}$ is the average labor income tax payment and also government rebate), and consumption c:

$$\int_0^d \left((1-\tau)e_{\tilde{d}}y_{\tilde{d}} + \tau\bar{c} - c\right) d\tilde{d}, \tag{B25}$$

where $e_{\tilde{d}}$ is desired employment and $y(\tilde{d})$ is potential gross earnings at age $\tilde{d}$. For $\tilde{d} \in [d_{\min}, d_{\max}]$, where $d_{\min}$ and $d_{\max}$ are the (endogenous) work-entry and -exit ages,

$$\begin{aligned}
e_{\tilde{d}}y_{\tilde{d}} &= w_{\tilde{d}}(h_{\tilde{d}} - \bar{h}) && \text{(B26)}\\
&= w_{\tilde{d}}(h_0\hat{w}_0^{-1/\gamma}w_{\tilde{d}}^{1/\gamma} - \bar{h}) && \text{(B27)}\\
&= [h_0\hat{w}_0^{-1/\gamma}w_{\tilde{d}}^{1+1/\gamma} - \bar{h}w_{\tilde{d}}] && \text{(B28)}\\
&= \begin{cases} [h_0\hat{w}_0^{-1/\gamma}\left(\hat{w}_0 - 0.5\hat{w}_1 + \hat{w}_1\tilde{d}\right)^{1+1/\gamma} - \bar{h}\left(\hat{w}_0 - 0.5\hat{w}_1 + \hat{w}_1\tilde{d}\right)] & \text{if } \tilde{d} < 0.5\\ [h_0e_0^{-1/\gamma}\left(\hat{w}_0 + 0.5\hat{w}_1 - \hat{w}_1\tilde{d}\right)^{1+1/\gamma} - \bar{h}\left(\hat{w}_0 + 0.5\hat{w}_1 - \hat{w}_1\tilde{d}\right)] & \text{if } \tilde{d} \geq 0.5, \end{cases} && \text{(B29)}
\end{aligned}$$

and 0 if $\tilde{d} \notin [d_{\min}, d_{\max}]$. The lifetime gross-of tax labor income up to age d is:

$$\int_0^d e_{\tilde{d}} y_{\tilde{d}} d\tilde{d} = \begin{cases} 0 & \text{if } d < d_{\min} \\ \left(\frac{h_{\tilde{d}}}{(2+\frac{1}{\gamma})\hat{w}_1} - \frac{\bar{h}}{2\hat{w}_1} \right) w_{\tilde{d}}^2 \Big|_{d_{\min}}^{d} & \text{if } d_{\min} \le d < 0.5 \\ \left(\frac{\tilde{d}}{(2+\frac{1}{\gamma})\hat{w}_1} - \frac{\bar{h}}{2\hat{w}_1} \right) w_{\tilde{d}}^2 \Big|_{d_{\min}}^{0.5} + (1-\tau) \left(- \frac{h_{\tilde{d})}}{(2+(1-\tau)\frac{1}{\gamma})\hat{w}_1} + \frac{\bar{h}}{2\hat{w}_1} \right) w_{\tilde{d}}^2 \Big|_{0.5}^{d} & \text{if } 0.5 \le d < d_{\max} \\ \left(\frac{h_{\tilde{d}}}{(2+\frac{1}{\gamma})\hat{w}_1} - \frac{\bar{h}}{2\hat{w}_1} \right) w_{\tilde{d}}^2 \Big|_{d_{\min}}^{0.5} + \left(- \frac{h_{\tilde{d}}}{(2+\frac{1}{\gamma})\hat{w}_1} + \frac{\bar{h}}{2\hat{w}_1} \right) w_{\tilde{d}}^2 \Big|_{0.5}^{d_{\max}} & \text{if } d \ge d_{\max}, \end{cases} \tag{B30}$$

from which follows lifetime net income if multiplied by $1 - \tau$.

Consider an individual of age d. Let m denote the length of the temporary wedge change. One solves for optimal consumption and labor supply by finding the consumption level $c_{\Xi,d}$ that balances the income's lifetime budget constraint, subject to (a) their labor income being subjected to a multiplier and (b) the individual adjusting the remainder of their lifetime's labor supply to meet extensive and intensive margin labor supply optimality conditions. In our experiment, for each given age level d, the time series of the aggregate prevailing wedge will be given by

$$1 - \Xi_{\tilde{d}} = \begin{cases} 1 - \Xi \ \text{ if } \tilde{d} \in [d, d+m] \\ 1 \ \text{ if } \tilde{d} > d + m. \end{cases} \tag{B31}$$

For a proposed consumption level $c_{\Xi,d}$ (where subscript d denotes the time at which the wedge pertubation started, rather than the period during which the consumption occurs, as consumption is constant across all post-wedge ages $\tilde{d} > d$), during the ages $\tilde{d} > d$, let $h_{\tilde{d},d}$ be the age $\tilde{d} > d$ labor supply choice of an individual that was age d when the temporary labor wedge shift began.

For ages $\tilde{d}$ where the individual works on the extensive margin, intensive margin labor supply implies that

$$\Gamma h_{\tilde{d},d}^{\gamma} = (1-\tau)(1-\Xi_{\tilde{d}}) u'(c_{\Xi,d}) w_{\tilde{d}}. \tag{B32}$$

As in the standard setup, there will be cutoff rules that dictate extensive margin labor supply. Under a temporary $1 - \Xi$ shift, one cannot dictate age cut-offs since the benefit of working does not follow the same single-peaked shape as the original model. However, one can determine wedge-productivity cutoffs in $(1 - \Xi_{\tilde{d}}) w_{\tilde{d}}$.

At ages $\hat{d}$ at which the individual is indifferent to extensive margin labor supply (conditional on optimizing on the intensive margin if working), the intensive and extensive margin conditions imply respectively:

$$\Gamma h_{\hat{d},d}^{\gamma} = (1-\tau)(1-\Xi_{\hat{d}})u'(c_{\Xi,d})w_{\tilde{d}} \tag{B33}$$

$$\Gamma\frac{h_{\hat{d},d}^{1+\gamma}}{1+\gamma} = (1-\tau)(1-\Xi_{\hat{d}})u'(c_{\Xi},d)w_{\tilde{d}}(h_{\hat{d},d}-\bar{h}). \tag{B34}$$

Combining these two implies an hours choice at the marginal age of

$$h_{\hat{d},d} = \frac{(1+\gamma)}{\gamma}\bar{h} \tag{B35}$$

on the basis of which we can solve for the marginal age (productivity level) as follows:

$$\Gamma\left(\frac{(1+\gamma)}{\gamma}\bar{h}\right)^{\gamma} = (1-\tau)(1-\Xi_{\hat{d}})u'(c_{\Xi,\hat{d}})w_{\tilde{d}} \tag{B36}$$

$$\implies (1-\Xi_{\hat{d}})w_{\tilde{d}} = \frac{\Gamma\left(\frac{(1+\gamma)}{\gamma}\bar{h}\right)^{\gamma}}{(1-\tau)u'(c_{\Xi,\hat{d}})}. \tag{B37}$$

The individual will prefer working over nonworking at age $\tilde{d}$ if $(1-\Xi_{\tilde{d}})w(\tilde{d}) \geq \Gamma\left(\frac{(1+\gamma)}{\gamma}\bar{h}\right)^{\gamma} / \left((1-\tau)u'(c_{\Xi,d})\right)$. From this cutoff, one can compute optimal planned extensive margin supply for every age $\tilde{d} > d$. For a proposed candidate for the consumption level, one can then compute the balance of the individual's lifetime budget constraint given both the change in consumption and the lifetime extensive and intensive margin labor supply responses.[39] The solution to the individual's problem is the consumption level $c_{\Xi,d}$ that balances the individual's lifetime budget constraint. Repeating this for every individual in the economy (i.e. repeating this for every age $d \in [0,1]$) delivers the aggregate labor supply response. We measure the labor supply response to this temporary (but noninstantaneous) wedge shift using the change in labor supply upon impact of the wedge.

We set the length of the uncompensated wedge shift to 1/240, to represent the length of one quarter out of a 60-year adult lifespan.

[39]We isolate the labor supply responses, and therefore hold fixed in our partial-equilibrium experiment all aggregate variables except for the prevailing wedge (i.e. government transfers and taxes, so the government budget is unbalanced in this exercise).

C Microempirical Analyis: Covariates of Individual-Level Wedges, and Correlation Employment Outcomes

In Section C.1 we detail the supplementary data sources from household surveys for reservation wedge proxies building on reservation wage data from the unemployed. We use these data for our covariate analysis in Section 3.3.

In Section C.2, we assess the micro-empirical relationship between an individual respondent's reservation wedge and her idiosyncratic realized employment outcomes in previous and future periods.

C.1 Supplementary Data: Proxies from Reservation Wage Household Surveys

To enlarge our sample size and exploit a larger panel structure, we supplement our custom household survey analysis with data from a set of existing larger surveys limited to unemployed workers and show how reservation wage (rather than wedge) questions can be constructed into reservation wedge proxies.

Additional Proxy: Reservation/Potential Wage Ratios Specifically, the wedge proxy measurable in more standard reservation wage surveys (usually covering the unemployed): the ratio of an individual's *reservation wage* to her (actual or potential) wage. We define an individual's (Frischian) net-of-$1-\Xi$ reservation wage (earnings) y^r_{it} (for indifference between employment and nonemployment for a short period of time, all else equal), by:

$$(1-\Xi_t) y^r_{it,j^*(1-\Xi_t)} \lambda_{it} = v_{it,j^*(1-\Xi_t)} \tag{C1}$$

$$\Leftrightarrow y^r_{it,j^*(1-\Xi_t)} = \frac{v_{it,j^*(1-\Xi_t)}}{(1-\Xi_t)\lambda_{it}}, \tag{C2}$$

where we as in Section 2.5 permit intensive-margin reoptimization.

This route requires characterizing the worker's actual or potential earnings $y_{it,j^*(1-\Xi_t)}$. We can write the reservation wedge as reservation-to-actual/potential-wage ratio, again centered around one and hence mirroring the $(1-\hat{\xi}^*_{it})(1-\Xi_t)$ analogue of the model object as in the direct wedge question presented in main text Section 3:

$$\Rightarrow \frac{y^r_{it,j^*(1-\Xi_t)}}{y_{it,j^*(1-\Xi_t)}} = \frac{\frac{v_{it,j^*(1-\Xi_t)}}{(1-\Xi_t)\lambda_{it}}}{y_{it,j^*(1-\Xi_t)}} \tag{C3}$$

$$= \frac{1-\tilde{\xi}^*_{it}}{1-\Xi_t}. \tag{C4}$$

Potential/actual wages for employed workers could be captured by their current wage. For nonemployed respondents, proxies for their potential wage are reported wage expectations for the reservation job, or their last job's wage. There exist surveys that ask about both wages and reservation wages, but almost exclusively the *unemployed* and/or job seekers.

We enlist three surveys for this supplementary analysis: a large administrative snapshot of

French unemployment entrants, a large German panel household survey with rich covariates, and a second German survey that we link to administrative employment biographies from social security data.

GSOEP Household Panel Survey The German Socioeconomic Panel (GSOEP) is a long household panel survey. It also elicits reservation wages from unemployed respondents. The reservation wage question is asked at a given survey date. We also have detailed labor market and other characteristics from this rich panel survey. Our potential wage proxy for this data is the last job's wage.

PASS Household Survey The Panel Study Labour Market and Social Security (PASS) of the German Employment Research Institute (IAB) is another household panel survey, designed by IAB to answer questions about the dynamics of households receiving welfare benefits.

Unlike GSOEP, PASS asks respondents about their *expected* wage, providing a potentially more precise potential-wage measure rather than the lagged wages (whereas disutility of labor, preferred hours or the worker's productivity may have changed leading to or following the separation). Moreover, the pairing of wage expectations and reservation wages about a hypothetical future job offer is more likely to hold the particular job constant (e.g. amenities, hours,...).

It also asks the questions of a broader set of households, including employed workers (about their most recent search). Among the nonemployed, it asks the current searchers (unemployed) as well as those not searching but who state they previously did search. For consistency, we restrict our PASS sample to the nonemployed, but for sample size we pool the unemployed (active searchers) with the out of the labor force (who are still asked about the reservation wages if they ever searched).

PASS–ABIAB Record Linkage to Administrative Matched Employer-Employee Social Security Records We also use a linkage of the PASS survey households to administrative social security records covering pre- and post-interview employment biographies, 1975 through 2014, from the Institute for Employment Research (IAB) (described in detail in Antoni and Bethmann, 2018). The spell data are day-specific, include information on unemployment and other benefit receipts, and therefore permit us to track even small interruptions in employment. We translate the day-specific spell data into monthly frequency, where we count as employment any job spell associated with positive earnings in that month. A limitation is that the IAB data only cover jobs subject to social security payroll taxes, and hence exclude the self-employed and the civil servants (*Beamte*) not subject to these payroll taxes. To limit concerns from such mismeasurement for this analysis in the merged sample, we use the occupation indicator in the PASS survey data to drop all observations where the previous labor market status indicated civil service or self employment. Our employment measure is a snapshot one, where by check the calendar date of the survey, and then forward and revert the year while keeping the month fixed when studying the employment status.

Administrative Data from UI Agency To benchmark the reservation wedge distributions for unemployed job seekers, we exploit within-worker ratios of micro data collected by the French UI administration (government employment agency) Pôle empoi.[40] The data are binned histograms; we therefore include this data set in the distributional analysis yet cannot provide a covariate analysis. The data cover all UI claimants in France, a context of high UI take-up, and elicit reservation wages at UI claim entry. Our potential wage proxy for this data is the last job's wage (and so the wedge is the worker-level reservation to lagged wage ratio).

Proxied Wedge Distributions from the Supplementary Surveys of the Unemployed We present histograms of the empirical reservation wedges from Pole Emploi, PASS and GSOEP in Appendix Figure A3, and summary statistics in Appendix Table A2. In both datasets, the distribution of reservation wedges exhibit a spike at one, where the individual's reported reservation wage is equal to the lagged wage (Pole Emploi and GSOEP) and expected wage (PASS).[41]

C.2 Empirical Relationship Between Micro Labor Supply Outcomes and Wedges

The degree to which desired labor supply is allocative for employment outcomes depends on market structure and potential labor market frictions. One extreme, the Walrasian, frictionless market-clearing model, implies that at the given wage, all workers with positive surplus from employment – with reservation wedges below the prevailing one – will be at work. Away from this benchmark, frictions such as wage rigidity or search frictions can detach the wedge-implied desired labor supply from prevailing employment allocations, due to search frictions, rationing from labor demand, or misperceptions about potential wages.

The reservation wedge measure at the micro level may provide an empirical handle and diagnostic tool for micro-level rationed labor supply, a notoriously challenging task to assess empirically (for analyses of the efficiency of employment adjustment at the group-level cyclical dimension and the separation margin, see respectively Bils, Chang, and Kim, 2012; Jäger, Schoefer, and Zweimüller, 2019).

To investigate the empirical consequences of such rationed labor supply (conversely, the allocative consequences of desired labor supply), we compare respondents' *realized* employment outcomes past, present and future (using the panel structure in the surveys and administrative data) with their stated reservation wedges, which determines her *rank in the aggregate labor supply curve*.

[40] We thank Le Barbanchon, Rathelot, and Roulet (2017) for sharing the binned data on administrative reservation wage distributions of French UI recipients.

[41] For GSOEP and Pole Empoi, the spike may reflect anchoring in the surveys to the previous wage, or sticky reservation wages as in Krueger and Mueller (2016); DellaVigna, Lindner, Reizer, and Schmieder (2017). In the GSOEP, the mass of unemployed workers whose reservation wedge is equal to one accounts for about 6.2% of workers for whom we calculate reservation wedges. By contrast, only 0.2% report a wedge between 0.99 and 1.01 that is not equal to 1. In PASS, the bunching at 1 arises from the structure of the survey question: the survey first asks about the expected wage, and then asks whether or not the worker would also take lower offers. Only those responding yes will be asked to specify the reservation wage. For Pole Emploi and GSOEP, a significant amount of workers have a reservation wedge above 1. This is likely the consequence of measurement error as we use past way for the potential wage, as unemployed job seekers should have a reservation wedge lower than one (otherwise should not be searching).

Formally, our empirical design investigates the discrete choice of desired labor supply $e^*_{it} \in \{0, 1\}$ following the wedge cutoff:

$$e^*_{it} = \begin{cases} 0 & \text{if} \quad 1 - \xi^*_{it} > 1 - \Xi_t \\ 1 & \text{if} \quad 1 - \xi^*_{it} \leq 1 - \Xi_t. \end{cases} \tag{C5}$$

Specifically, we plot the empirical employment rates $P(e_{it+s}|1 - \xi^*_{it})$ by *continuous* reservation wedges at various horizons s relative to the survey year and for our various surveys. Figure A4 presents the results using the PASS and GSOEP (household panels) and from our survey of U.S. households (where we included forward- and backward-looking employment questions).

Below we show our approximations in three data sets.

U.S. Survey Data In our survey, we ask three variants for study the intertemporal dimension in our cross section of respondents:

1. Thinking back to the last two years, how many months were you not working (not counting vacations)?

2. Consider your future plans and expectations regarding your work situation. How many months out of the next two years do you think you will likely not be working?

3. What do you believe is the probability you will be working in a job exactly two years from now? We are looking for a percentage number. For example, a 50% probability means that it is just as likely that you will be working as not. A 100% probability means that you are sure that you will be working. 0% means that you are sure that you will not be working exactly two years from now. You can give any percentage number between 0% and 100%.

Figure A4 Panels (a) and (b) present the results for the representative cross-section of the U.S. population. Observations above 1 are out of the labor force, below 1 are unemployed searchers or the employed by construction. Panel (a) presents the raw data, and Panel (b) after residualizing with labor force status fixed effects to remove the mechanical jump at 1 (hence tracing out within-labor-force-status variation). The data reveal a compelling downward-sloping pattern for all groups, validating the measure. However, the slope is far from clear-cut.

Unemployed Job Seekers Figure A4 Panel (c) presents the evidence for unemployed job seekers in GSOEP. We exploit the panel structure of the survey and plot employment rates by event time around the survey, where importantly the reservation wage question underlying our wedge proxy is only asked for unemployed job seekers (and so employment should be zero at survey time $t = 0$ and is hence not plotted).

Before the survey year, there is a clear pecking order: high-wedge workers are substantially less likely to be employed (40% five years before, less than 60% the year before) compared to low-wedge workers (more than 60% five years before, and nearly 80% in the pre-survey year). The picture is somewhat noisier less pronounced *after* the survey, although the ranking is stable. Perhaps the event that selects the GSOEP respondent into the reservation wage question – unemployment – is associated with a reshuffling of potential earnings introducing measurement error going forward.

Figure A4 Panel (d) plots the corresponding results for PASS, where we use the stated subjective *expected* reemployment wages (again for workers sampled during nonemployment episodes), and link the data with administrative employment biographies to track workers nearly over their entire life cycle. Here a binary distinction between workers declaring themselves willing to work at a lower wage and not, would yield a clear picture before and after the nonemployment spell and interview date. (Our employment outcomes are of administrative quality due to our linkage with social security records for the survey respondents, so do not perfectly square with the survey measure, and so at the interview date some workers are employed. Moreover, since we pool the unemployed job seekers and out of the labor force that previously searched, the pre and post interview employment rates are much lower than for GSOEP, for example, where we see only active searchers.) Yet separating the workers who report that the reservation wage is strictly below the potential wage yields no clear ranking within that group, perhaps due to selection for this questionnaire (where the continuous response of the reservation wage is only possible when one declares to be willing to take a wage below the expected one).

Interpretation There are three sources of potential discrepancies between realized and desired i.e. wedge-implied employment status: measurement error in the original wedges, idiosyncratic shocks (limited persistence) in the wedge, or frictions that detach realized and desired employment allocations.

Assessing the role of frictions in employment allocations is beyond the scope of our paper. Instead, we close with an attempt a suggestive hint asking whether higher unemployment, the canonical symptom of rationed labor and labor market frictions, may cause, or reflect, more severe allocational frictions inducing less-efficient rationing. In Figure A4 Panel (e) we revisit the German GSOEP sample, and split the survey waves in half: a high-unemployment time before 2006 (steadily around 10%), and after 2006 when unemployment sharply declined to 7% and in the later years even lower. The employment–wedge gradient does indeed appear somewhat flatter during high-unemployment period.

D Polynomial Approximation of Representative Household Aggregate Employment Disutility $V(E)$ to Empirical Wedge Distribution

In this section we describe how we choose the polynomial approximation of $V(E)$ (in fact by means of fitting $V'(E)$) from the survey data. Our empirical observations, indexed by $x = \{1, ...X\}$, come as a combination of wedge level and emplyoment rate $((1-\xi_x), E_x)$. Given a polynomial degree d, the goal is to choose the polynomial $p^*(E)$ such that

$$p^*(E) = \arg\min_{p(E)\in P_d(E)} \sum_{x=1}^{X} \omega_i \left(p(E_x) - (1-\xi_x)\right)^2 \tag{D1}$$

$$\text{s.t.} \;\; p^{*\prime}(E) \geq 0 \;\; \forall E \in [0,1], \tag{D2}$$

where $P_d(E)$ is the set of polynomials of degree d. We select the polynomial degree by informal visual experimentation. Weights are of the form $\omega_x = [\left|(1-\xi_x) - 1\right| + 0.01]^{-2}$, hence assigning more weight to local wedge (and hence employment) deviations e.g. relevant to business cycle fluctuations.

In lieu of the actual nonnegativity constraint on the derivative of $p^*(E)$ for the full and continuous support, we approximate this constraint as follows:

$$\text{s.t.} \;\; p^{*\prime}(E_j) \geq 0 \;\; \forall E_j \in \{E_1, E_2, \cdots, E_J\}, \tag{D3}$$

where $E_1, E_2, \cdots, E_J$ are a set of J points in $[0,1]$. In other words, we check that the derivative is positive at many points in the interval. This is computationally simple to implement. For a candidate polynomial $p(E) = p_0 + p_1 E + p_2 E^2 + \cdots + p_d E^d$, the constraints can be written as:

$$\implies p_1 + 2p_2 E_j + 3p_3 E_j^2 + \cdots + d p_d E_j^{d-1} \geq 0 \;\; \forall E_j \in \{E_1, E_2, \cdots, E_J\} \tag{D4}$$

$$\begin{bmatrix} 0 & 1 & 2E_1 & 3E_1^2 & \cdots & dE_1^{d-1} \\ 0 & 1 & 2E_2 & 3E_2^2 & \cdots & dE_2^{d-1} \\ \vdots & & & & & \\ 0 & 1 & 2E_J & 3E_J^2 & \cdots & dE_J^{d-1} \end{bmatrix} \begin{bmatrix} p_0 \\ p_1 \\ p_2 \\ \vdots \\ p_d \end{bmatrix} \geq \begin{bmatrix} 0 \\ 0 \\ 0 \\ \vdots \\ 0 \end{bmatrix}, \tag{D5}$$

which is a linear restriction in the polynomial coefficients $[p_0, p_1, \cdots p_d]$. One can similarly write restriction $p^*(E) \geq 0$ as a linear restriction on the coefficients of the polynomial. This problem can then be passed to an appropriate solver, where we use the ECOS solver through Julia's Convex.jl package (Udell, Mohan, Zeng, Hong, Diamond, and Boyd, 2014). We check the constraint with $J = 100,000$ equally spaced points in $[0,1]$. Here, the constrained polynomial fits the data almost as well as that of an unconstrained polynomial of the same degree; in fact, the derivative of the polynomial chosen with unconstrained weighted least squares is positive over much of the domain. The weighted R^2s of the unconstrained and constrained regressions are 0.9802 and 0.9800.