Comment

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Introduction and Summary

The discussion about the size of the wage elasticity of labor supply between macroeconomists and labor economists is an old one. Early contributions relevant for this debate include Lucas and Rapping (1969), Smith (1975), Ghez and Becker (1975), and MaCurdy (1985). Typically, macroeconomists keen on equilibrium models of the labor market need a sizable elasticity to rationalize relatively large fluctuations in hours of work over the business cycle in the face of limited movements in real wages, which in addition tend to exhibit only mild cyclicality.

More recently, the issue has been revived with several contributions that, on the one hand, attempt to explain differences in hours of work across different countries as a consequence of differences in the taxation of earnings and on the other, try to assess the ability of modern business cycle model to account for the joint variability of wages and hours. Papers that have looked at this include Prescott’s (2006) Nobel lecture, Ljungqvist and Sargent (2011), Blundell, Bozio and Laroque (2011), Chetty et al. (2011), and Chang et al. (2011). In this more recent literature, much attention has been devoted to the possible differences between “intensive” and “extensive” margins, where the former refers to the decision on the number of hours, conditional on working, while the latter refers to the decision about whether to work. In the presence of various types of nonconvexities, the extensive margin can become an important one and, it has been claimed, could help to reconcile the differences between macro and micro elasticities. In particular, the claim is that much of the micro-labor literature on small elasticities of labor supply refers to the intensive margin. A large “extensive margin elastic-
ity” therefore could reconcile the small estimates obtained in microdata (which have often looked at the intensive margin) with the large elasticities needed for aggregate hours by macroeconomists.

It is to this recent literature that the article by Chetty, Guren, Manoli, and Weber (CGMW, henceforth) contributes. The article starts from the observation that recent studies that have claimed to be able to reconcile macro and micro evidence using the presence of indivisibilities, nonconvexities, and (more generally) the extensive margin, have used the latter as an exogenous “free” parameter that could be chosen (calibrated) to fit the evidence from aggregate movements in employment. This practice, which might be partly induced by the paucity of empirical micro evidence on the extensive margin, is according to CGMW, questionable. In the same way in which the previous literature used estimates from microdata to “calibrate” the intensive margin labor supply elasticity, researchers wishing to use the extensive margin to explain aggregate fluctuations should use evidence from microdata on that margin.

The authors discuss different types of elasticities, which they refer to as Hicksian or long-run elasticities and Frisch or short-run (business cycle) elasticities. The former are informative about changes in labor supply in the long run originated by permanent changes in wages. They could be inferred from comparing different steady-state equilibria. The latter, instead, are informative about short-run changes in labor supply originated by anticipated and temporary movements in wages.

This distinction, while useful, is of course not new. Moreover, if one wants to be pedantic, the labeling of these elasticities is slightly misleading. In the standard static labor supply model, a Hicks elasticity is usually referred to as a compensated own elasticity that keeps utility constant. A Marshallian elasticity, instead, is an uncompensated wage elasticity. One can obtain the compensated elasticity from the Marshallian one and income/wealth elasticities using the Slutsky equation. It is not clear to me that the “steady state comparisons” discussed by CGMW deliver a “compensated” elasticity. In his 1985 paper, MaCurdy (1985) discusses very similar issues when he describes the differences between what he defines as “evolutionary” and “parametric” changes in wages and the different elasticity concepts. Finally, it is not clear to me how to define a “marginal utility constant” or Frisch elasticity at the extensive margin. I will come back to these issues later.

The authors then move on to consider a calibrated version of a re-
cent model, by Rogerson and Wallenius (2009), to check whether such a model is able to match the available micro evidence. For such a purpose they consider three different studies and setting, which differ in context and, relevantly for the discussion at hand, in the type of wage variation that is considered. In the first two cases considered, the tax holiday in Iceland and the wage subsidies for Canadian single mothers, the changes considered are temporary in nature, therefore allowing to get at the so-called Frisch elasticity, while the third case considered the introduction of the Earned Income Tax Credit in the United States, which is permanent change in the price of labor, and allows one to get at the Hicksian or long-run elasticity.

The main point the authors make in this part of the article is that a model like the Rogerson and Wallenius (2009) one, when calibrated to fit the macro data, does a decent job at getting the intensive margin elasticity but predicts too large a change in the extensive margin relative to what is observed in the microdata generated by the first two quasi-experiment considered. When fed a temporary increase in wages as the one generated by the Icelandic tax holiday, the increase in participation generated by the model is substantially larger than what is observed by the data.

In the second part of the article, CGMW conduct a meta-analysis of the available micro evidence on labor supply elasticities at the extensive margin. They conclude that the available micro evidence indicates that the extensive short-run (Frisch) elasticities are too small to be consistent with what the Rogerson and Wallenius (2009) model needs to generate the type of macro fluctuations observed in reality. On the positive side, instead, the model is consistent with the intensive margin elasticities and the long-run or Hicksian extensive elasticities. The authors only consider what they deem quasi-experimental evidence and purposely neglect evidence from the estimation of a structural model, a point to which I will return.

This is an interesting and provocative article that puts the current discussion into context and tackles some important issues. The point that the extensive margin cannot be treated as a free parameter to be fixed to fit the size of the macro fluctuations is an important one. In this discussion, I want to make three remarks:

1. Aggregation issues are important and do not receive enough attention in the article. Even at the intensive margin it is difficult to talk
about the elasticity. Nonlinearities can be important and pervasive and make aggregation difficult. The possibility that consumption and leisure are nonseparable in the utility function makes the issue even more complicated.

2. Extensive margins are particularly difficult to deal with, both in terms of getting evidence about and in terms of aggregation. As a consequence, it is difficult to map the estimates from quasi-experimental studies into structural parameters.

3. Estimates of labor supply elasticities vary depending on the type of variation that is used (legitimately and not) to identify the parameters of interest. Much work still needs to be done to pin down the value of these elasticities and the use of structural models, completely omitted from the meta-analysis considered in the second part of the article, seems to be key for this purpose.

Obviously, these are not the only points that would be worthwhile when discussing what micro-evidence about labor supply implies for aggregate movements in hours and employment in relation to wage movements. In particular, in what follows, I will not mention at all any issues related to search frictions and matching models. Frictions and other labor market imperfections can play an important role, especially in the discussion of extensive margins. My choice is only motivated by the necessity to focus on a few specific issues.

To make the three above-mentioned points, it is useful to frame the discussion within a simple life cycle model. In the following section, I sketch such a model, which is taken from Attanasio et al. (2012). In the section after that, I make the three above-mentioned points, using the theoretical structure in the second section to inform my discussion. The last section concludes my discussion.

A Theoretical Framework

In this section, I present a simple life cycle model with consumption and female labor supply. The model makes a number of simplifications, which are not necessarily realistic, but that are consistent with the framework implicit in CGMW. I focus on female labor supply only for ease of exposition and because, empirically, female labor supply is known to be more elastic than male labor supply. It would be straight-
forward to add male labor supply to this model. The main points I want to make would go through.

Unitary households maximize expected utility, which is assumed to be intertemporally separable. Instantaneous utility is assumed to be a function of consumption (female labor supply), which are chosen by the household. It is also affected by a number of other variables, such as family composition variables, seasonal fluctuations, and so on.

\[
U = \max_{c,l} E \sum_{j=0}^{T} \beta^j u(c_{t+j}, l_{t+j}, z_{t+j})
\]

(1)

where \(c\) is consumption, \(l\) female leisure hours, and \(z\) a vector of observable and unobservable variables that are not explicitly modeled here. The intertemporal budget constraint has the form:

\[
A_{t+1} = R_t (A_t + (w_f (H - l_f) - F(a_t) + w_m h_m - c_t)
\]

(2)

where \(A_t\) are beginning of period assets, \(R_t\) is the interest rate, and \(F\) is the fixed cost of work that depends on \(a_t\), the age of the youngest child. Variable \(P_t\) is an indicator of labor force participation. Female wages are given by \(w_f\), and husband wages are given by \(w_m\), with fixed husband hours of \(h_m\). In any period, individuals are able to borrow against the minimum income they can guarantee for the rest of their lives.

The household takes the process of female wages and that of male earnings as given. These two processes are exogenous. In the simulations that I report in the following, I use standard assumptions in the literature, namely that (log) female wages and male earnings are given by processes that include a temporary and a permanent component, as well as a deterministic trend. We assume that these processes are given by the following expressions:

\[
\ln w_f = \ln w_{0f} + h_f + v_f,
\]

(3)

where \(h_f\) is the level of human capital at the start of the period and \(v_f\) is the permanent productivity shock.

We assume men always work and so male earnings are given by

\[
\ln w_m = \ln w_{0m} + h_m + v_m.
\]

(4)

Both female and male wages, \(w_f\) and \(w_m\), in the household are subject to permanent shocks, \(v_f\) and \(v_m\), that are positively correlated. In particular we assume
\[ v_t^f = v_{t-1}^f + \xi_t^f \]
\[ v_t^{m} = v_{t-1}^{m} + \xi_t^{m} \]
where \( \xi_t = (\xi_t^f, \xi_t^{m}) \sim N(\mu_t^f, \sigma_t^2) \) (5)

\[ \mu_t = \begin{pmatrix} -\frac{\sigma_t^2}{2} \\ -\frac{\sigma_t^2}{2} \end{pmatrix} \quad \text{and} \quad \sigma_t^2 = \begin{pmatrix} \sigma_t^{2f} & \rho_{\xi_t^f, \xi_t^{m}} \\ \rho_{\xi_t^f, \xi_t^{m}} & \sigma_t^{2m} \end{pmatrix}. \] (6)

These shocks constitute the only uncertainty that households face (although we can also consider versions with uncertainty about the interest rate). Households are assumed to have perfect foresight regarding fertility, child care costs, and the fact that they will remain married. The processes for men and women human capital are assumed to be exogenous and given by the following expressions:

\[ h_t^f = \alpha_t^f t + \alpha_t^{f2} \]
\[ h_t^{m} = \alpha_t^{m2} + \alpha_t^m t. \]

Notice that these assumptions imply the absence of experience effects on human capital. The implications of such effects have been recently stressed forcefully by Keane (2010) to justify large labor supply elasticities. Keane’s argument, which is not discussed in CGMW, is that the empirical relationships that are usually estimated neglect the fact that changes in labor supply imply changes in future wages through experience effects and that ignoring this channel induces a substantial underestimate of the labor supply elasticity. The arguments we present following will be valid if experience effects happen through the participation margin.

Preference Specification

My specification of preferences, taken from Attanasio et al. (2012), allows for nonseparability between leisure and consumption. In particular, I assume that instantaneous utility is of the form:

\[ u(c_t, l_t; z_t) = \frac{1}{\sigma} \left( \alpha_t(z_t, \varepsilon_t) \frac{c_t^{\alpha_t} - 1}{\phi} + (1 - \alpha_t(z_t, \varepsilon_t)) \frac{l_t^{\beta_t} - 1}{\theta} \right)^{\sigma} \exp(z_t + \xi_t \varepsilon_t + v_t). \] (7)

This specification of preferences aggregates two power functions defined in terms of consumption and leisure. I let the weights \( \alpha \) depend on both observable (\( z \)) and unobservable (\( \varepsilon \)) variables. When \( \sigma = 1 \), preferences are additively separable between consumption and leisure, an
assumption that is often made both in the macro and in the micro labor literature. Depending on whether $\sigma$ is above or below 1, consumption and leisure are complements or substitutes. Notice that participation has a potential utility cost when $\xi \neq 0$, in which case, even when $\sigma = 1$, there is another source of nonseparability between consumption and leisure that acts through the extensive margin.

Utility could also have a separable component in participation, which could reflect a fixed utility cost of working. Such an element of the utility function could not be identified from the equilibrium conditions that we consider here and would be, in a sense, observationally equivalent to the monetary fixed cost of going to work we have included in equation (2). These fixed costs could not be identified separately from data, unless one had observations on fixed costs.

For future reference, it is useful to define

$$M_t = \left( \alpha_t \frac{c_t}{\phi} - 1 + (1 - \alpha_t) \frac{I_t}{\theta} - 1 \right).$$

Given this definition, one can obtain simple expressions for the marginal utilities of consumption and leisure:

$$u_c = M_t^{\sigma - 1} \alpha_t c_t^{\phi - 1} \exp(\pi z_t + \xi P_t + v_t) \quad (8)$$

$$u_l = M_t^{\sigma - 1} (1 - \alpha_t) l_t^{\theta - 1} \exp(\pi z_t + \xi P_t + v_t). \quad (9)$$

**Optimality Conditions**

Let us define $\lambda_t$ the marginal utility of wealth, or the multiplier associated to the budget constraint at time $t$. Then some of the first-order conditions for the above-mentioned problem are:

$$U_{c_t} = \lambda_t \quad (10)$$

$$U_{l_t} \geq \lambda_t w_t$$

$$\lambda_t = E_t[\lambda_{t+1} \beta (1 + r_{t+1})].$$

For consumers at an interior solution in terms of labor supply (that is for households for whom $P_t = 1$), the second of the equations in (10) holds as an identity. For these households, one can invert the second equation and derive a marginal utility of wealth constant (MUWC) labor supply function, as, for instance, in MaCurdy (1981):

$$l_t = F(\lambda_t, w_t, c_t; z_t).$$
For households at an interior solution optimality implies that the marginal rate of substitution between consumption and leisure equals the real wage.

$$w_t = \frac{u_t}{u_{c_t}} = \frac{1 - \alpha_t}{\alpha_t} \frac{c_t^{\theta - 1}}{c_t^{\phi - 1}}$$  \hspace{1cm} (11)

Equation (11) is obtained eliminating $\lambda_t$ from the first and second equation in (10). If we parameterize $\alpha_t = 1/(1 + \exp(\psi z_t + \epsilon_t))$ and take the log of equation (11) we get:

$$\ln w_t = \ln \frac{1 - \alpha_t}{\alpha_t} + (\theta - 1) \ln l_t - (\phi - 1) \ln c_t$$

$$= (\theta - 1) \ln l_t - (\phi - 1) \ln c_t + \psi z_t + \epsilon_t.$$  \hspace{1cm} (12)

This equation can be written as a traditional labor supply equation relating hours (of leisure in this case) to the wage:

$$\ln l_t = \frac{1}{(1 - \theta)} \psi z_t - \frac{1}{(1 - \theta)} \ln w_t + \frac{(1 - \phi)}{(1 - \theta)} \ln c_t + \frac{1}{(1 - \theta)} \epsilon_t.$$  \hspace{1cm} (13)

where $\ln c_t$ controls for the marginal utility of wealth. Under separability, $1/(1 - \theta)$ is the Frisch elasticity of leisure hours with respect to the wage. As well discussed in Keane (2010), under nonseparability, one will need to correct such an estimate to take into account the impact that changes in leisure have on the marginal utility of consumption.

Equations (12) or (13) can be estimated, in principle, with cross-section data and identify the parameters $\phi$, $\theta$, and $\psi$. To do so, however, one has to solve a number of econometric issues, including the fact that equation (12) can only be estimated on the selected sample of participants and the biases induced by endogeneity of the regressors on the right-hand side of the equation or measurement error (regardless of the normalization used).

As is it clear from the inspection of equations (12) or (13), they can only identify some of the parameters of the utility function—those that govern the intratemporal allocation of consumption and leisure. The marginal rate of substitution (MRS) conditions are not informative about intertemporal allocations or about the separability between consumption and leisure. The parameters identified by the MRS, however, can be used to compute Hicksian and Marshallian elasticities of labor supply.

Differentiating the MRS and the budget constraint with respect to wages, one gets Marshallian elasticities:
\[
\begin{bmatrix}
\frac{\partial \ln c}{\partial \ln w} \\
\frac{\partial \ln l}{\partial \ln w}
\end{bmatrix}
= 
\begin{bmatrix}
e_c^M \\
e_l^M
\end{bmatrix}
= 
\begin{bmatrix}
1 \\
-(\phi - 1) (\theta - 1)
\end{bmatrix}^{-1}
\begin{bmatrix}
w(H - l) \\
c
\end{bmatrix}.
\]

(14)

Differentiating the MRS and the budget constraint with respect to income one can get the income effects:

\[
\begin{bmatrix}
\frac{\partial \ln c}{\partial \ln y} \\
\frac{\partial \ln l}{\partial \ln y}
\end{bmatrix}
= 
\begin{bmatrix}
-(\phi - 1) (\theta - 1) \\
1
\end{bmatrix}^{-1}
\begin{bmatrix}
0 \\
y/c
\end{bmatrix}.
\]

(15)

Using the Slutsky equation, one can derive the Hicksian or compensated elasticities:

\[
\begin{align*}
\varepsilon^{H}_c &= \varepsilon^M_c - \frac{\partial \ln c}{\partial \ln y} \frac{c}{(c + w)} \\
\varepsilon^{H}_l &= \varepsilon^M_l - \frac{\partial \ln l}{\partial \ln y} \frac{w(H - l)}{(c + w)}.
\end{align*}
\]

(16)

Three points are worth making. First, the intensive margin elasticities in equations (14) and (16) can be computed from data and estimates of the parameters identified by the MRS conditions. Second, even for this simple specification, these elasticities are not a constant and can vary substantially across households. Third, as mentioned in the introduction, the parameters CGMW refer to as Hicksian elasticities in the article seem more akin to a Marshallian elasticity than the utility constant elasticity usually connected with the Hicksian concept. I will come back to these points later.

The MRS does not identify an important set of parameters: (a) \(\sigma\), which determines whether consumption and leisure are substitutes or complements; (b) \(\zeta\), which governs the nonseparability between consumption and participation; (c) \(\pi\), the parameters that govern how demographic variables affect the intertemporal allocation of resources. In addition, as mentioned before, the MRS does not identify any separable term in participation. These points were made by MaCurdy (1983) (see also Zilniak and Kniesner 2004; Keane 2010).

Some of the missing parameters can be identified through intertemporal first-order conditions. Other parameters, such as those related to
the fixed cost of going to work (either monetary or in terms of utility) require the solution of the entire model. The consumption Euler equation for the model we are considering is given by:

\[
\gamma_{c_t} = E_t \left[ \beta (1 + r_{t+1}) \gamma_{c_{t+1}} \right]
\]

(17)

\[
1 = E_t \left[ \beta (1 + r_{t+1}) \left( \frac{M_{t+1}}{M_t} \right)^{\sigma-1} \left( \frac{c_{t+1}}{c_t} \right)^{\phi-1} \exp^{(\lambda P_{t+1} + \pi_{t+1})} \right].
\]

Such an equation can be used to identify \( \sigma, \zeta, \) and \( \pi. \) Notice that equation (17) holds for both participants and nonparticipants. Participation is a decision that is chosen by households within the model and is determined jointly with consumption and hours of leisure. While fitting equation (17) is helpful in identifying the impact that participation has on the marginal utility of consumption, knowledge of this parameter is not sufficient to characterize participation and what determines it.

From equation (17), we can also derive an expression for the Frisch elasticity at the intensive margin. At an interior, using MRS to substitute out consumption, we get this equation for the Frisch elasticity:

\[
\varepsilon_{f} = \frac{1}{\theta - 1} \left[ \frac{M + [\alpha(\sigma - 1)/(\phi - 1)]c^{\phi}}{M + [\alpha(\sigma - 1)/(\phi - 1)]c^{\phi} + [\alpha(\sigma - 1)/(\theta - 1)]l^{\theta}} \right].
\]

As mentioned earlier, under separability, \( \varepsilon_{f} = 1/(\theta - 1). \)

**Some Issues with CGMW**

I will now use this framework to make the three points I listed in the first section. I will start with general aggregation issues and show that they are important even when considering the intensive margin. I will then move on to the main issue discussed in the article, the extensive margin and the mapping between the evidence from micro studies and the size of “aggregate” extensive margin elasticities. Then, I will discuss briefly the omission of structural evidence and argue that much work is still needed to identify fundamental parameters and that structural models should inform the interpretation of the micro evidence.

**Nonlinearities in Intensive Margins, Heterogeneity, and Aggregation**

The issues of nonlinearities and aggregation are not only relevant for the extensive margin, but also play a role in the evaluation of the inten-
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sive margin elasticities. In the first section, we have seen that within a simple life cycle labor supply model, it is possible to estimate Hicksian and Marshallian wage elasticities from the parameters of the MRS, using the expressions in equations (14) and (16). From those expressions it is also clear that these elasticities are not constant, but depend on the level of consumption and hours of leisure.

To check the importance of heterogeneity in practice, I use preliminary estimates obtained by Attanasio et al. (2012) to evaluate Marshall and Hicksian elasticities in a sample of US married couples, whose wives are between twenty-five and sixty years of age. The data comes from the Consumer Expenditure Survey and covers the period from 1980 to 2004. Consumption is measured as quarterly expenditure on nondurables and services, wages are computed as hourly earnings (obtained from total earnings and total hours) and are corrected for marginal tax rates using the NBER tax simulation program. The estimates take into account selection using a control function approach and also take into account endogeneity and measurement issues using instrumental variables, where fully interacted time, education, and regional dummies are used as instruments. Further details on these estimates are available in Attanasio et al. (2012).

The parameters $\theta$ and $\phi$ are estimated at 0.45 (standard error 0.065) and 0.725 (standard error 0.030), respectively. Using these parameters, I compute the Hicks and Marshall elasticities for each observation in the sample. In table 1, we report the twenty-fifth, fiftieth, and seventy-fifth percentile of the elasticities. The evidence that emerges is striking: the estimated elasticities exhibit substantial variation. Moreover, these estimates are considerably larger than many values reported in the literature. For instance, the median value of the Hicksian elasticities of hours of work is (for the females in our sample) 1.61, with the seventy-fifth percentile being 2.4.

<table>
<thead>
<tr>
<th></th>
<th>Marshallian</th>
<th>Hicksian</th>
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<tbody>
<tr>
<td>Consumption</td>
<td>[1.70, 2.12, 2.56]</td>
<td>[1.06, 1.57, 2.09]</td>
</tr>
<tr>
<td>Hours Worked</td>
<td>[0.80, 1.20, 1.99]</td>
<td>[1.27, 1.61, 2.41]</td>
</tr>
<tr>
<td>Leisure</td>
<td>${-0.97, -0.76, -0.54}$</td>
<td>${-1.18, -1.02, -0.85}$</td>
</tr>
</tbody>
</table>
The estimates used to obtain the figures in table 1 are preliminary and these results could be driven by a variety of factors. What is clear, however, is that even with such a simple specification, estimated elasticities vary substantially in the population under study. Only under very restrictive specifications on preferences, which can be and are easily rejected by the data, are the elasticities constant.

Note that this point is independent of the presence of nonconvexities and the like. If nonconvex budget sets are relevant, simple labor supply models or evidence derived from quasi-experiment even on the “intensive” margin is subject to the same problems we will discuss next in the case of “extensive margin” elasticities. As Keane (2010) puts it: “[G]iven non-convexities and piecewise linear budget constraints, utility function parameters are no longer tightly linked with any particular elasticity concept. Thus, labor supply may appear ‘elastic’ or ‘inelastic,’ depending on the type of budget constraint shift one considers” (p. 26). This consideration naturally leads me to my next point, which is key for the article.

**Extensive Margins Are Hard**

In the model we considered in the second section, the extensive margin is present because of the presence of fixed cost of going to work, which, as mentioned before, can be represented as utility costs or as monetary costs. For some individuals, it is optimal not to participate, which is equivalent to setting $P_t = 0$, $l_t$ to the maximum number of hours. For these individuals, $U_{l_t} > \lambda_t w_t$, where $\lambda_t$ is the marginal utility of wealth.

Two issues are relevant here. First, the characterization of the extensive margin is much harder than that of the intensive margin. It requires the complete specification and solution of the model. In other words, to establish how participation changes when wages change, one needs necessarily to specify the complete model and the entire stochastic environment where agents live. This could be avoided when looking at the intensive margin and at “$\lambda$-constant” labor supply functions. The first-order conditions that we discussed in the previous section and that can be used to estimate some of the parameters of the model are not sufficient to characterize how participation changes as a function of changes in the wage. Indeed, the marginal utility of wealth is not a sufficient statistics for this margin. Second, as the equilibrium condition is an inequality, and some households are at a kink of a budget constraint, even
the definition of a Frisch (marginal utility of wealth, or MUW constant) elasticity is ambiguous. Given the slack condition, it is not possible to keep the MUW constant.

The ambiguity in the definition of the Frisch elasticity at the extensive margin at the individual level is not just a pedantic academic point. The reaction to a given change in the wage on participation will depend on the size of the slack in the first-order condition on leisure, which implicitly defines a reservation wage. As mentioned by CGMW, one can define the extensive elasticity as the change in the fraction of individuals working for a certain change in wages. However, the size of the elasticity so defined depends on the density of the distribution of individuals around the reservation wage. If the distribution is thick around the kink, then the elasticity will be large, while if the distribution is thin, it will be small.

In turn, the distribution of households around the reservation wage will, in all likelihood, depend on the evolution of the system and on the characteristics of the sample of individual households one considers. The extensive elasticity discussed in the article, therefore, is likely to be heterogeneous, time-varying, and path-dependent.

These considerations have important implications in terms of mapping the quasi-experimental micro evidence discussed by CGMW and the macro extensive elasticities. If it is true that to characterize what happens at the extensive margin one needs to specify the entire model and that the relationships in this model are highly nonlinear and that average aggregate elasticities will be path dependent and population specific, then it is impossible to map the estimate of a single parameter from a quasi-experiment into a structural preference parameter of general relevance.

In other words, even if one neglects the issue of the specific population considered in the quasi-experiment (Canadian single mothers or average Icelanders), the quasi-experimental evidence considered, albeit interesting and suggestive, lacks external validity for the question at hand because its size will be history dependent.

In the face of these objections, a legitimate question is: How important are these issues? In other words, how does the extensive margin elasticity change over time and over the business cycle? And how important is heterogeneity across individuals? To provide some evidence on these questions, I simulate a version of the model I sketched earlier. In this exercise, I use the estimates of $\theta$ and $\phi$ obtained in Attanasio
et al. (2012) and set the additional parameters to reasonable values chosen to match basic patterns observed in US data for female labor supply: female participation rate, average hours worked, and the wage gender gap.3

I then perform two simulations. In the first, whose results I report in table 2, I simulate the life history for a large number of individual households facing the stochastic processes for female wages and male earnings. I add to the idiosyncratic shocks simulated from these processes a temporary shock to wages. I can then compute the aggregate extensive margin elasticity by comparing participation with and without these temporary shocks. I perform this exercise placing the temporary shocks at different ages (twenty-seven, thirty-seven, and forty-seven) and considering shocks of different sizes.

The evidence that emerges from table 2 is that participation elasticities vary both with age and with the size of the aggregate shock. Moreover, even the amount by which the elasticity changes with the size of the shock is a function of age. These numbers show how easy it is to generate heterogeneity in responses in a very parsimonious model and how extensive margin elasticities can vary with the path of the shocks that the economy experiences.

I perform the second simulation exercise only for women aged twenty-seven and for an expected wage increase of 5 percent size, and I report the results in table 3. I consider three different scenarios. The first is a baseline scenario without unexpected aggregate shocks (as in table 2). The second is a “recession” scenario under which all households receive, at a given time, an unexpected negative aggregate shock to women wages (6 percent) and husband earnings (7 percent), in addition to the idiosyncratic shocks. The third is a “boom” scenario under which all the households receive an unexpected positive aggregate shock to women wages (5 percent) and husband earnings (10 percent).

### Table 2

<table>
<thead>
<tr>
<th>Shock Size (Age)</th>
<th>1%</th>
<th>5%</th>
<th>10%</th>
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<tbody>
<tr>
<td>27</td>
<td>0.80</td>
<td>0.88</td>
<td>0.91</td>
</tr>
<tr>
<td>37</td>
<td>0.85</td>
<td>0.59</td>
<td>0.52</td>
</tr>
<tr>
<td>47</td>
<td>0.55</td>
<td>0.41</td>
<td>0.45</td>
</tr>
</tbody>
</table>
The elasticities for each scenario are then obtained comparing participation rates at a particular age with and without an expected and temporary wage shock.

In the first row of table 3, I report the changes in participation rates induced by various wage changes at age twenty-seven, in the different scenarios. Average participation in the calibrated version of the model I have been using is, at age twenty-seven, 60 percent. The changes in participation induced by the changes in wages I consider are not very large but the size of the responses varies with economic conditions. While the size of this elasticity might vary with the specific calibration performed, the main point to stress is that participation elasticities, even in a relatively simple model like the one we have considered, can vary considerably over the business cycle.

In table 3, in addition to participation elasticities, we report also the elasticities we obtain at the intensive margin; that is, the variation of hours conditional on working. Here we notice that the elasticity is anticyclical, being higher in recessions. A possible interpretation of this finding is that labor supply plays an insurance role.

Finally, in table 3, we report the aggregate total hours elasticity that one would obtain combining the intensive and participation elasticities. Not surprisingly, given the relative size of the intensive and extensive margins in this exercise, the path is similar to that of the intensive margin elasticities.

Notice that in this exercise I have not explored how elasticities vary for different past histories of shocks. This can be important because a certain sequence of shocks can lead to a thickening or a thinning of the distribution of households around the reservation wages.

<table>
<thead>
<tr>
<th></th>
<th>Recession</th>
<th>Baseline</th>
<th>Boom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensive Margin (60.0%)</td>
<td>0.96</td>
<td>0.88</td>
<td>0.98</td>
</tr>
<tr>
<td>Intensive Margin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25th percentile</td>
<td>5.31</td>
<td>4.75</td>
<td>4.65</td>
</tr>
<tr>
<td>Intensive Margin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50th percentile</td>
<td>2.77</td>
<td>2.40</td>
<td>2.31</td>
</tr>
<tr>
<td>Intensive Margin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75th percentile</td>
<td>1.60</td>
<td>1.49</td>
<td>1.39</td>
</tr>
<tr>
<td>Macro Elasticity</td>
<td>2.86</td>
<td>2.81</td>
<td>2.63</td>
</tr>
</tbody>
</table>
Wage Variability and Identification of Labor Supply Elasticities

In the second part of the article, CGMW conduct a meta-analysis of the existing evidence on extensive margin elasticities. The purpose of this analysis is to show that the three studies that they discuss in the first part and use to assess the performance of the Rogerson Waselius model are not outliers. They show that the size of the elasticities estimated in the studies considered indicates that it is much smaller than one would obtain if the Rogerson- Waselius model was in operation.

While this is certainly useful, I found the omission of studies based on structural estimates regrettable for several reasons. The previous discussion makes it clear that to assess the empirical size and relevance of the extensive marginal the structure and discipline of a structural model is indispensable to map the “quasi-experimental” evidence in something that can be interpreted and generalized. This is particularly true if one is interested in the aggregate elasticity.

Much of the macro literature on this set of issues discusses extensively the labor supply elasticity. Such a concept is well-defined and useful only in highly stylized models that are easily rejected in microdata. In my opinion the debate could become more fruitful if is recognized that aggregation and heterogeneity are of first-order importance and cannot be ignored in this context. I believe it is still possible to characterize the behavior of aggregate quantities, but simple shortcuts can be misleading. No simple mapping exists from simple parameters (estimated from a quasi-experiment in a cross-section or in a time series) and structural parameters that have external validity and can be used for welfare analysis. In a way, my criticism of the mapping attempted by CGMW is similar to the criticism of the attention that many macroeconomists pay to “balanced growth” predictions. It is often argued that plausible models should imply a zero Marshallian labor supply elasticity in which income effects completely offset substitution effects. The justification for such a choice is the fact that real wages have increased over a long period and hours of work have remained roughly constant. However, as noted by Browning, Hansen, and Heckman (1999) the latter aggregate fact hides a much richer heterogeneous behavior, with female labor supply increasing and male labor supply, by and large, decreasing. We can now build much richer equilibrium models that can handle much heterogeneity.

In addition to these basic points, in my opinion, much work still
needs to be done to extend our knowledge of labor supply behavior. This is certainly not the place for an extensive survey of the large literature that exists on the topic (Blundell and MaCurdy [1999] and Meghir and Phillips [2008] are two excellent and relatively recent surveys of the available evidence and literature). My take on this literature is that there are still many unresolved issues. I want to list some here to stress that an answer to these yet unanswered questions is germane to the questions posed in this study and requires the use of well-specified models.

1. When estimating equations (12) and (13) we include in the \( z \) vector a number of observable variables, such as the demographic composition of the household, education attainment, seasonal dummies and so on. Theoretically, the introduction of these variables stems from the fact that we allow the parameter \( \alpha \) in the instantaneous utility function to depend on them. Empirically, it means that we are allowing the taste for leisure and consumption to depend on these variables. We are therefore not using the variability in wages across categories defined by these variables to estimate the relevant elasticities. For instance, if we allow the MRS to depend on the level of education of the wife, we are not using the different in average wages for women with different levels of education to identify their labor supply elasticity. As to be expected, what taste shifters are introduced in the MRS does make a difference for the size of the estimated elasticities. Attanasio et al. (2012) use education and regional dummies as taste shifters. Given this degree of flexibility they rely on the variation over time in wages. A similar argument can be made about the intertemporal conditions and the Euler equation.

2. A large majority of the labor supply literature is based on regressions of hours of work on wages and other variables. Very few studies use consumption information and many rely on other variables to control for the marginal utility of wealth. It is not obvious what is the effect of these different approximations on the size of the labor supply elasticities.

3. Often wages are measured by hourly earnings obtained dividing total earnings by hours. If hours are affected by measurement errors, this approach might introduce substantial correlation between the variable on the right-hand side (wages) and the residuals. Many studies use IV techniques to take care of this problem (and possibly of the endogeneity of wages). While asymptotically the normalization of the MRS equations should not make a difference, in practice it may.
equations (12) and (13) might yield very different estimates. Only a few studies—such as Blundell, Meghir, and Neves (1993)—use normalization free methods, such as limited information maximum likelihood (LIML).

4. While intratemporal conditions do not speak to the issue of separability between consumption and leisure, intertemporal ones do. And, as mentioned before (see Keane 2010), whether consumption and leisure are separable is important for the characterization and the size of Frisch elasticities. Separability is routinely assumed in the labor supply literature, with very few exceptions. And yet much evidence from the literature on consumption Euler equations points out to important non-separabilities (see, for instance, Attanasio 2000).

5. In the model in the second section, we have taken the wage process as exogenous and, therefore, ruled out returns to experience. Imai and Keane (2004) and Keane and Rogerson (2012) have strongly argued that ignoring returns to experience leads to substantial underestimation of labor supply elasticities. If returns to experience are relevant at the extensive margin, then the analysis of MRS that we proposed in the second section goes through. If not, a much more complex analysis is necessary. In any case, returns to experience should be explicitly considered when regarding labor supply behavior.

6. If the participation margin is important and if this margin is driven by fixed costs and the like, it is unavoidable to rely on a fully structural model that needs to be calibrated and/or estimated. Much more work is necessary to understand fully the identification of such models and what aspects of the data identify which components of these models.

Conclusions

This article makes an important point: macro models often appeal to the extensive margin to generate large aggregate hours elasticities. However, the extensive margin elasticity should not be considered a free parameter that should be used to fit the aggregate data. Instead, it should be calibrated to microdata.

When they try to relate the extensive margin Frisch elasticity that is necessary to embed in a simple macro model to reproduce aggregate fluctuations to the evidence that comes out of quasi-experimental studies they point out at an important mismatch: when feeding into the
model the wage changes observed in these quasi-experimental studies, they obtain responses that are much larger than what was observed in the data.

The main limitation of this exercise, in my opinion, is that the labor supply elasticity (or elasticities, if one considers both intensive and extensive margins and both what they call Hicksian and Frisch elasticities) do not exist. Aggregation issues in labor supply are pervasive the moment one deviates from the simplest specifications. Even at the intensive margin, elasticities can vary much over time and in the population. The extensive margin is particularly hard because one needs to specify the entire stochastic environment in which agents live.

At the extensive margin, the labor supply elasticity is likely to be very heterogeneous, time-varying, and path-dependent. There is a fundamental gap from the single parameter estimated in a quasi-experimental study and the structural parameters that has external validity.

A plausible and attractive strategy is to specify a complete model with different margins and identify its different components and parameters from different pieces of data. These models have limitations and are identified under a set of stringent assumptions. However, they impose the necessary structure and discipline to make the experimental evidence generalizable. Indeed, the variation induced by a quasi-experiment can profitably be used to estimate richer behavioral models.

Endnotes

I would like to thank Richard Blundell, Mike Keane, and Costas Meghir for some useful discussions. I am especially grateful to Hamish Low and Virginia Sanchez-Marcos for many discussions and suggestions on the topic of this discussion. Much of the material presented in this discussion draws on our joint work (Attanasio, Low, and Sanchez-Marcos 2008; Attanasio et al. 2012). For acknowledgments, sources of research support, and disclosure of the author’s material financial relationships, if any, please see http://www.nber.org/chapters/c12748.ack.

1. In a life cycle model, the same elasticities should be defined in a slightly more complicated manner to make clear whether initial wealth and the entire path of wages or current wealth and wages after the current one are kept constant.

2. Surprisingly few papers have estimated MRS specifications of the type estimated in Attanasio et al. (2012). In particular, very few papers use information on consumption. These include MaCurdy (1983), Altonji (1986), and Blundell, Meghir, and Neves (1993). It should be stressed that the sample used for this exercise is one of married couples. One would expect single women to be even more elastic in their labor supply responses.

3. The calibrations are not dissimilar from those in Attanasio, Low, and Sanchez Marcos (2008) and in Attanasio et al. (2012). I thank Virginia Sanchez Marcos for performing the computations used in these simulations.
References


