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Labor supply responses to the 1990s Japanese tax reforms

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A R T I C L E I N F O

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A B S T R A C T

The consumption-leisure choice model implies that an exogenous change in tax rates will induce a change in labor supply. This implication is expected to be important to labor supplied by secondary earners under a progressive tax system when spousal income alters effective marginal tax rates. This paper examines labor supply responses to the income tax changes associated with Japanese tax reforms during the 1990s. The results indicate that the hours-of-work elasticity with respect to the net-of-tax rate is 0.8 for married women.

1. Introduction

Consumer theory implies that an exogenous shift in the budget constraint will induce a change in labor supply. Such a shift can occur by tax changes. Tax reform often alters incentives faced by individuals and thus may alter their work effort. Behavioral responses to tax changes determine not only the relevance of economic theory but also the deadweight loss of taxation and government revenue. Estimating labor supply responses to tax rate changes is indeed one of the central issues in empirical labor economics and public finance.

During Japan's so-called lost decade of the 1990s, the government implemented various income tax cuts as a policy to stimulate the economy and as a by-product of political compromise to introduce and subsequently to increase the consumption tax in Japan. As in many countries, Japan maintains a progressive tax system, under which marginal tax rates go up in a stepwise fashion as income increases. On the one hand, the cross-sectional variation in tax rates itself is not considered exogenous because tax rates can vary according to hours of work. On the other hand, when tax reform is implemented, a change in the tax schedule can generate a plausibly exogenous cross-sectional variation in tax rates over time. A series of Japanese tax reforms during the 1990s provides a good opportunity to identify the labor supply responses to tax rate changes.

Married women are most likely to be affected by Japanese tax reforms among all demographic groups for several reasons. First, the literature suggests that male labor supply responses are zero or small whereas female labor supply responses are measurable and possibly large (Pencavel, 1987; Killingsworth and Heckman, 1987; Blundell and MaCurdy, 1999). Second, female labor supply is low in their late 20s and early 30s, and many married women work part time in their late 30s and 40s in Japan, whereas prime-age male labor supply is highly stable over the life cycle. Finally, there is the "spouse allowance" system in Japan, which makes secondary earners in households more susceptible to the effect of income tax. Under this system, households with low-income secondary earners are eligible for greater tax deductions; thus, there has been serious concern that married women work less and adjust their income so that the spouse allowance will not decrease.

This paper provides the first estimate of labor supply responses in Japan to the changes in tax rates associated with a series of tax reforms using the Japanese Panel Survey of Consumers (JPSC). The spouse allowance system also provides a useful source of variation in tax rates. A life-cycle model of labor supply is used to analyze the impact of tax reforms. After deriving an intertemporal labor supply function, a simple solution is developed to solve the selection problem in employment for the panel data model with endogenous regressors. An important advantage of the approach here is that it can flexibly allow for the unobserved heterogeneity that may be correlated with the regressors.

The next section presents an intertemporal optimization problem and derives an estimable form of the intertemporal labor supply function. Section 3 discusses the econometric problems that can arise in estimating the labor supply model. Section 4 describes the key

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features of the Japanese tax system and the 1990s tax reforms. Section 5 describes the panel data used in the analysis. Section 6 presents the empirical results. The final section provides a conclusion.

2. Theoretical framework

2.1. The model

Quasi-experimental studies typically use a static consumption-leisure choice model as theoretical framework to analyze the impact of tax reforms on labor supply (Eissa and Liebman, 1996; Moffitt and Wilhelm, 2000; Meyer and Rosenbaum, 2001; Eissa and Hoynes, 2004).[1] Eissa and Hoynes (2004) describe explicitly a unitary household model in which the primary and secondary earners sequentially decide hours of work. This study considers a dynamic model of consumption and labor supply with uncertainty, although the assumption that married women are secondary earners who make their labor supply decisions conditional on their husband's income is maintained here, too, in order to exploit the variation in tax rates from the spouse allowance system in the empirical analysis. Recently, Blundell et al. (2007a) have developed the collective model of household labor supply in which male labor supply is discrete and female labor supply is continuous and possibly censored. The extension of the collective labor supply model to an intertemporal framework is, however, left for future work. Moreover, the assumption of sequential decision making made here seems a fair approximation of the actual decision process because more than 95% of observations in the JPSC sample are couples in which the husband works full time and the husband's earnings are greater than or equal to the wife's earnings.

The conceptual framework adopted here is the intertemporal model of labor supply à la Heckman and MaCurdy (1980) and MaCurdy (1981, 1985). The model involves uncertainty because most tax reforms are best described as once-and-for-all unanticipated shifts in net-of-tax wages in the present and the future, as noted by Blundell and MaCurdy (1999). Denote by E_t the expectation operator conditional on an information set in period t. Assuming that preferences are additively separable over time and between consumption and leisure, the intertemporal optimization problem faced by married women is to maximize the expected value of the discounted sum of total utility:

$$\mathbb{E}_0 \sum_{t=0}^{T} (1+\rho)^{-t}\left[u^c(c_t, s_{1t}) + u^h(h_t, s_{2t})\right] \tag{1}$$

subject to the budget constraint:

$$a_{t+1} = (1+r_{t+1})a_t + (1-\tau_t)w_t h_t - c_t - p_t q_t, \tag{2}$$

where ρ represents the rate of time preference, c is the consumption, h is the number of hours worked, s_1 and s_2 are preference shifters, a is the asset, r is the net-of-tax real rate of return on assets, w is the hourly wage rate, τ is the effective marginal tax rate, p is an indicator that equals one if the number of hours worked is positive and equals zero otherwise, and q is fixed costs of work.

A dynamic programming formulation of this problem provides a convenient framework for characterizing optimal consumption and hours decisions. Define $V(a_t, s_t)$ as the optimum value of the consumption-leisure choice problem given information up to period t. The value function satisfies the Bellman equation:

$$V(a_t, s_t) = \max\left[u^c(c_t, s_{1t}) + u^h(h_t, s_{2t}) + \frac{1}{1+\rho}\mathbb{E}_t V(a_{t+1}, s_{t+1})\right], \tag{3}$$

where s includes all relevant state variables.

[1] See also Moffitt and Kehrer (1981) and Pencavel (1987) for experimental studies on the US negative income tax programs in the late 1960s and 1970s.

The optimal solution can then be characterized by first-order conditions for consumption and hours, together with an intertemporal condition for the marginal utility of wealth in period t:

$$u_c^c(c_t, s_{1t}) = \lambda_t, \tag{4a}$$

$$u_h^h(h_t, s_{2t}) \geq -\lambda_t \omega_t, \tag{4b}$$

$$\lambda_t = \frac{1+r_{t+1}}{1+\rho}\mathbb{E}_t \lambda_{t+1}, \tag{4c}$$

where ω is the after-tax wage rate, and λ is the Lagrange multiplier associated with the budget constraint. The derivation uses the result that the Lagrange multiplier equals the marginal utility of wealth by the Envelop theorem. Eqs. (4a) and (4b) can be solved for consumption and hours in terms of ω, λ, s_1 and s_2 in the current period. The marginal utility of wealth (λ) serves as the sufficient statistic that captures all information from other periods that is needed to solve the current-period maximization problem. The implied solution for hours is referred to as the Frisch (or λ-constant) labor supply function.

To derive an estimable form of the labor supply function, consider the most popular parametric form in the analysis of intertemporal labor supply. While the instantaneous utility of consumption can remain unspecified, the utility of leisure is specified as an isoelastic function that exhibits constant relative risk aversion (CRRA) as follows:

$$u^h(h_t, s_{2t}) = -\exp\left(-\frac{f + \delta k_t + v_t}{\sigma}\right)\cdot\frac{1}{1+\frac{1}{\sigma}}h_t^{1+\frac{1}{\sigma}}, \tag{5}$$

where f is the time-constant unobserved taste heterogeneity, k is the number of young children, and v is an idiosyncratic preference shock. [2] Although the implied solution conveniently helps the interpretation of the model, the isoelastic function excludes a corner solution. Given the fact that some married women are not employed, to allow for a corner solution, consider an exponential function that exhibits constant absolute risk aversion (CARA) as follows:

$$u^h(h_t, s_{2t}) = -\exp\left(-\frac{f + \delta k_t + v_t}{\alpha}\right)\cdot\alpha\, exp\left(\frac{h_t}{\alpha}\right), \tag{6}$$

In the presence of uncertainty, the marginal utility of wealth can be written as:

$$\ln\lambda_t = \mathbb{E}_{t-1}\ln\lambda_t + \epsilon_{t,} \tag{7}$$

where ε is the forecast error. The Euler Eq. (4c) can then be rearranged as:

$$\ln\lambda_t = \phi_t + \ln\lambda_{t-1} + \epsilon_{t,} \tag{8}$$

where $\phi_t = ln\frac{1+\rho}{1+r_t} - \ln(E_{t-1}\exp(\epsilon_t))$.[3] The ϕ term can be captured by a common macroeconomic effect if ϵ is identically distributed across individuals. Substituting backward in Eq. (10) yields

$$\ln\lambda_t = \textstyle\sum_{\iota=1}^{t}\phi_\iota + \ln\lambda_0 + \sum_{\iota=1}^{t}\epsilon_\iota. \tag{9}$$

That is, the λ term can be captured by a time effect that is common across individuals and a fixed effect that can vary across individuals. The forecast error can be decomposed as:

$$\epsilon_t = \gamma\triangle\ln\omega_t + \xi_{t,} \tag{10}$$

[2] Age and its square can also be included as taste shifters, but the estimating equation derived below remains essentially unchanged.

[3] Eq. (7) can be written as $\lambda_t = \exp(\mathbb{E}_{t-1}\ln\lambda_t)\exp(\epsilon_t)$. Taking expectations yields $\mathbb{E}_{t-1}\lambda_t = \exp(\mathbb{E}_{t-1}\ln\lambda_t)\mathbb{E}_{t-1}\exp(\epsilon_t)$, or equivalently, $\exp(\mathbb{E}_{t-1}\ln\lambda_t) = \frac{E_{t-1}\lambda_t}{E_{t-1}\exp(\epsilon_t)}$. Thus, $\lambda_t = \mathbb{E}_{t-1}\lambda_t\frac{\exp(\epsilon_t)}{E_{t-1}\exp(\epsilon_t)}$. The Euler Eq. (4c) in period $t-1$ can be rewritten as $\mathbb{E}_{t-1}\lambda_t = \frac{1+\rho}{1+r_t}\lambda_{t-1}$. Hence, $\lambda_t = \frac{1+\rho}{1+r_t}\lambda_{t-1}\frac{\exp(\epsilon_t)}{\mathbb{E}_{t-1}\exp(\epsilon_t)}$.