Seminar Paper No. 727

WHY DO EUROPEANS WORK SO LITTLE

by

Conny Olovsson

INSTITUTE FOR INTERNATIONAL ECONOMIC STUDIES
Stockholm University

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stimulate discussion and critical comment.

February 2004
Institute for International Economic Studies
S-106 91 Stockholm
Sweden

Why do Europeans Work so Little?

Conny Olovsson*

February 9, 2004

Abstract

Market work per person is roughly 10 percent higher in the U.S. than in Sweden. However, if we include the work carried out in home production, the total amount of work only differs by 1 percent. I set up a model with home production, and show that differences in policy - mainly taxes - can account for the discrepancy in labor supply between Sweden and the U.S. Moreover, even though the elasticity of labor supply is rather low for individual households, labor taxes are estimated to be associated with considerable output losses. I also show that policy can account for the falling trend in market work in Sweden since 1960. The largest reduction occurs from 1960 until around 1980, both in the model and the data. After the early 1980s, the trends for both taxes and actual hours worked are basically flat. This is also true for hours worked in the model.

JEL Classification D13 H24 J22

Keywords: Labor supply, taxes, home production

International comparisons highlight quite large differences in the extent of market work across OECD countries. Fig. 1 below displays the average annual work hours across a subset of countries. I only find European countries at the lower and non-European countries at the higher end.[1] The difference between these ends is larger than 400 hours per year, that is, on average, people in New Zealand work 43 percent more than workers in Italy.[2]

*Institute for International Economic Studies, Stockholm University, 106 91 Stockholm Sweden, e-mail: conny@iies.su.se.
I am grateful for comments from Kjetil Storesletten, Mats Persson, Jeremy Greenwood, Edward Prescott, Assar Lindbeck and seminar participants at IIES, Stockholm School of Economics, The Research Institute of Industrial Economics, and Department of Economics, Stockholm University. Thanks to Annika Andreasson and Christina Lönnblad for editorial assistance. Financial support from the Jan Wallander and Tom Hedelius Foundation is greatly acknowledged.

[1] The data is for 2002 and is taken from the OECD Labor database. There are basically two reasons why I am focusing on people aged between 20-64. First of all, this is the population examined in the Swedish time use surveys. Second, the conflict of how to allocate the total amount of work time between market work and domestic work seems most relevant for people of these ages.

[2] A natural objection to the above data may be that these differences could be driven by the quite low level of employment (especially for women) in some European countries. However, the picture looks pretty much the same when we look at the average annual hours per employee. The European countries are once more found at the lower end, and the non-European countries at the higher end.

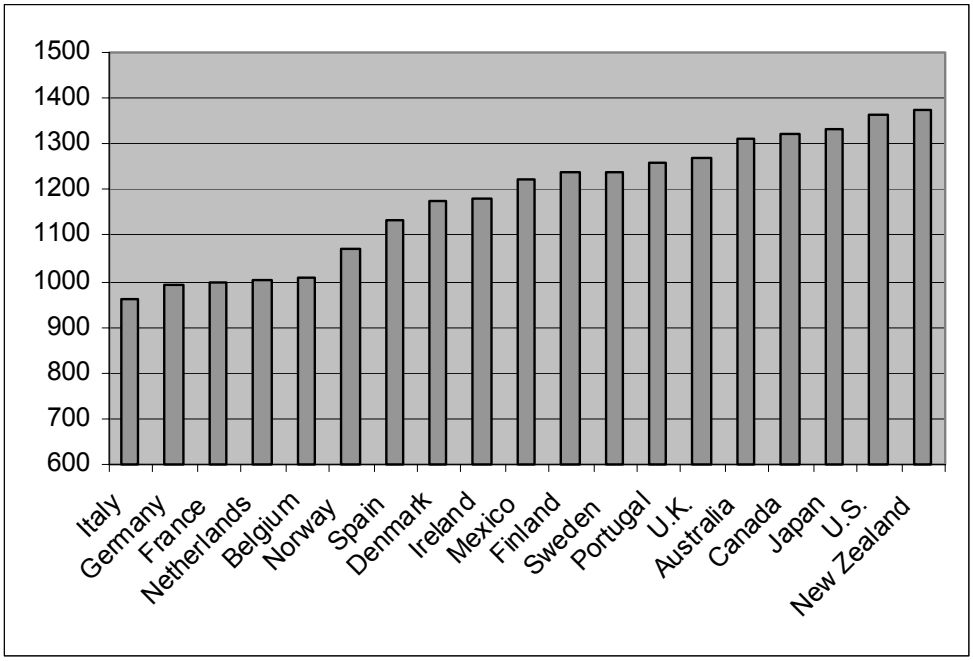

Figure 1: AVERAGE ANNUAL HOURS OF MARKET WORK PER PERSON (20-64)

Theoretical explanations for these differences could, for instance, be cross-country heterogeneity in preferences, labor taxes, benefits or any other factor influencing the incentives to supply labor. Matching the data with assumptions of heterogeneity in preferences is probably quite easy. This is worth noting, but too obvious to really be of interest. More challenging are questions about actual policy such as that dealt with in this paper: Could the differences in Fig.1 have been generated by cross-country heterogeneity in policy? Policy will be more explicitly defined below, but taxes will be the main policy instrument of analysis and I will concentrate on Sweden and the U.S. The reason for focusing on these two countries is that, to some extent, they represent polar extremes. Among the OECD countries, the U.S. has the second highest level of market work per person, in combination with a very low tax burden.[3] Sweden, on the other hand, has the highest tax burden and a much lower level of market work.[4]

The problem in explaining differences in labor supply by cross-country heterogeneity in labor taxes, is

[3] By tax burden I mean total tax revenue as a share of GDP (OECD Revenue statistics 2003). For the OECD countries, only Japan, Mexico and Korea have a lower tax burden than the U.S.

[4] Still, Sweden is at the upper end among the European countries, indicating that taxes alone cannot explain the differences. It has been pointed out that, besides taxes, the way the government uses its revenue may actually have a strong influence on the level of labor supply (see Lindbeck (1982) and Rogerson (2003b)). A feature of the model introduced in the next section is that labor supply is increasing in government consumption. As a result, the model will also, at least qualitatively, be consistent with Sweden's relatively high level of labor supply.

that the effect of labor taxation in standard models may generally be ambiguous. In particular, income and substitution effects often work in opposite directions, making the total effect sensitive to the chosen calibration. Moreover, as shown later in this paper, for a calibration of the model consistent with micro data, the net effect will generally not be sufficiently large to account for differences in labor supply of the magnitude displayed in Fig.1.

This paper takes into account the fact that households carry out a substantial amount of work outside their workplaces, mainly in home production. In Sweden, a working household devotes on average 44 percent of its total working time (consisting of market work and home production) to home production. The relation between the average annual hours of paid and unpaid work in Sweden and the U.S. is displayed in Fig. 2 below:

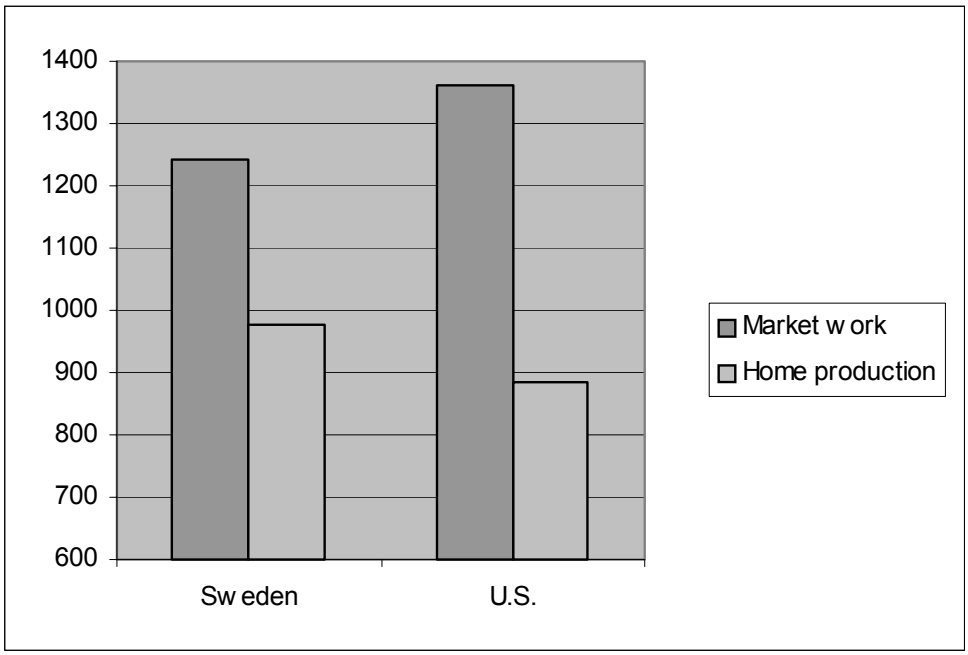

Figure 2: ANNUAL HOURS OF PAID AND UNPAID WORK

Market work per person is roughly 10 percent (more than 120 hours) higher in the U.S. than in Sweden, corresponding to 3 weeks of full time work per person and year, which is a substantial number. However, what is also displayed in Fig. 2 is that average total work only differs by 1 percent (or less than

three quarters of a week of full time work).[5] The difference seems to be that Swedes allocate a larger share of their total work effort to home production.

Examples of services produced in home production are child care, cleaning, shopping, preparing dinner but also repairs of household goods and vehicles. In most cases, households also have the option of buying these services on the market. A household's choice between buying and producing services will therefore generally depend on the price of market-produced services, and its productivity in market work relative to its productivity in home production. Taxes may distort this choice in two significant ways.[6] First, service taxes (VAT) raise the price of market-produced services, making them a less attractive deal. Second, labor taxes distort the household's time allocation choice between working in the market and in home production. Basically, labor taxes reduce the return to market work and increase the return to home production in relative terms. As a result, households subject to labor taxes may start allocating their time to home production instead of market work, even though their productivity may be lower in the former activity than in the latter. Their allocation of total work between market work and home production will no longer be governed by the law of comparative advantage but - in the words of Davis & Henrekson (2001) - by the tax distorted law of comparative advantage.

In addition to taxes, I analyze the implications of the variance in the wage distribution for aggregate labor supply. This variance may be expected to affect the demand for market-produced services, since compressed wages may impel high-productivity households to substitute market-produced for home-produced services. As a result, market work will decrease.

Naturally, a legitimate question is whether we should actually care about cross-country differences in the hours worked? My answer is that it is important to understand whether the observed numbers could have been generated by economic incentives. GDP per capita was 31 percent higher per person aged

[5] The data on market work is for 2002, and is once more taken from the OECD Labor database. The data on home production in Sweden is based on the estimate that Swedish households devote, on average, 44 percent of their total working time to domestic work. This relation has actually been quite robust over time (Juster & Staford (1991) and Tid för Vardagsliv. Kvinnors och mäns tidsanvändning 1990/91 och 2000/2001 (2003)). For the U.S., the data on home production is taken from Juster & Staford (1991), wherein it is reported that Americans devote, on average, 39.4 percent of their total working time to domestic work. The Swedish data in Juster & Staford (1991) is claimed to match the U.S. classification scheme. However, the numbers must be treated with some caution. The reason is that the data is generally for men and women aged between 20-64, except for the data in Juster & Staford (1991), which is for men and women aged 25-64.

[6] By now, it is quite well known that taxes may be somewhat more distortionary in the presence of home production; see, for example, Lindbeck (1981), McGrattan et al (1993), Pålsson (1997), Henrekson (1998) and Davis & Henrekson (2001).

20-64 in the U.S. than in Sweden in the year 2002.[7] There certainly exists a need to evaluate to what extent this difference can be accounted for by the fact that Swedes spend more time in home production where, on average, they are less productive.

To test the hypothesis that differences in labor supply are driven by cross-country heterogeneity in policy, I set up a dynamic general equilibrium model consisting of many households with three arguments in their utility function: consumption goods, services and leisure. Services may be bought at the market, or produced in home production.[8] Households are assumed to be heterogenous in labor productivity and, on average, their productivity will be higher in market work than in home production. The assumption of heterogeneity allows me to analyze the effects of wage dispersion. Households in the model must thus allocate their income between consumption goods and market-produced services, and their time between market work, home production and leisure.

The model is calibrated to match a number of Swedish features, such as time spent in market work and home production. A key parameter here is the Frisch elasticity of labor supply, calibrated to be less than 0.5 in accordance with empirical estimates.[9] Another important parameter in the model, governing a household's choice between market-produced and home-produced services, is the elasticity of substitution between these two objects. To estimate this elasticity, I use Swedish data on spending and estimate the fraction of total expenditures of Swedish households on market-produced services as a function of their disposable income. The elasticity is found to be 1.33, implying market-produced and home-produced services to be close to perfect complements.[10] This low elasticity supports the widespread notion among Swedes that even high-productivity households choose to engage a great deal in home production, instead of buying market-produced services. Policy parameters, such as taxes, wage dispersion and government consumption are set to their Swedish 2002 estimates. Finally, the policy parameters are changed to U.S. data to explore whether the model matches U.S. hours in market work and home production.

It is found that the model matches time spent in both market work and in home production, very well.

[7] Data on PPP adjusted GDP from the OECD Statistical Database.

[8] This assumption separates this paper somewhat from earlier macro research on home production. See, for instance, McGrattan (1993); Greenwood et al (1994); and Klein and Jonsson (2003). An exception is Rios-Rull (1993).

[9] The Frisch is defined as the elasticity of labor supply with respect to wage, holding the marginal utility of consumption constant. The standard assumption in the literature on the effect of taxes on labor supply, is log utility in leisure. This implies that the Frisch elasticity roughly ranges between 1 and 4. This may be true for the aggregate, but at the micro level, this elasticity is estimated to be in the interval $[0, 0.5]$. See Browning et al (1999) for a survey.

[10] Which they would be if the elasticity were 1.

The model predicts the GDP per capita to be 12 percent higher in the U.S. than in Sweden as a result of different policies. These results show that Swedish policy heavily influences the choice between home production and market work. The distortion comes from taxes in general, and labor taxes in particular. Even though the Frisch elasticity of labor supply is rather low in the model, labor taxes generate a substantial output loss. In fact, the model predicts that the Swedish GDP per capita would increase by almost 27 percent as a result of changing to U.S. tax rates (i.e, while holding other policy parameters constant). This is a huge number, roughly equal to 6800 dollars/person (denominated in 2001 prices).

The value added tax on services is found to be the least distortionary among the set of taxes analyzed in this paper. Reducing service taxes in Sweden from the present level of 25 to 0 percent would, according to the model, only slightly increase output (by 3 percent). This mild distortion is due to the low elasticity of substitution between market-produced and home-produced services.

A higher degree of wage dispersion is found to decrease market work, increase home production and slightly reduce output. The reason is that a higher dispersion enhances the incentive to supply labor for high-productivity households, while it is reduced for low-productivity households. The net effect is negative, but the fall in GDP per capita stemming from the smaller work effort of low-productivity households, is almost completely offset by the increased work effort of high-productivity households.

The model is also consistent with the falling trend in hours worked since 1960. The largest reduction occurs from 1960 until around 1980, both in the model and in the data. After the early 1980s, the trends for both taxes and hours worked are basically flat. This is also true for hours worked in the model. However, the model clearly overestimates the number of hours worked between 1960 and 1975.

Several recent related studies are analyzing the causes of labor supply, but they all differ from this paper in several important aspects. For instance Davis and Henrekson (2001), do not have a quanatitative approach. Neither Prescott (2003) nor Rogerson (2003a, b) consider heterogeneity in labor productivity (which may be important for the way an economy allocates time across market and nonmarket activities). Finally, Nickell (2003) concentrates on empirical findings concerning the effects of taxes and labor market institutions on the labor supply. Maybe most important, this paper is one of the first to incorporate an elasticity of labor supply consistent with micro estimates.

1 THE MODEL

1.1 CONSUMERS

Consider an economy with a continuum of infinitely lived households. The instantaneous utility for household i in period t is specified by

$$u\left(c_{it}, s_{it}, l_{it}\right) = \frac{\left(c_{it}^{\eta} s_{it}^{1-\eta}\right)^{1-\gamma}}{1-\gamma} + \varphi \frac{l_{it}^{1-\mu}}{1-\mu}, \tag{1}$$

where c_{it} is consumption goods, s_{it} services and l_{it} leisure.[11] Households can either buy services at the market or produce them themselves at home, i.e. in home production. For simplicity, the production function for services is assumed to be a linear function of efficiency hours $\epsilon_{hp} h_{it,hp}$ of work only.

$$f^{S}\left(\epsilon_{hp} h_{it,hp}\right) = \epsilon_{hp} h_{it,hp}, \tag{2}$$

where $h_{it,hp}$ is the time household i devotes to home production and ϵ_{hp} the productivity in that activity. I assume all households to have the same constant productivity in home production, i.e. that $\epsilon_{hp} = \overline{\epsilon}_{hp}$. Services are thus an aggregate of market-produced services $s_{it,m}$, and home-produced services $s_{it,hp}$:

$$s_{it} = \left[a\left(s_{it,m}\right)^{b} + (1-a)\left(s_{it,hp}\right)^{b}\right]^{\frac{1}{b}}. \tag{3}$$

Households supply labor to the labor market, consisting of the goods market and the service sector. We may consider this economy as one where households work some hours in the goods market and some in the service sector, so that the total amount of labor supply h_{it}, equals $h_{it,g} + h_{it,s}$.

I abstract from earnings uncertainty by assuming each household to be endowed with a constant, but heterogenous level of labor productivity $\epsilon_i = e^{\xi_i}$, where ξ is a permanent component assumed to be normally distributed with the mean zero and the variance σ_{ξ}^2. Each household also has one unit of productive time per week, which must be divided between labor, home production and leisure

[11] As a starting point, I have assumed a Cobb-Douglas function for consumption goods and services. Naturally, this implies that they are perfect complements.

$$h_{it} + h_{it,hp} + l_{it} = 1. \tag{4}$$

For households to be indifferent between working in the goods sector and the service sector, the wage rate must be the same in those two sectors, i.e. $w_{t,g} = w_{t,s} = w_t$. Denoting taxes on consumption, services and labor income by θ_t^C, θ_t^S and θ_t^I, respectively, the budget constraint of household i is

$$\left(1 + \theta_t^C\right) c_{it} + \left(1 + \theta_t^S\right) p_t s_{it,m} + a_{it+1} = \epsilon_i w_t h_{it} \left(1 - \theta_t^I\right) + (1 + r_t) a_{it} + \psi_t, \tag{5}$$

where a_{it+1} is the assets the household chooses to hold for the next period, p_t the market price of services, r_t the interest rate, w_t the wage rate in period t and ψ_t a transfer from the government.[12] Finally, it will be assumed that households cannot short-sell any assets[13]

$$a_{it+1} \geq 0, h_{it} \geq 0, s_{it,m} \geq 0, h_{it,hp} \geq 0. \tag{6}$$

Let β denote the subjective discount factor. The households' maximization problem is then to maximize their expected life-time utility,

$$U_0 = E_t \sum_{t=0}^{\infty} \beta^t u\left(c_{it}, s_{it}, l_{it}\right),$$

subject to (4), (5) and (6).

Finally, let $\chi(a, \xi)$ be the measure of households, and normalize the mass of households to unity.

1.2 FIRMS

The production side of the economy consists of goods and services. There is no aggregate uncertainty in the economy. Let K_t denote the period t aggregate capital stock, and $H_{t,g}$ the aggregate labor supply in efficiency units in the goods market, i.e. $H_{t,g} = \int \epsilon(\xi) h_g(a, \xi) d\chi$. The aggregate production of

[12] Due to the fact that households do not face any uncertainty, the distribution of wealth will depend on the initial wealth distribution. Chatterjee (1994) shows that in this type of model, the main properties of the wealth distribution are self-perpetuating and that people do not move from one economic level to another. That is, if all households hold the same wealth today, they will also hold the same wealth tomorrow.

[13] It is not important that the shortselling restriction for asset holdings binds at zero.

consumption goods is assumed to be given by

$$F\left(K_t, H_{t,g}\right) = K_t^{\alpha} H_{t,g}^{1-\alpha}. \tag{7}$$

Moreover, let $H_{t,s}$ be the aggregate labor supply in efficiency units in the service sector, i.e. $H_{t,s} = \int \epsilon\left(\xi\right) h_s\left(a,\xi\right) d\chi$. According to (2), the aggregate production of market-produced services is then given by $H_{t,s}$.

Firms are assumed to maximize their profit, while taking prices as given. Moreover, in a given period, firms must pay the period t payroll tax, θ_t^P.

1.3 THE GOVERNMENT

Let C_t denote the period t aggregate consumption of goods and $S_{t,m}$ the aggregate demand for market-produced services, i.e. $C_t = \int c\left(a,\xi\right) d\chi$, and $S_{t,m} = \int s_m\left(a,\xi\right) d\chi$. The period t income of the government is then

$$\left(\theta_t^I + \theta_t^P\right) w_t H_t + \theta_t^C C_t + \theta_t^S p_t S_{t,m}. \tag{8}$$

The government consumes a portion, G_t, and then makes a lump-sum transfer, Ψ_t, back to all households. For simplicity, government consumption is assumed to be useless. Moreover, the government is required to balance its budget in each period:[14]

$$\left(\theta_t^I + \theta_t^P\right) w_t H_t + \theta_t^C C_t + \theta_t^S p_t S_{t,m} - G_t = \Psi_t. \tag{9}$$

It has been pointed out that, besides taxes, the way the government uses its revenue may actually have a strong influence on the level of labor supply.[15] For instance, the relatively high level of labor supply in the Scandinavian countries, may to some extent be due to the fact that Scandinavian governments spend a relatively larger fraction of their money on child care (which is likely to stimulate labor supply). This mechanism will actually be present in the model, in an indirect way. Notice from (9) that benefits

[14] This is a natural benchmark, since the analysis will mainly concentrate on steady states.
[15] See Lindbeck (1982) and Rogerson (2003b).

are decreasing in government consumption (i.e., holding tax revenues constant). Lower benefits will then increase the incentive to supply labor. In this way, the model will, at least qualitatively, be consistent with Sweden's relatively high level of labor supply among the European countries.

2 EQUILIBRIUM

Denote the vector of taxes by $\Theta = \left[\theta^C, \theta^S, \theta^I, \theta^P\right]$. An equilibrium for this economy is then given by (i) decision rules for agents' asset holdings $a_{it+1} = \widehat{a}'\left(a_{i,t}, \xi_i; p, r, w, \Theta, \Psi\right)$, demand for market-produced services $s_{it,m} = s\left(a_{i,t}, \xi_i; p, r, w, \Theta, \Psi\right)$, hours of work in the service sector $h_{it,s} = h_s\left(a_{i,t}, \xi_i; p, r, w, \Theta, \Psi\right)$, hours of work in the goods market $h_{it,g} = h_g\left(a_{i,t}, \xi_i; p, r, w, \Theta, \Psi\right)$; (ii) aggregate values for asset holdings $A\left(p, r, w, \Theta, \Psi\right) = \int \widehat{a}'\left(a_{i,t}, \xi\right) d\chi$, the demand for market-produced services $S_m\left(p, r, w, \Theta, \Psi\right) = \int s\left(a_{i,t}, \xi\right) d\chi$, the level of efficiency units of labor supplied to the service sector $H_s\left(p, r, w, \Theta, \Psi\right) = \int h_s\left(a_{i,t}, \xi\right) d\chi$ and the goods sector $H_g\left(p, r, w, \Theta, \Psi\right) = \int h_g\left(a_{i,t}, \xi\right) d\chi$ such that the following conditions hold:

- The decision rules solve households' maximization problem
- Households are indifferent between working in the goods market and the service sector, i.e.

$$w_s = w_g = w. \tag{10}$$

- Factor markets clear

$$r = F_K\left(K, H_g\right) - \delta \tag{11}$$

$$w_{t,g} = F_{H_g}\left(K, H_g\right) \tag{12}$$

$$p = w, \tag{13}$$

where (13) can be obtained from the fact that profit in the service sector must be zero.

- Tax revenues equal government expenses, i.e. equation (9) holds
- The aggregate supply of savings is equal to firms' demand for capital,

$$A\left(p,r,w,\Theta,\Psi\right)=K\left(p,r,w,\Theta,\Psi\right). \tag{14}$$

- The demand for services equals the supply

$$S_m\left(p,r,w,\Theta,\Psi\right)=H_S\left(p,r,w,\Theta,\Psi\right). \tag{15}$$

Equation (13) can easily be derived from the profit maximization problem faced by firms in the service sector.

3 Computation of equilibrium

The computation of the steady state is very standard. Fix the tax rate and guess on K, H and H_s, with $H_g = H - H_s$. Compute prices, r, w, p and transfers, Ψ. Solve the households' problems. Check if aggregate savings are equal to the aggregate demand for capital, and if the implied labor supply equals the guess. Otherwise, update the guess and start again.

4 Calibration

My first goal is to calibrate the model to match a number of Swedish features. On the production side, standard values are used for the parameters, namely $\alpha = 0.3$; $\delta = 0.08$. The preference parameters are β, γ, μ, η, φ, a and b. I set $\beta = 0.96$ in order to generate an interest rate at around 4 percent. The intertemporal elasticity of substitution for consumption is set to 0.5 (which implies $\gamma = 2$), and parameter μ is set to 5, which implies that, on average, the intertemporal (Frisch) elasticity of substitution for labor

will be equal to 0.48.[16] These elasticities are within the range of the existing estimates.[17]

Parameter η is quite tricky to pin down, because it determines the elasticity of substitution between consumption and services (both home produced and market produced), which is a non-observable number. Instead, I set out to match the fact that Swedes spend more than 3 times more of their disposable income on goods than on (market-produced) services.[18] I set $\eta = 0.5410$, which generates a ratio around 3.2.

The weight parameter on leisure, φ, is set to match the average hours of market work. For Sweden, the average hours of market work are 23.88 hours per week (see table 3 below) and the implied value for φ is 0.895. The productivity parameter, $\overline{\epsilon}_{hp}$, is calibrated to match the hours worked in home production. For Sweden, the relationship between market work and home production is very stable in all three studies: Swedes devote approximately 56 percent of their total working time to market work and 44 percent to home production. To match this, I calibrate the model so that "the model Swedes" devote 18.76 hours per week to home production. I set $\overline{\epsilon}_{hp} = 0.43E[\epsilon_{it}]$.[19]

A key parameter governing a household's choice between market-produced and home-produced services is b, since the elasticity of substitution between these two goods is $\frac{1}{1-b}$. For example if $b = 1$, then $s_{it,m}$ and $s_{it,hp}$ are perfect substitutes, and if $b = 0$, then s_{it} is a Cobb-Douglas function of $s_{it,m}$ and $s_{it,hp}$, so that they are complements. In order to pin down b and a, I estimated (using a simple OLS-regression) the fraction of total expenditures households spend on market-produced services as a function of their disposable income.[20] a and b are then set to match the intercept and the slope of the estimated function.[21] The implied values are $b = 0.25$, and $a = 0.3835$.

I now turn to the policy parameters. The taxes included are set to $\theta^P = 0.3282; \theta^I = 0.3052; \theta^C = \theta^S = 0.25$. The parameter σ^2_ξ, determining the degree of wage dispersion, is calibrated with estimates from Flodén and Lindé (2001). For Sweden, they find that $\sigma^2_\xi = 0.143$.[22] Government consumption, G, is set to 25.7 percent of GDP, which is the value reported in European Economy (2000), table 61b.

[16] The Frisch elasticity of labor supply is defined as the elasticity of labor supply with respect to the wage keeping the marginal utility of consumption constant. In the model, this elasticity is given by $\frac{l_{it}}{h_{it}}\frac{1}{\mu}$.

[17] See Browning et al (1999) for a survey.

[18] See SOU (1997), table 3.16. I have excluded house rents from private consumption.

[19] In the model, $E[\epsilon_{it}] = 1.0743$.

[20] The data, which is taken from Utgiftsbarometern 2001 (2002), table 6, is denoted for deciles. Once more, I excluded house rents.

[21] a determines the intercept and b the slope.

[22] I thus view wage dispersion as a policy instrument. Admittedly, this is a somewhat crude way of capturing the ambition of some unions in Europe to compress wages.

Once the model is calibrated to Sweden, I am ready to test the hypothesis that differences in labor supply are driven by cross-country heterogeneity in policy. As stated above, this is done by re-calibrating all policy parameters so that they are consistent with U.S. data. At the same time, all preference and production parameters are kept constant.

Taxes for the U.S. are set to $\theta^P = 0.138$; $\theta^I = 0.2015$; $\theta^C = 0.0825; \theta^S = 0$.[23] The estimate for σ_ξ^2, is once more taken from Flodén and Lindé (2001), where they find that $\sigma_\xi^2 = 0.375$. U.S. government consumption, G, is set to 14.1 percent of GDP.[24] Finally, some assumptions regarding the wealth distribution are needed. I assume the distribution of wealth to be the same in both countries, and that the fraction of wealth held by the respective quintile is $\begin{bmatrix} 0 & .01 & .08 & .19 & .72 \end{bmatrix}$.[25]

To sum up, the parameters in table 1 are kept constant throughout the analysis, while the policy parameters in table 2 are changed.

Table 1: Preference parameters

β	γ	μ	φ	a	b	η	α	δ	ϵ_{hp}
0.96	2	5	0.895	0.3835	0.25	0.541	0.3	0.08	$0.43E[\epsilon_{it}]$

Table 2: Policy parameters

	θ^P	θ^I	θ^C	θ^S	σ_ξ^2	G (SHARE OF GDP)
SWEDEN	0.3292	0.31	0.25	0.25	0.143	0.257
U.S.	0.138	0.2015	0.0825	0	0.375	0.141

The target numbers are summarized in table 3 below. The data is the same as in Fig.2, except that the

[23] The employer is subject to a 7.65 percent Social Security and Health Insurance tax. In addition, the employer has to pay unemployment insurance, and workers' compensation, generating a total payroll tax of 13.8 percent. The employee pays 10 percent in federal income taxes (a household with two workers), and a 7.65 percent Social Security and Health Insurance tax. In addition, the employee pays 2.5 percent in state and local income taxes. The above tax rates are based on Schneider (2002) and Stansel (1998). The average sales tax on goods in the U.S. combining state, county and municipal levels was 8.25 percent in 1998. In most states, sales taxes on services are zero (see Isaacson & Bertoni (2000)).

Moreover, with the above tax rates, the total tax on labor in the U.S. (payroll taxes plus income taxes plus consumption taxes), is very close to the estimate reported in Nickell (2003).

[24] European Economy (2000), table 61b.

[25] The distribution is slightly adjusted, to make it consistent with the short-selling constraint. (See, for instance, Domeij and Klein (1998)). The assumption of equally distributed wealth is not at all restrictive. Using more realistic distributions does not affect the results in any significant way. I also carry out a sensitivity analysis for wealth distribution in the Appendix.

annual numbers are divided by 5200 (52 weeks times 100 productive hours per week), and then multiplied by 100 to obtain the percentage terms. In this way, the numbers both express hours in percent and hours per week.

Table 3: Actual Hours Worked in Percent

	SWEDEN	U.S.
MARKET WORK	23.88	26.18
HOME PRODUCTION	18.76	17.02
GDP/CAPITA	1	1.31

5 Steady State Results

As the title says, all results in this section are steady-state analyses implying that all variables are constant over time.

5.1 A Model Without Services

A useful benchmark here is the effects of labor taxes in a model with no service sector and no home production. Standard micro theory tells us that lower income taxes will generate a substitution effect and an income effect. Since these two effects often go in opposite directions, it is generally not obvious whether a household wants to increase or decrease its labor supply in response to the new tax.

In this subsection, I analyze whether labor taxes (i.e. θ^P and θ^I) can explain the observed difference in labor supply between Sweden and the U.S. In this section, I abstract from consumption taxes (i.e., $\theta^C_{Sw} = \theta^C_{U.S.} = 0$). Government consumption**,** however, is changed in order not to make counterfactual assumptions about transfers.

The result is presented in table 4. It shows that even though taxes and benefits are lower in the U.S. than in Sweden, labor supply is predicted to be lower in the U.S., implying that the income effect dominates the substitution effect with the chosen calibration.[26] Moreover, the effect is much too small.

[26] It is quite easy to analytically derive that this will be the case in a static environment whenever $\gamma > 1$.

Table 4: Hours Worked in the Data and the Model Without Services (in Percent)

	DATA		MODEL	
	SWEDEN	U.S.	SWEDEN	U.S.
MARKET WORK	23.88	26.18	23.88	23.10
GDP/CAPITA	1	1.31	1	.97

Even if the substitution effect had dominated, the average labor supply would still not even have come close to the observed value of 26.18, due to the low Frisch elasticity of labor supply in the model.

The result from this exercise basically confirms what was said in the introduction about standard models generally having a problem explaining differences in labor supply with cross-country heterogeneity in taxes. Let me now turn to my model with services and home production.

5.2 The Model With Services

5.2.1 Changing All Policy Parameters

In this section, the model with services and home production is used to explore whether heterogeneity in policy can explain the difference in labor supply between Sweden and the U.S. As a starting point, all policy parameters are changed simultaneously (their separate effects are analyzed in the subsequent sections). The result is presented in table 5.[27]

The model is clearly quite successful in replicating the data. It matches the time spent in market work and home production very well. In addition, it gets both the direction and the magnitude of the labor supply to be of the right order. Market work in the model only exceeds that in the U.S. by 3.78 percent, whereas the estimate for home production undershoots the data by 6 percent, corresponding to approximately 49 hours/year, or 8 minutes/day.

Finally, the model quantifies the output loss to be 12 percent, i.e. GDP per capita is quantified to be 12 percent higher in the U.S. than in Sweden, as a result of different policies. However, even though the

[27] GDP/capita adjusted is given by GDP/capita plus the amount of home-produced services evaluated at the market price.

Table 5: Hours Worked in the Data and the Model With Services (in Percent)

	DATA		MODEL	
	SWEDEN	U.S.	SWEDEN	U.S.
MARKET WORK	23.88	26.18	23.88	27.17
HOME PRODUCTION	18.76	17.02	18.76	16.07
GDP/CAPITA	1	1.31	1.00	1.12
GDP/CAPITA ADJUSTED	-	-	1.19	1.30

model can explain a fraction of the difference in GDP per capita between Sweden and the U.S., it still leaves a large share unexplained. Let us now go deeper and disentangle which policy instrument drives these results.

5.2.2 Analyzing Policy Instruments Separately

In the above experiment, all policy parameters were changed at the same time. To analyze their individual importance, the policy instruments are treated separately in this section. The result is shown in table 6. The first column is once more the benchmark case Sweden. The second column shows the effect of changing government consumption only, i.e., 20.74 would be the number of hours worked in the market if Sweden would have the same level of government consumption as the U.S., while keping all the other policy parameter at their Swedish levels. Consequently, the third column shows the effect of changing wage dispersion *only* and the fourth the effect of changing taxes *only*.

Table 6: Analysing Policy Instruments Separately

	SWEDEN	U.S. G	U.S. PRODUCTIVITY	U.S. TAXES
MARKET WORK	23.88	20.74	22.18	31.25
HOME PRODUCTION	18.76	20.25	20.30	13.83
GDP/CAPITA	1	.88	.99	1.27
GDP/CAPITA ADJUSTED	1.2	1.08	1.20	1.43

Table 6 shows a very clear result: the dominating effect is from taxes. In this model, taxes evidently have the capacity of highly distorting the choice between home production and market work. Moreover, a considerable output loss is associated with this distortion: GDP per capita is 27 percent (26.52, to be exact) higher in the economy with U.S. than with Swedish taxes. This is a substantial number, roughly equal to 6800 dollars/person (denominated in 2001 prices).

Changing government spending decreases both market work and GDP per capita. As discussed above, it follows from the government budget constraint (9) that reducing government spending, while keeping taxes fixed, implies increased transfers. This, in turn, reduces the incentive to work, mainly for low-productivity households.

Changing the wage dispersion decreases market work and increases home production. However, no major output loss is associated with such a switch. The reason for this should be that a higher dispersion enhances the incentive to supply labor for high-productivity households (they are facing a higher return to labor), while it is reduced for low-productivity households (they are facing a lower return to labor). The net effect is negative, but the fall in GDP per capita stemming from the lower work effort of low-productivity households is almost completely offset by the increased work effort of high-productivity households. This result indicates that heterogeneity in productivity does not really constitute an explanation.[28]

5.2.3 Analyzing Taxes Separately

In order to evaluate the quantitative importance of each of the different taxes, their separate effects are shown in table 7. Once more, the second column shows the effect of changing labor taxes only and so on. Both wage dispersion and government consumption are set to Swedish data.

Once more, there is a very clear result: labor taxes really distort the choice between working in the market and at home. The output loss associated with distortionary labor taxes is again substantial: GDP per capita is 17 percent higher with U.S. than with Swedish labor taxes.

The quite modest distortion associated with service taxes is somewhat surprising. Service taxes would

[28] However, it is important to understand that the result stems from the low value of b. Moreover, b is estimated in Sweden but may, in practise, be higher in the U.S.

Table 7: Analyzing Taxes Separately

	SWEDEN	U.S. θ^I AND θ^P	U.S. θ^C	U.S. θ^S
MARKET WORK	23.88	28.30	25.60	25.13
HOME PRODUCTION	18.76	15.81	17.58	17.74
GDP/CAPITA	1	1.17	1.07	1.03
GDP/CAPITA ADJUSTED	1.2	1.36	1.24	1.21

probably be expected to have the potential to heavily distort the choice between buying and producing services. The mild distortion in the model is due to the implied elasticity of substitution between market-produced and home-produced services being rather low (slightly above 1). In reality, services differ and the elasticity of substitution will be substantially higher for some services than for others (it is infinite for perfect substitutes). A higher elasticity will obviously generate larger distortions, but this cannot be captured in the present model.

6 Transition Analysis

In this section, I analyze whether policy can account for the trend in hours worked over time. More specifically, I look at Sweden during the period 1960-2002.

The model economy is assumed to start out in a steady state, calibrated with taxes and government consumption set to their 1960 values. Taxes and government consumption are then changed according to their observed values for each year, for the period 1960-2002.[29] From 2002 and onwards, taxes and government consumption are held constant at their 2002 values. All preference and production parameters are the same as in the above analysis. The transition is announced 20 years in advance, and households have complete information on this path. The result is presented in Fig. 3 below.[30] The tax wedge is

[29] Data on government consumption is taken from European Economy (2000) and SCB at www.scb.se. Data on hours worked, population and employment 20-64 from the OECD Labor Database. Income taxes are taken from Skattestatistisk årsbok 2002 (2002). And finally, the data on payroll taxes and value added taxes is taken from Skattebetalarnas Förening at www.skattebetalarnas.se.

[30] The data on average hours worked, employment and population for people between 20 and 64 was again taken from the OECD Labor Database.

defined as $1 - \frac{(1-\theta^I)(1-\theta^P)}{(1+\theta^C)}$

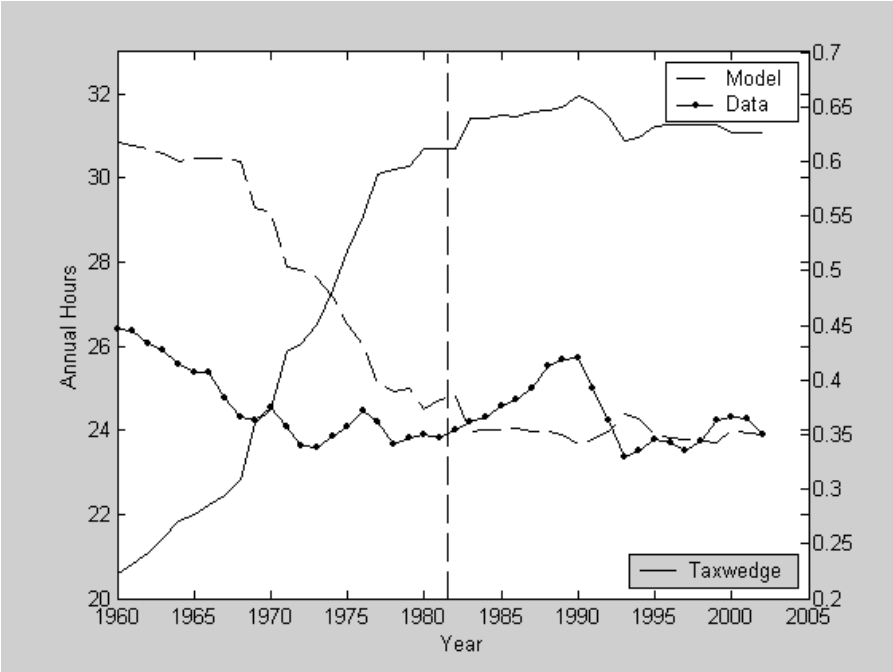

Figure 3: Average Annual Hours in the Model and the Data between 1960 and 2002.

The model is obviously consistent with the falling trend in hours worked since 1960. Both in the model and the data, the largest reduction occurs from 1960 until around 1980. This strengthens the paper's hypothesis, since this is also the period when taxes increased the most. After 1981 , the trends for both taxes and actual hours worked seem to be almost flat. This is also what the model predict for hours worked.

Some statistics are shown in the correlation matrix below. As can be seen, the correlation between hours worked in the data and the tax wedge is -0.53, and the correlation between hours worked in the data and the model is 0.52.

Even though the model seems to be consistent with the long-run behavior, it cannot really explain the short-term movements observed in the data, which is not very surprising, however. The model obviously abstracts from a number of potentially important features like business cycles. The discrepancy between 1985 and 1990 is, for example, most likely driven by the international boom during this period.

Finally, the model clearly overestimates the number of hours worked between 1960 and 1975. It is

Table 8: Correlation matrix

	HOURS (MODEL)	HOURS (DATA)	TAX WEDGE
HOURS (DATA)	1	0.52	-0.995
HOURS (DATA)	0.52	1	-0.53
TAX WEDGE	-0.995	-0.53	1

not really obvious how to reduce this gap. I have made some experiments with productivity growth, but that does not seem to improve the fit. However, since the low number of hours worked at the beginning of the period actually comes from the low employment/population ratio, a more promising way may be to introduce day-care in some form. I leave this for future research.

7 Conclusions

I have analyzed whether cross-country differences in labor supply could have been generated by heterogeneity in policy. The findings are that policy can account very well for the difference in average annual hours worked between Sweden and the U.S. The main distortion comes from taxes in general, and labor taxes in particular. Even though the Frisch elasticity for labor supply is low in the model, labor taxes create a substantial output loss. GDP per capita is estimated to be somewhat more than 26 percent higher with U.S. than with Swedish taxes, due to the fact that labor taxes really influence the choice between working in the market and in home production.

On the other hand, neither service taxes nor wage-dispersion seem to be associated with any significant output loss. In fact, the service tax is found to be the least distortionary tax among the set of taxes analyzed in this paper.

The model is also consistent with the falling trend in hours worked since 1960. The largest reduction occurs from 1960 until around 1980, both in the model and the data. After the early 1980s, the trends for both taxes and actual hours worked seem to be almost flat, which is as predicted by the model for hours worked. However, it clearly overestimates the number of hours worked between 1960 and 1975.

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A Appendix

A.1 Robustness and Sensitivity analysis

In this Appendix, I evaluate how sensitive the above results are to some of the assumptions made.

A.1.1 A Higher intertemporal elasticity of substitution for consumption

To evaluate the sensitivity to this parameter, I here set $\gamma = 1$, i.e. changing the Cobb-Douglas function for consumption goods and services to a log function. To match the hours worked, the following parameters were changed to $\overline{\epsilon}_{hp} = .42E\left[\epsilon_{it}\right]; \eta = .5430; \varphi = .0965; a_0 = .3832$

A.1.2 The distribution of wealth

To check how sensitive the results are to assumptions for the wealth distribution, I here make the extreme assumption that wealth is equally distributed across households (a gini coefficient of zero).

Table 9: Hours Worked in the Data and the Model With Services.

	DATA		MODEL	
	SWEDEN	U.S.	SWEDEN	U.S.
MARKET WORK	23.88	26.18	23.88	27.57
HOME PRODUCTION	18.76	17.02	18.76	16.35
GDP/CAPITA	1	1.31	1.00	1.17
GDP/CAPITA ADJUSTED	-	-	1.18	1.35

To match the hours worked, the following parameters were changed to $\overline{\epsilon}_{hp} = 0.38E\left[\epsilon_{it}\right]; \eta = .5521; \varphi = .8450; a_0 = .41$. The result is presented in the table below.

Table 10: Hours Worked in the Data and the Model With Services. Wealth Equally Distributed.

	DATA		MODEL	
	SWEDEN	U.S.	SWEDEN	U.S.
MARKET WORK	23.88	26.18	23.88	26.66
HOME PRODUCTION	18.76	17.02	18.76	16.33
GDP/CAPITA	1	1.31	1.00	1.11
GDP/CAPITA ADJUSTED	-	-	1.16	1.28

I have also experimented with earnings uncertainty (which generates an endogenous wealth distribution). Preliminary results from that experiment are almost identical to the case without uncertainty.

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ISSN 0347-8769
Stockholm, 2004
Institute for International Economic Studies