

# Women Prefer Larger Governments: Growth, Structural Transformation and Government Size\*

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July 2007

## Abstract

The increase in income per capita is accompanied, in virtually all countries, by two changes in the structure of the economy, namely an increase in the share of government spending in GDP and an increase in female labor force participation. This paper suggests that these two changes are causally related. We develop a growth model where the structure of the economy is endogenous so that participation in market activities and government size are causally related. Economic growth and rising incomes are accompanied by a greater incentive for women to engage in labor market activities as the opportunity cost of staying at home increases. We hypothesize that government spending decreases the cost of performing household chores such as, but not limited to, child rearing and child care so that couples decide to engage further in the labor market and chose a higher tax rate to finance more government spending. Using a wide cross-section of data for developed and developing countries, we show that higher participation by women in the labor market are indeed positively associated with larger governments. Furthermore, we investigate the causal link between the two variables using as instrumental variables a unique and novel dataset on the relative price of home appliances across OECD countries and over time. We find strong evidence of a causal link between participation in the labor market and government size: a 10 percent rise in participation in the labor market leads to a 7 to 8 percent rise in government size. This effect is robust to the country sample, time period, and a set of controls in the spirit of Rodrik (1998). The inclusion of an endogenous choice of government spending allows a considerable extension of the model in Galor and Weil (1996) so fertility can either rise or fall and phenomena like the baby boom and baby bust in Greenwood, Seshadri and Vandenbroucke (2005) can be addressed. In addition, the paper has important implications for the analysis of the secular as well as cross-country determinants of government size.

**JEL Classification Numbers:** O1, E62, H11

*Keywords:* Growth, Structural Transformation, Government Size.

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\*This paper has benefited from the financial support of Égide and Nova Forum at Universidade Nova as well as Fundação para a Ciência e Tecnologia and POCTI through FEDER, and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq-Brazil). We are indebted to Francesco Caselli, Allan Drazen, Chrissy Giannitsarou, Jeremy Greenwood, Arye Hillman, José Ferreira Machado, Marco Percoco, Michele Ruta, Guillaume Vandenbroucke, and Jaume Ventura for helpful suggestions and comments. We have also benefited from comments by audiences at the European University Institute in Florence, University of Cambridge, Universidade Nova de Lisboa, Universidade do Minho, Universidade Católica Portuguesa, the Asset Annual Conference in Spain 2004, the European Public Choice Society Annual Meeting 2004, the European Economic Association Annual Meeting 2004, and the Latin American Econometric Society Annual Meeting 2004. We thank Daniel Santos and Paulo David for access to data used in the paper.

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# 1 Introduction

In virtually all developed and developing economies, the growth of per capita income has been accompanied by two major structural changes in the economy: the share of government spending in Gross Domestic Product (GDP) has increased and the participation of women in the labor force has risen. In the last two decades the share of total government spending in GDP has increased by 10 percent in OECD countries,<sup>1</sup> the continuation of a long trend in government growth in the twentieth century. Tanzi and Schuknecht (2000) report, for a sample of industrialized countries, a rise in general government spending from 13 to 46 percent of GDP between the years 1913 and 1996. Apace with the rise in government share, female labor force participation has risen in the last two decades from 28 to 41 percent in OECD countries, which compares with a fairly constant level of male labor force participation of 57 percent.<sup>2</sup> As for the long-run, Goldin (1995) reports that female labor force participation in the United States increased from 3.1 to around 50 percent of the labor force between 1900 and 1980,<sup>3</sup> apace with an increase in government spending from 8 to 30 percent, as reported in Tanzi and Schuknecht (2000). This paper suggests that the twin increases in female labor force participation and government size are not a coincidence. Instead, there is a causal relationship involved: as women make the decision to work outside the home,<sup>4</sup> they naturally increase their demand for services that tend to be provided by governments, including education and health care. The provision of additional government services decreases the cost of home and family activities whose burden falls disproportionately on women. The resulting lower time cost of home activities makes it easier for female labor force participation to increase, closing a circle of causation towards more participation and larger governments.<sup>5</sup>

There is a long tradition in the economics literature of attempting to explain the causes of the rise in government size. One strand of this literature relates the size of government with the income of the median voter and the expansion of the franchise, in the tradition of Tocqueville (1835). In such a vein, Meltzer and Richards (1981) developed a seminal model that links increases in redistributive policies to the inclusion of voters from the lower end of the income spectrum. A recent study by Husted and Kenny (1997) of the United States between 1950 and 1988 analyzes the impact of abandoning poll taxes and literacy tests as requirements to vote, and finds that the resulting expansion of the franchise led to a rise in redistributive expenditures. The supply of government services, as opposed to pure redistribution, does not seem to respond in the same way to the extended franchise.<sup>6</sup> In fact, whether the demand for government services increases as low income voters join the franchise depends on the relative force of an income and a substitution effect: lower income voters tend to use public services instead of available private substitutes but, on the other hand, demand fewer public services as a direct consequence of their lower individual

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<sup>1</sup>According to World Bank (2001).

<sup>2</sup>See World Bank (2001). Blau (1998) shows that participation rates of men actually decreased about 6 percent between 1970 and 1995.

<sup>3</sup>See Goldin (1990) for a historical overview of female participation in the labor market in the United States. Fernández, Fogli and Olivetti (2004) raise the possibility that there were changes in male preferences as regards marrying working women.

<sup>4</sup>Olivetti (2001) sums up this phenomenon as: "In the past, married women of childbearing age tended to specialize in childrearing and home production activities at the expense of engaging in market work. Now, they do not curb the hours worked in the market."

<sup>5</sup>Blau (1998) reports that, in the decade from 1978 to 1988, the number of women work hours at home and in the market reversed from 27/20 to 21/26.

<sup>6</sup>This is consistent with the results in Peltzman (1980), who finds little relation between the franchise and total government spending in Great Britain, Canada and the United States.

income. As Husted and Kenny (1997) point out, the income effect may more than outweigh the substitution effect, which is entirely consistent with Wagner's law suggesting that a rise in a country's per capita income leads to an increase in the share of public spending in GDP.<sup>7</sup> A conspicuous observation is the fact that public spending has not always grown. The sustained growth in government size - even if it started in the early 20th century as income tax systems were set up - only gained momentum after World War I and the massive mobilization of women into the labor force. Following the war the size of government did not revert to pre-war levels, contrary to what had happened before.<sup>8</sup> According to Lott and Kenny (1997), giving women the right to vote was the decisive policy leading to a surge in government spending. These authors examine changes in government spending in the US as the latter extended the right to vote to the female population; turnout rates rose hand in hand with government spending.<sup>9</sup>

A second strand in the literature sees public spending - redistribution or consumption services - as the provision of risk insurance insofar as it smooths the consequences of income or employment shocks. In this view, the government provides a safety net in the form of subsidies, services or public employment. Rodrik (1998) uses this rationale in his study of the causes of the increase in government size, demonstrating that government spending is positively related to the degree of exposure to external shocks. However, a complete explanation of the dramatic growth in government in the twentieth century continues to elude economists.

The complementary issue is whether public spending affects the level of female participation in the labor market. A large portion of the tasks related to home and family traditionally have fallen on the shoulders of women. Some of these tasks - including but not limited to the care of children, the sick and the elderly, i.e., "redistribution" and insurance activities - have been progressively taken up by the state. Jaumotte (2003), for instance, examines the main determinants of female labor force participation in OECD countries and finds that childcare subsidies, paid maternal and parental leaves all encourage participation.<sup>10</sup> Public programs that perform such tasks are likely to decrease the time women need to devote to similar tasks, allowing increased female labor force participation. Gelbach (2002) shows that mothers increase their labor supply when government-sponsored childcare, in the form of kindergarten, is available.<sup>11</sup> Anderson and Levine (1999) find that the responsiveness of female labor market participation to the cost of child care is of the same order of magnitude as the response to wages. The decision to work outside the home is likely to lead women to demand wider and better provision of the public services that alleviate their unequal burden at home.<sup>12</sup> In addition, the role of the government as insurer, the basis for Rodrik (1998),

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<sup>7</sup>As in Wagner (1893).

<sup>8</sup>Lott and Kenny (1997).

<sup>9</sup>In a related but different argument Edlund and Pande (2002) argue that women have become more "left wing" as the increased incidence of divorce has made women poorer and men richer, leading the former to favor tax and transfer policies.

<sup>10</sup>Case and Paxson (2000) find that it is the mothers of children that make most of the investment in children's health, such as time consumed in visits to doctors and the like. Similarly, Costa and Kahn (2001) argue that the rise in female labor force participation is associated with the reduction in the production of "social capital" at home. Social capital is defined as activities that involve spending time with friends and relatives, which have been shown to have a positive impact on the social development of children.

<sup>11</sup>In surveys of working mothers in the United Kingdom and the United States, respectively 20 and 30 percent stated that childcare obligations restricted their labor force participation. A study by Chevalier and Viitanen (2002) found that regional variation in female labor force participation was related to the availability of childcare facilities.

<sup>12</sup>Lott and Kenny (1997) mention the consistent differences between the voting patterns of men and women.

may impact women more directly than men.<sup>13</sup>

In this paper we present a growth model with endogenous choice of fertility, female labor force participation and government size. We build on the model of Galor and Weil (1996) of fertility and growth by introducing a government sector of endogenous size. An important assumption is that an increase in public spending - in the form of public consumption or subsidies - decreases the cost of raising children as it is a substitute for time with household chores. As the average income in the economy rises, the rising opportunity cost of not working leads women to progressively join the labor force, increasing their hours of work.<sup>14</sup> As female labor force participation increases, there is a reduction in the total cost of raising children for two reasons: the total time at home (and number of children reared) decreases and the time cost per child falls as the increase in public spending partly substitutes for home “production” of care, education, etc.<sup>15</sup> One of the possible paths for the economy is for the income rises to be accompanied by higher female labor force participation, and higher government spending.

To examine the role of female labor force participation in government size we use a wide panel dataset of developed and developing economies in the last forty years to directly test this hypothesis.<sup>16</sup> We test the relationship between female labor force participation and government size and find that higher female labor force participation is significantly and positively related to government spending as a share of GDP - in the form of government consumption, subsidies and transfers or total spending. The result is robust to the inclusion of time and country fixed-effects and the inclusion of a set of control variables in the spirit of Rodrik (1998). Furthermore, the inclusion of male as well as female labor force participation shows that the former does not display the same positive association with government spending, rather the contrary. An increase in female labor force participation of 10 percent leads to an increase in government spending of about 2.5 percent as a share of GDP.<sup>17</sup> We assess causality by instrumenting for female labor force participation. Greenwood and Seshadri (2005) and Greenwood et al. (2002a, 2002b) study the relationship between technological

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Women are more likely to be liberal and vote for the Democrat presidential candidate traditionally associated with the defense of a larger role for the government.

<sup>13</sup>Government jobs in teaching and health tend to be filled primarily by women, as documented in Rosen (1996) for Sweden. Lott and Kenny (1997) mention that 55 percent of white-collar government jobs in the US are filled by women. Goldin (1995) shows that the percent of women in the total clerical jobs workforce increased from 15 to 62 percent of the total between 1900 and 1950.

<sup>14</sup>Goldin (1995) shows that female labor force participation of married women tends to decrease and then increase as national income rises. This decline is due to a strong initial income effect that is later dominated by a substitution effect. Goldin (1995) suggests that when women had lower levels of human capital and their wage was thus connected to the provision of manual work, social stigma added further resistance to female participation. As women become educated, stigma disappears. Goldin (1995) shows that high-school graduation rates were higher for women during the whole period from 1910. Blau (1998) shows that the more educated the woman, the more she tends to participate in the labor market, with those with more than 16 years of education having an 83% participation rate compared with 47% for those with less than 12 years. Acemoglu, Autor and Lyle (2004) find that, after the increase in female labor force participation in the wake of World War II, women were closer substitutes for male high-school graduates than for less than high-school or the lowest skilled males.

<sup>15</sup>It is important to make clear that childrearing is used as a metaphor for any time-consuming task at home that tends to be performed mostly by women.

<sup>16</sup>Iversen and Soskice (2001) find, for a small sample of European countries, that female labor force participation displays a positive correlation of 0.51 with the amount of state redistribution, measured as the difference between pre and post-tax income.

<sup>17</sup>This effect is quantitatively of the same order of magnitude as the effect of trade on government spending uncovered in Rodrik (1998).

progress in productive home capital (such as appliances), labor force participation and fertility. In this paper we compile a new dataset for OECD countries that allows us to compute an index of the relative price of home appliances to capture technological progress in this sector. We use the relative price of appliances to instrument for the effect of female labor supply on government size.<sup>18</sup> For a wider sample including a large number of developing countries, we use the lagged fertility rate as the instrumental variable of choice. We test for the exogeneity of instruments in both samples and for overidentification in the OECD sample, discarding these hypotheses. In both cases we confirm our result that there is a positive, significant and robust effect of female labor supply on public expenditures.

The paper is organized as follows. Section 2 presents the model that illustrates the relationship between female labor supply and government size. In section 3 we conduct the empirical test of the relationship, check for robustness and investigate causality. Section 4 concludes.

## 2 The Model

Our model adds an endogenously determined government sector into a growth model with labor specialization and endogenous participation as in Galor and Weil (1996). The economy is made up of men and women organized as couples. Agents live for three periods. In the first period, as children, women and men are indistinguishable: children do not make any decision, they only consume a fraction of their parents' time endowment, in the form of parental care and general childrearing.<sup>19</sup>

In their second period of life agents become adults and men and women differ as to their labor endowment: men are endowed with one unit of physical labor and one unit of mental labor while women are endowed with mental labor only. As will become clear, this assumption makes our model deliver two facts that are borne out by the available evidence: the existence of a gender wage gap and its decrease over time as income per capita increases.<sup>20</sup> In this second period, couples make their fertility choices and allocate their time between working and raising children. In the third period, each couple consumes the life savings.

### Technology

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<sup>18</sup>As stated in Greenwood, Seshadri and Yorukoglu (2005) "It seems unlikely that the small rise in the relative income of a female worker could explain the dramatic rise in labor force participation. It is more likely that the rise in overall real wages, in conjunction with the introduction of labor-saving household appliances, explains the rise in female labor-force participation." In our paper the relative price of appliances is used as instrumental variable in the empirical test of the hypothesis that female labor market participation affects the size of government.

<sup>19</sup>Blau (1998) points out that married women *not* in the labor force and men - irrespective of marriage status and wife's participation in the labor market - display a fairly constant level of involvement in home activities. While married women not in the labor force worked between 33 and 37 hours a week, men worked only 5 to 8 hours. Corman, Reichman and Noonan (2003) show evidence that the presence of children with fragile health decreases the hours at work of both male and females and the ability of the female to actually participate in the market.

<sup>20</sup>Blau (1998) reports that weekly wage ratios of women increased about 31 percent between 1970 and 1994 while men's weekly wage rates increased by only 3 percent, decreasing the male/female wage ratio. The increase in women's wages was concentrated on the wages of educated women, despite a relatively higher increase in supply. Weichselbaumer and Winter-Ebmer (2003) conclude, from a survey of studies on the gender wage gap, that its decrease over time is mostly due to increased labor market productivity of females.

The production technology uses capital,  $K_t$ , mental labor,  $L_t^m$ , and physical labor,  $L_t^p$ , to produce output,  $Y_t$ , according to a constant returns to scale production function. More specifically,

$$Y_t = A[\alpha K_t^\rho + (1 - \alpha)(L_t^m)^\rho]^{\frac{1}{\rho}} + BL_t^p, \quad (1)$$

where  $A > 0$ ,  $B > 0$ ,  $\alpha \in (0, 1)$ , and  $\rho \in (-\infty, 1)$ . Given the technology and the input prices, the representative firm chooses inputs so that profits are maximized.<sup>21</sup> It is convenient, however, to rewrite the variables in per-couple term. Since the number of couples in the economy is the same as the number of total physical labor input, define:  $y_t = \frac{Y_t}{L_t^p}$ ,  $k_t = \frac{K_t}{L_t^p}$ ,  $m_t = \frac{L_t^m}{L_t^p}$  as output per couple, capital per couple and the ratio of mental to physical labor. The first order conditions associated with the representative firm's problem are:

$$w_t^p = B, \quad (2)$$

$$w_t^m = A(1 - \alpha)[\alpha k_t^\rho + (1 - \alpha)(m_t)^\rho]^{\frac{1-\rho}{\rho}} m_t^{\rho-1}, \quad (3)$$

$$r_t = A\alpha[\alpha k_t^\rho + (1 - \alpha)(m_t)^\rho]^{\frac{1-\rho}{\rho}} k_t^{\rho-1}, \quad (4)$$

so that the wage rate of physical labor is exogenous and constant, and the wage rate of mental labor and the interest rate depend on capital per couple and the ratio of mental to physical labor.

## Preferences

Couples draw utility both from consumption in the third period of life and the number of children.<sup>22</sup> Let  $n_t$  be the number of children born at period  $t$ , and  $c_{t+1}$  be the consumption of a couple in their third period of life. Preferences are represented by

$$U_t = \gamma \ln n_t + (1 - \gamma) \ln c_{t+1}, \quad \gamma \in (0, 1). \quad (5)$$

where  $\gamma$  represents the relative weight of children in the couple's utility function.<sup>23</sup>

## Government

Consider now that there is a government sector in this economy. The government raises public revenues through a proportional tax,  $\tau_t$  and spends it as  $g_t$ , the per-couple government spending so that the budget is balanced throughout. Public spending is assumed to decrease the per-child cost of raising children.<sup>24</sup> In the spirit of Greenwood, Seshadri and Vandenbroucke (2005), we assume that children are costly and the "production function" associated with raising children is

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<sup>21</sup>Output is taken as the numeraire.

<sup>22</sup>Fernández-Val (2003) finds evidence in favor of the collective model of labor supply by couples, that is, the idea that husband and wife make their decisions jointly.

<sup>23</sup>Given the functional form of the utility function, it is clear that the introduction of consumption in the second period of life does not change any of the results.

<sup>24</sup>Observe that this is consistent to a recent study of Daly (2007), an economist from Goldman Sachs, who shows that countries that make the combination of work and family easier by providing generous support structures, such as subsidies for child care, also note a higher birthrate.

$$n_t = \phi[h_t(1 + g_t)]^\beta, \quad \phi > 0, \quad \beta \in (0, 1], \quad (6)$$

where  $h_t$  is the time that parents devote to raising children. Solving (6) for  $h_t$  gives the time cost of  $n_t$  children

$$h_t = \left(\frac{n_t}{\phi}\right)^{\frac{1}{\beta}} \frac{1}{1 + g_t}. \quad (7)$$

We can also interpret  $h_t$  as the time couples spend at home, and  $2 - h_t$  as the time devoted to market activities.

### Budget Constraint

Notice that the opportunity cost of raising children is higher for a man,  $(1 - \tau_t)(w_t^p + w_t^m)$ , than for a woman,  $(1 - \tau_t)w_t^m$ . Therefore, if  $h_t \leq 1$ , only the wife spends time raising children.<sup>25</sup> In the case where  $h_t > 1$  both will raise children but only the husband will work.<sup>26</sup> The couple's budget constraints are:

$$s_t \leq (1 - \tau_t)(w_t^p + w_t^m + (1 - h_t)w_t^m), \quad \text{if } h_t \leq 1, \quad (8)$$

$$s_t \leq (1 - \tau_t)(w_t^p + w_t^m - (h_t - 1)(w_t^m + w_t^p)), \quad \text{if } h_t \geq 1. \quad (9)$$

where  $s_t$  represents savings and the right-hand side shows net income of the couple.

In the last period of life, consumption by the couple must satisfy

$$c_{t+1} = (1 + r_{t+1})s_t. \quad (10)$$

Couples choose the number of children,  $n_t$ , and savings,  $s_t$ , to maximize (5) subject to (7)- (10). The fertility decision<sup>27</sup> satisfies

$$h_t = \left(\frac{n_t}{\phi}\right)^{\frac{1}{\beta}} \frac{1}{1 + g_t} = \frac{\gamma\beta}{(1 - \gamma) + \gamma\beta} \left[2 + \frac{w_t^p}{w_t^m}\right], \quad \text{if } h_t \leq 1, \quad (11)$$

$$h_t = \left(\frac{n_t}{\phi}\right)^{\frac{1}{\beta}} \frac{1}{1 + g_t} = \frac{2\gamma\beta}{(1 - \gamma) + \gamma\beta}, \quad \text{if } h_t > 1. \quad (12)$$

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<sup>25</sup>In this model, as in Galor and Weil (1996), the specialization of male and female into market and home activities is a consequence of assuming that one unit of male labor produces one unit of physical labor and one unit of mental labor while one unit of female labor produces only mental labor.

<sup>26</sup>This is consistent with the empirical fact that male labor force participation rates tend to be higher than their female equivalent.

<sup>27</sup>The fact that fertility affects labor market participation has been documented in Jacobsen, Pearce III and Rosenbloom (1999). These authors use the unexpectedness of twin births as an exogenous variation in fertility to determine the causal effect of fertility on married women's labor supply and earnings. They find that the impact is appreciable and has increased from 1980 to 1990.

In order to guarantee that women will eventually participate in the labor market for any tax rate, *we must assume that*  $\frac{2\gamma\beta}{(1-\gamma)+\gamma\beta} \leq 1$ . This implies that  $\gamma \leq \frac{1}{1+\beta}$ , so that couples have to assign a minimum weight on consumption for it to be worthwhile to increase labor market participation. Thus,

$$h_t = \left(\frac{n_t}{\phi}\right)^{\frac{1}{\beta}} \frac{1}{1+g_t} = \min\left\{1, \frac{\gamma\beta}{(1-\gamma)+\gamma\beta} \left[2 + \frac{w_t^p}{w_t^m}\right]\right\}. \quad (13)$$

The wage of physical labor is constant, since  $w_t^p = B$ , while the wage of mental labor increases with capital accumulation. Therefore, female labor force participation increases as the relative wage of mental labor increases (decreasing the gender wage gap), which increases the opportunity cost of staying at home. Private savings are given by

$$s_t = \frac{(1-\gamma)}{(1-\gamma)+\gamma\beta} (1-\tau_t)(2w_t^m + w_t^p) \quad \text{if } h_t \leq 1, \quad (14)$$

$$s_t = (1-\tau_t)(w_t^m + w_t^p) \quad \text{if } h_t = 1. \quad (15)$$

### Tax Rate Determination

The public sector maintains a balanced budget at every point in time. Therefore,

$$g_t = \tau_t(w_t^p + w_t^m) + \tau_t(1-h_t)w_t^m. \quad (16)$$

Substituting (13) into (16) yields

$$g_t = \begin{cases} \tau_t \frac{(1-\gamma)}{(1-\gamma)+\gamma\beta} (2w_t^m + w_t^p) & \text{if } h_t < 1, \\ \tau_t (w_t^m + w_t^p) & \text{if } h_t = 1. \end{cases} \quad (17)$$

We assume that  $\tau_t$  is endogenously determined in each period by a vote of the adult population. Since we assumed a homogenous population and given logarithmic utility, there is no conflict of interest. Given the list of factor prices  $w_t = (w_t^m, w_t^p, r_{t+1})$  and the tax rate, the indirect utility of the representative couple is

$$V(w_t; \tau_t) = \begin{cases} \gamma \ln\{[h_t(w_t; \tau_t)(1+g(w_t; \tau_t))]^\beta \phi\} + (1-\gamma) \ln[(1+r_{t+1})s_t(w_t; \tau_t)] & \text{if } h_t(w_t; \tau_t) < 1, \\ \gamma \ln[(1+g(w_t; \tau_t))^\beta \phi] + (1-\gamma) \ln[(1+r_{t+1})s(w_t; \tau_t)] & \text{if } h_t(w_t; \tau_t) = 1. \end{cases} \quad (18)$$

The representative couple chooses the tax rate  $\tau_t$  to maximize the indirect utility function, i.e.,

$$\tau_t^* = \arg \max_{\tau_t \geq 0} V(w_t; \tau_t), \quad (19)$$

subject to (17) and (13). There are two effects of an increase in the tax rate. The first is a direct effect, since a higher tax rate decreases net labor income. There is also an indirect effect: a higher tax rate increases government revenues, and public spending makes it easier to devote hours to market activities while increasing the effective time available to both home and market activities. This tradeoff will result in a chosen tax rate, which is given by:

$$\tau_t^* = \begin{cases} \frac{\gamma\beta}{(1-\gamma)+\gamma\beta} - \frac{(1-\gamma)}{((1-\gamma)+\gamma\beta)(w_t^m+w_t^p)}, & \text{if } h_t(w_t; \tau_t) = 1, \\ \frac{\gamma\beta}{(1-\gamma)+\gamma\beta} - \frac{1}{2w_t^m+w_t^p}, & \text{if } h_t(w_t; \tau_t) < 1. \end{cases} \quad (20)$$

Notice that if (20) is negative, then the optimal tax rate is zero. This implies that  $\tau_t^* \in [0, \frac{\gamma\beta}{(1-\gamma)+\gamma\beta})$ . It is easy to verify that the tax rate increases with the mental wage. Since the time that couples spend at home  $h_t$  is non-increasing with  $w_t^m$ , this implies that the tax rate increases as couples devote more time to market activities (see (13)).<sup>28</sup>

### Equilibrium

In equilibrium, demand must be equal to supply in all markets. In the market for mental labor this means that  $L_t^m = L_t^p(2 - h_t)$ , or  $m_t = 2 - h_t$ . Then, using the input market equilibrium conditions, (2) and (3) into (13), yields

$$h_t = \min\left\{1, \frac{\gamma\beta}{(1-\gamma)+\gamma\beta} \left[2 + \frac{B}{A(1-\alpha)[\alpha k_t^\rho + (1-\alpha)(2-h_t)^\rho]^{\frac{1-\rho}{\rho}} (2-h_t)^{\rho-1}}\right]\right\}. \quad (21)$$

Using the implicit function theorem it can be shown that (21) defines a function  $\psi(k_t)$  such that

$$h_t = \min\{1, \psi(k_t)\}, \quad \text{with } \psi'(k_t) < 0 \forall k_t \geq 0. \quad (22)$$

(22) determines a critical value  $k^*$  such that

$$h_t = \begin{cases} 1 & \text{for } k_t \leq k^*, \\ \psi(k_t) & \text{for } k_t \geq k^*, \end{cases} \quad (23)$$

and  $\psi(k_t) \in (0, 1] \forall k_t \geq k^*$ . As a consequence, time devoted to home activities decreases with capital accumulation. The condition that equilibrates the capital market is

$$K_{t+1} = L_t^p s_t. \quad (24)$$

When the optimal tax rate is positive,<sup>29</sup> we have that

<sup>28</sup>In other words, as female participation in the labor market increases (and male participation remains constant), the preferred tax rate increases.

<sup>29</sup>When the tax rate is zero, results are similar to those obtained by Galor and Weil (1996).

$$k_{t+1} = \frac{s_t}{n_t} = \begin{cases} D(w_t^m + B)^{1-\beta} & \text{for } k_t \leq k^*, \\ D\left(\frac{w_t^m}{2w_t^m + B}\right)^\beta \frac{(\gamma\beta + (1-\gamma)(1+2w_t^m + B))^{1-\beta}}{((1-\gamma) + \gamma\beta)^{1-2\beta}} & \text{for } k_t \geq k^*, \end{cases} \quad (25)$$

where  $D = \frac{(1-\gamma)}{\phi(\gamma\beta)^\beta((1-\gamma) + \gamma\beta)^{1-\beta}}$ , and

$$w_t^m = \begin{cases} A(1-\alpha)[\alpha k_t^\rho + (1-\alpha)]^{\frac{1-\rho}{\rho}}, & \text{for } k_t \leq k^*, \\ A(1-\alpha)[\alpha k_t^\rho + (1-\alpha)(1-\psi(k_t))^\rho]^{\frac{1-\rho}{\rho}} (1-\psi(k_t))^{\rho-1}, & \text{for } k_t \geq k^*. \end{cases} \quad (26)$$

Using (26) into (25) defines a non-linear difference equation  $k_{t+1} = \xi(k_t)$ . As in Galor and Weil (1996), it is clear that  $\xi(\cdot)$  is continuous, and it can be shown that  $\xi'(k_t) > 0 \forall k_t \geq 0$ . Moreover,  $\xi(0) > 0$ ,  $\lim_{k_t \rightarrow 0} \xi'(k_t) = \infty$ , and  $\lim_{k_t \rightarrow \infty} \xi'(k_t) = 0$ . Therefore, a steady-state equilibrium,  $\xi(\bar{k}) = \bar{k}$ , exists. However, here as in Galor and Weil (1996), one cannot guarantee that the steady-state equilibrium is unique. In order to see this, notice that if the degree of complementarity between capital and mental labor is sufficiently small, then the  $\xi(\cdot)$  function is strictly concave for  $k_t \in (0, k_t^*)$ . Specifically, if  $\rho \in [0, 1)$ , then  $\xi''(k_t) < 0$  for  $k_t \in (0, k_t^*)$ . Otherwise,  $\xi(\cdot)$  is strictly convex for  $k_t \in (0, k_t^*)$ . In contrast, for  $k_t \in (k_t^*, \infty)$  we cannot define whether the function  $\xi(\cdot)$  is concave or not. Regardless of whether multiple steady states exist, the model generates the following result.

**Proposition 1** *As the economy develops, then*

- i. the women's fraction of time spent with home activities decreases;*
- ii. per-couple government spending increases; and*
- iii. the share of government expenditure in total output increases.*

**Proof.** Item (i) follows directly from (23). (ii) follows from (17) and (20). In order to see this, notice that

$$g_t = \begin{cases} \frac{\gamma\beta(1-\gamma)}{((1-\gamma) + \gamma\beta)^2} (w_t^m + B) - \frac{(1-\gamma)^2}{((1-\gamma) + \gamma\beta)^2}, & \text{for } k_t \leq k^*, \\ \frac{\gamma\beta(1-\gamma)}{((1-\gamma) + \gamma\beta)^2} (2w_t^m + B) - \frac{(1-\gamma)}{((1-\gamma) + \gamma\beta)}, & \text{for } k_t \geq k^*, \end{cases}$$

which is increasing in capital accumulation. Dividing  $g_t$  by  $y_t$  yields item (iii). ■

Per-couple government spending increases because both income and the tax rate increase as the economy develops. The model, however, might display equilibria where both female labor force participation and fertility increase as the economy develops. The reason is simple. For parents, the only cost of a child is the opportunity cost of being at home. This opportunity cost is a decreasing function of per-couple government spending and goes to zero as spending goes to infinity. Then, even when female labor force participation is increasing (i.e.,  $h_t = \left(\frac{n_t}{\phi}\right)^{\frac{1}{\beta}} \frac{1}{1+g_t}$  is decreasing), fertility  $n_t$  might increase, as long as the rate of change in fertility is lower than that of  $1 + g_t$ .<sup>30</sup> In addition, the model abstracts from child quality.

<sup>30</sup>This, of course, depends on the functional form of the home production function  $n_t = \phi[h_t(1 + g_t)]^\beta$ . If we have assumed that  $n_t = \phi_1 + \phi_2[h_t(1 + g_t)]^\beta$ , then for some  $\phi_1$  and  $\phi_2$  fertility would decrease with capital accumulation. Alternatively, we could have followed Greenwood, Seshadri and Vandenbroucke (2005) and modified preferences to lower the marginal utility of consumption, such that  $U_t = \gamma \ln n_t + (1-\gamma) \ln(c_{t+1} + \mathbf{c})$ . Parameter  $\mathbf{c} > 0$  would represent some level of home production. Such functions, however, would complicate the algebra without adding any new insights.

Considering quality would add force to the transition from high to low fertility proposed in Galor and Weil (2000) and would generate an equilibrium with decreasing fertility, increasing female labor force participation and increasing per-couple government spending.<sup>31</sup>

The point that we emphasize, however, is the link between female labor force participation and per-couple government spending. **Proposition 1** suggests that the model generates a simple and powerful result: as the relative wages of mental labor increase, couples demand higher government spending in activities that facilitate child-rearing, further easing the transition of women into the labor force.

### 3 Empirical Results

The theoretical model in Section 2 suggests a positive association between the participation of women in the labor force and the size of government. In this section we conduct an empirical test of that relationship, concentrating on the direction from labor force participation to government size. In light of the review of the literature presented above, the effect of female labor force participation on government size is the novel element advanced in our model, as yet untested. In our empirical exercise we use yearly data for the years between 1960 and 1999, available from World Bank (2001) for a wide cross section of developed and developing countries. The variable of interest to be explained is an indicator of the relative size of government, including the ratio of Total Government Expenditures in GDP, and its decomposition into Public Consumption and Public Subsidies plus Transfers. As proposed in the model above, if subsidies and/or public consumption decrease the burden of household chores, their share in GDP tends to increase in response to the desires of women that work. Our prediction is that, as female labor force participation increases, so will public spending. Our coefficient of interest is associated with the level of female labor force participation in a specification that aims to explain government size. The equation to be estimated is:

$$GOVSIZE_{it} = \alpha + \beta_0.FEMALELFP_{it} + \beta_1.Z_{jit} + \varepsilon_{it}, \quad (27)$$

where  $GOVSIZE_{it}$  is one of the three alternative measures of the relative size of government (total spending, public consumption or subsidies) in country  $i$  at period  $t$ ,  $FEMALELFP_{it}$  is the share of working age women that participate in the labor force in country  $i$  at period  $t$  and  $Z_{jit}$  is a vector of additional determinants of government size.  $Z1_{it}$  corresponds to two alternative sets of control variables. The baseline specification is limited to the four independent variables proposed in Rodrik (1998), i.e., *GDP per capita*, the *Dependents to Working Age Population Ratio*, the share of *Urban Population* and the share of *Imports in GDP*. Results for this specification are presented in the first three columns of Table 1. The second set of control variables  $Z2_t$  is the benchmark specification, which adds five variables to the Rodrik (1998) specification: *Male Labor Force Participation*, *Growth of GDP per capita*, the *Female Unemployment Rate*, the *Male Unemployment Rate*, and *Life Expectancy*.<sup>32</sup> Results for the benchmark specification are displayed in the last three columns of Table 1 and in the other tables.

<sup>31</sup>This would not change the effect of female labor force participation on the size of government. In this case, however, we could not treat male and female as identical agents in childhood, since the time invested in education would depend on the participation in market activities.

<sup>32</sup>Jaumotte (2003) finds evidence that general labor market conditions are a major determinant of female labor force participation.

The variable Male Labor Force Participation is meant to control for effects of labor force participation on government size that are unrelated to the gender element. The growth rate of national income captures cyclical fluctuations in public expenditure in response to the business cycle. The male and female unemployment rates correct for any indirect impact of female labor supply on public expenditure through increased rates of unemployment, male or female. Life expectancy is included to control for the increase in government spending due to an aging population. All specifications include *a year trend* - or year dummies - as well as *regional dummies* for countries in the OECD, Latin America, Sub-Saharan Africa and East Asia. The year trend is included to correct for the trend of both government expenditure and female labor force participation to increase over time. The regional dummies correct for possible regional variations in government size unrelated to the determinants included in the specification.

Our estimation method is, first, Ordinary Least Squares where standard errors are robust to the presence of heteroskedasticity. This method uncovers the association between female participation in the labor market and the size of government. To assess causality, more specifically how the increase in labor force participation leads to a larger government, we estimate a linear regression model using instrumental variables. Female labor force participation is the endogenous variable to be instrumented for and, as mentioned above, we assemble a new dataset of exogenous variables to fix any causation problem.

### 3.1 Basic Results

In Table 1 we present results for the baseline and benchmark specifications. In columns (1) to (3), the addition of labor force participation to Rodrik's (1998) specification is associated with a highly significant and positive coefficient, irrespective of the measure of public expenditures used. According to the coefficient estimate in, say, Column 1, a 10 percent increase in female labor force participation increases the size of government by 2 percent of GDP. The coefficient on total expenditure is of the same order of magnitude as that on subsidies and public consumption and approaches the sum of the latter two. Columns (4) through (6) present results for the benchmark specification, which adds male labor force participation, GDP growth, gender-specific rates of unemployment, and life expectancy as determinants of government size. We find that the coefficients on female labor force participation remain highly significant and become more important as far as the estimated size of the effect. The impact of a 10 percent increase in the participation of women in the labor market is now 4.2 percent of GDP for total spending, 2.2 percent for public consumption, and 1.7 percent for subsidies and transfers. Between 1960 and 1999 the rate of female labor force participation increased 7 and 17 percent, respectively for the complete sample and for OECD countries.<sup>33</sup> Our estimates suggest that labor force participation explains a 7.6 percent increase in the share of public expenditures in GDP for the case of OECD countries and about 3 percent for the sample as a whole. The R2 summary statistics denote that the share of public expenditures and its components is reasonably well explained by our benchmark specification. Interestingly, male labor force participation is negatively related to public expenditure, a result that is confirmed below as robust. In contrast, the Unemployment Rate for men is positively related to government size, as one would expect. In a sense it is as if active women and inactive men demand more government intervention.

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<sup>33</sup>See World Bank (2001).

**Table 1:** Dependent Variable: Government Spending (Total, Consumption, Subsidies and Transfers). Ordinary Least Squares Estimation.

	Baseline Specification			Benchmark Specification		
	Total Public Expenditure	Public Consumption	Public Subsidies and Transfers	Total Public Expenditure	Public Consumption	Public Subsidies and Transfers
Female Labor Force Part.	0.20** (10.52)	0.07** (6.01)	0.10** (13.43)	0.42** (8.65)	0.22** (9.64)	0.17** (7.25)
GDP per capita	0.00025** (7.75)	0.00010** (6.46)	0.00010** (7.24)	0.00026** (6.39)	0.00011** (5.04)	0.00016** (7.75)
Dependent-Work. Age Ratio	13.19** (9.19)	8.67** (10.28)	-1.31** (-2.46)	11.29* (1.88)	9.87** (2.41)	-6.91** (-3.05)
Urban Population	0.13** (10.70)	0.05** (7.56)	0.06** (13.53)	0.12** (5.51)	0.05** (3.14)	0.05** (5.17)
Imports	0.064** (7.56)	0.073** (14.48)	-0.000 (-0.15)	0.020 (1.46)	0.014* (1.76)	-0.010 (-0.87)
Male Labor Force Part.	-	-	-	-0.62** (-6.06)	-0.37** (-5.24)	-0.32** (-7.29)
Real GDP Growth	-	-	-	-0.11 (-1.53)	-0.08** (-2.01)	-0.01 (-0.29)
Unempl. Rate - Women	-	-	-	-0.09 (-1.26)	0.03 (0.84)	-0.09** (-2.78)
Unempl. Rate - Men	-	-	-	0.38** (3.59)	0.06 (1.05)	0.24** (4.53)
Life Expectancy				0.41** (4.10)	0.27** (4.16)	0.03 (0.79)
Regional Dummies	<i>yes</i>	<i>yes</i>	<i>yes</i>	<i>yes</i>	<i>yes</i>	<i>yes</i>
Year Trend	-0.02 (-0.95)	0.03** (3.47)	-0.03** (-3.74)	-0.41** (-6.42)	-0.18** (-5.05)	-0.18** (-6.25)
R-Squared	0.46	0.25	0.66	0.65	0.46	0.69
Number of Obs.	2316	4566	2316	547	683	547

T-Statistics are in parentheses. Regional dummies are: Dummy for Latin America, OECD, Sub-Saharan Africa, and East Asia countries.

### 3.2 Causality and Robustness

Tables 2 and 3 investigate the causal link between female labor force participation, government spending and its components. We use two variables as instruments for labor force participation. The first exogenous variable, the ratio of a home appliance price index to the consumer price index, is here collected for the first time and is available only for OECD countries.<sup>34</sup> A decrease in the relative price of household appliances encourages their dissemination and is likely to reduce the burden of household chores, which encourages female labor force participation. Moreover, the evolution of the relative price of appliances is unlikely to impact public expenditures directly, making it a suitable candidate as an instrumental variable.<sup>35</sup> In order to assess causality in a sample of developed as well as developing countries, we consider the lagged fertility rate as an additional instrument. We conjecture that a lower past fertility rate facilitates the decision of women to participate in the labor market and is unlikely to have a relevant direct effect on the amount of current public expenditures.<sup>36</sup>

A model of household production à la Becker (1965) can explain the rise in married female labor-force participation in the twentieth century as a rational response to the relative costs and benefits of the use of time. Greenwood, Seshadri and Yorukoglu (2005) have raised the hypothesis that the development of cheap durable consumer goods facilitated the entry of women into the labor force.<sup>37</sup> In addition, Greenwood, Seshadri and Yorukoglu (2005) documents a decrease in the number of domestic workers and number of hours worked at home in the post-war period - a threefold decrease in the numbers working at home and a decrease from 60 to 20 hours per week in household work - associating all of these with the generalization of access to home appliances.<sup>38</sup> Landsburg (2003) also points out that by 1900 very few women worked outside the home and housework took an average of 58 hours a week, while by 1975 that average was down to 18 hours. Moreover, international comparisons show that the countries where durable goods are cheapest are the countries where more women work for wages. We compute the ratio of the household appliance index

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<sup>34</sup>These are, specifically, household appliances that are likely to save labor in household cleaning and maintenance. Furniture and audiovisual appliances are excluded.

<sup>35</sup>It can be argued that the technological innovation that increases the quality or lowers the price of appliances might be partly driven by demand (i.e., by a large female labor force participation). Therefore, to ensure the orthogonality condition between female labor force participation and the appliance price index, we use the lagged value of this index in the three years before the participation observation.

<sup>36</sup>One can argue that women who wish to participate in the labor force are more likely to choose contraception and attempt to decrease their fertility. We will specifically test whether this holds, and we do find that current fertility rate and female labor force participation are endogenous. However, as will be seen below, past fertility is not endogenous.

<sup>37</sup>According to Greenwood, Seshadri and Yorukoglu (2005) from 1920 to 1970 the availability of utilities such as electricity, flush toilet and central heating went from less than 20 percent to more than 80 percent of households in the United States. Running water became available sooner but also increased at a substantial rate. This author presents figures on the availability of different appliances that reduce the cost of household chores - such as refrigerators, vacuums, washer, dryer, dishwasher and microwave. The first three became widely available from the late 1940s and the last three from the 1970s and 1980s. Also, the investment in appliances and stock of appliances relative to GDP almost doubled between 1955 and 1990. Moreover, Greenwood, Seshadri and Yorukoglu (2005) uses cross-section evidence to document a positive relationship between the stock of appliances and female labor force participation, as well as a worldwide negative relationship between changes in the relative price of appliances worldwide and female participation. Our dataset compiles yearly data on these two variables for the first time.

<sup>38</sup>In a related paper, Greenwood, Seshadri and Vandenbroucke (2005) proposes an explanation for the baby boom in the context of a secular decline in fertility due to a rise in real wages and, consequently, the opportunity cost of having children. The baby boom itself, it is argued, is associated to a surge in technological progress related to household appliances in the middle of the twentieth century which dramatically lowered the cost of having children.

to the consumer price index using the first available year as the base year with a value of 1. This variable is generally available for the period 1975 to 1999 and it decreases at an average rate of 1 percent per year. This delivers a dramatic average decrease of around 20 percent for the typical country in the OECD sample.<sup>39</sup> A different viewpoint is that of Jones et al. (2003) who argue that technological improvements in home production will have too small an impact on female participation, unless home and market goods are highly substitutable (which is the case in our model). The issue is certainly partly empirical and is addressed in Cavalcanti and Tavares (2007).

Table 4 in Appendix B reports the first stage regression results. For the OECD sample (columns (1) to (3)) - the lag of the household appliance price index and the lag of the fertility rate are used as instruments. We can verify that the coefficients of both variables have the expected sign and are statistically different from zero. For instance, as it becomes less expensive to buy home appliances, it becomes easier for women to participate in market activities. Below we formally test for exogeneity and overidentification.

Table 2 presents the results for instrumented labor force participation for two samples: the OECD and the full country samples. The results show strong evidence in favor of a causal link: female labor force participation increases public expenditure in both the OECD and the full samples and these increases are quantitatively important. The coefficient associated with female labor force participation is larger in the OECD sample. This result might be expected given the greater average political development of OECD countries and the potential use of political action to induce changes in the size of government. As to the quantitative effect, the impact of a 10 percent increase in female labor supply on government size is about 8.5 percent for the OECD and 7.3 percent in the whole sample.

In Table 3 we conduct two additional robustness tests: the inclusion of year dummies instead of just a year trend and the analysis of the 1990 in isolation. Since the full sample is used, only lagged fertility is used as an instrument for female labor market participation, exactly as in the last three columns of Table 2. The inclusion of year dummies controls for year fluctuations in expenditure and labor force participation, an alternative (and more demanding) control than the time trend used in Tables 1 and 2. The study of the 1990s aims at checking whether the effect of female labor force participation is present in recent years, after government expenditure - at least in OECD countries - reached considerably high levels, making any further increases much the more unlikely. We find evidence for a strong causal effect of female labor force participation on expenditure and components, with the size of the coefficients of interest decreasing only slightly. A 10 percent rise in female labor supply results in a 7.0 percent increase in the ratio of total spending to GDP, equally split between a rise in public consumption and subsidies.

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<sup>39</sup>Greenwood, Seshadri and Yorukoglu (2005) also document this average decrease in prices for a sample of available countries, though no individual country data are discussed. There is also some information on the price change for different home appliances.

**Table 2:** Dependent Variable: Government Spending (Total, Consumption, Subsidies and Transfers). Instrumental Variables Estimation - OECD and Whole Sample.

	OECD Countries			Whole Sample of Countries		
	Total Public Expenditures	Public Consumption	Public Subsidies and Transfers	Total Public Expenditures	Public Consumption	Public Subsidies and Transfers
Female Labor Force Part.	0.85** (2.02)	0.62** (2.44)	0.18 (0.70)	0.73** (3.61)	0.49** (2.19)	0.48** (3.77)
GDP Per Capita	0.00023 (1.03)	-0.00002 (-0.20)	0.00026** (2.21)	0.00022** (4.19)	0.00010** (3.60)	0.00014** (5.14)
Dependent-Work. Age Ratio	11.77 (0.59)	2.13 (0.20)	11.22 (1.17)	4.50 (0.47)	7.49* (1.76)	-5.07 (-0.99)
Urban Population	0.02 (0.40)	0.02 (0.73)	0.02 (0.64)	0.08** (2.75)	0.05** (3.35)	0.03* (1.77)
Imports	0.20** (2.31)	0.12** (2.74)	0.06 (1.50)	0.07** (2.69)	0.02 (1.46)	0.03** (2.47)
Male Labor Force Part.	-0.28 (-0.54)	-0.30 (-1.22)	0.07 (0.25)	-1.07** (-3.68)	-0.53** (-2.35)	-0.66** (-4.36)
Real GDP Growth	-0.56** (-2.70)	-0.33** (-3.10)	-0.19** (-1.75)	-0.04 (-0.48)	-0.01* (-0.29)	0.01 (0.28)
Unempl. Rate - Women	0.25 (1.51)	0.17* (1.90)	0.07 (0.81)	0.35** (2.02)	0.02 (1.25)	0.16* (1.84)
Unempl. Rate - Male	0.53** (2.62)	0.28** (1.90)	0.43** (2.77)	0.17 (1.03)	-0.05 (-0.29)	0.11 (1.29)
Life Expectancy	3.54** (4.61)	1.77** (3.81)	1.74** (4.99)	1.01** (3.83)	0.49** (3.44)	0.35** (2.61)
Regional Dummies	-	-	-	<i>yes</i>	<i>yes</i>	<i>yes</i>
Year Trend	-1.22** (-4.04)	-0.64** (-3.88)	-0.54** (-3.57)	-0.78** (-4.65)	-0.37** (-3.13)	-0.39** (-4.57)
R-Squared	0.70	0.64	0.72	0.56	0.45	0.54
Number of Obs.	128	135	128	405	475	405

T-Statistics are in parentheses. Regional dummies are: Dummy for Latin America, OECD, Sub-Saharan Africa, and East Asia countries.

**Table 3:** Dependent Variable: Government Spending (Total, Consumption, Subsidies and Transfers). Instrumental Variables Estimation - Year Dummies and the 1990s.

	Including Year Dummies			Decade 1990-1999		
	Total Public Expenditures	Public Consumption	Public Subsidies and Transfers	Total Public Expenditures	Public Consumption	Public Subsidies and Transfers
Female Labor Force Part.	0.85** (3.44)	0.48** (2.16)	0.42** (3.51)	0.70** (2.56)	0.34** (2.76)	0.36** (2.75)
GDP Per Capita	0.00022** (4.34)	0.00010** (3.54)	0.00015** (5.50)	0.0002** (4.68)	0.00010** (8.64)	0.00016** (6.41)
Dependent-Work. Age Ratio	6.13 (0.67)	8.41** (1.99)	-4.78 (-0.99)	10.89 (1.29)	2.86 (0.69)	-3.31 (-0.73)
Urban Population	0.08** (2.76)	0.05** (3.25)	0.03* (1.94)	0.07** (2.22)	0.04** (3.16)	0.02 (1.50)
Imports	0.07* (2.86)	0.02 (1.60)	0.03** (2.43)	0.08** (2.81)	0.01 (0.91)	0.03** (2.46)
Male Labor Force Part.	-0.96** (-3.41)	-0.49** (-2.20)	-0.59** (-4.15)	-0.61** (-2.05)	-0.48** (-3.49)	-0.43** (-2.91)
Real GDP Growth	-0.05 (-0.63)	-0.01 (-0.26)	-0.01 (-0.03)	-0.10 (-1.22)	0.01 (0.25)	0.04 (0.92)
Unempl. Rate - Women	0.33* (1.95)	0.21 (1.33)	0.13 (1.62)	0.15 (0.79)	0.12 (1.35)	0.14 (1.23)
Unempl. Rate - Male	0.16 (1.04)	-0.06 (-0.38)	0.12 (1.53)	0.27 (1.19)	-0.03 (-0.24)	0.09 (0.73)
Life Expectancy	0.99** (3.95)	0.49** (3.41)	0.34** (2.70)	0.75** (4.99)	0.59** (3.78)	0.21** (2.41)
Regional Dummies	<i>yes</i>	<i>yes</i>	<i>yes</i>	<i>yes</i>	<i>yes</i>	<i>yes</i>
Year				-0.62** (-2.88)	-0.23** (-2.46)	-0.25** (-2.49)
R-Squared	0.60	0.47	0.60	0.62	0.54	0.62
Number of Obs.	405	475	405	278	342	278

T-Statistics are in parentheses. Regional dummies are: Dummy for Latin America, OECD, Sub-Saharan Africa, and East Asia countries.

Our empirical investigation uncovers a robust relationship between the participation of women in the labor force and the share of public expenditures in GDP. A higher level of market participation by women is associated with higher spending by the government, both in its components of consumption and subsidies. When we instrument for labor force participation we find strong evidence of a causal link between female labor force participation and government size. The size of this effect is considerable. For the OECD, about one third of the 1999 levels of spending are explained by the large increase in female labor force participation since the 1960s.

### 3.3 Overidentification Test

The availability of two instruments in the case of the OECD sample allows us to conduct an overidentification test to investigate the validity of our causality test. Our model suggests that technological innovation in home appliances - or any variable that saves time on household chores - increases female labor force participation. This in turn increases the government spending. The overidentification test assumes, in turn, that one of the instruments is truly exogenous (e.g., lag of the relative price of home appliances), and tests whether the other instrument (e.g., lagged fertility rate) is in fact exogenous. In the tests conducted for the three specifications - total expenditures, consumption and subsidies - we could not reject the null hypothesis that the instruments are truly exogenous.<sup>40</sup> Table 5 in Appendix B is an easy way to suggest the results obtained in the overidentification test. It adds the lag of the home appliance index as an additional exogenous regressor in the equation of government spending as a share of GDP and tests whether this index has a direct effect on government spending, beyond its indirect effect through female labor force participation. In all cases, the coefficient of the lagged relative price of appliances is not statistically significant. This confirms our hypothesis that the price of home appliances affects government spending only insofar as it has an impact on female labor force participation.

## 4 Conclusion

This paper presents a model of endogenous fertility, female labor supply and government size, in the spirit of Galor and Weil (1996), that illustrates a causal link between the secular rises in female labor force participation and government size. As the market wage available to females rises with income per capita, women decide to enter the labor force in response to the increase in the opportunity cost of housework. If we assume that different forms of government expenditures decrease the cost of performing household chores disproportionately undertaken by women at home, it is possible that the rise in female labor force participation is accompanied by a demand for larger governments. We illustrate the positive empirical correlation between female labor supply and the size of government for a wide sample of countries between 1960 and 1999.

In order to uncover the possible causal link between participation and government size we instrument for labor force participation with a new dataset on the relative price of household appliances, in line with the motivation in Greenwood, Seshadri and Yorukoglu (2005). Since this new variable is available for the OECD set only, we use the lag of the fertility rate

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<sup>40</sup>The test statistic for the model with total government spending, public consumption, and subsidies plus transfers as the dependent variable were 0.525, 1.108, and 0.112, respectively. The critical value of a  $\chi^2_{(1)}$  with a confidence level of 90% is 2.706.

as an additional instrument. As contraception became widespread and the availability of household appliances increases in response to its lower relative price, it is likely that female participation in the labor market increases. Furthermore, there is no reason for a direct effect of the price of appliances on government size, as confirmed by our tests. We find that, indeed, an increase in female labor force participation causes the size of government to increase. This increase is sizeable, a 10 percent increase in female labor supply leading on average to an increase in government size of 7 to 8 percent of GDP. This is a quantitatively significant effect, robust to country sample, time period and the addition of control variables, including those in Rodrik (1998).

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## A Data Appendix

*Total Public Expenditures* - Description: Total government spending, in percent of GDP. Unit: Percentage points. Source: World Bank (2001).

*Public Consumption* - Description: General government final consumption expenditure, in percent of GDP. Unit: Percentage points. Source: World Bank (2001).

*Public Subsidies and Transfers* - Description: Government spending in subsidies and transfers, in percent of GDP. Unit: Percentage points. Source: World Bank (2001).

*Female Labor Force Participation* - Description: Female labor force activity rate, percent of female population ages 15 to 64. Unit: Percentage points. Source: World Bank (2001).

*GDP Per Capita* - Description: Gross Domestic Product per capita. Unit: Constant 1995 US Dollars. Source: World Bank (2001).

*Dependent to Working Age Ratio* - Description: Age dependency ratio, dependents to working-age population. Unit: Ratio. Source: World Bank (2001).

*Urban Population* - Description: Urban population as percent of total. Unit: Percentage points. Source: World Bank (2001).

*Imports* - Description: Imports as a share of Gross Domestic Product. Unit: Percentage points. Source: World Bank (2001).

*Male Labor Force Participation* - Description: Male labor force activity rate, percent of female population ages 15 to 64. Unit: Percentage points. Source: World Bank (2001).

*Real GDP Growth* - Description: Growth in real per capita Gross Domestic Product. Unit: Yearly growth rate in percentage points. Source: World Bank (2001).

*Female Unemployment Rate* - Description: Female unemployment, percent of female labor force. Unit: Percentage points. Source: World Bank (2001).

*Male Unemployment Rate* - Description: Male unemployment, percent of male labor force. Unit: Percentage points. Source: World Bank (2001).

*Regional Dummies* - Description: Dummies taking the value 1 if the country belongs to given regional area and 0 otherwise, defined for Latin America, Sub-Saharan Africa, East Asia and OECD. Unit: Indicator dummy. Source: World Bank (2001).

*Fertility rate* - Description: Total fertility rate. Unit: Births per woman. Source: World Bank (2001).

*Life expectancy* - Description: Life expectancy at birth. Unit: Years. Source: World Bank (2001).

*Household Appliance Price Index* - Description: Ratio of price index of household appliances to consumer price index. Unit: Ratio with first available year taking value 1. Source: Eurostat (2003).

## B Additional Tables

**Table 4:** Dependent Variable: Female Labor Force Participation. First State Regressions - OECD and Whole Sample.

	OECD Countries			Whole Sample of Countries		
	Total Public Expenditures	Public Consumption	Public Subsidies and Transfers	Total Public Expenditures	Public Consumption	Public Subsidies and Transfers
GDP Per Capita	0.00049** (6.95)	0.00051** (7.33)	0.00049** (6.95)	0.00010** (2.25)	0.00003 (3.60)	0.00010** (2.25)
Dependent-Work. Age Ratio	51.99** (3.75)	46.41** (3.41)	51.99** (3.75)	35.34** (3.29)	23.40** (2.35)	35.34** (3.29)
Urban Population	0.06** (2.25)	0.02* (1.90)	0.06** (2.25)	0.06** (2.31)	0.06** (1.12)	0.06** (2.31)
Imports	-0.17** (-10.34)	-0.17** (-10.58)	-0.17** (-10.34)	-0.08** (-6.39)	-0.06** (-5.30)	-0.08** (-6.39)
Male Labor Force Part.	0.81** (4.95)	0.73** (4.53)	0.81** (4.95)	1.02** (9.43)	0.96** (9.49)	1.02** (9.43)
Real GDP Growth	0.13 (0.85)	0.13 (0.84)	0.13 (0.85)	-0.13* (-1.88)	-0.13** (-2.52)	-0.13* (-1.88)
Unempl. Rate - Women	-0.35** (-3.03)	-0.39** (-3.44)	-0.35** (-3.03)	-0.71** (-7.98)	-0.67** (-7.99)	-0.71** (-7.98)
Unempl. Rate - Male	-0.10 (-0.65)	0.01 (0.08)	-0.10 (-0.65)	0.56** (4.95)	0.64** (6.08)	0.56** (4.95)
Life Expectancy	-1.14** (-2.69)	-1.30 (-3.12)	-1.14** (-2.69)	-0.65** (-4.59)	-0.52** (-4.14)	-0.65** (-4.59)
Lag of Fertility	-6.62** (-2.71)	-6.70** (-2.74)	-6.62** (-2.71)	-6.76** (-5.41)	-3.81** (-3.34)	-6.76** (-5.41)
Lag of Appliance	-16.77* (-1.77)	-14.39* (1.65)	-16.77* (-1.77)			
Regional Dummies	-	-	-	<i>yes</i>	<i>yes</i>	<i>yes</i>
Year	0.37** (2.92)	0.41** (3.29)	0.37** (2.92)	0.51** (8.76)	0.47** (8.68)	0.51** (8.76)
R-Squared	0.84	0.83	0.84	0.60	0.57	0.60
Number of Obs.	128	135	128	405	475	405

T-Statistics are in parentheses. Regional dummies are: Dummy for Latin America, OECD, Sub-Saharan Africa, and East Asia countries.

**Table 5:** Overidentification Test. Government Spending (Total, Consumption, Subsidies and Transfers). Instrumental Variables Estimation.

	Appl. Index Lagged as an Addit. Regressor		
	Total Public Expenditures	Public Consumption	Public Subsidies and Transfers
Female Labor Force Part.	1.05** (2.00)	0.75** (2.63)	0.23 (0.88)
GDP Per Capita	0.00012 (0.52)	-0.00010 (-0.74)	0.00023* (1.95)
Dependent-Work. Age Ratio	5.47 (0.26)	-1.11 (-0.10)	9.72 (1.01)
Urban Population	0.01 (0.19)	0.01 (0.51)	0.01 (0.56)
Imports	0.23** (2.55)	0.14** (2.90)	0.07* (1.69)
Male Labor Force Part.	-0.47 (-0.87)	-0.42** (-1.53)	0.02 (0.08)
Real GDP Growth	-0.59** (-2.87)	-0.35** (-3.03)	-0.20* (-1.80)
Unempl. Rate - Women	0.30* (1.73)	0.21** (2.11)	0.08 (0.97)
Unempl. Rate - Male	0.57** (2.64)	0.21 (2.01)	0.30** (2.78)
Life Expectancy	3.54** (4.22)	1.77** (3.37)	1.74** (4.90)
Lag of Appliance	12.89 (1.02)	9.64 (1.32)	3.06 (0.53)
Regional Dummies	-	-	-
Year	-1.22** (-3.83)	-0.63** (-3.54)	-0.54** (-3.51)
R-Squared	0.70	0.60	0.72
Number of Obs.	128	135	128

T-Statistics are in parentheses. OECD Sample.