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Having It All? Employment, Earnings and Children

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Having It All?
Employment, Earnings and Children*

Tobias Laun† Johanna Wallenius‡

April 23, 2017

Abstract

Sweden boasts high fertility and high female employment. However, part-time employment is very prevalent. There is a notable gender gap in both wages and earnings, which widens substantially after women have children. In this paper we study the effect of family policies on female employment, fertility and the gender wage gap. To this end, we develop a structural, life cycle model of heterogeneous households which features endogenous labor supply, human capital accumulation, fertility and home production. We find that family policies, such as subsidized daycare and part-time work options, promote maternal employment and fertility. Part-time work contributes greatly to the widening of the gender wage gap following the arrival of children. However, restricting part-time work options would lower maternal employment, and thereby also widen the gender wage gap.

JEL classification: E24; J22; J24

Keywords: Life cycle; Labor supply; Human capital; Fertility; Home production

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1 Introduction

Sweden and the other Nordic countries provide substantial government support aimed at reconciling work and family life. Policies include generous parental leave, heavily subsidized daycare and the facilitation of part-time work for parents with young children. The Nordic countries spend much more on family policies than other countries. To illustrate, childcare expenditures average 1.5% of GDP in Sweden, compared with 0.5% in the United States. Consequently, out-of-pocket childcare expenses are very low in the Nordic countries. The net childcare cost to a dual-earner family in Sweden is roughly 6% of net income, compared with more than 19% in the United States.[1]

These generous family policies were implemented with the goal of promoting employment, fertility and gender equity. Sweden boasts high female employment, with more than 80% of women aged 25-54 working. It is also very common for mothers with young children to work. Namely, the employment rate of women with a child aged 3-5 is also around 80%. Fertility is also relatively high, with 1.9 children born per woman aged 15-49. While maternal employment is very high in Sweden, part-time employment is very prevalent. Parents with a child under the age of eight have the option of working a reduced workweek of 75%. Correspondingly, more than 40% of couples with the youngest child aged 3-5 have one parent working part-time and the other working full-time. There is a notable gender gap in both earnings and wages in Sweden, which widens substantially after women have children. By following matched husband and wife pairs, Angelov, Johansson, and Lindahl (2015) document an increase in the gender earnings gap of 28 percentage points and an increase in the gender wage gap of 10 percentage points, 15 years after the birth of the first child.

In this paper we study the effect of family policies on female employment, fertility and the gender wage gap. We are particularly interested in trying to understand why part-time employment is so prevalent in Sweden, and the effect of this on the widening of the

[1] See Thévenon (2011) for more details.

gender wage gap. We are also interested in understanding the role of home production, particularly the unequal division of home work across genders when children are young, in shaping women's career paths. Despite the fact that Swedish men do more housework than men in most other countries, Swedish women still work more in the home than their male counterparts. This is particularly true in families with small children, where women spend on average two hours more per day on home work than men.

We are interested in studying a broad range of government policies, and also their potential interaction over the life cycle. In order to do this, we develop a structural, life cycle model of heterogeneous households. Households differ with respect to labor market productivity, their preference for leisure, and their preference for children. Our framework is quite rich, and features endogenous home and market work, human capital accumulation and fertility. We calibrate the model to match Swedish data. In order to understand the driving forces behind the time allocation decisions of couples over the life cycle, we consider five different exercises: (1) eliminate the part-time work option, (2) increase the penalty for part-time work, (3) reduce the initial gender wage gap, (4) reduce the childcare subsidy and (5) introduce a subsidy on the market input in home production.

We find that the prevalence of part-time work contributes considerably to the widening of the gender wage gap following the birth of children. However, policies that limit part-time work options lower the employment rate of mothers with young children. In our benchmark, working a reduced workweek of 75% accrues 75% of the human capital of full-time work. We find that increasing the penalty for part-time work, by lowering this to 50%, has effects similar to those from eliminating the part-time work option altogether. The employment rate of mothers with the youngest child aged 3-5 declines by more than 10 percentage points. Because of this decline in employment, the gender wage gap continues to widen after children are born. Moreover, our model predicts that limiting part-time work also has a small negative effect on fertility, with fertility rate declining from 1.88 to 1.83.

In the vast majority of couples the husband is still the higher earner. We consider the

effect of reducing this initial gender wage gap by half. In this exercise we are asking how the career trajectories of women following the birth of children can be expected to evolve, if the initial gender wage gap narrows. Our model predicts an increase in female aggregate hours of market work of 2%. Interestingly, however, this arises almost exclusively from an increase in labor supply along the extensive margin – specifically the retirement margin – and not the intensive margin. As such, our model predicts that the gender wage gap will continue to widen after women have children, even if the initial gap narrows further.

We find that labor supply and fertility decisions are intertwined. This is especially evident when we study the effect of childcare subsidies on equilibrium allocations. When we cut the childcare subsidy by 10%, our model predicts that some women will work more and have fewer children, while others will continue to have several children but stay at home longer when children are young. The employment rate of young mothers declines by more than 20 percentage points. This is, however, offset by higher employment of men and women later in the life cycle (due to a decline in the tax rate, which accompanies the decline in the subsidy rate). The fertility rate declines substantially, to roughly 1.3. If we reduce the subsidy further, aggregate hours of market work decline significantly. For example, with a 50% cut in the childcare subsidy rate our model predicts that aggregate hours of market work for women decline by 2.1% relative to the benchmark.

The prevalence of part-time work, and the resulting widening of the gender wage gap following children, has been linked to high female hours of home work (see Angelov, Johansson, and Lindahl (2015) and Albrecht, Skogman Thoursie, and Vroman (2015)). Motivated by this, we study the labor supply implications of introducing a 10% subsidy on the market input in home production. Our model predicts heterogenous effects over education. We find very little effect on the labor supply of college educated women. Conversely, we predict a substantial increase in the aggregate hours of market work of high school educated women, 4% to be exact. This increase is due almost exclusively to an increase along the extensive margin of labor supply, and specifically from deferred retirement. Part-time work among women with young children is prevalent even with the

subsidy. Therefore, the widening of the gender wage gap following children is comparable to the benchmark. The introduction of the subsidy on the market input in home production also leads to an increase in male labor supply. All in all, aggregate hours of market work for the whole economy rise by 3.0%. Fertility is essentially unaffected by this subsidy.

Our results suggest that, due largely to the time costs associated with kids, combing two full-time careers and young children is challenging – even when inexpensive daycare is widely available, as is the case in Sweden. Also, given the design of the Swedish pension system, women find it preferrable to increase labor supply along the retirement margin than along the intensive margin. These findings stress the importance of modeling the full-life cycle, when considering changes to family policies.

Our paper is related to several strands of literature. There is an empirical literature on gender wage gaps and the penalties associated with time away from work. Angelov, Johansson, and Lindahl (2015) document that in Sweden the gender income/wage gap widens substantially after women have children. Albrecht, Björklund, and Vroman (2003) and Albrecht, Skogman Thoursie, and Vroman (2015) study the effect of parental leave on wages. There is also a notable empirical literature on the effect of childcare costs on female labor supply, dating back to Heckman (1974), which documents positive labor supply effects of childcare subsidies.[2] See Olivetti and Petrongolo (2017) for a recent survey of micro-level studies on the effect of family policies on labor market outcomes.

Our paper is closely related to a growing literature in macroeconomics which uses structural, dynamic models to study the labor supply behavior of heterogenous households. Erosa, Fuster, and Restuccia (2016) study the effect of children on the evolution of the gender wage gap in a quantitative life cycle model. However, contrary to us, they assume that children exogenously lower female hours of market work. Domeij and Klein (2013), Guner, Kaygusuz, and Ventura (2013) and Bick (2016) study the effect of subsidized daycare on female labor supply, and in the case of Bick (2016) also on fertility.

[2] See also Blau and Hagy (1998), Tekin (2007) and Baker, Gruber, and Milligan (2008) for more recent work.

There are, however, a number of distinguishing features to both our framework and our analysis. Notably, our framework incorporates home production. We know that the responsiveness of market work to changes in government policies is different when there is an additional margin of adjustment available to households (see, e.g., Ragan (2013)). Moreover, the inclusion of home production allows us to consider a richer set of policy measures. We study a broad set of family policies, and the effect of said policies on female and male labor supply, fertility and gender wage gaps.[3] Contrary to many papers, we also model the full life cycle, and can thereby study the interaction of various policies over the life cycle. Lastly, our paper is related to work by Siegel (2017) who studies the effect of rising wages on fertility and hours worked. However, he treats wages as exogenous and assumes a stand-in household.

An outline of the paper follows. Section 2 presents the model, and Section 3 describes the calibration procedure. Section 4 presents the results from our policy exercises, while Section 5 concludes.

2 Model

We develop a discrete time life cycle model to study household time allocation decisions. All economically active agents live in two-adult households, comprised of one man ($i = m$) and one woman ($i = f$), along with potential children. For simplicity, we assume that both spouses are of the same age and face the same deterministic life-span. A model period is a year, and individuals live for 53 periods with certainty. We abstract from bequests. Model age zero corresponds to age 28 in the data. Households decide on how many children, if any, to have in the first period of the model.[4]

Households differ with respect to labor market productivity (here educational attain-

[3] With the exception of Guner, Kaygusuz, and Ventura (2013), most papers studying female labor supply largely ignore male labor supply decisions.

[4] As such, this framework is not suited for studying the effect of the timing and spacing of multiple children.

ment), their preference for leisure and their preference for children. To ease notation, we suppress the heterogeneity in what follows.

Agents are endowed with one unit of time each period, as well as initial stocks of physical capital, human capital and pension capital (which is used to compute retirement benefits), denoted by k_0, e_0 and PC_0 respectively.

Preferences

Households have preferences over the consumption good (c), the home good (s), male and female market hours (h_m and h_f, respectively), male and female home hours (n_m and n_f, respectively) and children (b). Letting a denote model age, a household has preferences given by:

$$\sum_{a=0}^{52} \beta^a \Big[\ln\left(\frac{c_a}{\psi(b_a)}\right) + \alpha_s \ln\left(\frac{s_a}{\psi(b_a)}\right) + \alpha_b \frac{(b_a+1)^{1-\varepsilon}-1}{1-\varepsilon} - \frac{(\alpha_{hma}h_{ma}+\alpha_n n_{ma})^\gamma}{\gamma} - \frac{((\alpha_{hfa}+\mu(b,a))h_{fa}+\alpha_n(n_{fa}+tc(b,a)))^\gamma}{\gamma}\Big], \quad (1)$$

where β is the discount factor. Preferences are assumed to be separable and consistent with balanced growth. Children deflate consumption. We introduce an additional disutility term, μ, for maternal employment when there is a newborn in the household. This generates parental leave in the model. We also assume that young children impose a time cost on mothers, tc, which enters the utility function similarly to home hours. We allow for differing disutilities on home and market hours of work (this is similar to Siegel (2017)). There is, however, a relationship between the two. Namely, the marginal disutility of an additional hour of market work is increasing in home hours, and vice versa. We allow the disutility from market work to differ by gender and age. These features are necessary to match the life cycle profiles for market and home hours for men and women. The utility from children is increasing in the number of children, but exhibits decreasing returns.

Children

Children are modeled as a discrete choice. Couples choose between having zero, one, two or three children in the model.[5] As noted previously, for simplicity, we assume that this choice is made in the first period and that the first child is born in that same period. We assume that siblings are born in consecutive periods. This is intended to capture the fact that women with more children are entitled to more parental leave and more periods of part-time work. We elaborate on these institutional features below.

Labor Supply

We assume agents face a discrete choice of market hours. Women with young children can work full-time, part-time or not all in the market. Men choose between working full-time and not at all, as do women with either no children or older children. To ease the computational burden, we assume that all men work until age 60 after which they endogenously decide when to retire.

Home Production

Household services are produced using a combination of the husband's and wife's time and a market purchased input (m):

$$s_a = (\alpha(n_{ma} + n_{fa})^{\rho} + (1-\alpha)m_a^{\rho})^{\frac{1}{\rho}}, \tag{2}$$

where $\frac{1}{1-\rho}$ is the elasticity of substitution between home hours and the market input. Home hours are a continuous choice variable.

[5] In the data, we combine three or more kids into the same category.

Human Capital Accumulation

Labor income (y) is the product of the rental rate (w), human capital (e) and hours worked in the market. We model human capital accumulation in the spirit of Blundell, Costa Dias, Meghir, and Shaw (2016). Specifically, we assume that human capital next period depends on the amount of human capital in the current period and hours worked in the market in the following way:

$$e_{a+1} = (1-\delta)e_a + Ae^{da}g(h_a). \tag{3}$$

This specification captures several key features: (1) depreciation, (2) learning, (3) the possibility that learning becomes harder with age, and (4) a potential penalty associated with part-time work. The part-time penalty is governed by the $g(h)$ function.

The parameters of the human capital production function are education specific. We exogenously impose an initial gender wage gap, since even women working full-time have lower wages than men.

Budget Constraint

The household faces a sequence of budget constraints given by:

$$\begin{aligned}&(1+\tau_c)c_a + m_a + k_{a+1} - (1+r)k_a + B\left(b_a, h_{ma}, h_{fa}\right)\\ =&(1-\tau(y_{ma}))y_{ma} + (1-\tau(y_{fa}))y_{fa} + P_a + R_{ma} + R_{fa}.\end{aligned}$$

The interest rate is denoted by r. We impose a no-borrowing constraint.

If the household has young children and both parents work, the household must pay a childcare cost. We denote the out-of-pocket childcare cost by $B(\cdot)$. It is a function of the number of children. Childcare is heavily subsidized in Sweden.

P_a denotes the parental leave benefits. Parental leave benefits are of finite duration, and conditional on having just had a baby and the parent collecting the benefits not working in

the market. Benefits are dependent on the past earnings history of the parent on leave. For simplicity, we assume that parental leave can only be claimed by the mother. We model the duration of benefits as one year (the actual duration is roughly 16 months).

The retirement benefits of the husband and wife are denoted by R_{ma} and R_{fa}, respectively. Retirement benefits depend on the age and past earnings of the claimant through pension capital, which is accrued by working. The pension capital is paid out as an annuity. There is no restriction associated with working and collecting benefits. For simplicity, in the model we assume that the annuity is paid out starting at age 65, regardless of when the agent stops working.

The government levies a proportional tax on consumption, τ_c, and a progressive tax on labor income, $\tau(y)$. Retirement income is part of taxable income in Sweden. The government uses the proceeds from these taxes to finance parental leave benefits, the childcare subsidy, retirement benefits and government consumption. We assume that individuals value government consumption, but that it does not affect the marginal utility of private consumption (this is akin to assuming that the revenue allocated for government consumption is thrown away). We assume a balanced budget in equilibrium.

Recursive Formulation

We can write the household's decision problem in recursive form. The state x of the household is given by age (a), assets (k), the human capital of the husband and wife (e_m and e_f, respectively), the number of children (b) and the pension capital of the husband and wife (PC_m and PC_f, respectively). Households know x at the start of the period and decide how much to spend on the consumption good and the market purchased input, how much to save, whether or not the wife works in the market (part-time work also an option for women with young children), whether or not the husband works in the market (only a choice after age 60), how much the wife works in the home and how much the husband works in the home. The number of children is decided in the first period.

The value of state x is:

$$V(x) = \max_{\substack{c,m,k',h_m,h_f,\\ n_m,n_f}} u(c,s,b,h_m,h_f,n_m,n_f) + \beta EV(x') \tag{4}$$

$$\begin{aligned} s.t. \quad & (1+\tau_c)c + m + k' - (1+r)k + B \\ & = (1-\tau(x))y_m(x) + (1-\tau(x))y_f(x) + P(x) + R_m(x) + R_f(x) \end{aligned} \tag{5}$$

$$s = (\alpha(n_m+n_f)^{\rho} + (1-\alpha)m^{\rho})^{\frac{1}{\rho}} \tag{6}$$

$$e' = (1-\delta)e + Ae^{da}g(h) \tag{7}$$

2.1 Solving the Model

Each period the couple chooses consumption, investment in physical capital, expenditure on the market input in home production, male and female home hours, and male and female market hours. The household does this for each combination of physical capital, male and female pension capital, male and female human capital and number of children. The number of children is chosen in the first period. Men and women with older children choose between not working and working full-time in the market. Women with the youngest child below the age of eight, choose between not working, working part-time (75% of full-time) and working full-time in the market. To ease the computational burden, we assume that men work full-time from age 28 to 60, after which they optimally choose when to retire. Retirement is an absorbing state. We allow women with small children to cycle between employment and non-employment. For simplicity, however, we assume that a transition into non-employment after the youngest child turns eight is an absorbing one. We assume that both spouses are retired by 70.

The decision rules are solved for via backward induction. Assuming zero utility when dead, we know the value function at age 81. This enables us to solve the couple's problem

at age 80, for each possible combination of state variables. Given this, we know the value function at age 80, which in turn allows us to solve the couple's problem at age 79. Working iteratively backwards we are able to solve the full decision problem.

Once we have solved for the decision rules, we simulate the model given initial physical capital, male and female pension capital and male and female human capital.

3 Calibration

In this section we discuss the process of assigning values for the model parameters. We calibrate the model to Swedish data. The policy parameters are chosen to match the Swedish welfare policies, specifically parental leave, subsidized daycare and social security. We take particular care to match these institutional details. The remaining parameters are chosen to match moments of the data, particularly the time series averages for aggregate variables and the life cycle profiles for employment, earnings and hours worked in the home. Our primary data source is the Longitudinal Individual Data Base (LINDA), a registry-based dataset for Sweden.

Recall that the length of a period is calibrated to a year, and that model age zero corresponds to age 28 in the data. All households enter the model with zero assets and zero pension capital. We normalize initial human capital to one for all males and females. We assume an annual interest rate equal to 3%.

Households differ with respect to education, their preference for leisure and their preference for children. We model two education categories, college and non-college. This means that households fall into one of four educational bins: husband and wife both high school educated, husband college educated and wife high school educated, husband high school educated and wife college educated, or husband and wife both college educated. The weights for these bins are taken from the data. Assortative matching is quite prevalent in Sweden; in roughly 62% of Swedish households both spouses have a high school

degree and in roughly 15% of households both spouses have a college degree. In approximately 11% of households the husband has a college degree, while the wife has a high school degree. In the remaining 12% of households the wife has a college degree and the husband a high school degree.[6] We assume two female disutility from market work types, high and low. Similarly, we assume two utility from kids types, high and low. These weights are determined by the calibration (see below).

Preference and Home Production Parameters

For simplicity, we set the discount factor, β, equal to $1/(1+r)$. The parameters governing the disutility of male and female market hours (α_{hma} and α_{hfa}, respectively), the share of women with high disutility from market work, and the parameter governing the disutility of home hours (α_n) are critical for matching the life cycle profiles for male and female market and home hours. We set these parameters to target male and female employment by age and education, the prevalence of part-time employment among mothers with young children, and average male and female home hours at different stages of the life cycle (young children in household, older children in household, children out of household, retirement). The employment rates are constructed from LINDA for the year 1997. The home hours measures are constructed from the Harmonized European Time Use Survey (HETUS) for year 2000. A fair bit of preference heterogeneity is needed in order to match all of these moments. We allow the market work disutility parameters to differ by gender, education, age, and, in the case of women, also by utility type (high or low). Moreover, we allow the disutility from home work to differ from the disutility of market work. The additional disutility from working in the market with a newborn baby, μ, is set to ensure that women take parental leave. We set the parameter governing the elasticity of hours worked (γ) based on estimates in the literature for models with endogenous human capital accumulation.[7]

[6] Based on LINDA for year 2005.

[7] See Imai and Keane (2004) and Wallenius (2011).

The weight and curvature parameters in the utility from children (α_b and ε), as well as the share of households with a high utility from children, are set to target the fertility distribution. We construct the distribution of children across couples from the LINDA dataset. We restrict the data to years 1990-2005 and women aged 30-50. This is done to approximate total fertility, and not to mix vastly different cohorts.[8]

The level of average home hours at different points in the life cycle and the average ratio of consumption goods to market purchased services pin down the utility weight on the home good (α_s) and the relative weight of home hours (α) in the home good production function. Our value for the ratio of consumption to market purchased services is taken from Olovsson (2009). The parameter governing the substitutability of time and goods in the home production function is taken from the literature (see, e.g., Ragan (2013)).

Life Cycle Earnings

The parameters of the human capital production function, namely δ, A and d, are chosen to match the age-earnings profiles of college and non-college educated men (i.e., parameters education-specific). We use the LINDA dataset to construct life cycle earnings profiles for college and non-college educated men in Sweden. We limit the sample to men born between years 1925 and 1935. Incomes are made comparable across years by adjusting with the base-amount for the year in question. We delete all observations with income below one base-amount. For the two education groups separately, we run a regression of annual earnings on age and age squared.

In the model, labor income is the product of a rental rate, human capital and hours worked. The initial stocks of human capital are all normalized to one. For men, the rental rate is set so as to match age 28 earnings in the data, separately for the college and non-college educated. We assume that the human capital parameters δ, A and d are

[8] Using this approach, average fertility lines up well with that reported by Statistics Sweden for 2000.

the same for men and women. To match the initial gender wage gap, we follow Jones, Manuelli, and McGrattan (2015) and assume that the rental rate for women is given by $w_f = gwg \cdot w_m$, where $gwg < 1$. We compute the gender wage gap from the LINDA data, separately for college and non-college educated women. The age 28 gap is 10% for high school graduates and 13% for college graduates. In the benchmark, we assume that there is no additional penalty from part-time work. In other words, working a reduced workweek of 75% accrues 75% of the human capital of working full-time.

Taxes and Benefits

Parental leave benefits are of finite duration, dependent on past income, and conditional on having just had a baby and the parent collecting the benefits not working in the market. Parental leave benefits replace roughly 80% of the last wage. For simplicity, we assume that parental leave can only be claimed by the mother. We model the duration of benefits as one year.

Childcare in Sweden is heavily subsidized. Consequently, the out-of-pocket daycare expenses are low. The cost of placing one child in daycare is 3% of pre-tax household income. However, the cost is capped at roughly 140 USD a month. The cost of placing additional children in daycare is even lower. The cost for the second child is 2% of pre-tax household income, but at most just over 90 USD per month. According to estimates of the true cost of daycare, this implies a subsidy rate of roughly 86% for a couple paying the maximum amount for daycare for one child in Sweden.[9]

Retirement benefits depend on the age and past earnings of the claimant. Workers accumulate 18.5% of labor income up to a cap (of roughly 30 000 USD per year) as pension capital. The pension capital is paid out as an annuity. There is no restriction associated with working and collecting benefits. For simplicity, we therefore assume that the annuity is paid out starting at age 65, regardless of when the agent stops working.

[9] According to Janzon (2014), the true cost of a childcare spot in Sweden is around 12,400 USD per year. The out-of-pocket costs vary somewhat across municipalities; we use the formula for Stockholm.

The parental leave benefits, the childcare subsidies and the retirement benefits are funded through tax revenue. Our model includes consumption taxes, social security taxes and income taxes. Of these three, only income taxes are progressive. The income tax rate is 0.31 on income up to a threshold of roughly 33 000 USD. On income above the threshold, the income tax rate is 0.51. The consumption tax is set equal to 0.25, which is the value-added tax on most goods in Sweden. The social security tax of 0.23 includes employer and employee contributions.

The tax revenue that is left over from funding the above mentioned policies is spent on government consumption. We assume that individuals value government consumption, but that it does not affect the marginal utility of private consumption (this is akin to assuming that the revenue allocated for government consumption is thrown away). We assume a balanced budget in equilibrium.

3.1 Calibrated Economy

The parameters governing the disutility from market work are summarized in Table 1. The disutility from market work varies with gender, education (own and spousal) and age. For women, we also assume that there are two types, low and high disutility, within each education bin. This yields four profiles for men and eight for women. We assume a piece-wise constant profile over age, with the break at age 60. The higher disutility at older ages is intended to capture features not explicitly modeled here, such as worsening health. All the other calibrated parameter values for the benchmark Swedish economy are reported in in Table 2.

Table 1: Disutility from Market Work by Gender, Education and Age

	HS/HS	HS/CL	CL/HS	CL/CL
Male DU	$1.95 \rightarrow 3$	$1.35 \rightarrow 2.55$	$1.7 \rightarrow 3$	$1.8 \rightarrow 3$
Female, low DU	$1.6 \rightarrow 2.65$	$1.7 \rightarrow 2.9$	$0.7 \rightarrow 2$	$1.5 \rightarrow 2.7$
Female, high DU	$2.2 \rightarrow 3.25$	$2.7 \rightarrow 3.9$	$1.7 \rightarrow 3$	$2.1 \rightarrow 3.3$

HS: high school, CL: college. First value up to age 60, second above age 60.

Table 2: Calibrated Parameter Values

Parameter	Description	Target	Value
Utility			
α_{hma}	male disutility market work	male market work	see Table 1
α_{hfa}	female disutility market work	female market work	see Table 1
α_{nf}	disutility home work	male and female home work	0.85
γ	related to elasticity of hours	literature	2
α_b	utility children	fertility distribution	0.28/0.32
ε	elasticity of children	fertility distribution	0.8
α_s	utility home good	home hours & c/m	0.75
Home production			
α	weight on home hours in production	home hours & c/m	0.65
ρ	related to elasticity of substitution	literature	0.8
ct	maternal time cost from young kids	time use childcare	0.1
Human capital			
δ	depreciation rate	male age-earnings	0.020/0.017
d	age effect	male age-earnings	-0.021/-0.019
A	learning	male age-earnings	0.093/0.047
w_m	male rental rate	male income at 28	3.884/7.633
gwg	gender wage gap	initial gender gap	0.9/0.87

Two values for α_b, low/high utility from kids. Human capital parameters reported for non-college/college.

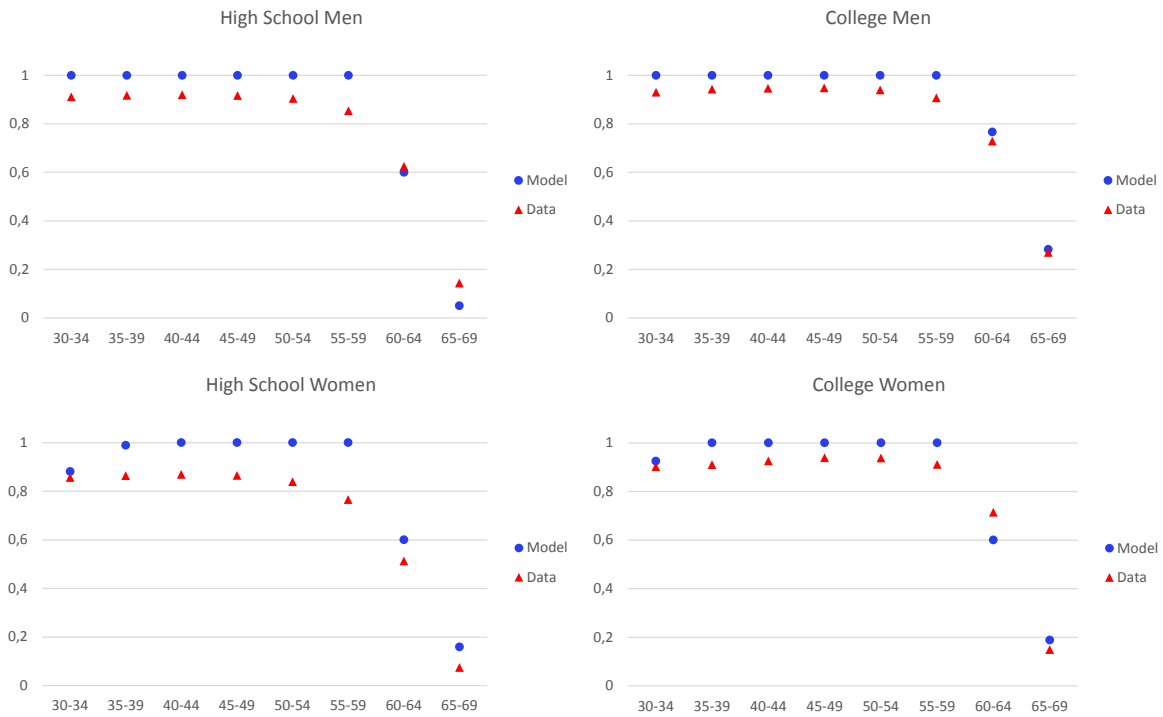
Next we highlight some of the key properties of our calibrated benchmark economy and discuss the fit of the model to the data.

Market Work

Figure 1 shows the model predicted employment rate by gender, education and age relative to the data. In our model, men work full-time until retirement. This is why we slightly over predict the employment rate of prime-aged men. We do a good job of capturing the decline in employment for men in their 60s. Female employment in Sweden is high. Moreover the employment rate of mothers with young children is also high. Nevertheless, our model still over-predicts the employment of prime-aged women. The reason for this is that our model is not able to generate non-employment for women without kids. Again, our model successfully generates the decline in employment for women at older ages.

Part-time work is very prevalent among Swedish mothers. Our model does a good

Figure 1: Employment by Age, Education and Gender – Model vs. Data



Data source: LINDA, 1997.

job of matching this. In the data, 43% of couples with the youngest child aged 3-5 have one spouse working full-time and the other working part-time. In our model, this share is 47%.[10]

Part-time work has a negative effect on the wage trajectories of women. Recall that we impose no part-time penalty in the baseline. This implies that working a reduced workweek of 75% accrues 75% of the human capital of full-time work. Even without a part-time penalty, there is substantial widening of the gender wage gap following children in our model. Specifically, 15 years after the birth of the first child, the gender wage gap has widened by 6pp. In other words, our model generates 60% of the widening in the gender wage gap reported by Angelov, Johansson, and Lindahl (2015), 15 years after the birth of the first child.[11]

[10]Data reported by OECD for 2008.

[11]By following matched couple pairs before and after the birth of children, Angelov, Johansson, and Lindahl (2015) are able to control for both observed and unobserved characteristics of the spouse, unlike most previous studies. As such, this is the appropriate measure to compare our model against.

Home Work

Table 3 reports model predicted home hours relative to the data. The HETUS database reports time use for couples over the life cycle. Their classification is: youngest child aged 0-6, youngest child aged 7-17, couple aged 45-64 with no under-age children at home, couple aged 65+. We map this into our model, given the timing of fertility that we assume.[12] Home hours include cooking and cleaning, laundry, gardening, caring for pets, home repairs, shopping and childcare. Note that the model numbers for home hours of women with young kids includes the fixed time cost we impose. Working mothers in Sweden with children aged 0-6 spend on average roughly two hours per day on childcare. This corresponds to 0.14 of the time endowment. To be on the conservative side, we set the fixed time cost equal to 0.1.[13] Our model does a rather good job of matching the life cycle profile for female home hours, with the exception that it over-predicts home hours at older ages. In particular, our model generates the inverted U-shape to female home hours that we observe in the data. Our model over-predicts male home hours, especially at older ages.

Table 3: Home Hours Over the Life Cycle – Model vs. Data

Female Home Hours		
Age	Model	Data
young kids	0.38	0.35
older kids	0.26	0.25
grown kids	0.23	0.22
retirement	0.37	0.30
Male Home Hours		
Age	Model	Data
young kids	0.26	0.23
older kids	0.25	0.18
grown kids	0.24	0.16
retirement	0.37	0.23

Data source: HETUS, 2000.

[12]For the first three categories in the data we look only at employed individuals.
[13]Folbre (2008) reports similar values for the United States.

Fertility

Fertility is relatively high in Sweden, with close to two children born per woman. Table 4 shows the model generated distribution of fertility across couples. Our model over-predicts the number of couples with no kids and the number of couples with three kids. Conversely, it under-predicts the number of couples with one and two kids. Nevertheless, the overall fit is quite good. This is evidenced by the fact that our model matches average fertility very well, with 1.88 children born per woman in our model, compared with 1.93 in the LINDA data.

Table 4: Distribution of Completed Fertility Across Couples – Model vs. Data

Kids	Model	Data
0	22%	9%
1	5%	16%
2	35%	47%
3	38%	28%

Data source: LINDA, 1990–2005.

4 Policy Exercises

Having calibrated the model, we turn to the policy analysis and some counterfactual exercises. Our goal is to further the understanding of household decision making, particularly as it pertains to market and home work and fertility. We are especially interested in the effect of family policies on employment, fertility and the gender wage gap. In order to understand the driving forces behind the time allocation decisions of couples over the life cycle, we consider five different exercises: (1) eliminating the part-time work option, (2) increasing the penalty for part-time work, (3) reducing the initial gender gap, (4) reducing the childcare subsidy and (5) introducing a subsidy on the market input in home production.

4.1 Results

In this sub-section we present the results from our policy exercises. All of the results are summarized in Table 5.

Exercise 1: Eliminate Part-Time Option

In Sweden, everyone with a child under the age of eight is entitled to work a reduced workweek of 75%. Entirely eliminating the part-time work option is of course rather extreme. This exercise should not be viewed as a policy proposal. Rather, the purpose of this exercise is to understand what effect part-time work policies, such as the one in place in Sweden, have on employment, wages and fertility. In particular, if we were to limit part-time work options, would more women work full-time or rather stay at home with young children? Moreover, what would be the effect on the evolution of the gender wage gap? And lastly, would there be fertility effects?

We find that eliminating the part-time work option leads to a decline in the employment rate of mothers with young children. Specifically, the employment rate of mothers with the youngest child aged 3-5 declines by 13 pp. However, while some women who worked part-time in the benchmark economy stay home longer with children when the part-time work option is no longer available, others move from part-time work to full-time work. Our model predicts that total hours worked by college educated women rise by 1.3%, while total hours worked by high school educated women decline by 1.3%. This implies a decline in female aggregate hours of market work of 0.6% relative to the benchmark. Interestingly, in some of the couples where the wife switches from part-time to full-time work, the husband reduces his labor supply. This effect, however, is quantitatively small. Aggregate hours for the whole economy decline by 0.3%. According to our model, there is also a small negative effect on fertility from eliminating the part-time work option. Some women who work full-time when the part-time option is no longer available, choose to have fewer children. The fertility rate declines from 1.88 to 1.83.

We find that part-time work contributes significantly to the widening of the gender wage gap following children. According to our results, however, if part-time work was not as readily available, many women would choose to stay home longer with their children. Therefore, eliminating part-time work would not lead to a narrowing in the gender wage gap. In sum, the facilitation of part-time work for parents with young children has a moderately positive employment effect and a small positive fertility effect.

Exercise 2: Increase Part-Time Penalty

Part-time work is generally thought to carry a penalty in terms of pay, job security, training and promotion. The empirical evidence regarding the part-time wage penalty for Sweden is somewhat mixed. Bardasi and Gornick (2008) find no part-time penalty for Sweden. Using quantile regressions, Wahlberg (2008) finds evidence of a part-time wage penalty, which rises with income. On a related note, Blundell, Costa Dias, Meghir, and Shaw (2016) suggest that one does not accrue essentially any human capital from part-time work. The study uses UK data. In the benchmark economy, we assume that human capital accrual is proportional to hours worked. In other words, one accrues 75% of the human capital of full-time work from working a reduced workweek of 75%. Now we consider the case where working a reduced workweek of 75% accrues only 50% of the human capital of full-time work. We are interested in understanding whether Swedish women would work more full-time and less part-time, if the penalty for part-time work was greater, or if they would instead stay home with small children.

Our model predicts an 11 pp decline in the employment rate of mothers with the youngest child aged 3-5, when we lower the accrual of human capital from part-time work. Again, the effects of increasing the part-time work penalty are heterogenous across married women. Some women who worked part-time in the benchmark economy would choose to work full-time if the part-time work penalty was higher, while others would stay at home longer when their children are young. Our model predicts an increase in the total hours worked by college educated women of 1.0%, but a decline in the total hours of high

school educated women of 1.1%. The aggregate effect is negative, with total female hours of market work declining by 0.6% relative to the benchmark. In a few instances where the wife switches from part-time to full-time work, the husband reduces his labor supply. Again, this effect is quantitatively small. Aggregate hours for the whole economy decline by 0.3% in relation to the baseline economy. The effect on aggregate hours worked is very similar to the scenario where we eliminated the part-time work option altogether. Note, however, that roughly 14% of mothers with the youngest child aged 3-5 continue to work part-time with the higher part-time penalty. Also similar to the case where the part-time work option is eliminated, there is a small negative effect on fertility from increasing the part-time work penalty. The fertility rate declines from 1.88 to 1.83.

Note that, despite the reduction in part-time work, the widening of the gender wage gap following children is comparable to the benchmark. This is due to the fact that the employment rate of young mothers declines relative to the benchmark economy.

Exercise 3: Reduce Initial Gender Gap

The gender wage gap in most Western economies, including Sweden, narrowed substantially over the second half of the 20th century. Nevertheless, in the vast majority of couples the husband is still the higher earner. It therefore makes sense from an economic stand point that, *if* one spouse is going to cut back on market work after the birth of the child, it be the woman. In the benchmark economy, the initial gender gap is 10% for high school educated women and 13% for college educated women. Here we consider the effect of reducing this initial gap by half. In this exercise we are asking how the career trajectories of women following the birth of children can be expected to evolve, if the initial gender wage gap narrows further.

When we cut the initial gender wage gap in half, female aggregate hours of market work rise by 2%. The increase is slightly more pronounced for more educated women than for their less educated counterparts, 2.3% for female college graduates and 1.9% for

female high school graduates. We find almost no reduction in the prevalence of part-time work in response to the narrowing of the initial gender gap. The majority of the increase in aggregate hours of market work stems from an increase along the extensive margin. Women spend on average 8 more months in employment. This does not come from young mothers, but rather from older workers deferring retirement. In response to the increase in female employment, male employment declines modestly. All in all, aggregate hours of market work for the whole economy rise by 0.7% relative to the benchmark. According to our model, the narrowing of the initial gender wage gap has a negligible effect on fertility, with the fertility rate going from 1.88 to 1.87.

A narrowing of the gender wage gap increases the incentives for female labor supply. It is interesting to note that, according to our model, the increase in female labor supply would arise almost exclusively from the extensive margin, and not from a decline in part-time work. As such, even with a smaller initial gender wage gap, the widening in the gap following children is comparable to the baseline.

Exercise 4: Reduce Childcare Subsidy

Childcare in Sweden is heavily subsidized. Based on a comparison of out-of-pocket expenditures and the true cost of a childcare spot, we estimate the subsidy rate to be roughly 86% for a couple paying the maximum amount for one child in daycare. Previous literature has found that childcare subsidies boost female employment (see Domeij and Klein (2013), Guner, Kaygusuz, and Ventura (2013) and Bick (2016)). We are particularly interested in the effect of childcare subsidies on the prevalence of part-time work. When childcare is very expensive, it may not make sense from an economic perspective for a woman with children to work part-time – she either works full-time and incurs the cost of paid childcare or stays at home with the children. While the cost of a part-time childcare slot is cheaper than a full-time childcare slot, roughly two-thirds in Sweden, this basic premise holds true. Here we study whether a large subsidy on daycare promotes part-time employment. In other words, would a reduction in the subsidy raise full-time employment

or just lower total female employment? Moreover, do childcare subsidies boost fertility?

We start by considering a 10% cut to the childcare subsidy. This amounts to increasing the out-of-pocket childcare cost to just over 2,700 USD per year, or by 63% relative to the benchmark. When we lower the subsidy to childcare we also lower the tax rate on labor income, so that government consumption remains the same.

We find that the fertility and labor supply decisions of women are very much intertwined. When we cut the childcare subsidy by 10%, our model predicts that some women will work more and have fewer children, while others will continue to have several children but stay at home longer when children are young. The employment rate of mothers with the youngest child aged 3-5 declines substantially, by 21 pp to be exact. The effect on aggregate hours of market work for women is, however, slightly positive, with female aggregate hours of market work rising by 0.9% relative to the benchmark. This is due to an increase in employment later in the life cycle. Some men also respond to the lower effective tax on labor income by working more. Aggregate hours for the whole economy rise by 0.7%. The fertility rate declines substantially, to roughly 1.3 children per woman. There is also a modest decline in average home hours of 3.0%.

In sum, a modest decline in the childcare subsidy reduces both the employment of young mothers and the fertility rate quite substantially. This decline is offset by higher employment for both men and women later in the life cycle. If we reduce the subsidy further, aggregate hours of market work decline substantially, and fertility declines even more.[14] Consider, for example, a 50% cut in the childcare subsidy rate. This increases out-of-pocket childcare costs to roughly 7,100 USD per year, which corresponds to an increase of more than 300% relative to the benchmark. With these childcare costs, model predicted aggregate hours of market work for women are 2.1% lower than in the benchmark.

[14]Note that, due to declining labor supply, it is not possible to further lower the labor tax rate when we continue to reduce the childcare subsidy.

Exercise 5: Introduce Subsidy on Market Input in Home Production

Angelov, Johansson, and Lindahl (2015) hypothesize that the prevalence of part-time work, and the subsequent widening of the gender wage gap after women have children, is linked to the unequal division of home work between men and women when children are young. According to time-use data, Swedish women with young children (living as a couple) spend on average almost two hours more per day on domestic work than men.[15] Albrecht, Skogman Thoursie, and Vroman (2015) speculate that the poor market substitutes for home goods – other than childcare – contribute substantially to the gender wage gap in Sweden. In the context of our model, we are able to study the importance of the home production channel. To do so, we introduce a 10% subsidy on the market input in home production.

The model predicted labor supply effects differ substantially by education. The labor supply of college educated women responds very little to the introduction of the subsidy. Aggregate hours of market work of college educated women rise by 0.2%. This arises from a small reduction in part-time work; there is no change along the extensive margin of labor supply. Conversely, aggregate hours of market work of high school educated women rise substantially, by 4%. This increase arises almost exclusively from the extensive margin. High school educated women work on average 16 months more. While some women return to work more quickly after having children, the bulk of the increase in employment comes from women deferring retirement. In sum, female aggregate hours of market work rise by 2.9% relative to the benchmark. The introduction of the subsidy on the market input in home production also leads to an increase in male labor supply. All in all, aggregate hours of market work for the whole economy rise by 3.0%.

It turns out that the home good subsidy is self-financing. In other words, due to the increase in labor supply, we do not need to increase the tax rate in order to balance the budget.

[15] Based on HETUS for year 2000.

The increase in market work is accompanied by a decline in home hours for both genders. Average home hours decline by 7.3%, with the decline somewhat more pronounced for men than women. Fertility is essentially unaffected by the increase in market work arising from the introduction of the subsidy, with on average 1.87 children born per woman (compared to 1.88 in the baseline).

As one would expect, a subsidy on the market input in home production leads to a reduction in home hours and an increase in market hours. However, the increase in labor supply is concentrated at the extensive margin – and in particular at the retirement margin. Part-time work among young mothers remains prevalent, with almost half of the women with a child aged 3-5 working part-time. Thus, the widening in the gender wage gap following children is comparable to the baseline specification. Moreover, both men and women reduce home hours and increase market hours of work when we introduce a subsidy on the market input in home production.

Table 5: Results from Policy Exercises

	Baseline	Ex 1	Ex 2	Ex 3	Ex 4	Ex 5
Employment rate mothers (with youngest kid aged 3-5)	0.95	0.82	0.84	0.95	0.74	0.97
Part-time employment rate mothers (with youngest kid aged 3-5)	0.47	0.00	0.14	0.46	0.46	0.48
Fertility rate	1.88	1.83	1.83	1.87	1.27	1.87
Δ Aggregate hours women (%)		-0.6	-0.6	+2.0	+0.9	+2.9
Δ Aggregate hours all (%)		-0.3	-0.3	+0.7	+0.7	+3.0

Ex 1: no part-time, Ex 2: larger part-time penalty, Ex 3: lower initial gender gap, Ex 4: lower childcare subsidy, Ex 5: home good subsidy. Change in aggregate hours relative to baseline (%).

Summary of Results

To summarize, we have documented that Sweden boasts high female employment and rather high fertility. Notably, also women with young children work to a great extent. Nevertheless, the gender wage gap widens substantially after women have children. This can in large part be attributed to the prevalence of part-time work among young mothers.

In this Section we have tried to shed some light on the time allocation decisions of couples, and in particular the role of family policies in shaping these outcomes. We find that family policies, such as the ones in place in Sweden, do indeed encourage part-time work. However, in the absence of these policies, maternal employment – and also fertility – would decline. We hypothesized that home production might play an important role in shaping female career trajectories. We find that, while a subsidy on the market purchased input in home production does increase female labor supply, it primarily does so at the extensive margin and not the intensive margin. Thus, this would not help narrow the gender wage gap.

The time cost associated with young children dampens both fertility and the labor supply of women with young children. Our findings suggest that, due in large part to the time costs associated with kids, combing full-time work and young children is challenging – even when inexpensive daycare is widely available. Moreover, when every year of additional work contributes to pension capital, the incentives for deferred retirement are substantial. This results in women finding it preferrable to increase labor supply along the retirement margin than along the intensive margin. In light of this result, we stress the importance of modeling the full-life cycle when considering changes to family policies.

5 Conclusions

Sweden is known for its family policies, which are aimed at reconciling work and family life. These policies include generous parental leave, heavily subsidized daycare and the facilitation of part-time work for parents with young children. Sweden boasts high female employment, and notably also high maternal employment. More than 80% of women with the youngest child aged 3-5 work. More than half of these women, however, work part-time. There is a notable gender gap in wages, which widens after the birth of children. Specifically, 15 years after the birth of the first child, the gender wage gap has widened by 10 percentage points.

In this paper, we study the effect of family policies on female employment, fertility and the gender wage gap. To this end, we develop a structural, life cycle model of heterogeneous households. Our framework is quite rich, and features endogenous home and market work, human capital accumulation and fertility. To further our understanding of household decision making, particularly as it pertains to time allocation decisions and fertility, we consider five different exercises: (1) eliminate the part-time work option, (2) increase the penalty for part-time work, (3) reduce the initial gender wage gap, (4) reduce the childcare subsidy and (5) introduce a subsidy on the market input in home production.

We find that, even if the accrual of human capital from part-time work is proportional to that of full-time work, the prevalence of part-time work accounts for 60% of the widening of the gender wage gap following children. However, according to our model, limiting part-time options or increasing the penalty for part-time work would lower maternal employment. The facilitation of part-time work also has a small positive effect on fertility.

Previous research has found that childcare subsidies promote employment. We are especially interested in the effect of childcare subsidies on part-time work and fertility. One can hypothesize that if childcare is expensive, it does not make sense for young mothers to work part-time. They either work full-time and bear the cost of daycare or stay home with the kids. It also seems natural that employment and fertility decisions are intertwined. We find that cutting the childcare subsidy does not noticeably lower the prevalence of part-time work, especially not among mothers with children aged 3-5. Rather it lowers both the fertility rate and the employment rate of mothers with young children.

Previous research has hypothesized that the prevalence of part-time work, and the resulting widening in the gender wage gap, is due to high female hours of home work. We find that, while a subsidy on the market input in home production would lower home hours and increase market hours of work, the increase comes from the extensive margin of labor supply. Moreover, it comes from delayed retirement – for both women and men.

As such, subsidizing the home good does not serve to narrow the gender wage gap. This result arises in part due to the design of the pension scheme, where each additional year of work adds to penison capital thereby increasing the retirement benefit.

Our results highlight the importance of modeling the full life cycle when studying family policies. Moreover, our analysis suggests that it is important to allow not only female labor supply, but also male labor supply, to respond when considering changes to family policies.

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