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DISENTANGLING THE DRIVERS OF LABOUR FORCE PARTICIPATION BY SEX – A CROSS COUNTRY STUDY.

Abstract

The relative trends in labour force participation rates of men and women have diverged across the OECD countries over recent decades. Female participation rates have, on average been on a rising trajectory while male participation rates have tended to fall, albeit with significant cross-country heterogeneity. Nevertheless, in most countries, female participation remains well below that of men. This paper uses panel modelling to assess the cross country drivers of male and female participation rates between 2002-2016 across 31 OECD economies. Our findings suggest that increasing the provision and take up of paternity leave can be an important policy instrument for lifting female participation, without weakening male labour force attachment. Higher female participation rates are also associated with lower levels of employment protection legislation for those on temporary contracts and lower tax wedges on second earners and single parents. These results have potentially important implications for policymakers seeking to increase female labour force participation for both equity and efficiency reasons, particularly in the wake of the COVID crisis, which has had a larger negative effect on female labour market outcomes.

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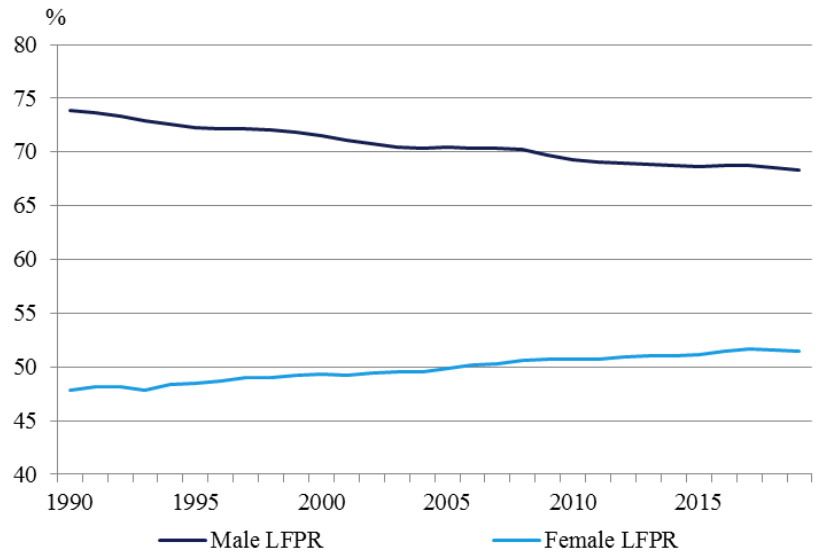
1 Introduction

1.1 Trends in Labour Force Participation Across Sexes

The labour force participation rates (LFPR) of men and women have been on diverging trends over recent decades, with male participation declining on average in OECD economies and female participation rising (see Figure 1). The OECD average male labour force participation rate declined from around 74% in 1990 to 68% by 2019. By contrast, the average female labour force participation rate increased from 47% to 52% over the same period.

Figure 1: Trends in labour force participation rates of men and women in OECD economies

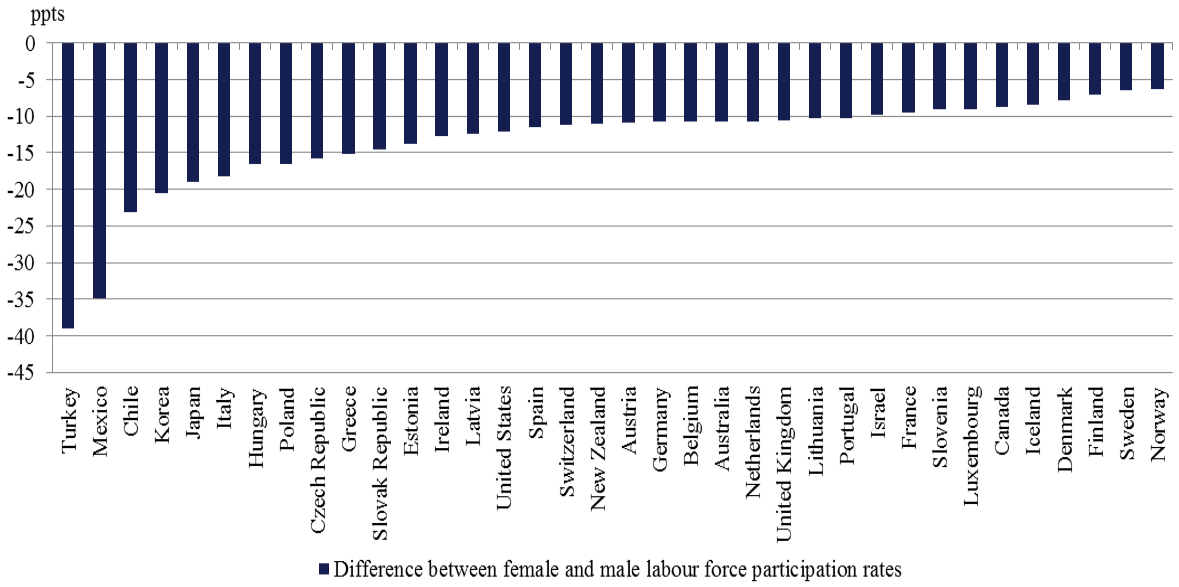


Source: World Bank WDI, 2019.

These averages however, hide significant differentiation across countries. For example, in Estonia, Hungary and New Zealand both male and female labour force participation rates have increased over the past 30 years. Whilst the opposite was true for the United States, Denmark and Finland, albeit by less for women

Despite the advances made in female labour force participation over recent decades, a large average gap of around 16ppts to men remains. Figure 2 shows that this gap is also highly dispersed around the mean. Turkey, Mexico and Chile have the largest gaps, while the Nordic countries stand out for having the smallest. Moreover, in many countries, these gaps have become wider in the wake of the COVID pandemic and associated economic crisis. Women are much more likely to work in service industries where labour demand has fallen the most. And they have also faced a disproportionate share of the additional care and unpaid work responsibilities associated with government responses to the pandemic.

Figure 2: Deviation of female from male participation rates across OECD economies



Source: WDI, World Bank, 2019

Understanding why the participation gap remains so large is important for long term economic outcomes and policy making. Increasing the participation rates of women, who are on average more highly educated than their male counterparts, has the potential to boost potential output, by increasing both aggregate labour supply and labour productivity through more effective and efficient use of available human capital. With aging populations weighing on the effective labour supply and hence potential growth across economies, making more efficient use of labour endowments has become even more important (Clements et al., 2015).

1.2 Literature on the Labour Force Participation Trends

Trends in participation rates across the sexes have been well studied but often along different dimensions and independently of one another. Grigoli et al. (2018) provide one of the few examples of a multi-demographic study of both macroeconomic cross country and micro level within country trends in participation rates for men and women, broken down by age category. They find that the increased participation of women, a common feature across the economies considered, can be attributed to changes in tax-benefit systems, labour market programs and policies encouraging labour market participation alongside increased educational attainment. Meanwhile, the decline in male participation is attributed to involuntary inactivity and higher representation in those sectors more vulnerable to automation.

In studies of female participation alone, most papers focus on the link between advancements in policies directly targeting the ability of women to manage work/family balance, alongside structural economic shifts such as the rise of services, which directly benefit women given their increased likelihood of working in the sector. Studies have been conducted at both the macroeconomic level, analysing the differences in female participation across and within countries, and the microeconomic level studying the influence of changes in specific policies within a country on the labour supply decision of women.

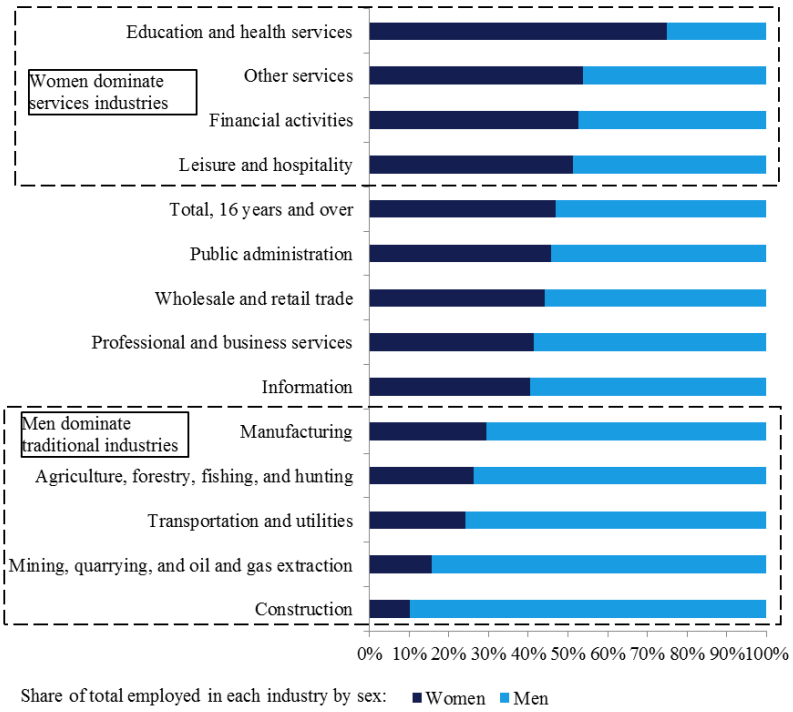
Early work from Ruhm (1998) considered the influence of parental leave policies in nine European Union economies between 1969-1993 on both female employment and wages. They found that whilst leave is consistently positively correlated with female employment rates, longer leave lengths may be detrimental for

women's wages. More recent work by Thévenon and Solaz (2013) considering a larger sample of 30 countries and 40 years of data, 1970-2010, also found a positive influence of parental leave on the participation of women in the labour force. They also noted that the negative effects of paid leave were found to begin at far higher leave lengths, around 2 years. Both Juamotte (2003) and Thévenon (2013) (referred to as J&T (2003,2013) from here onwards) consider a wide array of drivers of female labour force participation across OECD economies with leave policies, direct expenditure on families and childcare considered alongside tax incentives and macro factors and labour market structures.

A feature of these papers is the importance of policies such as maternity leave and childcare provision in enhancing the participation of women in the labour force. Thévenon (2013) extends the work of Juamotte (2003), using the technique of Bassanini and Duval (2009), to consider the interaction between policies and institutional frameworks in the determination of female participation rates. Interestingly, Thévenon (2013) finds that there is an important link between policies targeting women and labour market regulations – in countries where employment protection is greater, the impact of childcare provision on labour force participation is also higher. Also of note is the work of Blau and Kahn (2013), who found that the main drivers of the lack of improvement in US female employment and wages relative to other OECD economies since the early 90's was the lack of parental leave rights and inferior generosity of benefits.

In the study of declining male participation rates over recent decades, survey evidence from Grigoli et al. (2018) suggests that men's exit from the labour force has largely been involuntary. Among the most important factors driving their weaker labour force attachment have been lower labour demand in the sectors they are more likely to work in, and greater exposure to persistent illness and disability. Their research (Grigoli et al.,2018) showed that involuntary inactivity has been most highly concentrated in those sectors of the economy which are more vulnerable to automation such as wholesale and retail trade, manufacturing, mining and quarrying (see Figure 3).

Figure 3: Distribution of employed by sector and sex in the United States



Source: BLS, 2019

Blanchard, Cerutti and Summers (2015) also highlight the impact of hysteresis, in which economic shocks leading to high unemployment cause skills atrophy such that some become unemployable– they argue that men may have been more exposed to the shocks that lead to hysteresis over recent decades. In addition to these cyclical drivers of declining male participation, structural factors such as increased globalisation, offshoring and automation (Muro and Kulkarni, 2016) alongside declines in manufacturing in the pivot towards services (Baily and Bosworth, 2014) are likely to have contributed to the decline in male labour force participation.

1.3 Contributions to the Literature

This study contributes to the literature at the macroeconomic level by estimating the determinants of both male and female participation rates across countries, and across time, within a consistent empirical framework. This should strengthen our ability to make comparisons between the sexes, as well as draw conclusions about what contributes most to maximising aggregate participation.

Another important contribution is our treatment of leave policies. Until now, most studies of female participation have focused on the effect of policies targeted directly at women, like maternity leave. We expand this to also consider policies – like paternity leave – that are targeted at men – but have the potential to also influence female participation by altering firms' hiring incentives and biases and the optimisation of labour supply within the household. We also consider the effect of other types of leave, alongside tax wedges for second earners and single parents, the influence of the labour market structure across economies and finally cultural and demographic influences on participation. The assessment of these factors on male participation rates also extends the scope of the existing literature.

Our study also extends the literature by expanding the number of countries included in the analysis and considering a sample period covering more of the post-GFC era. This allows us to analyse the policy and other drivers of participation in countries with some of the largest gaps between men and women, while taking into account the significant policy and structural economic changes that have taken place since 2008.

The remainder of this paper is structured as follows: in section 2 we introduce the factors affecting labour force participation rates; in section 3 the data used in the analysis is described; in section 4 the empirical strategy employed is presented; in section 5 the key findings of the empirical work are discussed; in section 6 the limitations of the study are considered; and in section 7 we present the main conclusions to be drawn from our research.

2 Factors Influencing Labour Force Participation Rates

The factors affecting labour force participation rates are broad and do not necessarily fit into neatly defined categories. However to aid delineation, we divide the various potential drivers participation into five broad groups when discussing our data and results. These are:

1. Features of the macro economy;
2. Structural features of the labour market;
3. Demographic factors affected by culture;
4. Leave policies; and
5. Policies concerned with taxes, transfers and regulation.

Some factors of course – like the unemployment rates of men and women – could have been placed into more than one category (1 or 2). As such these categories should not be considered rigidly but instead as facilitators of exposition.

2.1 Features of the Macro Economy

When estimating the determinants of labour force participation rates across the sexes, accounting for the cyclicality in the broader economy, and hence the labour market, is important. To do so, variables like growth in GDP per capita, and male and female unemployment rates are included in the analysis. In addition, the level of GDP per capita is included in our analysis to control for countries' stage of economic development. Previous studies have suggested that the impact of economic development has a U-shaped effect on participation of women, with low-income countries featuring high female labour force participation, then declines in female participation as incomes begin to rise, before rising again at high incomes with increased education rates contributing to rising participation of women (Goldin, 1995 and Tam, 2011). In our dataset, the impact of this is likely to be limited given that the selection of economies in the sample is largely taken from the top quartile of the global income distribution, and thus likely sit to the right hand side of the U-shape.

2.2 Structural Features of the Labour Market

In addition to macroeconomic variables, structural characteristics of different countries' labour markets can influence participation rates. We include average educational attainment to capture how the stock of human capital affects participation and the shares of men and women working part time, to capture information relating to the intensive margin of labour supply decisions.

We include the share of industrial employment in total employment in the analysis to capture the potential effect of the uneven distribution of female and male employment across sectors, and its variation over time, on participation rates. Unionisation rates were also included in the analysis because collective bargaining may have implications for wage determination, labour demand and labour supply, and with different incidences between the sexes.

2.3 Demographic factors affected by culture

In addition to macroeconomic variables and those relating to the structural characteristics of the labour market, demographic trends and cultural preferences of populations can also influence participation trends and levels. In our work, the share of the population over 65 in each economy is used to control for the effects of population aging, while female fertility rates capture the intersection between aggregate reproductive trends and patterns of labour demand and supply – though it is worth noting that macroeconomic and policy factors can influence fertility rates too.

The direct measurement of culture is hard to quantify but one factor which is used to assess cultural influences on participation is the rate of marriage amongst women of reproductive age. Evidence from microeconomic studies of the influence of marriage on the wages of men indicates the presence of a 'marriage premium' in which married men have higher wages than their unmarried counterparts, yet for women the evidence is less decisively positive (Korenman and Neumark, 1991; Gray, 1997; Heimdal and Houseknecht, 2003; Light, 2004). This likely reflects the influence of marriage on the joint household labour supply decision with many men continuing to work and be the sole provider, whilst women are less attached to the labour force and tend to work fewer hours following marriage than their male counterparts.

2.4 Leave Policies

A primary contribution of this paper to the literature is the consideration of a wide range of public policies on the labour force participation rates of men and women. One critical aspect is the way that different types of leave entitlement - maternity and parental leave; paternity leave; family health leave; and sick leave – interact with participation and how that interaction differs across men and women. For example, family health leave may be more relevant for female participation, with the burden of care for extended family often resting with the female members of the household (Carr et al., 2018; Henz, 2006; Kelle, 2018; van Houtven, Coe, & Skira, 2013).

Leave policies related to the care of children for males and females are difficult to disentangle, in part because of measurement problems. Parental leave can be taken by both women and men, but because women are more likely to take such leave in practice, the OECD data attributes all non-father specific entitlements to women. In addition, the cross-country data we have access to captures legal entitlements but not take up rates or paid and unpaid leave offered by employers separately from what is legislated.

We cannot overcome all of these challenges – the consequences of which are taken up in more depth later in the paper. But by considering how paternity leave entitlements also impact female and male participation rates, we are able to develop a more nuanced perspective on the role of leave entitlements than has been possible up until now.

2.5 Taxation, Transfers and Regulation

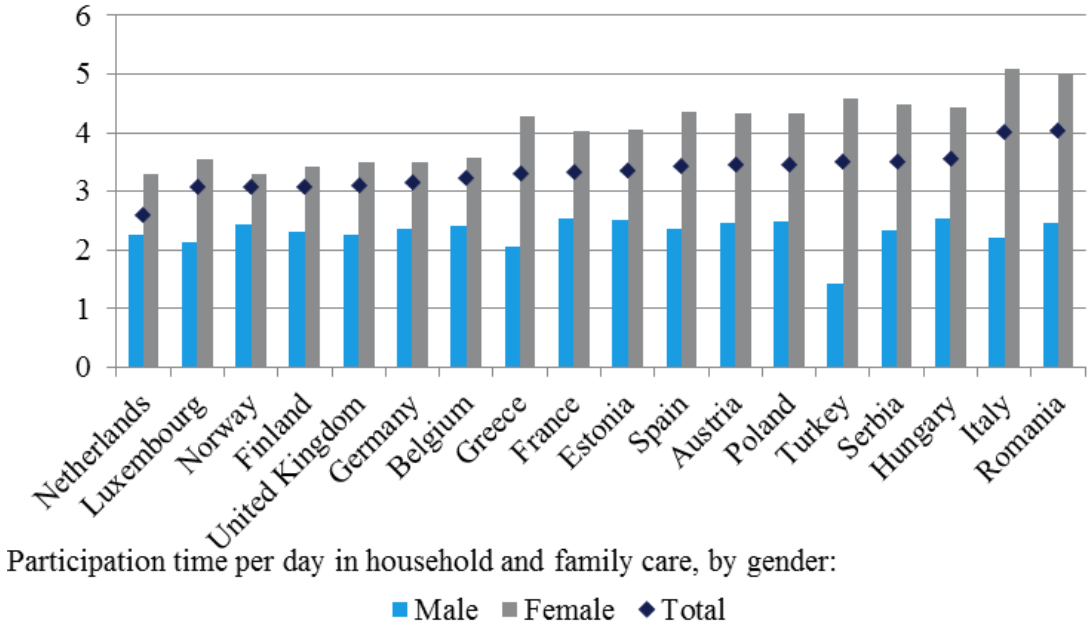
Beyond leave policy, we also examine how average tax rates (ATRs) influence participation rates of men and women following the extensive literature showing how average tax wedges facing second earners, or sole parents, can influence the labour supply decisions of women in particular in different household settings (Kayvla et al., 2018; OECD, 2020a; Radu et al., 2018). We analyse the effect of two measures of ATRs in particular: 1) the additional tax burden facing two-earner households with children compared to two-parent households with a single earner; and 2) the additional tax burden facing working sole-parent households compared to single, one-earner households without children. In both cases, higher ATRs are likely to be associated with lower female participation rates because of the way they lower the financial rewards to searching for and accepting work. Whilst ATRs allow us to assess the extensive margin, in terms of the number of people in work, the study of marginal tax rates across different household types would allow us to consider the intensive margin i.e. the extra incentive to work more hours. Extending the analysis in this paper to investigate the impact on the intensive margin of various tax incentives for different household types could lead to different conclusions but we leave this for further study.

We also include two measures of direct government support to families in our analysis. The first focuses on expenditure and captures direct cash benefits as well as benefits in kind such as childcare or housing support. The second captures the size of family specific tax breaks, like child tax rebates.

Additionally, measures of employment protections for regular and temporary contracts are included in the analysis. It is worth noting the ambiguous sign of these impacts on participation. One the one hand, employment protections can increase workers' attachment to the labour force. On the other, they can reduce the flexibility of the labour market – both in terms of firms' demand for different types of labour and the supply of that labour. Critically, these effects may also vary between men and women given observed average differences

in the type of work they do, and extent and nature of their attachment to the labour force, related to their larger care giving and household management roles (see Figure 4, Eurostat, 2019).

Figure 4: Participation time per day in household and family care, hh:mm, by gender



Source: Eurostat, 2010

Product market regulation can also influence aggregate labour demand and supply for men and women. Jaumotte (2003) refers to three key reasons why this may be an important determinant for female participation in particular: 1) because women are far more likely to work in services industries than men any regulations that limit the creation of employment opportunities may impede female participation; 2) females may benefit from the use of childcare and household services, which could become costlier if regulation of these industries is higher; and 3) restrictions on the opening hours of services which women may access could lead to less flexibility for women when trying to balancing work and unpaid work responsibilities.

3 Data

The paper focuses on a panel data set with 15 time periods, from 2002 to 2016, and 31 OECD economies[5]. This allows us to draw upon both cross section (across country) variation, and within (time series) variation, to improve the efficiency of the estimated coefficients in the models. The main dependent variable of interest is the labour force participation rate of those over the age over 15 by sex. The data used to capture this is taken from the ILOSTAT (2020), where cross country differences in labour force surveys are accounted for creating a more consistent measure of the labour force across countries. We do not exclude those over 64 from the analysis because they comprise a meaningful and growing share of the labour force. The regressors included in the analysis follow directly from the discussion in the previous section. Their descriptions, sources and transformations are set out in Table 1.

[5] The 31 countries considered in this paper are: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States.

Table 1: Data Set

	Variable	Description	Source	Transformation	Instrumented (female)	Instrumented (male)
Dependent Variables	Female Labour Force Participation Rate	Labor force participation rate, female (% of female population ages 15+) (modeled ILO estimate)	World Bank	log		
	Male Labour Force Participation Rate	Labor force participation rate, male (% of male population ages 15+) (modeled ILO estimate)	World Bank	log	X	
Demographic factors influenced by culture	Fertility Rate	Births per woman	UN	log		
	Married/Union	Proportion of married or in-union among women of reproductive age (15-49 years)	UN	log		
	Share of Population 65	Population ages 65 and above (% of total population)	UN	log		
Structural features of the labour market	Female Education	Average total years of schooling for females (25-64yrs)	Barro & Lee Database	log		
	Mean Years of Schooling	Mean years of schooling (years)	UN	log		
	Part Time Women	Share of Women Working Part Time	OECD	level	X	
	Part Time Men	Share of Men Working Part Time	OECD	level		
	Trade Union Density	Share of workers who are unionised	OECD	log		
	Industry Share of Employment	Total employed in industry as proportion of total employed	OECD	log		X
Features of the macro economy	GDP per capita growth	Annual growth rate of real GDP per capita in 2011US$	Maddison Project	level		
	GDP per capita level	Real GDP per capita in 2011US$, 2011 benchmark	Maddison Project	log		X
	Female Unemployment Rate	Unemployment rate for females 15-64y	OECD	level		X
	Male Unemployment Rate	Unemployment rate for males 15-64y	OECD	level		
Leave policies	Family Health Leave	Weeks of paid family health leave	Prospered Project	log	X	X
	Maternity Leave	Total weeks of paid maternity and parental leave	OECD	log	X	X
	Paternity Leave	Total weeks of paid paternity leave	OECD	log		
	Sick Leave	Weeks of paid sick leave	Prospered Project	log		
Tax, transfers and regulation	Tax Burden 1	Difference in tax wedges between 2 earner family with 2 children and 1 earner family with 2 children	OECD	level		
	Tax Burden 2	Difference in tax wedges between single earner with no children and single earner with 2 children	OECD	level	X	X
	Total Expenditure	Total public social expenditure on families as a % of GDP	OECD	level		
	Tax Breaks	Total public social expenditure on tax breaks for families as a % of GDP	OECD	level		
	Employment Protection (regular)	Employment protection index for regular contracts	OECD	level		X
	Employment Protection (temporary)	Employment protection index for temporary contracts	OECD	level		
	Product market regulation	Index of product market regulation, measure the regulatory barriers to firm entry and competition in a broad range of key policy areas.	OECD	level		

4 Estimation Strategy

In this study we rely on panel methods to estimate the determinants of female and male participation rates across the OECD countries. This is because they allow us to exploit both the cross-sectional and time series variation of the regressors in our attempts to statistically identify their impacts. However, panel methods also give rise to a range of estimation problems if not dealt with in the appropriate way. These include:

- Biased coefficients related to unobserved heterogeneity caused by country-specific determinants of labour force participation, such as cultural preferences that are not directly captured in the analysis, that are correlated with our policy and other regressors.
- Biased coefficients related to endogenous regressors caused by reverse causality from labour force participation to the regressors of interest, measurement error in the regressors themselves, or omitted variables.

The common 'fix' to unobserved heterogeneity is to estimate fixed effects models that overcome the bias that arises from the omission of country-specific determinants of participation that do not vary over time. However, because fixed effects estimators in our modelling framework draw only on the within-country variation of the regressors over time to explain changes in participation, this can introduce a new problem of inefficiency, if the regressors themselves vary more across countries than over time within countries. For this reason, we deploy a range of fixed, random and mixed-effects models to examine the relevant relationships and their sensitivity to different modelling choices. In the results section we focus mostly on those results that are robust to these different panel specifications.

To overcome the endogeneity problems likely to be present in our panel, we deploy a two-stage least squares (2SLS) instrumental variable method. Through the use of instrumental variables, which are correlated with the endogenous regressor but not correlated with the dependent variable, we can generate an unbiased estimate of the effect of the endogenous regressor. This is a two-stage process by which the endogenous variable is first regressed upon a set of instruments and then the fitted values from this first stage regression are used in a final stage regression in place of the endogenous regressor.

The validity of such an approach rests firmly upon two factors: the exogeniety of the instruments used; and the strength of the correlation between the instrument and the endogenous variable (Lousdal, 2018). There is a fine balance to be made between these two factors and both will be considered in more depth in section 4.1.2 of this paper.

4.1 Basic Panel Model

$$Y_{it} = \alpha + X'_{it}\beta + \delta_i + \gamma_t + \varepsilon_{it} \quad (1)$$

$$\varepsilon_{it} = \lambda_i + \eta_{it} \quad (2)$$

$$E(X_{it}\eta_{it}) = 0 \quad (3)$$

$$E(X_{it}\lambda_i) = 0 \quad (4)$$

Here, labour force participation, Y_{it}, is predicted using a set of regressors[6], X_{it}, which vary over time and across countries. The model may include either country (cross-section) effects, δ_i, or time (within) effects, γ_t, or both. Note that the country effect will influence the estimated constant, α, across countries in the model and can be estimated using a series of dummies which identify each country. The time effect will shift the constant across time periods and can be estimated with a series of dummies which identify each period. In the models presented in this paper, both country and time effects are included.[7]

In the basic panel model, it is assumed that rather than a composite error across time, t, and countries, i, the error takes the form of an idiosyncratic component, η_{it}, which varies across both time and countries, as well as an unobserved non-time varying component, λ_i, which captures deviations from the mean at the country level. The benefit of this structure versus the assumption made in simpler pooled OLS, where only the composite error is considered, is that we can directly account for and model the unobserved heterogeneity at the country level within the data.

[6] See section 3 for a discussion of the regressors included within the model analysis.
[7] See appendix 9.3 for the testing of the significance of the time fixed effects.

However, doing so comes at the cost of the introduction of possible bias into the estimation with the likelihood that the moment condition assumed in equation (4) is unlikely to hold. This is because assuming that country level effects are uncorrelated with the regressors may be problematic in reality.

In this paper, two models are estimated: a fixed effects model, where both the country and time effects are estimated with the fixed effects estimator, and a mixed effects model, where the country effects are estimated with the random effects estimator and the time effects are estimated with the fixed effects estimator. These models draw upon two main panel estimators which are outlined in the following section.

4.2 Panel Estimators

Fixed Effects Estimator. In the application of the fixed effects estimator, sources of unobserved heterogeneity, λ_i, and all time invariant omitted variables are removed by applying the within transformation in which both the dependent and independent variables are demeaned prior to estimation with 2SLS. This reduces concerns of bias in the estimated coefficients but can prove problematic if the model includes time invariant regressors of interest or if the dataset has more variation between the cross sections than within the cross sections. For unbiased estimation with the fixed effects estimator, the idiosyncratic error must be uncorrelated with the regressors as outlined in equation 6.

$$\tilde{Y}_{it} = \tilde{X}'_{it}\beta + \tilde{\lambda}_i + \tilde{\eta}_{it} \tag{5}$$

Where $\tilde{Y}_{it} = Y_{it} - \overline{Y_i}$, $\tilde{X}_{it} = X_{it} - \bar{X}_i$, $\tilde{\lambda}_i = \lambda_i - \bar{\lambda}_i = 0$, $\tilde{\eta}_{it} = \eta_{it} - \bar{\eta}_i$ with bars indicating the group mean.

$$E(X_{it}\eta_{it}) = 0 \tag{6}$$

Random Effects Estimator. One way to overcome a mixture of sources of variation in the dataset is to estimate the equation with the random effects estimator, which involves quasi-demeaning the data prior to estimation with 2SLS. The proportion of the mean which is removed is calculated as outlined in equation 8.

$$\ddot{Y}_{it} = \ddot{X}_{it}\beta + \ddot{\lambda}_i + \ddot{\eta}_{it} \tag{7}$$

Where $\tilde{Y}_{it} = Y_{it} - \theta\overline{Y_i}$, $\tilde{X}_{it} = X_{it} - \theta\bar{X}_i$, $\tilde{\lambda}_i = \lambda_i - \theta\bar{\lambda}_i$, $\tilde{\eta}_{it} = \eta_{it} - \overline{\theta\eta_i}$ with bars indicating the group mean.

$$\theta = 1 - \frac{\sigma_\eta}{(T\sigma_\lambda^2 + \sigma_\eta^2)^{\frac{1}{2}}} \; where \; 0 \leq \theta \leq 1 \tag{8}$$

$$E(X_{it}\eta_{it}) = 0 \tag{9}$$

$$E(X_{it}\lambda_i) = 0 \tag{10}$$

Intuitively, as the proportion of within (time series) variation increases, $\theta \to 1$, the random effects estimator converges to the fixed effects estimator. Whilst if the variation from within and between the cross sections is proportional then, $\theta \to 0$, and random effects converges to pooled OLS.

With the random effects estimator, there are now two moment conditions which must hold for unbiased estimation, one relating to the within variation, equation 9, and the other to the cross sectional variation, equation 10.

5 Results

Following from the discussion in section 4 we estimate a variety of model specifications to account for possible endogeneity, lack of within variation and possible time and cross section fixed effects.

In the estimations, we focus on 2 models for both male and female labour force participation: fixed effects estimator with both cross section and time fixed effects (1 & 3 in Table 2); mixed effects with cross section random effects and time fixed effects (2 & 4 in Table 2). Specifications 1 and 3 remove the presence of unobserved heterogeneity and are robust to the possibility of omitted time invariant regressors as outlined in 4.2.1 of the paper.

Specifications 2 and 4 use the random effects estimator to estimate the cross section effects to account for the fact that the dataset in the regression analysis contains a greater degree of cross sectional variation than within variation[8]. All of the specifications account for time fixed effects as specification testing suggested that there were statistically significant period effects within the sample period[9].

[8] See section 6.2 for a further discussion of this.

[9] See section 9.3 of the appendices for the test output. The joint significance in the male model was borderline but given the significance of some period effects, time fixed effects were used in the final model.

Table 2: Estimation Results

Dependent Variable	Female LFPR (log)		Male LFPR (log)	
Estimator	Fixed	Mixed Effects	Fixed	Mixed Effects
Equation #	(1)	(2)	(3)	(4)
Constant	-3.164**	-3.485**	2.186***	2.572***
log(familyhealthleave)	-0.009**	-0.007***	-0.001	-0.001
log(fertilityrate)	-0.06	-0.058	0.04***	0.055***
gdppcgrowth	0.001	0.0002	-0.0003	-0.0003
log(gdppclevel)	-0.018	0.081***	0.077***	0.047**
log(married)	0.276***	0.052	-0.052	0.038
log(education)[†]	0.223**	0.244***	-0.133	0.057***
log(matleave)	0.003	-0.003	-0.014**	-0.015**
[log(matleave)]^2	-0.004	-0.002	0.004***	0.004***
log(patleave)	0.024***	0.046***	0.007	0.001
[log(patleave)]^2	-0.005	-0.012***	-0.002	0
log(sickleave)	0.012	0.009	-0.014**	-0.013***
log(shareparttime)	0.077**	0.053***	0.002	-0.008
log(sharepop65)	-0.326***	-0.055	-0.018	-0.118***
taxburden1	-0.005***	-0.007***	0.001	0.002***
taxburden2	-0.003**	-0.005***	0	0.001
log(uniondensity)	0.013	0.026	0.004	-0.005
log(totalexp)	0.004	-0.006	-0.008	-0.002
taxbreaks	-0.002	0.019	0.015	0.005
femaleur	0.002	0.002	0.001	0.001
maleur	0.001	0.002	-0.001	-0.001
log(empprotection)	0.06***	0.027	-0.025	-0.007
log(empprotectiontemp)	-0.018**	-0.027***	0.006	0.009**
log(lfprmale)	1.456***	1.311***		
log(lfprfemale)			0.296***	0.253***
log(prodmarketreg)	0.024	0.028	0.008	0.006
log(industryempshare)	-0.009	0.029	0.114***	0.078***
dum_04	0.009		-0.003	
dum_05	0.021***		-0.006	
dum_06	0.032***		-0.008***	
dum_07	0.042***		-0.012**	
dum_08	0.055***		-0.014**	
dum_09	0.069***		-0.013	
dum_10	0.077***		-0.015***	
dum_11	0.089***		-0.019***	
dum_12	0.103***		-0.02***	
dum_13	0.113***		-0.022***	
dum_14	0.12***		-0.023	
dum_15	0.13***		-0.024	
dum_16	0.14***		-0.024	

[†]education is female specific education attainment in female equation and general education attainment in male due to data availablility

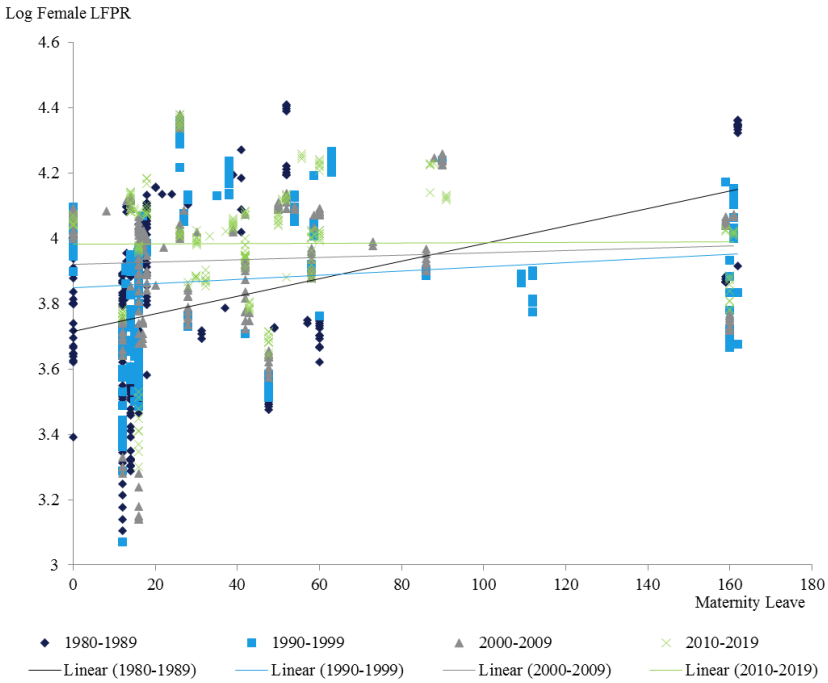
*** = significant at 1%; ** = significant at 5%; * = significant at 10%

5.1 Labour Force Participation and Leave Polices

Across the four leave policies considered in this paper, maternity, paternity, sick and family health leave, both significance and sign of influence differs across the male and female models. In the model specification, a squared term is included for the leave policies related to child rearing to allow for a possible non-linearity in their effect upon participation as leave lengths increase.

Maternity Leave. J&T (2003,2013) found that maternity leave had a positive and significant effect upon female labour force participation, with the squared term carrying a negative coefficient indicative of diminishing marginal returns to leave beyond a certain threshold. Interestingly, the results of our study suggest that maternity leave is statistically insignificant for female labour force participation. There are two main differences between the analysis of J&T and our study: 1) their sample period last from 1980 to 2007 whilst ours lasts from 2002 to 2016; and 2) J&T focus on a smaller subset of OECD economies than in our study where the addition of higher income emerging economies like Turkey and Mexico influence the results. Figure 5, in which we replicate the analysis used in the original papers of J&T to cover our sample period, suggests that the relationship between maternity leave and female labour force participation has flattened over time, with the strong positive association observed in the 1980s and 1990s diminishing by the 2000s.

Figure 5: Changing Influence of Maternity Leave



Source: OECD, Aberdeen Standard Investments, 2019

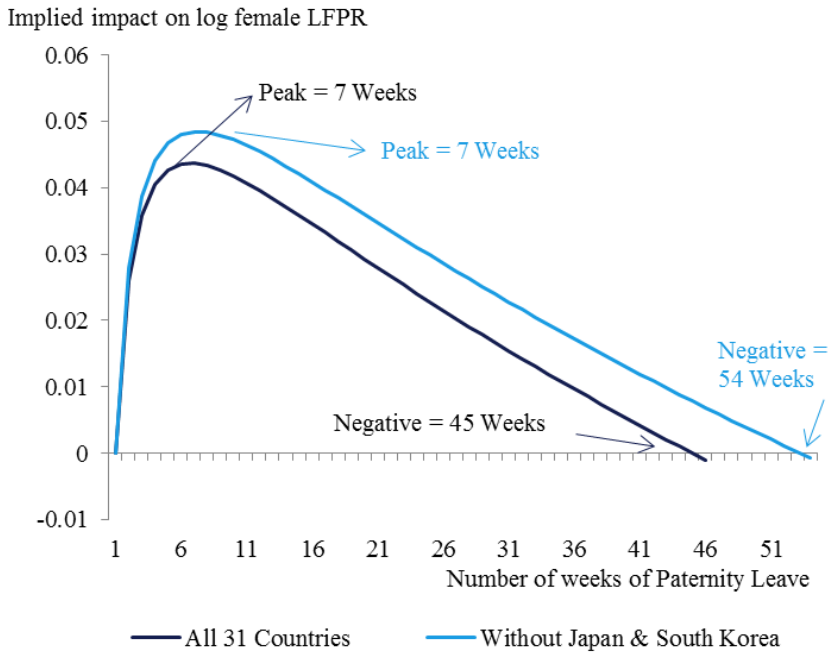
Why might that be? J&T found that maternity leave was associated with diminishing returns to participation as entitlements became more generous. Because our sample covers a period in which the average country's entitlement was significantly more generous, the most plausible explanation for the difference is that the average country is now operating on the flat part of the return curve. This is important; our finding that maternity leave has a statistically insignificant effect on female participation rates does not diminish the role that maternity leave can play in enabling labour force participation of women at the macroeconomic level, Instead it speaks to the progress that was made in the past related to the initial introduction and then extension of that leave over time.

A more difficult to explain finding of our research is that maternity leave is a negative and significant driver of male labour force participation. There are two possible explanations. One relates to the measurement problems with the maternity leave variable we referred to earlier. This variable captures parental leave as well maternity leave, and thus the estimates might be contaminated by male take up of parental leave. Issues around the data limitations of the study will be discussed in more detail in section 4.1 of this paper. The second is that the result is genuine, perhaps capturing the way the availability of maternity leave allows households to better optimise their joint labour supply decisions. This is speculative however, and best studied using

longitudinal household data that is able to link within-household labour supply decisions to specific changes to maternity leave entitlements and take up.

Paternity Leave. For female participation, the influence of paternity leave is statistically significant and positive. The influence of paternity leave entitlements on male labour participation rates is found to be insignificant, though this means that there is also no evidence that it damages their participation. The upshot is that increasing the availability of paternity leave is likely to be associated with higher aggregate labour force participation, albeit with diminishing returns, because the squared return is significant and negative (see Figure 6). Together these results imply that the peak impact of paternity leave availability occurs at 7 weeks, before falling to zero at around 45 weeks.

Figure 6: The Influence of Paternity At Different Thresholds



Source: Aberdeen Standard Investment, 2020

However, there are reasons to believe that these results may underestimate the true impact of paternity leave. Like the maternity leave variable, because we are measuring only the availability of entitled leave, not its take up (the variable we are truly interested in), estimates of the effect of parental leave are likely attenuated towards zero. Indeed, when we exclude Japan and South Korea from the analysis – two countries where entitlements are very high (52 weeks) but take up is very low (only 6% in Japan and 20% in South Korea) - the point at which an additional week of parental leave entitlement falls to zero is pushed out to 54 weeks (Japan Ministry of Health, Labor and Welfare, 2011; South Korean Ministry of Employment and Labor, 2019).

This raises interesting questions around not just the provision of leave policies but their enforcement and regulation. In Sweden, there has been a shift towards policies which allocate a specific portion of the parental leave to males only, meaning that if it is not taken by the father then the leave allocation is wasted. Ekberg et al. (2013) find that this does in fact significantly increase the extent of parental leave taken by fathers in Sweden, although gender gaps in employment and wages were not found to be significantly affected. This suggests that the structure of leave polices is important in the incentivisation of male take up but that at the country level there may be differences in its effectiveness in furthering participation.

Sick and Family Health Leave. The significance of the other leave policies considered in the study varies for males and females with the availability of higher family leave entitlements significantly associated with lower female participation and the availability of higher sick leave entitlements significantly associated with lower male labour force participation.

The insignificance of family leave for men could corroborate the view that women are more likely to be in care giving roles within the household and take leave for the care of dependents. But the negative estimated impact of family leave on female labour force participation is difficult to explain as it ought to increase women's attachment to the labour force. It is possible that we are picking up some sort of statistical discrimination whereby employers shy away from employing women when their family

leave entitlements are high. But it is just as likely to be spurious, particularly with family leave highly correlated with other types of leave, including maternity and paternity leave.

The negative and significant relationship between the availability of sick leave and male labour force participation could be linked to the way that very generous leave can act as a gateway to permanent exit from the labour force, in the same way that disability support payments have been found to be in other empirical studies. However, again there is the potential for measurement error to be confounding the estimates. In this case, a number of countries did not set ceilings on mandated sick leave, so we had to censor the data to include them in the study, which could be contaminating the results.[10].

5.2 Labour Force Participation and Taxes, Transfers and Regulation

There are two variables in the model capturing the way the design of the tax-transfer system might influence labour supply decisions:

- Taxburden1 captures the average additional tax paid net of transfers by a household with 2 married earners (one at 100% of the average national wage, the second at 67%) and a household with the same structure but where there is just one earner (at 100% of average national wage). For the average OECD economy Taxburden 1 is positive and equal to 4.5ppts, implying significant tax penalties on second earners. There are only 4 countries for which the tax-transfers system favours second earners in these types of households.
- Taxburden2 captures the difference in average tax borne net of transfers by a single person and earner (at 67% of average national wage) with two children compared with a single person and earner (at 67% of average national wage) with no children. For the average OECD economy, Taxburden2 is negative and equal to 16ppts. In all countries in our sample the tax-transfer system measured by this variable favours sole parents relative to single people, though in some (Mexico, Turkey, Japan and South Korea) the difference is very small.

In the female models, Taxburden1 has a significant and negative influence on female labour force participation in both specifications. This is consistent with standard theory, as well as the broader empirical evidence on the effect of tax wedges on labour supply at the extensive margin (Garcia and Sala, 2008; Dolenc and Laprosek, 2010; Radu et al, 2018).

Interestingly, Taxburden1 is statistically significant and positively related to male labour force participation, suggesting that there could be a substitution effect at the household level with men more likely to continue to participate in the labour force at the expense of women if having a second earner proves to be costly in terms of a higher net tax burden. Evidence from Kalyva et al (2018) suggesting that there are significant tax-transfer related disincentives for a non-working partner to move into work in most countries, corroborates these findings,.

. We found a significant and negative relationship between Taxburden2 and female participation but an insignificant relationship for men. This implies that female participation rates are higher the more the tax system favours working sole parents. This is an interesting finding as for the average OECD economy, 80% of single parent households are led by women (OECD, 2010). As such, our research suggests that there is a real opportunity to boost female participation rates in those countries for which the tax-transfer system does little to incentivise sole parents to work and overcome the other barriers to their labour force participation.

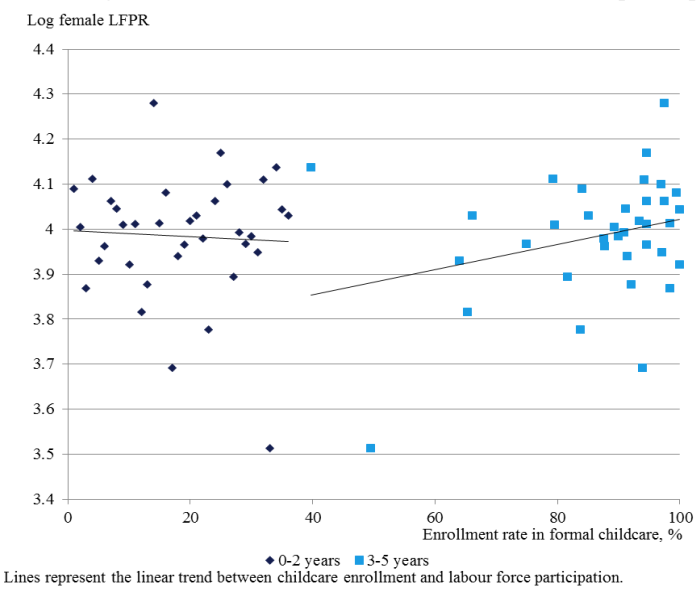
Direct government transfers to families are another important way in which participation in the labour force can be influenced particularly benefits in kind for the provision of childcare (Brewer et al, 2016; Carta and Rizzica, 2018). However, measures of direct expenditure for households on cash benefits, benefits in kind or tax breaks were not significant in our models for either sex.

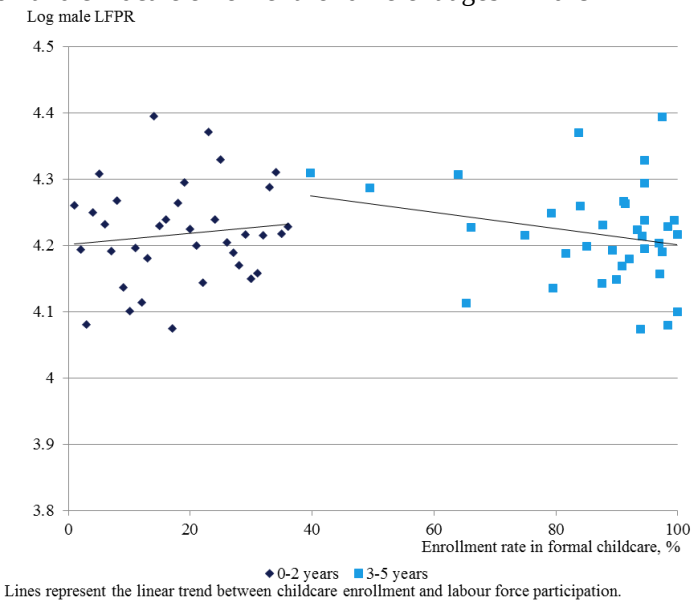
Ideally, we would have included specific measures of childcare provision, the take up of formal childcare services, or more refined indicators of childcare incentives in our modelling. However, consistent, high quality data across our sample was not available, even for core European countries. We caution therefore not to conclude that such incentives do not matter. Indeed, raw

[10] This, amongst other data limitations are discussed in section 4.1.1 of the paper.

correlations, as shown in Figure 7, suggest a small negative correlation between female participation and childcare enrolment for younger children and a positive correlation for older children. The reverse can be seen for male participation. One reason for this could be that in the initial stages of childrearing females may decide to remain out of the labour force before re-attaching as children age, with childcare availability facilitating both choices.. Men do not bear the same burden of unpaid child care, likely explaining the opposite result.

Figure 7: Correlations between male and female participation and childcare enrolment for different ages in 2018





Source: OECD, ILOSTAT, Aberdeen Standard Investments, 2018

Our results are suggestive of a nuanced relationship between employment protection legislation and female participation rates in particular. In the female models, higher levels of employment protection for regular contracts are positively associated with participation rates while the reverse is true for temporary contracts. This latter finding is consistent with evidence that the availability of part-time work is very important for female attachment to the labour force. As a consequence, where temporary contracts (which are more likely to be part-time) are more highly regulated, their usage is also likely to be lower, with flow on effects to the ability of women to obtain work. For men, there was some evidence of a positive relationship between their participation and the stringency of temporary contracts but the result was not robust to different specifications.

Whilst product market regulation is not significant in any of the model specifications in table 2, previous evidence did suggest that higher regulation of the product market sector was detrimental to the participation of women relative to their male counterparts (see section 2.5 of the paper. Further work could investigate this in more detail.

5.2 Labour Force Participation and the Macro economy

The upward trend in female participation rates across the average country in the sample and downward trend in average male participation rates is reflected in the significance of the positive time dummies in the female fixed effects specification, equation 1, and the significant negative time dummies in the male fixed effects specification, equation 3. These time fixed effects are also likely capturing some of the cyclicality of labour force participation that would otherwise be picked up by the macroeconomic variables in our models.

The only macroeconomic variable that is commonly statistically significant across our models is the level of GDP per capita. That is consistent with most countries operating in the right-hand side of the U-shaped relationship between living standards and female participation noted earlier in the paper (Goldin, 1994).

5.3 Labour Force Participation and Structural Labour Market Factors

The link between the 'structure' of the labour market and participation rates is explored via three main types of variable – the level of average educational attainment in a country, the shares of men and women in the workforce working part-time, and the share of employment in industrial occupations.

Educational attainment is significantly, positively associated with both female and male participation, but the male result is not robust across our different specifications. This is consistent with the idea that higher levels of human capital increase both the demand for labour and the willingness to supply that labour. Indeed, in most countries in our sample, women now have higher average levels of education than men (Ince, 2010). However, it could also be picking up cultural effects as countries with higher levels of education may have more positive attitudes to women's inclusion in the workforce.

Across the OECD, women are much more likely to be in part-time work, accounting for 68% of the total, despite average female participation rates being considerably lower than male rates. We find that higher shares of women working part-time are significantly associated with higher overall female labour force participation. This reinforces the earlier finding that less restrictive temporary employment protections, can boost female participation. It is also consistent with the idea that the availability of part-time work can act as a gateway to labour market attachment for women, even if it constrains the number of hours they are working and the quality of the work they are able to obtain.

Indeed, Blau and Kahn (2013) find that in the US, the quality of female jobs is higher than other OECD economies despite the overall participation of women falling short of other OECD economies in aggregate. Blau and Kahn (2013) attribute this difference in relative female labour supply to the provision of policies that encourage participation of women in part time work rather than full time. That said, it isn't obvious that women would be better off in the aggregate if there were larger barriers to their ability to obtain part-time work, at least without other counteracting policies being enacted.

Conversely, we do not find any relationship between the prevalence of male part-time work and their overall participation rates, despite other studies uncovering evidence of negative effects (Valletta et al., 2018).

Our research suggests that the prevalence of industrial employment is positively associated with male participation but has not discernible effect on female participation. The male result is not surprising. De-industrialisation in the advanced economies had a larger impact on men because they were much more likely to work in the manufacturing sector. And as men lost jobs in these sectors, many were unable to find alternative work in the growing services sector, in some cases causing exist from the labour force altogether.

Although we did not find a statistically significant relationship for women, the structural shift away from labour intensive industrial jobs towards skills intensive services sector jobs could benefit female participation over the longer run given the higher average education level of females. In fact, Grigoli et al. (2018) specifically studied the influence of technological progress on the participation rates of different demographics, finding that this has contributed to the rising participation rates of women in advanced economies.

Although investigating participation dynamics in the wake of the COVID pandemic was outside the scope of our paper, women's concentration in service sector occupations has proven disadvantageous thus far. Women have been disproportionately hit by the restrictions on services activity, with the US unemployment rate for women rising to 12% in the peak of the Covid crisis compared with 10% rate for men (Bateman and Ross, 2020). Bateman and Ross (2020) note that the increased prevalence of women in lower paid work, the reliance on childcare provision and the representation in the services sector are all key reasons for the disproportionate hit to women in the downturn. It will be important to investigate whether the relative effects of the shock on male and female labour market outcomes prove to be durable. However, addressing the provision and up take of leave for men could go some way towards shifting the attitudes towards childcare within society, reducing the reliance of women on childcare provision, and hence increasing their job stability during pandemic type shocks.

The final structural labour market variable we considered was the rate of unionisation, which was found to be insignificant across all models. In general, across the economies considered in the analysis, the rate of unionisation has been declining over time, but the dispersion across countries is only modest. This is likely interfering with our ability to identify any effects. Some of the impact of unionisation may also being captured by our measures of employment protection, high levels of protection are more common in countries with larger roles for organised labour.

5.4 Labour Force Participation, Culture and Demographics

Capturing the influence of cultural factors is complicated at the macroeconomic level and this one area where the model may suffer from significant omitted variable bias. We decided against taking the approach of Clark et al. (1991) to capture the effect of 'culture' through dummy variables, attributing specific cultural types to each country because we wanted to avoid unhelpful generalisation. However, Clark et al. (1991) did find evidence that female participation was lower in Islamic and Catholic Latin American nations compared with other cultural types.

Our approach was to proxy for cultural factors through the inclusion of demographic variables – specifically female fertility rates and the share of women of working age in marriages and unions - that are likely influenced by cultural factors. And while the share of the population aged over 65 is not usually considered a cultural variables, it is of course affected by historic fertility dynamics.

Across OECD economies, fertility rates have steadily declined over recent decades, falling on average from above 3 in the 1960s to around 1.6 in 2018, Aaronson et al. (2017) found that this decline in fertility has increased female participation in developed markets in particular. However, this decline in the average hides quite a wide dispersion across OECD economies, and the economies in our sample, with the fertility rate in Mexico and Turkey still above 2 and as low as 1.1 in South Korea. This dispersion is likely to be better captured in the mixed effects specifications - equations 2 and 4. In these specifications, we find that higher fertility rates are associated with higher levels of male participation but not for levels of female participation. If higher fertility rates primarily reflected a cultural preference for higher levels of male labour force attachment than women, we would expect to find a negative effect in the female equations. Instead, any impacts on female participation are likely to be confounded by the fact that cultures and policies that make it easier for family responsibilities to be balanced with work responsibilities may increase women's willingness to have families in the first place at all.

Our attempt to capture cultural factors through the inclusion of the share of women in marriages and other unions was also only partially successful. Evidence from other related studies suggests that marriage is associated with higher wages for men but not for women (Korenman and Neumark, 1991; Gray, 1997; Heimdal and Houseknecht, 2003; Light, 2004). And we might have expected to see a similar pattern for participation. However, although the share of women in unions was positive and statistically significant in one female equation, the result was not robust to different specification choices. It is possible that some of the potential impacts are being picked up by the country fixed effects, as some cultural factors that matter for participation change very little over time.

Similarly, while we find some evidence that older societies have lower levels of participation, consistent with the expected negative effect on aggregate labour supply, the significance of the impacts was not robust across the specifications.

6 Limitations of the Study

As referenced throughout the paper there are a number of instances in which either data limitations or the limitations of panel models themselves impeded our ability to robustly identify the drivers of female and male labour force participation rates.

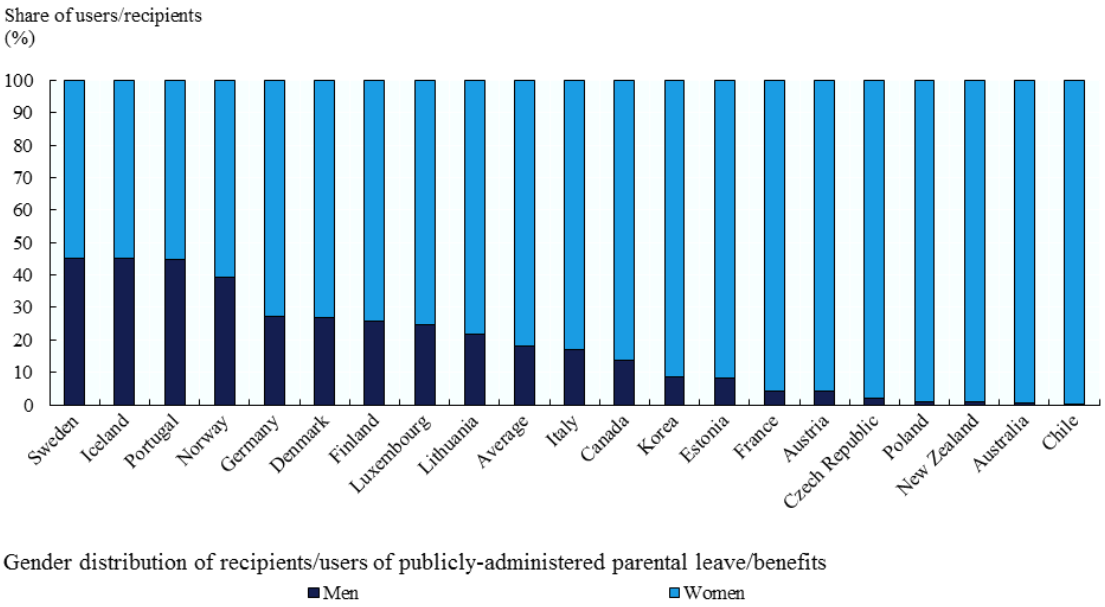
6.1 Data Limitations

Weaknesses in the construction of some of the policy variables available to us proved to be an important limiting factor in our analysis. Improving the quality of the leave data collected would be especially useful. Within this study we were only able to examine the effect of variation in the length of leave entitlements, rather than also being able to take into account other factors influencing the effect and success of those entitlements. For example, information about the number of full-pay equivalent weeks available would have allowed us to test the impact of the generosity of entitlements, holding the amount of leave constant.

Additionally, we do not have any comparable information about the take-up rates of entitlements, which can be particular important in countries where workplace and broader policy and cultural factors undermine people's willingness and ability to take the leave owed to them. It would also have been useful to have been able to measure paid and unpaid leave provisions granted by

firms to their staff that go beyond statutory entitlements. This is likely to be especially important in countries with less regulated labour markets and where work benefits are negotiated at the enterprise or sector level.

Figure 8: Use of parental leave by sex across OECD economies



Source: OECD, 2016

6.2 Methodological Limitations

The source of variation within a panel study is important when considering the type of estimator to use. As discussed in section 3.2 the nature of our data set presents us with a difficult trade-off – the random effects estimator introduces bias in the presence of the unobserved heterogeneity that is likely in our data but the fixed effects estimator can be inefficient when there is much more cross-sectional than time series variation in the key regressors to exploit, as is also the case in our data.

Our reading of the panel literature is that these issues, and the difficult to resolve nature of this trade-off, are often under-recognised. Indeed, Bell and Jones (2015) argue that it is better to directly model the unobserved heterogeneity rather than using the fixed effects estimator. This is a key reason why we have chosen to present the results of the fixed, random and mixed effects estimates, emphasising only those results that are robust to the different plausible specifications.

Table 3: Percentage of Variation from Between Panels and Within Panels in Each Variable[11]

	Source of Variation	
Variable	% Between	% Within
Family Health Leave	89%	11%
Fertility Rate	92%	8%
GDP per capita growth	15%	85%
GDP per capita level	96%	4%
Married/union	82%	18%
Female educational attainmnet	86%	14%
Maternity Leave	87%	13%
Paternity Leave	68%	32%
Sick Leave	99%	1%
Part time Women	97%	3%
Part time Men	89%	11%
Share of population over 65	93%	7%
Tax burden 1	88%	12%
Tax burden 2	87%	13%
Trade Union Density	95%	5%
Total expenditure on families	91%	9%
Tax breaks for families	77%	23%
Female Unemployment Rate	74%	26%
Male Unemployment Rate	52%	48%
Employment Protection (regular contracts)	99%	1%
Employment Protection (temporary contracts)	92%	8%
Male Labour Force Participation	94%	6%
Female Labour Force Participation	96%	4%
Product Market Regulation	74%	26%
Industry Employment Share	86%	14%

Source: Aberdeen Standard Investments, 2020

Another methodological limitation in this study is the instrumental variable strategy employed – finding instrumental variables is a complicated task. In the regressions presented in section 3 of this paper, a variable is considered endogenous if the null hypothesis of exogeneity is rejected by the robust Durbin-Wu-Hausman endogeneity test at the 5% significance level (Durbin, 1954; Wu, 1973; Hausman, 1978)[12]. The instruments employed in this paper follow that of Jaumotte (2003) and Thévenon (2013) whereby a lag of the endogenous variable and the exogenous variables within the regression are used as instruments.

Unfortunately, lags of the endogenous variables are not perfect instruments because: a) some of the lagged variables are highly correlated with the errors in the final stage regression creating some bias the estimation; and b) some of the lagged variables are only weakly correlated with the endogenous variables, causing a loss of information and imprecise estimates. In the modelling strategy we deploy, the models are exactly identified with the number of endogenous regressors equal to the number of instruments. Therefore we cannot test for exogeniety of the instruments with usual tests such as the Sargan (1958) test of over-identifying restrictions. Intuitively, there are some variables, such as family health leave, where the variation over time is lower and hence the lags of these variables would more likely contain similar information and may be endogenous in the final stage regression after instrumenting. Nevertheless, the overall strength of the instruments we use is at least high, with all displaying correlations above 0.85 (see Table 4). Overall, while we have done everything we can to deal with endogeneity problems in this study, we are cautious about implying true causality to our results, particularly because our model does not allows us to model and identify the channels through which variables are influencing participation. We therefore recommend follow-up research re-examining our most prominent results, like the positive impact of paternity leave on female participation rates, within quasi-experimental and methodologies better suited to causal inference.

[11] See the appendices for details of the calculation used here.
[12] Results of these tests are presented in appendix 7.2.

Table 4: Strength of instruments – variable correlation with lag

Instrumented Variable	Correlation with lag
Tax burden 2	0.873
Female unemployment rate	0.891
Maternity leave	0.901
Maternity leave squared	0.912
Family health leave	0.913
Male LFPR	0.919
Industry share of employment	0.919
GDP per capita	0.922
Share of women working part time	0.929
Employment protections	0.932

7 Conclusions

Understanding the determinants of the labour force participation rates is important for policymakers seeking to increase the efficiency of the labour market and broader economy. Within the constraints of the available data we have deployed a robust panel methodology to investigate the effects of macroeconomic, policy, and structural characteristics of the labour market and broader society on the participation rates of women and men across the OECD countries since the start of the century.

Our research shows that when examining the drivers of female labour force participation, it is just as important to consider polices that influence the demand and supply of male labour as it is policies that directly target women. In particular, while increases in maternity leave entitlements no longer seem to be associated with higher female participation, thanks to gains made over previous decades, increasing the availability of paternity leave has significant positive effects. Critically, these gains for women do not appear to come at the expense of male participation.

This finding should be examined more closely in follow-up research, with a focus on the mechanisms through which paternity leave is beneficial and additionally considering the financial generosity of leave and the take-up of entitlements.

Our research also adds to the literature suggesting that the design of tax-transfers systems have important implications for aggregate labour supply. We identify robust evidence that higher effective marginal tax rates on second earners – who are more likely to be women – are associated with lower female participation rates. Similarly, where the tax—transfer system does the most to counteract the barriers to participation faced by sole parents, participation rates are higher. This is something that can be directly addressed through policy changes that lower tax wedges for women whose labour supply is likely to be highly elastic.

We also note the importance of the design of employment regulations for women. While strong employment protection on regular contracts is positively associated with female labour force participation, strong protection for temporary contracts has the opposite effect. Women much more likely to be in part time work than men, and thus more likely to governed by temporary contract regulations. Additionally, our model found that part time work has a positive significant impact on female participation. These results suggest that part time, flexible work opportunities may facilitate greater female participation. That said, related evidence suggests that part-time work can also be associated with lower quality jobs. As such policymakers should consider options that avoid women becoming trapped in lower paid, more vulnerable jobs. In addition to the implications for policy, two further findings on the importance of economic strength and the significance of educational attainment are important in maintaining higher female labour force participation.

The final stand out conclusion from our research is the need for better data. This is particularly clear for leave policies, where a number of confounding factors make understanding the impact of these at the macroeconomic level a complex task. But also, a better understanding of the cultural factors at play across economies would be advantageous in testing some of the tentative theories which have come to light in the results of this paper. Further work to assess both of these aspects would improve not just

policy making but the understanding required to ensure that the full labour supply available within economies is put to good use, for the benefit of future generations.

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9 Appendices

9.1 Detailed Data Descriptions

- Total expenditure = Total public social expenditure on families as a % of GDP, this includes spending on childcare provision and on cash benefits; Source: OECD family database.
- Tax breaks for families = public social expenditure on tax breaks for families as % of GDP; Source: OECD Family Database.
- Employment protections regular and temporary contracts = OECD employment protection index compiled from 21 items covering different aspects of employment protection regulations for regular and temporary contracts separately. See OECD (2020b) for further details. In this analysis version 2 is used to ensure a full time series.
- Family health leave[13] = weeks of paid family health leave available to employees; Source: Prospered Project.
- Paid maternity leave[13] = weeks of paid maternity and parental leave available to mothers in weeks; Source: OECD family database.
- Paid paternity leave[13] = weeks of paid paternity and parental leave reserved specifically for fathers; Source: OECD family database.
- Paid sick leave[13] = weeks of sick leave employers are required to provide. Those where there is unlimited or no mandated leave are assumed to have leave equal to 1s.d. above the maximum mandated leave. Source: Prospered Project.
- Female Unemployment Rate = female unemployment as % of female labour force, working age population >15. Source: World Bank, ILO.
- Male Unemployment Rate = male unemployment as % of female labour force, working age population >15. Source: World Bank, ILO.
- Fertility Rate = number of births per woman; Source: World Bank, WDI.
- Growth Rate of GDP per Capita = Year-over-year growth in GDP per capita; Source: Maddison Project Database, series: rgdpnapc.
- Level of GDP per Capita = level of GDP per capita; Source: Maddison Project Database, series: rgdpnapc.
- Industry share of GDP = industry value add as % of GDP. Source: World Bank, WDI.
- Labour force participation rate of women = Labour force participation rate is the proportion of women ages 15 and older that are economically active: all people who supply labour for the production of goods and services during a specified period. Source: World Bank, WDI, ILO.
- Labour force participation rate of men = Labour force participation rate is the proportion of men ages 15 and older that are economically active: all people who supply labour for the production of goods and services during a specified period. Source: World Bank, WDI, ILO.
- Married/Union Women = Estimates and projections of the number and the proportion of married or in-union women of reproductive-age (15-49 years). Source: UN.
- Mean years of schooling = The average number of years of education received by people ages 25 and older, converted from educational attainment levels using official durations of each level.; Source: UN. Part time men = share of men employed part time; Source: OECD Employment Database.
- Part time women = share of women employed part time; Source: OECD Employment Database.
- Product market regulation = index of product market regulation, measured every 5 years linearly interpolated to annual data, note there was a methodology change between 2013 and 2018. See OECD (2020c) for further detail of the methodology. Source: OECD.

[13] For logged leave variables we scale such that variable is log(X+1) to account for 0 weeks in the raw data.

- Share of population >65 = proportion of total population over 65 years; Source: World Bank, WDI.
- Trade union membership = trade union density; Source: OECD Labour Database.
- Taxburden1 = average additional tax paid net of transfers by a household with 2 married earners (one at 100% of the average national wage, the second at 67%) and a household with the same structure but where there is just one earner (at 100% of average national wage).
- Taxburden2 = difference in average tax borne net of transfers by a single person and earner (at 67% of average national wage) with two children compared with a single person and earner (at 67% of average national wage) with no children.

9.2 Endogeneity Testing

Table 1: Results of Durbin-Wu-Hausman Test for Endogeneity

	P-value in Durbin-Wu- Hausman Test	
Variable	Male Model	Female Model
log(familyhealthleave)	0.039*	0.039*
log(fertilityrate)	0.149	0.986
gdppcgrowth	0.21	0.804
log(gdppclevel)	0.024*	0.06
log(married)	0.188	0.561
log(education)†	0.601	0.173
log(matleave)	0.003*	0.007*
$[\log(\text{matleave})]^2$	0.002*	0.002*
log(patleave)	0.574	0.844
$[\log(\text{patleave})]^2$	0.962	0.764
log(sickleave)	0.387	0.663
log(shareparttime)	0.053	0.007*
log(sharepop65)	0.896	0.784
taxburden1	0.172	0.165
taxburden2	0*	0.013*
log(uniondensity)	0.125	0.073
log(totalexp)	0.533	0.365
taxbreaks	0.991	0.899
femaleur	0.006*	0.076
maleur	0.084	0.067
log(empprotection)	0.003*	0.445
log(empprotectiontemp)	0.203	0.426
log(lfpr)	0.168	0.044*
log(prodmarketreg)	0.853	0.851
log(industryempshare)	0.048*	0.416

†education is female specific education attainment in female equation and general education attainment in male due to data availablility
* indicates statistically endogenous at the 5% level

9.3 Time Fixed Effects Testing

Table 2: Wald test for joint significance of time fixed effects in female equation

Wald Test:
Equation: Female Fixed Effects

Test Statistic	Value	df	Probability
F-statistic	3.719357	(13, 365)	0.0000
Chi-square	48.35164	13	0.0000

Null Hypothesis: C(27)=C(28)=C(29)=C(30)=C(31)=C(32)=C(33)=C(34)=C(35)=C(36)=C(37)=C(38)=C(39)=0

Table 3: Wald test for joint significance of time fixed effects in male equation

Wald Test:			
Equation: Male Fixed Effects			
Test Statistic	Value	df	Probability
F-statistic	1.471393	(13, 365)	0.1255
Chi-square	19.12811	13	0.1192
Null Hypothesis: C(27)=C(28)=C(29)=C(30)=C(31)=C(32)=C(33)=C(34)=C(35)=C(36)=C(37)=C(38)=C(39)=0			

9.4 Variance Decomposition Methodology

For a variable, x_{it}, measured across two dimensions, i = country and t = time, variance attributable to each dimension can be calculated as follows.

Overall Variation

$$S_o^2 = \frac{1}{NT-1}\sum_i\sum_t(x_{it} - \bar{x})^2 \text{ where } \bar{x} = \frac{1}{NT}\sum_i\sum_t x_{it} \tag{11}$$

Between/Cross-Section Variation

$$S_B^2 = \frac{1}{NT-1}\sum_i(x_{it} - \bar{x})^2 \tag{12}$$

Within Variation

$$S_w^2 = \frac{1}{NT-1}\sum_i\sum_t(x_{it} - \bar{x}_i)^2 \tag{13}$$

Contribution to total variation

$$Cross\ section \approx \frac{S_B^2}{S_B^2+S_w^2} \approx \frac{S_B^2}{S_o^2} \tag{14}$$

$$Within \approx \frac{S_w^2}{S_B^2+S_w^2} \approx \frac{S_w^2}{S_o^2} \tag{15}$$