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Table of Contents

Abstract

Pre-school education and care (PSEC) is often claimed as a 'win-win' policy which simultaneously enhances both economic competitiveness and social cohesion. High levels of PSEC are said to raise living standards by increasing female employment rates and improving young people's skills and to mitigate inequalities by reducing social gaps in learning outcomes. Much of the evidence for this rests on analysis of data for a small number of countries. In this paper we test the claims using cross-national time series data for a large number of OECD countries. The analysis of determinants of employment rates, using a variety of controls, does confirm the association between PSEC participation levels and female employment rates. However, the cross-national analysis does not support the argument that raising aggregate levels of PSEC participation necessarily reduces social gaps in attainment at 15 years of age. Participation in PSEC increases educational performance at 15 by similar amounts for children of all social groups in most countries. Social gaps in performance at 15 may only be mitigated by high levels of PSEC provision where children from less advantaged families get more – or better quality – provision. The recently announced Department for Education plan to extend free provision of PSEC for fifteen hours a week to two-year-old children from disadvantaged families (i.e. in care or qualifying for free school meals) therefore points in the right direction. However, it remains to be seen whether this will bias participation towards this group sufficiently to reduce inequalities in learning outcomes.

Introduction

Debates about policy frequently involve identifying social and economic trade-offs. A policy which is designed to boost economic competitiveness may have negative social consequences or, conversely, policies designed to enhance social cohesion may come at a high economic cost. The tensions between economic and social goals seem particularly evident in times of economic austerity. However, social scientists occasionally identify macro policies which they claim would have clear benefits, both on the macro-economic and macro-social side. Publicly-funded pre-primary education and care (PSEC) is one such policy area. Esping-Andersen (2009), in particular, has claimed that it represents a clear 'win-win' policy for developed countries.

The argument, put simply, is that increasing the availability and take-up of good quality pre-school education and care brings major economic and social benefits at the societal level. Affordable and accessible pre-school provision frees up mothers of young children to undertake paid work and is thus likely to increase the employment rates of mothers and female employment rates in general. Raising rates of employment makes an important contribution to raising GDP per capita and improving living standards and has been a central goal for European economies since the Kok Report (Kok, 2003). At the same time participation in pre-school education and external care is held to improve the cognitive abilities of young children which will help them to achieve more in their school education. As this feeds through to higher levels of skills and qualifications in the workforce this will benefit the economy through enhanced productivity. According to Esping-Andersen (2009) these macroeconomic gains would come at little net cost. Although publicly subsidized universal pre-school education is expensive, its costs to the exchequer are off-set by the increases in tax revenues which will accrue. Mothers who have access to good quality external care for their young children will take shorter maternity breaks from employment and thus be paying taxes on their earnings for several years when they would otherwise not be doing so. Their lifetime earnings, and so tax contributions, will also be enhanced, since they will not be so subject to the negative effects on women's career trajectories which are often associated with extended periods of maternity leave.

The social gains from accessible and affordable pre-school education and care are seen to accrue from the effects on both mothers and their children. Mothers gain through having greater choice as to whether to return early to work after childbirth or to look after their children at home. Children are said to gain because participation in pre-school education, at least for those between 1 and 5 years, generally improves cognitive abilities which increase the educational benefits from later schooling. Esping-Andersen (2009) also claims that widespread participation equalises educational outcomes in the longer term, pointing in particular, to the effects of near universal provision in the Nordic countries. He claims that social gaps in the quality of parenting, and the time investments made by parents in their children, are growing, and that this may be increasing the unequal effects social inheritance on life chances and reducing social mobility in many countries. High levels of participation in pre-school education, he says, can mitigate against this trend and reduce inequalities in school performance, since the gains to disadvantaged children, he supposes, are greater than to other children. He offers the example of the Nordic countries where, between the 1960s and 1990s, participation in pre-school education and external care and maternal employment rose in tandem, at the same time as inequality in education outcomes decreased.

The simultaneous social and economic benefits of widespread pre-school education and care, particularly as exemplified in the Nordic states, would seem to be highly impressive, yet few countries have invested sufficiently to universalise pre-school participation. Is the case in favour as clear cut as it would seem? Or do the benefits vary across countries, according to other contextual factors. In this paper we seek to test again the robustness of the claims using time-series international data on participation and female employment (full and part-time) and the cross-sectional international data from PISA on pre-school participation and inequalities in educational outcomes at age 15. We find that the relationships vary considerably across countries due to a variety of contextual factors.

The claims about the impact of pre-school education and care on female employment rates seem to be the most robust, although even here the patterns across countries are complex. Central and Eastern European countries, for instance, have seen gradual increases in pre-school participation since the 1980s but female employment levels have gone down from their previously quite high levels in some countries (the Czech Republic and Poland) and flat-lined in others (Hungary and Slovakia). Mediterranean states have generally seen

improvements in both participation and female employment rates between 1980 and 2010, but these did not occur simultaneously, with female employment rates not rising sharply until the mid 1990s, somewhat after the participation rates began to rise from their previously comparatively low levels. In the Netherlands rates of female employment rose rapidly during the period whilst pre-school attendance was going down until the last couple of years.

Our analysis of the social benefits of pre-school education are more equivocal. The evidence for the benefits of PSEC to the child's cognitive levels and later school performance seem robust enough, as the literature demonstrates, at least with regards to those participating between 1 and 5 years. However, there is little evidence across countries of high levels of pre-school participation reducing inequalities of educational outcomes at 15, as Esping-Andersen has claimed. The effects seem to vary across countries probably according to the distribution of participation across social groups and the quality of provision accessed by different groups.

Pre-School Education and Female Employment

There is a wealth of research evidence from different countries attesting to the positive impact of PSEC on the employment levels of mothers of small children and female employment levels generally. Various studies have analysed area data for particular countries to estimate the effects of variations in the affordability and availability of PSEC on female employment rates. Other studies have used cross-country time series data to analyse the relationship between PSEC participation and female employment rates. Most of the evidence points to a positive effect of factors pre-disposing participation and actual participation on female employment rates.

A number of studies in the US (Heckman, 1974; Connelly, 1992; Ribar, 1995; Kimmel, 1998; Powell, 2002) show that costly child care acts as a barrier to employment for women. Mason and Kuhlthau (1992, 915) found that up to 30% of mothers of pre-school age children in the US felt constrained in their employment due to childcare problems. Chevalier and Viitanen (2002) report, on the basis of the 1988 Family Resources Survey, that over 20% of British women aged 18-44 stated that childcare obligations restricted their employment possibilities. Their own analysis uses Labour Force Survey data from 1992 to 1999 on the proportion of

women aged 16-59, with a youngest child less than 5 years old, who are active in the labour force (ILO definition) and administrative data on the supply of child care. During the period the proportion of childcare workers increased by 50%, places in nurseries by 120%, childminders by 30%, whilst playgroups declined by 15%. The supply of childcare, lagged by five quarters, correlates with the female labour supply.

Simonsen's (2010) analysis of Denmark uses regional variations in cost and availability of PSEC up to 2001. Day care in Denmark is largely publicly funded and organised by the municipalities which provide all day nursery places for children of 2-5 years and all-day family day care (mostly in public centres) for children aged 0-2. The municipalities are bound to provide nursery or home care provision for any child over 6 months where at least 67% of the costs must be borne by the state. In 2002, 96% of children aged 3-5 years and 61% of children aged 0-2 years were in publicly-organised PSEC. However, availability and costs to parents vary between areas. She finds that an increase in the cost to parents of childcare by 1 Euro per month will decrease the female employment rate (during the first 12 months after childbirth) by around 0.08%. The effect on female employment propensity (for women 8-15 months after childbirth) where childcare is fully available (without waiting lists) is 6%.

Another study (Kreyenfeld and Hank, 2000) analyses the effect of the costs and availability of PSEC in western Germany where most provision is provided by the municipal authorities. Since 1996 local authorities have been obliged to offer day care for all children 3-6 for half a day each day but there is still some variation in availability between states and often very few day care slots for infants. Fees are means-tested and set quite low to cover only 10-20 % of operating costs. Given the very limited private day care market, and the low costs of public provision, it is availability rather than costs which are most salient for female employment. Kreyenfeld and Hank model availability of PSEC places (slots per 1000 children) and female employment rates, controlling for the age of the youngest child, mother's education, single parenthood, partner's wage and regional employment rates. They find that the likelihood of a women being employed is unaffected by single parent status and regional unemployment levels but rises where the mother is more educated. The chance of a mother being employed full-time increases with her partner's earnings and the chance of being employed full- or part-time rises with the age of the child up to four years. The availability of child care has more impact than the cost, but only has a small effect on the mother's propensity to employment.

This, they argue, is probably because the limited hours of day care restrict the mothers' ability to work anyway.

In addition to the effects of availability and costs of PSEC, maternal employment rates are likely to be influenced by mothers' preferences for either staying at home to look after young children or returning to work soon after childbirth and making use of external child care. Evans and Kelly (2001) analyse women's preferences across countries using International Social Survey Programme (ISSP) data. They find considerable variation with, for instance, Australian mothers generally preferring to stay at home with young children, and mothers in ex-communist countries in Central and Eastern Europe being more likely to want to return early to work. Better educated women, they find, are more likely to want to return to work, perhaps because their higher qualifications give them access to better paid employment which is more likely to provide them a net income gain after they have met the costs of the child care. According to Evans and Kelly, actual employment levels of mothers exceeds their preferences in 13 out of 23 countries for which data are available. If maternal employment rates are affected by the costs and availability of PSEC, as they appear to be, they are also affected by women's preferences and cultural traditions regarding family life in different countries.

All in all, the evidence from intra-country studies does seem to be that access to PSEC has a positive effect on maternal employment levels in many countries, even given other contextual influences. A cross-country study of the lagged effects of different variables on PSEC rates provides added evidence of this. O'Connor's (1988) study, using data for 68 countries between 1965 and 1980, is designed to illuminate the factors driving rises in PSEC enrolments across countries and female employment is just one of a number of hypothesised factors considered. These latter also include: the power of the state, levels of economic development and enrolments in primary, secondary and tertiary education. The dependent variable used in the regression analysis was the pre-school enrolment rate for 1980, the goal being to capture the lagged effects of variables measured in 1965 on enrolment rates in 1980, while controlling for the effects of independent variables at the earlier time point and for enrolment rates in 1960. Pre-school enrolments were standardised for comparability by the construction of a ratio of the gross enrolment figure for each country (taken from UNESCO data) in the numerator and the population aged 0-4 in the denominator. The analysis shows

that most of the independent variables – including the strength and pervasiveness of the state, and increased enrolments in school education – have no significant effects on PSEC enrolment rates. Levels of economic development, when controlling for women's participation in the labour force, had no significant positive effects for developed or developing countries. However, women's labour force participation had a significant positive effect on PSEC enrolment rates within the developed countries. O'Connor breaks down the analysis for all countries by types of employment and finds that while women's participation in agriculture has no effect, their participation in industrial and service sector employment in developed countries has a significant positive effect. O'Connor interprets the findings as showing that the main driver for increased pre-school enrolment in developed countries has been the rising demand by mothers participating in paid, non-agricultural employment. Although this study, using a time lagged procedure, reverses the causality of other studies, it supports the notion that availability of PSEC and maternal employment rates are related.

The Social Benefits of Pre-School Education and Care

The importance of early learning for children's cognitive development and future learning has been emphasised in many recent studies and the research that demonstrates this has been taken very seriously by policy-makers in a number of countries (Waldfogel, 2004). Recent studies based on the analysis of longitudinal data in the UK suggest that up to half of the gap in children's cognitive abilities is already established by the age of 11 years (Goodman et al, 2011) or earlier. This does not, of course, mean that formal schooling at primary or secondary level makes no difference to the distribution of educational outcomes. Up to half of the gap in cognitive development appears during that period and will be in part due to the schooling process. Moreover, inequalities in the broader educational outcomes, over and above those of tested cognitive ability, will emerge, and they are also important. However, it remains the case that learning during the early years is highly important to a child's cognitive and broader educational development and that different experiences of parenting and early years education and care do appear to contribute substantially to social inequalities in educational performance. As Esping-Andersen (2009) writes: 'If the race is already half run before the child begins school, then we clearly need to examine what happens in the early years.' These early years affect much that happens in the child's schooling later on. 'Like it or not, says

Esping-Andersen, 'the most important mental and behavioural patterns, once established, are difficult to change once children enter school.' (p. 81).

Waldfogel (2004) provides a useful review of recent international research on early cognitive development. She acknowledges that the research shows that there are multiple influences on development in the early years, and classifies these into three types which include child endowments, parenting and home environment and pre-school education and care. She says that what parents do generally matters more than what early schooling does, but that the latter can be effective. The research suggests that maternal employment in the first year of the child's life can be detrimental to cognitive development and be associated with behavioural problems, particularly if the mother's employment is full-time and from very early after childbirth. However, the research also shows that high quality PSEC is advantageous to children aged one year and above. Research in the UK and the US, based both on experimental PSEC programmes and using large-scale longitudinal surveys, generally suggests that there are significant cognitive gains to children over the age of one from receiving high quality PSEC. This is particularly the case for those attending centres which integrate care and learning and where the teachers are well qualified. In some studies the benefits are particularly marked for children from more disadvantaged homes. OECD studies (2010, p. 98) also suggest that PSEC improves performance in skills measured at 15 years. Over 72% of those tested at 15 years in the PISA 2009 study had received one or more years of pre-primary education. After controlling for social background, attending a year or more of PSEC was associated, on average across the OECD, with a 33 point gain in test scores at 15 years. In all countries children who participated for more than a year in PSEC got, on average, higher scores at 15 than those who didn't.

There is a fairly widespread consensus that high quality PSEC brings educational advantages to children after the first year. The cognitive gains associated with PSEC will enhance later learning and skills acquisition. The higher level of education and skills to which it contributes is, in turn, associated with a wide range of social and health benefits to the individual. So in this sense there is clear evidence of aggregate social gain from having accessible PSEC and high levels of participation in this. However, what is not so clear is whether high levels of participation tend to lead to the equalisation of educational outcomes and whether this could be seen to represent another measure of social gain. More equal distributions of skills and

qualifications amongst adults are associated cross-nationally with more equal income distributions and these, in turn, are associated with a wide range of social goods, including better public health, lower rates of crime, and higher levels of trust (see Green, Preston and Janmaat, 2006; Green and Janmaat, 2011; Wilkinson, 1996; Wilkinson and Pickett, 2009). Whether PSEC contributes to social gains through distributional effects as well as aggregate effects is not so clear.

Esping-Andersen (2009) has recently argued that universalising PSEC does contribute to equalising educational outcomes. In particular, he argues, that where there is near universal participation in consistently high quality PSEC for young children, as in the Scandinavian countries, this is contributing towards reducing social gaps in educational achievement at the end of compulsory schooling. In much of Europe attendance at Kindergarten for children aged 3-6 is near universal already, but attendance amongst 1-3 year olds is often much less so – at about 30% in Belgium, the Netherlands and the US, and at only around 10% in Austria, Germany and southern European countries (p. 93). What distinguishes the Scandinavian countries – and what most contributes towards their relatively equal educational outcomes at 15 - says Esping-Andersen, is that PSEC for 1-3 year olds is also very widespread and of consistently good quality. What is the evidence that Scandinavian PSEC contributes towards equalising educational outcomes?

Esping-Andersen provides three main arguments for the impact of PSEC on educational inequality, mostly evidenced by the Scandinavian cases.

Firstly, he shows that the availability of full-time PSEC, combined with generous provision for parental leave, raises the level and quality of mothers' workforce participation. Because mothers in Denmark are not obliged to take long career breaks when they have children, and because they are legally entitled to return to work at their former level, they suffer less financial disadvantages from having children by comparison with mothers in many other countries with less family-friendly policies. This is particularly important for lone mothers who are likely to have higher earnings in Denmark and other Scandinavian countries than in most countries, and whose children are thus less likely to be brought up in poverty. This has significant consequences for education, says Esping-Andersen, because the link between lone parenting and child under-achievement in education – which is mostly the result of family

poverty – is weaker in Scandinavia than elsewhere. Results from various countries as different as Denmark, the Netherlands and the UK, show that children from lone parent families generally do better in education when the mother is employed and the more so if the mothers are in relatively well-paid jobs. Given that a significant proportion of educational under-achievement across countries is associated with the effects of poverty in lone parent families, the mitigation of this in Scandinavia, argues Esping-Andersen, is likely to be contributing there to reducing the effects of social inheritance and overall social inequalities in educational outcomes.

Secondly, Esping-Andersen argues that the over-time evidence for Scandinavia suggests that PSEC has contributed to the amelioration of educational inequality. According to his figures, the decline in social inheritance effects in Nordic countries between the 1960s and 1990s coincided with increases in participation in PSEC and rising levels of maternal employment. 'Indirectly,' he writes, 'there is evidence to suggest that the arrival of universal pre-school attendance is associated with a significant equalisation of school attainment and, one can argue, also links with the comparably quite homogenous performance in PISA…tests.' The decline is most evident, he says, amongst the younger cohorts, who were the first to enjoy near universal participation in PSEC (p. 135). By contrast, in countries which have done less to universalise PSEC, such as Germany, the UK, and the USA, there was no equivalent decline in social inheritance effects over the last half century.

Thirdly, Esping-Andersen cites the evidence from some studies that PSEC is particularly beneficial for children from disadvantaged families who benefit disproportionally from attendance. Since PSEC is near-universal in Scandinavian countries he claims that this would mean that a larger proportion of those most prone to educational under-achievement were receiving benefits which will serve to close the social gaps in attainment generally. His general argument is made as follows:

> 'If early child care were to compensate for unequal cultural capital, we would expect that the latter's explanatory importance would be systematically weaker in the Nordic countries than elsewhere. The reasoning is that participation in child centres that are similar in quality across the board, so to speak, help cancel out the stimulus gap that children from low-educated and culturally weak homes suffer. Utilising again the PISA data this is in fact what we find.

> The influence of parents' cultural capital (and socio-economic status) is systematically lower in Scandinavia than elsewhere.' (p. 136)

The logic of Esping-Andersen's case is certainly very compelling. However, the evidence for it is rather somewhat speculative, as his tentative tone implies. It is certainly the case that educational outcomes in Nordic countries are relatively equal, and that this is borne out by the relatively low social gradients for PISA scores in these countries. However, Esping-Andersen is not able to prove that this is due to the effects of near-universal PSEC rather than, say, the relatively egalitarian nature of the compulsory school systems (Green, Preston and Janmaat, 2006). The associational evidence he provides comes some way short of proving causality. In fact, what the OECD analysis of PISA data shows is that in most countries the benefits from PSEC attendance is roughly the same for children in all social groups. Whether PSEC provision is equalising education outcomes in any given country will therefore depend on how it is distributed. In fact, as the OECD show (2010), participation is PSEC in most countries is skewed towards children of higher social class families. This is even true in Scandinavia, despite near-universal provision, since, as Esping-Andersen admits, non-attendance in PSEC, particularly during the crucial earliest years, is most common amongst immigrant and poorer families. It may be true that universal participation amongst 1-6 year olds would equalise educational outcomes, although the OECD analysis does give evidence for this since it suggests that children from all social groups benefit equally. However, the fact is that participation in PSEC is not equally spread around children from different social groups, even in Scandinavia. Esping-Andersen tacitly accepts that this may be the case, by suggesting there may be a need for positive discrimination measures to equalise up-take of PSEC, even in the Scandinavian countries.

Data, countries and variables

In this paper we are using a compiled macro-dataset for the following countries: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Italy, New Zealand, Norway, Spain, Sweden, Switzerland, UK, and USA. The variables included in the model can be classified in two groups: variables that vary over time and between countries and variables that are constant over time but vary between countries.

Time varying variables (they also vary between countries); these are collected for a period of 29 years from 1980 to 2008.

Logempt: the logarithm of the total employment rate. This is a dependent variable.

Logempf: the logarithm of the female employment rate. This is a dependent variable.

Logpresch: the logarithm of the gross enrolment ratio in pre-primary education. The gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown (in this case the age of 3 to 6). Note the gross enrolment ratios will often exceed 100% since the numerator includes children outside of the 3-6 age cohort.

Exp_unemp: social expenditure on unemployment as percentage of GDP (including active labour market policies).

Prison: prison population rate; number of prisoners per 100000 inhabitants.

Time constant variables (they vary between countries):

Rig_emp: the index of rigidity of employment (0=less rigid; 100=more rigid).

Unioncov: the index of union coverage. This is the percentage of employees covered by collective trade agreements. The variable is categorical (1 is under 25%, 2 between 25% and 70%, and 3 over 70%).

Coordin: the index of the level of wage coordination and bargaining. This is equal to the sum of union and employer coordination indices used in Nickel and Layard (1998).

Benfrep: benefit replacement rate (the share of income replaced by unemployment benefits).

Benfdur: the duration of unemployment benefits in number of years.

Owner: The percentage of individuals who own their houses. This variable should act as a brake on labour force mobility.

We also included the following variables: the degree of centralization of wage coordination (plant, firm, industry, or economy level); an index of employment protection (this is included in the World Bank's rigidity of employment index); migrant stock; the ratio of minimum to average wage; taxes on labour; and union density. None of these variables had a significant

effect on total or female employment when we controlled for the aforementioned ones. For this reason they were taken out of the equation.

The sources of the data are as follows:

Logempt, *Logempf*, *Prison*, and *Exp_unemp*: OECD data.

Logpresch and *Rig_emp*: World Bank data.

Unioncov, *Coordin*, *Benfrep*, *Benfdur*, and *Owner*: Nickel and Layard (1998).

It should be noted that the data was imputed for missing values before any analyses were conducted. For the imputation we used a Marcov Chain Monte-Carlo procedure (using an EM algorithm). The dataset contains 463 observations.

Methodology

In this paper, we are estimating five different models using the same data. These models vary in terms of their estimation methodology. The models are the following:

The Simple OLS model.[1]
$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$
Y_i: is the dependent variable for country i.
X_i: is a vector of characteristics of country i.
ε_i: is the error term of the model. It follows a normal distribution with zero mean and a constant variance. $\varepsilon_i \sim N(0, \tau^2)$. This error term is independent from all regressors, $cov(\varepsilon_i, X_i) = 0$.
β_0: is the intercept of the model.
β_1: is a vector of regression coefficients on the different independent variables.

We start our analysis with a simple OLS regression. In this estimation the time dimension is dropped. In other words, we are considering that time observations for the same country are independent. Of course, this is an inefficient method to use given the nature of the time panel

[1] All regressions are carried out using STATA.

we have (we have 29 observations per country over time). However, we start with this model in order to show how the rest of the regressions improve on it.

The fixed effects model

$Y_{it} = \beta_i + \beta_1 X_{it} + \varepsilon_{it}$

Y_{it}: is the dependent variable of country i in year t.

X_{it}: is a vector of time-varying characteristics of country i in year t.

ε_{it}: is the error term of the model. It follows a normal distribution with zero mean and a constant variance. $\varepsilon_{it} \sim N(0, \tau^2)$. This error term is independent from all regressors, $cov(\varepsilon_{it}, X_{it}) = 0$.

β_i: is the intercept of the model, with $\beta_i = \beta_0 + \mu_i$. β_0 is the overall intercept and μ_i is a country-specific unobserved effect. This effect represents any unobserved country specific factors (related to its history, context, institutions, etc).

β_1: is a vector of regression coefficients on the different independent variables.

In this regression we estimate a fixed effects (FE) model using the same variables as before. However, in FE models time-constant variables cannot be included. Hence, the independent variables only include those that vary over time. It should also be noted that in FE models, the part of the intercept which is specific to the country μ_i is treated as non-random and μ_i is assumed to be not independent of X_{it}.

The random effects model

$Y_{it} = \beta_i + \beta_1 X_{it} + \beta_2 Z_i + \varepsilon_{it}$

Y_{it}: is the dependent variable of country i in year t.

X_{it}: is a vector of time-varying characteristics of country i in year t.

Z_i: is a vector of time-constant characteristics of country i.

ε_{it}: is the error term of the model. It follows a normal distribution with zero mean and a constant variance. $\varepsilon_{it} \sim N(0, \tau^2)$. This error term is independent from all regressors, $cov(\varepsilon_{it}, X_{it}) = 0$ and $cov(\varepsilon_{it}, Z_i) = 0$.

β_i: is the intercept of the model, with $\beta_i = \beta_0 + \mu_i$. β_0 is the overall intercept and μ_i is a country-specific unobserved effect. This effect represents any unobserved country specific factors (related to its history, context, institutions, etc).

β_1 and β_2: are vectors of regression coefficients on the different independent variables.

In this regression we estimate a random effects (RE) model using all the variables from the simple linear regression. Note than in RE models it is possible to include time-constant variables. Further, in RE models the part of the intercept which is specific to the country μ_i is considered to be random and it follows a normal distribution with zero mean and a constant

variance $\mu_i \sim N(0, \tau_0^2)$. The random nature of $\mu_i$requires that it is independent from X_{it} and from Z_i. In other words $cov(\mu_i, X_{it}) = 0$ and $cov(\mu_i, Z_i) = 0$. Note that this model is estimated using a GLS random-effects with STATA.

The random intercept model

This model is exactly identical to the random effects model, except that the estimation is done using a maximum likelihood procedure. We estimate this model in order to compare it with the next one (the random slope model). For this comparison we are using the likelihood ratio test.

The random coefficient model

This model is similar to the random intercept model, but in addition to the random intercept we are introducing a random regression coefficient on Logpresch. The model is written as follows:

$Y_{it} = \beta_i + \lambda_i logpresch_{it} + \beta_1 X_{it} + \beta_2 Z_i + \varepsilon_{it}$

Y_{it}: is the dependent variable of country i in year t.

$logpresch_{it}$: the logarithm of the percentage of students attending PSEC in country i in year t.

X_{it}: is a vector of time-varying characteristics of country i in year t.

Z_i: is a vector of time-constant characteristics of country i.

ε_{it}: is the error term of the model. It follows a normal distribution with zero mean and a constant variance. $\varepsilon_{it} \sim N(0, \tau^2)$. This error term is independent from all regressors, $cov(\varepsilon_{it}, logpresch_{it}) = 0$, $cov(\varepsilon_{it}, X_{it}) = 0$ and $cov(\varepsilon_{it}, Z_i) = 0$.

β_i: is the intercept of the model, with $\beta_i = \beta_0 + \mu_i$. β_0 is the overall intercept and μ_i is a country-specific unobserved effect. This effect represents any unobserved country specific factors (related to its history, context, institutions, etc). As before $\mu_i \sim N(0, \tau_0^2)$ and is independent from all regressors $cov(\mu_i, logpresch_{it}) = 0$, $cov(\mu_i, X_{it}) = 0$ and $cov(\mu_i, Z_i)$.

λ_i: is the regression coefficient on Logpresch, with $\lambda_i = \lambda + \nu_i$. λ is the overall regression coefficient, and ν_i is a random part representing country *i*'s departure from the overall coefficient. ν_i can be seen as a specific country effect on the slope of Logpresch. It follows a normal distribution with zero mean and a constant variance $\nu_i \sim N(0, \tau_1^2)$. Further, it is considered to be independent from all regressors, $cov(\nu_i, logpresch_{it}) = 0$, $cov(\nu_i, X_{it}) = 0$ and $cov(\nu_i, Z_i)$.

β_1 and β_2: are vectors of regression coefficients on the different independent variables.

Note that in all of our models we do not model time heterogeneity explicitly. Time heterogeneity is absorbed in the error term ε_{it}.

Statistical tests

In our analyses, we are using two types of statistical tests. First, we use the Hausman test to compare the fixed effects to the random effects model. Secondly, we use the likelihood ratio test to compare the random intercept and the random coefficient models to the simple linear regression, and to compare the random coefficient to the random intercept model. The tests will allow us to identify which one is the most efficient.

Results and findings

The results for total employment.

	Simple OLS	FE	RE	Random intercept	Random coefficient
	Logempt	Logempt	Logempt	Logempt	Logempt
Logpresch	0.0628	0.0789	0.0809	0.0809	0.2010
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Rig_emp	-0.0023		-0.0018	-0.0018	-0.0024
	(0.000)		(0.079)	(0.088)	(0.084)
Unioncov	-0.1241		-0.1363	-0.1363	-.1398
	(0.000)		(0.000)	(0.000)	(0.000)
Coordin	0.0782		0.09	0.0901	0.0967
	(0.000)		(0.000)	(0.000)	(0.000)
Exp_umemp	-0.0592	-0.0489	-0.0494	-0.0494	-0.0347
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Benfrep	0.0034		0.003	0.0029	-0.0062
	(0.000)		(0.002)	(0.002)	(0.603)
Benfdur	0.0184		0.0249	0.0250	0.0309
	(0.000)		(0.034)	(0.038)	(0.832)
Prison	0.00002012	0.0002993	0.0002300	0.0002331	0.0001921
	(0.444)	(0.000)	(0.001)	(0.001)	(0.002)
Owner	0.0029		0.0029	0.0029	0.0319
	(0.000)		(0.033)	(0.039)	(0.072)
Cons	3.6178	3.8812	3.4838	3.4833	1.7761
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Between Var		0.0169	0.0028	0.0030	0.4240
Within Var		0.0017	0.0017	0.0017	0.0008

Between Var on Logpresch					0.0581
N	463	463	463	463	463

p-values in parentheses

Test statistics	Statistic	P Value
Hausman statistics comparing RE to FE	4.14	0.24
LR test comparing random intercept to linear regression	209	0
LR test comparing random coefficient to linear regression	409	0
LR test comparing random coefficient to random intercept	200	0

Starting with the simple OLS regression, it is possible to see that all variables have a significant effect on total employment. In fact, an increase in PSEC attendance of 1% leads to an increase in total employment of 0.06%. Even though the coefficient is statistically significant, it is obvious that its impact is weak. However, this OLS regression is far less efficient than the random intercept and the random coefficient ones as indicated by the Likelihood Ratio Test. When the RE, and the random intercept were estimated (these two are identical as stated before, the only difference is that the former was estimated using a GLS random-effects, while the latter was estimated using a maximum likelihood procedure), the coefficient slightly increases to 0.08. However, when the random coefficient model was estimated the coefficient increased to 0.2%. In other words, an increase in PSEC of 10% (PSEC becoming more universal) leads to an increase in total employment of 2%. This effect still seems to be relatively weak, but one should keep in mind that there are many factors affecting employment with PSEC being only one of them. The effect of PSEC is not expected to be very strong on total employment because our main argument was that PSEC increases total employment by encouraging female employment. In other words, the effect on female employment should be larger than that on total employment. Further, the effect is expected to be disproportional. Put differently, a larger increase in PSEC attendance is required to boost employment by a smaller amount. This is intuitive because if the reverse was true, (ie a small increase in PSEC attendance would lead to a large increase in employment), then PSEC would be a miracle solution to unemployment. This is obviously not the case. PSEC is a feasible solution since it increases employment (total and female), but it is not the magic bullet for all problems. As we will see, other factors also have an effect on employment, and hence PSEC should be thought of as a factor that should be combined with others.

The Hausman test indicates clearly that the RE regression is better than the FE model. In other words, the RE model does not suffer from endogeneity bias since it passed the Hausman test. Further, the random intercept and the random coefficient models are better than the OLS regression since they passed the Likelihood Ratio Test (LR test). This was expected since the simple OLS regression does not take the time structure of the panel data into account. The LR test also proved that the random coefficient model is better than the random intercept one. This is a clear indication that the effect of PSEC attendance vary between countries. In other words, it is true that there is an overall effect of PSEC on employment across all countries and a departure from this effect for certain ones. Considering all the tests, it is possible to say that the best model is the random coefficient one. In what follows we interpret the results for the random coefficient model, while comparing them with those obtained from the other models.

In the random coefficient model, an increase in PSEC attendance of 1% leads to an increase in total employment of 0.2%. In contrast, an increase in the index of the rigidity of unemployment of one unit leads to a decrease in total employment of 0.2%. The two variables that have the largest effect on employment are union coverage, and employer-employee coordination. In fact, an increase in union coverage of one point leads to a decrease of total employment of 13.9%. And an increase in coordination of one point leads to an increase in employment of 9.6%. One should not be surprised that these effects are stronger than those of other variables; this happens because both variables are categorical. In fact, union coverage takes only three values according to how many people are covered by union agreements (1 is under 25%, 2 between 25% and 70%, and 3 over 70%). So, in case union coverage increases from 1 to 2, this means a major shift in the situation of a country (moving from one economic regime to another). The same applies for coordination. It is also interesting to note that union coverage and coordination vary in the opposite direction and that they almost cancel each other out.

On the other hand, an increase in expenditure on unemployment of 1% (as a percentage of GDP) leads to a decrease in employment of 3.4%. Prison population also has a significant effect on total employment. An increase in prison population of one person (for every 100,000) increases total employment by 0.019%. The effect is not as weak as it looks. For

instance, a country like Norway had a prison population of 55 individuals for every 100,000 in 1995 while the USA has a prison population of 723 for every 100,000 in 2008. Hence, the difference between the two is 668 persons per 100,000, which corresponds to 12.69% in terms of total employment. One should note that prison population increases total employment because inmates are not considered members of the active labour force, so they are taken out of the denominator of the total employment rate. In more intuitive words, when prison population increases there will less individuals competing for the existing jobs, hence the total employment rate will be higher.

The percentage of home owners has a positive effect on total employment. An increase in the percentage of home owners of 1% increases total employment of 3.1%. At first sight, this result seems to be unintuitive since we expected that home ownership would limit labour mobility and thus reduce employment. Nickel and Layard (1998) got the same result. Their argument was that the percentage of home owners is not correlated with the level of labour mobility in the countries they selected. Another reason is that whether home ownership would be a barrier to labour mobility depends on the flexibility of the real estate market. For instance, in large cities in the UK it used to be relatively easy to sell property and move to another location. Therefore, the basic assumption that home ownership would reduce employment does not seem to be true. Further, the positive effect that we find may be the macro reflection of the fact that the likelihood of owning a home is positively correlated with the likelihood of being in employment or, put simply, that employed individuals are more likely to buy property because they can afford it.

Benefit replacement rate and benefit duration, have a significant effect across all models except in the last one (the random coefficient model). The loss of significance happens because we introduced a random coefficient on PSEC attendance. In other words, this random coefficient explains some of the between-country variance, and these two variables are time-constant so they can only explain the between-country variance. Hence, both the random coefficient and the two variables are competing for explaining the between-country variance (i.e. this variance is divided between the two) and therefore the two variables lose their significance.

Country	λ	ν_i	P Value on ν_i	$\lambda_i = \lambda + \nu_i$
Australia	0.201	-0.119	0.601	0.201
Austria	0.201	-0.186	0.176	0.201
Belgium	0.201	0.361	0.000	0.562
Canada	0.201	-0.077	0.942	0.201
Denmark	0.201	-0.084	0.387	0.201
France	0.201	0.047	0.383	0.201
Germany	0.201	0.099	0.266	0.201
Ireland	0.201	0.645	0.000	0.846
Italy	0.201	-0.057	0.475	0.201
New Zealand	0.201	-0.166	0.000	0.035
Norway	0.201	-0.159	0.014	0.042
Spain	0.201	0.122	0.060	0.323
Sweden	0.201	-0.089	0.000	0.112
Switzerland	0.201	-0.122	0.137	0.201
UK	0.201	-0.177	0.005	0.024
USA	0.201	-0.036	0.662	0.201

In this table, we interpret the random part of the regression coefficient on PSEC attendance (Logpresch). λ is the overall regression coefficient on PSEC, ν_i is PSEC's country specific effect, and the P value indicates if this specific effect is significant or not. If ν_i is significant then it adds up to the overall regression coefficient; if it is not then the total effect of PSEC (λ_i) does not deviate from the overall regression coefficient (λ). The countries where the effect of PSEC does not deviate from that of the overall regression coefficient are: Australia, Austria, Canada, Denmark, France, Germany, Italy, Switzerland, and the USA. The countries where the effect of PSEC is above the overall regression coefficient are: Belgium, Ireland and Spain. In contrast, the countries where the effect of PSEC is below the overall regression coefficient are: New Zealand, Norway, Sweden, and the UK. From these findings we can conclude that PSEC attendance works differently across the selected countries. In some it has a higher effect than the average (λ), and in others the reverse is true. The fact that the random coefficient model allows for a different coefficient for each country is the reason why this model is more efficient than the rest; it fits the data better.

The results for female employment.

	Simple OLS Logempf	FE Logempf	RE Logempf	Random intercept Logempf	Random coefficient Logempf
Logpresch	0.1938 (0.000)	0.2649 (0.000)	0.2674 (0.000)	0.2674 (0.000)	0.6176 (0.000)
Rig_emp	-0.0035 (0.000)		-0.0022 (0.368)	-0.0022 (0.380)	-0.0022 (0.089)
Unioncov	-0.2443 (0.000)		-0.2829 (0.000)	-0.2829 (0.000)	-0.2935 (0.000)
Coordin	0.1549 (0.000)		0.1845 (0.000)	0.1846 (0.000)	0.1855 (0.000)
Exp_umemp	-0.0937 (0.000)	-0.0696 (0.000)	-0.0706 (0.000)	-0.0705 (0.000)	-0.0358 (0.000)
Benfrep	0.0058 (0.000)		0.0047 (0.041)	0.0047 (0.046)	-0.0011 (0.972)
Benfdur	0.0374 (0.000)		0.051 (0.074)	0.0512 (0.080)	0.2025 (0.600)
Prison	0.0001638 (0.007)	0.0007468 (0.000)	0.0006342 (0.000)	0.0006385 (0.000)	0.0005584 (0.000)
Owner	0.0061 (0.000)		0.0064 (0.057)	0.0064 (0.063)	0.0940 (0.045)
Cons	2.5448 (0.000)	2.8707 (0.000)	2.0882 (0.000)	2.0874 (0.000)	-4.1065 (0.000)
Between Var		0.0625	0.0169	0.0179	3.1576
Within Var		0.0078	0.0078	0.0078	0.0029
Between Var on Logpresch					0.4073
N	463	463	463	463	463

p-values in parentheses

Test statistics	Statistic	P Value
Hausman statistics comparing RE to FE	3.87	0.27
LR test comparing random intercept to linear regression	274	0
LR test comparing random coefficient to linear regression	598	0
LR test comparing random coefficient to random intercept	324	0

The models for female employment are exactly identical to the previous ones except that the dependent variable is now different (i.e. female employment). It is worth noting from the start that the statistical tests generate the same results. The random coefficient model is still the superior model, since the LR test proves it to be better that the random intercept one, and the latter (which is identical to the random effects model) is better than the fixed effects model (hence the random models don't suffer from endogeneity bias). And, of course, all random models are better than the simple OLS regression. In what follows we interpret the results from the random coefficient model while comparing them to the other models and to those for total employment.

First, the effect of 1% increase in PSEC attendance on female employment increases from 0.19% (OLS regression) to 0.26% (fixed and random effects models) to 0.61% (random coefficient model). Since the random coefficient model is by far the most reliable, it is possible to conclude that a 1% increase in PSEC attendance does lead to a 0.61% increase in female employment. In other words, if PSEC is made more universal (an increase of 10%) this would lead to an increase of female employment of 6.1%, which is substantial. When compared with the results for total employment, it is obvious that PSEC is more effective (three times more effective) in boosting female employment rather than total employment (recall the coefficient for total employment was 0.2%). This is not surprising since women are the major benefiters of PSEC. This confirms the argument that PSEC helps women to get back to work after childbirth. Hence, countries with higher levels of PSEC attendance are more likely to have higher levels of female employment.

For the rest of the variables the results are as follows. An increase of one unit in the index of the rigidity of employment leads to a decrease of 0.2% in female employment. The magnitude of this effect is identical to that on total employment. On the other hand, the effects of union coverage and coordination become stronger. An increase of one unit in union coverage leads to a decrease of 29% in female employment. One reason for this is that unions are mostly dominated by men; hence the negative impact of union coverage on employment is exacerbated. For coordination, an increase of one unit leads to an increase in female employment of 18%.

The effect of expenditure on unemployment is almost the same as it was for total employment. An increase of 1% in expenditure on unemployment (as percentage of GDP) leads to a decrease in employment of 3.5%. Benefit replacement rate and benefit duration still have an insignificant effect (even though the two variables had a significant effect in the rest of the models). The reason for the loss of significance is the same as before; it happens because of the introduction of a random coefficient on PSEC attendance.

The impact of prison population becomes five times higher. In fact, an increase of the prison population of one individual for each 100,000 inhabitants leads to an increase of 0.055% of female employment. This effect is economically strong for the same reason mentioned above. The difference between Norway's prison population of 55 inmates per 100,000 inhabitants in 1995 and that of the US (723 inmates per 100,000 inhabitants in 2008) correspond to 36.74% in terms of female employment. One should note that inmates are more likely to be males; hence there are less males competing for the existing jobs. In other words, females will have a higher probability of getting a job and therefore female employment will be higher. The percentage of home owners increases female employment, and this effect is higher than that for total employment. The reason for it being positive is the same as above.

Country	λ	ν_i	P Value on ν_i	$\lambda_i = \lambda + \nu_i$
Australia	0.618	-0.130	0.452	0.618
Austria	0.618	-0.378	0.038	0.240
Belgium	0.618	1.116	0.000	1.734
Canada	0.618	0.112	0.561	0.618
Denmark	0.618	-0.360	0.098	0.258
France	0.618	0.151	0.289	0.618
Germany	0.618	0.270	0.186	0.618
Ireland	0.618	1.637	0.000	2.255
Italy	0.618	0.201	0.284	0.618
New Zealand	0.618	-0.571	0.001	0.046
Norway	0.618	-0.448	0.007	0.170
Spain	0.618	0.158	0.341	0.618
Sweden	0.618	-0.597	0.000	0.021
Switzerland	0.618	-0.305	0.112	0.618
UK	0.618	-0.568	0.001	0.049
USA	0.618	-0.288	0.129	0.618

The countries where the effect of PSEC does not deviate from that of the overall regression coefficient are: Australia, Canada, France, Germany, Italy, Spain, Switzerland, and the USA. The countries where the effect of PSEC is above the overall regression coefficient are: Belgium and Ireland. In contrast, the countries where the effect of PSEC is below the overall regression coefficient are: Austria, Denmark, New Zealand, Norway, Sweden, and the UK. From these findings we can conclude that PSEC attendance works differently across the selected countries.

The reasons why the strength of the effect of PSEC on employment varies across countries is clearly very complex since a number of different variables are involved, including, for instance, cultural factors and mothers' preferences. We can only speculate here on some explanations. The strong effect of PSEC participation on employment in Ireland may be high, for instance, because mothers of young children have a relatively strong preference for working (Evans and Kelly, 2001, p. 31). The weaker effects of PSEC on employment in the Scandinavian countries may be due to the fact that both PSEC participation rates and female employment rates are both very high, or because high female employment rates are being driven by factors other than PSEC participation (such as child-friendly employment practises at work). In the UK, the effects may be weaker because much of the PSEC participation is part-time, which allows fewer opportunities for mothers to work (at least in full-time jobs), or because preference amongst mothers for staying at home is still relatively high compared with other countries (19th highest out of 23 countries according to Evans and Kelly's (ibid) data for 1994).

PSEC effects on distribution of performance at 15

The argument for the social benefits to children of PSEC rests on the claims that it tends to improve learning outcomes and that it mitigates the social gaps in learning outcomes. What evidence is there for this from a range of countries?

The best evidence for the effects PSEC across a wide range of countries comes from the OECD PISA studies. PISA contains self-reported data from students on whether they had more than one year of pre-primary education, one year or none. Not surprisingly, PISA data

show considerable variation across countries in the prevalence and duration of PSEC participation. In Belgium, France, Hungary, Iceland, Japan and the Netherlands, for instance, more than 90% of students report having had more than one year of pre-school education, whereas in Canada, Chile, Ireland, and Poland less than 50% of students report having had more than one year of pre-primary education. On average across the OECD 72% of students report attending more than one year of pre-primary education. PISA data does not discriminate between students who have had two or three or four years of pre-primary education, unfortunately. However, as Esping-Andersen (2009) has pointed out, since in the more affluent countries most children have at least two years of pre-primary education, the major differences are probably between those where children typically participate for one or two years and those where the majority attend from one or two years of age for three or four years.

In all of the 34 OECD countries students who attended pre-primary education for more than one year out-performed those who did not at 15 years of age (by an average of 54 points). Even after controlling for social background, attending for more than one year increased performance on average by 33 points. However, there is substantial variation between countries in how much performance enhancement at 15 is associated with pre-primary participation. Attendance for more than one year adds over 100 points on average, before controls for social background (ESCS), in Belgium, France and Israel, but less than 30 points in Estonia, Finland, Ireland, Korea, Netherlands and Slovenia. OECD note that the variations in quality and average duration of pre-primary education probably account for the differences between countries here (OECD, 2010, 11, p. 98).

However, the data do not support the claim that widespread uptake of pre-primary education reduces the social gaps in performance. In our analysis we used data from PISA on the social gradients in performance at 15 years in 2009 and data from PISA and UNESCO on PSEC participation rates. The PISA data on participation give the proportion of students in the survey who report having had more than one year in pre-school education (in the late 1990s). The UNESCO data give the ‘gross participation rates’ in pre-school education, based on administrative data for the year 1996/7. The gross participation rate is the number of children (of any age) in pre-school education divided by the population aged 3-6 years. The latter data provide a more fine-grained

measurement of the variation in participation across countries, since they capture all the variation in duration of attendance, whereas the PISA data treats all participation of more than one year as one category. The range on the X axis on Figure Two is considerably greater than on Figure One.

Figures 1 and 2, below, plot, for a range of countries, the social gradients in performance at 15 against PSEC participation rates from, respectively, PISA (Figure 1) and UNESCO (Figure 2). In both cases the correlations are not significant (r = .26; p = .18; N = 28 using the PISA measure; r = .20; p = .27; N = 33 using the UNESCO measure). Figure 1 shows that in some countries where PSEC participation was very high, the social gradients are still high, as in France and Belgium, whilst in others they are considerably lower, as in Norway and Iceland. On the other hand, in countries where participation in PSEC was low, social gradients can be high, as in Australia, or low as in Ireland and Canada. The UK had a relatively high social gradient for performance at 15 in 2009 and below average enrolment rates in PSEC in the late 1990s, particularly when the latter is measured using the UNESCO gross enrolment rate measure which captures better the duration of PSEC participation.

Figure 1

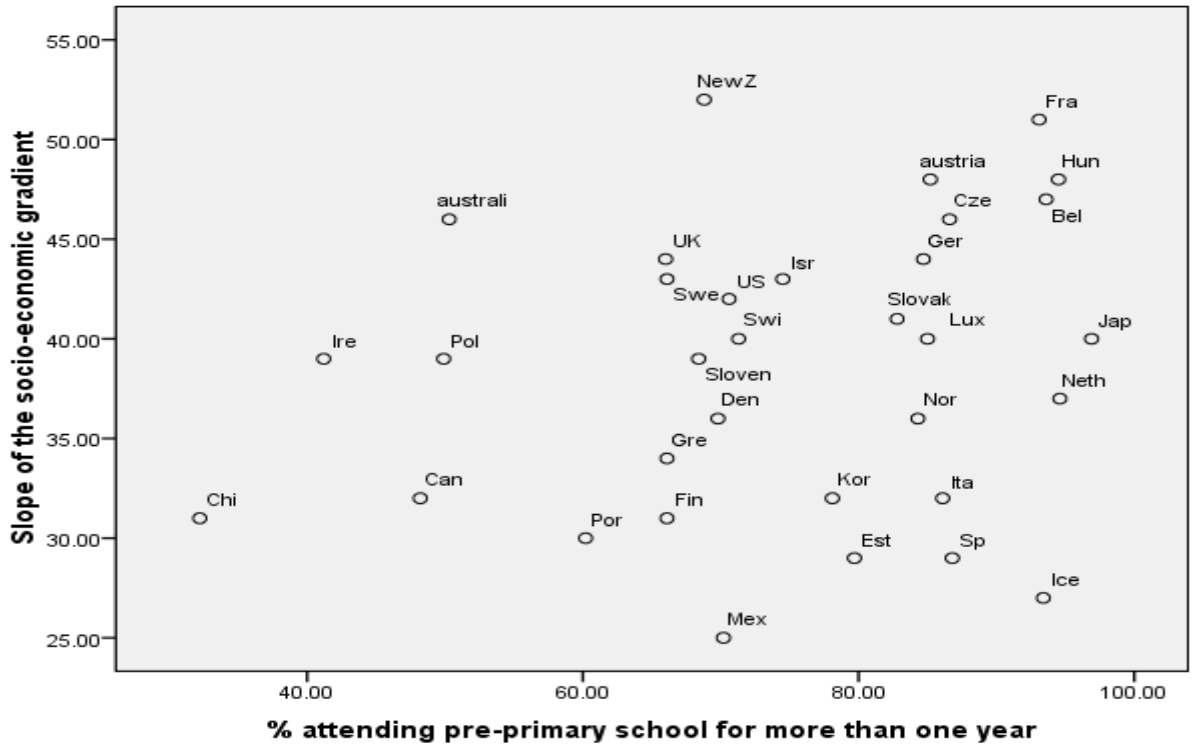
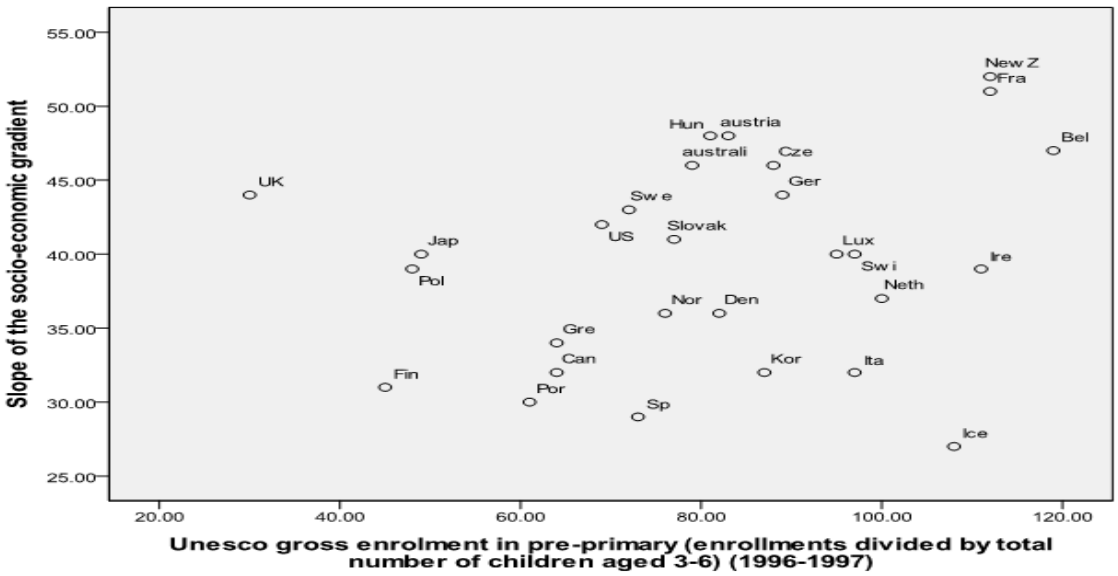


Figure 2



The OECD note that '[d]isadvantaged and advantaged students benefit equally from pre-primary attendance in 31 of the 34 OECD states.' (2010, 98). It is only in the USA that disadvantaged students seem to benefit more. This being the case, PSEC will only mitigate inequalities at 15 in most countries where participation is skewed towards less advantaged children. However, this does not seem to be the case, even in countries like the Nordics, where participation rates overall are highest.

The OECD data on the benefits from PSEC to different social groups shows how this works. In the first table we present the results published in the OECD report on PISA 2009 (OECD, 2010, Volume 2, Annex B1, Table II.5.7, part 2). In the second we present the results published in the same report (Annex B1, Table II.5.5, part 2 & table II.1.2, part 1). The results in the first table were obtained through the regression of reading performance scores on the following variables:

- Student attended pre-primary school (PSEC attendance as a binary variable).
- Student's socio-economic background (ESCS).
- (student attended pre-primary school)*(student's socio-economic background). This is an interaction term between PSEC attendance and ESCS that measures the additional returns to ESCS if a student attended PSEC.
- A square of student's socio-economic background. This term is included to reflect the nonlinear relation between ESCS and performance scores.

- School's socio-economic background. This is average ESCS at the school level.
- Gender.
- Student with an immigrant background.
- School in rural area.
- School in a city.
- School size.
- A square of school size.
- Private school.

The first column of the first table reports the regression coefficient on PSEC attendance (those who attended against those who did not, with the latter being the reference group). As we can see the effect of attending PSEC is positive and significant across all countries except Austria, Norway, and the USA where it is insignificant. The second column reports the regression coefficient on ESCS (the OECD variable for parental income and status), which is the return to social status. The coefficients are significant and positive in all countries except in Belgium, Germany, and Italy. The third column reports the regression coefficient on the interaction term between PSEC attendance and ESCS This interaction term represents the additional return to 1 unit increase in ESCS if the student attended PSEC. As we can see, the results are mostly insignificant across all countries except in Norway and the USA. According to Esping-Andersen's theory, this coefficient should have been negative and significant. In other words, attending PSEC should mitigate the effect of ESCS; or more simply, those with higher ESCS should benefit less from PSEC (the reverse is also true: those with lower ESCS would benefit more from PSEC).

In the second table, it is possible to see that the return to PSEC decreases after accounting for ESCS in the regression. Further, when ESCS is taken alone its effect is insignificant in Denmark, Ireland, Norway, Switzerland, and the USA. When comparing the two tables, one may notice that the return to PSEC (second table) decreases further when all the controls are accounted for (first table). This happens because the variation in performance scores is now explained by more variables. Note that the results in the first table are more reliable since they rely on multivariate regressions.

Country	The return to attending PSEC	The return to ESCS	The additional return on ESCS for students who attended PSEC
Australia	**30**	**32**	-2
Austria	6	**19**	-9
Belgium	**45**	13	0
Canada	**21**	**12**	7
Denmark	**32**	**24**	3
France	m	m	m
Germany	**22**	1	11
Ireland	**10**	**23**	8
Italy	**34**	-5	11
New Zealand	**25**	**34**	3
Norway	9	**13**	**23**
Spain	**25**	**16**	3
Sweden	**22**	**31**	0
Switzerland	**36**	**24**	-7
UK	**36**	**26**	0
USA	3	**50**	**-24**

Values that are statistically significant are indicated in bold. The values for France are missing because the school questionnaire was not administered.

	Difference in student performance in reading between students who report having attended pre-primary school (ISCED 0) for more than one year and those without pre-primary school attendance.		
Country	Before accounting for the socio-economic background of students	After accounting for the socio-economic background of students	Returns on ESCS (taken alone)[2]
Australia	**60**	**39**	**46**
Austria	**42**	**21**	**48**
Belgium	**103**	**76**	**47**
Canada	**48**	**33**	**32**
Denmark	**84**	**58**	36
France	**108**	**65**	**51**
Germany	**61**	**40**	**44**
Ireland	**24**	**8**	39
Italy	**79**	**65**	**32**
New Zealand	**60**	**39**	**52**
Norway	**31**	**18**	36
Spain	**53**	**39**	**29**

[2] Note that the return to ESCS was obtained through a single-level bivariate regression of performance scores on ESCS. However, one should keep in mind that bivariate regressions are less reliable than multivariate ones.

Sweden	**58**	**38**	**43**
Switzerland	**84**	**59**	40
UK	**76**	**57**	**44**
USA	**46**	12	42

Values that are statistically significant are indicated in bold.

From all these results, one can conclude that PSEC participation in itself boosts reading performance in most countries; the same is also true for ESCS since higher ESCS students are likely to achieve better results. However, in contrast with Esping-Andersen's theory, PSEC does not seem to reduce the positive impact of ESCS on reading performance scores. In the UK, for instance, there is no mitigation of social gaps in performance at 15 through PSEC. Hence, we can conclude that PSEC attendance does boost reading performance but it does not help reduce the impact of social inequalities on them.

The two exceptions to this general finding are Norway and the USA. In both countries PSEC does not have a significant direct effect on performance scores. However, in Norway the additional return on ESCS for students who attended PSEC is positive while in the USA it is negative. In other words, in Norway PSEC exacerbates inequalities because it increases the returns on ESCS and the reverse is true in the USA. One should note that the direct returns on ESCS are very low in Norway while they are very high in the USA. This means that in these two countries, respectively, PSEC increases social inequalities (resulting from ESCS) when they are too low and reduces them when they are too high.

It should be noted that we estimated different variants of this model by dividing ESCS into categorical variables (above and below country average ESCS, the top tercile versus the bottom tercile, and the top quartile versus the bottom quartile). All these models confirmed the results published in the PISA report. PSEC does not reduce the impact of ESCS on performance scores in most countries.

Conclusion

Our conclusions from this analysis do support the idea that high level PSEC provision is, to some extent, a 'win-win' policy, having both economic and social benefits. High rates of child participation in PSEC tend to occur where PSEC provision is widely available at an

affordable cost and a high level of participation does tend to increase female employment rates. The effect of PSEC on total employment is relatively small, but that on female employment is sufficiently strong to consider PSEC as a major instrument in boosting female employment. PSEC attendance also substantially increases fifteen-year-old reading performance scores on average in all countries, which will lead to social benefits both for individuals and society. However, there is little evidence to support the larger claims that high levels of PSEC participation mitigate social gaps in performance at 15. The reason for this would appear to be that whereas all children benefit similarly from PSEC participation in most countries, participation is not biased towards less advantaged groups. Even, as in the Scandinavian countries, where participation is at a very high level, attendance among 0-2 year olds is least likely amongst children from the most disadvantaged countries.

The important implication of this for policy is that for PSEC to reduce social gaps in school attainment it is not sufficient merely to increase aggregate PSEC participation rates. It would require policies with a substantial bias towards children from disadvantaged families so that they receive more – or better quality – PSEC than children from other social groups. Policy in England seems to be moving in this direction. On Sept 19th 2011 the Department for Education set out plans to extend the existing free entitlement to 15 hours per week of PSEC, which currently applies to all three and four year olds, to all disadvantaged two year olds ie for those qualifying for free school means or in local authority care. This should increase PSEC participation rates for disadvantaged families. DFE estimates that approximately 140,000 two year olds would be eligible to benefit. The question is whether the measure will increase participation amongst lower income families sufficiently to substantially reduce social gaps in achievement.

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