Women out, children out – the effect of female labor on Portuguese preschool enrollment rates[1]

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Abstract:

This article tests whether Portuguese female activity rates have increased preschool enrollment rates. Particularly during the last 20 years, Portuguese women have assumed new roles in the marketplace and have become active workers outside of the home environment. This change has encouraged more sensible decisions with respect to preschool enrollment. Using cointegration techniques, we concluded that female activity rates and real income per capita caused a long-term increase in preschool enrollment rates. Although the percentage of agricultural gross value added to the gross domestic product and the number of preschool institutes were also found to be significant in the estimated vector error correction model, their causal relationship with preschool enrollment was only short term.

1. Introduction

One of the most important transformations that has occurred in Portuguese society in recent decades is the increase in the female activity rate. Portuguese women have transitioned from domestic roles as married women to new roles outside of the home environment. This fundamental transformation has facilitated many other social and economic changes, including the increase in the average age of individuals at the time of their first marriage, the decrease in the number of children per family, and the more significant demand for public (i.e., social) expenditures.

In this article, we present a study that, to the best of our knowledge, is the first to empirically evaluate one of the subtlest consequences of the increasing female activity rate in Portugal – the increase in the preschool enrollment rate. This question is relevant because an affirmative answer would prove that if there is a dearth of professional child care institutions, women may be obliged to raise their own children at home, which may prevent many from joining the labor force.

In seeking to educate their children, urban female workers do not usually select the informal types of preschool educational arrangements that are often used by women living in rural areas. Instead, they tend to patronize private and public formal institutions, thus increasing the official preschool enrollment rate.

This hypothesis has been suggested or discussed in some studies. However, none of these studies has attempted to empirically test this hypothesis for Portugal. Using cointegration

techniques, we have performed the test in question. The results show that dimensions other than the female activity rate have also influenced the Portuguese preschool enrollment rate since 1974 (the year of the Carnation Revolution). More specifically, we identified the real gross domestic product (GDP) per capita, the percentage of agricultural value added to the Portuguese GDP and the number of preschool institutes as determinants of the enrollment rate. However, we do not believe that a final conclusion can be drawn from these results; rather, these findings provide an excellent starting point for an in-depth analysis of the institutional changes that have occurred in the Mediterranean and particularly in Portugal in recent decades.

Section 2 of this article will review the literature on the evolution of the female activity rate (especially in Mediterranean countries) and the consequences of these changes. Section 3 will present our empirical procedures and our main results. Section 4 will conclude the paper.

2 Institutional Changes in the Mediterranean, Female activity and preschool enrollment

At the beginning of the 20th century, most of the Mediterranean economy (in countries like Portugal, Spain, France, Italy, or Greece) was linked to the primary sector. In addition, most of the value added in the primary sector was linked to agriculture (Viazzo, 2003). There was little change in this respect prior to 1970. Workers usually did not migrate to other Mediterranean countries; those who migrated moved to United States of America or South America (Brazil, Argentina, or Venezuela), as noted by Kirk (1949). Those who remained in Mediterranean villages usually worked near their homes.

Generally, the men were the workers and provided the earnings for their families. Women did not usually work outside the home; instead, they worked both as domestic laborers and as the primary educators of their young children, who thus grew up under the daily supervision of a type of local gynaeceum composed of those women who worked at home in the villages.

Following Alves (2001), Almeida (2002) or Hudeckova (2005), we can understand this arrangement as a sort of institutional microcosm This microcosm shows that the social, economic and even personal realities of the Mediterranean rural context, which is strictly regulated the concept of the family, the family's values and, consequently, the social and economic roles of the rural man and woman. Exposure to urban environments was scarce, and such environments were mainly assumed to be the opposite of rural communities. Thus, a rural man or woman saw himself or herself as part of a given family from a given village

located in a well-delineated region. Likewise, the personal needs of a rural man or woman were primarily addressed by his or her family, and the needs of a rural family were primarily addressed by the rural community and its traditions and practices, i.e., by rural institutions. Ellis and Freeman (2004) listed and discussed some of these rural institutions, highlighting the focus on the family, the practice of reciprocity, the prevalence of the informal economy, the use of oral contracts governed by self-honor, and the existence of communitarianism.

In short, until the 1970s, the Mediterranean family was the institution in Portugal, Spain, France, Italy, or Greece that assisted the youngest and the oldest members of the community. As indicated by Viazzo (2003), the Mediterranean family as an institution was deeply linked to its rural context.

Even if a young mother worked outside the home, her mother, her mother-in-law, or one of her aunts usually took care of her children (Naldini, 2003). However, the changes that occurred during the last forty years produced a shift. The Mediterranean became fundamentally urban, and the rural economy has diminished (*PlanBleau – Environment and Development in the Mediterranean, 2009)*.

Most of the value added in the Mediterranean is now produced in towns or cities and is generated by the secondary and tertiary sectors (World Development Indicators, 2009). Tending to separate the concept of the family from that of the rural community, Mediterranean residents no longer expect rural institutions to supply their (globalized) needs. Furthermore, rural institutions have been replaced by arrangements that involve written legal contracts, services provided by professional workers, and in some cases, an increasing dependency on the state[2].

This change is clearly visible in the evolution of preschool enrollment in Mediterranean countries. The literature on female activity rates indicates that when these activity rates increase, more women tend to work outside the home (Carrasco and Recio, 2001). Working far from their homes, female workers with young children require preschool services for their children. In recent years, Mediterranean rural areas have deeply changed, as Karaca and Kocabap (2011) also found in comparing Turkey with other candidates for EU membership. In Portugal, according to the *World Development Indicators (WDI, 2009),* the percentage of agricultural gross value added to the GDP decreased from 20 in 1980 to 4 in 2000. This change was accompanied by significant demographic movement from rural areas to large towns and cities (Mourao, 2006). Families became smaller (Dreman, 1997), and urban female workers (and their children) could no longer receive the informal support that their older relatives usually provided in rural villages.

A report from 1970 (Blackstone, 1970) claimed that "Lack of resources and conflicting values are considered the main reasons for the slow growth of preschool in Europe." In contrast, today, Scheiwe and Willekens (2009) state that "With the number of women in the workforce increasing, public provision for care for children below school age has becoming a pressing policy issue".

Because of the tertiarization of Mediterranean economies, urban women require professional preschool assistance for their children. According to Tamm and Kaldaru (2008) and Detang-Dessendre, Goffette-Nagot and Piguet (2008), this tertiarization is reflected in the decreasing

[2] There is also considerable debate in the European Union, including the Mediterranean countries, about whether women should participate in the paid labor market and about the *number of hours* that they should work—whether part-time or full-time. In the debate, people sometimes refer to the "Dutch" model, which recommends that women work part-time, in counterpoint to the full-time model, which is used in the Nordic countries, France, the UK, and Germany, for example.

percentage of agricultural gross value added to the GDP and the diminishing relative size of the rural population.

However, other authors identify different reasons for the changes in preschool enrollment. Studies by Formosinho (1995) and Nien (2001) suggest that preschool enrollment may also be influenced by the changes in children's health and in each country's fertility and birth rates. The logic governing this idea is simple: it is suggested that there are scale effects associated with preschool enrollment. Increases in the number of children, it is suggested, will occur together with higher preschool enrollment rates, especially in communities that highly value children (as indicated by higher fertility and birth rates) and their well-being (as proxied by the percentage of children immunized against easily transmitted diseases, following Vasconcelos, 2000). Du Prel *et al (*2006) also showed that healthy children tend to be enrolled in preschool more often than other children.

Studies by Pendleton (1986) and Barreto and Preto (1996) complement this research. Pendleton (1986) and Barreto and Preto (1996) show that preschool enrollment is a consequence of economic growth. A higher average income makes families more able to hire professional workers to prepare their youngest children for primary school. However, higher average income can also promote a substitution effect: urban grandmothers tend to remain in the workforce until they reach retirement age and consequently can no longer care for their preschool-age grandchildren as they often did a few decades ago[3].

The real GDP per capita is not a sufficient measure of economic growth. Other measures such as population density or the consumption of electricity per capita should also be considered. Because these measures are also correlated with urban trends and indicate access to modern services, they can be used to test the statistical significance of the dimensions of economic growth. Hence, in this study, we will test the hypothesis that in Portugal, higher female activity rates led to higher preschool enrollment rates[4]. We will also consider the other potential

[3] If the data allowed, it would be interesting to measure the influence of income in different socioeconomic groups on preschool enrollment rates. For instance, we might consider whether an increase in the average income in the lowest group generates a more or less dramatic increase in the preschool enrollment rates in that group compared to the enrollment rates in the highest income group. However, the current Portuguese data do not allow this relevant extension of the present research.

[4] The literature has also considered the reverse hypothesis: that changes in preschool enrollment rates precipitate changes in the female activity rate (Chevalier and Viltanen, 2002; Connelly, 1992; Berlinski and Galiani, 2007). However, for Portugal, our findings (see the results of our causality tests as presented in Table 4) support our prior hypothesis: that changes in the female activity rate precipitate changes in preschool enrollment rates.

factors that have been examined. A brief description of the availability of Portuguese preschool programs can be provided if requested to the author.

3 Empirical procedures and Results

This research process involves the use of cointegration techniques for the following reasons. First, as will be further discussed, this research will employ time-series data. When one uses time-series data to test the determinants of a given social phenomenon, one must employ a series of methodological steps to avoid the use of redundant variables and to eliminate the chance of spurious relationships among the variables. Cointegration analysis is used to test various determinants of a given phenomenon, mainly to identify long-term relationships among the variables. Such relationships can be expressed by a cointegration equation, in which the variables on the right side are the significant determinants of the dependent variable. Those who are interested in the formal aspects our methodology should refer to Krolzig and Hendry (2000); those who are interested in more comprehensive details should refer to Hamilton (1994) or Maddala and Kim (1998).

3.1 Preliminary stages and database

In the first stage, we followed Krolzig and Hendry (2000) and used static ordinary least squares regression to analyze the coefficients of the variables associated with our main explicative variable. These variables were taken from sociological studies that have discussed the influences that determine Portuguese preschool enrollment: Barreto and Preto (1996), Formosinho (1995), and Vasconcelos (2000). The variables were also taken from studies that have discussed the global determinants of cross-country preschool enrollment rates: Pendleton (1986) and Nien (2001).

In addition to the female activity rate, the following variables have been statistically correlated with preschool enrollment rates:

- Birth rates
- The per capita consumption of electricity
- Fertility rates
- The percentage of children immunized against easily transmitted diseases
- The real GDP per capita
- Population density
- The gross value added by the agricultural sector as a percentage of the GDP
- The rural population relative to the overall population

We had also included two control variables: the number of preschool institutes and the primary school attendance rate (Berlinksi and Galiani (2007)). The rationale for this decision is as follows. Because we cannot assume that the supply of preschool institutes is unlimited, we must determine whether preschool enrollment rates have been influenced by the supply of available Portuguese preschools. For similar reasons, we will use the primary school attendance rate as a proxy for the positive changes in Portuguese social norms regarding preschool and school issues.

The previous studies present various reasons for the use of these variables. Mainly, the researchers argue that economic development and new views regarding the role of children in society (and even their civic rights) have increased the overall school enrollment rates. In Portugal, preschool in particular has mainly developed within the private sector since the 1950s. These authors recognize that in Portugal, factors other than economic development have exerted a special effect preschool education. For instance, the authors also note improvements in women's rights and the transition from the rural model (i.e., that of a large family concentrated near the men's place of work) to a tertiary model (i.e., that of a small family living in the suburbs, far from the parents' place of work). Table 1.1 synthesizes these arguments and details each variable and the source of the data for that variable. Table 1.2 shows the descriptive statistics for these variables.

[Insert here Table 1.1]

[Insert here Table 1.2]

Our data sources are the World Development Indicators (WDI) provided by the World Bank and the Electronic Data Bank http://www.pordata.pt. The variables in question were studied for the period from 1977 to 2010 based on data availability. Therefore, we will focus our analysis on the last forty years. Although this choice could be viewed as a limitation, it is important to note that the Portuguese data show that the main institutional changes have occurred since the Carnation Revolution (1974). Consequently, this decision is not problematic in the Portuguese case.

In this first stage, we ran a static ordinary least squares regression (SOLS), using the preschool enrollment rate as our dependent variable and all of the other variables as regressors. We used the log variables because of their non-stationarity (Hamilton, 1994). We confirmed that the statistically significant coefficients were those related to the female activity rate, the real GDP per capita, the percentage of agricultural gross value added to the GDP, and the number of preschool institutes. The other variables

(the non-significant variables) were omitted after this stage[5]. The following equation reveals the SOLS results:

$$preschool_t = \underset{(2,329)}{6,457} + \underset{(0,976)}{2,269} * female\_activity_t + \underset{(0,678)}{0,452} * natality\_rate_t +$$
$$+ \underset{(0,893)}{0,768} * electricity_t + \underset{(1,763)}{1,365} * fertility\_rate_t + \underset{(1,984)}{0,218} * children\_immunization_t +$$
$$+ \underset{(0,134)}{0,762} * gdp_t + \underset{(0,742)}{0,843} * density_t - \underset{(0,086)}{0,326} * agriculture_t - \underset{(0,187)}{0,097} * rural_t -$$
$$- \underset{(0,393)}{0,458} * college\_attendance_t + \underset{(0,234)}{0,834} * preschool\_institutes_t + e_t$$

.

Still following Krolzig and Hendry (2000), in the second stage, we will evaluate the cointegration equation for our dependent variable (the preschool enrollment rate) and our set of significant independent variables (the female activity rate, the real GDP per capita, and the percentage of agricultural gross value added to the GDP). We will conduct this process using a vector error correction model (VECM). Using a VECM can yield a better understanding of the nature of non-stationarity in different component series and can improve long-term forecasting.

Augmented Dickey-Fuller statistics for these series are available under request. These values were computed using the JMULTI 4.14 software. These values show that these series are stationary at the first difference[6].

[5] We also wanted to analyze whether the female activity rate is a proxy for other factors that could impact preschool enrollment rates (namely, social norms governing the role of women in society or ideas regarding the relevance of preschool attendance). Although factors such as the birth rate and fertility rate can also be used for this purpose, we analyzed the variable 'college attendance' for this purpose, conducting alternative procedures in which we considered this variable as a dependent variable in our cointegration space and the other variables (regressing 'preschool enrollment rates') as independent variables. However, the statistical values that we attained do not allow us to reject the null hypothesis of no cointegration when 'college attendance' is used as a dependent variable. This evidence is consistent with the SOLS results that indicated the statistical non-significance of the coefficient of 'college attendance'.

[6] This means that the stochastic process derived from taking the first differences of these variables does not change if we modify the time sample that is used. We also confirmed that these series are stationary at first difference using other tests, including the DF-GLS, Ng-Perron, and KPSS. The full results are available on request.

3.2. Empirical results obtained using the cointegration equation

During this stage, we estimated the vector error correction model (VECM) based on the optimum number of lags in each series using the Schwarz Information Criteria[7]. We also included a constant in the cointegration equation, as suggested by Oxley and McAleer (1999).

Equation 1 synthesizes our results for the Cointegration Equation (standard errors in parentheses)[8]. Table 2 describes the statistic values for some tests. This table includes the values obtained using the Trace test[9], the optimum number of lags for the variables in the VECM, the average time value used to adjust the dependent variable (ΔEC_{t-1}), and the statistics for the misspecification tests (the Portmanteau[10], joint significance, ARCH[11] and AR4 tests[12]). Overall, these misspecification tests allow us to conclude that there are no significant issues of this type with our estimated model.

$$preschool_t = \underset{(1,811)}{-11,774} + \underset{(0,855)}{10,510} * female\_activity_t + \underset{(0,085)}{1,357} * gdp_t - \underset{(0,115)}{1,749} * agriculture_t + \\ + \underset{(0,102)}{0,965} * preschool\_institutes_t + e_t$$

(eq. 1)

[7] The optimum number of lags in each series, given a particular information criterion, is the number of lags for each series/model that provides the maximum goodness of fit under certain statistical restrictions (namely, there must be a small number of parameters in the model).

[8] Full results (including VAR results) will be reported on request.

[9] The null hypothesis of the (Johansen) Trace test is that the number of cointegration vectors (r) is smaller than or equal to the tested number (ra).

[10] The Portmanteau test determines whether a group of autocorrelations of a residual series differs from zero.

[11] The ARCH test determines whether a residual time series follows an autoregressive conditional heteroskedasticity process.

[12] The AR4 test analyzes whether a residual time series follows an autoregressive model of order 4.

[Insert here Table 2]

Based on the results of the Trace test (Johansen, 1991), we can verify that these series form a cointegration space. This conclusion is also supported by the statistical significance of the coefficient estimated for ΔEC_{t-1} in the VECM (-0.396). This value allows us to compute the speed of adjustment of the model. In this case, we can confirm that the model has a relatively low adjustment speed: for $\left(\frac{1}{\Delta EC_{t-1}}\right)$, the speed is 2 years and 181 days.

The results obtained using equation 1 confirm that the preschool enrollment rate reacted positively to the higher levels of female activity, to Portuguese economic growth, to the decrease in the percentage of agricultural gross value added to the GDP, and to the increase in the number of preschool institutes. The most significant effect is that of the female activity rate: an increase of 1% in the female activity rate leads to an increase of 10.51% in the preschool enrollment rate.

To test the causal relationships between the four determinants and the preschool enrollment rate, we ran Granger Causality tests and Instantaneous Causality tests (Lutkepohl, 1991) using JMulti. Table 3 reports the results.

[Insert here Table 3]

Table 3 confirms that there are statistical relationships of female activity rates and real GDP per capita with preschool enrollment rates. This finding again proves that changes in the female activity rate and in the GDP induce changes in preschool enrollment. Although the values for the agricultural gross value added and the number of preschool institutes are significant in the cointegration equation, these variables do not seem to influence preschool enrollment; in analyzing these variables, we follow Bellaumi (2009) and conclude that the causal relationship is short-term and loses statistical significance in the long term[13].

[13] In fact, as suggested by Figure A1, the preschool enrollment rate consistently increased, whereas the relative value of the agricultural GVA began to stabilize in 2000.

These findings are revolutionary within the research on preschool enrollment in Portugal. They clarify which factors have truly influenced the evolution of preschool enrollment in Portugal, providing the first empirical evidence in a debate that has thus far been dominated by rhetorical arguments. Thus, we can conclude that the preschool enrollment rate mainly reacted to the changes in the female activity rate. The tertiarization of the economy also led to the development of the preschool education sector in Portugal during the last 20 years (as is also visible in the legislation that is relevant to this sector) (Mourao and Gaspar, 2010).

4. Conclusions and Political Implications

This article empirically evaluated the relationship between Portuguese preschool enrollment rates and female activity rates. It also studied the direction of this cointegration relationship. We observed that one of the most significant social transformations that has occurred in Portugal during the last 40 years has been the increase in female activity outside the home. Portuguese women no longer work exclusively as wives and mothers; instead, they have gradually begun to work outside the home, away from their children.

Prior to 1980, Portuguese female workers left their children under the supervision of their own mothers or of other available women, most of whom were relatives. However, with the tertiarization of the Portuguese economy and the urbanization of Portuguese culture (which accelerated after the 1980s), this arrangement has become rare in Portugal, as in the rest of the Mediterranean. Instead, Portuguese women now tend to leave their youngest children with professionals, increasing the preschool enrollment rate.

To test this hypothesis, we ran a vector error correction model. The dependent variable was the preschool enrollment rate, and the independent variables were the female activity rate, the gross value added by agriculture to the GDP and the real per capita GDP. Other independent variables (such as the relative size of the rural population or fertility or birth rates) were tested but were not found to have significant coefficients.

The estimated vector error correction model indicated cointegration between Portuguese preschool enrollment rates and three factors: Portuguese female activity rates, the proportion of the GDP added by agriculture and the real GDP per capita. To analyze the details of this statistical relationship, we examined the degree of influence of each of the independent variables from the vector error correction model. We concluded that Portuguese female activity rates and the real GDP per capita affect preschool enrollment rates in the long term.

The agricultural gross value added is only influential in the short term; the effect tends to diminish in the long term.

We know that other dimensions may also be important. For instance, the number of children per family may also be a critical factor. Because people are having fewer children, parents may be more able to devote more resources to each preschool child, and families that could not have afforded preschool in the past (when they had more children to support) may now be able to. Another factor to consider is the increasing mobility of society: if a person's children are more likely to move to cities or other regions, then the demand for preschool for their own children is likely to increase. Other relevant variables that we should consider as soon as the data are available include the number of adults in the household, the importance of schooling in the region (as measured by the degree to which the government supports the region's schools) and the average distance from the home to the school.

It is important to note that our results "tell only part of the story." Future data will help us to draw more detailed conclusions. For now, however, these results should influence the current debate in Portuguese society regarding what factors will help to develop the preschool sector and make it more accessible to each child and each family.

Indeed, these results have two sets of political implications. First, our results are consistent with those of Kolontai (1916) and Sonalkar (1975), which indicate that female labor is one of the most relevant sources of the professionalization of society and one of the most important factors driving the transition from rural, family-based social structures to institutionalization. Our results show that when female activity rates increased, modern women workers tended to choose professional care for their children, which encouraged them to search for more specialized professionals in the preschool industry and increased the demand for services by both private preschool institutions and public preschools.

Second, in the long term, we expect the real GDP per capita to increase. Furthermore, according to our results, the increase in the real GDP per capita will increase preschool enrollment rates. However, we have already noted the decreasing effect of the proportion of agricultural gross value added and of the availability of preschool institutes, and it is also nearly certain that female activity rates will not increase *in aeternum.* In fact, our figures (Figure 1) show that female activity rates have been stationary for several years. This fact should encourage decision-makers, especially public decision-makers, to consider cultural factors as long-term drivers of preschool enrollment. If it is believed that preschool enrollment rates may significantly increase, then decision-makers should consider the role of marketing in promoting a positive image of preschool institutions. Such institutions should be marketed as necessary to the development of a more educated society, as this type of campaign should

help to maintain the increase in Portuguese preschool enrollment rates. Otherwise, preschool enrollment rates may become stationary and may not reach their potential as their determinants also become stationary.

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Figures

Figure1

Total agricultural populations in the Mediterranean countries,1960-2025 in thousands

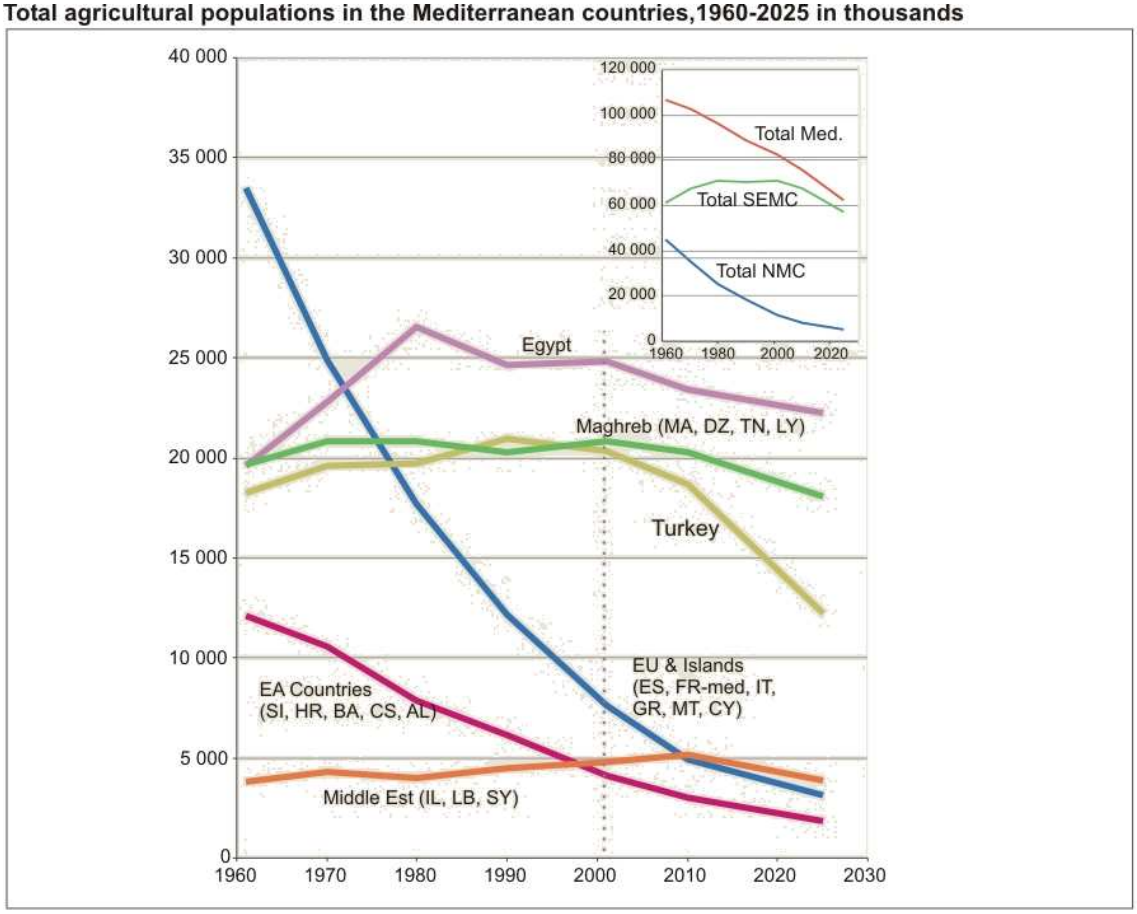
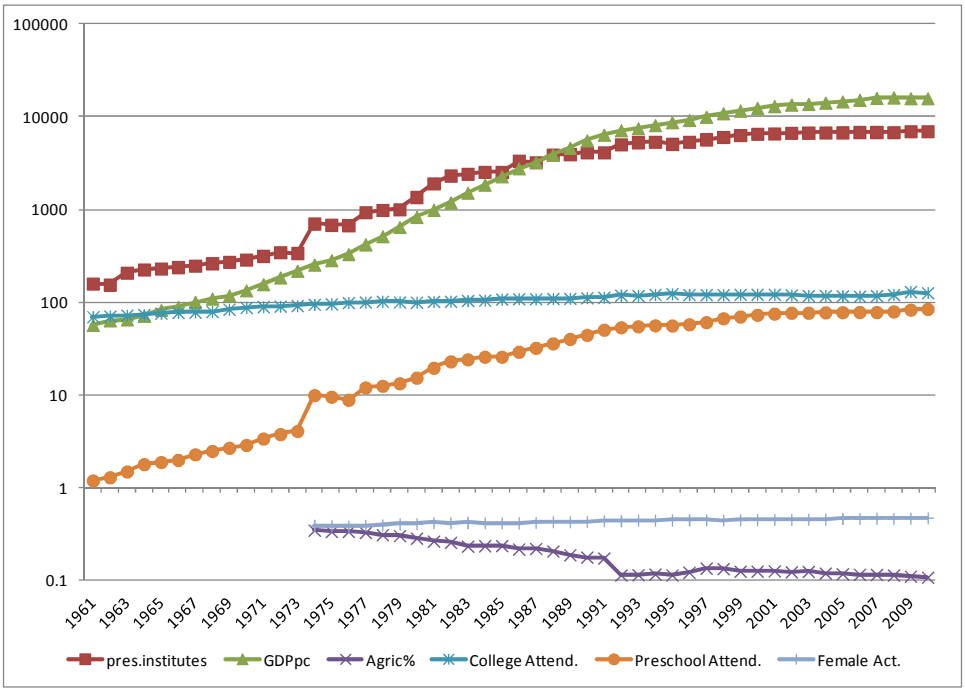


Figure 2 – Portuguese Series: Preschool Institutes, GDP per capita, Agriculture GAV (% GDP), College Attendance, Preschool enrollment rate, Female Activity rate, 1960-2010



Tables

Table 1.1 – **Variables associated to the preschool enrollment rate**

Variables	**Authors**	**Expected sign**	**Source**
Natality rate [Rate at which new individuals are born by reproduction]	Formosinho (1995); Nien (2001)	+	World Development Indicators (2009)
consumption of electricity [Per capita]	Pendleton (1986); Barreto and Preto (1996)	+	World Development Indicators (2009)
Fertility rate [Expected number of children a women who survives to the end of the reproductive age span will have during her lifetime]	Formosinho (1995) ; Nien (2001)	+	World Development Indicators (2009)
Children immunization against easily transmitted diseases (%) [Percentage of total number of children]	Vasconcelos (2000)	+	World Development Indicators (2009)
Female activity rate [Proportion of women doing paid work]	Pendleton (1986); Barreto and Preto (1996)	+	World Development Indicators (2009)
Real GDP [Per capita]	Pendleton (1986); Barreto and Preto (1996)	+	World Development Indicators (2009)
Population density	Vasconcelos (2000)	+	World Development Indicators (2009)

Gross value added in the agricultural sector [% of GDP]	Tamm and Kaldaru (2008); Detang-Dessendre, Goffette-Nagot and Piguet (2008)	-	World Development Indicators (2009)
Rural population [% of Portuguese population]	Tamm and Kaldaru (2008); Detang-Dessendre, Goffette-Nagot and Piguet (2008)	-	World Development Indicators (2009)
Number of preschool institutes	Berlinksi and Galiani (2007)	+	http://www.pordata.pt
Primary school (College) attendance rate	Berlinski and Galiani (2007)	+	http://www.pordata.pt

Note: If there were data, we also would use the female employment rate as an alternative dependent variable. It would be an interesting challenge because we recognize that unemployed and employed mothers have different patterns of use of preschool services. The electronic data bank http://www.pordata.pt provided the values for the preschool enrollment rate.

Table 1.2 – Descriptive statistics of the variables (Portugal, 1977-2010)

		%GVA in Agriculture	Natality Rate	Consumption of electricity per capita	Fertility Rate	Real GDP per capita	Children immunization	Female Activity Rate	Population Density	% rural population	Preschool enrollment rate	Preschool institutes	Primary school attendance
Mean	log	2.125	0.499	7.798	2.536	9.765	4.381	3.681	4.696	3.927	4.029	7.752	4.178
Std deviation		0.646	0.181	0.38	0.166	1.271	0.265	0.452	0.025	0.099	0.306	0.291	0.198
Maximum		3.163	0.895	8.386	2.950	11.646	4.595	3.839	4.748	4.067	4.363	8.841	4.394
Minimum		1.285	0.322	7.171	2.342	8.691	3.829	1.481	4.638	3.747	3.378	7.024	3.807
Mean	raw	8.373	1.647	2435.726	12.629	17413.482	79.918	39.686	109.508	50.754	56.205	2326.22	65.235
Std deviation		7.634	.4	974.758	3.238	48410.016	9.535	3.396	2.923	3.814	11.144	2292.84	7.864
Maximum		23.641	2.447	4385.242	19.106	114233.514	98.988	46.479	115.353	58.382	78.492	6911.901	80.964
Minimum		3.615	1.38	1301.145	10.402	5949.128	46.016	4.397	103.337	42.394	29.312	1123.271	45.015

Table 2 – Johansen Cointegration Tests Results

Variables set, C	Trace Test (p-value) H0: $r \leq ra$	*Lags* in VECM	ΔEC_{t-1}	Portmanteau; Joint significance; ARCH; AR(4) (p-values)
{preschool enrollment; Female activity; GDP per capita; Agriculture GAV; Preschool institutes}	r0:0,000 r1:0,000 r2:0,156 r3:0,289 r4:0,671	2	-0,396[a]	0,997; 0,060; 0,100; 0,100.

Legend – Significance level – a: 1%

Table 3 – Causality tests

	H0: female activity rate does not cause preschool enrollment rate	**H0: real GDP per capita does not cause preschool enrollment rate**	**H0: % agricultural GAV does not cause preschool enrollment rate**	**H0: Preschool institutes does not cause preschool enrollment rate**
Granger Causality	Test statistic l = 5.1175 pval-F(l; 2, 56) =	Test statistic l = 6.988 pval-F(l; 2, 82) =	Test statistic l = 0.619 pval-F(l; 2, 56) =	Test statistic l = 0.6829 pval-F(l; 2, 56)

	0.0214	0.0016	0.5421	= 0.9205
Instantaneous Causality	Test statistic: c = 0.8693 pval-Chi(c; 1) = 0.3512	Test statistic: c = 0.0207 pval-Chi(c; 1) = 0.8855	Test statistic: c = 0.0026 pval-Chi(c; 1) = 0.9516	Test statistic: c = 20.558 pval-Chi(c; 1) = 0.000