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Conference Paper

Reversing the depressive dynamics of the Portuguese peripheral areas: DEMOSPIN model

53rd Congress of the European Regional Science Association: "Regional Integration: Europe, the Mediterranean and the World Economy", 27-31 August 2013, Palermo, Italy

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: de Castro, Eduardo Anselmo; Silva, Carlos Jorge; Gomes, Maria Cristina Sousa; Borges, Monique Pereira (2013) : Reversing the depressive dynamics of the Portuguese peripheral areas: DEMOSPIN model, 53rd Congress of the European Regional Science Association: "Regional Integration: Europe, the Mediterranean and the World Economy", 27-31 August 2013, Palermo, Italy, European Regional Science Association (ERSA), Louvain-la-Neuve

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**Reversing the depressive dynamics of the Portuguese peripheral areas:
DEMOSPIN model**

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Abstract

Portugal is divided in two major parts: i) the coastal zone, with a higher demographic density and where the main economic activities are concentrated; ii) the periphery, where a low economic performance and a depressed demographic dynamics coexist.

Economy and demography interact, reinforcing each other, and many European peripheral regions are characterised by a negative circle of cumulative causation between the economic and demographic evolution. So, policies to reverse such a dynamics must address simultaneously the demographic and economic dimensions, requiring models able to simulate this interactive process. This is the main objective of DEMOSPIN project which develops a model combining an input-output growth approach with population forecasts where migrations are driven by the positive or negative employment opportunities generated by economic growth.

The model has two integrated modules: an economic component and a demographic one.

The first component corresponds to regional input-output matrices, one for each NUTS III regions under study; these matrices are estimated for 2007, based on the national input-output matrix and assuming three types of products: i) regionally non-tradable products, ii) regionally tradable products and iii) fully tradable products.

The regional 2007 matrices are the basis for projections up to 2030, based on a set of economic scenarios which assume several levels of exogenous demand growth and hypotheses concerning sectoral productivity growth.

The use of the input-output matrices allows the estimation of employment growth rates, which in turn will feed the demographic component of the integrated model, in order to estimate net migrations for each region, age-group and sex, linking the economic and the demographic components.

The demographic component estimates, in a first step, population growth for each region, age group and sex, assuming zero net migrations: they are based on mortality and fertility projections. Such estimates give us values about the supply of labour force which would be expected if the employment rates were made constant. These rates are calculated from the age groups employment distribution given by census data.

The comparison between this (demographic) employment with the figures provided by the economic component is the basis for migration estimates, which are the last element of demographic projections. The net migrations estimations are calculated for each region, age group and sex, using a simultaneous estimation technique.

This paper will present a detailed description of the used methodology and of the obtained results concluding with the policy guidelines which such results suggest.

Keywords: economic and demographic model, human desertification, peripheral regions, public policies

1. Introduction

Economy and demography interact, reinforcing each other in a circle of cumulative causation. In many European peripheral regions this cumulative causation leads to a vicious circle which can only be broken by a regeneration impulse, redirecting the co-evolution of economy and demography towards a positive dynamics. Moreover, because the demographic dynamics has a strong inertia, arising from an age structure which can only change very slowly, such an impulse must endure for a long time.

This problem will be addressed looking at the particular case of Portuguese peripheral regions. However, the model developed and the conclusions derived can be extended to the generic case of the European periphery, where successive waves of outmigration and low fertility rates generated an inverted age pyramid and where the scarcity of young entrepreneurial people, combined with the absence of dynamic economic centres, created poor prospects for economic growth.

The main purpose of the paper is to present a model combining demographic and economic dynamics, which was developed in the project *Economically Sustainable DEMOgraphy ReverSing Decline in Peripheral RegIoNs/ DEMOSPIN*, supported by the Portuguese Foundation for Science and Technology. The outputs are estimates of economic growth and population evolution in peripheral

Portuguese regions up to 2030, using a regional input-output SAM type model adjusted to different socio-economic scenarios. The estimates will support policies to revert the demographic decline of these peripheral areas. Low fertility rates and the shortage of people in fertile age make this reversal only possible by attracting young population moving in response to job opportunities (Park and Hewings, 2007).

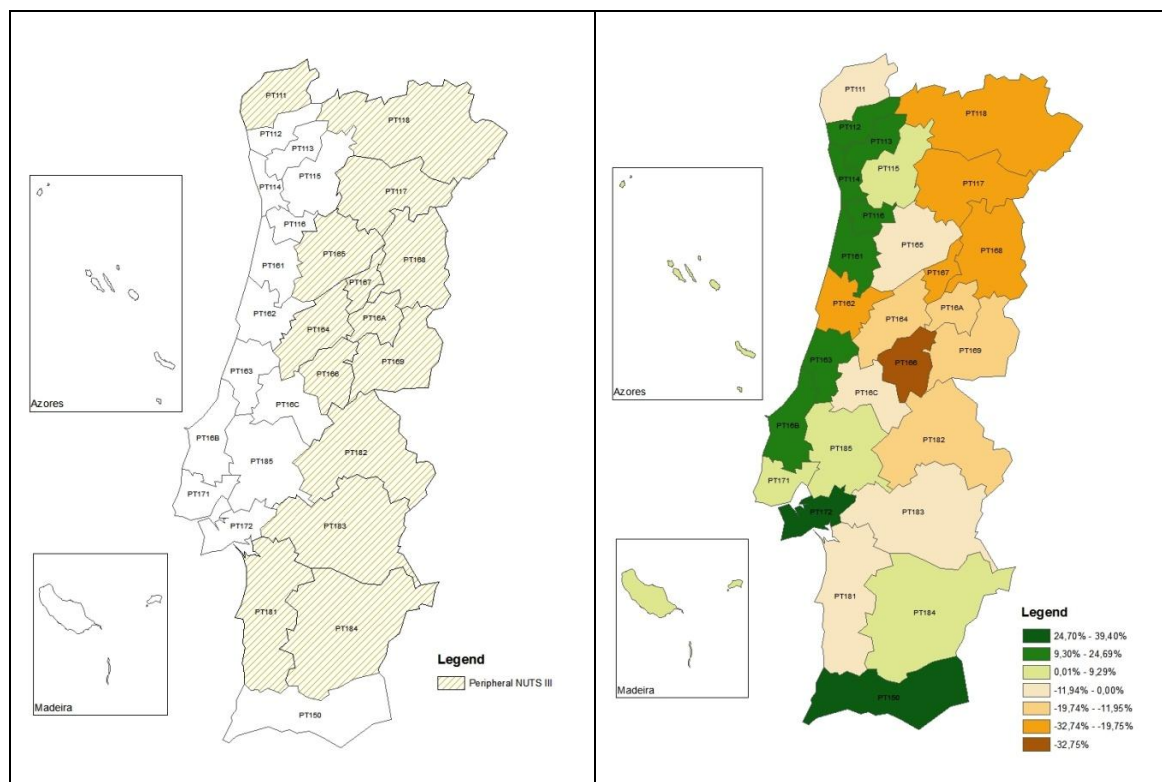
In short, the model explains net migration, for sex and age group in each region, as a function of net creation of employment and previous migration flows, using GDP per capita and demographic potential as control variables. The use of time lagged migrations is based on the idea that the observed pattern of elderly people net positive migration in the Portuguese peripheral regions corresponds to the return of people which leaved the region several years ago. The model provides information to support future growth policies and, at the same time, stimulates the development of new techniques to improve demographic projections and to build Social Accounting Matrices at NUTS III level, based on the national matrix and some regional data.

This paper is divided into six sections, in addition to the present introduction: (i) a brief characterization of the demographic evolution and migration trends; (ii) the presentation of the DEMOSPIN model; (iii) the economic block of the model; (iv) the demographic block of the model; (v) results and conclusions.

2. Demographic evolution of the Portuguese Population

The Portuguese demographic evolution is characterized by the concentration of population along the coast, through a process of continuous urban and industrial agglomeration. The other side of this process is a significant decline and ageing in the peripheral NUTS III, in spite of the increase in the total Portuguese population (Magalhães, 2003).

Table 1 and figure 1 show the evolution in the last three decades and separate coastal from peripheral Portuguese regions (which, from now on will be called PPR). The Autonomous Regions (Islands of Azores and Madeira), in spite of their social and economic specificities, are included in the coastal group. Looking at the global evolution 1981-2011, the coast-periphery divide is clear, to the extent that population in all the peripheral NUTS III decreased while in the others, with the exception of Médio Tejo, there was an increase.



Source: Statistics Portugal Census 1981, 1991, 2001 and provisional data from the 2011 Census

Figure 1 - (A) - Portuguese regions codes;

(B) - Portuguese population growth (1981-2011)

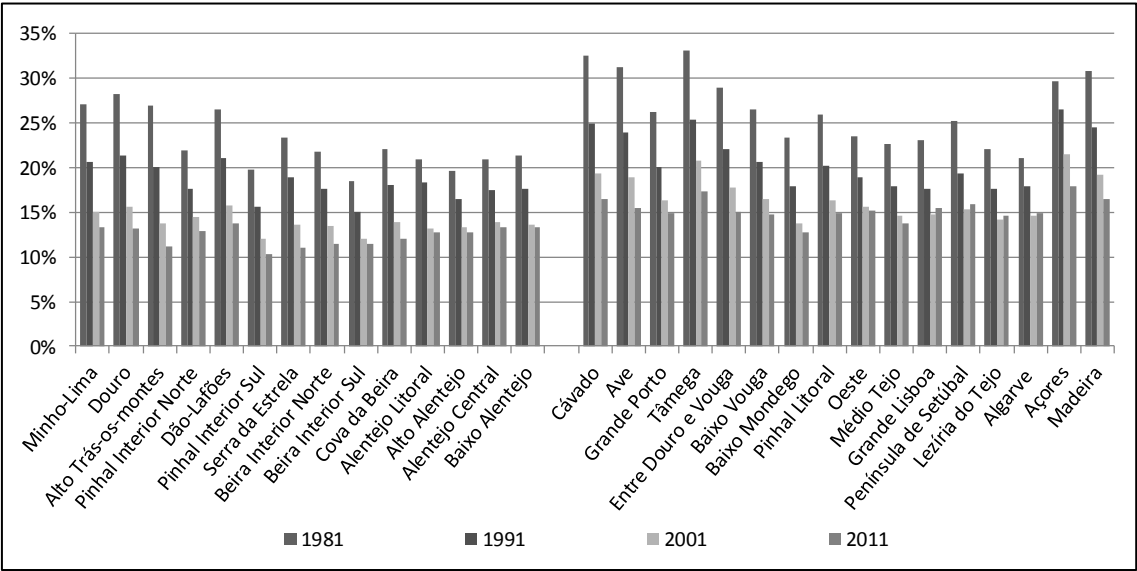
Table 1 – Portuguese population growth rates

	Regions NUTS III	Region code	Evolution 1981-2011 (%)	1991-2001			2001-2011		
				Rate of total increase	Rate of natural increase	Rate of net migration	Rate of total increase	Rate of natural increase	Rate of net migration
Peripheral NUTS III (PPR)	Minho-Lima	PT111	-4,66	0,1%	-2,2%	2,3%	-2,1%	-3,3%	1,2%
	Douro	PT117	-21,28	-7,0%	-1,8%	-5,3%	-7,2%	-4,1%	-3,0%
	Alto Trás Montes	PT118	-24,99	-5,0%	-4,3%	-0,8%	-8,3%	-6,2%	-2,0%
	Pinhal Interior Norte	PT164	-13,60	-0,7%	-5,9%	5,2%	-5,3%	-6,4%	1,1%
	Dão Lafões	PT165	-6,06	1,4%	-1,5%	2,9%	-2,9%	-2,8%	-0,1%
	Pinhal Interior Sul	PT166	-32,75	-11,8%	-9,4%	-2,5%	-9,1%	-11,7%	2,6%
	Serra Estrela	PT167	-23,26	-7,7%	-5,9%	-1,8%	-12,4%	-8,8%	-3,6%
	Beira Interior Norte	PT168	-19,75	-2,7%	-5,8%	3,1%	-9,5%	-7,6%	-1,9%
	Beira Interior Sul	PT169	-12,90	-3,6%	-7,5%	3,9%	-4,2%	-8,4%	4,2%
	Cova Beira	PT16A	-11,95	0,5%	-4,0%	4,5%	-6,2%	-4,4%	-1,9%
	Alentejo Litoral	PT181	-5,09	1,5%	-4,8%	6,2%	-2,1%	-4,9%	2,8%
	Alto Alentejo	PT182	-17,06	-5,6%	-6,1%	0,5%	-6,4%	-7,8%	1,3%
	Alentejo Central	PT183	-7,58	0,2%	-3,6%	3,9%	-3,5%	-4,3%	0,8%
	Baixo Alentejo	PT184	-20,30	-5,6%	-7,0%	1,4%	-6,3%	-7,1%	0,8%
		Total peripheral Regions		-14,60	-2,63%	-4,11%	1,48%	-5,42%	-5,36%
Coastal NUTS III	Cávado	PT112	24,69	11,4%	6,6%	4,8%	4,5%	3,9%	0,6%
	Ave	PT113	18,51	9,5%	6,2%	3,3%	0,3%	2,6%	-2,4%

Grande Porto	PT114	15,15	8,0%	3,5%	4,5%	2,0%	2,1%	-0,1%
Tâmega	PT115	9,29	8,4%	7,2%	1,2%	-0,1%	3,4%	-3,5%
Entre Douro e Vouga	PT116	16,02	9,8%	4,9%	4,9%	-0,6%	2,0%	-2,6%
Baixo Vouga	PT161	16,10	10,1%	1,8%	8,3%	1,3%	0,3%	1,0%
Baixo Mondego	PT162	0,71	3,5%	-1,3%	4,8%	-2,4%	-2,4%	0,0%
Pinhal Litoral	PT163	20,90	12,5%	1,8%	10,8%	4,1%	0,8%	3,3%
Oeste	PT16B	16,64	7,3%	-1,2%	8,5%	6,6%	-1,1%	7,7%
Médio Tejo	PT16C	-3,05	2,1%	-3,3%	5,4%	-2,2%	-3,5%	1,3%
Grande Lisboa	PT171	7,63	3,6%	1,2%	2,4%	4,7%	2,4%	2,3%
Península Setúbal	PT172	33,31	11,6%	1,8%	9,8%	8,9%	2,5%	6,4%
Lezíria Tejo	PT185	5,72	3,3%	-3,3%	6,6%	2,9%	-2,8%	5,7%
Algarve	PT150	39,40	15,7%	-1,9%	17,6%	14,0%	0,1%	13,8%
R A Açores	PT200	1,37	1,8%	3,7%	-1,9%	1,8%	2,0%	-0,2%
R A Madeira	PT300	5,91	-3,3%	2,5%	-5,8%	9,4%	0,8%	8,5%
Total coastal Regions		13,97	7,03%	2,21%	4,82%	3,73%	1,53%	2,20%
Portugal		7,41	4,98%	0,87%	4,11%	1,93%	0,17%	1,76%

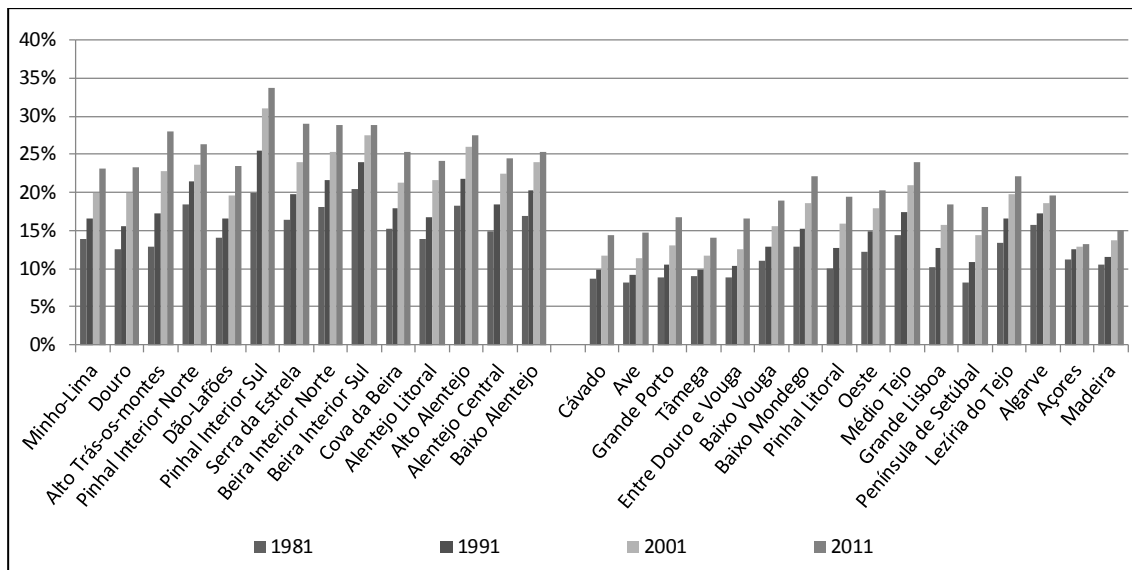
Source: Statistics Portugal Census 1981, 1991, 2001 and provisional data from the 2011 Census

Figure 1 (A) identifies the Portuguese NUTS III which are considered peripheral (PPR) and coastal areas; figure 1 (B) and table 1 present a synthesis of demographic changes, by NUTS III. The main source of growth in the last two decades was a positive net migration, while the growing contrast between the coast and the periphery was caused both by differences in natural growth and net migration. However, even in PPR net migrations were either positive or null, though in general they were not enough to compensate the negative natural growth (Bijak, 2006). The present crisis, which is generating a strong outmigration flow since the beginning of the decade, reverted the situation, seriously accelerating the decline of periphery. Along with population change, the ageing process took place quickly and intensively. Since 1981 the proportion of young population, (0-14 years old) decreased in all regions, though less markedly in the coastal NUTS.



Source: Statistics Portugal Census 1981, 1991, 2001 and Provisional data from the 2011 Census
 Figure 2 - Proportion of young population (0-15 years old)

The opposite occurred in the evolution of elderly population (65 years old and more), whose proportion increased all over the period, with a stronger incidence in the PPR.



Source: Statistics Portugal Census 1981, 1991, 2001 and Provisional data from the 2011 Census

Figure 3 - Proportion of elderly population (65 and more years old)

Population ageing, with a consequent deficit of young fertile adults, originates a serious barrier to long term growth, which can only be overcome by strong migration flows. As we referred to above, the opposite is occurring now. Population forecasts, developed by the DEMOSPIN project by applying a cohort component method to data collected from Statistics Portugal, show how depressive can be the demographic dynamics of PPR. In the extreme case of Pinhal Interior Sul - a hilly sparsely populated area - population in 2030 will be less than 60% of the 1991 census value (See Figure 4).

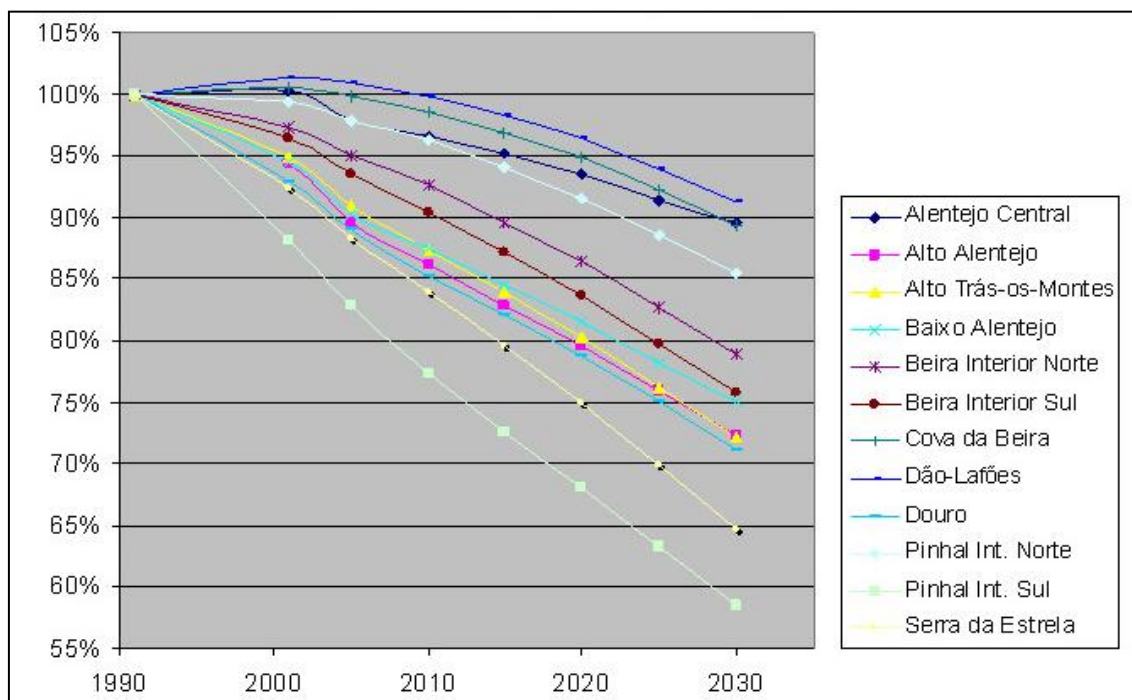


Figure 4– Population Projections for peripheral Portuguese NUTS III

3. DEMOSPIN model

DEMOSPIN model relies on two basic ideas. The first states that economic and demographic dynamics are interrelated, defining a single regional growth process. The second is that the nexus between the demographic and economic components corresponds to a dynamic overlapping generations model (Raymer and Rogers, 2007).

This means that when an exogenous economic change occurs in a region in time n , there is an effect on regional production and employment which may induce net in or out-migration of population less than 65 years old (active population and dependents) (Termote, 2003 and Lee, 1966). Migrations are also driven by stimulus other than employment opportunities, such as return of elderly people, somewhat reversing the trends occurred in the past (Zlotnik, 2003).

The demographic dynamics induce endogenous changes in demand, which, added to new exogenous changes, define regional production and employment in time $n+x$ that in turn cause new waves of net migration. The model starts in 2007, year when the last complete set of required data is available, and is adapted to 2010, using the last census data, and then proceeds with calculations for 5 years intervals, up to 2030.

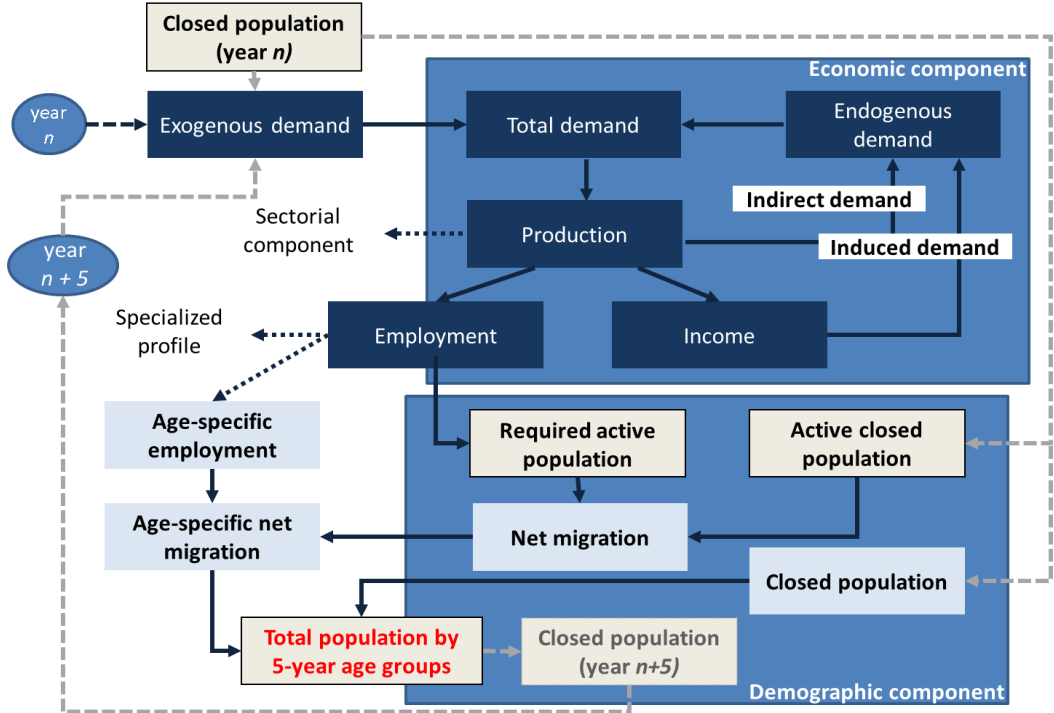


Figure 5– DEMOSPIN Model

Figure 5 describes how the model works. An exogenous change in demand or in productivity has a direct impact in production, employment and income, which in turn induce changes in endogenous demand and again in production, employment (economic employment) and income, through a cumulative process typically described by multiplier models. In parallel, the regional demographic dynamics define the expected population structure which will occur

in the absence of migrations (closed population), driven by births, deaths and ageing. Assuming that the rate of employment by age group and sex is kept constant, the value of closed population will give an expected level of employment (demographic employment).

The coherence between the economic and the demographic dynamics is ensured by assuming that the values of economic and demographic employment must be equal, being the migration flows of people under 65 years the mechanism which creates such a balance (Termote, 2003). Migrations of people over 65 years old are exogenous to the employment mechanism but, in addition to the other migration flows, induce a new change in demand which must be incorporated in the model (Ramos et al, 2011). The successive inclusion of exogenous changes (varying according to different proposed scenarios) and endogenous reactions feeds the model up to 2030, target year for which a forecast of regional demographic and economic structures for all the PPR is made. The adopted scenarios can either be mere changes in the outside world or intended results of specific policies. A more detailed description of the models is presented in the following two sections.

3.1. The economic block

The multiplier mechanism above described is modelled using an input-output methodology. For such purpose, 14 Social Accounting Matrices (SAM) were built, one for each PPR. It must be emphasized that such regional matrixes are not provided by Portuguese official statistics and then their estimation, using different data sources, was a major task of the DEMOSPIN project.

The point of departure was the national rectangular input-output table for 2007 with 125 industries and 431 products. The IO table, defined in domestic flows and basic prices, was then regionalised, using a methodology which can only be sketched in this paper but may be seen in detail in Ramos et al. (2010). The final consumption vector was disaggregated in three categories, discriminating households headed by people above 65 years old, skilled people under 65 and unskilled people under 65.

Being the regional vectors of total production and consumption available, the main problem is the absence of information about inter-regional imports. To identify, for each input, the fraction produced in the region, two main steps were carried out. First, each of the 431 products were carefully analysed and allocated in three categories: A, regionally non-tradable products, which must be consumed in the region where they are produced (such as construction, retail services, public administration or education); B, fully tradable products internationally or inter-regionally; C, special cases, where intermediate situations were

admitted. In general, increases in demand for products A are totally satisfied locally, while increases in demand for products B are only locally met in a proportion corresponding to the regional contribution to the respective national output. Finally, C products are either tradable between neighbour regions (high shipping costs) or correspond to services which are delivered locally by nationwide companies with a significant part of the business activity accounted in the headquarters' region (banks, insurance, etc). It should be mentioned that backward linkages of PPR result mainly from type A products, being most of the indirect and induced effects of the other products leaked to central regions or to other countries.

Once the 14 SAM were built, it was necessary to define scenarios for the future evolution of the exogenous variables. As stated before, population under 65 is endogenous, being adjusted to economic growth through migration flows. As it can be seen below, migrations of elderly people are not endogenous to the economy but, rather than being defined by scenarios, they will be estimated in the demographic block of DEMOSPIN model.

Table 2 – Selected scenarios to the economic evolution

Scenarios	Elderly demand (per capita)	Productivity	Exogenous demand (without public sector)	Public sector demand
I	Constant	Constant	Constant	Constant
II	Constant	Grows (different sectoral paths)	1% annual growth	1% annual growth
III	Constant	Like II and gains spills over to the employers	1% annual growth	1% annual growth
IV	Constant	Like III but obsolescence of some products affecting international competitiveness	1% annual growth	1% annual growth
V	Constant	Like III	1% annual growth	Restrained due to the population decline (equal 2010)
VI	Constant	Like III	Domestic demand constant and exports grow 2% per year	Reduction by 0,5% each year (2020) and constant onwards
VII	Annual reduction of 3% (2010-2015) Constant afterwards	Like III	Mixed decrease on domestic demand* 4% annual growth on exports (2010-2015)	Reduction by 2,5% each year

* 2010-2015 – 1% decrease in inter-regional exports and 5,5% decrease in investment; 2015 onwards – like scenario V.

Seven scenarios were selected, according to different possible evolutions of the world (see table 2): scenario I is a reference where everything is kept constant, while scenarios II to V correspond to a relatively optimistic perspective, still possible in the beginning of the project; they define moderate increases in all items of exogenous demand as well as productivity gains. The last scenario is more in line with the current crisis, assuming that all the elements

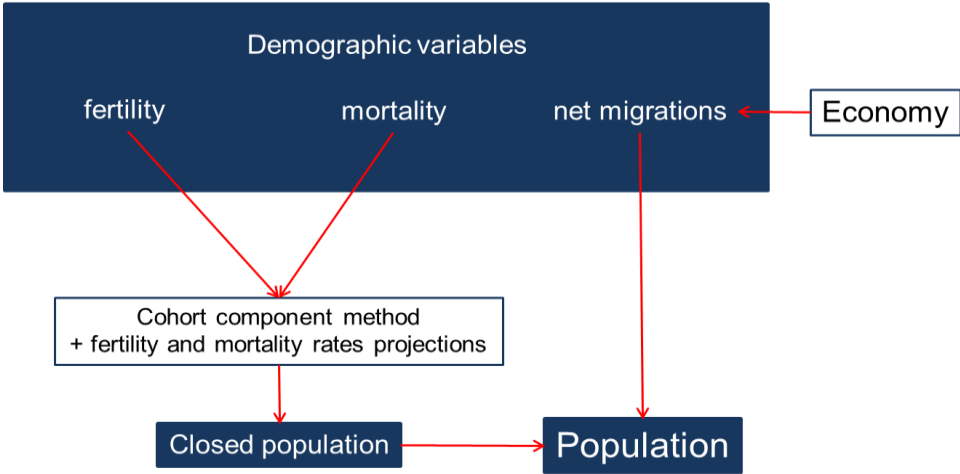
of domestic consumption are declining and that, given a moderate growth in competitiveness, exports grow. Given the actual situation, an even more bleak scenario is required.

The results obtained by the economic block of the model are key inputs for the demographic model, described in the next section.

3.2. The demographic block

The central element of this block is demographic projections for each of the 14 PPR, by five years age groups and separated by sex. They are based on the cohort component method and they are made for 5 years intervals, up to 2030 (Preston, 2001). The projections for the year *t* are obtained from year *t-5* data, in two phases. In the first phase population is projected assuming null net migrations for all age groups. Such a closed population is compared with the results provided by the economic block for year *t*, being that comparison the basis for the estimation of net migrations (see figure 6).

Population projections



18

Figure 6 – Population projections methodology

To perform the first phase it is necessary to estimate the future values of mortality and fertility rates, extrapolating to the future the patterns observed in previous years.

Mortality time series have a small regional heterogeneity and a relatively smooth pattern of decline. As consequence, we opted for the simple solution of making independent OLS estimations for each age group, sex and region. Different functional specifications were tested in order to find the best fit. It is planned as a future improvement to adopt an ARIMA method combined with the best transformation to de-trend the time series.

The estimation of fertility rates is a more difficult problem, because heterogeneity is considerably bigger, both in which concerns regions and age groups and because the pattern is changing in the last years. Figure 7 shows that though total fertility rate is generally declining in Portugal, the most developed regions, such as Grande Lisboa, Península de Setúbal (both part of the metropolitan area of Lisbon) and Algarve had a significant increase, while regions in the north of Portugal such as Tâmega and Cávado, which traditionally were in the top of fertility rank, are facing a sharp decline. A straightforward explanation for this phenomenon is the fast cultural change which occurred in Portugal in the last decades. The Catholic cultural influence is traditionally much stronger in the north of the country, inducing a traditional family structure and a high number of births; such influence is now much weaker and birth rates depend now on economic factors rather than in culture and, as a consequence, the fertility rates are higher in the more affluent regions. Along with those regional changes, the age distribution of fertility was also significantly altered, decreasing for the younger ages and increasing or stabilising for older women (see figure 8).

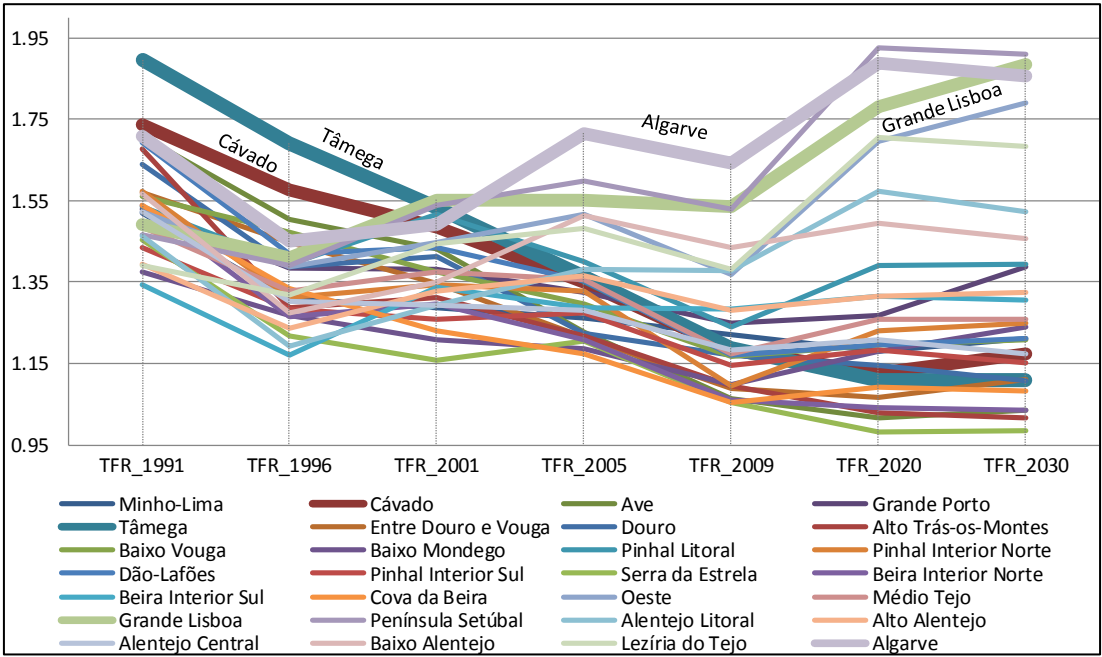


Figure 7 - Continental Portuguese NUTS III Total Fertility Rate

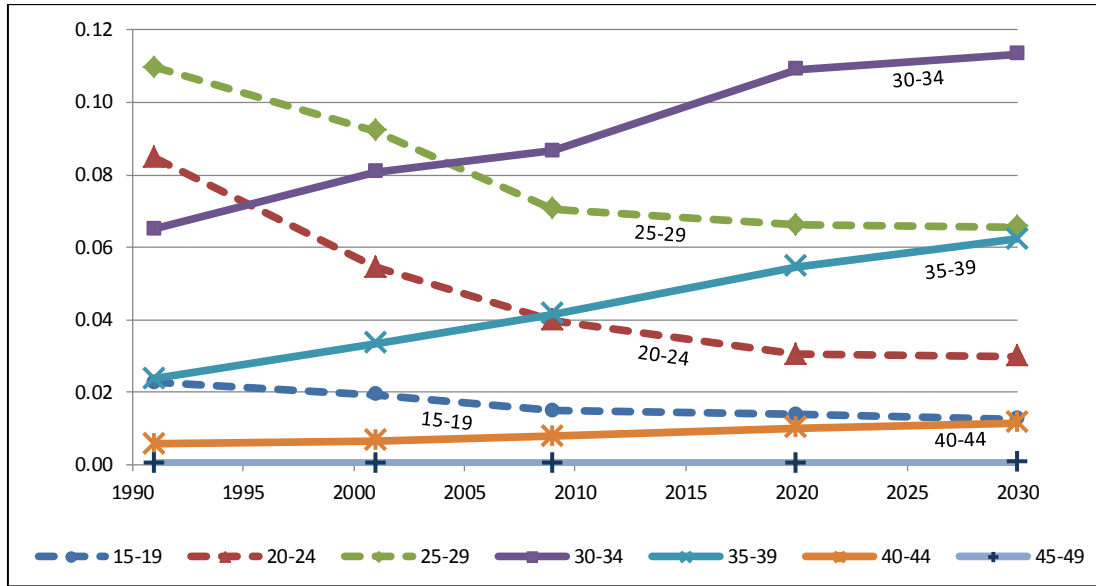


Figure 8 – 5 year age-specific groups fertility rates

In order to deal with heterogeneity the following technique was adopted: first, independent OLS estimates of fertility, for each age group and region and adopting the best fit functional forms were calculated; then, for each year (t), age group (x to x+n) and region (r) estimates were compared with the equivalent figures for the overall country:

$${}_n f_{x_{rt}} - {}_n F_{x_t} = {}_n \delta f_{x_{rt}} \quad \text{equation 1,}$$

where f refers to the region and F to the country.

Then, we assume that the best estimate of the difference to the national values is given by the following weighted average

$${}_n \Delta f_{x_{rt}} = W_i {}_n \delta f_{x+ni_{rt}} \quad \text{equation 2,}$$

being $i = \dots -2, -1, 0, 1, 2, \dots$

and the weights $W_0 > W_1, W_{-1} > W_2, W_{-2} > \dots$

The first correction of the estimates is then

$${}^c f_{x_{rt}} = {}_n f_{x_{rt}} + {}_n \Delta f_{x_{rt}} \quad \text{equation 3,}$$

A second correction is made by a weighted average of ${}^c f_{x_{rt}}$ for each region and the neighbour regions

$${}^{cc} f_{x_{rt}} = W_r {}_n \delta f_{x+n_{rt}} \quad \text{equation 4,}$$

where W_r is maximum for the region and decreases with distance.

As a future work we will improve the estimations using ARIMA models for the time series and smoothing the obtained results using a technique where the above described corrections, rather than based in ad hoc weights W, will be calculated by a simultaneous estimation

method. In short we admit that the best estimate of the fertility rate for each region and age group will be

$$\varphi_{xrt} = f_{xrt} + a_{0t} + a_{xt}F_{xt} + a_{rt}f_{rt} + \varepsilon_i \quad \text{equation 5,}$$

where

f_{xrt} is the observed value of fertility, F_{xt} and f_{rt} are the fertility rates for each age group in the country and for each region, respectively: the coefficients a_{0t} , a_{xt} and a_{rt} , the equivalents to the weights W , are estimated by a cross validation method and by assuming that fertilities follow a Poisson distribution. As a significant pattern of spatial autocorrelation is detected, the obtained results will be finally corrected adding a CAR (contingent autoregressive) model. Once mortalities and fertilities are estimated, closed population projections can be calculated and then, the second phase of the demographic block can start in order to estimate migrations for each region, age group and sex (Rogers, 1990). Another paper presented in this conference (Martins et al, 2012) describes this work in detail and, then we only make a short synthesis here. Migrations for people younger than 15 years old will be made dependent on the migration pattern of the mothers. All the other migrations are estimated for each 5 years period, by comparing the local supply of employment (here called demographic employment E_D) with the employment calculated in the economic block (economic employment E_E). E_D corresponds to the number of employees available in the region if there were null net migrations and if the employment rate was kept constant in the period; in turn, E_E is the employment determined by the SAM model, for each economic scenario. The difference between both types of employment is the basic explanatory variable for the migrations in each age group; other variables such as per capita GDP and demographic potential were added, being lagged migration rates also included, in order to capture the effect of elderly people return to the regions of origin.

The model provides a very accurate explanation of migration behaviour to people under 65 years old. For the older age groups some refinements will be made in the future. Meanwhile we are assuming, as a simplifying procedure, that net migrations are null for these age groups.

4. Results and conclusions

The results obtained are summarised in these section. In order to avoid the overburden of the paper, we limit the figures to two contrasted examples of the 14 PPR: i) Pinhal Interior Sul, a hilly, heavily forested and scarcely populated region and ii) Cova da Beira, a region served by

a motorway linking Lisbon with the Spanish border, with a University and good potential to develop qualified activities and also with a relatively strong urban structure.

Table 3 shows that economic employment will decrease in Pinhal Interior Sul, whatever the chosen scenario. Such decline varies from an almost stagnation value to a sharp decrease (26,6%) for scenario VII (if we consider that the outcome of the present crisis is probably worse than scenario VII shows, we can foresee the future of this region). The global situation for all the PPR is slightly better and is similar to the observed results for Cova da Beira. However, in all the cases the situation is markedly worse than the national estimates, which in turn are not good at all.

Table 3 - Economic employment evolution under the assumed scenarios

Regions	Initial year (2010)	Final year (2030)						
		Scenario I	Scenario II	Scenario III	Scenario IV	Scenario V	Scenario VI	Scenario VII
Pinhal Interior Sul	16982	-0.6%	-7.8%	-9.4%	-10.0%	-13.0%	-22.0%	-26.8%
Cova da Beira	41138	1.3%	-5.4%	-7.3%	-8.8%	-12.0%	-19.1%	-23.5%
PPR	817823	0.9%	-3.7%	-5.8%	-6.3%	-10.7%	-18.9%	-24.1%
Portugal	4769202	5.6%	1.9%	-2.7%	-4.0%	-8.9%	-11.2%	-16.6%

Looking now at table 4 it is evident that the less pessimistic scenarios are not stable in demographic terms. In the absence of positive net migration flows, the regional population will be not enough to fill the job opportunities generated by the local economies. Even in scenario VII negative net migrations in the first years will be followed by positive net migrations, necessary to fill employment opportunities. The reason for such results is the very low reproductive capacity of PPR, where low fertility rates are combined with an inverted age pyramid, reflecting the scarcity of people in age reproduction.

Table 4 - Net migrations evolution

Regions	Scenarios	2010	2015	2020	2025	2030
Pinhal Interior Sul	Scenario I	-2338	-1447	-486	661	1852
	Δ		891	961	1147	1191
	Scenario VII	-2338	-3206	-3145	-2850	-2403
	Δ		-868	61	295	447
Cova da Beira	Scenario I	-3963	-2381	-433	1845	4164

	Δ		1582	1948	2278	2319
	Scenario VII	-3963	-6739	-6874	-6462	-5764
	Δ		-2776	-135	412	698

Considering that a long term stationary population with null migrations corresponds to the long term effect of a total fertility rate slightly higher than two children per woman, we can compare the basis of an imaginary stationary pyramid to the equivalent results in the PPR under analysis. Table 5 compares the number of children in both cases, showing a very big deficit which can only be compensated with net positive migration flows.

Table 5 - 0-5 years old children (stationary and estimated populations)

Regions	Population / Δ	2010	2030 (scenario I)	2030 (scenario VII)
Pinhal Interior Sul	Stationary	2532	2163	1881
	Estimated	1008	995	757
	Δ	-1524	-1168	-1124
	Δ (%)	-60%	-54%	-60%
Cova da Beira	Stationary	5667	5348	4692
	Estimated	2856	2276	1772
	Δ	-2811	-3072	-2920
	Δ (%)	-50%	-57%	-62%

The work developed by DEMOSPIN project revealed how serious the problem of desertification in PPR is. It can be argued that the required positive net migrations can be interpreted under a positive perspective: unemployment will be low in those regions. Such an argument disregards the fact that economy and demography interact. Rather than attracting new migrants, the imbalance described above can drive firms out of the regions as a reaction to the lack of young, dynamic people. If this is the case, a fast auto-destructive vicious circle may be going on.

Acknowledgements

We thank the Portuguese Foundation for Science and Technology by the support provided to the project DEMOSPIN, PTDC/CS-DEM/100530/2008, and the GOVCOPP - Research Unit in Governance, Competitiveness and Public Policies of the University of Aveiro.

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5. INTRODUCTION