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THE CONVERGENCE THEORIES AND THE GEOGRAPHIC CONCENTRATION IN THE PORTUGUESE MANUFACTURED INDUSTRY

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ABSTRACT

The aim of this paper is to present a further contribution to the analysis of absolute convergence, associated with the neoclassical theory, of the manufactured industry productivity at regional level and for the period from 1986 to 1994 (1)(Martinho, 2011a). This paper pretends, also, to analyze the importance which the natural advantages and local resources are in the manufacturing industry location, in relation with the "spillovers" effects and industrial policies. To this, we estimate the Rybczynski equation matrix for the various manufacturing industries in Portugal, at regional level (NUTS II) and for the period 1986 to 1994 (2)(Martinho, 2011b).

Keywords: convergence; geographic concentration; panel data; manufactured industries; Portuguese regions.

1. INTRODUCTION

(3)Islam (1995) developed a model about the convergence issues, for panel data, based on the (4)Solow model, (1956).

Taking into account the work of (5)Kim (1999), we seek, aldo, to analyze the importance of the natural advantages and local resources (specific factors of locations) have in explaining the geographic concentration over time in the Portuguese regions, relatively effects "spillovers" and industrial policies (in particular, the modernization and innovation that have allowed manufacturing in other countries take better advantage of positive externalities). For this, we estimated the Rybczynski equation matrix for the different manufacturing industries in the regions of Portugal, for the period 1986 to 1994. It should be noted that while the model of inter-regional trade, the Heckscher-Ohlin-Vanek, presents a linear relationship between net exports and inter-regional specific factors of locations, the Rybczynski theorem provides a linear relationship between regional production and specific factors of locations. In principle, the residual part of the estimation of Rybczynski, measured by the difference between the adjusted degree of explanation (R2) and the unit presents a approximated estimate of the importance not only of the "spillovers" effects, as considered by Kim (1999), but also of the industrial policies, because, industrial policies of modernization and innovation are interconnected with the "spillover" effects. However, it must be some caution with this interpretation, because, for example, although the growth of unexplained variation can be attributed to the growing importance of externalities "Marshallians" or "spillovers" effects and industrial policies, this conclusion may not be correct. Since the "spillovers" effects and industrial policies are measured as a residual part, the growth in the residual can be caused, also, for example, by growth in the randomness of the location of the products manufactured and the growing importance of external trade in goods and factors.

2. CONVERGENCE MODEL

The purpose of this part of the work is to analyze the absolute convergence of output per worker (as a "proxy" of labor productivity), with the following equation Islam (1995), based on the Solow model, 1956):

$$\Delta \ln P_{it} = c + b \ln P_{i,t-1} + v_{it}$$

3. THE MODEL THAT ANALYZES THE IMPORTANCE OF NATURAL ADVANTAGES AND LOCAL RESOURCES IN AGGLOMERATION

According to Kim (1999), the Rybczynski theorem states that an increase in the supply of one factor leads to an increased production of the good that uses this factor intensively and a reduction in the production of other goods.

Given these assumptions, the linear relationship between regional output and offers of regional factors, may be the following:

$$Y = A^{-1}V \text{ ,}$$

where Y (nx1) is a vector of output, A (nxm) is a matrix of factor intensities or matrix input Rybczynski and V (mx1) is a vector of specific factors to locations.

For the output we used the gross value added of different manufacturing industries, to the specific factors of the locations used the labor, land and capital. For the labor we used the employees in manufacturing industries considered (symbolized in the following equation by "Labor") and the capital, because the lack of statistical data, it was considered, as a "proxy", the production in construction and public works (the choice of this variable is related to several reasons including the fact that it represents a part of the investment made during this period and symbolize the part of existing local resources, particularly in terms of infrastructure). With regard to land, although this factor is often used as specific of the locations, the amount of land is unlikely to serve as a significant specific factor of the locations. Alternatively, in this work is used the production of various extractive sectors, such as a "proxy" for the land. These sectors, include agriculture, forestry and fisheries (represented by "Agriculture") and production of natural resources and energy (symbolized by "Energy"). The overall regression is then used as follows:

$$\ln Y_{it} = \alpha + \beta_1 \ln Labor_{it} + \beta_2 \ln Agriculture_{it} + \beta_3 \ln Energy_{it} + \beta_4 \ln Construction_{it} + \varepsilon$$

In this context, it is expected that there is, above all, a positive relationship between the production of each of the manufacturing industry located in a region and that region-specific factors required for this industry, in particular, to emphasize the more noticeable cases, between food industry and agriculture, among the textile industry and labor (given the characteristics of this industry), among the industry of metal products and metal and mineral extraction and from the paper industry and forest.

4. DATA ANALYSIS

Considering the variables on the models presented previously and the availability of statistical information, we used the following data disaggregated at regional level. Annual data for the period 1986 to 1994, corresponding to the five regions of mainland Portugal (NUTS II), and for the several manufactured industries in those regions. The data are relative, also, to regional gross value added of agriculture, fisheries and forestry, natural resources and energy and construction and public works. These data were obtained from Eurostat (Eurostat Regio of Statistics 2000).

5. EMPIRICAL EVIDENCE OF ABSOLUTE CONVERGENCE, PANEL DATA

Table 1 presents the results for the absolute convergence of output per worker, in the estimations obtained for each of the manufactured industry of NUTS II, from 1986 to 1994.

The convergence results obtained are statistically satisfactory for all manufacturing industries of NUTS II.

Table 1: Analysis of convergence in productivity for each of the manufacturing industries at the five NUTS II of Portugal, for the period 1986 to 1994

Metals industry											
Method	**Const.**	**D_1**	**D_2**	**D_3**	**D_4**	**D_5**	**Coef.**	**T.C.**	**DW**	**R^2**	**G.L.**
Pooling	0.190 (0.190)						-0.024 (-0.241)	-0.024	1.646	0.002	30
LSDV		2.171** (1.769)	2.143** (1.753)	2.161** (1.733)	2.752** (1.988)	---	-0.239** (-1.869)	-0.273	1.759	0.198	27
GLS	0.407 (0.394)						-0.046 (-0.445)	-0.047	1.650	0.007	30
MInerals industry											
Method	**Const.**	**D_1**	**D_2**	**D_3**	**D_4**	**D_5**	**Coef.**	**T.C.**	**DW**	**R^2**	**G.L.**
Pooling	0.738 (0.903)						-0.085 (-0.989)	-0.089	1.935	0.025	38
LSDV		1.884* (2.051)	1.970* (2.112)	2.004* (2.104)	1.926* (2.042)	1.731** (1.930)	-0.208* (-2.129)	-0.233	2.172	0.189	34
GLS	0.967 (1.162)						-0.109 (-1.246)	-0.115	1.966	0.039	38
Chemical industry											
Method	**Const.**	**D_1**	**D_2**	**D_3**	**D_4**	**D_5**	**Coef.**	**T.C.**	**DW**	**R^2**	**G.L.**
Pooling	2.312** (1.992)						-0.225** (-1.984)	-0.255	2.017	0.104	34
LSDV		6.104* (3.750)	6.348* (3.778)	6.381* (3.774)	6.664* (3.778)	6.254* (3.777)	-0.621* (-3.769)	-0.970	1.959	0.325	30

GLS	2.038** (1.836)						-0.198** (-1.826)	-0.221	2.034	0.089	34
Electric goods industry											
Method	**Const.**	**D_1**	**D_2**	**D_3**	**D_4**	**D_5**	**Coef.**	**T.C.**	**DW**	**R^2**	**G.L.**
Pooling	0.781 (0.789)						-0.083 (-0.784)	-0.087	1.403	0.016	38
LSDV		3.634* (2.363)	3.552* (2.360)	3.673* (2.362)	3.636* (2.376)	3.429* (2.324)	-0.381* (-2.355)	-0.480	1.259	0.167	34
GLS	0.242 (0.285)						-0.025 (-0.279)	-0.025	1.438	0.002	38
Transport equipments industry											
Method	**Const.**	**D_1**	**D_2**	**D_3**	**D_4**	**D_5**	**Coef.**	**T.C.**	**DW**	**R^2**	**G.L.**
Pooling	4.460* (3.110)						-0.464* (-3.136)	-0.624	2.258	0.206	38
LSDV		8.061* (4.948)	8.526* (5.007)	8.614* (4.986)	8.696* (4.998)	8.077* (4.961)	-0.871* (-5.014)	-2.048	2.049	0.429	34
GLS	5.735* (3.780)						-0.596* (-3.807)	-0.906	2.159	0.276	38
Food industry											
Method	**Const.**	**D_1**	**D_2**	**D_3**	**D_4**	**D_5**	**Coef.**	**T.C.**	**DW**	**R^2**	**G.L.**
Pooling	0.314 (0.515)						-0.027 (-0.443)	-0.027	1.858	0.005	38
LSDV		2.841* (2.555)	2.777* (2.525)	2.899* (2.508)	2.617* (2.471)	2.593* (2.470)	-0.274* (-2.469)	-0.320	1.786	0.198	34
GLS	0.090 (0.166)						-0.005 (-0.085)	-0.005	1.851	0.001	38
Textile industry											
Method	**Const.**	**D_1**	**D_2**	**D_3**	**D_4**	**D_5**	**Coef.**	**T.C.**	**DW**	**R^2**	**G.L.**
Pooling	4.276* (4.639)						-0.462* (-4.645)	-0.620	1.836	0.388	34
LSDV		5.556* (4.288)	5.487* (4.276)	5.506* (4.272)	5.561* (4.253)	5.350* (4.431)	-0.595* (-4.298)	-0.904	1.816	0.431	30
GLS	3.212* (6.336)						-0.347* (-6.344)	-0.426	1.848	0.542	34
Paper industry											
Method	**Const.**	**D_1**	**D_2**	**D_3**	**D_4**	**D_5**	**Coef.**	**T.C.**	**DW**	**R^2**	**G.L.**
Pooling	2.625* (2.332)						-0.271* (-2.366)	-0.316	1.534	0.128	38
LSDV		3.703* (2.803)	3.847* (2.840)	3.837* (2.813)	3.684* (2.812)	3.521* (2.782)	-0.382* (-2.852)	-0.481	1.516	0.196	34
GLS	1.939** (1.888)						-0.201** (-1.924)	-0.224	1.556	0.089	38
Several industry											
Method	**Const.**	**D_1**	**D_2**	**D_3**	**D_4**	**D_5**	**Coef.**	**T.C.**	**DW**	**R^2**	**G.L.**
Pooling	5.518* (4.004)						-0.605* (-4.004)	-0.929	2.121	0.297	38
LSDV		7.802* (5.036)	7.719* (5.022)	7.876* (5.033)	7.548* (5.023)	7.660* (5.018)	-0.847* (-5.032)	-1.877	2.024	0.428	34
GLS	6.053* (4.308)						-0.664* (-4.309)	-1.091	2.081	0.328	38

Note: Const. Constant; Coef., Coefficient, TC, annual rate of convergence; * Coefficient statistically significant at 5%, ** Coefficient statistically significant at 10%, GL, Degrees of freedom; LSDV, method of fixed effects with variables dummies; D1 ... D5, five variables dummies corresponding to five different regions, GLS, random effects method.

6. EMPIRICAL EVIDENCE OF GEOGRAPHIC CONCENTRATION

In the results presented in the following table, there is a strong positive relationship between gross value added and labor in particular in the industries of metals, chemicals, equipment and electrical goods, textile and several products. On the other hand, there is an increased dependence on natural and local resources in industries as the mineral products, equipment and electric goods, textile and several products. We found that the location of manufacturing industry is yet mostly explained by specific factors of locations and poorly explained by "spillovers" effects and industrial policies.

Table 2: Results of estimations for the years 1986-1994

$$\ln Y_{it} = \alpha + \beta_1 \ln Labor_{it} + \beta_2 \ln Agriculture_{it} + \beta_3 \ln Energy_{it} + \beta_4 \ln Construction_{it} + \varepsilon$$

	IMT (2)	**IMI (1)**	**IPQ (1)**	**IEE (1)**	**IET (1)**	**IAL (2)**	**ITE (1)**	**IPA (1)**	**IPD (2)**
α	10.010 (0.810)					34.31$^{(*)}$ (3.356)			83.250$^{(*)}$ (5.412)
Dummy1		18.753$^{(*)}$ (5.442)	-13.467$^{(*)}$ (-3.134)	14.333$^{(*)}$ (2.811)	9.183 (1.603)		15.175$^{(*)}$ (3.652)	17.850$^{(*)}$ (3.162)	
Dummy2		19.334$^{(*)}$ (5.733)	-12.679$^{(*)}$ (-2.930)	13.993$^{(*)}$ (2.802)	10.084$^{(**)}$ (1.766)		14.904$^{(*)}$ (3.597)	17.532$^{(*)}$ (3.100)	

Dummy3		19.324(*) (5.634)	-13.134(*) (-3.108)	14.314(*) (2.804)	10.155(**) (1.797)		14.640(*) (3.534)	18.586(*) (3.313)	
Dummy4		18.619(*) (5.655)	-11.256(*) (-2.599)	14.022(*) (2.857)	9.384 (1.627)		15.067(*) (3.647)	15.001(*) (2.654)	
Dummy5		17.860(*) (5.629)	-11.060(*) (-2.682)	12.629(*) (2.653)	7.604 (1.377)		13.206(*) (3.344)	13.696(*) (2.574)	
β_1	1.420(*) (4.965)	0.517(*) (4.651)	1.098(*) (8.056)	0.817(*) (7.695)	0.397(*) (2.455)	0.378(*) (2.000)	0.809(*) (5.962)	-0.071 (-0.230)	0.862(*) (10.995)
β_2	0.844 (1.353)	-0.358(*) (-2.420)	0.709(*) (2.628)	-0.085 (-0.480)	-0.314 (-0.955)	-0.026 (-0.130)	-0.484(**) (-1.952)	-0.171 (-0.505)	-0.148 (-0.780)
β_3	0.431 (1.468)	-0.242(*) (-3.422)	0.120 (0.721)	-0.084 (-0.876)	0.147 (0.844)	-0.067 (-0.706)	-0.229(**) (-1.738)	-0.165 (-0.904)	-0.524(*) (-5.289)
β_4	-1.459(*) (-4.033)	0.359(*) (2.629)	0.260 (1.185)	0.061 (0.318)	0.433(*) (2.066)	0.166 (0.853)	0.529(*) (2.702)	0.427 (1.596)	-0.085 (-0.461)
Sum of the elasticities	1.236	0.276	2.187	0.709	0.663	0.451	0.625	0.020	0.105
R^2 adjusted	0.822	0.993	0.987	0.996	0.986	0.968	0.997	0.983	0.999
Residual part	0.178	0.007	0.013	0.004	0.014	0.032	0.003	0.017	0.001
Durbin-Watson	1.901	2.246	1.624	1.538	2.137	1.513	2.318	1.956	2.227
Hausman test	(c)	115.873(b)(*)	26.702(b)(*)	34.002(b)(*)	9.710(b)(*)	(c)	34.595(b)(*)	26.591(b)(*)	1.083(a)

For each of the industries, the first values correspond to the coefficients of each of the variables and values in brackets represent t-statistic of each; (1) Estimation with variables "dummies"; (2) Estimation with random effects; (*) coefficient statistically significant at 5% (**) Coefficient statistically significant at 10%; IMT, metals industries; IMI, industrial mineral;, IPQ, the chemicals industries; IEE, equipment and electrical goods industries; EIT, transport equipment industry; ITB, food industry; ITE, textiles industries; IPA, paper industry; IPD, manufacturing of various products; (a) accepted the hypothesis of random effects; (b) reject the hypothesis of random effects; (c) Amount not statistically acceptable.

7. CONCLUSIONS

The signs of absolute convergence are different from one manufactured industries to another, but there is a curious results for the equipment transport industry, because present strong evidence of absolute convergence and we know that this industry is a dynamic sector.

Of referring that the location of the Portuguese manufacturing industry is still mostly explained by specific factors of locations and the industrial policies of modernization and innovation are not relevant, especially those that have come from the European Union, what is more worrying.

So, we can say that the surprising signs of convergence in some industries are because the location of the manufactured industries in Portugal is mostly explained by the specific factors of the locations.

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