NEW CONSTRUCTION AND RECONSTRUCTION: IMPACT ON GROWTH OF SUB-REGIONS OF MAINLAND PORTUGAL

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Abstract
Based on a panel made up of 28 sub-regions (NUT III) of mainland Portugal for the period 1995-2006, we show that building reconstruction has a positive impact on the economic growth of sub-regions of mainland Portugal, whereas the effect of new construction seems to be of negligible importance. The empirical evidence obtained in this study lets us make suggestions on urban policy for countries in general, and for Portugal in particular, namely to concentrate on reconstruction rather than new buildings.

Keywords: construction of new buildings, dynamic panel estimators, economic growth, reconstruction of buildings, sub-regions

JEL Classification: C23, O40, R59

Introduction

For a long time the term "growth" meant an arithmetic increase in production, leading to increased national wealth and material standard of living. Nowadays, this term has a more and more restricted meaning and "development" which includes growth itself is set against its repercussions on people's well-being and the social system itself, as well as sustainability.

Developing the idea that the city belongs to all and it is the shared responsibility of all involved parties, the idea of belonging and the notion of the role of the urban environment in the future of humanity and the planet, are fundamental for sustainable development. Throughout history, we find that cities have always been centres of civilization, innovation, culture and invention. Certainly, economic development is unimaginable without the city, for both economic and social reasons.

Urban restoration should be integrated and promoted as a practice in European, National and Local Urban Policy, emerging as the means for consolidating small and medium-sized

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towns and an instrument for creating a poly-centred urban system. In this context, urban restoration becomes a dimension of sustainable development.

Setting out from recognition of the unprecedented dangers and challenges facing historical cities at the start of the third millennium, and taking into account their singular past of adapting to change, rehabilitation and urban renewal, we can have a model for cities that aim for a secure and sustainable future, conciliating conservation, sustainable local development and the competitiveness of urban areas. In this context, assuming that urban restoration will be an important pillar for sustainable development, also being important for more rational use of resources, at the outset we must ascertain if restoration is relevant for regions' economic growth compared to the relevance of new building. This important subject has not been dealt with in the literature, although its study is relevant for urban policy guidelines set out by the European Union and also by countries' national and local governments.

Attempting to fill the gap identified in the literature, this study intends to investigate the impacts of both building reconstruction and new building on economic growth in sub-regions of mainland Portugal. Initially, we estimate regressions considering each variable in isolation, and then go on to consider both variables together in regressions. We use as dependent variable the GNP *per capita* of each sub-region (NUT III) of mainland Portugal in each period of analysis (1995 to 2006), and as independent variables: 1) investment *per capita* in new building and 2) investment *per capita* in building reconstruction. We opt to consider the variables in logarithms in the regressions, an identical procedure to the one used in empirical studies of economic growth.

To estimate the regressions which are subject to analysis we use dynamic panel estimators. Initially, we use the GMM system (1998) estimator. However, given the rather low number of observations we also use the LSDVC (Least Squares Dummy Variable Corrected) estimator, by Bruno (2005). Use of the LSDVC (2005) estimator is fundamental in order to test the robustness of the results obtained with the GMM system (1998) estimator, due to the considerable number of instruments generated through using the GMM system (1998) estimator compared to the number of cross-sections, which could lead to bias of the estimated parameters.

After this introduction, the article is divided as follows: 1) section 2 concerns methodology, with presentation of the database and variables as well as the estimation method used; 2) section 3, presents the empirical evidence obtained in this study; and 3) finally section 4 presents the conclusions and implications of the study.

1. Methodology

1.1 Database and Variables

The data used in this study were gathered from the INE (National Institute of Statistics), and from the ANMP (National Association of Portuguese Local Authorities). All the data were deflated, so as to remain at constant prices.

Table no. 1 below presents the variables used in this study together with their corresponding measures.

Table no. 1: Variables and Measures

Variable	Measure
$\ln GNPpc_{i,t}$	Logarithm of the ratio of GNP to the resident population, in each sub-region of mainland Portugal
$\ln NCpc_{i,t}$	Logarithm of the ratio of investment in new building to the resident population in each sub-region of mainland Portugal
$\ln RECpc_{i,t}$	Logarithm of the ratio of investment in reconstruction to the resident population in each sub-region of mainland Portugal

As dependent variable we use the GNP *per capita* of each sub-region of mainland Portugal in each period of analysis. Given that the aim of this study is to analyze the impacts of investment in new building, as well as investment in building reconstruction, on economic growth in the sub-regions of mainland Portugal, we use as independent variables: 1) investment *per capita* in new building and 2) investment *per capita* in building reconstruction.

It is worth pointing out that in the estimated regressions we use the variables in logarithms. However, in presenting the descriptive statistics of the variables, we choose to present the variables not as logarithms, so as to make comparisons more easily.

1.2 Method of Estimation

Initially, we estimate the regressions considering each independent variable in isolation, and then go on to consider both variables together in the regressions. In addition, since the GNP *per capita* is a persistent series, i.e. GNP *per capita* in the present and previous periods will be highly correlated, in estimating the regressions we consider the relationship between GNP *per capita* in the present and previous periods. We choose to consider the variables as logarithms in the regressions, an identical procedure to the one used in empirical studies of economic growth. Therefore, the regressions to estimate can be given by the following expressions:

$$\ln GNPpc_{i,t} = \beta_0 + \lambda \ln GNPpc_{i,t-1} + \beta_1 \ln NCpc_{i,t} + u_i + d_t + e_{i,t} \quad (1)$$

$$\ln GNPpc_{i,t} = \beta_0 + \lambda \ln GNPpc_{i,t-1} + \beta_2 \ln RECpc_{i,t} + u_i + d_t + e_{i,t} \quad (2)$$

$$\ln GNPpc_{i,t} = \beta_0 + \lambda \ln GNPpc_{i,t-1} + \beta_1 \ln NCpc_{i,t} + \beta_2 \ln RECpc_{i,t} + u_i + d_t + e_{i,t} \quad (3)$$

in which: $\ln GNPpc_{i,t}$ is the logarithm of GNP *per capita* in the present period; $\ln GNPpc_{i,t-1}$ is the logarithm of GNP *per capita* in the previous period; $\ln NCpc_{i,t}$ is the logarithm of investment *per capita* in new building construction; $\ln RECpc_{i,t}$ is the logarithm of investment *per capita* in building reconstruction; u_i are non-observable

individual effects of the territorial units analyzed; d_t are annual dummy variables measuring possible macroeconomic effects on the logarithm of GNP *per capita*; and $e_{i,t}$ is the error which is presumed to have normal distribution.

Compared to using static panel models, dynamic estimators have the following advantages: 1) control of endogeny; 2) control of possible collinearity between explanatory variables; and 3) greater control of the possible effects of omission of relevant independent variables in explaining the dependent variable.

Besides the above, use of dynamic estimators avoids possible bias of the parameter measuring the relationship between GNP *per capita* in the present and previous periods, a bias arising from the correlation between u_i and $\ln GNPpc_{i,t-1}$, and between $e_{i,t}$ and $\ln GNPpc_{i,t-1}$.

Based on what has been stated, in this study we estimate equations (1), (2) and (3) using dynamic panel estimators. Blundell and Bond (1998) conclude that when the dependent variable is persistent and the number of periods is not particularly high, use of the GMM (1991) estimator, by Arellano and Bond (1991), leads us to bias of the estimated parameters, mainly regarding the parameter measuring the relationship between the dependent variable in the present and previous periods. What is more, Blundell and Bond (1998) conclude that in the case of persistence of the dependent variable and a rather low number of periods, the instruments generated by the GMM (1991) estimator are weak. Given that GNP *per capita* is normally a persistent series, i.e. the correlation between GNP *per capita* in the present and previous periods is considerable, in this study use of the GMM system (1998) estimator is seen to be more suitable than use of the GMM (1991) estimator. This being so, we opt for the GMM system (1998) estimator.

However, the results obtained with the GMM system (1998) estimator can only be considered valid on two conditions: 1) validity of the instruments; and 2) no second order autocorrelation.

To test instrument validity, we use the Hansen test. The null hypothesis indicates validity of the instruments, the alternative hypothesis being invalidity of the instruments. Rejection of the null hypothesis means the instruments are not valid. On the contrary, by not rejecting the null hypothesis, we conclude the instruments are valid.

In the case of second order autocorrelation, the null hypothesis is non-existence of second order autocorrelation, the alternative hypothesis being existence of second order autocorrelation. In the case of rejecting the null hypothesis, we conclude there is second order autocorrelation. By not rejecting the null hypothesis, we conclude there is no second order autocorrelation.

Due to the rather low number of observations, we use the LSDVC (Least Squares Dummy Variable Corrected) estimator by Bruno (2005), which is suitable for samples made up of limited observations[1]. In this study, use of the LSDVC (2005) estimator becomes

[1] The LSDVC (2005) estimator is used in various empirical studies where the number of observations is not very high, in order to test robustness of the results obtained with the GMM system (1998) estimator, as for example in Serrasqueiro and Maçãs Nunes (2008) and in Serrasqueiro (2009).

fundamental, given the considerable number of instruments generated by use of the GMM system (1998) estimator, compared to the number of cross-sections, a fact that may lead to bias of the estimated parameters. Therefore, we estimate the regressions given by equations (1), (2) and (3) using, besides the GMM system (1998) estimator, the LSDVC (2005) estimator.

2. Results

In this section, we first present the descriptive statistics of the variables used in this study. Then we present the results of the regressions obtained with the GMM system (1998) and LSDVC (2005) estimators.

2.1 Descriptive Statistics

Table no. 2 below presents the results of the descriptive statistics of the variables used in this study.

Table no. 2: Descriptive Statistics

Variable	Observations	Mean	Standard Deviations	Minimum	Maximum
$GNPpc_{i,t}$	336	11443.13	3382.118	5897.33	24607.8
$NCpc_{i,t}$	336	0.012606	0.004499	0.003012	0.027229
$RECpc_{i,t}$	336	0.0009901	0.0008237	0	0.0047626

We can see the standard deviation of GNP *per capita* is under the respective mean, and so the volatility of GNP *per capita* is not particularly high, the same happening in the case of investment *per capita* in new building and investment *per capita* in building reconstruction.

We observe that investment *per capita* in new construction, in sub-regions of mainland Portugal, is on average considerably above investment *per capita* in building reconstruction.

2.2 Growth Regressions

Table no. 3 below presents the results of the growth regressions, using the GMM system (1998) estimator.

Table no. 3: GMM System (1998) Estimator – Growth Regressions

Dependent Variable: $\ln GNPpc_{i,t}$			
Independent Variables	I	II	III
$\ln GNPpc_{i,t-1}$	0.9739994*** (0.009084)	0.981075*** (0.011765)	0.9864065*** (0.0085133)
$\ln NCpc_{i,t}$	-0.004125 (0.005307)		-0.0024405 (0.004993)
$\ln RECpc_{i,t}$		0.0050074** (0.0021727)	0.0044054** (0.0019993)
$CONS$	0.2448579*** (0.089327)	0.234281** (0.100683)	0.169444** (0.074349)
$F(N(0.1))$	5771.92***	5229.08***	6587.18***
$Hansen(\chi^2)$	27.32	27.64	27.31
$m1(N(0.1))$	-6.31***	-6.39***	-6,46***
$m2(N(0.1)$	0.54	0.57	0.56
Observations	308	308	308

Notes: 1. Standard deviations are reported in parenthesis. 2. *** indicates significance at 1% level, ** indicates significance at 5% level. 3. The estimates include time *dummy* variables, but not shown. 4. We use the collapse lag (2.2) in the GMM system (1998) estimator so that the number of instruments generated by the GMM system (1998) estimator does not exceed the number of cross-sections.

Firstly, observing the results of the Hansen test, we find that whatever the regression estimated, we cannot reject the null hypothesis of validity of the instruments used. Secondly, the results of the second order autocorrelation test let us conclude we cannot reject the null hypothesis of absence of second order autocorrelation, for any of the regressions estimated. Therefore, based on the Hansen and second order autocorrelation tests, we can conclude that the results with the GMM system (1998) estimator are valid.

We find there is a statistically insignificant relationship between investment *per capita* in construction of new buildings and GNP *per capita*. However, we see that the relationship investment *per capita* in building reconstruction and GNP *per capita* is positive, and statistically significant at 5% significance.

Finally, the relationship between GNP *per capita* in the present period and GNP *per capita* in the previous period is positive, and statistically significant at 1% significance. This result indicates that growth in the sub-regions of mainland Portugal is a continuous process over time, an identical result to that obtained in various studies of economic growth, as for example in Sequeira and Maçãs Nunes (2008), Sequeira and Martins (2008) and Sequeira and Ferraz (2009).

We calculate the coefficient of the correlation between GNP *per capita* in the present period and GNP *per capita* in the previous period. The value of the correlation coefficient is 0.9922, showing that GNP is clearly a persistent series. Therefore, use of the GMM

system (1998) estimator is clearly seen to be suitable, rather than use of the GMM (1991) estimator by Arellano and Bond (1991).

The results are robust since estimating the regressions, considering each explanatory variable individually, or taken together, does not mean significant changes in the estimated parameters regarding magnitude and statistical significance.

It is relevant to highlight that building reconstruction has a positive effect on economic growth in the sub-regions of mainland Portugal, whereas construction of new buildings has an apparently negligible effect.

Table no. 4 below presents the results of the growth regressions using the LSDVC (2005) estimator.

Table no. 4: LSDVC (2005) Estimator – Growth Regressions

Dependent Variable: $\ln GNPpc_{i,t}$			
Independent Variables	I	II	III
$\ln GNPpc_{i,t-1}$	0.9219301***	0.933394***	0.9392145***
	(0.0201097)	(0.0190015)	(0.0187687)
$\ln NCpc_{i,t}$	0.0151991		-0.0089485
	(0.0094496)		(0.0100505)
$\ln RECpc_{i,t}$		0.0105237***	0.0120032***
		(0.0031783)	(0.0036177)
Observations	308	308	308

Notes: 1. Standard deviations are reported in parenthesis. 2. *** indicates significance at 1% level. 3. The estimates include time *dummy* variables, but not shown.

We find the results obtained using the LSDVC (2005) estimator are quite similar to those obtained with the GMM system (1998) estimator, which confirms the robustness of the empirical evidence obtained in this study.

The empirical evidence obtained indicates that building reconstruction should be encouraged as a measure of urban policy, as an alternative to new building, since it contributes positively to increased economic growth in the sub-regions of mainland Portugal, while new building is of negligible importance for economic growth in these sub-regions.

Conclusion

At present, almost half the planet's population live in urban areas with the consequent worsening of living conditions and lack of adequate infrastructure to satisfy cities' ever-growing needs. On one hand, concentration in urban areas causes problems of gentrification and security in these areas, and on the other it causes depopulation in rural districts. This urban problem is on a world scale, and is also visible in Portugal through great imbalance, with congestion on the coast and poor perspectives for growth inland.

Apart from the foreseeable economic impacts (job creation, economy of use and occupation, and profitability of buildings) of policies based on cultural heritage as a resource, it is seen that rehabilitation is a key instrument in the search for sustainable development. In this context, the restoration of historical city centres is particularly relevant

and can be seen as a huge recycling operation, in which the process itself is an example of sustainable development.

The aim of this study was to test empirically the possibility of new building and reconstruction contributing, or not, to increased GNP *per capita* in the sub-regions of mainland Portugal.

We find that building reconstruction has a positive effect on the economic growth of the sub-regions of mainland Portugal, whereas new building has a negligible effect. The empirical evidence obtained in this study is particularly relevant because it shows that, besides building reconstruction being of relatively greater importance for economic development in the sub-regions of mainland Portugal, compared with new building, it also contributes to growth in these sub-regions, something which does not happen when analyzing the impact of new building on the economic growth of these sub-regions.

As measures of Local and National Urban Policy, but which can and should be extended to the Local and National Governments of other countries, a preference for building reconstruction is clearly indicated, as an alternative to the construction of new buildings. In terms of impacts we consider this policy could create: 1) significant economic impacts in sub-regions, 2) when accepted by the local population, urban rehabilitation in general, and building reconstruction in particular, can create synergies that contribute to improved quality of life for the inhabitants.

It is up to us to reflect on this urban problem, of which we are an integral part, and contribute daily towards a sustainable solution.

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