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# A MODEL OF THE KEYNESIAN THEORY FOR THE PORTUGUESE MANUFACTURED INDUSTRY. ANOTHER ANALYSIS

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## ABSTRACT

With this work we try to present a model for the Portuguese manufactured industry based on the Keynesian theory. We built the model testing the Verdoorn Law, with the alternative specifications of (1)Kaldor (1966), for the five Portuguese regions (NUTS II) and from 1995 to 1999. It is intended to test, yet in this work, the alternative interpretation of (2)Rowthorn (1975) about the Verdoorn's Law for the same regions and periods.

**Keywords:** Keynesian theory; linear models; manufactured industries; Portuguese regions.

## 1. INTRODUCTION

Kaldor rediscovered the Verdoorn law in 1966 and since then this law has been tested in several ways, using specifications, samples and different periods (3)(Martinho, 2011). However, the conclusions drawn differ, some of them rejecting the Law of Verdoorn and other supporting its validity. (4)Kaldor (1966, 1967) in his attempt to explain the causes of the low rate of growth in the UK, reconsidering and empirically investigating Verdoorn's Law, found that there is a strong positive relationship between the growth of labor productivity ( $p$ ) and output ( $q$ ), i.e.  $p = f(q)$ . Or alternatively between employment growth ( $e$ ) and the growth of output, i.e.  $e = f(q)$ .

Another interpretation of Verdoorn's Law, as an alternative to the Kaldor, is presented by (5)Rowthorn (1975, 1979). Rowthorn argues that the most appropriate specification of Verdoorn's Law is the ratio of growth of output ( $q$ ) and the growth of labor productivity ( $p$ ) with employment growth ( $e$ ), i.e.,  $q = f(e)$  and  $p = f(e)$ , respectively (as noted above, the exogenous variable in this case is employment). On the other hand, Rowthorn believes that the empirical work of Kaldor (1966) for the period 1953-54 to 1963-64 and the (6)Cripps and Tarling (1973) for the period 1951 to 1965 that confirm Kaldor's Law, not can be accepted since they are based on small samples of countries, where extreme cases end up like Japan have great influence on overall results.

It should be noted, finally, that several authors have developed a body of work in order to test the Verdoorn's Law in a regional context, including (7)Leon-Ledesma (1998).

## 2. ALTERNATIVE SPECIFICATIONS OF VERDOORN'S LAW

The hypothesis of increasing returns to scale in industry was initially tested by Kaldor (1966) using the following relations:

$$p_i = a + bq_i, \text{ Verdoorn law (1)}$$

$$e_i = c + dq_i, \text{ Kaldor law (2)}$$

where  $p_i$ ,  $q_i$  and  $e_i$  are the growth rates of labor productivity, output and employment in the industrial sector in the economy  $i$ .

On the other hand, the mathematical form of Rowthorn specification is as follows:

$$p_i = \lambda_1 + \varepsilon_1 e_i, \text{ first equation of Rowthorn (3)}$$

$$q_i = \lambda_2 + \varepsilon_2 e_i, \text{ second equation of Rowthorn (4)}$$

where  $\lambda_1 = \lambda_2$  e  $\varepsilon_2 = (1 + \varepsilon_1)$ , because  $p_i = q_i - e_i$ . In other words,  $q_i - e_i = \lambda_1 + \varepsilon_1 e_i$ ,  $q_i = \lambda_1 + e_i + \varepsilon_1 e_i$ , so,  $q_i = \lambda_1 + (1 + \varepsilon_1) e_i$ .

Rowthorn estimated these equations for the same OECD countries considered by Kaldor (1966), with the exception of Japan, and for the same period and found that  $\varepsilon_2$  was not statistically different from unity and therefore  $\varepsilon_1$  was not statistically different from zero. This author thus confirmed the hypothesis of constant returns to scale in manufacturing in the developed countries of the OECD. (8)Thirlwall (1980) criticized these results, considering that the Rowthorn interpretation of Verdoorn's Law is static, since it assumes that the Verdoorn coefficient depends solely on the partial elasticity of output with respect to employment.

### 3. DATA ANALYSIS

Considering the variables on the models of Kaldor and Rowthorn presented previously and the availability of statistical information, we used the following data disaggregated at regional level. Annual data for the period 1995 to 1999, corresponding to the five regions of mainland Portugal (NUTS II), and for the several manufactured industries in those regions. These data were obtained from the INE (National Accounts 2003).

### 4. THE LINEAR MODEL

The results obtained from the regression analysis based on panel estimation show that the original specification of Verdoorn's Law is the more robust and confirm the presence of increasing economies to scale.

### 5. CONCLUSIONS

At the level of the estimates made for the several manufactured industries, it appears that this industries have high economics dynamics.

The results from the Verdoorn equation are the most robust and statistically satisfactory and confirm the presence of increasing returns to scale.

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