ECONOMIC DEVELOPMENT AND PUBLIC EXPENDITURE IN THE GREEK ECONOMY

by

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Summary

This paper aims in constructing an econometric model in order to ascertain the relationship between public expenditure and economic development. The model used contains a system of five functions and three identities which interpret the wages, unemployment, prices, consumption and investment determination in the Greek economy. The estimates of the equations in this model were obtained by using the two - stages least squares method and the Microfit 4.0 package. Data covers the period 1961 to 2000. The sensitivity analysis was performed with the aid of the dynamic simulation model and the corresponding dynamic multipliers by using PCTSP 4.1 package.

1. Introduction

In the post war period the most permanent and important problem of all countries was economic development. The Greek economy for at least thirty and more years, experienced rapid growth in public expenditures (wages mainly) which resulted in an increase in the public deficit. The relationship between economic development and public expenditures is the problem this paper deals with. The same problem was investigated in an international level by other researchers in such as Landau(1983), Kormendi and Meguire (1985), Barro (1990, 1991), Hsieh and Lai (1994), Easaw and Garratt (2000), Dalamagas (2000).

Landau (1983) after taking into consideration all cases came to the conclusion that public expenditure and economic development are related with a negative sign. However, he left some ground for research investigating the effect of total public expenditure in economic development.

Kormendi and Meguire (1985) after taking into consideration the supply theories which emphasize in investments and production, assumed that the relationship between public expenditure and economic development is negative.

Barro (1990 and 1991) has structured a model which presents the stable return on capital (public and private) and came to the conclusion that an increase in public expenditure in non productive services will decrease the rate of the development. On the contrary, an increase in the public expenditure of productive services can increase or decrease the rate of the economic level.

Hsieh and Lai (1994) based on Barro’s model came to the conclusion that the relationship between public expenditure and economic development may vary significantly with regard to pass of time and between industrialized countries.


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Dalamagas (2000). A negative relationship between public sector and economic growth due to the increasing importance of debt accumulation deriving from government activities. In the present paper all function used are expressed in the linear form. In part 3 we present the specialization of the model used for investigation of economic development and public expenditure. The estimations of the model as well as their significance are presented on part 4. In part 5 we deal with the dynamic simulation of the model. Finally, in part 6 we summarize the main findings of the paper.

2. The interactive model

In diagram 1 we present all the system of the structural functions. It can be seen that some of these functions are dynamic and the variables show with *, public consumption (G) and total deposit (TD), are the exogenous variables used in this paper.

3. The rationale of the model


a) The average level of wages (W) depends from:

1) Gross National Product (GNP): The higher the GNP, the higher the level of wages.
2) The level of prices (P): The higher the level of prices, the higher the level of wages.
3) The level of unemployment (UNE): The higher the level of unemployment the lowest the level of wages.

According to the above, the function of wages in its linear form is expressed as follows:

\[ W_t = a_0 + a_1 GNP_t + a_2 P_t + a_3 UNE_t \]  \hspace{1cm} (1)

where: \( a_1 > 0, \quad a_2 > 0, \quad a_3 < 0 \)

b) The level of unemployment depends upon the following factors:

1) Gross National Product (GNP): The higher the GNP, the lowest the level of unemployment.
2) Total investment (I): The higher the total investment, the lowest the unemployment level.
3) The unemployment level in one period depends on the unemployment level in the previous period.

With regard to be above the unemployment function is written:

\[ UNE_t = b_0 + b_1 GNP_t + b_2 I_t + b_3 UNE_{t-1} \] \hspace{1cm} (2)

where: \( b_1 < 0, \quad b_2 < 0, \quad 0 < b_3 < 1 \)
DIAGRAM 1

The interactive model
c) The level of prices depends upon the following factors:

1) The level of wages (W): The higher the level of wages, the highest the level of prices.
2) The productivity of labor (PW): The higher the labor productivity, the lowest the level of prices.

According to the above, the function of prices is written:

$$P_t = c_0 + c_1 W_t + c_2 P_t$$  \hspace{1cm} (3)

where: \(c_1>0, \quad c_2<0\)

d) The function of consumption (C) depends upon the following factors:

1) Gross National Product (GNP): The higher the GNP, the higher the private consumption.
2) Total deposit (TD): The higher the total deposit, the higher the private consumption.
3) The consumption level in one period depends on the consumption of the previous period.

According to the above the function of consumption is written.

$$C_t = d_0 + d_1 GNP_t + d_2 TD_t + d_3 C_{t-1}$$  \hspace{1cm} (4)

where: \(d_1>0, \quad d_2>0, \quad 0<d_3<1\)

e) The investment function (I) depends upon:

1) Gross National Product (GNP): The higher the GNP the highest the investment.
2) The level of prices (P): The higher the prices the lower the investment.
3) The investment in one period depends on the investment in the previous period.

According to the above the investment function is written.

$$I_t = e_0 + e_1 GNP_t + e_2 P_t + e_3 I_{t-1}$$  \hspace{1cm} (5)

where: \(e_1>0, \quad e_2<0, \quad 0<e_3<1\)

f) The identities

In order for the model to be complete the following identities must be introduced:

Gross National product

$$GNP = C + I + G + NX + STD$$  \hspace{1cm} (6)

where: \(G = \) Public expenditure
**Labor productivity**

\[ PW = \frac{GNP}{L} \]  

(7)

where: \( L = \) labor

**Labor**

\[ L = POP - \left( \frac{POP \times UNE}{100} \right) \]  

(8)

where: \( POP = \) Population.

From the model presented just now we see that the economic policy variables are government spending and total deposits. Public expenditure is a fiscal policy variable.

4. **The estimated model**

The model of the five simultaneous functions and the three identities was assessed with the two-stages least squares method (2SLS), using the microfit 3.11 package.

The identification of the data used in the assessments is as follows:

- \( W = \) wages of labor.
- \( GNP = \) Gross national product.
- \( P = \) Price index of total domestic private consumption.
- \( UNE = \) unemployment.
- \( I = \) Gross fixed asset formation.
- \( PW = \) Productivity of labor.
- \( C = \) Private consumption.
- \( TD = \) Total deposit.
- \( G = \) Public consumption.
- \( NX = \) Net Exports.
- \( STD = \) Statistical differences including changes in stock.
- \( L = \) Number of workers.
- \( POP = \) Population.
- \( D = \) Dummy.
- \( t = \) Time trend.

The main sources of data are: National Statistical Service of Greece (N.S.S.G), Greek economy in number (ICAP), European Economy. Base year is 1970. The results of the estimation of the model through the use of the 2SLS method follow:

**The wages function:**

\[ W_t = 0.316738 + 0.71034 GNP_t + 0.89133 P_t - 0.09045 UNE_t \]  

\[ [1.2962] \quad [3.0611] \quad [2.9871] \quad [-2.0177] \]  

(9)
\[ R^2 = 0.8849 \quad \text{DW} = 1.8022 \quad F(3,35) = 27.9322 \]

A: \( X^2(1) = 2.0121 \)  
\( (0.277) \)

B: \( X^2(1) = 0.2444 \)  
\( (0.507) \)

C: \( X^2(2) = 3.1431 \)  
\( (0.144) \)

D: \( X^2(1) = 3.3282 \)  
\( (0.073) \)

E: \( X^2(2) = 4.9761 \)  
\( (0.096) \)

**The unemployment function:**

\[
\text{UNEt} = 2.0642 - 17.1281 \text{GNPt} - 0.19117 \text{It} + 0.73127 \text{UNEt-1} + 0.49190 \text{Dt} \quad (10)
\]

\[ \begin{bmatrix} 1.4287 \end{bmatrix} \quad \begin{bmatrix} -3.1655 \end{bmatrix} \quad \begin{bmatrix} -2.9822 \end{bmatrix} \quad \begin{bmatrix} 4.6388 \end{bmatrix} \quad \begin{bmatrix} 2.8733 \end{bmatrix} \]

\[ R^2 = 0.8874 \quad \text{Dh} = 1.4312 \quad F(4,34) = 103.562 \]

A: \( X^2(1) = 3.6521 \)  
\( (0.059) \)

B: \( X^2(1) = 2.1777 \)  
\( (0.185) \)

C: \( X^2(2) = 5.8745 \)  
\( (0.053) \)

D: \( X^2(1) = 0.0119 \)  
\( (0.812) \)

E: \( X^2(1) = 3.2312 \)  
\( (0.101) \)

**The prices function:**

\[
P_t = 0.127661 + 0.67339 \text{Wt} - 1.3785 \text{PWt} \quad (11)
\]

\[ \begin{bmatrix} 1.7612 \end{bmatrix} \quad \begin{bmatrix} 5.6723 \end{bmatrix} \quad \begin{bmatrix} -2.8422 \end{bmatrix} \]

\[ R^2 = 0.8912 \quad \text{DW} = 1.9044 \quad F(2,35) = 103.197 \]

A: \( X^2(1) = 0.0223 \)  
\( (0.766) \)

B: \( X^2(1) = 0.5932 \)  
\( (0.441) \)

C: \( X^2(2) = 3.4231 \)  
\( (0.307) \)

D: \( X^2(1) = 0.1234 \)  
\( (0.567) \)

E: \( X^2(2) = 1.3366 \)  
\( (0.098) \)

**The consumption function:**

\[
\text{Ct} = 0.79102 + 0.58314 \text{GNPt} + 0.095432 \text{TDt} + 0.17893 \text{Ct-1} \quad (12)
\]

\[ \begin{bmatrix} 3.7685 \end{bmatrix} \quad \begin{bmatrix} 3.4722 \end{bmatrix} \quad \begin{bmatrix} 3.7891 \end{bmatrix} \quad \begin{bmatrix} 2.9458 \end{bmatrix} \]
\[ \bar{R}^2 = 0.90765 \quad \text{Dh} = 0.9311 \quad F(3,35) = 101.103 \]

A: \[X^2(1) = 0.8411 \quad (0.477)\]
B: \[X^2(1) = 0.5823 \quad (0.407)\]
C: \[X^2(2) = 2.1345 \quad (0.238)\]
D: \[X^2(1) = 1.1238 \quad (0.176)\]
E: \[X^2(2) = 4.1732 \quad (0.092)\]

**The investment function:**

\[
I_t = -1.01712 + 1.0071 GNP_t - 0.1191 P_t + 0.14564 I_{t-1} + 0.29876 D_t \quad (13)
\]

\[
[-1.8829] \quad [16.6663] \quad [-3.1932] \quad [2.3317] \quad [1.4389]
\]

\[ \bar{R}^2 = 0.82194 \quad \text{Dh} = 1.2872 \quad F(4,34) = 142.002 \]

A: \[X^2(1) = 2.0773 \quad (0.166)\]
B: \[X^2(1) = 1.2946 \quad (0.457)\]
C: \[X^2(2) = 0.1894 \quad (0.704)\]
D: \[X^2(1) = 0.9976 \quad (0.349)\]
E: \[X^2(1) = 2.7862 \quad (0.047)\]

In the above estimates, the symbols indicate:

\[ \bar{R}^2 = \text{Coefficient of determination (corrected for the degrees of freedom)} \]
\[ \text{DW} = \text{Durbin - Watson d statistic.} \]
\[ \text{Dh} = \text{Durbin h statistic.} \]
\[ F(i,j) = \text{Statistic of distribution F for the regression.} \]
\[ A:X^2(i) = \text{Lagrange multiplier test of residual serial correlation.} \]
\[ B:X^2(i) = \text{Ramsey’s RESET test using the square of the fitted values, for equation specification.} \]
\[ C:X^2(i) = \text{Based on a test of skewness and kurtosis of residuals, for testing normality.} \]
\[ D:X^2(i) = \text{Based on the regression of squared residuals on squared fitted values, for testing heteroscedasticity.} \]
\[ E:X^2(i) = \text{Sargan’s test using the (2SLS) method.} \]

\[ [\quad ] = \text{The number in brackets under the estimated coefficients represent the T -ratios.} \]
\[ (\quad ) = \text{The number in parentheses under the diagnostic test represent the level of significance.} \]

The above estimations are generally accepted, as shown by the statistical and diagnostic tests accompanying the estimations, as well as the fact that the signs of the parameters that we
estimated coincide with the signs of the a priori restrictions we developed in the model in part 3.
Although in the following section we will present the forecasting capability of the
dynamically simulated model, we consider it advisable to point out here the average
elasticities that results from the estimations of the five functions of the model.

Table 1
Average elasticities

<table>
<thead>
<tr>
<th></th>
<th>GNP</th>
<th>P</th>
<th>UNE</th>
<th>I</th>
<th>W</th>
<th>PW</th>
<th>TD</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>0.3843</td>
<td>0.7159</td>
<td>-0.1056</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNE</td>
<td>-0.7924</td>
<td></td>
<td>-0.2473</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>0.9388</td>
<td>-0.4499</td>
<td></td>
<td></td>
<td>0.0745</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>1.2274</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>0.9386</td>
<td>-0.1562</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results presented in the above table come from the results of the structural functions. The
system of these structural functions is a dynamic one (Theil 1966, Ash - Smyth 1973, Hendry
From the data in table 1 we can see that the elasticities of all dependent variables are inelastic,
except for the consumption with respect to GNP.

5. The simulated model.

In table 2 we present the indexes of the variables of the model, which we took from the
dynamic simulation of the system of the five estimated functions and three identities through
the use of PCTSP 4.1. in this table:
CC = Correlation coefficients of actual and predicted variables.
RC = Regression coefficients of actual on predicted variables.
U = Theil’s inequality coefficient.
UM = Fraction of error due to bias.
US = Fraction of error due to different variation.
UC = Fraction of error due to difference covariation.

Table 2
Indices of dynamic simulation

<table>
<thead>
<tr>
<th></th>
<th>CC</th>
<th>RC</th>
<th>U</th>
<th>UM</th>
<th>US</th>
<th>UC</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>0.97722</td>
<td>1.01752</td>
<td>0.06412</td>
<td>0.000006</td>
<td>0.03324</td>
<td>0.96688</td>
</tr>
<tr>
<td>UNE</td>
<td>0.98441</td>
<td>1.00203</td>
<td>0.07238</td>
<td>0.000003</td>
<td>0.01021</td>
<td>0.98995</td>
</tr>
<tr>
<td>P</td>
<td>0.98499</td>
<td>0.99593</td>
<td>0.07892</td>
<td>0.000017</td>
<td>0.00389</td>
<td>0.99627</td>
</tr>
<tr>
<td>C</td>
<td>0.99962</td>
<td>0.99866</td>
<td>0.02289</td>
<td>0.00018</td>
<td>0.00213</td>
<td>0.99780</td>
</tr>
<tr>
<td>I</td>
<td>0.89998</td>
<td>1.02197</td>
<td>0.11992</td>
<td>0.00067</td>
<td>0.07496</td>
<td>0.92454</td>
</tr>
</tbody>
</table>

The indexes in table 2 show that the forecasting performance of the dynamic simulated model
is satisfactory. This may be used either for forecasts or for sensitivity analysis in various
economic policies.
Tables 3 and 4 show the dynamic multipliers % of the five endogenous variables of the
model. These multipliers came from the shocks of the exogenous variables of one year (i.e.
1962) and are equal to 5% of the real value in that year. The multipliers values are the ratios % of the dynamic solution of the simulation which came from shocking the exogenous variables with regard to the dynamic solution simulation (the solution without the shock).

### Table 3
Dynamic multipliers for 5% increase in total deposit

<table>
<thead>
<tr>
<th>Years</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean %</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>1.03267</td>
<td>1.01213</td>
<td>0.99127</td>
<td>1.01176</td>
<td>1.02134</td>
<td>-1.3834</td>
</tr>
<tr>
<td>UNE</td>
<td>0.96674</td>
<td>0.97892</td>
<td>0.99912</td>
<td>1.00548</td>
<td>1.00985</td>
<td>0.7978</td>
</tr>
<tr>
<td>P</td>
<td>0.99964</td>
<td>0.99743</td>
<td>0.99652</td>
<td>0.9970</td>
<td>1.00785</td>
<td>0.0228</td>
</tr>
<tr>
<td>C</td>
<td>0.99983</td>
<td>0.99832</td>
<td>0.99711</td>
<td>1.00843</td>
<td>1.01257</td>
<td>-0.3252</td>
</tr>
<tr>
<td>I</td>
<td>1.00563</td>
<td>1.00275</td>
<td>0.99403</td>
<td>1.00967</td>
<td>1.02805</td>
<td>0.8026</td>
</tr>
<tr>
<td>GNP</td>
<td>1.00473</td>
<td>0.99748</td>
<td>0.99023</td>
<td>1.01456</td>
<td>1.03452</td>
<td>0.8304</td>
</tr>
<tr>
<td>PW</td>
<td>0.99850</td>
<td>0.99978</td>
<td>0.99673</td>
<td>1.01654</td>
<td>1.04679</td>
<td>1.1668</td>
</tr>
<tr>
<td>L</td>
<td>1.00765</td>
<td>1.00673</td>
<td>1.00127</td>
<td>0.99858</td>
<td>0.99047</td>
<td>0.0940</td>
</tr>
</tbody>
</table>

### Table 4
Dynamic multipliers for 5% increase in public consumption

<table>
<thead>
<tr>
<th>Years</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean %</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>0.83211</td>
<td>1.27387</td>
<td>0.90155</td>
<td>1.54312</td>
<td>0.88233</td>
<td>8.6596</td>
</tr>
<tr>
<td>UNE</td>
<td>0.81337</td>
<td>1.22317</td>
<td>0.92055</td>
<td>1.35416</td>
<td>0.88713</td>
<td>3.9676</td>
</tr>
<tr>
<td>P</td>
<td>0.93058</td>
<td>1.12787</td>
<td>0.96128</td>
<td>1.23672</td>
<td>0.97014</td>
<td>4.5318</td>
</tr>
<tr>
<td>C</td>
<td>0.92445</td>
<td>1.26674</td>
<td>0.94876</td>
<td>1.34576</td>
<td>0.97412</td>
<td>9.1966</td>
</tr>
<tr>
<td>I</td>
<td>0.88745</td>
<td>1.34278</td>
<td>0.90128</td>
<td>1.56722</td>
<td>0.93412</td>
<td>12.657</td>
</tr>
<tr>
<td>GNP</td>
<td>0.92130</td>
<td>1.34128</td>
<td>0.95184</td>
<td>1.42167</td>
<td>0.98126</td>
<td>12.347</td>
</tr>
<tr>
<td>PW</td>
<td>0.94312</td>
<td>1.23566</td>
<td>0.96924</td>
<td>1.34276</td>
<td>0.98455</td>
<td>9.5066</td>
</tr>
<tr>
<td>L</td>
<td>1.34567</td>
<td>0.98764</td>
<td>1.30674</td>
<td>0.99012</td>
<td>1.24574</td>
<td>13.518</td>
</tr>
</tbody>
</table>

From tables 3, 4 presented above we come to the following:

1. The multipliers are greater (in absolute rates) when computed for the changes in public consumption than when computed for changes in total deposit.
2. The multipliers take their highest value in the first five years and then tend to their own equilibrium level in relation to time.
3. Generally, most of the multipliers reach their extreme value (positive or negative) in the first or second year after the shock and then tend smoothly to zero.

### 6. Concluding Remarks

From the econometric investigation of the estimated model we came to the following conclusions:
1. The increase of 5% in the total deposits in the first five years caused an average annual increase of 1.3834 % in wages, 0.0228 % in prices, of 0.3252 % in consumption, of 0.8026 % in investment, of 0.8304 % in gross national product, of 1.1668 % in the productivity of labor, of 0.0940 % in the number of workers and an average annual decrease of 0.7978 % in unemployment.

In this paper we use total deposits as exogenous variables. In reality, however, it is not used as purely exogenous, since the change in that variable is a result of the change in the interest rates.

2. The increase of 5% in public consumption in the first five years of 8,6596 % in wages, 3,9676 % in unemployment, 4,5318 % in prices of 9,1966 % in consumption, 12,657 % in investment, 12,347 % in GDP, 9,5066 % in labor productivity, and 13,518 % in the number of workers.

3. Generally speaking by using these two economic policy variables it is obvious from tables 3 and 4 that the public expenditure changes bring stronger effects in almost all the variables used and especially in economic development presented by GNP.

7. References


