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**Article**

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## **Euro and Technology Effects on Job Turnover in Greek Manufacturing**

**Theodore Papadogonas<sup>1</sup> and Fotini Voulgaris<sup>2</sup>**

### **Abstract**

*This paper investigates the effects of Greece's European Union (EU) accession and European Economic and Monetary Union (EMU) entry, as well as R&D intensity and industry concentration on job creation and job destruction in the Greek manufacturing sector. The study is based on firm-level economic data of 1418 firms and covers the time period from 1995 to 2004. The econometric model, besides other firm-level determinants used in similar studies, incorporates variables that capture the potential impact of EU accession and EMU entry. In addition, the effects of variables, such as R&D, size, age, exports, new investment, profitability and industry concentration ratios are examined. The study reveals that EMU has a substantial negative effect on employment growth in the Greek manufacturing sector. However, it strengthens the effect of exports, new investments in tangible assets and R&D expenditures on the creation of new work positions.*

**Keywords:** Industry study, dynamic growth, manufacturing, financial performance

**JEL classification:** C23, D21, G32, J23, L11, L6

### **1. Introduction**

Employment growth is a key measure of a country's economic performance. In Greece, for the last 20 years job destruction has been higher than job creation, leaving a net unemployment rate of approximately 10% (IMF, 2009 World Economic Outlook). The issue of unemployment is a big one also on an international level and many empirical studies so far have been undertaken on determinants of employment growth in firms. A growing number of studies have analyzed data at the firm level and have found correlations between employment growth and variables, such as size (Hall, 1987; Singh and Whittington, 1975), age (Audretsch, 1995), ownership structure (Variyam and Kraybill, 1992), research and development (R&D) activities (Hall, 1987), capital structure (Lang, Ofek and Stulz, 1996), human capital and export activities (Liu, Tsou, and Hammitt, 1999).

This study examines the effects of various factors on the employment growth of Greek firms and especially the Euro effect after the European Monetary Unification of Greece, through the use of econometric models based on panel data analysis.

The main contribution of this paper is the investigation of the Euro effect, besides

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other factors on employment growth in the Greek manufacturing sector, which has not been analyzed so far to our knowledge. The fact that firm level economic data of a very large number of Greek manufacturing firms (1418) are used enables the investigation of firm specific factors determining the employment growth. Our data are based on ICAP, the largest firm database in Greece.

Greece has experienced significant economic changes during the 1995-2004 period, following its accession to the EU and the European Economic Unification. The policy of the hard drachma affected adversely the competitiveness of the Greek industry in the years 1997-1999, followed by the stable currency effect of the single currency. This is indicated in Table 1, with the decrease of Greek exports. Furthermore, the tight fiscal and monetary policy followed in order to meet the Maastricht requirements, resulted in a substantial decrease of the inflation rate and labor cost. This resulted in an increase of GDP compared to EU, as shown in Table 2.

**Table 1: Percentage of Greek Exports**

Year	Exports of Goods (% of GDP)
1995	9.4
1996	9.4
1997	9.2
1998	8.2
1999	8.2
2000	9.3
2001	8.7
2002	7.0
2003	6.9
2004	6.6
2005	7.0
2006	7.7
2007	7.5

Source: Eurostat

**Table 2: Economic indicators for the Greek economy, 1995-2004  
(Percentage changes)**

Year	GDP Greece	GDP Euro Area (12 countries)	Inflation	Real unit labour cost
1995	2.1	-	9.0	3.5
1996	2.4	1.5	8.2	-0.6

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1997	3.6	2.6	5.4	3.4
1998	3.4	2.8	4.5	-0.6
1999	3.4	3.0	2.1	1.1
2000	4.5	3.8	2.9	-1.8
2001	4.5	1.9	3.7	0.0
2002	3.9	0.9	3.9	1.5
2003	5.0	0.8	3.4	-1.6
2004	4.6	2.1	3.0	-2.3
2005	3.8	1.6	3.5	0.2
2006	4.2	2.7	3.3	1.9
2007	4.0	2.6	3.0	-

Source: Eurostat, OECD

The hard drachma resulted in an increase in employment in Greece for the period under study, as shown in Table 3, with an average annual growth rate of 1.40 %. However, the employment in the manufacturing sector shows a decreasing trend in that period indicated by the share of manufacturing to total employment. Consequently, it is obvious that for the period under study, there is a reallocation of jobs from the manufacturing to the service sector in the Greek economy (see Table 3).

**Table 3: Employment in Greece, 1995-2004 (in thousands)**

<b>Year</b>	<b>Total (1)</b>	<b>Manufacturing (2)</b>	<b>(2)/(1)</b>
1995	3820.5	577.4	15.11%
1996	3868.3	575.3	14.87%
1997	3853.3	558.6	14.50%
1998	4023.7	585.8	14.56%
1999	4040.4	577	14.28%
2000	4097.9	571.5	13.95%
2001	4103.2	580.3	14.14%
2002	4190.2	579.2	13.82%
2003	4286.6	565	13.18%
2004	4330.5	569.7	13.16%
2004	4368.9	561.4	12.85%
2004	4452.3	561.6	12.61%
2004	4509.8	560.5	12.43%

Source: Eurostat

## 2. Theory and Empirical Findings

In the theory of the Growth of the Firm, Penrose (1959) examined the internal processes that determine a firm's rate of growth. Penrose sees the firm as a coherent administrative organization where managerial resources are critical. It is the manager's entrepreneurial skills that provide the inducement for growth and determine the rate of expansion. However, for Penrose, managers are not primarily interested in profitability per se, but in the profitable expansion of the activities of their firms. In the long run, the profitability, the survival and the growth of a firm do not depend so much on the efficiency the firm organizes its production, but on its ability to detect external opportunities and threats and align internal resources to take advantage of the expected business environment.

The neo-classical view of the firm states that profits are a necessary condition for growth and determine the rate of growth. The higher the retention rate (which is the percent of non distributed profits, calculated as one minus dividend rate), the higher the growth rate of the firm, and the higher the profitability (Net Profits over Total Assets or return on assets, symbolized by ROA) of the firm the higher the growth rate ( $g$ ), according to the equation:

$$g = (\text{retention rate}) \times (\text{return on assets}) \quad (1)$$

A comprehensive theory of the firm must be able to explain not only the incentive for firms to expand their horizontal boundaries, but also why firms within the same industry grow to different sizes and why for some firms growth is negative. The economies of scale and the stage in the life cycle of a firm do not explain the varying growth performance of individual firms. The competency approach theory places great emphasis on the entrepreneurial ability of the firm's senior management to perceive new productive opportunities and to utilize the firm's accumulated knowledge to exploit them (Rickard, 2006). According to Jovanovic's (1982) life-style model, managerial efficiency and learning by doing are the key factors for firm growth. The most efficient firms grow and survive and some of the inefficient ones do not. Jovanovic also showed that young firms grow faster than older ones and, since young firms are usually small, this confirms the negative correlation between firm size, age and growth. Based on this theory, firm size and age are considered as determinants of growth.

According to Gibrat's Law of Proportional Effect, the growth rate of a firm is independent of its current size and its past growth history. The Law has been tested in numerous studies, but the findings are conflicting. Gibrat's law fails to hold for small firms (Hart and Oulton, 1996; Audretsch, Santarelli and Vivarelli, 1999), where empirical results show that growth is inversely related to size.

There is considerable evidence that smaller firms grow faster than larger firms, not altogether surprising when smaller firms are growing from a small base. Empirical research in EU and in other developed countries has shown that small and medium sized enterprises (SMEs) play a major role in job creation and job destruction. Birch (1981) was the first one to find that large firms are no longer the major providers of new jobs for Americans, and that the bulk of new jobs has emanated from small enterprises in the USA. Gallagher and Stewart (1986), Storey and Johnson (1987), Dunne and Hughes, (1994) and Konings (1995) found similar results for the United Kingdom. Evans (1987a) found that growth declines with age.

Broesma and Gautier (1997) for Dutch manufacturing firms, and Klette and Mathiassen (1996) for Norwegian manufacturing firms, also found that employment

creation is negatively related to size and age, with newly established firms having the greatest creation rates. However, the evidence is less compelling for Germany. Wagner (1995) found that there is no dramatic job generation by small firms in Germany. Regarding Greek manufacturing, empirical findings suggest that job creation and job destruction rates are substantially higher in small firms (1-20 employees) but decrease with the size of the firm, (Voulgaris, Papadogonas and Agiomirgianakis, 2005). The large-sized firms have the lowest rates of employment growth with the medium-sized firms having rates somewhere in between. Further analysis shows that for continuing firms, job destruction rate was the highest for large firms and the lowest for the small firm class.

The empirical literature, though, indicates that firm characteristics besides size and age, may play an important role in the growth of firms. These characteristics are capital structure (Lang, Ofek and Stulz, 1996), research and development (Hall, 1987), human capital and export activities (Liu, Tsou and Hammitt, 1999).

The growth of a firm is directly connected to employment growth through job creation and job destruction. Job destruction occurs either because firms go out of business or because they reduce their workforce. In general, closing establishments represent a small share of total employment (Lee and Rudick, 2006). It is job losses at continuing business that play a more important role in aggregate employment changes. An increase in the job destruction rate in the manufacturing sector does not necessarily suggest that the economy has been less competitive. This might be the result of creative destruction with workers placed from old jobs and less efficient firms to jobs that better fit the needs of the economy. This is a natural and necessary step to economic growth making the economy more competitive in the long run. In the case of Greece, the job reshuffling is basically among manufacturing and service firms and in the manufacturing sector, from labor intensive to new technology and heavy industry firms (Voulgaris, Papadogonas and Agiomirgianakis, 2005).

Exports are an indication of competitiveness in a firm and a determinant of growth. R&D expenditures are perceived as an indicator of innovation by researchers (Wakelin, 1998; Willmore, 1992). Therefore, both must have an impact on the growth of the firm and the net job creation. However, the level of the exchange rate and its volatility will certainly affect export performance in a firm and consequently its growth.

### **3. Data and Methodology**

The purpose of this paper is to identify the factors affecting employment growth in the Greek manufacturing sector.

The period of study is of particular interest, because it allows us to evaluate the effects of Greece's European Union (EU) accession and European Economic and Monetary Union (EMU) entry on job creation and job destruction in the Greek manufacturing sector. The research is based on panel data, covering the period 1995-2004 broken down by the sub-periods 1995-99 and 1999-2004 on a sample, which includes all private firms of corporate forms (sociétés anonymes and limited liability companies), while sole proprietorships and partnerships are excluded. The database, which also contains information on financial data for those firms, in addition to the number of employees, is provided by ICAP Hellas S.A., a Greek private research company. Data was carefully treated for mergers, acquisitions, changes in legal status etc. The time span covered in

the database is from 1995 to 2004 due to lack of available reliable data before 1995. Data are on a firm level, instead of an establishment level. This causes a downward bias to job creation and destruction, because jobs created and lost by different establishments of the same firm will cancel out. However, this bias should be considered negligible for Greek manufacturing, since, as Droucopoulos and Papadogonas (1999) report, the proportion of multiplant firms to uniplant firms in Greek manufacturing is 1 to 27. As a result, our measure of job creation and destruction slightly underestimates the true magnitude of job creation and destruction.

### **Regression Analysis**

While simple OLS estimations are often used in growth research, their application on data having a cross-section and a time dimension may provide biased and inconsistent estimates. For this reason, we performed the analysis using panel data estimation techniques. In the econometric specification models, we estimated employment growth rate as a function of several independent factors.

Based on the theory and empirical findings for Greece and abroad, we hypothesized that positive effects on the employment growth of the Greek manufacturing firms are expected from the following variables:

1. Deflated sales growth taken as a proxy for activity growth. Sales are measurable and for the short run they can serve as a more practical goal versus profits which are residual and can be influenced by events beyond a firm's control. Sales also can act as a proxy for diversification, since the higher the rate of diversification, the faster the rate of growth of demand for a firm's products.
2. Relative investment (Relinv), calculated as  $(\text{gross fixed assets in year } t_1 - \text{gross fixed assets in year } t_0) / (\text{gross fixed assets in year } t_0)$  over the same ratio for the 2-digit industry where the firm belongs). This is a relative efficiency ratio and is taken as a proxy for application of new technology through new investments in fixed assets. The growth in net Capital expenditures, including machinery, equipment and buildings, embody past innovations and influence the marginal cost of production of the firm. As a result, a positive relationship between capital expenditures and firm growth is expected.
3. Leverage (Debt to Total Liabilities) measured at the base year. Financial leverage increases firm risk. Lang, Ofek and Stulz (1996) studied how capital structure affects the future growth at the firm level and found a negative relation between financial leverage and both investment intensity and employment growth. As of that, a negative relationship is expected between leverage and employment growth.
4. Two performance variables showing a firm's efforts for efficiency and profitability, namely Net Profit to Total Assets (ROI) as well as its changes between 1995-99 and 1999-2004 ( $\Delta\text{ROI}$ ). The reasoning behind those variables is that a growing firm needs additional resources, therefore, a high ROI must contribute to growth and new jobs. Additionally, these variables are expected to capture the response of firms to new conditions, and indicate that by their own efforts they can affect their job creation in the industry and the economy. According to the neo-classical



- view of the firm, profits are a necessary condition for growth and determine the rate of growth.
5. R&D intensity (R&D expenditures divided by sales) at the base year. An innovative environment (as approximated by a high R&D intensity) is expected to affect positively employment growth.
  6. Industry Herfindahl index of concentration. It is assumed that highly concentrated industries do not offer many opportunities for employment growth.
  7. EMU effect: The significant improvement in most of the macroeconomic variables of the Greek economy had as a result the meeting of the criteria for joining the EMU in 2000. This development improved the investment climate, but also removed the possibility of increasing competitiveness through currency devaluation. Using a dummy variable in an attempt to capture the EMU effect, its effect on employment growth should be regarded as indeterminate a priori, since a positive effect should be expected, if firms took advantage of the more stable economic environment, or a negative effect should be expected, if the adverse effects of reduced competitiveness dominate.
  8. The remaining independent variables were designed to examine the correlation of job creation to export activity, expected to be positive, and to age and size (measured by the number of employees), both expected to correlate negatively with the dependent variable, based on other empirical findings from the international literature.

According to Rickard (2006), it is possible that exogenous factors are in part responsible for the stochastic growth paths of firms, but the weight of academic study puts the emphasis on endogenous factors.

The model was estimated only for those firms which were active in all three years under examination (1995, 1999 and 2004), i.e. we excluded from the regression analysis firms that closed down or were created during this period, firms that underwent some merger/acquisition and firms that changed legal status. There were 1418 continuing firms in our database.

The results of the analysis are presented in Table 4 (since the White test detected the existence of heteroskedasticity, the standard errors reported below have been corrected for heteroscedasticity).

In Equation 1, we added as independent variables the products of the EMU variable with all others independent variables, in order to distinguish whether the effects of these variables have changed significantly between the two sub-periods. In the case where the product of EMU with the variable is statistically significant, the effect of the Euro is strong for the specific variable. In the case where the product sign is insignificant, the EMU effect for the specific variable is weak.



**Table 4: Determinants of Employment Growth**  
 Estimation method: Pooled EGLS with cross-section weights

	(a)	(b)
Empl	-0.0002**	-0.0002***
	(2.32)	(5.90)
Age	-0.0048***	-0.0040***
	(5.83)	(5.18)
Exports	0.0658***	0.0347**
	(3.49)	(2.62)
Relinv	0.0004***	0.0003***
	(3.468)	(3.84)
R&D	0.0942***	0.0522***
	(5.06)	(3.89)
SalesGrowth	0.0110	0.0667***
	(1.55)	(3.85)
Leverage	0.0582	0.1011**
	(1.54)	(2.28)
ROI	0.6774***	0.6303***
	(5.97)	(4.88)
$\Delta$ ROI	0.2998***	0.2154***
	(3.96)	(3.13)
Herf	0.1583	0.0141
	(0.74)	(0.65)
EMU	-0.0806***	-0.0658***
	(4.42)	(4.07)
EMU×Empl	-	0.0002***
	-	(4.68)
EMU×Age	-	-0.0004
	-	(0.75)

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EMU×Exports	-	0.0472***
	-	(5.18)
EMU×Relinv	-	0.0082***
	-	(3.28)
EMU×R&D	-	0.0520**
	-	(2.11)
EMU×SalesGrowth	-	-0.0675***
	-	(4.69)
EMU×Leverage	-	-0.1081***
	-	(2.83)
EMU×ROI	-	-0.0574**
	-	(2.18)
EMU×ΔROI	-	-0.0146**
	-	(2.15)
EMU×Herf	-	0.1591
	-	(1.27)
Adj. R-squared	0.602	0.841

Notes: \* Significant at the 10% level (two-tailed test), \*\* Significant at the 5% level (two-tailed test), \*\*\* Significant at the 1% level, (two-tailed test), t ratios are in parentheses. Standard errors are White Heteroscedasticity consistent.

As mentioned before, the model was estimated only for the firms that existed in both periods i.e. 1995-99 and 2000-04. We excluded from the analysis firms that closed or were established during those periods. As a result, the number of firms was 1418 in our database.

#### 4. Results

The variables found to affect significantly employment growth in the Greek manufacturing sector, for the first model, are:

- Negatively, as expected, *the size of the firm*, measured with the number of employees,
- Negatively, as expected, *the age of the firm*
- Positively, as expected, *the investments in new productive assets*,
- Positively, as expected, *the R&D expenditures*

- Positively, as expected, *the profitability measurement (ROI) and its changes* and
- Negatively, the effect of EMU, indicating that the adverse effects of reduced competitiveness dominated in that period, over the increase in investments and growth due to the more stable economic environment and the hard currency positive effects. It can be argued that the positive effect of the latter did not have yet enough time to develop and show their results for the period under study.

In the second model, the effects of EMU on employment growth are indicated more clearly. The product of EMU with exports suggests that the effect of exports on employment growth was strengthened by the EMU. The same holds for the new capital investments and the R&D expenditures. On the contrary, the EMU weakens the effect of the size of the firm, Sales Growth, financial leverage and profitability of the firm on its employment growth.

The difference between the two models is also the fact that all variables, except the industry concentration index and the effect of EMU on the age variable, came out as significant in the second model.

The  $R^2$  and the standard error of the variables indicate that the variables in the model explain well the variation in employment growth in the Greek manufacturing sector.

The first model could be easily used to forecast employment growth for a Greek manufacturing firm, especially in the case of large amount of data where other methods of forecasting are time consuming and cumbersome.

## 5. Conclusions

Although, overall empirical studies suggest that a firm's growth tends to follow a random walk over the long run, this paper, besides defining some factors affecting significantly the employment growth in the Greek manufacture, sheds some light on the EMU effect on the growth of those firms. This type of research for the Greek manufacturing sector, which, to the best of our knowledge, has not been done so far, reveals some interesting results.

Basically, our findings agree with those of other empirical studies abroad in line with the literature, specifically, that employment growth is positively affected by exports, new capital investments, asset profitability and R&D expenses and negatively by size and age. However, the findings also suggest that EMU has overall adversely affected employment growth. Furthermore, we found that after the EMU Greek firms became even more dependent on exports for their growth, on new investments in fixed assets and technology. Size also came out to be a significant determinant of growth after the EMU. This is explained by the fact that after EMU, Greece became part of a big unified market where firms must become competitive through new investments and application of new technology, in order to be able to export and thus survive and grow. They have to take advantage of new opportunities and sales in the global market, in order to create job positions. Small manufacturing firms show to be more competitive in the Greek manufacturing sector given their flexibility and specialization in the unified market place. Financial leverage and Sales Growth did not come out to be very significant determinants of employment growth or affected by the Euro.

According to literature, the main way in which diversified growth is accomplished is by merger or acquisition, since it offers not only a rapid increase in scale but also a wider range of growth opportunities in the future. It remains a topic for our future research to find what the situation is in the Greek manufacture and compare employment growth rates.

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