GROSS PRODUCTION VS. VALUE ADDED APPROACHES TO REGIONAL COMPARISONS OF SECTORAL GROWTH

Natalia ALDAZ*, Joaquín A. MILLÁN**

*University of Lleida, **Polytechnic University of Madrid

Abstract

This paper presents estimates of Total Factor Productivity (TFP) of 13 manufacturing sectors for the 17 Spanish regions, using both a value added approach and a gross production approach. These estimates, which cover the period 1980-1992, differ greatly, as a theoretical decomposition shows, so that the choice between them really matter, being not a mere theoretical nicety. This finding suggests that the results of most recent empirical comparisons of regional and international productivities and growth at the sectoral level, perhaps with additional explanations as human capital an so, are probably biased.

* Natalia Aldaz
Dept. of Management and Natural Resource Economics
ETSEA, Rovira Roure 157
Lleida 25198 Spain
natalia @aegern.udl.es

** Joaquín A. Millán
Dept. of Agricultural Economics
ETSIA, Ciudad Universitaria
Madrid 28040 Spain
jmillan@eco.etsia.upm.es

This research has been funded by SEC98-484 of the Spanish DGICYT.

GROSS PRODUCTION VS. VALUE ADDED APPROACHES TO REGIONAL COMPARISONS OF SECTORAL GROWTH

1. INTRODUCTION

The manufacturing sector remains as an important responsible of the Spanish economic activity. Although this importance has been falling in the last 20 years, the share of manufacturing is always over 25 per cent of the Spanish GDP. On the other side, the Spanish manufacturing sectors differ in composition among the seventeen Spanish regions (Autonomous Communities). We are concerned with the growth of 13 manufacturing sectors in the 17 Spanish regions between 1980-1992.

A considerable literature exists on productivity growth across industries. As examples, Jorgenson et al. (1987), for the United States, and Oulton and O'Mahony (1994) for the United Kingdom, use a gross production approach in the measurement of Total Factor Productivity (TFP). It is more usual the use of value added approaches. Bernard y Jones (1996a,b) in an intercountry approach and Harris and Trainor (1997) for the regional UK are examples of the value added approach. In Spain, Gumbau-Albert and Maudos (1996), Segarra and Arcarons (1999) and Pedraja et al. (1999) are recent references using a value added approach to regional comparisons of productivity. However, Goerlich and Orts (1994,1996) have underlined the differences in the estimates of sectoral TFP in the value added and in the gross production approaches, at an aggregate Spanish level.

Aldaz (1998) analyzes TFP in the food industry in Spain comparing these two approaches (gross production vs. value added). The results show that TFP mean rates following the value added approach are about three times those obtained through the production approach. This fact could be explained by the great importance of intermediate consumption (mainly rough materials) in the food industries. The importance of the intermediate consumptions in determining output growth is perhaps the rule rather than the exception. One of the fundamental findings in Jorgenson et al. (1988) is the contribution of materials to the US sectoral growth.

In an overlooked paper, Slade (1988) compares the production and the value added functions analyzing the results of different specifications of cost shares, separability and technical progress biases using Monte-Carlo simulation. Although this is not a general rule, under several usual patterns the overvaluation of TFP in the value added approach emerges clearly.

Thus, a theoretically correct measure of TFP should include all the inputs and outputs involved in the production process. Lack of data is one of the reasons behind the measurement of productivity based on the value added function. In this setting, Input-Output Tables can provide the detailed information for filling the data gaps. The other reason of productivity measurement based on the value added approach is that intermediate consumptions compensate themselves in make and use. However the way intermediate consumptions are used is not equal among sectors, as an interindustry input-output approach reveals.

In this paper we analize productivity measurement on gross production approach vs. value added approach. The empirical analysis is on Spanish manufacturing sector using a disaggregated data containing information on 13 manufacturing industries for the years 1980-92 for the 17 Spanish regions.

In Section 2 *Data* we explain the database construction. The metholodogy is sum up in Section 3. Section 4 begins by examining the rates of growth of output and inputs across regions and industries, with special attention to the two 'alternative' measures of TFP considered: by production or by value added. Section 5 presents the main conclusions.

2. DATA

Available statistic allows the building of one homogeneous database for the period 1980-92. Data follows several sources. The analysis is performed considering one output (production), and three inputs: labor, intermediate consumptions (hereafter, materials) and capital. The main source of information about output and consumptions is published at the different issues of the Industrial Survey (EI) of the National Bureau of Statistic (INE) of Spain, and capital data come from Mas et al. (1998). Sectoral agregation is conditioned by compatibility of these two sources of data. Table 1 shows the sector aggregation, with correspondences with sectors in EI and IO-85.

EI publishes by regions (Autonomous Communities) from 1978 the number of persons, the gross production, the value added, and the costs of labor; the last three variables only in current prices. Materials are calculated as the difference between production and value added. Thus, series of output and materials at current prices are available.

To build volume series we need a set of different regional price indexes (deflators) for production and materials. These deflators are obtained in a two step approach. First, we collect national deflators for output and materials for each of the 89 subsectors in EI. Price indexes for each of the sectors in EI are obtained from the Industrial Prices Indexes (base 1974) of INE. However, for the 18 subsectors of the food, drink and tobacco industries considered in EI (sectors 47 to 64), we use the price indexes directly calculated in Millán and Aldaz (1997). In this way, we have national output deflators, for each subsector in EI. Also prices for the service sectors are collected, as the deflators in the National Accounts. We use the prices for ouputs and for services and the intermediate matrix in the Spanish Input-Output Table for 1985 (TIO85) for estimating Laspeyres-like material prices at the national level. Thus, we adjust the 55 column coefficients in the intermediate matrix in TIO85 to sum-up to one. The adjusted coefficients are the weights in the computation of material prices. Due to aggregation, the same set of material deflators is calculated for some subsectors, mainly in chemicals. Again, for the 18 subsectors of the food, drink and tobacco industries, we use the directly calculated price indexes in Millán and Aldaz (1997).

In the second step, regional price indexes are estimated for each of the 13 sectors considered, aggregating the output and material national prices for each of the 89 sectors in EI, on a regional basis. The same idea about the construction of separate regional deflators, but aggregating with Laspeyre-like indexes, is used in the study directed by Alcaide (1999): 'Renta Nacional de España y su distribución provincial'. The approach followed in this paper means that the different production structure in each region is instrumental in the estimation of different price indexes for output and materials for each sector and region. Information about the published variables at the most disaggregated 89 industrial sectors at a regional level, was provided by INE in diskette. We use the different regional structures in output and materials and the national prices by means of the translog price formula, in the estimation of regional price indexes. Using the estimated price indexes, we have outputs and materials series in volume and in value for the 13 sectors and the 17 regions for the period 1980-1992. The years 1978 and 1979 have been excluded due to the poor quality of the regional subsector information.

It is irrelevant the period chosen as a basis in the presentation of the deflators and the volume series because we are not interested in this paper in interregional comparisons. We have arranged our data with base period for prices in 1986.

EI publishes regional information by sectors on number of persons and labor costs. Because a preferable measure of labor is number of hours worked, this information has been requested to INE, and provided in diskette, distinguishing between paid and unpaid labour. Thus we have for each sector and region the number of hours worked by paid and unpaid labor, and the cost of paid labor. The cost of unpaid labor is priced at the ratio of cost of paid labor and the number of hours of paid labor. Not further correction for labor quality is possible with the data basis we use. We use the labor data with price indexes based in 1986 and quantities in 1986 prices.

Mas et al. (1998) publish series of regional (by Autonomous Communities) capital stock (KS) at constant prices for the different sectors. Using the implicit deflator for investments in the same source, we calculate current capital stocks (VK). The flows of capital services are valued in an ex ante approach, following VSK= VK (r+d), being r the long-run interest rate, and d the depreciation rate for each sector. An alternative view is considering the cost of capital as a quasi-rent, in an ex post perspective. This choice is preferable on an accounting basis, but there is a problem with negative estimates for some regions and years. Although some averaging is possible in order to fix this problem, we perform the analysis with the ex ante approach. We calculate implicit price indexes of capital services by dividing VSK by KS, and normalize the obtained price indexes with base 1986. Then, the flows of capital services in constant terms are estimated dividing VSK by the normalized price indexes.

In this way, we have obtained regional quantities of gross production and three inputs at 1986 prices and the corresponding price indexes. We have value added at current prices from our original source (EI), but we need deflators for value added.

In principle, the correct approach is the aggregation over the price indexes for labor and capital. However, this is unclear because capital price could be estimated ex ante (as in this paper) or ex post. Van Ark (1996) has used simple deflation, using the deflator for gross production, with the idea that output price involves the ‘competitiveness’, fundamental in any productivity analysis. However, this reinforces the argument of the gross production approach to sector productivity. In this paper, the more usual procedure of double deflation has been used. Again, deflators are based in 1986.

3. METHODOLOGY

The main methodological tool consists of a production function for each industry with output expressed as a function of capital, labor, and materials inputs and the level of technology. The production function for the *i*th industry gives the quantity of output, say *Yi*, as a function of the primary inputs, capital services, *Ki*, and labor services, *Li*, the intermediate inputs (materials), *Mi,* and the level of technology, Ai*,* where all inputs are measured as service flows rather than stocks:

$$Y_i=g(A_i,L_i,K_i,M_i) \quad (1)$$

We first describe growth accounting. As in most of the literature, the Solow residual μ, the measure of TFP growth, is calculated using the translog index :

$$\mu_t = \log_e(Y_t/Y_{t-1}) - \Sigma_j \, 0.5\,(w_{jt}+w_{jt-1}) \log_e(X_{jt}/X_{jt-1}) \quad (2)$$

where Y is output, X_j is input j (Xj=L,K,M), w_j is the cost share of input j ($\Sigma_j w_{jt}=1$), and the subscript t refer to time period. Each of the addends under the sumatory represents the particular contribution of input j to growth.

An aggregate production function gives GDP as a function of aggregate capital and labor inputs, so that intermediate inputs – goods produced by one sector and sold to another – are excluded. The aggregate value added function is

$$V=g(A,L,K) \quad (3)$$

where *V* is real, aggregate value-added, *K* is capital services, *L* is labor input.

A sectoral value added function takes the form

$$V_i=g(A_{vi},L_i,K_i) \quad (4)$$

TFP growth is now calculated as

$$\mu_{vt} = \log_e(V_t/V_{t-1}) - 0.5\,(s_{Lt}+s_{Lt-1}) \log_e(L_t/L_{t-1}) - 0.5\,(s_{Kt}+s_{Kt-1}) \log_e(K_t/K_{t-1}) \quad (5)$$

where s_j is the share of input j in primary input cost ($s_L+s_K=1$).

Equations (2) and (5) define industry-level productivity growth in terms of industry gross output or in terms of industry value added. Clearly μ_t and μ_{vt} differ, and A_i and A_{vi} are also different. The gross production approach has an advantage in providing an explicit role for intermediate goods in allocating economic growth, and in identifying the sources of growth at the industry level. This provides a more detailed understanding of the forces driving aggregate trends.

Slade (1988) analyses the biases in the measurement of TFP when the value added approach is followed at the sectoral level. The conclusions of Monte-Carlo experiments under several assumptions on substitution, separability, and technical change, indicate that errors are larger when input substitutability is easier, when technical change is materials using or when materials price growth is relatively lower. Econometric work is needed in the analysis of the first two explanations. However, materials price increases below of wages in many sectors, and the third explanation suggest than overvaluation of TFP growth is expected using the value added approach.

4. RESULTS

First of all, we remark the considerable differences in sectoral composition among the 17 Spanish regions, as shown in Table 2. The main region is Catalonia which produce about 25 per cent of the total gross production (mean for the whole period 1980-92), mainly due to Food production, Textile and Chemical. Other three regions produce over 10 per cent Madrid, Valencia and Basque Country. Andalucia and Castilla León shares are above 5 per cent the remaining regions produce less than 5 per cent each of them. FDT is the main sector in 9 of the 17 regions, with a remarkable 43.6 per cent in Rioja. In other three regions (Canary Islands, Extremadura and Castilla-Mancha) FDT ranks second behind energy sectors. Energy production also ranks first in Asturias and is very important in several other regions. There are other important sectors for particular communities: Basic Metal in Asturias, Transport equipment in Aragón and Castilla-Leon, and Chemical in Catalonia. Madrid presents the more diversificated industrial structure, being printing first, sharing 15.9 per cent of regional production.

Table 3 shows the production shares and the growth of input as an translog aggregate and output. As we can see, two northern regions (Rioja and Navarra) exhibit rates of growth for gross production higher than 4 per cent. There are output increases in all regions, except Asturias and Extremadura, where input use decreases as well. Input decreases also in Canary Islands, Cantabria, Murcia and Basque Country, at a rate lower than 1 per cent per year.

In Table 4, we present the share of value added, and the growth of output and input for each Spanish region. So, it is possible to appreciate the differences considering production or value added. Focusing in shares, the mean values do not differ a lot between production and value added. However, in a year by year analysis, differences are larger than in the average. This fact have as a consequence that we cannot distinguish between more value added and less value added oriented regions. As an example, the shares in production and in value added in 1992 are in the contrary order than in average for two main industrial regions, Catalonia and the Basque Country.

There is a fundamental difference with gross production concerning trends in output and input use and productivities. As we can see in Table 4, value added increases in all regions except in Extremadura, and primary inputs use decreases. In the gross production approach, input evolution presents a more variate pattern due to trends in materials.

Now, we focus in sectoral data. Table 5 shows the average results for the whole period. As we have commented, *FDT (S9)* and *Energy (S1)* are the main sectors based on production, and both together represents about 44 per cent of total production. Two sectors, *Metal (S2)* and *Textiles (S10),* have decreased output production, being *Paper & Printing (S11)* and *Rubber & Plastics (S12)* the sectors with a greatest growth of output in the period analysed. Considering value added, Table 6 shows that *FDT (S9)* diminishes its share when compared with production, leading *Energy (S1)* to the first position. *Chemical (S4), Fabmetal (S5) and Machinery (S6)* decrease value added, in addition to the sectors in gross production.

TFP indexes have been calculated, following the methodology explained in section 3. Tables 7 and 9 present the decomposition of gross production growth by region and by sector, respectively. The same for value added growth in Tables 8 and 10. In both approaches (production and value added) the average rate of growth of TFP is positive for all regions. The average rate of growth is 1.2 per cent per annum with the production approach, whereas this rate is 3.3 per cent per annum considering value added. It seems clear that an overvaluation of TFP growth appears considering the value added function instead of the gross production function. TFP growth following the value added approach is more than double in all regions except in Extremadura, the region with lesser TFP growth in any approach.

On a regional characterisation, and following the production approach, Cantabria has the greatest rate of TFP growth, being 2.2 per cent per year, followed by Rioja (2 per cent). We are interested in knowing the input contribution to growth, particularly, the materials contribution. As Table 7 shows, for ten regions and in average, materials is the main contributor to growth. Capital contribution is almost negligible, labour contribution is negative for all regions, and TFP is an important contributor to growth in several regions. It is remarkable in Table 8 that TFP growth is larger than output growth following the value added approach. In addition to the theoretical limitations of the value added approach, the main empirical result lacks of an intuitive appeal.

On the other side, the same overvaluation of TFP rates in the value added approach applies to sectoral growth, for all the 13 sectors considered. One sector (*Fabmet S5*) presents a negative TFP rate of growth with the production approach whereas a slightly positive rate with the value added function. Gross production growth is due to both TFP growth and input growth. TPF is more important for sectors *Energy (S1), Nomet (S3), Machinery (S6),* and *Other (S13).* On the other side, input growth is the main contributor to growth in sector *Chemical (S4), Fabmet (S5), Electrical (S7), FDT (S9), Paper (S11)* and *Plastics (S12).*

5. CONCLUSIONS

This paper presents an industry and region decomposition of aggregate growth for the Spanish manufacturing sector from 1980 to 1992. The results show industry evolution on a regional basis is a heterogeneous process that is impossible to capture in a single pattern. This empirical fact is critical with simple explanations of economic growth based on the developments of individual industries.

First, we have compared the results based in gross production and value added approaches to productivity growth. This comparison is important in both the level of measured TFP growth, as Slade (1988) has investigated, and in the qualitative implications about growth patterns. As an example, Basu and Fernald (1997) show that the evidence for economies of scale (Hall, 1988) or spillovers (Caballero and Lyons, 1992) disappears treating capital, labor, and intermediate inputs in a gross production approach, instead of only primary inputs in a value added approach.

We prefer the results with the gross production approach for theoretical reasons and because they explicitly state the possibility of differences in intermediate purchases as a determinant of sectoral growth. The results presented also highlight the wide variation among industries and regions. From one perspective, sectoral variation is not surprising since the different industries produce different outputs and respond differently to evolving technologies. However, the differences among regions within a particular sector must be explained. Perhaps, the result is partly due to differences in subsectoral composition, but more probably, the results reflect real differences in the state of the technology among regions. This point must be emphasized because an assumption in most equilibrium studies of regional and international trade is the equality of technology.

Moreover, there are difficulties in interpreting TFP growth as true ‘technical progress’ when it reflects such disparate trends within regions. Perhaps an analysis of differences in the state of productivity (efficiency) within regions is needed. Whatever the case, the heterogeneity among industries and regions suggests that the aggregate production function masks important sectoral and spacial growth differences. The analysis of regional productivity provides not only more data to the empirical analysis, but also evidence of a more complex pattern in the driving forces in economic growth.

A fruitful next step will be the identification of industry differences across regions. The analysis of regional data within a country reduces the difficulties in international comparisons due to different currencies, but there are remaning aggregation problems, such as differences in composition of both primary and intermediate inputs. A closer look at regional differences in interindustries activities seem promising in explaining differences in the sectoral evolution of regional manufacturing.

6. REFERENCES

Alcaide, J. (dir.) (1999): *Renta Nacional de España y su distribución provincial. Serie homogénea. Años 1955 a 1993 y avances 1994 a 1997*. Fundación BBV. Bilbao.

Aldaz, N. (1998): "Productividad en la industria alimentaria de las Comunidades Autónomas Españolas." III Congreso Nacional de Economía Agraria. Lleida. Spain.

Ark, B. van (1996): "Productivity and competitiveness in manufacturing: a comparison of Europe, Japan and the United States", 23-52, in Wagner, K and van Ark, B (eds) *International productivity differences: measurement and explanations.* North-Holland, Amsterdam.

Basu, S., and Fernald, J.G. (1997): "Returns to Scale in U.S. Production: Estimates and Implications." *Journal of Political Economy*, 105(2), 249-83.

Bernard, A. and Jones, C. (1996a): "Productivity across industries and countries: time series theory and evidence." *Review of Economics and Statistics*, 78(1), 135-46.

Bernard, A. B. and Jones, C.I. (1996b): "Comparing apples to oranges: Productivity convergence and measurement across industries and countries." *American Economic Review*, 78(1), 1216-38.

Caballero, R. J.and Lyons, R.K. (1992): "External Effects in U.S. Procyclical Productivity." *Journal of Monetary Economics*, 29(2), 209-25.

Goerlich, F.J. and Orts, V. (1994): "Margen precio-coste marginal and economías de escala en la industria española: 1964-1989" *Revista de Economía Aplicada*, 6(vol. 2), 29-53.

Goerlich, F.J. and Orts, V. (1996): "Economías de escala, externalidades and atesoramiento de trabajo en la industria española, 1964-1989" *Revista de Economía Aplicada*, 11(vol. 4), 151-166.

Gumbau-Albert, M. and Maudos, J. (1996): "Eficiencia productiva sectorial en las regiones españolas: Una aproximacion frontera." *Revista Española de Economia*, 13(2), 239-60.

Hall, R. E. (1988): "The Relation between Price and Marginal Cost in U.S. Industry." *Journal of Political Economy*, 96(5), 921-47.

Harris, R.I.D. and Trainor, M. (1997): "Productivity growth in the U.K. regions, 1968-91" *Oxford Buletin of Economics and Statistics*, 59(4), 485-509.

Jorgenson, D.W. , Gollop, F. and Fraumeni, B. (1987). *Productivity and U.S. Economic Growth*. North- Holland. Amsterdam.

Mas, M., Pérez, F. y Uriel, E. (1998): *El stock de capital en España y su distribución territorial*. Fundación BBV. Bilbao.

Millán, J.A. and Aldaz, N. (1997): "Productividad en la industria alimentaria: un análisis sectorial." *Investigacion Agraria. Economia*. 12, 61-87.

Oulton, N. and O'Mahony, M. (1994): *Productivity and growth: A study of British industry, 1954-1986*. Cambridge University Press. Cambridge.

Pedraja, F., Ramajo, J. and Salinas, J. (1999): "Eficiencia productiva del sector industrial español: un análisis espacial and sectorial. " *Papeles de Economía Española,* 82, 51-68.

Segarra, A. and Arcarons, J. (1999): "Economías externas en la industria española. Un análisis regional, 1980-1992" *Revista de Economía Aplicada*, 19(vol. 7), 31-60.

Slade, M. E. (1988): "Value-Added Total-Factor-Productivity Measurement: A Monte-Carlo Assessment", 809-30, in Eichhorn, Wolfgang (ed.): *Measurement in economics: Theory and applications of economic indices.* Physica-Verlag. Heidelberg.

Solow, R.M. (1957). "Technical Change and the Aggregate Production Function." *Review of Economics and Statistics*, 39, 312-320.

Table 1. Sector Aggregation.

	Name	Description	EI	R44
S1	Energy	Energy and water	1-8	03, 05, 07, 09, 11
S2	Metal	Basic metal industries	9, 10, 11	13
S3	Nomet	Non-metallic minerals&products	12 - 18	15
S4	Chem	Chemicals	19 - 30	17
S5	Fabmet	Metal Products	31 - 35	19
S6	Machinery	Machinery	36, 37, 40, 46	21, 23
S7	Electrical	Electrical	38, 39	25
S8	Transport	Transport	41 - 45	27, 29
S9	FDT	Food&drink&tobacco	47 - 64	31, 33, 35, 37, 39
S10	Textiles	Textiles&Clothing	65 - 74	41, 43
S11	Paper	Paper&Printing	80, 81, 82	47
S12	Plastics	Rubber&Plastics	83, 84	49
S13	Other	Other manufacturing	75-79, 85-89	45, 51

Table 2 Sector composition of manufacturing, by regions (%). 1992

	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**
ANDALUCIA	19.3	5.6	6.8	7.7	3.5	1.5	1.8	6.8	36.3	3.6	3.2	1.2	2.7
ARAGON	12.5	2.5	4.3	4.4	6.0	4.8	6.8	29.3	14.8	3.9	5.5	2.6	2.6
ASTURIAS	35.3	29.0	6.1	2.3	4.9	1.0	0.4	3.7	12.9	0.4	2.4	0.1	1.5
BALEARIC ISLANDS	23.6	0.0	7.6	0.6	5.1	0.3	0.3	0.9	32.6	11.4	4.1	1.1	12.2
BASQUE COUNTRY	12.0	18.1	3.7	5.4	14.5	8.0	7.1	7.2	7.3	1.1	6.2	5.9	3.5
CANARY ISLANDS	37.6	0.2	9.4	1.7	2.1	0.2	0.2	1.7	35.3	0.2	6.3	2.1	3.0
CANTABRIA	7.3	11.1	6.1	13.3	13.9	1.0	6.5	6.0	24.7	2.5	2.4	4.1	1.1
CASTILLA LEON	16.2	1.3	5.0	5.4	3.4	1.2	0.7	28.7	24.3	2.5	3.4	4.8	2.9
CASTILLA MANCHA	30.2	0.7	9.3	11.4	3.2	2.1	3.3	1.3	25.4	6.1	1.7	1.2	4.0
CATALONIA	9.3	1.2	4.0	17.6	6.0	3.8	5.8	11.0	18.2	9.7	7.3	4.3	1.9
EXTREMADURA	47.6	0.2	4.0	0.5	4.7	0.7	0.7	0.1	34.8	2.2	1.1	0.6	2.9
GALICIA	21.8	5.3	6.9	4.3	3.1	1.3	1.5	20.1	22.9	3.6	2.6	1.5	5.2
LA RIOJA	5.8	0.5	5.3	2.5	9.9	2.2	2.7	5.4	43.6	8.2	4.6	4.7	4.6
MADRID	7.7	2.8	4.9	13.2	5.8	6.2	9.1	12.5	11.6	4.3	15.9	2.8	3.1
MURCIA	23.0	1.7	4.9	5.4	6.7	1.8	0.4	1.8	35.1	7.1	3.0	2.6	6.3
NAVARRE	4.3	9.9	5.6	2.9	7.6	4.3	6.5	22.9	19.3	1.6	8.5	3.6	3.0
VALENCIA	10.1	1.4	12.3	5.6	5.0	4.6	0.9	14.1	15.0	13.5	4.5	4.6	8.4

Table 3. Input and output growth, by regions. Production. 1980-1992

Region	Share	Rates of growth Input	Output
ANDALUCIA	0.080	0.010	0.022
ARAGON	0.042	0.019	0.031
ASTURIAS	0.032	-0.009	-0.001
BALEARIC ISLANDS	0.007	0.011	0.019
BASQUE COUNTRY	0.128	-0.006	0.006
CANARY ISLANDS	0.012	-0.002	0.006
CANTABRIA	0.016	-0.004	0.018
CASTILLA LEON	0.060	0.011	0.025
CASTILLA MANCHA	0.031	0.011	0.028
CATALONIA	0.252	0.009	0.020
EXTREMADURA	0.007	-0.007	-0.005
GALICIA	0.049	0.013	0.022
LA RIOJA	0.010	0.029	0.049
MADRID	0.117	0.022	0.039
MURCIA	0.019	-0.001	0.010
NAVARRE	0.028	0.027	0.044
VALENCIA	0.110	0.025	0.035
mean		0.009	0.022
Weighted average		0.011	0.023

Table 4. Input and output growth, by regions. Value added. 1980-1992

ccaa	Share	Rates of growth Input	Output
ANDALUCIA	0.079	-0.007	0.035
ARAGON	0.040	-0.007	0.030
ASTURIAS	0.036	-0.026	0.000
BALEARIC ISLANDS	0.008	-0.011	0.006
BASQUE COUNTRY	0.131	-0.025	0.010
CANARY ISLANDS	0.010	-0.005	0.020
CANTABRIA	0.017	-0.030	0.012
CASTILLA LEON	0.063	-0.012	0.026
CASTILLA MANCHA	0.029	-0.004	0.041
CATALONIA	0.249	-0.013	0.018
EXTREMADURA	0.008	-0.015	-0.012
GALICIA	0.049	-0.008	0.022
LA RIOJA	0.010	-0.002	0.035
MADRID	0.125	-0.013	0.024
MURCIA	0.017	-0.012	0.028
NAVARRE	0.027	-0.005	0.043
VALENCIA	0.103	-0.002	0.030
Mean		-0.012	0.022
Weighted average		-0.012	0.022

Table 5. Input and output growth, by sectors. Production. 1980-1992

			Rates of growth	
		Share	**Input**	**Output**
S1	Energy	0.203	0.003	0.040
S2	Metal	0.071	-0.035	-0.020
S3	Nomet	0.056	0.001	0.009
S4	Chem	0.062	0.008	0.013
S5	Fabmet	0.061	0.020	0.018
S6	Machinery	0.029	-0.001	0.001
S7	Electrical	0.034	0.018	0.020
S8	Transport	0.083	0.031	0.052
S9	FDT	0.236	0.012	0.023
S10	Textiles	0.060	-0.020	-0.011
S11	Paper	0.039	0.034	0.055
S12	Plastics	0.027	0.043	0.062
S13	Other	0.040	0.004	0.016

Table 6. Input and output growth, by sectors. Value added. 1980-1992

			Rates of growth	
		Share	**Input**	**Output**
S1	Energy	0.208	0.004	0.114
S2	Metal	0.052	-0.036	-0.003
S3	Nomet	0.073	-0.007	0.014
S4	Chem	0.060	-0.024	-0.005
S5	Fabmet	0.074	-0.007	-0.005
S6	Machinery	0.035	-0.024	-0.017
S7	Electrical	0.041	-0.007	0.001
S8	Transport	0.078	-0.008	0.052
S9	FDT	0.191	-0.004	0.045
S10	Textiles	0.065	-0.037	-0.009
S11	Paper	0.045	0.009	0.065
S12	Plastics	0.031	0.006	0.053
S13	Other	0.049	-0.017	0.011

Table 7. Decomposition of production growth, by regions. 1980-1992

	Materials	Labor	Capital	Production	TFP
ANDALUCIA	0.013	-0.005	0.002	0.022	0.012
ARAGON	0.022	-0.006	0.003	0.031	0.012
ASTURIAS	0.003	-0.011	-0.001	-0.001	0.009
BALEARIC ISLANDS	0.018	-0.009	0.002	0.019	0.008
BASQUE COUNTRY	0.004	-0.010	0.000	0.006	0.012
CANARY ISLANDS	0.003	-0.008	0.003	0.006	0.007
CANTABRIA	0.009	-0.012	-0.002	0.018	0.022
CASTILLA LEON	0.016	-0.007	0.003	0.025	0.013
CASTILLA MANCHA	0.013	-0.006	0.004	0.028	0.016
CATALONIA	0.015	-0.008	0.002	0.020	0.010
EXTREMADURA	0.000	-0.008	0.002	-0.005	0.002
GALICIA	0.016	-0.005	0.002	0.022	0.009
LA RIOJA	0.031	-0.004	0.002	0.049	0.020
MADRID	0.028	-0.008	0.003	0.039	0.016
MURCIA	0.004	-0.007	0.002	0.010	0.011
NAVARRE	0.029	-0.004	0.002	0.044	0.017
VALENCIA	0.027	-0.004	0.003	0.035	0.009

Table 8. Decomposition of value added growth by regions. 1980-1992

	Labor	Capital	Value added	TFP
ANDALUCIA	-0.013	0.006	0.035	0.042
ARAGON	-0.015	0.008	0.030	0.037
ASTURIAS	-0.024	-0.002	0.000	0.027
BALEARIC ISLANDS	-0.016	0.006	0.006	0.017
BASQUE COUNTRY	-0.024	0.000	0.010	0.035
CANARY ISLANDS	-0.014	0.009	0.020	0.025
CANTABRIA	-0.026	-0.004	0.012	0.042
CASTILLA LEON	-0.019	0.007	0.026	0.038
CASTILLA MANCHA	-0.015	0.011	0.041	0.045
CATALONIA	-0.019	0.006	0.018	0.032
EXTREMADURA	-0.018	0.004	-0.012	0.003
GALICIA	-0.014	0.006	0.022	0.030
LA RIOJA	-0.009	0.007	0.035	0.037
MADRID	-0.021	0.008	0.024	0.037
MURCIA	-0.017	0.006	0.028	0.040
NAVARRE	-0.011	0.006	0.043	0.048
VALENCIA	-0.010	0.008	0.030	0.032

Table 9. Decomposition of production growth, by sectors. 1980-1992

		Materials	Labor	Capital	Production	TFP
S1	Energy	0.001	-0.003	0.005	0.040	0.037
S2	Metal	-0.022	-0.012	-0.001	-0.020	0.015
S3	Nomet	0.004	-0.009	0.005	0.009	0.009
S4	Chem	0.017	-0.005	-0.004	0.013	0.004
S5	Fabmet	0.024	-0.007	0.003	0.018	-0.002
S6	Machinery	0.012	-0.014	0.001	0.001	0.002
S7	Electrical	0.023	-0.010	0.005	0.020	0.001
S8	Transport	0.037	-0.002	-0.004	0.052	0.021
S9	FDT	0.013	-0.002	0.001	0.023	0.011
S10	Textiles	-0.005	-0.016	0.001	-0.011	0.009
S11	Paper	0.031	-0.002	0.005	0.055	0.021
S12	Plastics	0.042	-0.003	0.004	0.062	0.019
S13	Other	0.012	-0.011	0.002	0.016	0.012

Table 10. Decomposition of value added growth, by sectors. 1980-1992

		Labor	Capital	Value added	TFP
S1	Energy	-0.006	0.010	0.114	0.075
S2	Metal	-0.033	-0.003	-0.003	0.033
S3	Nomet	-0.019	0.012	0.014	0.021
S4	Chem	-0.014	-0.010	-0.005	0.018
S5	Fabmet	-0.014	0.007	-0.005	0.002
S6	Machinery	-0.028	0.005	-0.017	0.006
S7	Electrical	-0.020	0.013	0.001	0.008
S8	Transport	-0.003	-0.004	0.052	0.059
S9	FDT	-0.009	0.006	0.045	0.049
S10	Textiles	-0.039	0.002	-0.009	0.028
S11	Paper	-0.004	0.013	0.065	0.055
S12	Plastics	-0.006	0.012	0.053	0.047
S13	Other	-0.023	0.006	0.011	0.028