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Abstract

Testing for the existence of internal and external economies in Egyptian manufacturing industries can help defining an active targeted industrial policy promoting long-run growth. The Caballero and Lyons (1989) methodology has been used to disentangle external from internal economies in a production function at the two-digit level. Our findings suggest that on average in both public and private manufacturing sectors, the returns to scale are constant and that the externalities are non-existent. But some industries should deserve special attention, generating positive externalities: Chemicals, Mineral and Engineering industries in the public sector; Food and Textile industries in the private sector.

Introduction

Theoretical literature dealing with increasing returns and externalities is abundant, especially within the framework of endogenous growth. Though, empirical literature lags behind, specially for developing countries.

The internal and external economies are most likely to be found in the manufacturing sector, which has a strong capacity to generate them through several channels: investments in R&D, leading to the differentiation of products (Romer, 1990), improvement in quality of products (Grossman and Helpman, chap 4, 1991; Aghion and Howittt, 1992); investment in human capital and in learning-by-doing (Lucas 1988; Young 1993). The existence of internal and external economies is of big concern, and has several implications. According to the endogenous growth theory, their presence insures a positive growth rate in the long run (Romer, 1986). It can also explain why some countries grow faster than others, and why in this context, there is no absolute convergence (Barro and Lee, 1993). Finally, their presence in some sectors and not in others induces an asymmetry between sectors and in this context the specialization is not neutral on growth. There will be "good" and "bad" specializations, and they will tend to self-reinforce over time through cumulative mechanisms linked to learning effects (Krugman 1987; Lucas 1988; Young 1991).

Testing for the presence of increasing returns and of externalities in Egyptian manufacturing seems particularly relevant for two main reasons. First, the economy has known many positive shocks that have induced a Dutch disease, that is, a relative decline in the size of the manufacturing sector. This reaction is really a disease and not an optimal adjustment if the manufacturing sector generates some cumulative effects such as dynamic externalities (van Winjbergen 1984). In such a case, a decline in the relative size of the sector, even temporarily, will have some irreversible effects on growth. Second, the signature of the Association Agreement with the European Union implies a total removal of trade barriers in Egyptian manufacturing until 2012. Or, the presence of internal and/or external economies in any given sector should lead theoretically to protect this sector (Krugman 1984). The existence of such a case could be problematic as for the choice of the path of liberalization in the concerned activities.

The paper is organized in five sections. Section I outlines the theoretical bases of the production function regressions found in the literature. Section II describes the Caballero-Lyons (1989) methodology for finding externalities. Section III presents the data. Section IV presents the results; and our conclusions are presented in Section V.

I. Production Function Regressions Found in the Empirical Literature

A number of recent papers have used simple linear regressions in an attempt to identify the extent of returns to scale, and possible external effects in US and European manufacturing industries.

The pioneer of this line of research was Hall (1988, 1990), who however only considered economies internal to the firms or sector, not externalities. The role of economies of scale and of externalities have been investigated by Caballero and Lyons (1989, 1990, 1992) who have modified the production function tested by Hall, by disentangling internal from external economies. They study the determinants of manufacturing output growth at the sectoral (two-digit) level. In essence, their method is to regress the growth of sectoral output on two variables, the growth of sectoral input and the growth of some higher level aggregate, such as aggregate output or input into manufacturing. A significant coefficient on aggregate output or input is interpreted as evidence of an externality associated with the expansion of manufacturing as a whole. A coefficient on sectoral input greater than one is taken as evidence for the presence of increasing returns which are internal to the sector under study. They find that in US and European manufacturing sectors, internal returns to scale at the sectoral level seem on the whole to be unimportant, but they find external returns to be large and significant. As far as the U.S. manufacturing is concerned, their latest estimates (1992) suggest that a 1 percent expansion of aggregate manufacturing input raises sector level output by between 0.32 percent and 0.49 percent, holding sector input constant. As for the European manufacturing, their estimates (1990) indicate that a 1 percent expansion of aggregate manufacturing input raises sector level output by 0.26 percent in Germany, 0.88 percent in France, 0.26 percent in U.K. and 0.48 percent in Belgium. The models and results of Hall and Caballero and Lyons have been criticized on many points.

First, since they use annual data, the alleged externality seems to operate at business cycle frequencies and to be identical with the phenomenon of procyclical productivity. Second, some authors such as Abott et al. (1988), Burnside, Eichenbaum and Rebelo (1995a) argue that the explanation is measurement error: changing utilization rates of labor and capital over the cycle are not fully reflected in their data and this mimics the effects of externalities. However, Caballero and Lyons (1992) tackle this problem and show that after controlling for labor hoarding and for variation in utilization of capital, the externalities are lower but still positive and highly significant. They conclude then that increasing returns and unmeasured factor utilization tied to own-activity are not complete explanations for aggregate procyclical productivity: externalities matter. Unmeasured effort variation accounts however for about half of the measured external effect.

A more radical criticism is that of Basu and Fernald (1995a), who argue that the Caballero and Lyons results are due to the use of inappropriate data, which are on value added basis. They apply the same estimation methods to data on gross output in two-digit industries (those used by Jorgenson-Gollop-Fraumeni (1987)), and they find little evidence of productive spillover to output but strong evidence that internal returns to scale are approximately constant. They show that regressions with value-added are misspecified, and after correcting for these misspecifications, they find, even with value-added data, that external effects are small or nonexistent and returns to scale are about constant. Though, Bartelsman *et al.* (1994) used gross output production functions as well and they found positive and significant externalities at the four digit-level coming from aggregate (of the other four-digit industries) input use. An earlier (1991) version of their paper indicates that most of the externalities are coming from other two-digit industries, not from within the same industry group. Hence, Basu and Fernald (1995) recognize that the difference in results is not explained simply by externalities at the four-digit level that would have been internalized at the two-digit level. But they remain skeptical about the Bartelsman *et al*. results for three main reasons. First, the four-digit data on intermediate inputs does not include business services, which have become increasingly important over time. This omission could show up as an external effect. Second, labor would be underweight relative to capital in the Bartelsman *et al*. data, so that measured productivity becomes more cyclical than true productivity. Finally, the sample period differs. When Basu and Fernald have estimated their basic gross-output regression on the same sample they have reached hardly the same results that Bartelsman *et al*. But Basu and Fernald discount this finding because it is highly sensitive to the estimation technique used. Albeit Basu and Fernald are quite skeptical about the short-run results of Bartelsman *et al*., they find their long-run supplier-driven externalities interesting and potentially important. And they are the ones that matter for the long-run growth.

Burnside (1996) argues that all the previous regressions may have been misleading for two other reasons. First, most regression-based evidence is obtained by imposing cross-industry equality restrictions on parameters. Unfortunately, in almost every case, these restrictions are strongly rejected when tested. In some cases, restricted estimates tend to be upwardly biased relative to various summary statistics for unrestricted estimates. Second, external effects regressions are particularly sensitive to the instrument set. This is argued to be the result of both the instruments and the measure of the external effects being highly correlated with aggregate business cycle dynamics. The second objection seems to us irrelevant concerning the regressions of Caballero and Lyons (1989, 1990). Bound, Jaeger and Baker (1993) argue that instrumental variables regression with weak instruments can lead to a great bias in small samples, and that the cure can be worse than the disease. Hence, they prefer uninstrumented estimates.

This paper attempts to apply the Caballero and Lyons models to Egyptian two-digit manufacturing data. We will also take the main criticisms into account. Gross output instead of value-added data will be used, a capacity utilization correction will be made on capital input and the parameters will be allowed to vary across the industries. The following section presents the detailed theoretical background to Caballero-Lyons analysis.

II. The Caballero-Lyons Method for Finding Externalities

The starting point of Caballero and Lyons (1989, 1990, 1992) investigations is the model of Hall (1988), in which he has tested for the presence of increasing returns in U.S. manufacturing. Caballero and Lyons argue that if external economies are present, then the estimates of increasing returns will be upward biased. They modify Hall's model in order to disentangle internal from external economies. Instead of using a value-added production function, we will use here a gross-output production function, following Basu and Fernald (1995a) and Oulton (1996) specifications, respectively for U.S. and U.K. manufacturing.

We begin with the following production function for the *i*th industry (Oulton, 1996):

$$Y_{it} = G^i(K_{it}, L_{it}, M_{it}, Z_t, t) = e^{(\delta_i Z_t + \theta_{it} t)} F^i(K_{it}, L_{it}, M_{it}) \qquad (1)$$

where Y is gross output (not value added), K is capital, L is labor, M is intermediate input (energy, materials, business services, etc.), Z is an index of externalities, and t is time, which proxies as an index of technological progress. θ_{it} can be interpreted as the growth rate of total factor productivity (TFP). The production function G^i is assumed to be homogenous of degree γ_i in capital, labor and intermediate input. γ_i is thus the degree of internal returns to scale. The model is somewhat restrictive in that the elasticity of scale γ_i and the effect of externalities δ_i are assumed constant over time. However, neither input shares nor TFP growth are necessarily assumed constant over time.

Logarithmically differentiating (1) with respect to time, letting lower case letters denote the natural logarithms of the corresponding upper case letters, we obtain:

$$dy_{it} = G^i_K \frac{K_{it}}{Y_{it}}.dk_{it} + G^i_L.\frac{L_{it}}{Y_{it}}.dl_{it} + G^i_M.\frac{M_{it}}{Y_{it}}.dm_{it} + \delta_i dz_t + \theta_{it}$$

where $G^i_J = \frac{\partial G^i}{\partial J_{it}}$, is the marginal product of input J.

Now assume in addition that firms have some degree of monopoly power in the goods markets, though they are price-takers in factors markets. Assume also that all factors are freely variable. Under these assumptions, firms hire inputs up to the point where the marginal revenue product of each input equals the input price that is to say where marginal revenue equals marginal cost. Then we can write:

$$dy_{it} = \gamma_i \left[c_{Kit} dk_{it} + c_{Lit} dl_{it} + (1 - c_{Kit} - c_{Lit}) dm_{it} \right] + \delta_i dz_t + \theta_{it},$$

where γ is the ratio of average cost to marginal cost (= marginal revenue). Under monopolistic competition, this parameter can also be interpreted as the price-cost margin, the ratio of price to marginal cost, since price equals average cost in this market setting. And c_{Jit} are the shares of input J in total cost of industry i,:

$$c_{Jit} = \frac{P_{Jit} J_{it}}{C_{it}}, \quad J = K, L$$

and

$$C_{it} = P_{Kit} K_{it} + P_{Lit} L_{it}$$

where $P_{Kit} = r_{it}$ is the rental price of capital, and $P_{Lit} = w_{it}$ is the wage rate. The cost shares for all three inputs must add to one. Defining the growth of total input x as the cost-share-weighted average of the growth of individual inputs:

$$dx_{it} \equiv \left[c_{Kit} dk_{it} + c_{Lit} dl_{it} + (1 - c_{Kit} - c_{Lit}) dm_{it} \right],$$

we can finally write:

$$dy_{it} = \gamma_i dx_{it} + \delta_i dz_t + \theta_{it} \qquad (2)$$

The equation to be estimated, based on (2), but modified in various ways for empirical purposes, is as follows:

$$\Delta y_{it} = \alpha_{0i} + \alpha_{1i} \Delta x_{it} + \alpha_{2i} \Delta z_t + \varepsilon_{it}, \qquad i = 1,\ldots,N; \qquad t = 1,\ldots,T \qquad (3)$$

The growth rate of TFP has been absorbed into the constant term α_{0i} and the error term ε_{it}. For empirical purposes, discrete growth rates replace continuous ones and the index of input growth is a Törnqvist one, where the weights are the arithmetic average of the shares at the beginning and the end of each period. The specification is fairly general since the degree of returns to scale and the effects of externalities are allowed to differ across industries. The externality index is taken by Caballero and Lyons to be the growth of aggregate output. But this gives rise to econometric difficulties, since we cannot expect that the error term will be independent of the changes in aggregate output. The reason is that a random shock to technology in any industry will raise output in that industry, and consequently aggregate output. However, as they have shown, it is possible to replace aggregate output by aggregate input, which is not vulnerable to this criticism.

Aggregating (3) across industries,

$$\Delta y_t = \frac{\left[\alpha_0 + \alpha_1 \Delta x_t + \varepsilon_t \right]}{(1 - \alpha_{2i})}$$

where:

$\alpha_0 = \sum_i w_{it} \alpha_{0i}$, and w_{it} the set of appropriate weights ($\sum_i w_{it} = 1$),

α_1 is the cross-industry mean of α_{1i},

$\Delta x_t = \sum_i w_{it} \Delta x_{it}$ (aggregate input), and

$\varepsilon_t = \sum_i w_{it} \varepsilon_{it} + \sum_i (\alpha_{1i} - \alpha_1) w_{it} \Delta x_{it}$. The second summation can be neglected if N is large and if, as seems likely, $w_{it} \Delta x_{it}$ is uncorrelated with the deviation of α_{1i} from its mean.

Substituting in (3), we find:

$$\Delta y_{it} = \alpha'_{0i} + \alpha_{1i} \Delta x_{it} + \alpha'_{2i} \Delta x_t + \varepsilon'_{it} \qquad (3')$$

where in particular $\alpha'_{2i} = \left[\frac{\alpha_{1i} \alpha_{2i}}{(1 - \alpha_{2i})} \right]$.

However, though this solves the problem of correlation between the error term and aggregate output growth in (3), there may still be a correlation between the error term in the revisited equation (3') and the other independent variable, Δx_{it}. The reason is that a shock to output will change (presumably usually increase) the demand for an industry's own inputs. Instrumental variables (IV) are a possible solution here. All the authors have used the set of IV discussed by Hall (1988) and that are: the growth rate of real military expenditure, the political party of the president, and the growth rate of the world price of crude petroleum in dollars. But as Bound *et al*. (1993) have stressed, the use of instruments that are only weakly correlated with the endogenous variables can be worse than the disease. Using such IV lead to two problems. First, using potential instruments that explain little the variation in the endogenous explanatory variables can lead to large inconsistencies of the IV estimates even if only a weak relationship exists between the instruments and the error in the structural equation. Second, in finite samples, IV estimates are biased in the same direction as ordinary least square (OLS) estimates. The magnitude of the bias of IV estimates approaches that of OLS estimates as the R^2 between the instruments and the potentially endogenous explanatory variable approaches 0. Caballero and Lyons (1989) have calculated that the inconsistency in OLS estimates is likely to be small in this context. Finally, all the instruments seem not very relevant in the case of Egypt, such as the dummy variable concerning the party of the President. That is why we won't use this instrumental variable in our regressions.

III. The Data

The data employed in this paper are the two-digit level *Annual Industrial Output Statistics* published by the CAPMAS. They cover the establishments having more than ten employees. The sample covers the period 1970-1997 for the nine two-digit ISIC, revision 2 industries. The nine industries are the following (their ISIC code in brackets): Food, beverage and tobacco (31); Textile, leather and footwear (32); Wood and its products (33); Paper and its products, editing (34); Chemicals, rubber and plastics (35); Non-ferrous mineral industries (36); Basic metals, iron and steel (37); Engineering (38); Non elsewhere classified industries (39). The data distinguish the public from the private sector for all the variables and over all the period.

The dependant variable is the growth rate of the industry's real gross output at factor cost (the deflators are the appropriated industry-level producer price indexes). The independent variables are the Törnqvist indexes of input growth rate and externality, the latter being measured as the growth of aggregate inputs. All growth rates are log differences, and the weight for calculating the Törnqvist indexes are arithmetic average of the shares at the beginning and at the end of each period (one year). The capital input index is the growth rate of the real net capital stock. Labor and intermediate inputs are Törnqvist indexes, build up from respectively two and six components.

Total fixed capital input comprises for the public and the private sectors three types of assets: plant and machinery, building and vehicles. The net real capital stocks for each type of assets were calculated from gross investment by the perpetual inventory method, over the period 1957-1997. Taking a benchmark (Harberger (1978) methodology) stock in 1957 reduces the measurement error close to null in 1970. The depreciation rates are assumed constant all over the period. We have calculated the depreciation rate for each type of capital input from the data published in the second volume of the *Unified Accounting System* by the Egyptian Ministry of Planning (1995). The nominal values of the different capital components, as well as their price indexes are published by CAPMAS, in the *Economic Indicators Survey.* A capacity utilization correction has been made on the capital input. Following Bartelsman *et al*. (1991), and Abott *et al.* (1988), we have constructed an index of capacity utilization for each industry based on the ratio of hours per workers to peak hours in that industry. The real net capital stock is then multiplied by this rate to proxy the capital utilization. Finally, the capital input is defined as the growth rate of the capacity utilization adjusted real net capital stock.

In order to weight the capital input index into the total input index, we need to calculate the cost of capital. This cost is for each capital input, the real net capital stocks times the rental prices of capital, where the latter vary across both asset types and industries. They take account of depreciation, and are calculated in the same way than Christensen and Jorgensen (1969):

$$r_t = \rho_t p_{t-1} + \delta p_t - \left(p_t - p_{t-1}\right),$$

where for each capital input at time *t*, *r* is the rental price, *p* the capital input price index, δ the depreciation rate, and ρ the rate of return of capital. Christensen and Jorgenson (1969) argue that the best rate of return is the internal nominal rate of return specification. But this specification can lead to negative rental prices. Harper, Berndt and Wood (1990) have compared and evaluated five alternative capital rental price formulas depending on the rate of return specification. Their findings suggest that at least three viable alternatives to the standard nominal internal rate of return specification are available, of which a constant external rate. We have calculated rental prices with both internal and constant external rate of return specification, the latter having been fixed at 13 percent (following the average discount rate all over the period).

Labor inputs are measured by hours worked and distinguish between white and blue-collar workers. These different labor inputs are weighted together by the appropriate wage rates to form total labor input for each industry of the public and the private manufacturing sector. Hours worked are published yearly by the CAPMAS in its *Statistics on Employment, Wages, and Work Time.*

The *Annual Industrial Output Statistics* distinguish for six components of intermediate inputs: raw materials, packaging, fuel, electricity, spare parts and business services. The total intermediate inputs index is the weighted average of each component growth rate, the weights being the arithmetic average of the shares of each component in total intermediate inputs at the beginning and the end of the period. Each intermediate input is deflated by the appropriate industry-level producer price indexes.

The aggregate input index is the weighted average growth rate of capital, labor and intermediate inputs indexes. The weights are the arithmetic averages of the shares of each component in total cost at the beginning and the end of the period. We have two different ways of weighting the capital input: the capacity utilization corrected real net capital stock index can be weighted either by the rental price based on internal or external rates of returns. This leads to two different measures of aggregate input index.

The externality index is, for each industry, measured in two different ways: as growth of total manufacturing inputs ($\Delta z1$), and as growth of other industries' inputs (inputs of the considered industry are not included, $\Delta z2$).

IV. The Results

The results to be presented were estimated in different steps. We first constrained the coefficients of equation (3') to be the same across industries. Then, we relaxed this assumption. Different tests on the estimations have been performed. The unconstrained results appear to be econometrically better. Third, we searched for the presence of internal and external economies at the aggregate manufacturing level. Finally, we analyzed the industries at the sources of the externalities in the public and the private sectors.

IV.1- The Constrained Model

We check first for industry specific fixed effects, but they turn out to be insignificant. That means that the production of each industry is not determined at all by unobservable specific factors at this industry. The production of each industry is determined by some common observable factors, captured by the input and the externality indexes.

To estimate the coefficients of these factors, we could use OLS to test the constrained equation (3'), that is with a single constant term, and the degree of economies of scale and the effect of externalities being constrained to be the same in all industries ($\alpha_{1i} = \alpha_1$ and $\alpha'_{2i} = \alpha'_2$, all *i*). But in this model, a positive shock to output, whether coming from the demand or the supply side, will tend to raise inputs, so Δx_{it} will be positively correlated with the error term in (3'). In such a case, an econometric problem arises, that is, the correlation of equation errors, leading to a contemporaneous correlation specification bias. Separate runs of OLS may ignore factors in the error term, which affect all of the equations. The Seemingly Unrelated Regression (SUR) estimator is then the appropriate one, since it generates contemporaneous correlation (and heteroskedasticity as well) consistent standard errors and covariance.

We test equation (3') with both OLS and SUR estimators. Then, we use the Hausman (1978) specification test to see to what extent SUR is better than the OLS specification. This test relies on the comparison of the parameter of primary concern yielded by two alternative procedures leading to consistent estimates under the null hypothesis (no specification error) and diverging ones under the alternative. Under the hypothesis of no specification error, both b, the least squares estimator, and b_{sur}, the SUR estimator, are consistent estimators, although least squares is efficient whereas the SUR estimator is inefficient. But if the hypothesis is false, only b_{sur} is consistent. The test then examines the difference between b and b_{sur}. Under the null hypothesis, plim(b- b_{sur})=0.

The Hausman test is:

$$(b - b_{sur})'[V - V_{sur}]^{-1}(b - b_{sur})$$

where V and V_{sur} denotes the generalized inverse of the variance-covariance matrix of respectively the vector b and b_{sur}. Under the null hypothesis, this statistic is distributed χ^2 with degrees of freedom equal the rank of the variance-covariance matrix. The results of this test are reported in Table 1. The null hypothesis is rejected in almost all the cases. The SUR estimator is then the best one.

The SUR estimates of the constrained model are shown in Table 1. The six columns represent different measures of the own and aggregate input indexes (c.f. the note 1 at the bottom of the table). The estimates are quite robust, since the R^2 is around 0.75 for the public sector and 0.83 for the private one.

Consider first the coefficient on the industries' own input growth Δx_{it} (α_1). In the public sector, this coefficient is always significantly greater than one, and ranges between 1.25 and 1.30. A value greater than one implies increasing returns to scale, at least, on average across industries. This result is quite robust even when the externality index is suppressed (columns (5) and (6)). In the private sector, we find no evidence of increasing returns. When Δx_i and Δz are weighted by cost of capital based on external rate of return (columns (1), (2) and (6)), α_1 is significantly lower than 1, implying decreasing returns to scale. When Δx_i and Δz are weighted by cost of capital based on internal rate of return (columns (3), (4) and (7)), α_1 is not significantly different from 1. The result is more conform to what is in the literature. This result could help us to discriminate between the different index measures, and allow us to say that measures of Δx_i and Δz as weighted by the cost of capital based on the internal rate of return are the best ones.

Turning to the impact of externalities, the only significant coefficient in the public sector is negative. It is based on the growth rate of total manufacturing inputs index, weighted by the internal rate of returns. In the private sector, the three significant coefficients are positive. In that sector, α'_{2i} ranges in size from 0.09 (internal weighted) and 0.13 (external weighted). In the public sector, its value is –0.17. In other words, an expansion of 1 percent of aggregate manufacturing or other industries' (public or private) inputs is predicted to increase output by between 0.09 and 0.13 percent in the private sector, and to decrease it by 0.17 percent in the public sector, holding industry inputs constant. From α'_{2i}, we can deduct $\alpha_{2i} = \alpha'_{2i} / (\alpha'_{2i} + \alpha_{1i})$ which reflects the impact of total manufacturing *output* growth on each industry's production (c.f. equation (3)). The impact of total manufacturing output expansion is not quite the same as total manufacturing inputs expansion.

The results concerning externalities are not quite robust though, being somewhat sensitive to the measurement method. The externalities tend to be negative in the public sector and positive in the private sector. As for the public sector, the fact that the expansion of manufacturing as a whole might handicap the individual industries may reflect the problem of resource allocation in a context of shortage and State intervention. They may also be interpreted in terms of market and demand size, which would be too small in Egypt; an expansion of an industry, instead of pushing the others, would hamper their expansion. In the private sector, the supply conditions are different. The economic environment is much more competitive on the products market and inputs are not allocated by industries, but offered and demanded on the market; that is, the economic environment is closer to the standard competitive conditions. On the demand side, the conditions are quite the same for both sectors. Positive externalities in the private sector would suggest that complementarities are stronger than exclusions between industries.

We shall wonder which are the best estimates among those presented in the four first columns of Table1. The J-Test proposed by Davidson and MacKinnon (1981) provides one method of choosing between two non-nested models. The idea is that if one model is the correct model, then the fitted values from the other model should not have explanatory power when estimating that model. For example, to test model H1 against model H2, we first estimate model H2 and retrieve the fitted values. Then we estimate model H1 including the fitted values from model H2. If the fitted values from model H2 enter significantly in model H1, we reject model H1. We must also test model H2 against model H1, doing the same. We have applied this test to the four different alternatives. The results, presented in Table 2, show that econometrically, there is no possible discrimination between all the different input and externality index measures.

In the course (sequence) of the paper, we will not present the unconstrained results for all the four cases. We can see from the previous analysis that for the private sector at least, the internal weighted measure was economically better than the external one. This measure gives also lightly best fitted results in the public sector (compare the R^2). But the main reason to keep this measure is that rental price based on internal rate of return specification is the one recommended by the literature. Now, in order to discriminate between the two measures of Δz (columns (3) and (4)), we can also refer to the R^2 and prefer then the expansion of aggregate manufacturing inputs to the expansion of other industries' inputs. This measure is also the one used in the literature on externalities. We have introduced the second externality index to avoid a multicollinearity problem between the own input and the externality indexes. Or, the choice of the externality index has no impact on the rate of internal returns. $\Delta z2$ has then no major interest.

The results corresponding to these choices (column 3, Table 1) tell us that at the 2-digit level, there are no externalities neither in the public nor in the private sectors. In the former, the rate of return is increasing (1.30), it is constant in the latter (0.98).

IV.2- The Unconstrained Model

Let's turn now to unconstrained estimates. Table 3 presents the results of the F-tests for different levels of constraints. For our four measurement alternatives, we have tested the totally constrained model ($\alpha_{1i} = \alpha_1$, $\alpha'_{2i} = \alpha'_2$, all i) against: first, the totally free model (α_{1i} and α'_{2i} unconstrained); second the model constrained on α_{1i}; third, the model constrained on α'_{2i}.

For all the alternatives and for both public and private sectors, the F-tests show that the totally free model is better than the constrained one, the p-values being widely farther than the critical value rejecting the null hypothesis of equality of the coefficients across industries.

The model constrained on α_{1i} only is rejected in the private sector and accepted in the public sector, for the four measurement alternatives.

The model constrained on the α'_{2i} has less clear results. It is rejected in the public sector in the four cases. It is rejected as well in the private sector when the weighting is based on the internal rate of return, but accepted when it is based on the external one.

We won't present the entire unconstrained models, but only the totally free one, which is the only one better than the constrained model for both the public and the private sectors.

From the previous discussion, we will work only with Δx_i and $\Delta z1$,weighted by cost of capital based on internal rate of return. The SUR estimates of the unconstrained model are presented in Table 4.

We observe first that the estimates are better fitted than in the constrained model, since the R^2 is 0.81 and 0.85 for respectively the public and the private sectors. Let's analyze the results in the public sector first.

The unconstrained model shows that the internal rates of return are constant in five out of nine industries, these are: food, beverage and tobacco (31); Textile, leather and footwear (32); Paper and printing (34); Non-ferrous mineral industries (36); and Basic metals (37). The rates of return are decreasing in the Chemical, rubber and plastics (35) industries. They are increasing in the Wood (33), Engineering (38) and Others (39) industries.

The bottom of Table 4 displays summary statistics. The median internal rate of returns is 1.05, the average one is 1.15 and the weighted (share of the industry in gross output) average is 0.96[1]. These results indicate that in the unconstrained model, the internal rates of return are constant at the two-digit level. This result is quite different from the constrained model, where we found increasing internal rates of return (c.f. bottom of Table 3). Constraining the model leads then to misleading results, rejected by the F-test.

As for externalities, they turn out to be significantly positive in Food, beverage and tobacco (31) and Chemical, Rubber and Plastics (35) industries. They are significantly negative in Paper and Printing (34); Non-ferrous mineral (36) and Engineering (38) industries. The summary results show no evidence of significant externalities at all, which conforms to the results obtained in the constrained model.

Let's turn now to the private sector. The internal rates of return are constant in four out of nine industries, namely in Wood (33), Basic Metals (37), Engineering (38) and Others (39) industries. They are increasing in Textile, leather and footwear (32) and in Paper and printing (34) industries. They are decreasing in Food, beverage and tobacco (31); Chemicals, Rubber and Plastics (35) and Non-ferrous mineral (36) industries. We can note that the results concerning the food industry are very ill fitted, and the internal rates of return are very low. Given the important share of this industry in the private sector over the period (27 percent), this poor result affects the weighted average $\tilde{\alpha}_1$, which turns out to be decreasing. When removing this sector, the weighted average rates of return are constant, just as the simple average. As for the unconstrained model, we conclude that the internal returns are constant on average in the private sector at the two-digit level, though varying greatly across industries.

The externalities are significantly positive only in the food industry (31), and significantly negative in the textile industry (32). In all the other industries, there is no evidence of externalities. The summary results show that on average there are no externalities in the private sector at the two-digit level.

[1] This low weighted average mean is due to the low internal rates of return in Food and Chemical industries, the share of which is important in the total public manufacturing sector (refer to Appendix 1).

To sum up, the unconstrained model gives the same result on average as the constrained one, except for the internal rates of return in the public sector. The results are then quite robust. The main and strong conclusion is that globally, there is constant returns to scale and no externalities in the public and private sectors at the two-digit level. We should turn now to what happens at the aggregate manufacturing level.

IV.3- Returns to Scale at the Aggregate Manufacturing Level

The results found previously concern the two-digit manufacturing level. The model presented in equation (3') allowed indeed the disentangling of internal from external economies at the two-digit level. It is now interesting to see to what extent the externalities are internalized at the aggregate manufacturing level.

We proceeded in two steps. First, we tested the degree of internal returns from a production function at the aggregate manufacturing level for both public and private sectors. Here we do not take account of the presence of externalities. The results are presented in part A of Table 5. Second, we took account of externalities and we calculated the internal returns at the aggregate level from the production function at the two-digit level. This reveals how economies that are external at one level become internal at higher levels of aggregation.

At the two-digit level, the production function is given by equation (3). Aggregating (3) across industries, we obtain:

$$\Delta y_t = \frac{[\alpha_0 + \alpha_1 \Delta x_t + \varepsilon_t]}{(1-\alpha_{2i})}$$

Where α_{2i} is deducted from α'_{2i} as follows:

$$\alpha_{2i} = \alpha'_{2i} / (\alpha'_{2i} + \alpha_{1i})$$

We have aggregated from the unconstrained two-digit level production functions those estimates that were found to be econometrically better. The results are presented in part B of Table 5.

From a theoretical point of view, if externalities are present and significantly positive, the estimates of internal return yielded by the aggregate production function (part A of Table 5) included an upward bias. If external diseconomies prevail the sign of the bias is reversed.

At the aggregate level, the internal returns turn out to be constant in both the public and the private sector. The estimates are well fitted, the R^2 being 0.85 and 0.83 for the public and the private sectors respectively.

When taking account of externalities, we have to interpret the results cautiously, because we don't know the significance of the coefficients. We can postulate than when the coefficient α_1 turned out to be significant (insignificant) at the two-digit level, they can be considered as significant (insignificant) as well at the aggregate manufacturing level. Hence, we find also constant returns in both public and private sector when aggregating from the two-digit level.

The results at the aggregate level are coherent with the fact that no externalities have been found at the two-digit level.

IV.4- Sources of Externalities

Till now, we have worked with an aggregate index of externalities. Its coefficient allowed us to test the presence of externalities coming from the expansion of global manufacturing input or output. We have found that on average, there were no externalities at the two-digit level. Some industries of the public and private sector are not benefiting from the manufacturing sector expansion yet, as analyzed in the section IV.2.

What is important in the matter of industrial policy is to identify the industries at the sources of the externalities. If an industry generates positive externalities, it can be a source of long-run growth, and special attention should be given to it, such as subventions. These industries should also be temporarily protected from internal competition. On the other side, if an industry generates negative externalities, its expansion is a nuisance for the overall manufacturing sector and the economy in general.

One way of analyzing the sources of the externalities, is to break down the aggregate externality index in its different components, that is in the different industries inputs. The externality index $\Delta z1$ is the growth rate of the manufacturing sector (public or private) as a whole. If in equation (3'), we replace $\Delta z1$ by the sum of each industry input growth index, the coefficient associated to each individual index will reflect the level of externalities generated by this industry. We can rewrite the equation (3') as follows:

$$\Delta y_{it} = \alpha''_{0i} + \alpha_{1i}\Delta x_{it} + \sum_{k=31}^{39} \alpha''_{2ik}\Delta x_{i(t-1)} + \varepsilon''_{it} \qquad (4)$$

The production of each industry is determined by its own inputs, with the associated internal returns α_{1i}, and by the sum of the industry specific input growth index of the precedent period. We instrumented the specific industry externality index by its lagged value in order to avoid a problem of multicollinearity with the own input index. The externality level is determined for each industry by the coefficient α''_{2ik}, i representing the concerned industry, and k indexing the industries associated to the externality individual indexes.

Equation (4) has been SUR estimated in two ways: First, the coefficients α''_{2ik} have been constrained to be equal across all i. Second, this assumption has been relaxed. In both alternatives, the coefficients α_{1i} have been constrained to be the same. The F-test indicated that for both public and private sectors, the constraint on α''_{2ik} model was to be rejected. The estimates of the unconstrained model on α''_{2ik}, are presented in Table 6. The summary statistics are displayed in Table 7.

The results of Table 6 show to what extent the different industries generate externalities in the others. The results of Table 7 describe what happens on average at the two-digit level. Let's start with the public sector.

Significant positive externalities are generated by the Food industry in the Wood industry (1.41) and engineering (0.49); by Wood industry in basic metals industry (0.29); by Chemicals industries in textile (0.22), paper (0.43), and other industries (1.06); by Mineral industries in food industry (0.20) and in themselves (0.57); by Basic metals industry in engineering industries (0.15); by Engineering industries in food (0.31), textile (0.36) and mineral industries (0.47); by Other industries in wood (0.28), paper (0.15), mineral (0.28) and engineering (0.15) industries.

Significant negative externalities are generated by the Food industry in textile industries (-0.49); by Textile industries in themselves (-0.38) and in other industries (-1.37), by Paper industries in food (-0.37), wood (-0.98), paper (-0.44), mineral (-1.03) and engineering (-0.47) industries.

But on the average (and weighted average as well), no industry displays significant positive or negative externalities in other industries at the two-digit level in the public sector (Table 7).

Even so, a particular attention should be given to the industries generating positive externalities at the individual level, and especially the food, chemicals and engineering industries. The expansion of these industries has a positive impact on some other industries' growth. On the contrary, the expansion of industries like textile and especially paper have a negative impact on several industries. Their expansion has a cost in terms of growth.

In the private sector, the industries generating significant positive externalities are more diversified. The Food industries' expansion induce growth in themselves (0.32), textile (0.13), chemicals (0.19), basic metals (0.50) and other industries (0.29). The Textile industries' expansions have a positive impact on their own growth (0.29), on wood (0.59) and other industries (0.48). Paper industries generate positive externalities on wood (0.45) and other industries (0.35); Chemical industries on basic metals industries (0.34); Mineral industries on engineering industries (0.23); Basic metals industries on wood (0.11) and mineral (0.07) industries; other industries on themselves (0.15).

Negative externalities are generated by the following industries: Food industries in wood industries (-0.67); Wood industries in textile (-0.08) and mineral (-0.14) industries; Paper industries in chemicals industries (-0.12); Chemicals industries in textile (-0.13) and wood (-0.32) industries; mineral industries on food (-0.27) and other industries (-0.26); basic metals industries on food (-0.01) and themselves (-0.22); Engineering industries on basic metals industries (-0.30); and other industries on basic metals industries (-0.15).

Even, if as in the public sector, no industry's expansion induce significant other industry's expansion/recession at the two-digit level in the private sector, it remains that some industries' expansion have a positive impact on growth, specially the food and textile industries in the private sector. There is no special industry identified to generate strong negative externalities, as paper in the public sector. The results tell us that in the private sector, the expansion of chemicals and heavy industries (from 36 to 38) induce a shrinking in light industries such as food and textile. Or those industries are generating positive externalities in several kinds of industries, so their contraction is not good for the private manufacturing growth. Maybe, the private sector should accentuate its specialization in the food and textile industries and leave the chemicals, mineral, basic metals and engineering to the public sector, where moreover the generated externalities are positive in these industries.

Conclusions

After having presented the debate around the Caballero and Lyons modeling of externalities, we have tested for the presence of internal and external economies in Egyptian public and private manufacturing. We have taken into account the criticisms made by different authors on the Caballero and Lyons models. We have estimated a gross production function, and not a value added one. We have corrected the capital input of capacity utilization and we allowed the parameters to vary across industries.

Our preferred results show that there are on average constant returns to scale, and no significant externalities in the public and private sectors at the two-digit and aggregate manufacturing level. The economic implication of these results is quite important since they imply that the endogenous growth theory is not pertinent to the Egyptian manufacturing sector as a whole.

But at the industry level, the things are different, since some industries have non-constant returns to scale and enjoy non-null externalities. In the public sector, five out of five industries display constant returns to scale: Food, beverage and tobacco (31); Textile, leather and footwear (32); Paper and printing (34); Non-ferrous mineral industries (36); and Basic metals (37). The rates of return are decreasing in the Chemicals, rubber and plastics (35) industries. They are increasing in the Wood (33), Engineering (38) and Others (39) industries. The Food, beverage and tobacco (31) and Chemicals, Rubber and Plastics (35) industries are benefiting from the expansion of the public manufacturing sector. On the contrary, the production in Paper and Printing (34); Non-ferrous mineral (36) and Engineering (38) industries is declining when the whole public manufacturing sector expands.

In the private sector, the internal rates of return are constant in four out of nine industries, namely in Wood (33), Basic Metals (37), Engineering (38) and Others (39) industries. They are increasing in Textile, leather and footwear (32) and in Paper and Printing (34) industries. They are decreasing in Food, Beverage and Tobacco (31) as well as in Chemicals, Rubber and Plastics (35) and Non-metallic Mineral (36) industries. The externalities are significantly positive only in the Food industry (31), and significantly negative in the Textile industry (32).

The industries displaying increasing returns to scale should be given special attention according to the endogenous growth theory, being a source of long run growth.

When pushing the analysis further, towards the industries at the sources of non-null externalities, it appears that the public and the private sector should specialize in the industries generating positive externalities. The public sector should especially focus on Chemicals, Rubber and Plastics; Non-ferrous minerals; and Engineering industries. The private sector should concentrate specially on lighter industries such as Food, Beverage and Tobacco and Textile, Leather and Footwear.

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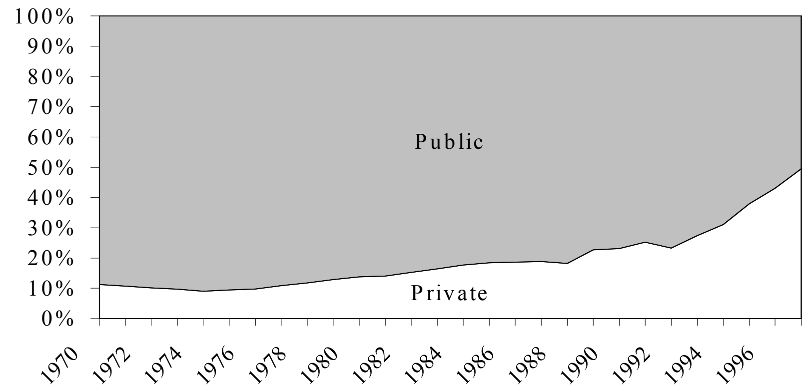
Appendix: Structure of Manufacturing Sector in Egypt, 1970-1997.

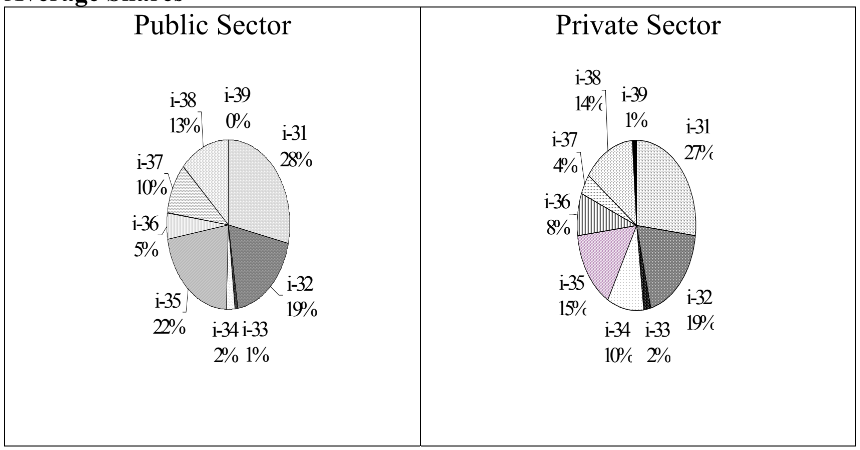
Figure 1: Share of Public and Private Sector in Egyptian Manufacturing Value-Added



S

ource: Author's Calculation from CAPMAS Data

Figure 2: Structure of Gross Manufacturing Production, 1970-1997, Average Shares



Source: Author's Calculation from CAPMAS Data

Table 1: SUR estimates of Eq (3'), Nine Sets of Equations. Constrained Model: $\alpha_{1i} = \alpha_1$, $\alpha'_{2i} = \alpha'_2$, all i. Dependant Variable Δy_{it} .

	External Rate Weight $\Delta z1$ (1)	External Rate Weight $\Delta z2$ (2)	Internal Rate Weight $\Delta z1$ (3)	Internal Rate Weight $\Delta z2$ (4)	External Rate Weight (5)	Internal Rate Weight (6)
Public Sector						
Constant	-0.012*	-0.015*	-0.016*	-0.019*	-0.017*	-0.021*
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
α_{1i}	1.27*	1.25*	1.30*	1.29*	1.25*	1.29*
	(0.038)	(0.035)	(0.040)	(0.036)	(0.034)	(0.034)
α'_{2i}	-0.166***	-0.061	-0.122	-0.058		
	(0.098)	(0.077)	(0.094)	(0.070)		
$\alpha_{2i}=\alpha'_{2i}/(\alpha'_{2i}+\alpha_{1i})$	-0.15	-0.05	-0.10	-0.05		
R^2	0.750	0.747	0.753	0.751	0.75	0.75
Hausman						
Specification Test:						
OLS vs SUR.	7.97**	7.25**	10.36*	6.0**	4.65**	1.55
χ^2 p-value	0.02	0.03	0.00	0.05	0.03	0.21
Private Sector						
Constant	0.001	-0.001	-0.003	-0.006	0.010*	-0.000
	(0.006)	(0.006)	(0.004)	(0.004)	(0.004)	(0.003)
α_{1i}	0.91*	0.92*	0.98	0.98	0.92*	1.00
	(0.021)	(0.020)	(0.025)	(0.022)	(0.021)	(0.021)
α'_{2i}	0.126***	0.134**	0.059	0.092**		
	(0.066)	(0.061)	(0.051)	(0.046)		
$\alpha_{2i}=\alpha'_{2i}/(\alpha'_{2i}+\alpha_{1i})$	0.12	0.13	0.06	0.09		
R^2	0.831	0.833	0.826	0.827	0.83	0.83
Hausman						
Specification Test:	Near				Near	
OLS vs SUR	singular	63.2*	13.27*	11.18*	singular	5.74**
χ^2 p-value	matrix	0.00	0.00	0.00	matrix	0.02

Notes: 1-Definition of Δx_i and Δz varies. Columns (1), (2) and (5): Δx_i and Δz are weighted by cost of capital based on external rate of return. Columns (3), (4) and (6): Δx_i and Δz are weighted by cost of capital based on internal rate of return. Column (1) and (3): $\Delta z1$ is growth of total manufacturing inputs. Columns (2) and (4): $\Delta z2$ is growth of other industries inputs index. 2- n=252, i=9, t=28. Cross-section heteroskedasticity and contemporaneous correlation consistent standard errors and covariance. SE are in brackets. 3- *** Significant at 10% level or better, ** Significant at 5% level or better, * significant at 1% level or better. The estimated α_{1i} coefficients are compared with the value 1.

Table 2: Results of the J Test for Eq (3'). Constrained Model: $\alpha_{1i} = \alpha_1$, $\alpha'_{2i} = \alpha'_2$, all i. Dependant Variable Δy_{it} . SUR Estimates

	$\Delta z1$ vs $\Delta z2$ and $\Delta z2$ vs $\Delta z1$		Int. vs Ext. weight and Ext. vs Int. weight
Public Sector:		Public sector:	
Internal weight	No discrimination	$\Delta z1$	No discrimination
External weight	No discrimination	$\Delta z2$	No discrimination
Private Sector:		Private sector:	
Internal weight	No discrimination	$\Delta z1$	No discrimination
External weight	No discrimination	$\Delta z2$	No discrimination

Table 3: Results of the F-test (p-values) for Eq. (3'): Constrained versus Unconstrained Model, SUR Estimates

	$\Delta z1$	$\Delta z2$
Public Sector		
Internal weight		
$\alpha_{1i} = \alpha_1$ and $\alpha'_{2i} = \alpha'_2$,	0.00	0.00
$\alpha_{1i} = \alpha_1$	0.00	0.00
$\alpha'_{2i} = \alpha'_2$	0.73	0.52
External weight		
$\alpha_{1i} = \alpha_1$ and $\alpha'_{2i} = \alpha'_2$,	0.00	0.00
$\alpha_{1i} = \alpha_1$	0.00	0.00
$\alpha'_{2i} = \alpha'_2$	0.49	0.21
Private Sector		
Internal weight		
$\alpha_{1i} = \alpha_1$ and $\alpha'_{2i} = \alpha'_2$,	0.00	0.00
$\alpha_{1i} = \alpha_1$	0.48	0.42
$\alpha'_{2i} = \alpha'_2$	0.14	0.16
External weight		
$\alpha_{1i} = \alpha_1$ and $\alpha'_{2i} = \alpha'_2$,	0.00	0.00
$\alpha_{1i} = \alpha_1$	0.20	0.26
$\alpha'_{2i} = \alpha'_2$	0.06	0.08

Table 4: SUR Estimates of Eq (3'), Nine Sets of Equations. Unconstrained Model: $\alpha_{1i} \neq \alpha_1$, $\alpha'_{2i} \neq \alpha'_2$. Dependant variable Δy_{it}

	Public Sector Internal weight, $\Delta z1$				Private Sector Internal weight, $\Delta z1$			
	Constant	α_{1i}	α'_{2i}	R²	Constant	α_{1i}	α'_{2i}	R²
Industry 31	-0.01**	0.92	0.23***	0.82	0.02	0.15*	0.49**	0.32
	(0.00)	(0.07)	(0.12)		(0.02)	(0.14)	(0.20)	
Industry 32	-0.02***	1.03	0.33	0.63	0.02	1.18**	-0.31**	0.80
	(0.01)	(0.19)	(0.34)		(0.01)	(0.08)	(0.12)	
Industry 33	-0.02	1.67*	-0.42	0.75	-0.05**	1.03	0.29	0.82
	(0.02)	(0.13)	(0.45)		(0.02)	(0.05)	(0.27)	
Industry 34	-0.00	1.16	-0.51**	0.80	0.01	1.12***	-0.22	0.82
	(0.01)	(0.12)	(0.26)		(0.02)	(0.07)	(0.20)	
Industry 35	0.00	0.55*	0.89*	0.73	0.01	0.88*	0.15	0.88
	(0.01)0	(0.12)	(0.26)		(0.01)	(0.03)	(0.11)	
Industry 36	0.04***	1.05	-0.99*	0.38	0.03***	0.73*	-0.13	0.71
	(0.02)	(0.22)	(0.35)		(0.02)	(0.09)	(0.21)	
Industry 37	-0.01	0.88	0.12	0.70	-0.01	0.97	0.10	0.88
	(0.01)	(0.10)	(0.29)		(0.03)	(0.05)	(0.28)	
Industry 38	-0.02***	1.48*	-0.51***	0.88	0.00	1.08	-0.05	0.86
	(0.01)	(0.11)	(0.28)		(0.02)	(0.07)	(0.20)	
Industry 39	-0.01**	1.60*	0.82	0.79	-0.02	0.99	-0.06	0.85
	(0.03)	(0.12)	(0.71)		(0.02)	(0.06)	(0.27)	
Global R²				0.81				0.85
Summary Statistics								
α_{1Med}		1.05				0.99		
$\bar{\alpha}_1$		1.15				0.90		
		(0.13)				(0.07)		
$\tilde{\alpha}_1$		0.96				0.79*		
		(0.12)				(0.09)		
α'_{2Med}		0.12				-0.05		
$\bar{\alpha}'_2$		-0.00				0.03		
		(0.34)				(0.21)		
$\tilde{\alpha}'_2$		0.21				0.07		
		(0.25)				(0.18)		
$\tilde{\alpha}_2$		0.18						
$\bar{\alpha}_2$						0.03		
Restricted Estimates (Internal weight, $\Delta z1$)								
α_1		1.30*				0.98		
		(0.04)				(0.02)		
α'_2		-0.12				0.06		
		(0.09)				(0.05)		
α_2		-0.10				0.06		

Notes: 1- Δx_i and $\Delta z1$ are weighted by cost of capital based on internal rate of return. $\Delta z1$ is defined as growth of total manufacturing inputs. 2- n=252, i=9, t=28. Cross-section heteroskedasticity and contemporaneous correlation consistent standard errors and covariance. SE are in brackets. 3- *** Significant at 10% level or better, ** Significant at 5% level or better, * significant at 1% level or better. The estimated α_{1i} coefficients are compared with the value 1.

Table 5: Estimation of Internal Returns in Aggregate Manufacturing

	A- Not Accounting for Externalities:	B-Accounting for Externalities:
	Eq: $\Delta y_t = \alpha_0 + \alpha_1 \Delta x_t + \varepsilon_t$	Eq: $\Delta y_t = \frac{[\alpha_0 + \alpha_1 \Delta x_t + \varepsilon_t]}{(1 - \alpha_{2i})}$
	α_1	$\alpha_1/(1-\alpha_{2i})$ (²) Unconstrained Model $\Delta z1$
	OLS	SUR
Public Sector Internal rate weight	1.10 (0.09)	
	R²= 0.85	1.17
Private Sector Internal rate weight	0.94 (0.10)	
	R²= 0.83	0.93

Notes: 1. Part A: T= 28- Newey-West HAC Standard Errors and Covariance (lag truncation=3). Standard errors in brackets; 2. $\alpha_{2i} = \alpha'_{2i}/(\alpha'_{2i} + \alpha_{1i})$. In the unconstrained model, the calculations are based on $\tilde{\alpha}_1$ and $\tilde{\alpha}_2$ .for the public sector and on $\bar{\alpha}_1$ and $\bar{\alpha}_2$ for the private one (c.f. Table 4). *** Significant at 10% level or better, ** Significant at 5% level or better, * significant at 1% level or better. The estimated α_1 coefficients are compared with the value 1.

Table 6: Sources of the Externalities by Decomposition of the Externality Index; SUR Estimated Eq: $\Delta y_{it} = \alpha''_{0i} + \alpha_{1i}\Delta x_{it} + \sum_{k=31}^{39} \alpha''_{2ik}\Delta x_{i(t-1)} + \varepsilon''_{it}$ **.**

Model Constrained on: $\alpha_{1i} = \alpha_1$, all i. α''_{2ik} unconstrained

	Public Sector								
	i-31	i-32	i-33	i-34	i-35	i-36	i-37	i-38	i-39
Cst	-0.03*								
	(0.00)								
α_1	1.27*								
	(0.03)								
α''_{2-31}	0.00	-0.49**	1.41*	0.14	0.26	-0.22	-0.04	0.49*	-0.18
	(0.14)	(0.2)	(0.37)	(0.22)	(0.26)	(0.34)	(0.31)	(0.15)	(0.63)
α''_{2-32}	0.13	-0.38***	0.32	0.00	-0.03	0.37	0.18	0.05	-1.37**
	(0.14)	(0.20)	(0.38)	(0.22)	(0.26)	(0.34)	(0.30)	(0.15)	(0.63)
α''_{2-33}	0.10	-0.11	0.24	-0.06	-0.14	0.20	0.29***	0.02	0.04
	(0.08)	(0.11)	(0.21)	(0.12)	(0.14)	(0.18)	(0.16)	(0.08)	(0.34)
α''_{2-34}	-0.37*	-0.03	-0.98*	-0.44**	-0.04	-1.03*	-0.09	-0.47*	0.70
	(0.12)	(0.17)	(0.31)	(0.18)	(0.21)	(0.28)	(0.25)	(0.13)	(0.51)
α''_{2-35}	-0.07	0.22***	-0.23	0.43*	-0.11	0.01	0.16	0.06	1.06*
	(0.08)	(0.11)	(0.22)	(0.12)	(0.15)	(0.19)	(0.17)	(0.09)	(0.36)
α''_{2-36}	0.20***	0.13	-0.19	-0.05	0.19	0.57**	0.06	-0.16	-0.43
	(0.11)	(0.15)	(0.28)	(0.16)	(0.19)	(0.24)	(0.22)	(0.11)	(0.45)
α''_{2-37}	-0.03	0.00	-0.19	-0.13	0.13	-0.27	0.25	0.15**	-0.47
	(0.07)	(0.10)	(0.19)	(0.11)	(0.13)	(0.17)	(0.15)	(0.08)	(0.32)
α''_{2-38}	0.31*	0.36**	0.45	-0.06	0.18	0.47***	0.07	0.03	0.03
	(0.11)	(0.15)	(0.29)	(0.17)	(0.20)	(0.26)	(0.23)	(0.12)	(0.48)
α''_{2-39}	0.02	-0.02	0.28**	0.15**	0.14	0.28**	-0.02	0.15*	-0.26
	(0.05)	(0.07)	(0.13)	(0.07)	(0.09)	(0.11)	(0.10)	(0.05)	(0.21)
R^2	0.86								

Table 6: Contd.

	Private Sector								
	i-31	i-32	i-33	i-34	i-35	i-36	i-37	i-38	i-39
Cst	-0.00								
	(0.00)								
α_1	1.02								
	(0.02)								
α''_{2-31}	0.32***	0.13***	-0.67*	0.04	0.19**	0.11	0.50*	-0.10	0.29***
	(0.17)	(0.07)	(0.15)	(0.13)	(0.08)	(0.13)	(0.16)	(0.13)	(0.17)
α''_{2-32}	-0.14	0.29*	0.59*	0.03	-0.07	-0.21	-0.13	-0.04	0.48***
	(0.26)	(0.11)	(0.22)	(0.20)	(0.12)	(0.19)	(0.24)	(0.19)	(0.26)
α''_{2-33}	0.04	-0.08**	-0.10	0.05	0.04	-0.14***	0.07	-0.01	0.14
	(0.10)	(0.04)	(0.08)	(0.07)	(0.05)	(0.07)	(0.09)	(0.07)	(0.09)
α''_{2-34}	-0.11	-0.06	0.45*	0.05	-0.12**	0.14	-0.02	0.01	0.35*
	(0.11)	(0.05)	(0.10)	(0.09)	(0.04)	(0.08)	(0.10)	(0.08)	(0.11)
α''_{2-35}	0.20	-0.13**	-0.32*	-0.15	-0.01	0.09	0.34**	-0.07	-0.15
	(0.14)	(0.06)	(0.12)	(0.11)	(0.07)	(0.10)	(0.13)	(0.10)	(0.14)
α''_{2-36}	-0.27**	-0.04	0.03	-0.11	-0.09	-0.11	-0.10	0.23**	-0.26**
	(0.13)	(0.05)	(0.11)	(0.10)	(0.06)	(0.09)	(0.12)	(0.09)	(0.13)
α''_{2-37}	-0.10***	-0.02	0.11**	-0.01	-0.02	0.07***	-0.22*	0.00	-0.06
	(0.06)	(0.02)	(0.05)	(0.04)	(0.03)	(0.04)	(0.05)	(0.04)	(0.06)
α''_{2-38}	-0.01	0.00	-0.06	0.16	0.08	-0.11	-0.30**	0.03	-0.10
	(0.13)	(0.05)	(0.11)	(0.10)	(0.06)	(0.09)	(0.11)	(0.09)	(0.12)
α''_{2-39}	-0.05	0.05	0.08	-0.02	0.04	-0.07	-0.15**	-0.00	0.15**
	(0.07)	(0.03)	(0.06)	(0.06)	(0.03)	(0.05)	(0.07)	(0.05)	(0.07)
R^2	0.90								

Notes: 1- Δx_i are weighted by cost of capital based on internal rate of return; 2- n=252, i=9, t=28. Cross-section heteroskedasticity and contemporaneous correlation consistent standard errors and covariance. SE are in brackets; 3-*** Significant at 10% level or better, ** Significant at 5% level or better, * significant at 1% level or better. The estimated α_{1i} coefficients are compared with the value 1.

Table 7: Summary Statistics on the Sources of Externalities

	Public Sector			Private Sector		
Constant	-0.03*			-0.00		
	(0.00)			(0.00)		
α_1	1.27*			1.02		
	(0.03)			(0.02)		
	Median	**Mean**	**Weighted Mean**	**Median**	**Mean**	**Weighted Mean**
α''_{2-31}	0,00	0,15	0,03	0,13	0,09	0,15
		(0,29)	(0,21)		(0,13)	(0,12)
α''_{2-32}	0,05	-0,08	0,00	-0,04	0,09	0,05
		(0,29)	(0,21)		(0,20)	(0,18)
α''_{2-33}	0,04	0,06	0,02	0,04	0,00	-0,02
		(0,16)	(0,12)		(0,07)	(0,07)
α''_{2-34}	-0,37	-0,31	-0,26	0,01	0,08	0,00
		(0,24)	(0,18)		(0,08)	(0,08)
α''_{2-35}	0,06	0,17	0,03	-0,07	-0,02	0,01
		(0,17)	(0,12)		(0,11)	(0,10)
α''_{2-36}	0,06	0,04	0,13	-0,10	-0,08	-0,08
		(0,21)	(0,16)		(0,10)	(0,09)
α''_{2-37}	-0,03	-0,06	0,05	-0,02	-0,03	-0,04
		(0,15)	(0,11)		(0,04)	(0,04)
α''_{2-38}	0,18	0,20	0,24	-0,01	-0,03	0,01
		(0,22)	(0,16)		(0,10)	(0,09)
α''_{2-39}	0,14	0,08	0,07	0,00	0,00	-0,01
		(0,10)	(0,07)		(0,05)	(0,05)

Notes: Results based on Table 6; 3-*** Significant at 10% level or better, ** Significant at 5% level or better, * significant at 1% level or better. The estimated α_{1i} coefficients are compared with the value 1.