Manufacturing and competitiveness: the case of Greece

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Abstract *Despite long-standing debates on deindustrialisation and the importance of manufacturing, as well as tests of the deindustrialisation hypothesis, little empirical work exists on the impact of manufacturing on competitiveness, where manufacturing is the independent variable. To address this first presents a conceptual framework that links manufacturing to competitiveness and deindustrialisation and tests it for a case of serious apparent deindustrialisation and "relative decline", that of Greece, in the context of a novel "simultaneous equation model" that tests both for deindustrialisation and "manufacturing matters". Finds that the change in manufacturing shares have a positive and significant impact on competitiveness measured by per capita income, confirming that "manufacturing matters".*

I. Introduction

The link between manufacturing and competitiveness is (remains) a hotly debated issue in economics. This is true for the question whether a decline in manufacturing may result in (and/or exacerbate any existing tendencies for) deindustrialisation. It is surprising that, despite such interest, there has been little econometric work on the impact of manufacturing on competitiveness, with manufacturing being the independent variable. It is also interesting that the debate on this issue seems to be focused primarily on the (relative decline and regeneration of the) UK. Another case of "relative decline" in Europe (at least up to the mid 1990s) is that of Greece. Despite interest and repeated claims that Greece has been a victim of deindustrialisation as a result of manufacturing decline, there has been no econometric investigation of this claim. Following from the above, the aim of this paper is to contribute towards filling these two gaps in the literature. Section II briefly discusses the issues of "manufacturing matters", competitiveness and deindustrialisation in general

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and with reference to the case of Greece. In Section III, we first present a conceptual framework and then use it to provide a test of the link between manufacturing and competitiveness for our case in point. Concluding remarks follow in Section IV.

II. Manufacturing and deindustrialisation

Whether "manufacturing matters" for economic performance is hotly debated. Here, we provide a bird's eye view of the debate, see Kitson and Michie (2000) for more details. From the various arguments in the literature, the following are notable. First, manufacturing is more capital intensive and (thus) more productive, than other sectors, e.g. services. It is also suggested that manufacturing is characterised by increasing returns to scale, while services by constant returns[1]. Both these arguments have been subjected to criticisms. For example, it can be suggested that new technologies tend to increase the productivity of services, while services can be characterised by increasing returns (Sugden, 1995).

Another argument in favour of manufacturing concerns the relatively larger size of manufacturing firms, *vis-à-vis* firms in the service sector (for example, the largest multinationals are in manufacturing). The above factors are related, and are linked to productivity[2]. Another argument concerns the tradability of manufacturing products versus services. The latter are said to be less tradable due to various factors, e.g. dependence on locality[3]. A less debated factor, of importance in some countries, is that some services can be of high risk. Notable is the case of tourism which can be highly sensitive to weather conditions, and (other) exogenous factors such as wars, terrorist attacks, "travel directives", etc.

In addition to the above arguments, it also seems to be the case that there is a strong interdependence between manufacturing and services. First, in many cases, services are created in order to satisfy the requirements of large, e.g. multinational firms in manufacturing. Such firms may well build their own services firms, namely, "captive" insurance companies, the provision of banking services by major multinationals, etc. Moreover, especially in the 1980s, the practice of many large manufacturing firms to downsize, through, e.g. outsourcing etc., has generated many "independent" new service firms that used to be part of the manufacturing firm originally. Lastly, the boundaries between manufacturing and services tend to become fuzzy, for all the aforementioned reasons, but also because many manufacturing products tend to have a large service component.

The above arguments are sufficiently widely accepted and have led to the recognition of the importance of manufacturing already in the conservative government's White Paper (HMSO, 1994). Indicative is also the view of UNICE. For example in its 1994 "competitiveness report" (HMSO, 1994) it asserts that "a strong manufacturing sector remains important for Europe, because it creates the demand for a large part of production in the services sector".

Recent developments and evidence on the "new endogenous growth" theory could provide extra impetus to the "manufacturing matters" thesis. The "new" theories recognize the importance of "increasing returns" and point to the role of human capital and innovation as determinants of growth (Lucas, 1988; Romer, 1986, 1990). Historically, much of the innovation has been the prerogative of industrial firms, as explained by Chandler (1962), Penrose (1959) and Schumpeter (1987). For example, improvement in skills through learning within industrial firms, has been a theme for no less than Smith (1776) and more recently Penrose (1959). Evidence on the importance of innovation and human capital is in line with the above (Ahn, 2002) for an extensive summary and evidence.

"Deindustrialisation" refers to a tendency for a decline in the absolute or relative weight of manufacturing in terms of an index; usually value added, production, employment etc. To varying degrees, most OECD countries exhibit a deindustrialisation tendency (thus defined), mainly from the mid 1970s. This tendency goes hand in hand with the increase in the relative weight of services (Rowthorn and Ramaswamy, 1997, 1998; Rowthorn and Wells, 1987). A case of apparently severe deindustrialisation is the UK, where manufacturing employment as a percentage of total employment fell from 38 per cent in 1960, to around 20 per cent in 2002 (the lowest ever). The severity of this decline has led to numerous attempts to explain the phenomenon, see Buxton *et al.*, (1998), Crafts and O'Mahony (2000) and debate on the issue in the "controversy" section of *The Economic Journal* (1996).

Another case of "deindustrialisation" is Greece, where the manufacturing value added share to GDP declined from around 20 per cent in the mid 1970s to less than 13 per cent in the late 1990s[4]. It is interesting that in Greece the deindustrialisation tendency started before the "completion" of industrialisation (relative for example to other OECD countries). In this sense, the case here is more of an interruption and reversal of the industrialization process. Also interesting is that deindustrialisation was relatively more severe in terms of value added, as opposed to employment in Greece. This is what one would expect on the basis of consecutive governments' attempts to protect employment in ailing industries (Athanassiou and Pitelis, 2000)[5].

Various arguments have been advanced to explain deindustrialisation. They can be divided into two major categories. First, those which see deindustrialisation as a positive process of, for example, maturity of the economy. Second, those which attribute deindustrialisation to negative factors like bad economic performance (deindustrialisation may be both an effect and a cause of bad performance). The distinction is due to Rowthorn and Wells (1987). Two reasons for positive deindustrialisation follow from the previous discussion on "manufacturing matters". To the extent, for example, that manufacturing is characterised by higher productivity, this will lead, *ceteris*

paribus, to a reduction in the relative cost of manufacturing products, thus a reduction in the relative share of manufacturing (provided manufacturing and services are characterised by relatively inelastic demand). Moreover, to the extent that manufacturing firms downsize through, e.g. outsourcing, contracting out etc., this will reduce the manufacturing share without negative and potentially with positive results in the economy (provided such actions increase firm productivity and performance).

A third factor for positive deindustrialisation concerns the structure of demand. This is argued to change in favour of services, as (when) incomes increase. Services are thought to be characterised by income elasticity larger than unity, which means that the growth of demand for services will tend to exceed that of income, leading to an increase in the relative weight of services. It is worth noting here that none of the above views have gained global acceptance, with many critiques and alternative views, see Athanassiou and Pitelis (2000) and *The Economic Journal*, (1996) for more extensive accounts and evidence[6].

Returning to our case, in Greece, the extent of deindustrialisation does not appear to be in line with the positive deindustrialisation view[7]. This is supported by the evidence on manufacturing and the overall economic performance. Indicatively, per capita incomes in Greece in terms of purchasing parity power (PPP), fell from 64.6 per cent of the EU average in 1978 to 57.3 per cent in 1995, while unemployment went up to over 10 per cent in 2001 from below 2 per cent in the 1976-79 period, see *European Economy Annual Economic Reports* (various issues). Concerning manufacturing, estimates by Spraos (1997) show that average annual rate of labour productivity improvement between 1980 and 1992 has been as low as 0.0245 per cent while the ratio of exports minus imports as a percentage of GDP deteriorated from -8.22 in 1984 to -14.09 in the same period. If one adds the apparent decline in the profit rate in manufacturing from 8 per cent in 1984 to only 1.4 per cent in 1991[8], then one could conclude reasonably safely that economic development has not been responsible for Greek deindustrialisation.

Three types of factors have been offered to explain Greek deindustrialisation: macroeconomic, meso-economic and micro-economic (to include firm-level). Prominent among the first is the "Dutch disease" idea (Spraos, 1997). According to this, the emergence of a source of foreign exchange (e.g. oil in Holland and Britain) tends to increase the exchange rate of the receiving country, and (thus) undermine the competitiveness of its manufactures. The foreign exchange in Greece came from shipping, tourism and the émigrés. When these sources started drying out, there emerged the transfers from the EU[9].

Supply-side, meso-economic explanations focus on the new international division of labour, the "new competition", the entry to the EU, the cost of capital, the quality (and incentives) of labour and management, and economic

(including competition and supply-side industrial) policy, either independently or in conjunction with other factors, see Pitelis (1997) for an account[10]. Although most of these factors seem plausible, there has been no sufficient analysis and evidence to substantiate them, so they remain at the level of informed speculation. In any event it is clear that, for a series of reasons, in the 1980s and much of the 1990s, the Greek economy has been unable to continue to be the small tiger of Europe (as she was in the 1960s and 1970s) and instead has been led to extended relative decline and deindustrialisation. Our aim here is to explore econometrically whether there is a link between the decline in manufacturing and competitiveness.

III. Manufacturing competitiveness and deindustrialisation: a framework and econometric investigation

As already noted, the impact of manufacturing (as an independent variable) on competitiveness has not been tested directly before. Tests on "deindustrialisation" like Rowthorn and Wells (1987) for example, have focused attention to the link between manufacturing share (as the dependent variable) and a set of explanatory variables suggested by their theoretical analysis (e.g. per capita incomes) in an attempt to test whether deindustrialisation (the decline in manufacturing share) is being caused by economic development and/or other factors. In a logarithmic equation where manufacturing share is regressed on, among others, per capita income and per capita income squared, support is found for the idea that the former affects positively and significantly manufacturing shares, while the latter significantly and negatively. This suggests that after a certain level of economic development, further development reduces the manufacturing share. This shows that deindustrialisation can be a result of positive factors.

The above is an important result, further developed by Athanassiou and Pitelis (2000) and Rowthorn and Ramaswamy (1997, 1998). It does not (however) test the direct link between manufacturing and competitiveness. For the latter to be tested, its competitiveness has to be explained by manufacturing. Accordingly, the causality has to run from manufacturing (shares) to competitiveness. As it has already been noted and found by the aforementioned studies, deindustrialisation is itself influenced by competitiveness. Accordingly, the full "manufacturing matters" – "deindustrialisation" hypothesis should ideally be tested with a simultaneous equation model of the following type:

$$C = f_1(M, X) \tag{1}$$

$$M = f_2(C, Z) \tag{2}$$

where C stands for competitiveness, M for manufacturing share and X, Z for other explanatory variables.

Equation (1) tests for manufacturing and competitiveness while equation (2) tests for "deindustrialisation".

In the above context, important questions pertain to the choice and definition of variables; the specification of the equation; and the estimated method(s) and overall methodology.

Starting from the choice and definition of variables, the choice of the competitiveness variable in this case is per capita income. There is an extensive literature suggesting the suitability of this measure; in part it represents a broad macro-economic equivalent to the total factor productivity, arguably a good measure of economic performance (Krugman, 1994; Porter, 1990; Pitelis, 1998). In a productivity-competitiveness model, manufacturing should be expected to affect productivity and per capita incomes positively, for the reasons already discussed. If, as claimed, manufacturing is a positive determinant of productivity and (thus) per capita incomes, the latter becomes a theory-inspired candidate for a dependent variable. In effect, we are testing a theoretical model of the determinants of productivity and competitiveness, where competitiveness is approximated by productivity and the latter is proxied by per-capita incomes (Pitelis, 1998)[11].

Considering *M*, it has already been hinted that employment may not be a satisfactory measure, as it is subjected strongly to government policy measures towards protecting "employment" in ailing firms-industries. This is particularly true in the Greek case, with a well-known history of attempts to salvage "problematic" enterprises to protect employment[12]. A better measure in this context is manufacturing output share(s), which are used accordingly.

Other explanatory variables used in equation (1) are the share of services to GDP, the share of agriculture to GDP and the lagged dependent variable (LDV). The choice of the services share is obvious, given the long lasting "manufacturing versus services" debate in economics. It intends to test for the impact of services on competitiveness. The justification for the agriculture share is on similar grounds. Although the sum of these three explanatory variables is unity, keeping them separate serves the purpose of testing their respective effect on performance, to include the direction and strength of the relationship[13].

The presence of LDV can be justified *per se*; namely competitiveness of the previous period is expected to affect next period for reasons related to trend, economic cycle, confidence and expectations, and cumulative causation-type arguments. In addition, however, LDV's presence can result from a number of econometric models (distributed lags, partial adjustment, etc., see Wallis, 1979), which provides extra justification for its inclusion.

Equation (2) uses *M* as the dependent variable, to be affected by *C*, and variables such as the services and agriculture share, and also the LDV. The reasoning, justifications and measures used are as in equation (1). The agriculture and services shares are intended to measure the degree of

substitutability between the respective variables. The overall equation is the broad equivalent of the deindustrialisation hypothesis, as tested in the literature.

We pursue a "general-to-specific" methodology in line with prevalent practice (Davidson *et al.*, 1978; Harvey, 1983). The data is annual Greek time series in constant 1970 prices for the 1963-1994 period. They are taken from the *National Accounts of Greece*, various issues[14]. The first step is to test the variables of interest for cointegration[15].

The relevant Dickey-Fuller (DF) and augmented Dickey-Fuller (ADF) tests for unit roots and stationarity indicate that the hypothesis of a unit root in the variables included in equations (1) and (2) cannot be rejected at least at the 5 per cent level. Therefore, the variables in question are integrated of order one [I(1)] and the null hypothesis of non-cointegration of the variables are tested. The relevant ADF test (Davidson and Mackinnon, 1993) suggests that this hypothesis should be rejected.

Having established that the variables of interest are cointegrated, we proceed with general estimated equations in line with the propositions depicted in equations (1) and (2), and gradually impose parameter restrictions in order to find our "preferred" equations. Equations (1) and (2) are estimated by the OLS method using the following general ADL (*n*, *k:m*) form:

$$y_t = a_{0+}\sum_{i=1}^{n} a_i y_{t-1} + \sum_{k=1}^{m}\sum_{i=0}^{n} \hat{a}_{ki} x_{k,t-1} + u_t$$

where y is the dependent variable, x_k is the kth explanatory variable and u_t is a white noise disturbance that is assumed to satisfy the usual requirements.

Due to the sample size, two lags are introduced in each of the dependent and the explanatory variables. Non-significant lags are excluded on the basis of the *F*-test and the Likelihood Ratio test for the validity of exclusion restrictions. After an efficient specification search and re-estimation of the system by the 3SLS method, we obtained the following preferred (set of) equation(s):

$$\begin{aligned}(Y/P)_t = {} & 3044.193(1.374)^* + 1.027\ (Y/P)_{t-1}(61.613)^{***} \\ & + 1191.895\ \Delta(Y_{\mathrm{M}}/Y)_t(6.802)^{***} - 831.373\ \Delta(Y_{\mathrm{S}}/Y)_t \\ & \times(-7.112)^{***} - 55.198\ (Y_{\mathrm{S}}/Y)_{t-2}(-1.107)\end{aligned}$$

$$\bar{R}^2 = 0.996$$

$$(Y_M/Y)_t = 19.281(5.789)^{***} + 0.782\ (Y_M/Y)_{t-1}(17.171)^{***} + 0.0002\ \Delta(Y/P)_t(4.983)^{***} - 0.199\ (Y_A/Y)_t(-4.745)^{***} - 0.229\ (Y_S/Y)_{t-1}(-6.136)^{***}$$

$$\bar{R}^2 = 0.977$$

t-values are shown in parentheses; (*) denotes significance at the 10 per cent level; (***) denotes significance at the 1 per cent level; Y/P stands for per capita GDP, Y_M/Y for the share of manufacturing output in GDP, Y_S/Y for the share of services output in GDP, Y_A/Y for the share of agricultural output in GDP and R^2 adjusted for the degrees of freedom. Δ is the first difference operator.

Eliminating gradually the insignificant variables and re-estimating the equations we obtain:

$$(Y/P)_t = 610.919(1.442)^{*} + 1.013\ (Y/P)_{t-1}(90.878)^{***} + 1220.447\ \Delta(Y_M/Y)_t(6.720)^{***} - 805.872\ \Delta(Y_S/Y)_t \times(-6.777)^{***}$$

$$\bar{R}^2 = 0.996$$

$$(Y_M/Y)_t = 18.947(5.708)^{***} + 0.797\ (Y_M/Y)_{t-1}(18.339)^{***} + 0.0002\ \Delta(Y/P)_t(4.924)^{***} - 0.193\ (Y_A/Y)_t(-4.632)^{***} - 0.230\ (Y_S/Y)_{t-1}(-6.159)^{***}$$

$$\bar{R}^2 = 0.976.$$

Before discussing the results, the following points are worth making. First, the exact form of the equation resulted from the data and estimation procedure. Accordingly the difference in the right hand side of equations (1) and (2) resulted from (accepted) equality restrictions on the more general forms. Second, the same results emerged when other estimation procedures were used, e.g. SURE. Third, all conventional econometric tests were passed by our preferred system, which suggests that the results are reasonably reliable. Some results and tests are provided in the Appendix (in order to help substantiate the above points). Further results are available from the authors on request. They are in line with those reported.

With the above explanations, it feels reasonably safe to proceed to the results, which suggest that:

- the change in the share of manufacturing is linked positively to competitiveness;
- agriculture is not (the variable has dropped out from the preferred regression in equation (1));
- the change in the share of services exerts a negative and significant influence on competitiveness;
- competitiveness matters, for manufacturing (its change exerts a positive and significant influence on the manufacturing share)[16];
- there is a small degree of substitutability between the manufacturing share on the one hand and agriculture and services share on the other; and
- there is interdependence between competitiveness and changes in manufacturing shares, suggesting the possibility of cumulative effects as suggested by Kaldor (1966).

Overall, the results are in line with expectations. The explanatory power of the regressions is high (even for time series), especially considering that we are talking about a hitherto untested (system of) equation(s), mainly for the manufacturing equation. The one apparently peculiar finding concerns the role of services[17]. A series of factors ranging from improvements in productivity in services, to the strong link between services and manufacturing and the traditionally important role of tourism in Greece, may appear to render this suspected result. However, there are arguably plausible explanations. Data for services in Greece, include all services, private and public sector. There is a large debate in the literature for the inefficiency of the public sector in general and for Greece in particular (Pitelis, 1997). Our finding in this framework can be interpreted to imply that to the extent private sector services affect economic performance positively, this effect was more than offset by the inefficiency of the (Greek) public sector. Unfortunately, there is no separate data to test this interesting hypothesis, which thus remains (educated) guess in line with our finding(s). Another explanation for our result has to do with the finding that it is the change of the services sector share (not the level) that exerts the negative influence. This can be interpreted as evidence for an imbalance in the composition of Greek output in favour of services, that could/should be fruitfully reduced *vis-à-vis* that of manufacturing.

To conclude and summarise, our results support both that manufacturing matters and the deindustrialisation hypotheses. The results seem both robust and reliable. Their strength is also supported by the fact that the equations are derived from a conceptual framework widely adhered to, that manufacturing affects positively productivity.

IV. Concluding remarks

We have tested the hitherto untested relationship between competitiveness and manufacturing (where the latter is the independent variable) and also the hypothesis of deindustrialisation, focusing for the case of Greece, in the context of a novel simultaneous equations model, that accounts for the theoretically widely adhered to view the relationship between these two factors. We found support for both hypotheses. Interesting (and not too surprising for Greece) is also the finding of the negative influence of the change in the share of services on competitiveness. Overall, the results lend support to a long held view concerning the importance of manufacturing. They imply that the balance of manufacturing/services shares in the composition of Greek output[18], could/should be fruitfully shifted in favour of manufacturing. Government supply-side-competitiveness policies could take stock of this and try to create conditions, institutions and mechanisms in support of manufacturing competitiveness. The discussion of more detailed measures is beyond the scope of this paper.

Notes

1. For a discussion on the revival of the concept of increasing returns, see Arthur (1996). For an early exponent, see Young's (1928) excellent classic piece.
2. Large firm size can not only be a cause of productivity increases (through economies of scale, scope, learning etc.), and also an effect of productivity increases (Demsetz, 1973; Penrose, 1959; Schumpeter, 1942).
3. This also can be a cause as well as an effect.
4. There are various measures here, varying from 15 per cent to below 13 per cent, depending on, among others, whether one uses the old (pre-1994) or new (post-1994) measurement of GDP (the latter showing higher GDP, thus lower share). What matters, however, is the severity of the decline.
5. This observation raises questions about the suitability of using the employment share as a measure of deindustrialisation (Athanassiou and Pitelis, 2000).
6. The most recent statistics available by Eurostat show Greece's per capita income in terms of PPP to stand at just below 70 per cent of the EU average. The improvement is due to the improved performance in the late 1990s, but also a change in the measurement of GDP in 1994.
7. There is some evidence for outsourcing strategies of large Greek firms in recent years, especially to the Balkan countries. The structure of demand argument cannot be tested due to the lack of data. It would be surprising, however, if those two alone would suffice to explain the severity of the decline.
8. See OECD (1993) and Eurostat (2002) for more recent data.
9. A version of this argument focused on the need for high interest (and exchange) rates to service the debt and/or satisfy the Maastricht criteria (Pitelis, 1997). Another result of the "Dutch disease" may be the blunting of incentives to firms and individuals.
10. It is beyond the scope and objectives of this paper to enter this debate.
11. Our choice of per capita income as a measure of productivity and competitiveness does not mean to belittle the huge debate at present on the determinants and measurement of competitiveness, see for example the recent summary in Cellini and Soci (2002). Instead we are choosing to side with authors such as Krugman (1994), Pitelis (1998) and Porter (1990) who consider productivity as the best available measure of competitiveness, despite

conceptual limitations (Pitelis, 1998) and empirical ones (Bartelsman and Doms, 2000). In partial recognition of such arguments, official statistics (Eurostat, 2002) define explicitly macro-productivity in terms of per capital incomes per employed person. While technically a more accurate measure of productivity, this measure is a less reliable reflector of the overall competitiveness-performance, as it does not account for unemployment. Our selected measure of per capita income, accounts also for the role of unemployment, so we believe it as a better measure of competitiveness and performance.

12. Greece remains a champion of support to industry among EU countries.
13. It is also self evident, yet worth noting that we do not have an identity here; the denominator of the dependent variable is population, while that of the three explanatory variables is income. This is in addition to the presence of the other explanatory (lagged dependent) variable.
14. The choice of the end period is determined by a change in the measurement of GDP post 1994.
15. Otherwise the disturbances will be non-stationary and either relevant variables are missing or a subset of the variables are cointegrated and the remainder are included by mistake (Holden and Thompson, 1991). For a set of variables to be cointegrated it is required that the individual series should be integrated to the same order, and the residuals from fitting the postulated relationships should be integrated to a lower order than the individual series (Engle and Granger, 1987).
16. In its current form, our equation cannot test for maturity and related (longer term) hypotheses. The estimation of a regression *à la* Rowthorn and Wells (1987), however, has confirmed their findings for Greece, namely that the squared per capita income variable exerts a negative and significant influence on the manufacturing share. The results are available from the authors on request.
17. The slightly higher than unity coefficient of the LDV in equation (1) could be taken to confirm the presence of cumulative effects, *à la* Kaldor (1966).
18. See Pitelis (1994, 1998, 2001) for extensive discussions on supply-side strategies.

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Further reading

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Appendix

On estimation of the system of equations (1) and (2) by the seemingly unrelated regression method, we obtained the following preferred set of equations:

$$(Y/P)_t = 3044.251(1.374)^* + 1.027\ (Y/P)_{t-1}(61.613)^{***} + 1191.9\ \Delta(Y_M/Y)_t(6.802)^{***} - 831.371\ \Delta(Y_S/Y)_t(-7.112)^{***} - 55.200\ (Y_S/Y)_{t-2}(-1.107)$$

$$\bar{R}^2 = 0.996$$

$$(Y_M/Y)_t = 19.281(5.789)^{***} + 0.782\ (Y_M/Y)_{t-1}(17.172)^{***} + 0.0002\ \Delta(Y/P)_t(4.983)^{***} - 0.199\ (Y_A/Y)_t(-4.745)^{***} - 0.229\ (Y_S/Y)_{t-1}(-6.136)^{***}$$

$$\bar{R}^2 = 0.977.$$

Eliminating the insignificant variables and reestimating the equations we get:

$$(Y/P)_t = 610.913(1.442)^* + 1.013\ (Y/P)_{t-1}(90.879)^{***} + 1220.452\ \Delta(Y_M/Y)_t(6.720)^{***} - 805.869\ \Delta(Y_S/Y)_t(-6.777)^{***}$$

$$\bar{R}^2 = 0.996$$

$$(Y_M/Y)_t = 18.947(5.708)^{***} + 0.797\ (Y_M/Y)_{t-1}(18.339)^{***} + 0.0002\ \Delta(Y/P)_t(4.924)^{***} - 0.193\ (Y_A/Y)_t(-4.632)^{***} - 0.230\ (Y_S/Y)_{t-1}(-6.159)^{***}$$

$$\bar{R}^2 = 0.976$$