Does Market Liberalization Increase Total Factor Productivity:

Evidence from the Manufacturing Sector in Zimbabwe

by

Hans Bjurek and Dick Durevall

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Department of Economics
Göteborg University

ABSTRACT

In this paper we analyze if the structural adjustment program (ESAP), implemented during 1991-1995, contributed to an increase in total factor productivity in the manufacturing sector. To evaluate if productivity has grown we first estimate indexes of total factor productivity for 31 manufacturing sub-sectors for the period 1980-1995. Then we use panel data methods to test for the effects of trade reform and other variables related to ESAP. In general the growth rates vary greatly both over time and across sections. The overall impression is that there was no growth in total factor productivity on average during the whole period of ESAP. However, during the last two years, 1994-1995, most sub-sectors experienced increases in total factor productivity.

Keywords: Structural adjustment, trade reform, foreign aid, Malmquist index

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School of Economics and Commercial Law
Göteborg University
Department of Economics
P.O. Box 640
SE 405 30 Gothenburg, Sweden
Fax: +46 31 773 1326
E-mail: Hans.Bjurek@economics.gu.se
Dick.Durevall@economics.gu.se

1. INTRODUCTION

The main goal of Zimbabwe's structural adjustment program (ESAP), implemented during 1991 to 1995, was to improve living conditions through rapid and sustainable economic growth. To achieve this, the economy was to become more competitive and productive (GOZ, 1992). Improvement in competitiveness and productivity was expected to occur as liberalization of the economy led to more efficient resource allocation and expansion of domestic and international competition. In this paper we analyze if ESAP contributed to an increase in total factor productivity in the manufacturing sector.

Zimbabwe constitutes a good case for evaluating the impact of a change from import substitution to market-oriented policies on productivity. It has a very well developed manufacturing sector, which at the end of the 1980s contributed over 25% to GDP and produced about 7000 different products. Before implementation of ESAP controls were widespread, and the vast majority of the firms produced under conditions where there was no foreign or domestic competition. Moreover, foreign exchange rationing severely constrained access to imports of machinery, spare parts and raw materials, resulting in chronic breakdowns and low capacity utilization (Riddell 1988). Hence liberalization in general, and trade reform in particular, should have had a strong impact on productivity.

When reviewing the effects of opening up to international trade, Harrison and Revenga (1995) concluded that economists have not reached a consensus on the relationship between liberal trade policies and productivity. They indicated that this

might be due to two flaws common in many studies, lack of good data on trade policy, and endogeneity problems with the measures used. For Zimbabwe, there exist data on administrative allocations of foreign exchange and these constitute a good measure of trade policy during the 1990s, although other policy instruments also were used. Furthermore, controls on international trade were to a large extent dismantled as planned in the original structural adjustment program, so it is unlikely that trade policy responded to total factor productivity growth.

To evaluate if productivity has grown since the introduction of ESAP we first estimate indexes of total factor productivity for 31 manufacturing sub-sectors for the period 1980-1995. Total factor productivity is measured with Malmquist productivity indexes, obtained with the non-parametric (DEA) approach. Then we use panel data methods to test for the effects of trade reform and other variables related to the structural adjustment program, such as foreign aid and imports, on total factor productivity growth, while controlling for exogenous variables. This two-step procedure is used because the sub-sectors are heterogeneous and have their own specific technology.

The following section first describes some of the consequences that import substitution had on the Zimbabwean manufacturing sector, and then gives a brief outline of the structural adjustment program launched during 1991-1995. Section 3 presents the methodology used to measure productivity and reports results from our estimations of the growth rates of TFP. In Section 4 we first discuss the explanatory variables used in the panel data analysis, and then carry out the regressions. Conclusions are drawn in the final section.

2. IMPORT SUBSTITUTION AND MARKET LIBERALIZATION IN ZIMBABWE

As a response to international sanctions, imposed in 1965, the regime of Rhodesia introduced widespread controls on both external and internal trade. At independence in 1980, the new Government thus inherited a highly controlled economy. During the rest of the decade most of these controls were maintained. In practice, the policy was one of import substitution (IS) similar to that of many other developing countries.

The centerpiece of the IS policy was regulation of foreign trade. All foreign exchange earnings and capital inflows had to be surrendered to the Reserve Bank, and the distribution of foreign exchange to importers was mainly done administratively through the Direct Local Market Allocation (DLMA). Companies were allowed to apply twice a year for the right to import certain goods and services. The DLMA worked as a system of import quotas where the size of the quotas varied over time.

One consequence of the DLMA was that once companies were in the system they could be quite certain to continue receiving foreign exchange allocations. The reason was that imported inputs are required for production so removing companies from the DLMA for a year would have had devastating effects on the manufacturing sector. Since there by definition was a shortage of foreign exchange, this made entering the DLMA quite difficult. As a result there were relatively few firms entering and exiting the manufacturing sector, making turnover-based productivity gains small or nonexistent.

Since practically all investments in Zimbabwe require imported capital goods, a consequence of the import controls was that the authorities effectively controlled investments as well. In view of the excess demand for foreign currency generated by the IS strategy, the only sensible investment policy was to channel import licenses to a limited numbers of producers of each type of good. This resulted in the creation of a number of oligopolistic and monopolistic markets; in mid-1980s about 50% of all goods manufactured in Zimbabwe were produced by one company and 80% by three companies or less (UNIDO 1986). Hence, Zimbabwean producers were not only protected from international competition but also from domestic competition.

To restrain firms from taking advantage of their market power, price controls were widely used. These were in general based on cost-plus, and permissible margins were gazetted. An implication of the price controls was that for many firms higher costs meant higher profits in dollars. Selling the goods was usually not a problem because rationing generated excess demand.

The economic structural adjustment program was launched at the end of 1990. Two of its major components were trade liberalization and deregulation of domestic markets. Government control over allocations of foreign exchange and import licenses was to be dismantled gradually over five years by sequentially putting import goods on an Open General Import License (OGIL) list; such goods could be imported in any quantity without import permits. However, the original plan was altered after a couple of years and OGIL was replaced by the Export Retention Scheme (ERS) as the main policy instrument. The ERS allowed exporters to retain part of their export earnings in the form of import certificates and sell these at a market-determined price. During the

course of the reform the foreign exchange allocations were reduced, and in January 1994 the DMLA, ERS, and OGIL were all abolished. Since then the exchange rate has been determined largely by market forces, although with occasional interventions by the Reserve Bank.

The creation of a foreign exchange market implied that restrictions on domestic demand for imports disappeared, and that local companies became exposed to foreign competition. Nevertheless, some protection remained in the form of import tariffs, although they had played a minor role before liberalization. The average tariff rate was only about 20%, but the structure was complicated and the maximum rate was 90% (for cars). In addition there was an import surtax of 20% (RPED, 1993). Apart from a reduction in the surcharge to 10% in 1994, there was little advance in tariff reform until 1997 when a new tariff system was introduced with the aim of removing distortions in the old regime.

The deregulation of the domestic markets included removal of the price controls in the goods market, reduction of government's involvement in wage setting and introduction of new labor regulations making it cheaper and easier to retrench employees, and liberalization of the financial markets. Substantial progress was made in all these areas: Almost all price controls were abolished during the first years of ESAP. The labor market underwent profound changes already in 1990, as wages in general became determined by collective bargaining and retrenchment no longer required ministerial approval (Ncube, 1998). And in the financial markets, the majority of the interest rates were deregulated already by 1991.

3. TOTAL FACTOR PRODUCTIVITY

The general understanding of total factor productivity (TFP) is that it is measured by an index of outputs divided by an index of inputs, or as the shift in the production function. These two approaches are identical when the production function is defined on continuous time and production is assumed to be efficient. Technological change is also defined and measured as the shift in the production function and is thus often used synonymously with TFP. When production is allowed to be inefficient, however, TFP change also includes technical efficiency change.

There are many possible causes for changes in productivity in a plant; in the short run productivity can increase as a result of higher capacity utilisation, which might be due to higher domestic and international demand, or access to rationed inputs. More fundamental sources of increased productivity are the use of new techniques, scale economies, investments in human capital and a more efficient allocation of resources in relation to relative factor prices.

Productivity can be measured in several ways. One way is to use the so-called Malmquist index, first defined as a quantity index in a consumer context by Malmquist (1953), and then proposed as a productivity index by Caves et al (1982). Compared to indexes like the Fisher ideal index and the Törnqvist index, the Malmquist index has several advantages. No assumptions regarding market structure or economic behavior, e. g. cost minimizing or revenue maximizing, needs to be made. Moreover, the Malmquist index requires no information on prices. However, the index requires specific assumptions of the technology, which can be specified as, for instance a translog

technology (see Caves et al, 1982 and Nishimizu and Page, 1982), or a non-parametric technology (see Färe et al, 1994 and Bjurek, 1996).

In this paper we measure TFP by means of the Malmquist productivity index based on a non-parametric technology. Since we know little about the economic behavior of the firms and the market structure in the different sectors, and since price information is weak, the Malmquist productivity index is well motivated. The main advantage of the assumption of a non-parametric technology is that we do not have to specify a specific functional form.

The productivity change is estimated for 31 manufacturing sub-sectors, at the 4-digit level of ISIC, for the years 1980 to 1995. For each sub-sector we have sixteen observations on production, measured in 1990 manufacturing prices, capital stock, labour and materials. The capital stock is calculated using the perpetual inventory method using investment data from the Census of Industrial Production as far back as from 1967. In the calculations of the capital stock, we used the value of real output in 1967 as a proxy of the initial capital stock, and a depreciation rate of 5%. Since the sub-sectors are heterogeneous, each sector has its own specific technology and we cannot estimate TFP using a panel. Thus, the non-parametric technology is also justified because of the restricted number of observations, which excludes the estimation of a translog function or other flexible functions.

3.1 The Malmquist Productivity Index

In this sub-section, we define the Malmquist productivity index and the underlying assumptions. Let the technology for each manufacturing sub-sector be represented by

a technology set, S, defined as:

$$S = \{(x, y) : y \, can \, be \, produced \, by \, x \ \} \tag{1}$$

where y is a vector of outputs and x a vector of inputs. We assume that S is closed, convex, exhibits constant returns to scale and free disposability of outputs and inputs. The output distance function for a feasible point (x, y) is defined as:

$$D^o(y,x) = min_\delta \left\{ \delta : (x, \frac{y}{\delta}) \in S \right\}, \delta > 0. \tag{2}$$

The input distance function is defined as:

$$D^i(y,x) = max_\theta \left\{ \theta : (\frac{x}{\theta}, y) \in S \right\}, \theta > 0. \tag{3}$$

Introducing observations from two periods, t and t+1 and given constant returns to scale, the input and the output based Malmquist productivity indexes are equal and are defined as (see Caves et al (1982)):

$$M(y^t, x^t, y^{t+1}, x^{t+1}) = \frac{D^o(y^{t+1}, x^{t+1})}{D^o(y^t, x^t)} = \frac{D^i(y^t, x^t)}{D^i(y^{t+1}, x^{t+1})} \tag{4}$$

The output based index measures productivity change given input quantities, while the input based index measures productivity change given output quantities. A productivity value larger then one indicates a productivity improvement and a value less than one a productivity decline. Note that since we measure productivity relative to a common technology we do not separate technical change and technical efficiency change. In fact, for each sub-sector, productivity is measured relative the most

productive observations during the entire period. In most applications panel data sets are used and the index is decomposed into technical change and efficiency change. Although, it is possible to decompose the index in the case with only time series data, there are serious identification problems.

Since the output based and the input based Malmquist productivity index are equal for the non-parametric (DEA) technology given constant returns to scale, one can estimate either input or output distance functions. The output distance function, equals the inverse of the optimum value of the linear programming problem (5) to (8) i.e. $D^o(y,x)=\bullet^{-1}$

$$Min\ \mu = \sum v_i\ x_{i0} \tag{5}$$

$$\sum_{k=1}^{s} u_k\ y_{k0} = 1 \tag{6}$$

$$-\sum_{k=1}^{s} u_k y_{kj} + \sum_{i=1}^{m} v_i\ x_{ij} \geq 0 \quad j = 1,\ldots,N \tag{7}$$

$$u_k, v_i \geq 0 \tag{8}$$

where u_k and v_i are the weights of the LP problem and N is the number of observations, i.e., equal to the number of years in this case. There are three inputs, m, capital, labor and materials, and a single output s.

3.2 Total Factor Productivity Results

Total factor productivity change for the manufacturing sub-sectors are reported in Table 1 for the periods 1981-1985, 1986-1990, 1991-1995 and 1994-1995. During the periods 1981-1985 and 1986-1990 productivity increased in most sub-sectors, while during the period 1991-1995 more than half of the sub-sectors show decreasing productivity. We have also reported the yearly productivity change for 1994-1995, when the trade reform was more or less completed. During this period productivity increased for approximately two thirds of the sub-sectors. To give a visual impression of the changes we have included two figures. Figure 1 and Figure 2 compare average productivity growth for the period 1986-1990 with 1991-1995 and 1994-1995, respectively. In general the growth rates vary greatly both over time and across sections. The overall impression is that total factor productivity growth was lower during the period of ESAP than during the period 1986-1990. However, during the last two years, 1994-1995, most sub-sectors experienced higher productivity growth than during 1986-1990. The observed differences between the periods could be a result of liberalization, but they could also be due to changes in exogenous factors such as changes in demand, foreign aid and weather conditions. Thus, in the following section we test for the determinants of TFP.

4. ECONOMETRIC ANALYSIS

To investigate if market liberalization in general, and trade reform particular, have contributed to an increase in TFP growth, panel data methods were used to estimate fixed-effects models. The purpose was to evaluate the impact on TFP growth of variables related to ESAP, while controlling for others. Since little is known about the determinants of TFP the analysis was exploratory and several different models were estimated.

Our primary measure of trade liberalization is the share of total imports financed through the DLMA. It should capture the process of opening up during the 1990s well, since its evolvement is quite close to the plan laid out by Government (GOZ, 1992). However, during the 1980s variations in the degree of import rationing are likely to have affected the share between Government and private imports, resulting in relative decreases in allocations for reasons that are unrelated to trade liberalization. Thus, in constructing the variable we kept its values for the period 1981-1989 constant, e.g. the average value for the latter part of the 1980s was used. This means that we do not measure changes due to export promotion programs implemented before ESAP, such as the Export Revolving Fund and the Bonus Scheme Imports. Since these only constituted minor changes within the import-substitution policy regime they are not of central interest to our study.

As an additional measure of trade liberalization we have used the premium on the parallel foreign exchange market. It is not ideal because it can also reflect factors not directly related to trade policy, such as changes in monetary policy. However, the behavior of the premium during the 1990s is closely related to that of the share of foreign exchange allocations, and thus gives support to the results obtained with the latter.

We also used two step dummies to test for the impact of trade reform. One dummy was set to zero up to 1993, and to unity in 1994 - 1995 when the DLMA had been abolished and a unified foreign exchange market had been established. The other dummy was set to unity for the whole period of ESAP (1991-1995). Both dummies

are of course more likely than the two other measures to capture the impact of reforms in general.

One goal of trade reform is higher TFP growth, due to increased foreign competition. There is hardly any doubt that competition has increased in many of the sub-sectors in Zimbabwean manufacturing, as indicated both by anecdotal evidence and data on imports of manufactured goods. For instance, calculations made by Durevall et al (1998) showed that imports of goods, classified according to the ISIC categories used for the manufacturing sector, grew by 35% in current U.S. dollars between 1993 and 1995. This should have resulted in reduced market power for domestic firms and decreases in their mark-ups. Thus, an indirect way of testing the effects of trade reform is to include mark-ups in the empirical model.

Since independence Zimbabwe has received a great deal of foreign aid, and during the first years of the implementation of the structural adjustment program it increased considerably; in real terms foreign aid was more than 40% higher during 1991-1995 than during the previous five years. The most direct effect of foreign aid on TFP is probably through Balance of Payment support and commodity import programs, which intend to alleviate bottlenecks due to shortages of imported inputs and allow the authorities to maintain a stable currency. However, foreign aid can affect TFP in many other ways, from increasing demand to having a positive impact on infrastructure. To capture these effects we added the rate of change in the real value of foreign aid in our estimation model.

Two variables were included to capture the availability of inputs, the growth in imports and the amount of rainfall. During most of the 1980s import rationing kept capacity utilization down, and thus the possibility to import inputs more freely during the 1990s should have increased productivity. However, import growth is also likely to measure increases in foreign competition, in particular for 1994 and 1995, and thereby capture two of the channels through which trade reform affects TFP. Ideally we would have liked to disaggregate imports into goods produced by the different manufacturing sectors and their imported inputs, but this was not feasible for the whole sample period due to paucity of data.

Rainfall is the most important determinant of yearly changes in agricultural production in Zimbabwe, and it is used instead of marketed agricultural output of which there is a lack of information due to liberalization of the agricultural markets. Since many industries use inputs from the agricultural sector, the size of the harvests can have a direct effect on productivity through variations in both availability and price of agricultural raw materials. Moreover, changes in agricultural production also affect exports and imports. Good harvests boost exports and reduce the need to import food. During the period of import rationing this resulted in more foreign exchange being made available to the manufacturing sector for imports of intermediate goods and capital. After liberalization, the result is probably cheaper imports through the impact on the value of the currency.

Over the course of ESAP inflation rose from about 15% to close to 50% and then dropped to about 25%. As a result, both the variability and the dispersion of relative prices probably increased during this period. This is likely to have had a negative

effect on the efficiency of price signals and could have affected decisions to invest in new technology by increasing uncertainty (Dixit and Pindyck, 1994). Thus, to control for the impact of the rapid growth in inflation during ESAP we included the rate of change in inflation as a proxy for price variability.

Studies on developing countries have shown that variations in demand due to business cycles can affect total factor productivity in the short run. A sector in manufacturing is likely to experience decreases in productivity during booms and vice versa (Roberts and Tybout, 1997). The reason is that when demand is high the less efficient firms increase their market shares, and during recessions they lose shares. Moreover, more new firms enter the market when times are good and in general they have lower productivity than the average of old firms. However, this is not likely to have been an important factor in Zimbabwe before liberalization because of the difficulties of entering the DLMA system. To capture the effect of business cycles we have included two variables; the deviations from trend of the log of GDP in Zimbabwe and industrial production in the industrialized countries. The trends were obtained with the Hodrick-Prescott filter.

Output growth is usually found to have a strong effect on TFP growth (see Tybout, 1992 and Weiss, 1992). This is known as Verdoon's Law, which states that high output growth increases TFP growth through scale economies. We share Tybout's (1992) concern that the empirical results might reflect a spurious correlation since output growth also enters on the left-hand side of the equations estimated, i.e. in the measures of productivity. However, as an additional check on the robustness of our results we estimated models with output growth as an explanatory variable.

In Table 2 we report a selection of the estimated models. They were estimated as 'one way' fixed effect models using least squares with White's robust estimation of the covariance matrix under the assumption that variances are equal within groups. We also estimated models that allowed for a more general form of heteroscedasticity and an autocorrelated error structure, but these gave results very similar to those reported.

The columns numbered (1) to (4) in the table present estimates of our base-line model and the four variables measuring trade reform, i.e., the share of imports financed through the DLMA, the premium, and the two step dummies. Neither of these measures is even close to being significant, indicating that trade reform by itself has not contributed to growth in TFP. However, the results do suggest that the increase in the growth of imports and foreign aid that occurred during ESAP raised TFP; an increase by one percentage point in imports or foreign aid raises TFP growth by about 0.2 and 0.1 percentage points, respectively. The results also show that increases in the growth rate of inflation reduce TFP growth, that there is a strong and clearly significant negative effect from the foreign business cycle, and that there is a positive effect from rainfall.

In column (5) the domestic business cycle lagged one year has been added to the model, but it is not significant. This result is dependent on the inclusion of the foreign business cycle, which dominates the domestic one. We also tried adding business cycles contemporaneously but that reduces the t-values considerably. In any case, our measure of trade liberalization was not significant in any of the models estimated.

Column (6) reports estimation results when the mark-up is included the model of column (1). It is clearly significant, having a t-value of 5.5. But the coefficient is positive, not negative as we predicted. Since there might have been a change the relation between the mark-up and TFP during ESAP, we constructed two interaction dummies, one for the period of no quota restrictions (1994-1995) and one for entire ESAP (1991–1995). As shown in column (7) and (8), the coefficient on the mark-up does not appear to have changed during the structural adjustment program. It is interesting to note that adding the mark-up only marginally affects the estimates of the parameters of the other variables.

Finally we included output growth to control for potential dynamic scale economies. As reported in column (9), it is highly significant and has a strong positive effect on TFP growth; its coefficient is 0.32. The inclusion of output does not change our main findings; the trade reform variable remains insignificant, and imports, foreign aid and the foreign business cycle still affect TFP. However, the coefficient on foreign aid has dropped from 0.1 to 0.04, maybe reflecting foreign aid's impact on demand for manufactured goods. Moreover, inflation and rainfall are no longer significant. This casts doubts on our earlier findings about the relevance of inflation for TFP growth, because changes in inflation might result from changes in output. Rainfall, on the other hand, is not caused by output, only correlated with it. The insignificance of rainfall is probably due to output growth being sector specific, and thus more correlated with TFP growth.

5. CONCLUSION

There are several reasons to expect that ESAP has generated substantial TFP growth in the manufacturing sector. During the 1980s, there were chronic shortages of both imported inputs and capital goods, resulting in the use of old machinery at low capacity utilization. Moreover, there was little domestic and international competition, a price-control system which reduced incentives to control production costs, labor regulations that made it costly and cumbersome to fire workers, and a foreign exchange allocation system that limited entry and exit of firms.

Nonetheless, the TFP growth rates, estimated for 31 different manufacturing sectors over the period 1980 to 1995, do not show a clear tendency to increase during the implementation of ESAP; in fact more than half of the sub-sectors experienced declines in TFP during the period 1991-1995. The performance during 1994-1995 was clearly better when the average growth rate was higher than during the latter half of the 1980s.

Since the growth performance of TFP is determined by many different factors, not just market reforms, we estimated a panel data model to control for exogenous variables. We then tested formally if TFP growth was higher after the implementation of ESAP than before. None of our measures of trade reform turned out to be significant. However, two variables related to ESAP had an impact on TFP growth, the growth rate of imports and foreign aid.

We also tested if the mark-up influenced TFP. The hypothesis was that trade liberalization leads to increased competition, causing mark-ups to decline and TFP to

grow faster, that is, they should be negatively correlated. Our finding was that the correlation is positive, not negative, and it does not appear to change during ESAP. One explanation for the positive correlation is that changes in labor input and wage costs coincide, and that these have strong influences on TFP growth and the mark-up, respectively. An alternative explanation is that increasing foreign competition leads to lower sales for domestic firms. If the domestic firms are slow to adjust but stay in the market productivity might decline. This would also imply a positive correlation between mark-up and productivity.

Another result is that both domestic and foreign business cycles, lagged a year, have a negative effect on TFP growth. This is in accordance with the findings reported by Roberts and Tybout (1997) for other developing countries. It could be due to a reallocation of market shares over the cycle as inefficient plants expand more than efficient ones when aggregate demand grows, and contract more during recessions.

We also found that rainfall increases TFP growth, and the change in inflation decreases it. However, these results were not robust to the inclusion of the rate of change in output. In the case of rainfall, this is not surprising since it is obviously correlated with output growth. For the change in inflation, the lack of robustness implies that inflation decreases when output grows. Since causality is most likely to run mainly from output to inflation, we have no evidence that inflation growth reduces TFP growth.

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APPENDIX: DATA DEFINITIONS AND SOURCES

The data used to measure TFP, output, labor, materials, and investments are taken from the Census of Industrial Production (various issues) published by the Central Statistical Office (CSO). There are 31 sectors measured at the 4 digit level defined according to the ISIC rev 2. The census is carried out yearly and covers all registered businesses with a Gross Output over Z$2000 (in 1995 approximately US$300). A number of establishments with self-employed persons are excluded because of collection difficulties. In total about 1000 companies are surveyed each year. The period of response runs from April to March so data listed for 1994 in our sample are for 1994/95. To calculate real values we used deflators for production and gross fixed capital formation in manufacturing. The capital stock was calculated using the perpetual inventory method. For the initial values we used output for 1967 in each sector. The depreciation rate was assumed to be 5%.

- The mark-up was calculated as (V-W)/Y where V is value added, W total wages, and Y output. Value added is defined as Y-M, where M is material inputs. The source of the data is Census of Industrial Production (various issues).

- Share of imports financed through the (DLMA). The source of the data from DLMA is the Reserve Bank of Zimbabwe. Imports are taken from Quarterly Digest of Statistics (QDA) (various issues) from the CSO.

- Foreign Aid is from the World Bank World Development Indicators 1997. The nominal value in U.S. dollars was divided by the U.S. whole sale price index taken from International Financial Statistics database (IFS) of the IMF.

- Change in inflation is based on the consumer price index published in QDS.

- Rainfall data was provided by Zimbabwe Meteorological Services of the Government of Zimbabwe. Rainfall year *x* is measured as the amount of rainfall between October the previous year and April year *x*.

- The premium on the parallel foreign exchange market was calculated with data obtained from World Currency Yearbook (various issues). After the liberalization of the foreign exchange market in 1994 the premium is assumed to be zero.

- The series for imports was obtained from the World Bank World Development Indicators 1997. It is measured in constant 1987 U.S. dollars.

- The domestic business cycle was measured as the deviation of the log of the real GDP from its trend. The trend was calculated with the Hodrick-Prescott filter. Real GDP was taken from IFS.

- The foreign business cycle was measured as the deviation from trend of the log of an index of industrial production in industrialized countries. The trend was calculated with the Hodrick-Prescott filter. The index of industrial production was taken from IFS.

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Table 1. Total Factor Productivity Change in the Manufacturing Industry 1981-1995 (percent per year).

	1981-1985	1986-1990	1991-1995	1994-1995
Meat	1.4	0.2	2.8	0.0
Grain mills	-0.2	-1.2	0.7	2.6
Bakery products	4.2	0.2	0.0	11.1
Confectionery	2.4	-0.5	-0.2	3.3
Miscellaneous foods	1.4	1.6	0.0	0.2
Alcoholic beverages	18.3	0.0	-7.7	-4.7
Soft drinks	3.7	4.6	-1.1	2.9
Tobacco products	5.2	-5.2	5.6	16.5
Cotton textiles	0.0	0.0	-0.4	3.6
Knitted products	0.0	1.4	-0.1	7.9
Other textile products	2.8	0.0	-4.4	-7.1
Wearing apparel	1.2	-0.1	-2.8	1.5
Footwear	4.9	-2.4	-5.8	-3.6
Wooden products	-3.3	4.9	0.0	0.0
Furniture	0.1	0.8	0.0	12.0
Paper products	0.9	0.0	-2.0	-2.2
Printing	0.0	0.0	-4.0	-9.5
Fertiliser	0.7	-3.0	0.7	-5.5
Paints	5.7	-0.1	-8.1	-5.2
Soaps-pharmaceuticals	0.1	0.2	-2.4	1.1
Miscellaneous chemicals	3.3	-1.3	-3.4	-1.9
Basic chemicals	-1.7	1.2	0.5	8.4
Rubber products	0.9	-2.2	-0.8	-3.8
Plastic products	3.0	0.9	-7.8	-4.2
Structural clay products	6.7	0.0	-5.0	1.9
Non-metallic mineral products	-1.2	1.2	2.3	15.6
Basic metals	-1.1	0.2	1.2	9.3
Metal products-machinery	-0.7	-0.1	0.1	6.6
Electrical machinery	0.9	0.6	-0.2	0.3
Motor vehicles	1.7	-1.0	2.8	0.8
Other vehicles	0.6	0.0	-3.3	5.1

Note: The source is the Census of Industrial Production (various issues).

Table 2. Determinants of Total Factor Productivity Growth in Manufacturing

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Share of imports financed by DLMA	-0.011 (-0.241)				-0.040 (-0.764)	0.021 (0.490)	0.066 (0.835)	-0.011 (-1.354)	0.023 (0.591)
Premium on parallel exchange rate market		-0.118 (-0.803)							
Dummy for trade liberalization			0.005 (0.277)						
Dummy for ESAP				-0.009 (-0.771)					
Growth in imports	0.191 (2.716)	0.186 (2.644)	0.185 (2.412)	0.199 (2.842)	0.211 (2.924)	0.257 (3.831)	0.232 (2.956)	0.255 (3.814)	0.166 (2.805)
Growth in foreign aid	0.103 (4.201)	0.101 (4.140)	0.103 (4.203)	0.102 (4.179)	0.105 (4.295)	0.099 (4.262)	0.099 (4.257)	0.102 (4.431)	0.041 (1.932)
Growth of inflation	-0.228 (-2.531)	-0.198 (-2.024)	-0.228 (-2.562)	-0.250 (-2.778)	-0.266 (-2.792)	-0.269 (-3.148)	-0.262 (-3.149)	-0.284 (-3.341)	0.047 (0.588)
Foreign business cycle lagged one year	-1.179 (-4.653)	-1.244 (-4.668)	-1.143 (-4.040)	-1.149 (-4.490)	-1.463 (-4.230)	-1.500 (-6.126)	-1.345 (-3.980)	-1.406 (-5.586)	-0.856 (-4.025)
Log of rainfall	0.079 (2.376)	0.082 (2.617)	0.079 (2.409)	0.064 (1.911)	0.120 (2.519)	0.0672 (2.104)	0.0667 (2.116)	0.055 (1.734)	-0.019 (-0.663)
Domestic business cycle lagged one year					0.366 (1.203)				
Mark-up						0.445 (5.460)	0.434 (5.139)	0.500 (5.584)	
Mark-up dummy (1994-1995)							0.073 (0.580)		
Mark-up dummy (1991-1995)								-0.137 (-1.670)	
Growth in production									0.342 (12.513)
Standard deviation	0.118	0.118	0.118	0.118	0.118	0.112	0.112	0.111	0.099
R^2	0.095	0.096	0.094	0.096	0.097	0.196	0.189	0.199	0.363

Note: The dependent variable is the growth rate of total factor productivity. The sample runs from 1981 to 1995 and there are 31 groups, giving 465 observations. All equations were estimated with Least Squares allowing for fixed effects. The standard errors are corrected for heteroscedasticity assuming variances are equal within groups. T-statistics are reported in parenthesis. All results were obtained with LIMDEP 7.1.

Diagram 1. Productivity growth 1986-1990 (black) 1991-1995 (stripes)

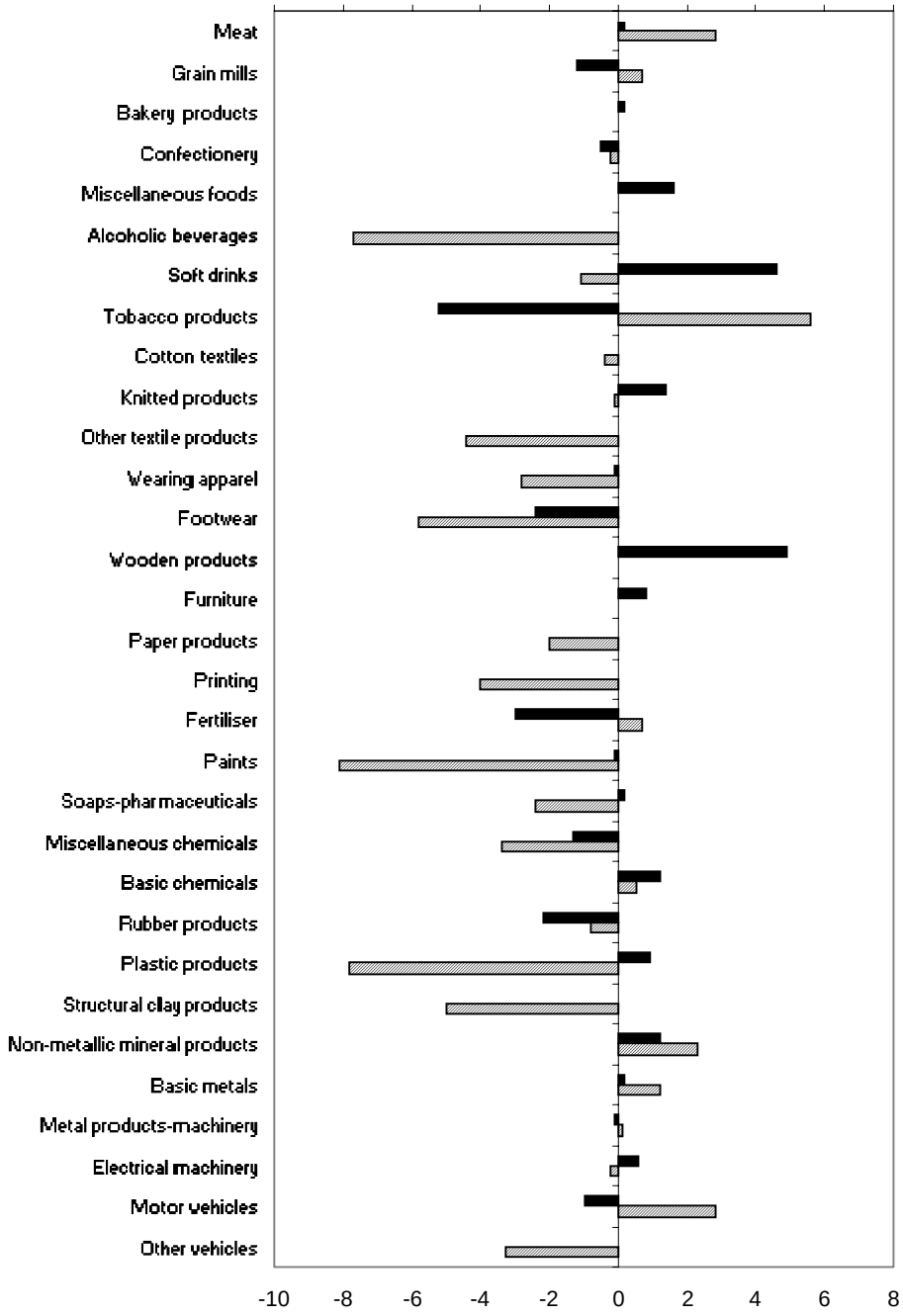

Diagram 2. Productivity growth 1986-1990 (black) 1994-1995 (stripes)