The Impact of Economic Globalisation on the South African Auto Industry

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ABSTRACT

This paper assesses the impact of economic globalisation on the South African auto industry. First, a duopoly model of differentiated products is used, which allows the determination of the free trade and protection dividing line. This determines the stay-exit function, which shows the profitability level of the domestic industry. Second, to determine the relationship between employment, profitability and export in the auto industry, a log-linear equation is estimated in which the logarithm of employment is expressed as a function of the logarithm of the distance between the stay-exit function and the trade line and the logarithm of export. These estimates suggest that policy makers take measures to either prevent the destruction of the domestic industry and the decrease in employment in the auto industry, or increase its profitability and employment.

JEL F1, L1

1 INTRODUCTION

Economic globalisation was first explicitly used in the literature by Modelski (1972). According to him, the term refers to European-led expansion to gain control over other communities and integrate these into one global trading system. In current terms, however, economic globalisation can be defined as the intensification of profit seeking abroad by states or businesses through the widening of world markets, the fast processing of information, the improvement and relocation of production units world wide, and the voluntary participation of countries in the world trading system. And its engines are free trade and government hands-off economic policies.

Economic globalisation has profound effects on societies in general and industries in particular. Like the auto industries of the US and Korea, South African auto industry[1] faces intense competition from other auto industries because of economic globalisation. However, since its inception in 1920, the South African auto industry has played an important role in the economy of the country as a large

employer. Therefore, if no preventive measure is taken, economic globalisation may sharply reduce the profitability and employment capacity of the South African auto industry. This will worsen unemployment and decrease the national revenue in South Africa. This paper, therefore, uses a duopoly model of differentiated products[2] to determine the free trade and protection dividing line on the one hand, and the relationship between the profitability and employment level of the South African auto industry on the other hand. Below this dividing line or trade line, the profit of the domestic industry is negative. As a result, the domestic industry can be driven out of business by foreign competitors. Above the line the profit of the domestic industry is positive, enabling the possible increase in employment in the auto industry. The determination of the dividing line enables policy makers to implement economic policies that can prevent the destruction of the domestic industry and the decrease in employment capacity in the auto industry. Additionally, an empirical estimate of the relationship between the percentage change in employment and profitability enables policy makers to determine the increase or decrease in employment induced by the increase or decrease in profitability respectively.

The paper comprises four parts. First, is a review of the literature, followed by an analysis of the impact of globalisation and policy implications of globalisation. Third, relevant hypotheses are represented and tested, and the research methodology described. Finally, the specification is given for the equations that are estimated.

2 LITERATURE REVIEW

Although there is a large literature on free trade and protectionism, there has been little attempt to determine the dividing line between free trade and protectionism. Smith (1937) argues that if countries specialise in the production of commodities in which they have an absolute advantage, free trade will be mutually beneficial for the trading partners. Ricardo (1911) improves Smith's theory by arguing that even if a country does not have an absolute advantage in the production of a commodity, it can still benefit from free trade by specialising in the production of the commodity in which it has a comparative cost advantage. More recently, Samuelson (1962) argues that free trade is better than no trade. Using a production possibility frontier (PPF) in his 1962 paper, he shows that free trade shifts the PPF outward, making consumers better off.

Dissenting from these arguments, Hamilton (1968) in his *Report on Manufactures* stresses the need for protection of the US manufacturing industries. List (1841) also questions Smith's "cosmopolitical" viewpoint, arguing that a nation's economic interest can be undermined with free trade,

particularly if its young manufacturing industries are put at risk by allowing free competition between them and the established manufacturing industries of other countries. He then calls for the protection of young German manufacturing industries. Bhagwati (1988), too, argues for some protective measures for developing economies so that they can benefit from trade. Bouare (1998) shows that Smith's and Ricardo's theories are inadequate for explaining international trade. He argues that countries are not involved in trade because they have an absolute advantage in the production of a good or can produce a good relatively cheaper as compared to their trading partners, but they are involved in trade because they can make a relative greater profit. Bouare introduces a theory of comparative profit advantage in which trade is not always mutually beneficial to two trading partners.

Perhaps the lack of determination of a dividing line between free trade and protectionism derives from the rift between proponents of Smith's critique of mercantilism and proponents of Hamilton and List's support for economic protection.

State interventions in the South African auto industry since 1920 should be perused against the background of these two opposing approaches. According to Duncan (1993), the Federated Chamber of Industries, presided over by Harold J. Laitte in the 1920s, strongly supported the expansion of industry through tariff protection. In 1934, Pirow announced his vision of engine and casting building in South Africa, and the complete manufacture of cars and trucks in the country. The ensuing project was a state-driven enterprise, with the government committing itself to purchasing a minimum number of vehicles and holding shares in a South African engine manufacturing company. From 1961 onwards, assemblers were required by the government to include 11 basic local components in their vehicles. The government offered bonuses to assemblers who included more local components in their vehicles. This policy successfully reduced the drain on foreign exchange from R145.6 m (of a total import expenditure of R941.4 m) in 1960, to R110.6 m in 1961 (the total import expenditure that year being R812.0 m). Encouraged by tariff protection, by assemblers' anxiety to buy locally, by increasing vehicle sales and by the government's Industrial Development Corporation, investment in the components sector grew from R15 m in 1961 to R85 m in 1967. By 1967, there were over 200 motor component factories in South Africa. In 1970, all manufactured models had to reach a net local content by weight of 50 per cent (excluding tyres and tubes). The government maintained this basic policy of import substitution through the 1970s and 1980s, with steady increases in local content percentages (Duncan, 1993: 68-76). For further discussion on this issue, see East (1981), Bizos (1985), Bell (1989) and Ducan (1993).

But if we judge the success of free trade on its expansion in the world community[3], it would seem that the proponents of free trade are winning the contest. However, in spite of these agreements, every country continues to seek to protect its own economic interests by implementing some protective measures[4]. This suggests that free trade does not seem to be a win-win situation for every country otherwise there would be no need for these agreements or protections. As a result, countries need to set up devices to increase their national revenue and employment, and thereby ensure their economic prosperity.

3 IMPACT OF GLOBALISATION AND POLICY IMPLICATIONS

The engines of economic globalisation are free trade and a government hands-off policy, both which foster the expansion of businesses world wide. However, globalisation is not necessarily conducive to an increase in the national revenue of third-world and developing countries, as the recent Asian crisis has shown. Yet globalisation is strongly advocated throughout the world. Developed countries in general and the US in particular are pressurising third-world and developing countries to subscribe to free trade and government hands-off economic policies. The reason is that developed countries have reached a stage of development in the capitalist mode of production in which their respective domestic markets can no longer absorb their production. As a result, the sustainability of their production depends on the existence of outlets. If these countries cannot export the surplus of their output they will face either an economic recession or depression. An important part of American economic growth is derived from American exports. It is therefore not surprising that the US is now a vocal supporter of globalisation, free trade and the opening of foreign markets, whereas in the nineteenth century it erected a wall of protection to secure its economic interests[5]. What is missing in the globalisation equation is room for third-world and developing countries to secure their industrialisation in order to protect their economic interests as every developed country has actually done[6]. Although developed countries are pressing third-world and developing countries to open their goods and capital markets to international financial capital with which developed countries are well endowed, they close their labour markets through their immigration laws to international labour with which third-world and developing countries are well endowed. If developed countries really believe that globalisation, free trade and government hands-off economic policies are beneficial for all countries, why do they keep at bay the labour of third-world and developing countries? The reason is that the free flow of labour is not beneficial for the economy and standard of living of developed countries. For instance, the free flow of labour will sharply decrease the wage rate in developed countries, create a reserve of cheap labour and lower the standard of living. Developed countries will also become overcrowded and economically unmanageable. A

similar economic difficulty to that of Asia will occur in third-world and developing countries if international financial capital is allowed to flow freely. Therefore, third-world and developing countries should protect their economic interest and adopt government hands-on economic policies when necessary.

Economic globalisation increases competitive pressure on the domestic auto industry in South Africa because it increases the number of suppliers of automobiles in the domestic market. This results in a decrease in the price of automobiles in South Africa, which benefits domestic consumers if the domestic industry is not driven out of business. However, since there is no guarantee that the domestic industry will survive the competitive pressure, it would be ill-advised to allow the possibility of the destruction of the domestic industry, which is a large employer in the country.

The reason is that not only will foreign producers increase their prices when the domestic industry is destroyed, making domestic consumers worse off, but unemployment will also increase with such magnitude that the country will face acute social tension. Therefore, if the point at which the domestic industry may be driven out of business can be determined, some preventive measures can be taken to protect the profitability of the industry and thereby employment in the industry.

When the domestic industry is prevented from being driven out of business, the issue then is to determine the relationship between the percentage change in profitability and in employment. However, there is no clear-cut theoretical solution to this. It depends on the demand for automobiles, the wage rate, workers' productivity within the industry, and the bargaining power of the unions, all of which are specific to each country and industry. Therefore, to determine this relationship, we will use an empirical estimate of a linear relationship between the percentage change in employment and in profitability over the period under study.

4 HYPOTHESES AND RESEARCH METHODOLOGY

4.1 Hypotheses

Before setting up any device to ensure the economic prosperity of the South African auto industry, we need to assess the impact of economic globalisation on the industry. To do so we will test the following hypotheses:

1 Economic globalisation decreases profitability in the South African auto industry.

2 Economic globalisation increases unemployment in the South African auto industry.

4.2 Research methodology

To test these hypotheses, we first set up a duopoly model of differentiated products in which foreign and domestic automobiles are sold in the domestic market in order to determine the free trade and protection dividing line. From our model, we determine the price that maximizes the profit of the domestic industry. This price in turn is used to determine what we call the stay-exit function. If the stay-exit function is above the dividing or trade line, the domestic industry's profit is positive; if the stay-exit function is on the line, the profit is equal to zero; and if the stay-exit function is below the line, the profit is negative. Thus, free trade can be implemented by policy makers if the stay-exit function is above the dividing line because in this zone the domestic industry *stay*s in business since it is not at risk. However, when the stay-exit function is below the dividing line, some protection measures should be implemented to prevent the domestic industry from *exit*ing business or being driven out of business by foreign competitors.

Because it may be too late to rescue the domestic industry if the stay-exit function is at or just above the dividing line, we determine a second line above the dividing line, called the GATT or WTO line. If the stay-exit function is between the GATT line and the trade line, i.e. in the GATT zone, some agreements should be negotiated with trading partners to prevent the stay-exit function from being pushed below the trade line, i.e. in the protection zone. In other words, managed trade should be implemented in the GATT zone. When the stay-exit function is above the GATT line, i.e. in the free trade zone or banquet zone, the domestic industry is on safe ground because the stay-exit function is far away from the trade line. We call this zone the banquet zone because foreign producers of automobiles produced outside South Africa are allowed to freely reap the gain from trade in this zone in the South African domestic market.

An estimate of the trade line, the GATT line and the values of the stay-exit function in South Africa from 1991 to 1998 will indicate the location of the stay-exit function in the free trade zone, the GATT zone or the protection zone. From the beginning to the end of the period under study, the stay-exit function is expected to have a downward sloping trend or to move from the free trade zone to the GATT zone or the protection zone. This will confirm our first hypothesis, i.e. economic globalisation decreases profitability in the South African auto industry.

Second, we use a linear relationship between the logarithm of employment, the logarithm of the distance between the stay-exit function and the trade line, and

the logarithm of export to examine the rate of change in employment induced by the rate of change in profitability in the auto industry. In this relationship, the logarithm of employment is the dependent variable, while that of the distance between the stay-exit function and the trade line, and that of exports are the independent variables. An econometric estimate of this linear equation will tell us how much change in employment in the South African auto industry will result from a 1 per cent change in its profitability. From the beginning to the end of the period under study, we expect a relative decrease in employment in the auto industry due to the relative decrease in its profitability. This will confirm our second hypothesis, i.e. economic globalisation increases unemployment in the South African auto industry.

From these estimates, we will suggest economic policy measures to pull the stay-exit function into the free trade zone or maintain it there, and thereby increase or maintain profitability and employment in the South African auto industry.

5 EMPIRICAL STUDY

In the recent studies of the US auto industry, Toder (1978), Bresnahan (1981) and Dixit (1988) have used unobserved hedonic prices that are determined from a regression equation where the price is the dependent variable and the physical characteristics of automobiles such as weight, horsepower, automatic transmission, power steering, length, etc. are independent variables. However, there is some uneasiness about this method because not only are hedonic prices not observed prices, but automobile characteristics are also not tractable when new characteristics are introduced through the invention of a new model or a change in the features of an existing model. In these cases, it is difficult to have a set of homogeneous characteristics. Instead of hedonic prices, one can use observed prices. But, since automobiles are differentiated products, if one uses observed prices, one faces the problem of homogenising the data. For instance, how can one transform the quantity of trucks into an equivalent quantity of cars? This problem can be solved by transforming the revenue obtained from the sales of trucks into an equivalent revenue of sales of cars.

Suppose that the revenue obtained from the sales of trucks is:

$$R_T = P_T.Q_T,$$

where R_T is the revenue obtained from the sales of trucks, P_T the price of a truck, and Q_T the quantity of trucks sold. If the price of one truck can buy for instance k cars, the revenue obtained from the sales of trucks can be written as:

$$R_T = (P_T/k).\ (k.Q_T),$$

where (P_T/k) is the price of one car and $(k.Q_T)$ the equivalent quantity of cars bought. Thus, the revenue obtained from the sales of trucks is transformed into an equivalent revenue of sales of cars. Then, R_T can be written as:

$$R_T = P_c.Q_c,$$

where $P_c = (P_T/k)$ is the price of one car and $Q_c = k.Q_T$ the equivalent quantity of cars bought. This technique can be used to transform all the annual prices and quantities of every variety of automobiles (small, medium-sized, luxury cars, sport utility van, pickup trucks, trucks) into the corresponding annual prices and quantities of our standard car, which is medium-sized.

This homogeneous data will be used to estimate the elasticities of demand for domestically produced cars and imported cars and the elasticity of supply of imported cars in order to determine the annual values of the interaction-elasticity, e_0.

We also use the homogeneous values of the quantity of domestic and foreign products demanded, i.e. Q_I and Q_D, to compute the values of the relative sales of imported automobiles (Q_I/Q_D). The market share ß of domestically produced automobiles will be measured by:

$$\frac{\text{Revenue spent in buying domestically produced automobiles}}{\text{Total revenue spent in buying automobiles in South Africa}}.$$

This value will be used to determine the relative market share [ß/(1-ß)] of the South African auto industry.

Since the marginal cost (MC) is considered constant in our model, its annual value will be the average variable cost because Average variable cost = Variable cost/Total quantity = (MC.Q)/Q = MC. The sum of payroll and material cost divided by the total quantity of South African automobiles is used as a proxy to measure the marginal cost because the average cost figures are unavailable.

We then can estimate the log of the South African price-cost margin equation by OLS to determine the elasticity of substitution s_{ID} because $1/(s_{ID}-1)$ will be a coefficient in the following regression:

$$\text{Ln}\left(\frac{P_D - MC_D}{P_D}\right) = a_0 + a_1\text{Ln}\left(\frac{Q_I}{Q_D}\right) - \frac{1}{s_{ID}-1}\text{Ln}\left(\frac{ß}{1-ß}\right) + a_3\text{Ln}\left[\frac{1-ß}{ß} - \left(\frac{1-ß}{ß}\right)^2.\frac{1}{e_0}\right].$$

Where P_D is the domestic price and the term in bracket the market share elasticity-interaction.

The estimates of the elasticities of demand of domestically produced and imported automobiles and the elasticity of supply of the latter will enable us to determine our trade line (TL):

$$d_0 = \frac{\frac{\partial Q_I}{\partial P_D}[\,1 + e_{IS}\,]}{\left[\frac{\partial P_I}{\partial Q_I}\cdot\frac{\partial Q_D}{\partial P_D}\cdot\frac{\partial Q_I}{\partial P_I}\right] - \left[\frac{\partial P_I}{\partial Q_I}\cdot\frac{\partial Q_D}{\partial P_I}\cdot\frac{\partial Q_I}{\partial P_D}\right] - \left[\frac{\partial Q_D}{\partial P_D}\right]},$$

where e_{IS} is the elasticity of supply of imported automobiles and P_I the price of imported automobiles.

Let us call $S^{-1/sID-1}.e = SE$ the stay or exit function, where $S = P_DQ_D/P_IQ_I$ is the terms of sale and e the variable cost curve elasticity. If SE < TL, the domestic producer is driven out of business (or exits) because the stay-exit function is below the trade line. That is, the domestic producer will be driven out of business when we have: $S^{-1/\,sID-1}.e < d_o$. If SE ≥ TL, the domestic producer stays in business because the stay-exit function is above the trade line. That is, the domestic producer stays in business when we have: $S^{-1/\,sID-1}.e \geq d_o$.[7]

Let us graph the stay-exit function. The vertical axis represents the values of the stay-exit function, while the horizontal axis represents the values of the terms of sale (figures 1 & 2). The value of the trade line is represented on the vertical axis.

Figure 1 $S_{ID} > 1$

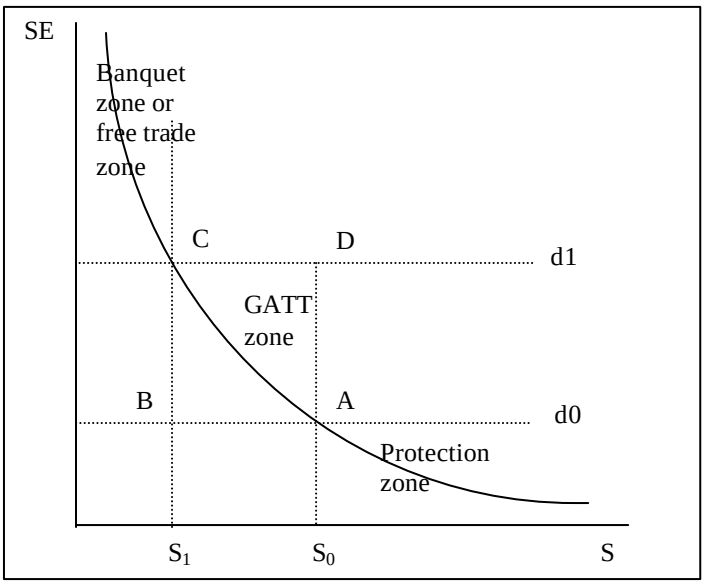


Figure 2 $S_{ID} < 1$

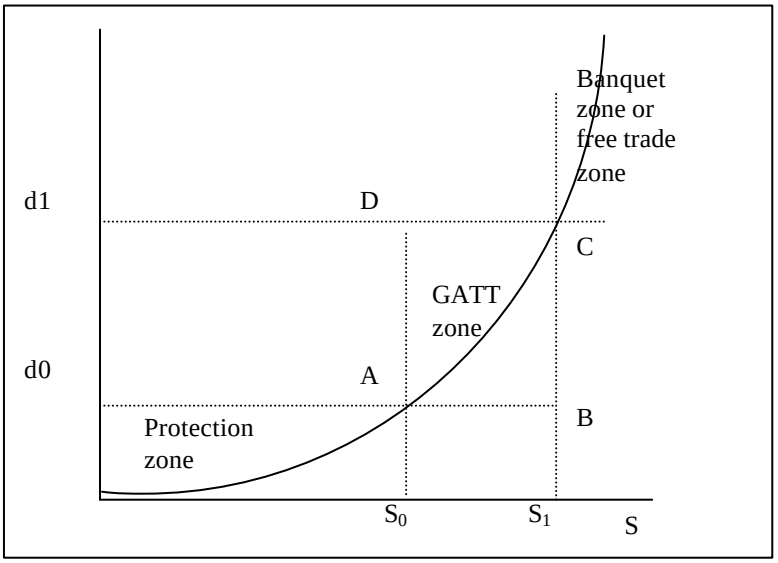
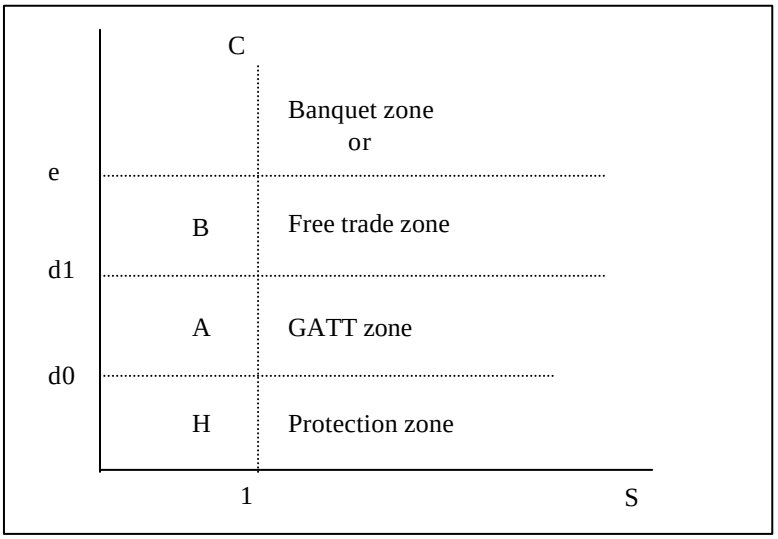


Figure 3 $S_{ID} = 1$



The SE function intersects the trade line d_o at point A, corresponding to the critical value of the terms of sale (S_o), where the domestic producer is driven out of business.

Because it might be too late to rescue the domestic industry when it reaches its critical value of exit (S_o), a second critical value S_1 is determined, where the domestic industry is still on safe ground. When $s_{ID} > 1$ (Figure 1), S_1 should be on the left of S_0 because the stay-exit function has a hyperbolic shape; while if $s_{ID} < 1$ (Figure 2), S_1 should be on the right of S_0 because the stay-exit function has the shape of the right branch of a parabola.

Finally, when $s_{ID} = 1$ (Figure 3), the stay-exit function is a straight line which runs parallel to the trade line because it equals the variable cost curve elasticity (e) of

domestic production. In this case, there is no need to determine the intersection S_0 of the stay-exit function with the trade line or the second critical value S_1.

When $s_{ID} > 1$ or $s_{ID} < 1$, the determination of S_1 is an empirical matter because it is dependent on each type of industry. As a rule of thumb, $S_1 = S_o$ - 50 per cent S_o when $s_{ID} > 1$ (Figure 1); and $S_1 = S_0$ + 50 per cent S_0 when $s_{ID} < 1$ (Figure 2). Again, this is simply a matter of convention. Alternate values of S_1 can be chosen by the domestic industry.

When $s_{ID} > 1$ or $s_{ID} < 1$, the vertical line from S_1 will intersect the SE function at point C corresponding to the value d_1 of SE which will be called the GATT line. Also, the vertical line from S_1 will intersect the trade line d_o at point B, while the vertical line from S_o will intersect the trade line at point A and the GATT line at D.

When $s_{ID} > 1$, the area on the right of S_0A, determined by S_0A and the trade line d_0, will be the protection zone; the area of the rectangle ABCD will be the GATT zone; and the area in the North-West of point C will be the free trade zone or banquet zone. We call this area the banquet zone because other countries can freely reap the gain from trade in this zone.

When $s_{ID} < 1$, the area on the left of S_0A, determined by S_0A and the trade line d_0, will be the protection zone; the area of the rectangle ABCD will be the GATT zone; and the area in the North-East of point C will be the free trade zone or banquet zone.

When $s_{ID} = 1$, as a rule of thumb, the GATT line d_1 will be equal to d_0 + 50 per cent (e - d_0), which is above the trade line d_0 if $e > d_0$. In this case, the terms of sale are such that $S = 1$[9]. As a result, the protection zone will be the segment HA; the GATT zone will be AB; and the banquet zone [B,C).

The estimates of the trade line (d_0), the elasticity of the cost curve (e), and the elasticity of substitution (s_{ID}) enable us to determine $S_0 = (d_0/e)^{-(sID\ -1)}$, which is the value of the terms of sale $S = P_DQ_D/P_IQ_I$, where the stay-exit function intersects the trade line. This allows us to determine the value of the terms of sale ($S_1 = S_0/2$) under which the South African auto industry is on safe ground. The value of S_1 as well as those of s_{ID} and e enable us to determine the GATT line $d_1 = (S_1)^{-1/\ sID-1}.e = 2^{1/\ sID-1}.d_0$.

Finally, we determine the values of the stay-exit function $SE = S^{1/\ sID-1}.e$ with the estimates of s_{ID}, e and the values of the terms of sale S.

Data will be collected from the publications of the National Association of Automobiles Manufacturers of South Africa (NAAMSA), National Productivity

Institute and the Department of Trade and Industry. The study will cover the period 1991-1998, with a structural change in 1994. We started the study in 1991 because the complete set of data was not available before this period.

The table below shows the estimates of the price-cost margin equation:

Table 1 Estimation of the log linear price-cost margin (OLS)

Constant	-0.27
	(3.53)
Log(Import Share)	-0.21
	(2.71)
Log(SA Rel. Market Share)	-1.43
	(2.35)
Log(SA Rel. Market Share El. Interaction)	1.61
	(2.38)
Dum	0.03
	(4.15)
R^2	0.87
Durbin-Watson	2.11

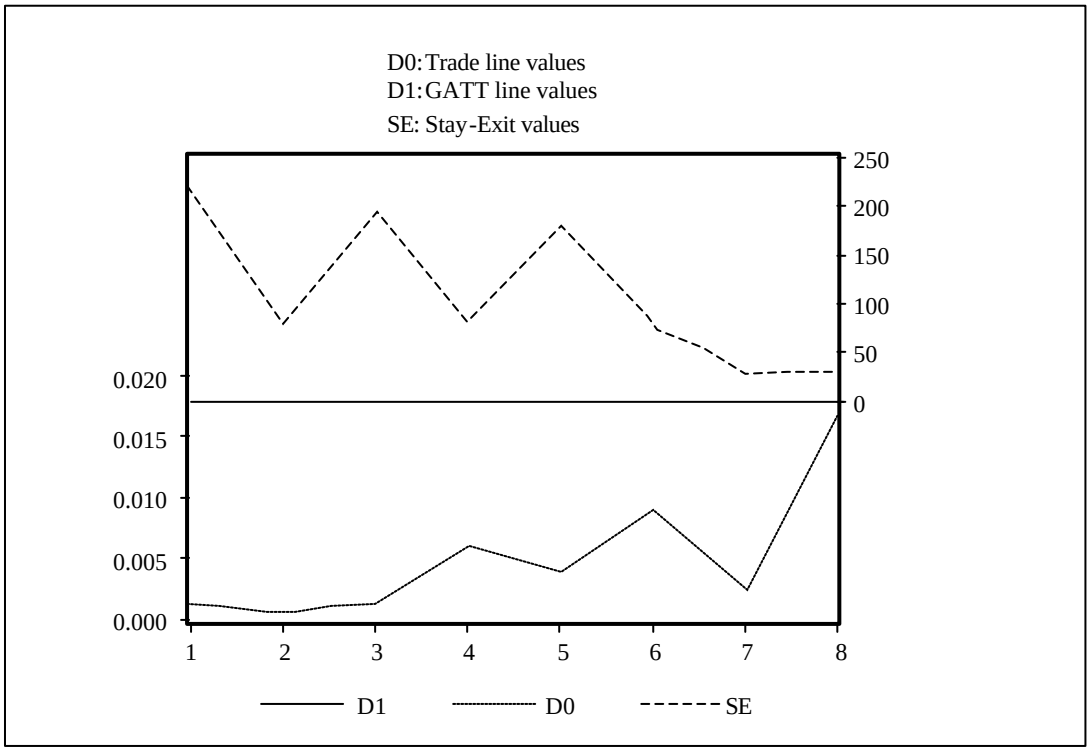
Note: The t-statistics are shown in parentheses.

The explanatory power of the model or R^2 is 87 per cent[10]. All the variables are statistically significant at the 5 per cent level, including the dummy variable (Dum) which account for the structural change in the South African economy in 1994. The coefficient (-1.43) of the Log(SA Rel. Market Share) enables us to determine the elasticity of substitution $s_{ID} = 0.3$. This means that South African consumers by and large prefer locally produced automobiles to imported automobiles in terms of price and quality. The computation of the elasticities and cross-elasticities enables us to determine the values of the terms of sale (S), the two critical terms of sale (S_0, S_1), the trade line (d_0), the values of the GATT line (d_1) and those of the stay-exit function (SE). The estimates of S_0, S_1, S, SE, d_0 and d_1 are as follows:

Table 2 Estimates of variables

Years	S_0	S_1	S	d_0	d_1	SE
1991	0.010725	0.0160875	49.41113	0.0012700	0.002267	217.3978
1992	0.006362	0.009543	23.91816	0.0006022	0.001075	77.11106
1993	0.009998	0.014997	45.57469	0.0011488	0.002267	193.6916
1994	0.032168	0.048252	24.35570	0.0060991	0.010885	79.13406
1995	0.041266	0.061899	43.03306	0.0040526	0.007233	178.4468
1996	0.024163	0.0362445	23.47203	0.0090203	0.016098	75.06458
1997	0.016794	0.025191	11.48414	0.0024100	0.004301	27.03536
1998	0.06555	0.098325	12.58096	0.0168620	0.030093	30.79818

Graph 1 Trend of profitability of the South African auto industry: 1991-1998



The graphs of the trade line (d_0), the GATT line (d_1) and the stay-exit function (SE), which are at the bottom, the middle and the top respectively, show that the stay-exit function has a downward sloping trend from 1991 to 1998. This means that economic globalisation decreased profitability in the auto industry. However, the stay-exit function is not in the risky zone because it is located above the GATT line, i.e. in the free trade zone.

When the level of profitability decreases, a company usually reduces its variable cost of production, i.e. lays off employees in order to stay in business. This

results in an increase in unemployment. In contrast, an increase in employment in a company is due to the increase in the demand for its products, i.e., an increase in its level of profitability. This suggests that the percentage change in employment in a company or industry is a function of the percentage change in their level of profitability. We use the distance between the stay-exit function and the trade line as a proxy for the level of profitability on the domestic market. Because some of the profits realised by the auto industry are due to exports, export will be the second independent variable. To determine this relationship, we will use the following equality:

$$Ln(E) = a + b.Ln(SE\text{-}d_0) + c.Ln(Exp),$$

where Ln(E) is the logarithm of employment in the industry; $Ln(SE\text{-}d_0)$ the logarithm of the distance between the stay-exit function and the trade line; Ln(Exp) the logarithm of exports; a the y-intercept; and b and c the coefficients.

The table below shows the estimates of the employment equation:

Table 3 Estimates of the log linear employment equation

Constant	20.41
	(50.49)
Log(Stay-Exit – Trade Line)	-0.11
	(2.20)
Log(Export)	0.13
	(4.56)
R^2	0.89
Durbin-Watson	2.02

Note: The t-statistics are shown in parentheses

The explanatory power of the equation or the R^2 is 89 per cent. All the independent variables are statistically significant at the 5 per cent level. The distance between the stay-exit function and the trade line is negatively related to employment. That is, a 1 per cent change in the distance between the stay-exit function and the trade line induced a 0.11 per cent decrease in employment. This means that globalisation increased unemployment in the auto industry. However, the export is positively related to employment. That is, a 1 per cent increase in export induced a 0.13 per cent increase in employment over the period under study.

6 POLICY RECOMMENDATIONS

The state of the South African auto industry calls in general for short-run and long-run policies to prevent the destruction of the domestic industry by foreign competition.

6.1 To stay in business in the short run

To stay in business in the short run, i.e. to maintain the stay-exit function in the banquet (free trade) zone, the domestic industry cannot vary the trade line (d_0), which is determined by the elasticities of supply and demand, cross-elasticities and the elasticity of substitution (s_{ID}) between the domestic and foreign automobiles, which substitution depends on consumers' preference. However, the domestic industry can increase the elasticity of its cost curve, i.e. decrease its unit cost of production and vary its relative market share or terms of sale (S).

If the government does not protect the industry, as is the case in South Africa, the domestic industry's policy should be as follows:

Given that South African consumers by and large prefer locally produced automobiles, i.e. $s_{ID} < 1$, to increase its terms of sale the domestic industry should increase its revenue by increasing the quantity supplied and the price to the extent that S will be greater than S_0. Here, the domestic industry need not target consumers loyal to its brand because most of them will buy its products since they are preferred to foreign products.

6.2 To improve business in the long run

To improve business in the long run, i.e. to reverse the trend of the stay-exit function in the free trade zone, the domestic industry should improve its technology to reduce its cost of production and make better automobiles so that the elasticity of the cost curve increases.

Also, given that a 1 per cent change in the distance between the stay-exit function and the trade line induced a 0.11 per cent decrease in employment, to improve business, the domestic industry should isolate its market from foreign competition by further differentiating domestic automobiles from imported automobiles. This can be done by increasing the characteristics of domestic automobiles. This will enable the domestic industry to minimize the negative effect of globalisation.

Finally, given that a 1 per cent increase in export induced a 0.13 per cent increase in employment, the domestic industry should make better automobiles in terms of

price and quality to target the export market. This not only will increase employment in the South African auto industry but it will also increase the revenue of the industry because the export market is far larger than the domestic market. This will enable the domestic industry to maximise the positive effect of globalisation.

7 CONCLUSION

To assess the impact of economic globalisation on the South African auto industry, we use a duopoly model of differentiated products to determine the free trade and protection dividing line. This enabled us to determine the stay-exit function, which showed the level of profitability of the domestic industry, depending on its location in the free trade zone, the GATT zone or the protection zone. If the stay-exit function moved, for instance, from the free trade zone to the GATT zone or the protection zone or had a downward sloping trend, this meant that economic globalisation was decreasing the profitability of the South African auto industry in the South African market. We found that the stay-exit function had a downward sloping trend. However, the domestic industry is not at risk because the stay-exit function has remained in the banquet (free trade) zone.

Second, to determine the relationship between employment, profitability and export in the auto industry, we estimated a linear equation in which the logarithm of employment was expressed as a function of the logarithm of the distance between the stay-exit function and the trade line, and the logarithm of export. We found that the logarithm of the distance between the stay-exit function and the trade line was negatively related to the logarithm of employment. In other words, globalisation increased unemployment in the auto industry, i.e. a 1 per cent change in the distance between the stay-exit function and the trade line induced a 0.11 per cent decrease in employment. However, a 1 per cent increase in export induced a 0.13 per cent increase in employment.

In the light of these estimates, we suggested the implementation of economic policies to improve business in the short and the long run in the South African auto industry. This will reverse the trend of the profitability in the industry and maintain the stay-exit function in the free trade zone. That is, the suggested policies will minimise the negative effect and maximise the positive effect of globalisation.

ENDNOTES

1 Although the automobile plants in South Africa are branches of multinationals such as BMW, Nissan, Toyota, Honda, Delta and Samcor, we call them collectively the South African auto industry because their production takes place on South African soil.

2 By a duopoly model of differentiated products, we mean a situation in which there are two producers or two industries (one domestic and the other foreign) selling two similar products in the domestic market where they compete. See the model and mathematical proofs in the *HSRC Report*, Bouare *et al.* (2001). Due to the lack of space in the journal the model and mathematical proofs were removed from the paper.

3 NAFTA (North American Free Trade Agreement) and the EU (European Union).

4 Agricultural subsidies in Europe and the US, voluntary export restraints on Japanese cars in the US and preferential trade agreements for developing countries in the World Trade Organisation.

5 See Hamilton, 1968, pp. 301-314; Mathias, 1983, pp. 289-290.

6 See Henderson, 1961, pp. 10-11; Johnson, 1982; Mathias, 1983, pp. 84-93; Smith, 1976, pp. 405-406.

7 The cut off point should not be seen as a point at which the domestic producer can be driven out of business. Indeed, the cut off point is not an indication that the domestic producer will be immediately driven out of business because with a zero or negative profit a domestic industry may not be closed down for a while. Instead, the cut off point is a warning sign indicating that if no measure is implemented to rescue the domestic industry, it will be driven out of business.

8 Figure 3 is the limit case because in our model s_{ID} is different from 1.

9 See *HSRC Report*, Bouare *et al.*(2001).

10 It should be pointed out that the small size of the data reduces the degree of freedom of the regression equation.

11 To avoid correlation, we did not include a dummy variable among the independent variables because the stay-exit function and the trade line values were determined from the previous regression in which the dummy variable was used.

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