Productivity, market structure and trade liberalization in Nigeria

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Abstract

This study investigates the relationship between trade liberalization and the market structure and productivity performance of the Nigerian manufacturing sector. The study uses firm-level panel data for the three years from 1988 to 1990, a period of considerable liberalization in the country. The data cover 382 manufacturing firms. The study shows that in general, the productivity level of Nigerian manufacturing is very low. This reflects in part an outcome of years of industrialization strategy that stressed factor accumulation rather than the efficiency with which factors are utilized. The findings from the study show that sectors with a high component of local raw materials generally performed better than those depending on imported inputs.

The study also shows that foreign ownership has an important bearing on firm performance and foreign-owned firms generate positive spillover effects on the other firms in the industry. Moreover, the findings support the current trade liberalization effort of the government as we found that the policy of trade liberalization and the lowering of average tariff rates open up the economy to foreign investment, the promotion of manufactured exports impinges positively on total factor productivity in the Nigerian manufacturing sector. However, the government needs to exercise some caution with the pace of import liberalization, as import growth rate was found to have a negative impact on productivity. While this may be a short-run phenomenon, the implication that the pace of import liberalization proceeded too fast for domestic firms to cope with.

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1. Introduction

A central issue in development policy debate for decades has been the relative merits of import substitution and export promotion industrialization strategies. Following the classic works of Raul Prebisch (1950) and associates, several developing countries especially those of Latin America adopted and pursued with religious zeal the tenets and propositions of import substitution. By the turn of the 1970s, however, two mutually reinforcing trends emerged to force a rethink of this development path: countries of Latin America that embraced the import substitution model generally registered less than impressive economic performance, while the East Asian countries who chose and stayed the course of outward orientation recorded spectacular growth rates.

This dramatic contrast marked the formal ascendancy of export promotion or, more generally, trade liberalization, as a viable development route. Thus, by the 1980s, this strategy had obtained the endorsement of the World Bank and International Monetary Fund, who overtly advocated it as a crucial component of structural adjustment programmes (SAPs) recommended for countries in economic and financial difficulties.

Indeed, it would seem those of the orthodox mainstream who propagate "outward orientation" have won the debate. To Bhagwati (1988: 1), "The question of the wisdom of an outward oriented (export promoting) strategy may be considered to have been settled". But the huge terminological confusion, theoretical ambiguity and empirical ambivalence that is the lot of the contributions and evidence on this issue must necessarily temper this conclusion. Indeed, the term "trade liberalization" itself remains fluid and intensely polemical. One view sees it as pandering to free trade. Another, comprising in large part the proponents of this philosophy, is that far from advocating wholesale opening up, it rather encompasses a plethora of measures including the elimination of anti export biases, lowering of import tariffs and tariffication of quantitative restrictions.

Two views of trade liberalization

It is certainly not our place here to dwell on the chequered issue of the superiority of one development paradigm over another, which at the extreme has taken on ideological and political colouration. What is useful though, in the context of this study, is that the orchestrated benefits of trade liberalization are hinged on its capacity to foster overall productivity in the domestic economy by allowing the home country to concentrate investment in sectors in which it has a comparative advantage.

To be sure, there are two diametrically opposed views on this as well. One perspective is that trade liberalization will stifle industrial productivity by opening up the economy

to superior foreign products, compelling infant industries to close up. The other is that outward-oriented trade policy will induce overall industrial efficiency in the economy by exposing local firms to competition and thereby improving the allocation of factors across sectors and increasing the value of domestic production.

The latter view, which unarguably is the more influential, has given rise to a robust set of theoretical propositions encapsulated under the following headings: "X-efficiency", "foreign exchange constraint" and "technological catch-up". By way of contextualizing this study, it is pertinent to elucidate briefly the main themes of these formulations. The kernel of the X-efficiency construct is that trade protection reduces industrial sector efficiency and that when there is liberalization and greater opening up to international markets, the ensuing competition precipitates a "challenge response" mechanism forcing domestic industries to adopt new technologies that will reduce "X-inefficiency" and costs generally.

The foreign exchange constraint thesis proceeds from the premise that intermediate and capital goods imports are not readily substitutable with domestically produced goods. Hence, imported inputs embody technologies that are unavailable to domestic producers and can only be obtained through imports. Policies that tend to limit such imports will invariably lead to poor productivity performance. Conversely, policies that increase the availability of imported inputs or lower their costs (e.g., an export-led development strategy) will lead to better productivity performance.

The technological catch-up postulate posits that the competition engendered by trade liberalization will facilitate the adoption, diffusion and consequent internalization of modern, more efficient technology from developed countries.

These mainstream arguments in support of trade liberalization are no doubt persuasive, but the empirical evidence is not definitive. Several recent overviews of the link between trade regimes and productivity gains show that the evidence is weak, mixed and inconclusive (Tybout, 1991; Havrylyshyn, 1990; Bhagwati, 1988; Nishimizu and Page, 1991). For Nigeria, evidence on this link is scant. A modest attempt by Chete and Adenikinju (1994) failed to establish causation as the inferences drawn were based on correlation relationships. Besides, the study also did not incorporate market structure assumptions, which have been found critical to productivity estimates (Harrison, 1990).

These provided the motivation for this study. Our chief concern is to document the impact of trade liberalization on efficiency in the manufacturing sector under various market structures. Apart from bridging the observed lacuna, this study was also spurred by the need to provide definitive recommendations for policy as the Nigerian government —despite interludes of protectionism—has remained committed to trade liberalization as evidenced by the recent announcement of new incentives for export.

Objectives of the study

This study seeks in broad terms to establish quantitative relationships among trade liberalization, market structure and the productivity growth in the Nigerian manufacturing sector.

Specifically, the study:

- Characterizes specific trade policy reforms instituted in Nigeria since 1986.
- Estimates sectoral and firm level productivity in the Nigerian manufacturing sector during the period of considerable trade liberalization.
- Evaluates the quantitative impact of trade liberalization and market structure on firm level productivity in Nigeria.

The remainder of this report is organized as follows: In the subsequent three sections, the objectives of the study are stated, the manufacturing sector is profiled and major trade policies since 1986 are elaborated. Section 5 reviews related works, Section 6 elucidates an analytical framework for the study and Section 7 outlines the models. Section 8 discusses data sources and preparations, while Section 9 provides descriptive statistics on the manufacturing sector based on surveys of manufacturing industries' data. Section 10 presents results from the estimation of the production function, Section 11 discusses estimation results on the impact of trade liberalization and market structure on productivity in the Nigerian manufacturing sector, and Section 12 concludes.

2. The Nigerian manufacturing sector

After experiencing phenomenal growth between the mid 1970s and 1980, the Nigerian manufacturing sector has witnessed stagnation, and for the most part decline, since 1983. This is due in large part to the collapse of the global oil market and consequent plummeting of oil prices. Government revenue and foreign exchange earnings were severely reduced in the wake of the crisis of the oil market, forcing government to institute sweeping austerity measures. Stringent trade controls like the rationing of foreign exchange, import restrictions via import licensing and import tariff hikes, as well as quantitative restrictions, were components of this regime.

Manufacturing suffered from precipitous cutbacks in raw materials and spare parts induced by these measures. This was translated into widespread industrial closures, extensive retrenchment of the industrialwork force and a massive drop in capacity utilization. Real output fell by 25% between 1982 and 1986, contrasting sharply with the annual growth rate of 15% recorded between 1977 and 1981.

Much of the manufacturing growth up to 1981 stemmed from the expansion of investment rather than enhanced productivity. Correspondingly, the growth decelerations since then result largely from the substantial decline in gross investment—a feature of virtually all sectors of the Nigerian economy. The ratio of gross capital formation to gross domestic product (GDP), which was 18.5% in 1981, fell to 11.4% in 1983 and further to 3.7% in 1988. A large proportion of this drop occurred in the manufacturing sector and was reflected in the fall in imports of capital goods, e.g., machinery and transport equipment.

The share of manufacturing in GDP rose from about 4% in 1977 (at 1984 constant prices) to a peak of 13% in 1982. It has since fallen to less than 10% today. A number of factors account for this, chief among which is the inadequate access to raw materials and spare parts because of chronic foreign exchange shortages. The lack of vital industrial inputs negatively affected industrial capacity utilization, which fell from 70% between 1977 and 1981 to about 25% in the period 1982–1986.

The foregoing provides a sketch of the manufacturing situation when the structural adjustment programme was introduced in July 1986. The programme envisaged the enhancement of manufacturing performance through a restructuring process geared at reducing import dependence and promoting manufacturing for export. In particular, capacity utilization rates were expected to reach official targets of 55% by 1986 and 60% by 1989. However, as seen in Table 1, the evidence suggests that these expectations were not met. Average capacity utilization remained less than 40% in the period 1988–1993. Viewed from a sectoral performance distribution, domestic resource based industries

showed higher capacity utilization rates than industries with high import content. There is need for caution here, as evidence shows that on an inter firm basis, there is a direct correspondence between the level of capacity utilization and financial strength represented by access to foreign exchange and, consequently, raw materials and spare parts.

Table 1: Industrial capacity utilization by sector (percentage)

S/N	SECTOR	1988	1989	1990	1991	1992	1993
1.	Food beverages & tobacco	37.81	32.50	36.67	32.61	45.34	37.83
2.	Textiles, wearing apparel, footwear, leather products & carpets/rugs	39.73	41.00	51.12	35.40	50.11	43.49
3.	Wood and wood products including furniture	NA	NA	NA	67.75	49.05	34.75
4.	Pulp, paper and paper products, printing and publishing	38.56	41.00	30.07	30.35	35.19	32.26
5.	Chemicals and pharmaceuticals	37.76	24.00	32.67	31.01	30.35	31.06
6.	Non-metallic mineral products	50.01	33.50	47.09	45.10	37.39	32.63
7.	Plastic, rubber and foam products	38.69	34.50	41.86	48.90	42.45	41.11
8.	Electrical and electronics	NA	26.50	26.35	28.67	34.58	24.24
9.	Basic metal, iron and steel	28.33	17.50	35.46	24.32	25.52	25.46
10	Motor vehicles miscellaneous	NA	23.50	23.08	13.79	24.06	25.87
Average capacity utilization		37.56	30.00	36.92	33.53	35.44	32.33

Note: NA = Not available.
Source: Manufacturers Association of Nigeria.

A major feature of the SAP is increased cost of imported inputs (through the correction of the naira's over-valuation) and thereby increased incentive to use local inputs. Shortage of foreign exchange and high tariffs or bans on imported inputs have also forced companies to source locally inputs they previously imported. Table 2 shows the performance of the various industrial subsectors in this regard in the period 1988–1993. It is apparent from the data that the achieved level of local raw materials sourcing at less than 50% is still low.

Subsectorally, wood products and furniture, and non-metallic mineral products recorded the highest proportion of usage of local raw materials in the range of 70 to 80%. Also performing well are the food, beverages and tobacco, and textiles, wearing apparel, leather and leather products subsectors. At the bottom of the table are chemicals and pharmaceuticals, motor vehicles and miscellaneous assembly, as well as the electrical and electronics subsectors.

One conclusion emerging from Table 2 is that the degree of dependence on imported inputs is still high and this has been attributed to, among others, inadequate supply of materials that are locally available, unreliability of contract suppliers, poor quality of what is available and failure to meet user specifications.

It is striking that subsectors with traditionally high potential for local sourcing of inputs performed much less well than expected, e.g., food, beverages and tobacco, textiles, and furniture and wood products. The problem may be inelastic supply response arising

from structural rigidities in production and in some cases the raw materials are not locally available at all.

Table 2: Local sourcing of raw materials by sector (percentage)

S/N	SECTOR	1988	1989	1990	1991	1992	1993
1.	Food, beverages and tobacco	62.9	62.9	72.4	65.4	67.1	63.6
2.	Wood, wood products and furniture	NA	NA	74.0	80.3	81.3	79.0
3.	Textiles, wearing apparel, carpets and leather products	54.8	62.0	66.8	67.0	67.0	68.0
4.	Pulp, paper and paper products	28.7	40.0	45.4	39.0	32.9	31.2
5.	Non-metallic mineral products	86.7	79.0	78.0	83.4	72.7	65.6
6.	Chemicals/pharmaceuticals	36.2	37.5	47.5	42.0	40.5	46.5
7.	Plastic and rubber products	50.5	22.3	31.5	36.6	43.8	30.2
8.	Electrical/electronics	NA	31.5	28.0	35.5	33.4	31.1
9.	Basic metal, iron and steel and fabricated metal products	34.9	42.0	22.3	24.9	43.0	43.3
10.	Motor vehicles and miscellaneous assembly	NA	38.5	34.9	25.5	37.4	41.1

Note: NA = Not Available
Source: Manufacturers Association of Nigeria: *Half Yearly Economic Review* (adapted).

Unlike raw materials, some of which can be sourced locally, virtually all industrial machinery and spare parts are imported. This is the inevitable consequence of the lack of engineering industries in the country and technological backwardness. Apart from the cost implications, this dependence also has the potential of incessantly disrupting manufacturing activities as several production outfits may be put out of operation because of the lack of a single spare part.

3. Trade policies

Nigeria's trade policy stance since 1986 has been decidedly liberal, indicating a dramatic shift from the erstwhile inward-looking strategies pursued during most of the post independence period. Two particularly important policy developments marked this period: the institution of a flexible exchange rate mechanism and the adoption of a comprehensive tariff system, which departs from the pre 1987 situation in several significant respects. First, the number of tariff classifications was raised from 1,560 under the 1980 tariff system to 4,960. Second, the dispersion of tariff rates was reduced and the trade-weighted average nominal tariff declined from 33% to 23%. Most duty rates fell in the range of 10 to 30%. Some agricultural and industrial import products, which competed with major domestic producers, remained subject to higher nominal rates of up to 60% and some luxury goods such as motor vehicles were subject to rates of 100% or more.

Despite its intent to ensure stability in the tariff structure, tariff rates for a number of key products were subsequently modified, sometimes on an ad hoc basis. For instance, in 1986, in accord with the spirit of liberalization, import duties on basic industrial raw materials and agricultural inputs including tractors, (as completely knocked down parts, CKD) were reduced by 5 percentage points.

Those on components and completely built up agricultural tractors were reduced by 10 percentage points. The 50 to 100% range of import duties on agricultural commodities (e.g., grains, chocolate powder and rubber tiles) was reduced by 20%. Duties on consumer/final goods and luxury items were also reduced by 10 to 20 percentage points. However, the range of import duties on capital goods was raised from 5–10% to 10–20%. Similarly, the range of import duty on essential consumer goods like milk and medicaments was raised from 15–20% to 20–30%. Duties ranging from 5–20% were imposed on other agricultural machinery and equipment (e.g., dairy machines and equipment, and combine harvesters), which were hitherto exempted from duty.

In 1987, the three import duty surcharges that were components of the 30% consolidated import levy abrogated on the coming into effect of second-tier foreign exchange market (SFEM) in September 1986 were reintroduced. These were the Port Development Surcharge of 5% for the Nigerian Ports Authority, the Raw Materials Research and Development Council Surcharge of 1%, and the Freight Rate Stabilization Surcharge of 0.02% for the Nigerian Shippers Council. Furthermore, some items were prohibited, such as baby feeding bottles, acids, acid oils from refining, fatty alcohols, and animal or vegetable oils and fats wholly or partly hydrogenated or solidified. Export prohibition was extended to unprocessed or unsawn rubber except gmelina. Also in 1987, the advance payment for import duty was reduced from 100% to 25%.

The comprehensive tariff structure, which aimed at providing a higher degree of protection for local industries and reducing the number of excisable products from 412 to 182, was formally adopted in 1988. Also, the Harmonized Commodity and Coding System (HS) was incorporated into the new tariff structure. Further, anti-dumping tariffs were imposed on roofing sheets, tomato paste and puree, aluminum, oils, batteries, and alkyd resins.

In 1989, as a revenue generating measure, a number of products were removed from the import prohibition list and high tariffs were imposed on them. These included cigarettes, precious metal, and gaming machines, each attracting 200% duty. Again, with a view to protecting domestic industries, import duties on some intermediate products used in local industries were reduced, e.g., battery parts (45 to 25%), cold rolled and hot rolled sheets (20 to 10%) and tin plates (45 to 20%). Duties on some final locally produced goods such as syringes were raised from 25 to 40% but thereafter declined annually to 25% in the sixth year. Duties on enamelware were also raised from 40 to 55%, also to decline annually to 40% in the sixth year. Other commodities that attracted higher duties included mosquito repellant coils (30 to 200%) and motorcycles and bicycles (35 to 45%).

During 1989, some measures were instituted to cushion the harsh effects of the structural adjustment programme on the populace. Among these were measures to ease transportation bottlenecks. Thus, the import duty on component parts of commercial vehicles and tractors was slashed from 25% to 5%. Commercial vehicles were also to be imported duty free during the second half of 1989.

In 1990, a ban was placed on the exportation of primary products such as raw hides and skins and palm kernels. This was intended to make sufficient quantities of the commodities available for local consumption and processing, as only leather-based products and palm kernel oil and cake were allowed to be exported. Again, to prevent dumping as well as protect local industries, import duties on fluorescent tubes, R-20 batteries, starch, GLS tubes and glass shells were raised from a range of 35–70% to 200%. Import duties were also increased for a number of products, such as jewellery (100 to 200%), toothbrushes (35 to 70%) and wheelbarrows (15 to 50%).

A comprehensive package of incentives, many of which were incorporated into the Exports (Incentives and Miscellaneous Provision) Decree of 1986, has also been articulated to boost non-oil exports. A summary of these incentive schemes, their objectives and operating agents, is detailed in the Appendix.

4. Review of related studies

Since the path-breaking Bhagwati (1978) and Krueger (1978) studies of trade regimes, empirical works on trade and GNP growth have proliferated. The specific theme of trade policy and productivity growth, however, has attracted scant attention. For an excellent survey of the state of the art on the latter see Havrylyshyn (1990). Expectedly, the contributions show a sharp divide into two camps: those who hold that trade liberalization is capable of fostering productivity growth and those who challenge this position. Nishimizu and Robinson's (1984) effort was a seminal contribution to the literature. Their analysis explored the impact of trade regimes on sectoral total factor productivity (TFP) growth within a quantitative framework in a study embracing Korea, Turkey and Yugoslavia with Japan as the comparator. On the strength of their analysis conducted within the purview of inter-industry differences in TFP growth at the two-digit level, they concluded that substantial portions of the variation in TFP growth rates are explained by output growth allocated to export expansion and import substitution in Korea, Turkey and Yugoslavia, but interestingly not in Japan. Nishimizu and Robinson conclude that import substitution regimes thus seem to be negatively correlated with TFP change, whereas export expansion regimes are positively correlated with TFP change.

Krueger and Tuncer's (1982) study for Turkey also deserves mention. Using sector level data, they provided stronger support for the efficiency gains to be derived from liberalization, concluding that periods of greater liberality have coincided with periods of faster growth in total factor productivity. Parallel conclusions have also been reached by Condon, Corbo and de Melo (1985) for Chile, Page (1984) for India, and Pitt and Lee (1981) for the Indonesian weaving industry.

On the other side of the divide is Tsao (1985), who finds for Singapore, a country with extremely rapid growth in the 1970s, that productivity growth is negligible or negative in some sectors of manufacturing. Pack (1988) also wrote that "comparison of total factor productivity among countries pursuing different international trade orientation do not reveal systematic differences in productivity growth in manufacturing." After reviewing studies based on within-country temporal correlations, Pack (1988) and Havrylyshyn (1990) both conclude that there is no strong evidence linking productivity and openness.

The studies reviewed above use as their analytical framework the traditional neoclassical theory on trade and perfect competition, which unambiguously asserts that the effect of more trade is to increase competition and efficiency. However, in seeking to explain why intra industry trade among similar countries had been increasing, orthodox trade theories ran into theoretical difficulties. According to mainstream theories, international trade occurs between countries because of differences in technologies, factor

endowments or tastes and, therefore, there are no trade creating forces if countries are the same in these respects. In reality, however, since World War II the volume of trade in similar goods among similar countries has expanded considerably. Indeed, according to Grubel and Lloyd (1975), the share of such intra industry trade in all trades is more than 50% and rising.

Thus, as a direct consequence of the increase in international linkage among national product markets, the fields of international trade and industrial organization, which had hitherto evolved separately, began to integrate. Recent frameworks have, on the one hand, introduced the role of imperfect competition and product differentiation to the explanation of international trade theory (Krugman, 1980; Lancaster, 1980; Dixit and Norman, 1980; Helpman, 1981) and, on the other, have recognized the role of foreign trade in the determination of market structure, conduct and performance (Jacquemin, 1982; Huveneers, 1981; Geroski and Jacquemin, 1981). A considerable body of literature has accumulated from the use of these frameworks and these are briefly reviewed here.

A survey by Lyons (1979) of 23 cross-sectional studies, which related prices, profitability or price–cost margins to various measures of foreign competition, suggested a large support for the hypothesis that imports restrict market power. An apparent exception for Canada was rejected by Caves, Porter and Spence (1980), who found that an interaction variable between seller concentration and import share had a significant effect on Canadian industry profits, i.e., concentration affects profits significantly only when import competition is low. Pugel (1980) confirmed that the influence of import competition should be entered interactively with seller concentration and entry barriers to explain price–cost margins in US manufacturing industries. Jacquemin, de Ghellinck and Huveneers (1980) estimated a two-equation model of Belgian manufacturing industries and also found a negative relationship between import and profit margins, as well as an interaction with seller concentration.

The influence of exports on domestic competition is much less straightforward. Because of the different sets of theoretical alternatives, empirical research does not lead to convergent results. Many studies suggest that exports reduce industrial profitability (see, for example, Pagoulatos and Sorensen, 1976; Caves et al., 1980; Neumann, Bobel and Haid, 1979). Another research on industries in the UK (Geroski, 1982) endogenized its rates of exports and imports and adopted a non-linear specification for the relationship between profit margins and degree of concentration. The results show a very significant positive effect of the rate of exports on the profit margin and a negative effect from the rate of imports.

Not only is international trade able to reduce the loss of efficiency due to domestic monopoly power; it could also allow an expansion in the number of efficient producers in industries with continuing economies of scale. By expanding the total market, trade is expected to result in lower average costs. This is true even in the case of a domestic monopolist confronted with increasing returns: then it may be profitable to export even if the net price that exporters receive from the foreign market is below minimum average cost. By increasing its production, the domestic firm can improve its profits as long as the reduction in profits via the fall in average revenue is smaller than the increase in profits via the reduction in average cost (Basevi, 1970; Frenkel, 1971).

Using a Cournot–Nash model, Dixit and Norman (1980) showed also that in general, the integration of two economies leads to an increase in the number of firms that is less than proportional to the size of the economy.

On the empirical side, the available cross-sector evidence suggests that international trade favours technical efficiency. For the Swedish case, Carlsson (1972) showed that tariff protection to reduce import competition could expand the number of inefficient producers. Similarly, Bloch (1974) suggested that the effect of tariff protection in Canada resulted in inefficient industrial structures; other things being equal, cost appears to be highest in the high tariff industries, which also have higher prices.

In a simultaneous equation context, Saunders (1980) confirmed that Canadian efficiency was reduced by a conjunction of scale economies, product differentiation and the existence of tariff protection. For Belgian industries, Jacquemin et al. (1980) suggested that the main impact of exposure to export markets came through making room for more efficient size sellers in the domestic market. Scherer et al. (1975) found for 12 manufacturing industries located in six industrial countries that the export fraction of total shipment positively affected the extent to which plants reached their minimum efficient scale.

Much more recently, a couple of studies have emerged under the aegis of the World Bank investigating the impact of trade liberalization and market structure on productivity. One such study is by Haddad (1993), conducted for Morocco. She found a strong positive correlation between trade liberalization and productivity controlling for market structure. This suggests, for the Moroccan case, that an increase in productivity is generated not only by outward orientation (through export promotion) but by import liberalization as well. Thus Haddad concluded that the experience of trade liberalization in Morocco seems to have been beneficial to productivity in the manufacturing sector. On the one hand, firms with a higher level of exports, by facing more competition from abroad, have been forced to become more productive. On the other hand, import penetration also put pressure on domestic firms, driving them to increase their efficiency or exit the industry.

Harrison (1990) also analysed changes in firm behaviour and productivity during trade liberalization in Côte d'Ivoire. For a panel of 287 firms, she estimated market power before and after a trade reform implemented in 1985. Her findings suggest that price–cost margins fell in a number of sectors following the reform and that when productivity estimates are modified to account for changes in price–cost margin over the period, the positive correlation between trade reform and productivity is strengthened in some sectors and reversed in others.

Forountan's (1991) effort for Turkey cannot be ignored. He found that greater exposure to international competition generally had a beneficial effect on the Turkish industry during the 1980s. The effect of international competition, however, appears to be significant mainly in the private sector, especially in tradeable industries. International competition decreased the price–cost margin and increased the rate of growth of productivity in the private sector. In the public sector, higher trade penetration lowered the price-cost margin in the public enterprises that had a higher than average capital intensity but did not affect the productivity performance of the sector.

5. Analytical framework

This section undertakes a terse survey of the expected roles of imports and exports on market structure and performance within the framework of oligopoly theories and the conjectural variation model.

Beginning with market structure, the impact of the import share on the concentration ratio depends on the reaction of domestic producers to imports and this could be positive or negative. If threats from imports force domestic firms to merge, a positive impact will be expected.[1] But if inefficient producers improve their productive efficiency in response to an increase in imports, the impact may be negative. As a consequence of the increase in the number of efficient producers, the concentration ratio will inevitably decline.

The effect of export share on concentration is similarly ambiguous. If an expansion in export opportunities engenders average cost reductions following scale economies generated from larger market size, a producer engaged in exporting activities would witness increased market share. This indicates a positive relationship and is more likely if the fixed cost of entering exporting activities is high. The relationship turns negative if economies of scale in distribution and production are not important because a larger market size resulting from export opportunities can support a greater number of producers.

On the role of imports in profitability, the thrust of research has been on establishing conditions under which a negative relationship would hold between the import share and profitability. This derives from the fact that previous empirical results tended to confirm the negative relationship and because of the pervasive perception that foreign competitors are capable of restraining domestic firms from exercising market power on the domestic market. Thus, emerging from these studies is the crucial role of conduct in determining the outcome of the relationship.

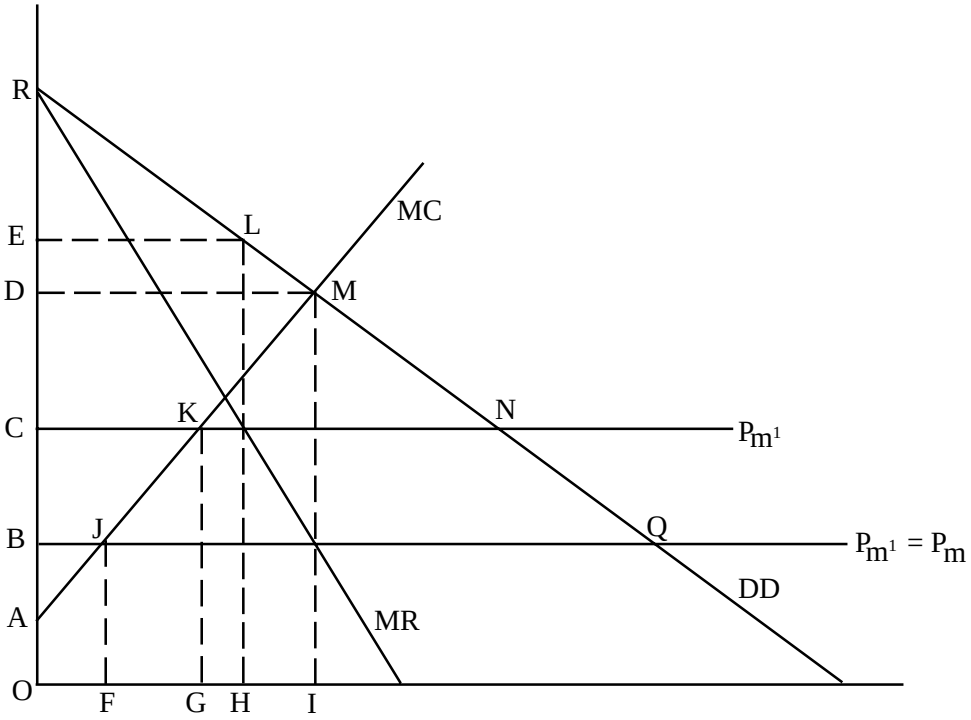
Geroski and Jacquemin (1981) use a model where dominant firms make their choice of a selling price contingent on the supply of a price-taking fringe comprising firms that are too small to exert a perceptible influence on the price. They show that if foreign producers are treated as the competitive fringe and the entire domestic industry forms the control, then the expected negative relationship between imports and profitability holds. But moving from this simple case, the relationship becomes ambiguous as, for example, in the mixed case where both domestic and foreign firms belonging to a multinational group form a cartel. This ambiguity is corroborated by Urata (1994) with a conjectural variation oligopoly model where he shows that rather than being negative, a positive relationship obtains if the implicit collusion between domestic firms is lower than that between domestic and foreign firms and if domestic concentration (measured by the Herfindahl index) is low.

The price–cost margin can also be shown to be positively associated with the import share in a model where an oligopolistic firm is engaged in both production and importing simultaneously. These outcomes have been a feature of trade liberalization episodes in Chile, Argentina, Sri Lanka and Uruguay (de Melo and Urata, 1984) and are explained by the lack of distribution channels at the beginning of the liberalization programme because of the absence of import competition for a long time.[2]

Figure 1 examines the implications for the price–cost margin of a firm engaging in both production and importation of a homogenous good. It is presumed that the firm exercises market power in the selling of the commodity irrespective of its origin (domestic or imported). This is possible if the firm controls the distribution system, a situation usually occurring during reforms as for example producers shifting their work force from production to assembling and preparing imported products similar to the ones they produced, or firms importing and distributing imported products under their own brand name.

Depicted in Figure 1 is the positive relationship between the price–cost margin and the import share for two monopolists (1 & 2) in a small country. The monopolists are assumed to have an identical marginal cost curve (MC) and face an identical demand curve (DD).[3] Choice of units ensures that the border price of respective imports is identical under free trade (Pm), but different tariff rates make their user prices diverge. In the figure, no tariff is imposed on commodity 1, whereas a positive tariff rate is applied to

Figure 1: Price–cost margin for monopolist engaged in production and importing



commodity 2. Assuming both firms have monopoly power in selling domestically produced goods as well as imported goods, their respective marginal cost curves are AJPm1 (monopolist 1) and AKPm2 (monopolist 2). With profit maximization, monopolist 1 produces OF, imports FF and sells OI at price OD, whereas monopolist 2 produces OG, imports GH and sells OH at price OE. The price–cost margin of monopolist 1, DB/OD, with import share IF/OI, is greater than the price–cost margin of monopolist 2, EC/OE, with the smaller import share GH/HO.

The role of exports in profitability is extremely difficult to investigate (de Melo and Urata, 1984), however. First, it is hard to incorporate exports satisfactorily into the formal analysis. If we assume that firms can charge different prices at home and abroad because of differences in product quality or characteristics, or alternatively when the product is homogeneous because of dumping and poor arbitrage, then the export share will enter into the equilibrium determination of profitability. It can be shown that export activities constrain non-competitive sectors to behave competitively as long as the sector is not allowed to discriminate between domestic and foreign markets. Since in most developing countries manufactured exports consist of undifferentiated products where the scope for discrimination across markets is likely to be small, one may expect exports to have a depressant effect on profitability.

It has also been posited that because exporting is a risky undertaking—especially in developing countries where it is difficult to hedge against large exchange rate fluctuations—firms must be rewarded by a risk premium due to high information costs, market penetration, etc. In that case, industries with higher export sales may have higher overall rates of return on sales without adverse implications for market performance.

The link from market structure to productivity is relatively straightforward. When firms within the domestic economy enjoy market power related to the absence of competition, the stimulus to innovate or become more efficient is absent or minimal. But when market power is eroded following competition from imports, this acts as a catalyst for innovation and enhancement of productive efficiency.

6. Model specification and estimation technique

The model for this study follows the lead of similar works by Tybout (1991), Tybout and Westbrook (1991), Haddad (1993), and Harrison (1990).We begin with a Cobb–Douglas (CD) specification of technology at the firm level. The choice of CD technology is based on two reasons.[4] First, census data are unlikely to support more complex functional forms (Griliches and Ringstad, 1971) and second, the CD approach affords maximum flexibility in dealing with data imperfections (Tybout, 1991). Thus, we have

$$Q_{it} = AL^{\alpha}{}_{it}K^{B}{}_{it}e^{ut} \tag{1}$$

where Q = value added,[5] L is labour measured in efficiency units, K is the true capital stock, A is the average level of productive efficiency within an industry, and α and B are scalars for which the sum represents returns to scale for each industry. The subscripts i and t represent the firm and the time period, respectively. The industry subscript has been suppressed. A key variable in Equation 1 is the error term, u_{it}, which is a random disturbance reflecting some combination of technical efficiency, measurement error in Q and peculiarities of the enterprise production process.

The disturbance term, u_{it}, can then be decomposed into its components:

$$u_{it} = \mu_i + \tau_i + \varepsilon_{it} \tag{2}$$

where μ_i is a firm specific effect that reflects firm efficiency and management skills, τ_i is a time effect common to all firms that reflect industry-level changes such as general fluctuations in capacity utilization, technological innovation and returns to scale, and ε_{it} is a pure random variable that satisfies all the stochastic assumptions of OLS. Hence one may estimate Equation 1 without correcting for simultaneous bias (Zellner et al., 1966). In Equation 2, therefore, μ_i depicts the firm level technical efficiency, which will be estimated and is assumed to be fixed.

Estimation techniques

The empirical estimation of this model is based on the panel data technique. The analysis of panel data is an increasingly active and innovative aspect of econometrics. It improves the efficiency of the econometric estimates compared with what is obtained using either cross-sectional or time series techniques.

The basic framework of the panel data methodology is a regression model of the form:[6]

$$Q_{it} = \mu_i + \gamma' X_{it} + \varepsilon_{it} \tag{3}$$

There are *k* regressors in X_{it}, excluding the constant term. The firm specific effect is captured by μ_i, which is taken to be constant over time, *t,* and specific to the individual cross-sectional unit, *i*. In other words, the μ_i for each *i* is obtained by including *i* dummy variables, which take the value 1 for the corresponding *i* and 0 otherwise. We assume ε_{it} to be white noise.

One method through which we obtain the numerical estimates for the parameters in Equation 3 is the use of a fixed effect estimator. The intercept μ_i (which is also the productivity index) is obtained as follows:

$$\mu_1 = \overline{Q} - y^1 \overline{X}_1 \tag{4}$$

where

$$\overline{Q}_1 = \left(\frac{1}{T}\right)\sum\nolimits_t Q_t$$

$$\overline{X}_1 = \left(\frac{1}{T}\right)\sum\nolimits_t X_{1t}$$

γ^i is the OLS estimator of γ.[7]

Year dummies were included in the estimation to control for macroeconomic shocks and measurement errors in output growth that are the result of, for example, an inappropriate price deflator (Tybout and Westbrook, 1991). In order to allow for the possibility of different technologies across industry, a separate production function is estimated for each industrial subsector. Furthermore, since the concept of productivity also relates to the technology used, and since technology is different across sectors, productivity in levels is therefore not comparable. To permit reasonable comparison, the TFPG per firm (μ_i) is expressed as deviations from the productivity of the most efficient firm (i.e., the firm with the highest productivity within each sector; Haddad, 1993). In percentage terms, this becomes:

$$\mu^*_{1j} = \left\lfloor \mu_{1j} - \max\left(\mu_j\right) \right\rfloor / \max\left(\mu_j\right) \tag{5}$$

where

i = firm; j = two digit industry; $\mu^*_{ij} \leq 0$.

The smaller the μ^*_{ij} (or the larger in absolute value), the less efficient the firm compared with the most efficient firm.

Linking productivity with market structure and trade liberalization

The second level of our analysis involves establishing quantitative relationships among estimates of total factor productivity, trade liberalization and market structure.An outcome of the first welfare theorem is that a competitive economy is Pareto efficient. In other words, an economy in which perfect competition prevails leads to efficient allocation of resources. Any divergence from competition therefore amounts to inefficiency. This conclusion can also be extended to component units within the economy. Price theory has traditionally held that the degree of competition in a market is related to the number and the size distribution of competing units. The smaller the number of competitors and the more skewed their size distribution, the lower is the probability that there will be aggressive competition. The point of stimulating competition is that lower prices and profits and more efficient allocation of resources usually prevail in markets where active competition exists (Katrak, 1980). Trade liberalization reduces monopolist distortions and thus enhances efficiency.

Two measures of concentration are common in the literature to gauge the relative power of competing units. The first is the concentration ratio (CR), which measures the percentage of sales controlled by a given number of the largest firms in a market. This is also called the Herfindahl index. It is determined by entry barriers and past growth performance. Scale economies play a large role in explaining concentration in developed countries. Market power plays a significant role in profitability.

Another proxy for market power is the price–cost margin (PCM) for each firm. According to conventional theory, a high PCM is an indication of market power by at least some firms in that industry. Thus, an increase in competitive pressure, say through import liberalization, should lower the industry's PCM and thus improve efficiency.

There is a near consensus in the literature as reviewed in earlier sections of this paper that trade liberalization enhances total factor productivity.[8] It forces inefficient firms to adjust to foreign competition by adopting cost minimizing production and management techniques. However, adjustment cost in the short run may lead to the closure of several firms. While new firms may come up to absorb resources thrown into unemployment by the closure of older firms, this adjustment may not be immediate. Thus there is the problem of weak effective demand arising from the twin problems of unemployment and declining purchasing power. In the short run this may lead to unwanted inventory and exacerbate the problem of low capacity utilization.

Trade liberalization leads to openness of the economy by removing barriers to trade and altering the incentive structure in favour of tradeable goods. The openness of the

economy coupled with the incentive structure encourages the flow of foreign investment into the economy. A general belief is that foreign firms are more productive and use better technologies than domestic firms, and that the knowledge or new technology embodied in foreign firms is transmitted to domestic firms within the industry. The entry of foreign companies may influence the productivity of local firms in three main ways. First, the ensuing competition will compel domestic firms to improve their production and management techniques. Second, local firms may benefit from direct and indirect technology transfer from foreign firms, and third, if new opportunities are created for local companies as a result of the entry of foreign ones, capacity utilization may be raised, which may lead to improvement in the level of TFP (Okamoto, 1994). In the case of Morocco, Haddad (1993) reported a higher TFP for foreign firms than for their domestic counterparts. However, she found that the presence of foreign firms in an industry does not necessarily cause a higher TFP for all firms in that industry.

In our model, the foreign ownership effect is proxied by two distinct procedures. First, a dummy variable, FOROWN is created. This is coded 0 for wholly Nigerian firms and 1 for firms with foreign participation. If FOROWN is positive and significant, it means that firms with foreign participation are more efficient. The second proxy is the share of foreign investment that goes to the sector, SFOROWN. This is intended to capture any "spillover" effect that might arise from the existence of foreign firms in the two-digit sector.

Other measures of openness include tariff levels, the extent of non-tariff barriers, and import and export penetration indexes. These measures would help to answer the question of whether liberalization enhances the competitive atmosphere of the manufacturing sector and hence fosters rapid growth. We shall attempt to answer this question and the proxies to be used for this purpose include: the simple average tariff rate, quota weighted effective protection rate,[9] and export and import penetration ratios. Export and import penetration will be captured by the growth of export and import at the sectoral level.[10] Growth in import penetration will capture the effect of exposure to foreign competition on efficiency.[11] This is expected to force domestic firms to maximize productive efficiency. Growth in import penetration is therefore expected to be positively related to TFP growth. In contrast, the coefficient of export growth is expected to be positive, because significant externalities should accrue to manufacturing exporters through the acquisition of commodity knowledge, production techniques and other benefits from foreign customers.[12]

Competitive pressure from foreign producers affects domestic producers via imports. In the same vein, foreign direct investment exerts competitive pressure on domestic firms. Urata and Yokota (1994), in a study of TFP in Thailand, used the effective rate of protection (ERP), which indicates the degree of protection, to mirror competitive pressure from abroad. Theoretically, a high ERP should engender a decline in TFP. A negative coefficient on ERP therefore suggests that where protection was initially high, progressive trade liberalization will cause a rise in production efficiency.

Non-tariff barriers (NTBs) represent an important part of trade policy, especially in developing countries. Empirical measurement of NTBs is intricate, however, and various approaches have been attempted in the literature. A simple and common approach is the estimation of coverage ratios (see, for example, Harrison, 1991). This method estimates

the percentage of imports covered by trade barriers. Its limitation is that it places a small weight on an extremely effective barrier that excludes almost all imports. However, the coverage method is useful in that it indicates that barriers to trade exist, although it cannot measure their effectiveness. An intricate but more effective approach is the computation of differences between domestic prices and the cif prices of imports. The massive data and computational requirements of this method preclude its use in this work, however.

In Nigeria at the initial stage of trade reform covered by this study, the scope and intensity of NTBs declined (see GATT, 1992; Nash 1993), except for a number of agricultural items to protect domestic production. According to Nash (1993) the reform programme in Nigeria included reduction of the coverage of NTBs. The trade reform programme allows virtually all imports to be imported without licence, using funds purchased from either the government or private sources (Nash, 1993).

Given such a scenario, this study adopts a second best approach to account for the impact of NTBs. Since the ERP already captures the influence of NTBs, we create a dummy variable NTBDUM that takes the value 1 for every firm that enjoys any form of NTBs and 0 otherwise. In spite of its obvious limitations, this approach serves to indicate where NTB occurred and its impact on firm productivity.

Thus, the empirical model is specified as follow:

$$\mu_{1k} = f(CR_k, CRSQ_k, PCM_{ik}, FOROWN_{ik}, SFOROWN_k, ATR_k, ERP_k, IMPGRW_k, EXPGRW_k, NTBDUM_{ik}, SECTDUMs) \quad (6)$$

where

i refers to the firm and *k* refers to the two-digit industry

μ	=	Productivity level
CR	=	Concentration ratio
CRSQ	=	CR squared
PCM	=	Price cost margin at the firm level
FOROWN	=	Dummy for foreign participation
SFOROWN	=	Sectoral share in total foreign investment in the manufacturing sector
ATR	=	Simple average tariff rate
ERP	=	Effective rate of protection
IMPGRW	=	Import growth rate
EXPGRW	=	Export growth rate
NTBDUM	=	Dummy for NTBs
SECTDUMs	=	A set of sectoral dummies

The estimations are undertaken at firm level. All explanatory variables are means across the 1988–1990 period.[13] Sector dummies are also incorporated into the regression to allow for differences across sectors.

On the basis of the review above, the theoretical relationship between TFP growth and the trade and market structure indexes are specified in Table 3.

Table 3: Theoretical relationship between TFPG and trade liberalization policy indexes

Variables	PCM	CR	CRSQ	ATR	ERP	NTB DUM	SFOR OWN	FOR OWN	EXP GRW	IMP GRW
Expected sign	+/-	+/-	+	-	-	-	+	+	+	+/-

Note: - denotes a negative relationship
+ denotes a positive relationship

8. Data: Sources and preparations

The data used for this study were sourced in the main from the firm-level industrial survey data collected by the Federal Office of Statistics (FOS). Since 1962, the FOS has conducted annual surveys of manufacturing industry (SMI) except for two years, 1979 and 1986. The latest years for which survey data are available in processed form are 1988–1990. Table 4 summarizes the questionnaires returned by the establishments.

The SMI provided us with data on the following:

- Labour input defined as total number of production persons
- Total labour cost comprising wages and other payments for labour
- Intermediate inputs
- Value added at current prices
- Investment expenditure
- Capacity utilization

These are complemented by data from the Central Bank of Nigeria's *Statistical Bulletin* (1993) on the following:

- Book value of fixed assets for industries in the manufacturing and processing sector for 28 three-digit ISIC industries
- Foreign investment for 28 manufacturing and processing industries in Nigeria
- Export and import values

Other variables were obtained as follows:

- Capacity utilization in the manufacturing sector from Manufacturers Association of Nigeria (MAN) sample surveys
- Manufacturing sector's price deflator from World Bank (1990)
- 1990 input-output coefficient from 1990 I-O table prepared at the Centre for Econometric and Allied Research (CEAR), University of Ibadan, Ibadan

The ideal measure of labour input is in terms of efficiency units. This is to reflect the heterogeneity among workers, which the number of labour employed broadly defined does not capture. This variable is then constructed as the wage bill of each firm divided by the minimum wage prevailing in the Nigerian manufacturing sector.

Table 4: Number of establishments in the 1988–1990 survey of the manufacturing sector

Type of industry		No. of firms	Sole proprietorship	Partnership	Private limited companies	Public limited companies	Statutory corporations	Government establishments
ISIC 312	Food products	31	12	2	17	-	-	-
ISIC 313	Beverages	18	10	1	4	2	1	-
ISIC 321	Textiles	13	5	-	7	-	-	1
ISIC 322	Wearing apparel	94	77	4	9	4	-	-
ISIC 323	Leather and fur products	6	1	-	5	-	-	-
ISIC 324	Footwear	5	3	-	2	-	-	-
ISIC 331	Wood and wood products	24	17	4	2	1	-	-
ISIC 332	Furniture and fixtures	58	42	5	11	-	-	
ISIC 341	Paper and paper products	16	2	-	12	1	-	1
ISIC 342	Printing and publishing	20	8	-	10	-	-	2
ISIC 353	Other chemical products	8	-	-	8	-	-	-
ISIC 352	Petroleum refinery	2	-	-	2	-	-	-
ISIC 355	Rubber products	5	-	-	3	2	-	-
ISIC 365	Plastic products	10	-	1	9	-	-	-
ISIC 361	Pottery, china and earthenware	5	3	-	2	-	-	-
ISIC 369	Other non-metallic mineral products	17	10	2	5	-	-	
ISIC 371	Iron and steel	2	-	-	2	-	-	-
ISIC 381	Metal products (fabricated)	34	16	3	14	1	-	-
ISIC 382	Non-electrical machinery	5	1	-	4	-	-	-
ISIC 383	Electrical machinery	3	-	-	2	-	-	1
ISIC 384	Transport equipment	2	-	-	2	-	-	-
390	Other manufacturing industries	10	2	-	7	1	-	-
	TOTAL	388	209	22	139	12	1	5

These 388 establishments were reclassified into two-digit sectoral classifications as shown in Table 5.

Table 5: Reclassification into two-digit sectors

S/N	Industry	No of firms
1.	Food, beverages and tobacco	48
2.	Textiles, wearing apparel and leather	114
3.	Wood, wood products and furniture	88
4.	Paper, paper products, printing and publishing	36
5.	Chemicals, rubber and plastic products	26
6.	Non-metallic mineral products	22
7.	Fabricated metals, iron and steel	35
8.	Machinery and equipment	13
Total		382

Our measure assumes that wage is a good proxy for productivity and skill. Value added and wages were deflated using the manufacturing sector price index and 1987 base year. This was obtained from the World Bank study on Nigeria (World Bank, 1990). Firms that did not report any figure for value added or recorded negative value added were deleted from the analysis.

A common approach to capital stock estimation is the perpetual inventory method. This assumes that the capital stock measure was available for at least one year, which is not the case at our level of disaggregation.

Our approach is again second best. Since the SMI does not provide information on capital stock but only gives statistics on gross additions to fixed assets and capacity utilization, to construct capital stock we proceeded as follows:

First we calculated the capital–output ratio for each industrial grouping from the book value of fixed assets for 28 industrial groups reported in the CBN statistical bulletin. The justification for this is that the manufacturing sector in Nigeria depends on capital imports from the same sources.

Second, we took the observed output for the firm and blew it up to give "potential" output for the firm using the capacity utilization variable.[14] The capacity utilization rates were reported by the firms. For firms that did not make returns on capacity utilization, the industrial average reported by the Manufacturers Association of Nigeria (MAN) was used. Thus, we allow for differences in actual capital–output ratios across firms.

Third, we calculated the capital stock for each firm using the capital–output ratio obtained for the base year, 1988. After computing capital stock for 1988, we generated capital stock for 1989 and 1990 using the perpetual inventory method as follows:

$$k_{t+1} = k_t + NKE_{t+1}$$

where NKE is net capital expenditure and k_t is capital stock.

The capital stock was then deflated using the manufacturing sector price deflator. This is to say that our measure of capital stock is a crude approximate of the true capital.

Our method for generating the capital stock introduces measurement errors and biases into the estimates. First, the coefficient in capital is likely to be overstated as capital shows a high correlation with the value added. This in turn understates the labour coefficient. Second, the capacity utilization rate reported by the firm may be underestimated if they did not give allowance to old and technologically outdated equipment and machinery.

The instrument various (IV) method was used to correct for the measurement error in the model. The IV method will correct for any situation in which a regressor is contemporaneously correlated with the disturbance term. The problem, however, is how to find "good" instruments, i.e., variables that are highly correlated with the independent variable but not with the disturbance term.

The following instruments were selected:

- Average capacity utilization, since it is correlated with capital input without being correlated with the noise in capital due to measurement error.
- Energy input, since this is highly correlated with the amount of capital used in a firm.

- Wage rate, since firms' decisions to use labour and capital depend on the wage rate, but the latter is not correlated with output.

However, Griliches and Ringstad (1971) argued that this measurement error biases the estimated elasticity significantly, even though the effect on the estimated scale coefficient is quite small. Similarly, Tybout (1991: 30) reported that the measurement error is more likely to "undermine analyses of marginal productivities than to affect scale or technical efficiency comparisons".

9. Descriptive statistics of the Nigerian industrial sector

Table 6 provides summary statistics on the Nigerian manufacturing sector in 1988 based on the SMI. Food, beverages and tobacco leads other sectors in terms of number of labour employed and is second only to chemicals, rubber and plastic products in terms of labour productivity (column 6). Textiles, wearing apparel and leather products, and fabricated metals, iron and steel are the two sectors with the highest capital intensity (column 5). Capacity utilization was below 50% in all the sectors; it was lowest in fabricated metals, iron and steel and highest in non-metallic mineral products.

Concentration is measured in two ways. First, by the share of output produced by the four largest firms, CR4 (column 9), in each industry and second, in terms of price–cost margin measured as the value added of each industry minus total labour cost divided by the value of output. The table shows that the Nigerian manufacturing sector exhibits properties of non-competitiveness. From column 8, the food, beverages and tobacco sector is dominated by a few firms, while the paper, paper products, printing and publishing sector is the least concentrated.

Column 11 also shows that the food, beverages and tobacco sector enjoyed the highest rate of effective protection, while fabricated metals, iron and steel, and machinery and equipment were the least protected.

Table 6: The Nigerian manufacturing sector in 1988

Sector*	1 N	2 L	3 VAQ	4 LCOSTVA	5 KQ	6 QL	7 PCM	8 CR4	9 Tariff	10 CU	11 ERP	12 SVA	13 SFI	14 AWR	15 K/L
1.	48	9335	79.6	9.0	12.9	89,482.2	0.91	91	73.7	32.82	156.0	63.17	0.22	6,261.87	11,587.5
2.	114	3134	37.7	20.1	167.4	35,684.3	0.80	88	72.2	41.90	85.5	6.86	0.18	2,397.67	38,089.0
3.	88	3362	39.6	29.6	11.1	29,873.7	0.70	82	45.2	41.68	79.3	5.82	0.02	3,211.54	3,325.1
4.	36	2114	58.0	11	16.0	65,305.4	0.89	62	30.8	30.45	30.3	8.82	0.09	8,621.05	10,378.0
5.	26	3577	67.0	13	24.0	90,948.1	0.87	79	22.5	34.35	39.4	3.56	0.20	8,621.05	22,162.9
6.	22	1710	66.0	25.3	63.3	62,627.7	0.75	85	28.1	44.77	92.7	8.26	0.07	10,296.56	39,631.5
7.	35	1791	55.7	19.1	103.6	34,974.8	0.81	79	38.8	25.87	12.7	2.57	0.07	3,510.51	36,234.5
8.	13	1075	48.7	43.1	57.7	15,675.5	0.60	77	18.6	30.46	33.6	0.94	0.15	3,176.88	9,047.3

*Sectors as in Table 5.
N = Number of firms
L = Labour
VA = Value added
K = Capital stock
Q = Production
CU = Capacity utilization
CR4 = Concentration ratio of the four largest firms in the industry
PCM = Price cost margin
ERP = Effective rate of protection
SVA = Share of value added
SFI = Share of foreign investment in manufacturing and processing
AWR = Average wage rate
LCOST/VA = Labour cost as ratio of value added
TARIFF = Average tariff rate
Variables are in ₦'000 where relevant.

a. The measures reported do not necessarily apply to all products within the respective categories.

Table 7 shows the distribution of foreign direct investment in the manufacturing and processing sector for the period of study. The table reveals that food, beverages and tobacco, chemicals, rubber and plastic products, and textiles, apparel and leather, in that order, have the highest shares.

Table 7: Sectoral share in direct foreign investment inflow 1988–1990 (%)

S/N	SECTOR	1988	1989	1990
1	Food, beverages and tobacco	21.76	23.39	28.50
2	Textiles, wearing apparel and leather	17.83	14.46	12.98
3	Wood, wood products and furniture	2.03	10.71	8.46
4	Paper, paper products, printing and publishing	8.68	5.86	4.17
5	Chemicals, rubber and plastic products	20.46	20.96	19.20
6	Non-metallic mineral products	7.21	6.52	14.96
7	Fabricated metals, iron and steel	7.28	4.95	0.90
8	Machinery and equipment	14.76	13.15	10.82

Source: Computed from CBN (1994) *Statistical Bulletin.*

10. Empirical estimation of the production function

Table 8 shows the means of the estimated firm level productivity for each sector. Wood, wood products and furniture, textiles, wearing apparel and leather, paper and paper products, and non-metallic mineral products recorded the highest TFPFE of 2.621, 2.583, 2.483 and 2.322, respectively. By contrast, fabricated metals, iron and steel, and machinery and equipment recorded the lowest productivity performances.

Two of the sectors with the highest productivity performance, textiles, wearing apparel and leather, and food, beverages and tobacco, also recorded the highest share of foreign direct investment inflow of 18% and 22%, respectively. The presence of large firms in these industries assured them reasonable levels of economic reserves that were used to cushion the shock that accompanied adjustment. Smaller firms that lacked such leverage were forced to shut down or, at best, scale down operations.

Table 8: Productivity indicators (average)

Sector*	Firm	TFPFE	MAXTFPFE	DTFPFE	MINTFPFE
1	32	2.109	3.862	-0.454	0.129
2	81	2.583	3.586	-0.221	0.226
3	47	2.621	3.690	-0.290	0.441
4	27	2.483	3.156	-0.213	0.678
5	22	1.164	2.872	-0.595	0.380
6	14	2.322	3.015	-0.230	0.944
7	28	0.963	1.286	-0.251	0.250
8	10	0.872	1.151	-0.292	0.221

Note:
* Sectors as in Table 5.
"Firm" is the number of firms appearing throughout the period of study.
TFPFE is total factor productivity calculated from the fixed effect model. MAXTFPFE and MINTFPFE are the maximum and minimum value of TFPFE, respectively, within each sector. DTFPFE is the percentage deviation of firm level TFPFE from MAXTFPFE.

Among industries exhibiting the least deviation of productivity from the most efficient firm are paper and paper products, non-metallic mineral products, and textiles, wearing apparel and leather. In contrast, chemical, rubber and plastic products, and food, beverages and tobacco exhibit the highest deviation of productivity from the most efficient firm.

However, there is need for circumspection in the interpretation of these dispersions. Haddad (1993) noted that a small dispersion of a firm's productivity from the efficiency frontier does not necessarily mean that the firm is at a higher level of productivity. This

is especially true of textiles, wearing apparel and leather, which enjoys a high level of protection from external competition.

The results from the estimations of the production function are presented in Table 9. The overall performance of the fixed effect model appears satisfactory as reflected in the high R^2. In general, the estimated output elasticities with respect to capital are higher and more significant than the estimated output elasticities with respect to labour. This reflects the high capital intensity of the Nigerian manufacturing sector (Adejugbe, 1994).

Table 9: Production function estimation (fixed effect) instrumental variable approach (parameters estimate)

Sector	InL	InK	D89	D90	RTS
1	0.2644*	0.7619*	0.3492	-0.1956	1.026
	(1.826)	(12.33)	(0.631)	(-0.830)	
			R^2 =	0.913	N = 96
2	0.1299*	0.9258*	0.0172	0.005	1.06
	(2.02)	(21.09)	(0.044)	(0.623)	
			R^2 =	0.92	N = 141
3.	0.3711*	0.6427*	-0.2421	-0.0649	1.014
	(3.331)	(21.09)	(-0.727)	(-0.381)	
			R^2 =	0.914	N = 141
4.	0.1342*	0.8966*	-0.2426	0.1812	1.031
	(2.231)	(15.991)	(-0.601)	(0.892)	
			R^2 =	0.927	N = 69
5.	0.17077*	0.8122*	-1.1277	0.5294	0.983
	(2.119)	(4.515)	(-1.005)	(0.976)	
			R^2 =	0.67	N = 24
6.	0.2780*	0.8307*	0.0682	-0.381	1.109
	(4.898)	(20.43)	(0.112)	(-1.639)	
			R^2 =	0.94	N = 84
7.	0.1738*	0.7984*	3.097	-0.561	0.972
	(3.47)	(7.08)	(1.198)	(-0.60)	
			R^2 =	0.77	N = 60
8	0.1578*	0.7532*	0.19904	0.086	0.911
	(0.114)	(19.64)	(0.417)	(0.450)	
			R^2 =	0.95	N = 48
Aggregate	0.3210*	0.674*	0.002	0.005	1.07
	(7.609)	(39.45)	(-1.319)	(0.309)	
			R^2 =	0.895	N = 663

Note: Sectors are as in Table 5. Dependent variable is ln Y; L and K are labour and capital, respectively. Standard errors are in parentheses. D89 and D90 are time dummies for 1988 and 1989, respectively; RTS is returns to scale.
* implies significance at the 0.05 level.
N is the number of observations.

The signs of the dummy variables are indicative of the direction of the growth of the industry over the study period. Most sectors recorded negative growth rates, probably resulting from the financial stress occasioned by structural adjustment. Overall, though, the manufacturing sector recorded a marginal positive growth over the study period.

This is especially due to the performance of the food, beverages and tobacco and textiles, wearing apparel and leather subsectors.

Table 9A: A production function estimation (fixed effect) instrumental variable approach (parameters estimate)

Sector	InL	InK	D89	D90	RTS
1.	0.2800*	0.7506*	0.00943	-0.1066	1.031
	(2.080)	(12.60)	(0.049)	(-0.0555)	
			$R^{2=}$	0.918	N = 96
2.	0.1344*	0.9228*	-0.0901	0.1022	1.057
	(2.102)	(21.129)	(-0.872)	(0.975)	
			R^2 =	0.92	N = 141
3.	0.3582*	0.6355*	-0.0669	0.0614	0.994
	(3.104)	(22.132)	(-0.569)	(0.511)	
			R^2 =	0.915	N = 141
4.	0.1375*	0.8942*	0.0174	0.1007	1.032
	(2.293)	(15.97)	(0.106)	(0.601)	
			R^2 =	0.928	N = 69
5.	0.2461*	0.8037*	-0.077	0.2116	1.049
	(2.21)	(5.485)	(-0.218)	(0.587)	
			R^2 =	0.666	N = 24
6.	0.2755*	0.8319*	-0.056	-0.343	1.107
	(4.858)	(20.182)	(0.387)	(-2.30)	
			R^2 =	0.94	N = 84
7.	0.1782*	0.7877*	0.2649	0.2556	0.966
	(3.606)	(12.978)	(0.844)	(0.8793)	
			R^2 =	0.779	N = 60
8.	0.159*	0.8281*	0.0064	0.1489	0.987
	(3.110)	(19.21)	(0.041)	(0.986)	
			R^2 =	0.95	N = 48
Aggregate	0.3197*	0.7169*	-0.031	-0.736	1.07
	(7.805)	(41.002)	(-0.429)	(-0.155)	
			R^2 =	0.899	N = 663

Note: Dependent variable is ln Y; L and K are labour and capital respectively. Standard errors are in parentheses. D89 and D90 are time dummies for 1988 and 1989 respectively; RTS is returns to scale.
* implies significance at the 0.05 level.
N is the number of observations.

11. Impact of trade policy and market structure on productivity growth in Nigerian manufacturing

The results of the model linking productivity growth with trade liberalization and market structure is presented in Table 10. The coefficient of the two market structure indexes—the price–cost margin (PCM) and the Herfindahl index (CR4)—show positive and significant impact on productivity. This could be explained by the fact that the higher profits made by firms are being re-invested into the business. It could also be indicative of learning-by-doing at the firm level. Alternatively, it may simply reflect the dominant feature of the Nigerian economy, which has been aptly characterized as a seller's market.

Table 10: Estimation of the effect of trade and market structure on TFP (parameter estimates)

Variable	Coefficient	t-Ratio
PCM	1.5185	5.479
CR	1.993	2.027
CRSQ	-1.324	-1.959
ATR	-0.00887	-4.065
ERP	-0.04175	-8.206
NTBDUM	-0.3216	-1.573
SFOROWN	2.9297	2.292
FOROWN	2.2344	10.532
EXPGRW	0.0992	3.532
IMPGRW	-0.0676	-2.287
CONSTANT	5.876	1.628
R2 = 64.19	F (10,890) = 470.8	

Similarly, we found a non-linear and statistically significant relationship between TFPG and the square of the concentration index. This implies that as concentration deepens at the industry level, productivity exhibits a U-shape, that is, it diminishes at first and later accelerates. This is possibly a consequence of the fact that most industries in Nigeria are dominated by a few conglomerates or multinationals that are able to exploit the advantages of scale economy, possess the financial clout to acquire foreign technology and use superior marketing strategies.

Turning to the trade variables: average nominal tariff rates (ATR) negatively and significantly affects productivity, as does effective protection rates (ERP), which mirrors the effectiveness of protection.

The sign of foreign share in ownership (FOROWN), an index of openness, conforms to expectation. The result indicates that foreign firms recorded higher TFP growth than

did their domestic counterparts. Evidently, foreign firms' connection with their parent companies and their concomitant access to vintage technology and marketing capability precipitated higher productivity performance. Moreover, the relatively higher wages paid by foreign firms to their employees also constitute a spur to productivity. The magnitude of the coefficient on this variable reflects a significant productivity difference between foreign and local firms.

The presence of foreign firms in an industry, SFOROWN, did not exert a positive influence on the TFP of firms in that industry. This is a validation of the postulate that domestic firms benefit from their interactions with foreign firms in the same industry with a real possibility of significant inter-firm technology transfer.

Furthermore, increase in foreign exposure, gauged by the export growth index, influences positively the level of productivity. This substantiates the hypothesis that firms selling in the international market are compelled to heighten productivity to place them in good stead to compete internationally. Thus efforts by government to encourage manufactured exports appear well placed. However, the direction of causation between export and productivity growth remains unclear.

Contrary to expectation, the estimated import growth coefficient turned out negative although statistically insignificant. The basic intuition here is that the inflow of imported goods into the Nigerian market induced a slowdown in the productivity of competing sectors. One plausible explanation for this is that for some sectors import liberalization proceeded at such a rapid pace that sector earnings deteriorated. Another conjecture is that domestic industries may not be able to compete with better quality and sometimes cheaper foreign goods and may therefore experience productivity slowdowns or may be forced to shut down. However, this is expected to be a short-run occurrence as the negative effects are expected to peter out with time (Havrylyshyn, 1990). The period of considerable liberalization covered in this study is perhaps too short for these effects to play themselves out.

Yet another conceivable reason for the wrong sign of the import growth coefficient is that the liberalization induced increases in the cost of essential imports may have led to a fall in demand for these imports and, by extension, a lowering of capacity utilization among domestic firms.[15] Faced with tight financial and working capital constraints, many firms that are presently or potentially efficient were, under the weight of dramatic policy change, forced to close down or operate far below installed capacities.

Finally, non-tariff barriers (NTBDUM) has a positive, albeit insignificant, effect on productivity. This is expected because, as indicated earlier, the role of non-tariff barriers declined significantly during the period covered by this study.

12. Policy implications and conclusion

The study has been preoccupied with the effect of trade liberalization on the total factor productivity performance of the Nigerian manufacturing sector. This was accomplished in two stages. First, the TFP indicator was estimated at the firm level using the fixed effect model. Second, the TFP indicators so generated were regressed against trade liberalization and market structure variables.

Two important findings from this research of concern to policy makers deserve amplification. The first is the relatively low productivity in the Nigerian manufacturing sector. This could be attributed to a plethora of factors, including a weak technological base and low level of capacity utilization.

The second major finding from this study is that there are significant pay-offs from the policy of trade liberalization. The current policy of trade liberalization, which emphasizes lower tariffs and increasing openness of the economy, was found to be growth enhancing. Quite interesting is the role of foreign direct investment in productivity growth at both firm and sectoral levels: there is a spillover effect generated by foreigners in the economy. Thus, the implementation of policies that encourage or restrict foreign ownership can be expected to have direct effects on industry performance, quite apart from the indirect effects that result from modification of the behaviour of locally owned firms or changes in the size and distribution of firms.

The effort of the government to encourage foreign participation in the economy is therefore a step in the right direction. In 1995, the government abolished the Nigerian Enterprises Promotion Decree of 1989, which restricted foreign participation in certain areas of the economy, and replaced it with the Nigerian Investment Promotion Commission Decree 16 of 1995.

An important finding of the study is that in general the sectors that are less dependent on the external sector for raw materials recorded higher total factor productivity. These sectors generally have higher capacity utilization, suggesting a positive relationship between capacity utilization and productivity performance. The sectors with low capacity utilization, such as fabricated metals, machinery and equipment, recorded lower productivity performance.

The study also shows that sectors with high export performance also perform well in total factor productivity. This substantiates the notion that firms selling in the export market have to be very efficient in order to compete internationally. Thus the efforts of the government to promote manufactured exports in Nigeria seem well placed.

However, the government needs to exercise some caution with the pace of import liberalization. One of the findings of the study is that import policy can have a negative impact on productivity. While this may be a short-run phenomenon, it could also imply

that the pace of import liberalization proceeded too fast for domestic firms to cope with it.

In conclusion, the lowering of average tariff rates, opening of the economy to foreign investment and promotion of manufactured exports impinges positively on total factor productivity in the Nigerian manufacturing sector. Active policy intervention is needed to relieve the multifarious constraints against meaningful entrepreneurial endeavours. The most compelling among these is the deplorable state of basic infrastructure. Alleviating infrastructure bottlenecks is absolutely critical to the performance of the Nigerian manufacturing sector.

Notes

1. See Jacquemin, de Ghellinck and Huveneers (1980) for elaboration.

2. It takes time to obtain licences to import new products. Producers of similar products are most likely to have licences at the beginning of the removal of import restriction. Even if these delays are absent, the distributor still has to evaluate the cost of installing distribution channels vis-a-vis expected profits, taking into account expectations about the duration and course of the liberalization reforms. It is therefore easy to imagine the first importers incurring low distribution costs when selling small amounts at high prices because of inelastic demand due to a shortage of imported commodities for years.

3. A monopolistic case is depicted here for simplicity. However, this can be generalized to an oligopoly case (see de Melo and Urata, 1984).

4. A previous study on the Nigerian manufacturing sector fails to reject the assumptions of unitary elasticity of substitution for the sector (Iyaniwura, 1974).

5. We empirically tested for the value added concept by estimating the following model:

   $$X_i = a + bY_i + U_i$$

   where X_i is industrial costs and Y_i is gross output. If a and b are, respectively, insignificant and significant, the assumption that raw materials are in fixed proportion to gross output is sustained (Iyaniwura, 1974). The result we obtained is:

   $$X_i = \underset{(0.98)}{7.239} + \underset{(6.13)}{0.62Y_i} \quad R^2 = 0.98$$

6. We assume for simplicity that there are no time-specific effects.

7. This is also called the covariance estimator or the within-group estimator, because only the variation within each group is used in forming this estimator.

8. However, this relationship may be non-linear (Krueger and Tuncer, 1982).

9. The effective protection rates at three-digit industry level were computed by the Policy Analysis Department (PAD) of the Federal Ministry of Industries for the period 1988–1994. Prohibited goods were given the highest rate of tariff in the corresponding year.

10. The use of export and import penetration ratios as measures of openness/trade liberalization is common in the literature (see example, Harrison, 1991; Haddad, 1993; Forountan, 1991).

11. Using the import penetration index to measure trade liberalization, unlike the tariff rates, captures the effects of both tariffs and the non-tariff rates that are used extensively in developing countries (Urata, 1994).

12. Chen and Tang (1990) argued that the impact of export expansion on productivity growth is unclear a priori. This is because ability to export to a foreign market requires adjustment in the whole chain of productive processes, from product design to after sales service. This imposes an extra burden on production costs and is thereby detrimental to productivity growth.

13. Since this is how the dependent variable was computed.

14. Capacity utilization is the ratio of realized output to potential output, the latter being defined as the maximum output that can be produced given the available input of the firm.

15. Kwon (1986) shows that a positive relationship exists between capacity utilization rate and TFP growth.

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Appendix

Summary of export incentive schemes currently in operation in Nigeria

Incentive	Operating agent	Objectives/comments and status of implement action
1. Refinancing and Rediscounting Facility (RRF) and Foreign Input Facility (FIF)	Central Bank of Nigeria (CBN) and NEXIM	To provide liquidity to banks in support of their finance business, directed on export promotion and development. RRF took off in 1987 and FIF in 1989.
2. Currency Retention Scheme	CBN and Commercial/ Merchant Bank	To allow exporters to hold export proceeds in foreign currency in their bank. Took off in 1986.
3. Tax relief on interests earned by banks on export credit	Banks and Federal Board of Inland Revenue	To encourage banks to finance exports by reducing their tax burden. Became effective in September 1986.
4. Export Credit Guarantee and Insurance Scheme	CBN/NEXIM	To assist banks to bear the risks in export business, thereby facilitating export financing and export volumes.
5. Duty draw back scheme	Customs Dept, Standard Organization of Nigeria, NEPC, Banks and CBN	To reimburse customs duty paid by exporters on imported input used for export production. This has not been widely used by exporters because of the cumbersome procedural requirements involved, although the fund has been increased to ₦50 million. Started in 1988.
6. Export expansion grant	Nigeria Export Promotion Council (NEPC)	To encourage companies to engage in export business, rather than domestic business,

continued...

Incentive	Operating agent	Objectives/comments and status of implement action
		especially exporters who have exported ₦50,000 worth of semi-manufactured or manufactured products.
7. Export price adjustment scheme	NEPC	To provide a form of export subsidy to compensate exporters of products whose foreign prices become relatively unattractive, because of factors beyond the exporters' control.
8. Subsidy scheme for use of local raw materials in export production	NEPC	To encourage exporters to use local raw materials. Still to be implemented.
9. Export Development Fund	NEPC	To assist exporters in partly paying the costs of participation in trade fairs, foreign market research, etc. This is an old scheme.
10. Abolition of export licensing	Federal Ministry of Commerce & Tourism	To remove administrative obstacles from the export sector as much as possible. Has been administratively effected.
11. Supplementary allowance in favour of pioneer companies	Federal Ministry of Commerce & Tourism	To extend supplementary incentive to pioneer companies that export their products.
12. Accelerated depreciation and capital allowance	Federal Ministry of Commerce & Tourism	To extend supplementary incentive to industrial organizations for export of their products. Took effect in 1986.
13. Manufacturing-in-bond scheme		To assist potential exporters of manufactured products to import free of duty, the raw materials needed for production of exportable products.

Source: Oshuntogun et al. (1998).

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