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An Application of the Stolper-Samuelson Theory

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An Analysis of Globalization and Wage Inequality in the Philippines
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Leonardo A. Lanzona, Jr.

I. Introduction

The controversy surrounding globalization revolves around two interrelated issues: (a) the effect of increased trade on the production of goods that are being sold domestically and abroad, and (b) the effect of this change on the social conditions, particularly income distribution. Difficulties in the assessment of these issues stem from the problems of linking trade policy to long-term equilibrium growth and identifying its distributive effects, which are influenced by many factors, including the country's technological conditions and skill accumulation. While the experiences of various developing countries show the value of trade to growth as well as to general welfare improvement, there is less agreement on how trade liberalization affects the level and distribution of gains and losses to producers and workers (Krueger, 1983). Recent studies indicate that while the East Asian open trade experience has narrowed the wage gap between unskilled and skilled workers, the increased trade liberalization in Latin America has widened wage differentials (see Wood, 1997).

The Hecksher-Ohlin theory maintains that countries export goods that use intensively those resources that are relatively abundant at home and import goods that use intensively those resources that are locally scarce. Trade therefore increases the demand for the abundant factors, assuming the expansion of the export sector, and reduces the demand for scarce factors, assuming the contraction of the import-competing sectors. In low-income developing countries, where abundant unskilled labor is found and skilled labor is scarce, trade tends to increase unskilled labor wages and lower skilled wages, thereby narrowing the gap between them.

However, for middle-income developing countries, like the Philippines, where a band of skilled labor exists in select industries alongside a pool of unskilled labor in less advanced sectors, the impact of international openness on wage equality is less certain. According to the Stolper-Samuelson theory, factor prices are dependent upon the effect of trade on product demand and product prices. Wage inequality between skilled unskilled and labor may increase if the product prices of goods produced by the less advanced sectors increase vis-à-vis the imported goods. For these sectors to be competitive, their prices may have to decrease, resulting ultimately in lower wages and increasing the wage gap between the skilled and unskilled.

This study aims to determine the effects of globalization on the distribution of income, particularly wages, through an empirical model that account for factors affecting wage increases, including the country's technological structure and the education levels. Moreover, it seeks to provide a methodology to measure the price

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effects of globalization as opposed to possible technological changes that can also affect export and product prices. Most of the studies have focused mainly on the effects of world prices and of technology, at home or abroad, on wage distribution (Jones and Engerman, 1996). Another important issue, however, is to consider also how skills, perhaps due to education, can be able to influence whatever effects that globalization may have on wage inequality.

In the Stolper-Samuelson theory, globalization is viewed as a "shock" that increases the foreign goods produced by unskilled workers associated with the increasing wave of economic liberalization around the world. However, the process of globalization results from the rising levels of involvement in the world economy, increasing interdependence, the establishment of global markets, prices and production, and the diffusion of technology and ideas (Lairson and Skidmore, 1997). The three main components of globalization are (1) the growth of foreign direct investments (FDI) due to financial liberalization and relatively costless international financial transactions; (2) the growth of trade due to the emergence of global markets and the reduction of trade barriers; and (3) the diffusion of global technology and innovation due to easier communication. These changes can be categorized primarily in terms of financial and trade liberalization, which in turn influence technological changes. To apply the Stolper-Samuelson theory, it is then necessary to consider not only the price changes but the technical innovations as well.

Previous studies on wage inequality sought to understand the effects of trade by measuring the so-called factor content of imports and exports, estimating the amount of skilled and unskilled labor embodied in exports as well as the amount of skilled and unskilled labor needed to produce domestically the imported goods. The influence of trade on relative wages of skilled and unskilled labor can be then be inferred by calculating the net differences in demand for the two types of labor resulting from exports and imports.

Several authors, however, pointed out the problems and difficulties with this factor-content approach. Burtless (1995) emphasizes that this procedure, because of its focus on the trade flows, fails to consider the important role of trade in determining product prices. Leamer (1996) claims that the Stolper-Samuelson theorem stresses the wage effects of product prices, not the level of products or inputs. Furthermore, he notes that the factor-content procedure fails to consider the changes in tastes and technology in the non-traded sector that influences external demand for labor as well as on the prices of the good. To determine the effects of globalization on wage inequality, the study aims to apply the Stolper-Samuelson theory, and will thus consider tracking the influence of trade on factor prices through the trends in relative prices of goods produced by different skill-intensive industries. The focus will be on the key industries, inclusive of certain subsectors that are characterized by differences in skill intensity and adequate exposure to the process of globalization.

This paper also deals with the empirical issues on the estimation of the effects of globalization on wage inequality. The objective is to provide an empirical framework to measure the effects of increasing trade liberalization on the earnings of skilled and unskilled workers in selected industries in the Philippines. Despite varied data limitations, the empirical model used should be able to assess efficiently and adequately the effects of globalization on wage inequality.

The rest of the paper is divided into the following parts: Section II discusses further the conceptual issues found in the model. Section III provides the empirical model to apply the theoretical framework. Section IV describes the existing data and the choice of the industries to be considered. Section V presents the results of the empirical test, and Section VI the conclusion.

II. Conceptual Issues

According to the Hecksher-Ohlin theory, countries will export goods that use its more abundant resource and will import goods that use scarce resources more intensively. Trade thus increases the demand for abundant factors, because of the expansion of export sectors, and reduces the demand for scarce resources because of the contraction of import-competing sectors. In turn, factor prices will change correspondingly, with prices of abundant factors increasing and those of scarce resources declining. In developing countries, where unskilled labor tends to be abundant and skilled labor scarce, trade tends to increase the wages of unskilled workers and lower the skilled wages, thereby narrowing the gap between them.

Trade barriers (e.g., transport costs and tariffs) create wedges between the prices of goods in two countries and result in either no trade or autarky. These barriers will then keep the price of the exportable lower in the developing countries than in the developed countries, and the opposite for the importable. A reduction of trade barriers, and the resulting expansion of trade, would thus raise the price of exportable and lower the price of the importable in the developing country.

Such a change in relative domestic producer prices would raise the wage of unskilled workers relative to that of skilled workers. This link, known as the Stolper-Samuelson theorem, exists because, as the Heckscher-Ohlin theory assumes, technology (that is, the production function for each good) is given. In other words, it assumes a fixed functional relationship between outputs of goods and inputs between the prices of goods and wages of factors.

This outcome can be illustrated in a type of supply-and-demand-curve diagram adapted from Leamer (1995) and Wood (1997). In Figure 1, the downward-sloping line, dd, is the demand curve for unskilled labor in relation to skilled labor, which would prevail in a state of autarky. In the absence of trade, wages would be determined by the intersection of this demand curve with a supply curve (assumed for simplicity to be completely inelastic), whose position depends on the country's endowment of skilled and unskilled labor. With supply S_2, which stands for a country's endowment of skilled and unskilled workers, the relative wage of unskilled labor would be at the low level, w_o.

The demand curve in a country open to trade is the line DD. It crosses dd at B on the horizontal axis—if it had this skill supply ratio, even an open country would not trade. The developing country, which has a relatively large supply of unskilled labor, and hence is a net exporter of the unskilled-labor intensive good, must lie to the right of B. The developed country must lie to the left of B. So, for a developing country, opening to trade shifts the demand curve in favor of unskilled labor (DD lies above dd) and narrows the gap in wages. With a skill supply ratio S_2, the relative wage of unskilled labor would rise from w_0 to w_2.

The open-economy demand curve DD has an odd shape, with two downward-sloping segments separated by a flat segment in the middle—to the right of B, there are two distinct segments in the developing-country range. The flat segment covers the range of skill supplies in which a trading economy would be diversified in the sense of continuing to produce both goods that are unskilled labor-intensive and skill-intensive. However, moving beyond this flat segment, a country with a high proportion of unskilled workers would not produce the skill-intensive product. Such specialization puts a country on a segment of the demand curve that slopes downward, because increases in the relative-wage-induced changes in the technique chosen to produce the single good.

Trade may raise the relative wage of unskilled workers, whether the outcome is diversified or specialized. But the effects on wages of subsequent changes in the relative domestic supply of labor differ. In a diversified country (as at S_1), relative wages are fixed by world prices, at w_1. Changes in the domestic labor supply, unless they are big enough to affect world prices, do not change relative wages; they alter only the composition of output and trade. By contrast, in a specialized country on a downward-sloping segment of DD, as at S_2, changes in domestic labor supply do affect relative wages. For instance, an increase in the relative number of skilled workers would raise the relative wage of unskilled labor.

The model can be extended to include many goods (differentiated by skill intensity) without changing the basic proposition that reduction in trade barriers will lead to an improvement in the wages of unskilled laborers relative to the skilled, assuming that goods exported are unskilled labor-intensive. Figure 2 is drawn with six, rather than two, goods. Instead of having just one flat segment, five surfaces, alternating with negative sloping segments, are found. In a less diversified economy, the changes in relative labor supplies will have little impact on the wages. However, in a situation where an infinite continuum of goods is being traded, it is expected that the demand curve will approach the straight dashed line, as shown in Figure 2. This denotes an infinite number of traded goods, reflecting differing skill intensities and relative wages in proportion to factor supplies.

This analysis has two important implications:

(1) If the Hecksher-Ohlin theory, as presented above, has any relevance to income-inequality trends in low-wage countries, globalization must have resulted in price increases in the country's exportables and price decreases in the importables. Such changes, according to the Stolper-Samuelson theory should be accompanied by increases in the wages for the kind of unskilled labor that makes up the bulk of employment in the country. In other words, it is not the relative supply of skilled and unskilled workers, but the set of world prices that will more significantly determine the relative skilled and unskilled wages, as proposed by the Factor Price Equalization theorem.

(2) The relevance of the factor content of trade (FCT) method used in many studies seems substantially appropriate only in cases where there is an infinite number of goods being traded. For a small country trading under competitive conditions, such a condition may be also be found since prices will indicate the scarcity levels of such factors. However, in a setting where most firms trade on the basis of scale economies, then the value of FCT as a tool of analysis may be limited.

These imply that, except for conditions approximating competitive market conditions, the relative prices of goods will be the critical factor, since these will ultimately determine the distribution of income, as reflected in the wages. Although factor supplies are generally likely to have some effect on relative wages, the effects of prices are expected to be the more relevant factor, as the markets will no longer be based domestically, but internationally.

III. Empirical Model

The empirical model that will be used in this study will build upon the U.S. study on wages and globalization by Leamer (1996, see Appendix). The variability of wages is assumed to be affected by two main factors—technological changes and globalization. Furthermore, while technological progress and globalization "shocks" are seen to have perceptible effects on wages, greater skill is expected to either mitigate or reinforce these changes in wages, depending on whether the product in which these are being used has a comparative advantage. The empirical framework should not only disentangle the effects of technology and globalization on wages, but more importantly, distinguish these effects on the varied skills of workers. It is expected that these diverse factors of production, such as skilled labor, unskilled labor and capital, will be affected differently. The rates of return from globalization and technological change of these factors and ultimately wage inequality should be determined.

Based on this factor returns model, the equation that will be used for separating the impact of globalization and technological change is given as follows:

$$\hat{p}_g = \ln p_{it} - \ln p_{ht} = \ln p_{it} + \lambda \ln TFP_{it} = \sum_{k=1}^{3} \theta_{itk} \hat{v}_k \qquad (1)$$

Given panel data on export prices, $\hat{p}_{it}$, the total factor productivity, TFP_{it} and the shares of skilled and unskilled labor, and intermediate inputs, θ_{itk}, k=1,2,3, we can estimate this logarithmic equation. The TFP term in the equation basically suggests that technologically-induced price changes, $\hat{p}_{ht}$, should be removed from the overall price effects that result solely from trade. Certain technological innovations can be realized that might keep wages high even in the face of increased foreign supply of labor-intensive imports. This means that even though product prices have declined, wages are kept high in the world market because of the factor-biased technology.

The coefficient λ indicates a "pass-through" factor indicating the extent to which the change in TFP is passed on to the economy in the form of lower prices. A value of λ=1 means that technological improvements result in product export price reduction. This denotes that the price impact of globalization cannot be fully measured from the observed growth of prices, as the latter may ignore the effects of technological innovation in prices.

We can thus interpret the relative difference in trade and the TFP, p_g, as the proportional benefit from globalization in terms of its likely effects on prices. A positive value in the left-hand side of the equation therefore indicates a greater return from trade than from technology.

Furthermore, we can view the coefficients of the factor shares, $\hat{v}_k$, as the percentage changes in factor returns from globalization, and the net of technological changes measured by the TFP. These are the changes in returns to factor owners (or costs to firms) that are needed to keep the zero economic profit conditions working even as changes in technology and product prices. A positive (negative) value of ω_k indicates a greater (lower) return to the factor (Hilton, 1984).

Because the model is seen in terms of changes over time, the overall timing trend of these variables is somehow captured. Nevertheless, because there may be unobserved individual sector and time factors involved in the change, random effects estimates may be more efficient.

The measurement of the impact of globalization on wages will thus consist of three main stages:

1) Measurement of the relative factor shares of workers by skill levels

Using the available data on Philippine industries, wages, and education, the factor shares of labor inputs by skill levels will first be calculated. These shares can be calculated from the sectoral wages of individuals and level of employment per skill unit (Leamer, 1996). For instance, given the highest sectoral wage (w_S) and the lowest sectoral wage (w_U), the level of employment for the skilled (S) and the unskilled (U) can be computed if the data for the earnings of workers (E) and the total employment (L) in the various sectors can be obtained. This can be done through the mapping of employment and earnings into the skilled and unskilled employment as follows:

$$\begin{bmatrix} w_S & w_u \\ 1 & 1 \end{bmatrix} \begin{bmatrix} S \\ U \end{bmatrix} = \begin{bmatrix} E \\ L \end{bmatrix} \qquad (2)$$

This can be inverted into:

$$\begin{bmatrix} S \\ U \end{bmatrix} = \frac{1}{w_S - w_u} \begin{bmatrix} 1 & -w_U \\ -1 & w_S \end{bmatrix} \begin{bmatrix} E \\ L \end{bmatrix} \qquad (3)$$

From these, the factor shares, relative to total value added (VA), for the highly educated workers, the uneducated workers, and intermediate inputs can be computed as follows:

$$\theta_S = w_S S / VA = w_S [(E - w_U L)/(w_S - w_U)] / VA$$
$$\theta_U = w_U U / VA = w_U [(-E + w_S L)/(w_S - w_U)] / VA \quad (4)$$
$$\theta_I = rI / VA = 1 - \theta_S - \theta_U - \theta_K$$

The term θ_K in the share for intermediate refers to the share of intermediate inputs to VA. This can be estimated directly from the given costs of fixed assets and the value added.

2) Measurement of TFP

To measure total factor productivity or TFP, this author first assumed the following Cobb-Douglas unit production function (see Pack, 1984):

$$q_i = A k_i^{a} z_i^{1-a} \quad (5)$$

where q_i is one peso of value-added in industry i , k_i is the capital output ratio, and z_i is the total number of employees required to produce a unit of valued-added. The variable A is the efficiency index used to measure TFP. We can then rewrite this equation in logarithmic form as:

$$\log q_i = \log A_i + \alpha \log k_i + (1-\alpha) \log z_i \quad (6)$$

In this study, capital stock is measured in terms of the value of fixed assets and other intermediate costs rather than the flow of services. No attempt is made to disrupt the flow of services or the potentially different marginal productivities of the different components of the capital stock. Labor input is measured as total worker compensation to facilitate the distinction between the skilled and unskilled workers.

The value of the output elasticities is clearly important for the calculation of total factor productivity. To measure this, this author shall use the factor shares from the industry's total output. Of course, elasticites obtained from production function estimates from different countries differ depending on the definitions, and often diverge from relative shares of national income. The range of variance is greater for developing countries like the Philippines because of the larger deviations of factor markets from the competitiveness assumption used to justify the equality of the appropriate elasticities and the observed factor shares (Pack, 1984). Nevertheless, given the industries that have opened substantially to the world market, the "as if" assumption about competitive markets will be used, and factor shares will be imputed to measure the required elasticities.[1]

3) Regressions of Export Prices and TFP on the estimated Factor Shares

The effects of globalization on wages can be inferred from the changes in product prices. However, prices may also be by total factor productivity, thus possibly

[1] Aside from the definition of the inputs, the estimate of TFP here differs from the growth accounting method of Cororaton and Caparas (1999) in at least two ways. First, the measure is derived in monetary levels rather than as growth rates. Second, the composition of industries is more restricted and includes those that are able to export extensively. These differences make the estimate more stable and less subject to variances than the previous study.

resulting in a bias in the estimates. To solve this problem, one can derive the full effects of globalization by regressing changes in product prices, conditioned by total factor productivity changes, on input shares. To disentangle the effects of globalization on wages, one must measure the effect of technological changes, proxied by changes in total factor productivity, on wages.

Depending upon product demand and supply conditions, improvements in total factor productivity are expected to influence wages. For instance, under competitive conditions, if supply is fixed, improvements in total factor productivity can lead to higher wages as the demand for the goods increases. On the other hand, if supply is infinitely elastic, the potential supply increase from increased technological efficiency may be choked by higher wages if the demand for labor is reduced. The idea then is to consider these possibilities as well as the probable intermediate cases.

IV. Empirical Strategy and Data Description

Using the above model, the paper will then try to measure the effect of globalization on wage inequality in the Philippines. Following the Stolper-Samuelson theory, the author assumes that the effects of globalization on wages are associated with the changes in product prices. The empirical strategy data to be analyzed in this paper will then focus on capturing the different facets of globalization with a view to disentangling them from the price effects of globalization.

Time Period of the Study: Clocking trade and financial liberalization policies

The investment regime of the Philippines has evolved over time in line with the Philippines' economic condition and development strategy. Because of the shortage of government resources and domestic savings, foreign direct investment (FDI) was considered desirable. However, in line with the protectionist industrial strategy of the time, the import substituting industries were the only beneficiaries of tax exemptions, favorable credit terms, market protection, and so forth.

The situation, however, changed in 1990 with the implementation of an economic stabilization program supported by a stand-by credit facility from the International Monetary Fund. This paved the way for reforms in trade and investment that were subsequently expanded in the Ramos administration. Several important measures were made just before the end of Aquino administration. The most important of these was the passage of the Foreign Investment Act of 1991. The enactment of this law liberalized investment by allowing 100% foreign equity in a domestic or export enterprise as long as its activity did not fall under a negative list. Furthermore, this law simplified the procedure for the entry of foreign investments by requiring foreign investors to register only with the Securities and Exchange Commission (SEC), unless they were seeking incentives from the Board of Investments (BOI).

Since 1992 a more comprehensive market-oriented approach to economic structural reform has been followed. Under this approach, many key sectors, including the downstream oil, shipping, domestic and international aviation, telecommunications, and mining industries, as well as infrastructure (through Build-

Operate-Transfer and Build-Operate-Own schemes) have been opened to the private sector, including foreign investors. Ten foreign banks also were initially allowed to open branches.

Trade policies, on the other hand, have evolved since 1980. So far, four major programs have resulted in a substantial reduction in tariffs. The first phase of the Tariff Reform Program (TRP-I) was implemented in 1981, covering a five-year period, aimed at leveling off protection rates across industries and achieving effective protection rates (EPRs) within the 30 to 80% range. The second phase of TRP was implemented with the issuance of Executive Order (EO) No. 470 on 20 July 1991, which became effective on 24 August 1991. The tariff structure under TRP-II is such that locally produced and imported raw materials would have a tax of 10% and 3% rates of duty, respectively; intermediate goods at 20% and finished goods at 30%. TRP-II (EO 470), which was supposed to end by December 1995 was overtaken by the third phase of TRP in August 1995. TRP-III liberalized further the trade environment by reducing the level and spread of tariffs toward a uniform level of EPRs across all sectors, thus promoting global competitiveness and simplifying the tariff structure for ease of customs administration, and providing a level playing field for local manufacturers vis-à-vis foreign competitors. Finally, as TRP-III met a number of objections from the business sector, the government considered a tariff calibration scheme to serve as a framework for TRP-IV vis-à-vis the pace of liberalization in the ASEAN countries. The tariff adjustments were contained in EO 465 and 486, implemented effective 22 January and 10 July 1998, respectively. TRP-IV provides a structure of 30-25-20-15-10-7-5-3% tariff reduction scheme instead of the previous 30-20-10-3% structure to respond to the business sector's clamor for further protection to "assist them to compete globally."

Having looked at all these policies, this paper will then provide an analysis focusing on the time period when the effects of these policies have already been in place. This means that the study will only involve the years covering 1991 to 1996. This time period, as opposed to starting from 1980, will have the following two advantages: (1) it will limit the number of structural factors that need to be accounted for in the study; and (2) it will capture the full impact of globalization. In considering globalization, capital movements have to be incorporated since interest rates can affect the demand for labor and correspondingly the wage rates. The main disadvantage of course is that the number of observations that can account for the impact of globalization will be limited.

Industries to be examined: Identification of Key Industries

The theory discussed in Section II considers mainly the country's tradables. To focus on the impact of globalization on the labor productivity, employment, and earnings, this author considers only the top, fast-growing manufacture exports in the country. The theory also considers the imports whose costs may be influenced by globalization. Import-competing industries will then be expected to change with the trade and financial liberalization. However, in the Philippines, the exports and the exporting industries are heavily import-independent. In this case, the export price changes will be affected not only by the costs of domestic inputs but by the imported inputs as well. Because this condition leads to a broader representation of the

Hecksher-Ohlin theory[2], analyzing the exporting industries will be sufficient to consider both the effects of investment and trade liberalization.

To focus on the key industries, this author uses the exportables that have been in the top 20 from 1989 to 1995 for a number of reasons. First, these are the industries that probably benefit from the globalization, and the effects of this liberalization trend will then be highlighted. Second, the changes in employment and wage rates will be expected to be more pronounced in these industries. Third, the effect of technological innovations will be more substantial in these industries. The underlying assumption in this strategy is that assumptions of the Stolper-Samuelson model are more evidently applicable for these industries. Although the recent programs may influence other industries, their overall effects for the particular time period in question may not be significant. These industries and the corresponding values and volumes of their exports are shown in Table 1.

The source of the data here is the Philippine Trade Statistics that had been categorized using the PSCC code. Because the data on factor inputs and technology trends are gathered from the Annual Survey of Establishments, which is based on the PSIC code, there will thus be a need to match these two data sets. In the absence of any objective way of comparing these two codes, the author used the following pairing of industries with their corresponding PSIC and PSCC categories:

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2 Note that the Hecksher-Ohlin theory examines the consequences of trade on goods and their associated factors, rather than industries. However, since the exporting industries use imported goods along with domestic inputs, then each industry can be seen as self-contained economies as assumed in the model. However, because the imports are used as inputs, increased trade liberalization may induce more production of goods that uses imports whose costs have declined. Nevertheless, the theory remains valid (though weakly) if globalization should still result in greater exports of goods that use the more abundant domestic resource.

PSIC	Industry
3115	Canning, Preserving and Prosg of Fish, Crustacea and other Sea Foods
3125	Manufacture Desiccated Coconut
3114	Canning and Preserving of Fruits and Vegetables
3123	Sugar Milling and Refining
3319	Manufacture of Wood, Cork and Cane Products N.E.C.
3530	Petroleum Refineries
3116	Production of Crude Coconut Oil, including Cake and Meal
3512	Manufacture of Fertilizers
372	Non-Ferrous Metal Basic Industries
3831	Manufacture of Elecl machy and apparatus
3909	Manufacturing Industries, N.E.C.
3832	Manufacture of Radio, Television and Commun Eqpt and Apparatus
3836	Manufacture of Elec Wires and Wiring Devices
3825	Manufacture of Ofc, Computing and Acctg Machy
3839	Manufacture of Elecl Apparatus and Supplies N.E.C
3845	Manufacture of Motor Vehicle Parts and Accessories
38609	Manufacture and Repair of Furn and Fixtures Primarily of Metal
3223	Embroidery Establishments
3222	Ready-made Clothing Mfg
3212	Knitting Mills

PSCC	Industry
037.1	Fish, prepared or preserved in airtight containers
057.7	Coconuts, fresh, matured, dessicated
057.9	Pineapples, avocados, mangoes, guavas and mangosteens, fresh or dried and other fresh fruit, n.e.s.
061.1	Centrifugal sugar, muscovado, and "panocha"
292.9	Vegetable materials of a kind used primarily in brushes or brooms , hard seeds for carving, seaweeds and moss, dried
334.1	Motor spirit (gasoline), including aviation spirit, other light petroleum oils obtained from bituminous materials (other than crude) and petroleum naptha
422.3	Coconut (copra) oil and its fractions
562.9	Fertilizers, manufactured
682.1	Refined copper (including copper alloys other than master alloys), unwrought
764.1	Electrical apparatus for line telephony or line telegraphy (including such apparatus for carrier-current line systems)
764.3	Transmitters-Receivers
764.9	Parts and accessories of phonographs (gramophones) including record players and tape decks and t.v. image and sound recorders and reproducers, magnetic
773.1	Magnet wire and insulated electric wire, cable, bars, strip and the like, n.e.s.
776.3	Transistors, photocells (including photodiodes and phototransistors), diodes and similar semi-conductor devices
776.4	Electronic microcircuits
784.3	Other parts and accessories of the motor vehicles of groups 722, 781, 782 and 783
821.1	Chairs and other seats, whether or not convertible into beds, of wood, of metal, of bamboo, of rattan, of other materials n.e.s.
844.2	Undergarments (excluding shirts but including collars, shirt fronts and cuffs), of synthetic fibers or other fibers, other than knitted or croheted
845.1	Jerseys, pullovers, slipovers, twinsets, cardigans, bed jackets and jumpers, of cotton, wool or fine animal hair, or of other fibers, knitted or crocheted
845.9	Other outer garments and clothing accessories (other than gloves, stocking and the like), of cotton, of synthetic or of other fibers, knitted or crocheted, not elastic nor rubberized

The problem in considering only these industries may be that the estimated effects of globalization may be biased upward. Realism requires the inclusion of non-traded goods in the model. The high ratio of trade to output indicates, however, transport costs, tariffs, and quotas have not been substantial barriers to trade, even before the process of liberalization was implemented in full force. Moreover, the presence of non-traded goods does not necessarily alter the expected effects of trade on relative prices, especially for the industries that are clearly affected by globalization.

Using the data in Table 1, we can compute for values of these products in the world market by dividing the value of the product to its volume. Figure 3 and 4 show the export price trends of these products, classified into non-manufacturing and manufacturing products, respectively. The following points are important. For the non-manufacturing exportables, except for fish and fruits that recorded sharp price increases in 1990, the products exhibit generally limited variation in these prices. For fish and fruits, 1990 was the year when the supply had also sharply decreased. Copper also had a lower supply of exports in that year and registered also a significant increase in prices. Other products such as vegetable materials, coconuts, and coconut oils appear to indicate a stable rise in the prices. These prices fluctuated but had seemed generally in 1995 to record slight increases.

For the manufacturing exports, the prices have also remained generally constant throughout the period, except for microcircuits, transistors, transmitters, and sound equipment that displayed significant increases. For microcircuits, the impressive improvements in prices can be attributed to possible changes in the quality of the product, aside from the increases in the demand for the good. If one were to interpret this result using the Heckscher-Ohlin theory, one may conclude that the opening of markets revealed the country’s comparative advantage in manufacturing these two products.

Figures 5 and 6 show my calculations of TFP for the same non-manufacturing and manufacturing sectors. The low variability of these graphs suggests sluggish technical improvements in these industries, and seems to complement the generally stable movement in prices. Several points are noteworthy. First, despite the by and large low variability in both of these sub-groupings, the general movement appears to be a gradual fall in the TFP. Several products, such as coconuts, fertilizers, microcircuits, undergarments and transistors, registered significant increases in some periods, but unfortunately these improvements were not sustained as they also showed substantial declines later. Second, there were nonetheless several cases of gains for non-manufacturing-based products. These include fruits, coconut oils and vegetable materials in the agriculturally based group. Third, while the TFP movements are minimal, these nonetheless remain positive.

The general complementarity in the movements of TFP and the observed export prices appears to show some relationship between these two variables. To some extent, prices of these highly tradable goods may be expected to increase as markets have been opened, and world market demand has increased. However, prices of some industries can be reduced if the cost of inputs has become cheaper or the productivity of inputs has increased. The minimal, and generally declining, estimates of TFP may have reinforced these upward pressures in the prices. However, industries that recorded higher TFP may have kept some of these prices at a steady and more competitive level. In any case, the sectoral variability of TFP justifies the analysis of technological innovations into the analysis of globalization. Given these observed variances in the data, certainly time and industry factors have influenced these observed prices.

Employment and Wage Incomes

Figures 7 and 8 show the employment levels for these identified non-manufacturing and manufacturing products, respectively. Despite the various structural changes occurring both here and abroad, the general movement has been relatively unchanging all throughout. This means that the industries that previously had high levels of employment—fish, coconuts, fruits, and sugar—continued to be the industries that employed the most number of workers. For the non-manufacturing products, the same unresponsiveness of employment to the globalization process can be noted. The production of ready-made clothes, such as jerseys, is seen to be the most-labor intensive, while sound equipment industries are increasing the demand for labor.

Wage incomes, however, appear to have been somehow influenced by the globalization process. One way of showing this is by analyzing the highest and lowest sectoral wage incomes for the three main sectors, i.e., agriculture, mining, and manufacturing. Table 2 shows these two levels of incomes for 1991 and 1994 from the Family, Income, and Expenditure Surveys. Note that there is no clear indication that only the wage incomes of the skilled or the unskilled have increased during the period, as indicated by the highest and lowest sectoral wages, respectively. Nevertheless, the manufacturing sector had a significant increase in the highest sectoral wages from 1991 to 1994, and a decrease in the lowest incomes observed. This may be important since from the data on prices, it appears that only these sectors had benefited from globalization.

Another way of viewing this phenomenon is to compare the incomes of highly educated households (with high school degrees and higher) and poorly educated households (with no high school degrees) from the Family, Income and Expenditure Surveys. Figures 9 and 10 show the movements of wage incomes between 1991 and 1994 for all industries. Two points are important. First, there is a significant difference in the wages found between the highly educated and poorly educated families, suggesting that education is crucial factor in the determination of wage incomes. Second, the improvements from 1991 to 1994, when globalization was operative, are seen to be greater for the highly educated families than their counterparts. This is particularly so for such industries as agriculture, manufacturing, utilities, wholesale and finance. This suggests the high premium placed on education by much of these globalization trends.

The data then appear to indicate that these industries have responded to globalization not through greater employment but through wage changes. This supports the Stolper-Samuelson theory that hypothesizes the independence of prices and wages to the composition and level of employment and resources. Table 3, Panel A, provides the means and standard deviations of the variables for all industries considered for the empirical test. Three main points can be made. First, prices have consistently increased during the period from 1989 to 1995. This can be because of the wide-ranging depreciation of the pesos (particularly in 1990) as well as the increased demand expected from globalization.[3] Second, the estimated TFP measure has on the average declined in this same period. This means that part of the increase in prices is due to the failure to innovate. Hence, there is a need to consider not only the price effects of globalization but also its possible technological effects if we are to apply the Stolper-Samuelson theory. Third, the share of factors generally has not changed significantly from the 1989 levels. In between these years, however, the share of unskilled labor has declined substantially. Capital share (mainly share of fixed assets) is seen to be very erratic, experiencing substantial changes upwards and downwards. The share of skilled labor and intermediate inputs has remained steady, even as the former experienced a significant increase in 1994.

A breakdown of these movements of these variables into three sub-groupings of industry is shown in the succeeding panels of the table. For agriculture-based industries, the changes are different from those indicated as the general trend. For one, the estimated TFP has remained stable from the 1989 levels, suggesting technological innovation in these areas. This is in sharp contrast to the manufacturing-based industries that showed a steady decline after an increase in 1990, while the natural-resource-based industries registered abrupt and irregular fluctuations.

Moreover, the share of unskilled labor in the value added of agriculture-based industries has steadily increased (with lower skilled labor and intermediate inputs shares) since 1993 when the full impact of trade liberalization was felt. In contrast, the other industries featured declining shares in unskilled labor. For manufacturing-based industries, capital and skilled labor shares have increased substantially, while for natural resource-based industries, there was a noticeable increase in intermediate input share. The general trend seems to indicate that as the value-added share of unskilled laborers in manufacturing-based industries has decreased, the share of unskilled labor in agriculture-based industries has increased.

These points all seem to suggest that the movement of prices has been influenced by international markets as well as the country's foreign exchange movements. Furthermore, the changes in prices are transferred conceivably to changes in factor returns, as predicted by the Stolper-Samuelson theory. However, the effects on factor returns will seem to be different for each industry.

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[3] These average figures can also reflect the composition of the exports recorded in the year. In which cases, if one high-priced product were to become more dominant in one year, its price would be given a larger weight in the estimated average price.

V. Results of the Empirical Test

Table 4 presents four sets of estimates to measure factor returns from world export prices, total factor productivity, and globalization, which is defined as the sum of the first two factors. Respective breakdowns across different sub-groups are shown in the succeeding panels. As already discussed and as shown by the previous section, a number of unobserved industry and time effects could have affected the data. Hence, there is a need to consider the random effects models to determine the significance of these unobserved factors. Ordinary least squares and fixed effects estimates are shown in Tables 5 and 6.

Fixed effects models are generally seen to be a reasonable approach to taking account of differences between industries over time that are viewed as parametric shifts in the regression function (Greene, 1990). These effects can then be interpreted as applying only to the cross-sectional units of the study, or the included industries, and no longer to additional ones outside of the sample. However, in most other cases, it may be more appropriate to consider these industry-specific constant terms as randomly distributed across cross-sectional units. In which case, it will be more acceptable to assume that the sampled cross-section was drawn from a larger population over time. In this case then, the model can be modified to approximate a random effects model.

In view of this, the random effects model is believed to be more efficient than the former. However, there is uncertainty about its extremely small sample properties, a problem that we obviously have in this paper. In this case, it is necessary to test the appropriateness of the model using the so-called Hausman test. This test is designed to determine whether there are systematic differences between the two models. Note that the test shows the robustness of the random effects model for the combined effects of prices and technological innovation as well for the estimates for export prices and the TFP. However, estimates for sub-groupings are seen to be less reliable.

The random estimates found in Table 4, Panel A, indicate that, for all industries concerned, capital (reflected in the constant since capital is the control variable) and skilled labor have positive and significant returns from the observed movement in export prices, and lower returns are seen for unskilled labor and intermediate inputs.[4] However, technological innovations appear to be biased against both capital and skilled labor but more favorable to intermediate inputs. This means that the prices are somewhat decreased by improvements in the productivity of the unskilled labor units and intermediate, although somewhat increased by the seeming lack of productivity improvements arising from the use of intermediate inputs. Although higher export prices do not benefit unskilled labor more than the other inputs, improvements in total factor productivity raise the rate of return from investments in unskilled labor.[5] However, these increases in productivity earned by

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[4] The estimated coefficients are interpreted as the differences from the constant that is supposed to reflect the rate of return from capital, the control variable. Insignificant coefficients then show no change from the constant. If the coefficients are negative but lower than the constant, this means that the rate of return from the associated factor is still positive but lower than the rate of return from capital.

[5] As already discussed, because the available data may be influenced by a number of industry-specific effects, random effects estimates are seen to be more efficient than the OLS estimates (see Table 5), where unskilled labor is seen to have the same rate of return as capital from globalization.

owners of unskilled labor do not offset their lower returns from export prices, implying relative wage inequality arising from globalization.

This overall assessment, however, is somewhat modified when we view the breakdown by industry. Panel B shows the estimated factor share returns in agriculture. Note that all factor shares receive positive returns equal to roughly 2% (as coefficients, except the constant, are statistically insignificant). Nevertheless, owners of unskilled labor generate increases in the total productivity, causing a higher total return relative capital. Hence, if increases in total factor productivity are transferred fully in the form of lower prices, the wage returns of unskilled labor will amount to roughly 8% in agriculture.

The results for the other industries all suggest a higher return for the other inputs. The outcomes for the natural resource-based industries (Panel C) however indicate a lower rate of return for all inputs, indicating that the three exporting products are losing their competitiveness in the face of globalization. For manufacturing-based industries (Panel D), the estimated returns from prices and total factor productivity indicate that all factors generate positive returns, although some returns are greater than others. Unskilled labor are able to earn only about 3.5% return, while the owners of the other factors bring in a rate of return close to 8%. Hence, while all inputs are benefited, the returns for unskilled labor are moving slower than others.

In summary, relative to skilled labor, the returns to unskilled labor are smaller, indicating that the country's exports are becoming skilled-intensive. After accounting for the returns from technology, i.e., the price effects from lower productivity, the returns to unskilled labor are nonetheless shown to have increased. What matters, however, are the movements across industries over time.[6] Increased investment in unskilled labor is seen to cause a higher return due to increased total factor productivity. Furthermore, if we allow the closure inefficient industries, such as natural resource based-industries, the inequality will be lower.

VI. Conclusion

Globalization has not taken full advantage of the abundant unskilled labor resources in the country. Unskilled labor inputs are shown to have lower returns relative to other inputs from the globalization process. This means that relative to the other inputs, unskilled labor earns significantly lower returns. In which case, the globalization process is expected to bring about some wage inequality, favoring, first, the owners of capital, second, the skilled employees, and, third, the owners of intermediate inputs.

[6] The main results of the fixed effects estimates (see Table 6) appear nonetheless to confirm the results of the random effects model. The only difference seems to be the less insignificant returns from productivity of the unskilled labor units, and the greater difference in rate of returns between unskilled labor and the other input. Hence, controlling for industry-specific conditions alone can be misleading. Without accounting for time trends, one can attribute higher wage inequality to globalization increase wage inequality, and view technology innovations to be less unfavorable to unskilled labor.

Nevertheless, according to these results, the development of agriculture-based industries for export competition is crucial in reducing this inequality. This sector has been shown to obtain a higher value-added for unskilled labor and, with improvements in technology, the contribution of unskilled labor can be further increased. Given the improvements in technology in this sector, the returns to unskilled labor can be expected to be higher, thus reducing inequality produced by the manufacturing industries.

This seems to suggest that upgrading the country's skills in the manufacturing sector may not necessarily lead to favorable results, as is often claimed. In this case, the globalization process measured in terms of changing world market prices and technology, not the existing skill/education accumulation processes, is the real culprit of the existing wage inequality. The country's high exporting manufacturing industries have become too dependent on capital, skilled labor, and intermediate inputs, as the export prices tend to favor the use of such inputs. Technological innovation, which is seen to favor unskilled labor, has not been sustained. The country will have to consider restructuring its technological system, especially in the agricultural sector if labor is to benefit from the globalization and if wage inequality is to be reduced.

Furthermore, another source of inequality is the presence of inefficient industries that can slightly benefit some factors of production, but fail to generate enough returns for everyone. The study here shows that these low-return industries, particularly those under natural resource-based industries, tend to exacerbate the inequality problem.

The results thereby indicate that despite the shortcomings of the present globalization process, its overall benefits have so far been extended, albeit not equally, to all resource owners. Two conditions can address this problem. First, as already discussed, improving technology, which ultimately means improving the returns of unskilled labor, is called for. Efforts within the Asia-Pacific Economic Cooperation (APEC) for economic and technical cooperation should then be encouraged. Second, the closure of inefficient industries that only benefit selected resource owners, but leave others with substantial losses, should be allowed. Further liberalization that reduces protection to inefficient industries is thus recommended.

These results nevertheless are exploratory and subject to a number of errors. The major shortcomings of the paper are similar to Leamer's (1998) paper and the Mincerian wage model. This can be listed as follows:

a) The estimates are based on one special type of Hecksher-Ohlin model that presumes that labor demand is infinitely elastic and that globalization is primarily a product price shock that determines the returns to factor inputs. In this model, skills matter, but only in terms of how prices have already determined its likely returns. In this case, the supply of such qualities will not affect the returns.

b) The separation of observed changes in prices and technology is at best questionable. The assumption of a "pass-through" value of unity in the regressions is doubtful.

c) The data on prices, and total factor productivity—the dependent variables—are all measured with error.

This means that more detail have to be incorporated. In particular, future work needs to consider further product-mix changes, as well as the possibility that factor supply can have an impact on factor returns. There may be a possibility that marginal demand for labor, and ultimately the wages, is determined internally from the labor found in non-traded goods sector. In any case, the results here remain consistent with the Stolper-Samuelson model, which adheres to the Hecksher-Ohlin assumption. It provides empirical evidence to the view that globalization, as it is presently implemented, does bring about wage inequality to some extent. Nevertheless, moving away from this process will not necessarily result in any improvements. Hence, the solution is not to impede globalization, but to design appropriate technologies and to reduce protection of particular industries that will use our more abundant resources more efficiently.

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Table 1. Value and Volume of Exports of Selected Industries (1989-1996)

PSCC CODE		Unit	1989 Value (US$)	1989 Volume	1990 Value (US$)	1990 Volume	1991 Value (US$)	1991 Volume	1992 Value (US$)	1992 Volume
776.4	Electronic microcircuits	Gross kg	319,738,771	748,681,848	235,434,332	688,668,878	292,409,141	1,800,742	374,495,617	2,230,488
773.1	Magnet wire and insulated electric wire, cable, bars, strip and the like, n.e.s.	Net kg	573	34	158,125,607	13,801,411	181,004,759	15,905,032	267,875,668	20,953,610
776.3	Transistors, photocells (including photodiodes and phototransistors), diodes and similar semi-conductor devices	Gross kg	46,239,369	194,240,238	46,367,320	678,287,841	165,774,819	2,452,391	182,517,626	2,576,733
682.1	Refined copper (including copper alloys other than master alloys), unwrought	Net kg	114,272,308	330,377,375	280,643,691	109,702,957	222,205,923	98,047,037	217,420,903	98,055,262
764.9	Parts and accessories of phonographs (gramophones) including record players and tape decks and t.v. image and sound recorders and reproducers, magnetic	Gross kg	475,156	43,963	6,465,556	246,964	59,421,432	1,676,625	67,507,589	2,014,299
061.1	Centrifugal sugar, muscovado, and "panocha"	Net kg	79,688,362	186,911,546	110,528,087	244,828,808	115,132,055	274,549,469	88,046,589	208,518,489
334.1	Motor spirit (gasoline), including aviation spirit, other light petroleum oils obtained from bituminous materials (other than crude) and petroleum naptha	Liter	51,888,246	269,243,895	112,177,553	463,771,179	144,791,260	687,180,476	110,478,744	707,859,887
037.1	Fish, prepared or preserved in airtight containers	Net kg	64,586	20,031	38,901	8,631	107,911,140	48,247,788	97,367,707	48,828,230
764.3	Transmitters-Receivers	No.	104,074,401	1,770,802	113,389,214	2,504,291	110,904,007	2,745,444	142,254,515	3,574,301
845.1	Jerseys, pullovers, slipovers, twinsets, cardigans, bed jackets and jumpers, of cotton, wool or fine animal hair, or of other fibers, knitted or crocheted	No.	2,655,986	290,206	1,183,690	127,957	94,883,300	37,166,201	129,650,903	47,637,012
292.9	Vegetable materials of a kind used primarily in brushes or brooms , hard seeds for carving, seaweeds and moss, dried	Net kg	37,245,052	30,993,768	49,882,996	35,345,833	44,999,916	36,051,794	38,266,001	27,596,849
562.9	Fertilizers, manufactured	Net kg	16,205,404	96,355,415	33,627,046	208,237,562	108,663,724	606,837,779	83,119,537	476,723,411
057.7	Coconuts, fresh, matured, dessicated	Net kg	75,755,133	94,516,710	60,676,517	75,341,238	69,408,629	84,483,656	90,100,412	88,392,971
845.9	Other outer garments and clothing accessories (other than gloves, stocking and the like), of cotton, of synthetic or of other fibers, knitted or crocheted, not elastic nor rubberized	No.	3,028,104	697,205	3,495,172	1,116,242	50,245,718	14,100,758	48,748,562	12,906,954
057.9	Pineapples, avocados, mangoes, guavas and mangosteens, fresh or dried and other fresh fruit, n.e.s.	Gross kg	23,940,694	152,055,424	71,226	23,389	53,205,943	198,351,386	52,632,584	183,823,680
821.1	Chairs and other seats, whether or not convertible into beds, of wood, of metal, of bamboo, of rattan, of other materials n.e.s.	No.	4,535,009	68,089	5,912,203	74,823	42,281,055	1,023,532	38,178,528	907,029
764.1	Electrical apparatus for line telephony or line telegraphy (including such apparatus for carrier-current line systems)	Gross Kg	1,426,272	74,820	9,820,762	363,345	28,938,030	987,617	52,271,007	1,947,687
784.3	Other parts and accessories of the motor vehicles of groups 722, 781, 782 and 783	Gross Kg	17,138,370	2,511,532	18,963,984	2,920,280	22,369,909	4,053,398	53,845,041	5,634,504
422.3	Coconut (copra) oil and its fractions	Net Kg	358,347,840	728,557,392	334,411,172	1,059,256,623	298,533,088	839,890,093	481,161,242	882,225,907
844.2	Undergarments (excluding shirts but including collars, shirt fronts and cuffs), of synthetic fibers or other fibers, other than knitted or croheted	No.	7,190	10,500	262	2,400	39,847,477	11,443,778	36,969,426	10,383,962

Table 1. Continuation

PSCC CODE		Unit	1993		1994		1995		1996	
			Value (US$)	Volume	Value (US$)	Volume	Value (US$)	Volume	Value (US$)	Volume
776.4	Electronic microcircuits	Gross kg	575,032,741	2,853,496	798,754,967	3,193,062	1,140,313,33	4,191,277	1,477,742,570	4,778,744
773.1	Magnet wire and insulated electric wire, cable, bars, strip and the like, n.e.s.	Net kg	303,040,598	24,195,009	442,636,417	33,407,040	467,604,842	33,624,423	491,756,214	35,553,659
776.3	Transistors, photocells (including photodiodes and phototransistors), diodes and similar semi-conductor devices	Gross kg	197,712,676	2,704,942	263,779,728	3,369,334	383,532,546	3,646,377	443,107,187	4,198,458
682.1	Refined copper (including copper alloys other than master alloys), unwrought	Net kg	264,617,001	136,919,038	269,894,979	137,465,018	406,317,693	139,636,475	343,059,032	143,107,809
764.9	Parts and accessories of phonographs (gramophones), including record players and tape decks and TV image and sound recorders and reproducers, magnetic	Gross kg	85,123,529	3,094,552	117,937,806	4,644,450	196,269,115	6,867,449	223,063,458	6,629,379
061.1	Centrifugal sugar, muscovado, and "panocha"	Net kg	102,240,247	324,807,647	61,410,020	183,013,466	66,490,429	153,837,411	136,682,475	318,113,481
334.1	Motor spirit (gasoline), including aviation spirit, other light petroleum oils obtained from bituminous materials (other than crude) and petroleum naptha	Liter	75,751,806	631,774,487	77,229,018	788,747,205	90,643,845	828,832,141	135,158,494	1,034,608,607
037.1	Fish, prepared or preserved in airtight containers	Net kg	127,440,118	58,981,527	144,411,756	61,219,318	115,224,027	48,559,329	133,859,353	59,698,102
764.3	Transmitters-Receivers	No.	173,258,041	3,647,485	193,406,957	4,752,989	190,970,148	4,231,453	127,164,103	3,312,720
845.1	Jerseys, pullovers, slipovers, twinsets, cardigans, bed jackets and jumpers, of cotton, wool or fine animal hair, or of other fibers, knitted or crocheted	No.	146,840,454	53,986,062	134,037,125	47,265,390	141,792,195	52,494,330	118,929,361	37,213,025
292.9	Vegetable materials of a kind used primarily in brushes or brooms, hard seeds for carving, seaweeds and moss, dried	Net kg	46,507,411	31,807,967	56,093,003	34,560,141	84,225,231	40,455,458	94,752,704	38,533,813
562.9	Fertilizers, manufactured	Net kg	77,946,630	509,776,606	92,259,195	552,188,670	110,774,311	641,538,939	90,750,089	530,921,613
057.7	Coconuts, fresh, matured, dessicated	Net kg	86,107,449	97,410,493	71,078,905	76,397,598	69,152,550	74,248,870	85,209,446	69,936,271
845.9	Other outer garments and clothing accessories (other than gloves, stocking and the like), of cotton, of synthetic or of other fibers, knitted or crocheted, not elastic nor rubberized	No.	57,803,856	16,285,642	65,853,820	17,075,987	75,935,049	21,131,395	80,136,858	22,001,155
057.9	Pineapples, avocados, mangoes, guavas and mangosteens, fresh or dried and other fresh fruit, n.e.s.	Gross kg	51,226,520	189,624,015	55,008,018	195,889,611	69,222,589	212,847,959	65,177,999	189,419,122
821.1	Chairs and other seats, whether or not convertible into beds, of wood, of metal, of bamboo, of rattan, of other materials n.e.s.	No.	41,250,718	1,028,900	45,925,287	1,132,216	55,117,437	1,236,088	53,622,481	1,161,251
764.1	Electrical apparatus for line telephony or line telegraphy (including such apparatus for carrier-current line systems)	Gross kg	65,296,822	2,470,064	100,954,083	3,272,782	134,534,153	3,910,287	376,850,877	10,634,806
784.3	Other parts and accessories of the motor vehicles of groups 722, 781, 782, and 783	Gross Kg	95,559,188	8,837,904	164,883,496	14,488,247	208,089,067	20,494,852	269,045,731	23,437,112
422.3	Coconut (copra) oil and its fractions	Net Kg	357,608,373	859,200,185	475,164,833	848,755,972	826,088,526	1,340,410,11	570,638,557	792,651,567
844.2	Undergarments (excluding shirts but including collars, shirt fronts and cuffs) of synthetic fibers or other fibers, other than knitted or crocheted	No.	29,502,058	9,401,741	29,035,378	8,917,745	37,491,921	10,989,061	45,724,441	12,252,228

Source of Basic Data: Philippine Foreign Trade Statistics, various years

Table 2. Highest and Lowest Wage Incomes in the Three Main Sectors

Sector	Highest Sectoral Wage Income		Lowest Sectoral Wage Income	
	1991	1994	1991	1994
Agriculture	1,047,828	1,004,750	40	54
Mining	840,000	316,500	500	542
Manufacturing	3,550,878	5,439,798	150	65

Source: Family Income and Expenditure Survey, 1991-1994

Table 3. Means and Standard Deviations of Selected Variables

Panel A. All Industries

Variables	Years						
	1989	1990	1991	1992	1993	1994	1995
Price	218.2471	269.6622	564.6169	537.7193	619.1570	672.9290	737.171
	(411.34)	(484.81)	(1057.77)	(1010.65)	(1262.30)	(1498.82)	(1614.72
Foreign Exchange Rate (P:US$)	21.74	24.31	27.48	25.51	27.12	26.45	25.7
Total Factor Productivity	0.4584	0.5731	0.5572	0.5249	0.7232	0.4364	0.428
	(0.26)	(0.33)	(0.44)	(0.30)	(0.87)	(0.27)	(0.17
Unskilled Labor Share	0.0011	0.0009	0.0008	0.0008	0.0004	0.0005	0.000
	(0.00113)	(0.00102)	(0.00080)	(0.00086)	(0.00031)	(0.00027)	(0.00028
Skilled Labor Share	0.2571	0.2447	0.2391	0.2527	0.2175	0.2829	0.255
	(0.15)	(0.16)	(0.14)	(0.16)	(0.13)	(0.17)	(0.16
Capital Share	0.1542	0.1212	0.1731	0.1782	0.1924	0.1965	0.180
	(0.11)	(0.08)	(0.17)	(0.25)	(0.24)	(0.13)	(0.14
Intermediate Input Share	0.5875	0.6332	0.5870	0.5683	0.5897	0.5201	0.564
	(0.20)	(0.17)	(0.19)	(0.29)	(0.22)	(0.21)	(0.18
N	20	20	20	20	20	20	2

Notes: Figures in parentheses are standard deviations. See text for the computation of variables.

Panel B. Agriculture-based Industries

Variable	Years						
	1989	1990	1991	1992	1993	1994	199
Price	22.8384	42.6892	24.5003	24.0388	24.8957	26.8404	28.954
	(24.42)	(40.72)	(20.71)	(16.80)	(20.57)	(21.78)	(22.66
Total Factor Productivity	0.3852	0.4063	0.3864	0.4182	1.0879	0.4955	0.430
	(0.15)	(0.16)	(0.17)	(0.16)	(1.46)	(0.35)	(0.15
Unskilled Labor Share	0.00005	0.00004	0.00003	0.00003	0.00033	0.00036	I.
	(0.00004)	(0.00002)	(0.00003)	(0.00003)	(0.00020)	(0.00025)	(0.00027
Skilled Labor Share	0.2873	0.2610	0.2615	0.2653	0.2148	0.2404	0.241
	(0.17)	(0.17)	(0.13)	(0.18)	(0.10)	(0.13)	(0.16
Capital Share	0.1221	0.1327	0.1237	0.1052	0.1335	0.1680	0.181
	(0.08)	(0.08)	(0.08)	(0.08)	(0.13)	(0.10)	(0.11
Intermediate Input Share	0.5906	0.6062	0.6148	0.6295	0.6514	0.5912	0.577
	(0.21)	(0.17)	(0.09)	(0.15)	(0.15)	(0.12)	(0.11
N	6	6	6	6	6	6	

Panel C. Natural Resource-based Industries

	1989	1990	1991	1992	1993	1994	199
Price	5.1218	23.9987	24.3298	21.6645	19.9374	19.6468	27.343
	(2.09)	(33.09)	(32.87)	(30.22)	(28.13)	(27.97)	(41.09
Total Factor Productivity	0.1750	0.2833	0.2400	0.5837	0.9090	0.2360	0.257
	(0.10)	(0.11)	(0.19)	(0.66)	(0.94)	(0.06)	(0.05
Unskilled Labor Share	0.0008	0.0004	0.0007	0.0004	0.0002	0.0003	0.000
	(0.00076)	(0.00033)	(0.00085)	(0.00050)	(0.00014)	(0.00027)	(0.00020
Skilled Labor Share	0.0617	0.0260	0.0720	0.0438	0.0273	0.0489	0.039
	(0.06)	(0.01)	(0.09)	(0.04)	(0.01)	(0.04)	(0.02
Capital Share	0.2173	0.1138	0.3636	0.1796	0.3882	0.1682	0.104
	(0.26)	(0.05)	(0.36)	(0.12)	(0.59)	(0.19)	(0.04
Intermediate Input Share	0.7201	0.8598	0.5636	0.7762	0.5844	0.7826	0.855
	(0.32)	(0.05)	(0.45)	(0.13)	(0.58)	(0.16)	(0.01
N	3	3	3	3	3	3	

Panel D. Manufacturing-based Industries

	1989	1990	1991	1992	1993	1994	199
Price	382.9588	460.4648	1006.5770	958.6509	1106.7230	1203.5090	1317.061
	(504.78)	(597.06)	(1283.72)	(1227.70)	(1563.97)	(1892.01)	(2032.56
Total Factor Productivity	0.5756	0.7431	0.7369	0.5670	0.4736	0.4588	0.473
	(0.26)	(0.34)	(0.51)	(0.25)	(0.21)	(0.25)	(0.19
Unskilled Labor Share	0.0018	0.0016	0.0012	0.0013	0.0005	0.0005	0.000
	(0.00106)	(0.00095)	(0.00071)	(0.00081)	(0.00034)	(0.00027)	(0.00029
Skilled Labor Share	0.2940	0.2954	0.2724	0.3027	0.2708	0.3699	0.321
	(0.12)	(0.13)	(0.13)	(0.13)	(0.12)	(0.14)	(0.12
Capital Share	0.1546	0.1168	0.1481	0.2177	0.1712	0.2199	0.200
	(0.07)	(0.08)	(0.10)	(0.33)	(0.12)	(0.14)	(0.17
Intermediate Input Share	0.5497	0.5862	0.5782	0.4782	0.5574	0.4096	0.477
	(0.17)	(0.14)	(0.15)	(0.34)	(0.09)	(0.17)	(0.14
N	11	11	11	11	11	11	1

Table 4. Random Effects Estimates of Factor Share Returns

Panel A. All Industries

	Price	TFP	Globalization (Price + TFP)
Unskilled Labor Share (%)	-4.8226**	1.3945**	-3.7444**
	(2.62)	(2.03)	(1.94)
Skilled Labor Share (%)	-0.0055	0.0072	-0.0147
	(0.35)	(1.43)	(0.89)
Intermediate Input Share (%)	-.0140**	.0124**	-.0040
	(2.09)	(4.79)	(0.56)
Constant	5.7024**	-1.8339**	4.4333**
	(7.13)	(7.27)	(5.23)
Wald test	10.72	26.54	5.02
R-sq (overall)	0.003	0.19	0.11
Rho	0.73	0.34	0.75
Hausman	48.01	48.18	15.03
N	140	140	140

Notes: Figures in parentheses are absolute values of z-values. **,* refer to 5 and 10 percent levels of significance. Wald tests and R-sq (overall) are used to test the model's overall fit. Rho measures the proportion of the variance explained by the error term. Hausman test is used to determine whether there are systematic differences between the fixed effects and random effects models.

Panel B. Agriculture-based Estimates

	Price	TFP	Globalization (Price + TFP)
Unskilled Labor Share (%)	3.5039 (0.90)	7.1347* (1.71)	8.4235* (1.67)
Skilled Labor Share (%)	0.0175 (1.13)	0.0149 (1.49)	0.0032 (0.17)
Intermediate Input Share (%)	.0074 (0.76)	.0014 (0.14)	.0135 (1.08)
Constant	2.0341** (2.14)	-1.4765* (1.84)	1.0475 (0.88)
Wald test	1.75	10.98	4.50
R-sq	0.14	0.24	0.06
Rho	0.66	0.01	0.59
Hausman	0.76	43.21	14.48
N	42	42	42

See notes in Panel A.

Panel C. Natural Resource–based Industries

	Price	TFP	Globalization (Price + TFP)
Unskilled Labor Share (%)	-15.6762 (1.38)	3.7699 (0.54)	-11.9063 (0.90)
Skilled Labor Share (%)	0.3588** (2.73)	-0.0865 (1.07)	0.2724* (1.79)
Intermediate Input Share (%)	.0150 (1.62)	.0144** (2.53)	.0294** (2.74)
Constant	0.1310 (0.15)	-2.1585** (4.00)	-2.0275** (1.99)
Wald test	13.19	16.64	8.74
R-sq	0.44	0.49	0.34
Rho	0.00	0.00	0.00
Hausman	0.00	27.03	0.00
N	21	21	21

See notes in Panel A.

Panel D. Manufacturing-based Industries

	Price	TFP	Globalization (Price + TFP)
Unskilled Labor Share (%)	-5.8771** (2.50)	1.7069** (2.77)	-4.2479* (1.81)
Skilled Labor Share (%)	-0.0370* (1.71)	-0.0004 (0.08)	-0.0403* (1.86)
Intermediate Input Share (%)	-.0307** (2.70)	.0105** (3.58)	-.0217* (1.91)
Constant	9.1469** (8.14)	-1.3888** (4.99)	7.9289** (7.02)
Wald test	15.81	23.90	9.94
R-sq	0.18	0.32	0.10
Rho	0.37	0.25	0.39
Hausman	1.06	14.29	2.39
N	77	77	77

See notes in Panel A.

Table 5. Ordinary Least Square Estimates of Factor Share Returns

Panel A. All industries

	Price	TFP	Globalization (Price + TFP)
Unskilled Labor Share (%)	2.5495 (1.00)	1.1377* (1.71)	3.6872 (1.36)
Skilled Labor Share (%)	0.0172 (1.12)	0.0228** (5.65)	0.0400** (2.44)
Intermediate Input Share (%)	-.0173* (1.68)	.0153** (5.64)	-.0021 (0.19)
Constant	4.8035** (5.48)	-2.3721** (10.34)	2.4313** (2.61)
Adj. R-sq	0.08	0.27	0.11
F-test	5.08	17.84	6.64
N	140	140	140

Notes: Figures in parentheses are absolute values of t-values. **,* refer to 5 and 10 percent levels of significance.

Panel B. Agriculture-based Industries

	Price	TFP	Globalization (Price + TFP)
Unskilled Labor Share (%)	9.8005 (1.58)	7.0748* (1.68)	16.8753** (2.56)
Skilled Labor Share (%)	0.0240* (1.65)	0.0150 (1.52)	0.0390** (2.51)
Intermediate Input Share (%)	.0164 (1.14)	.0008 (0.08)	.0171 (1.12)
Constant	1.2173 (1.03)	-1.4420* (1.80)	-0.2247 (0.18)
Adj. R-sq	0.09	0.18	0.31
F-test	2.40	3.95	7.02
N	42	42	42

See notes in Panel A.

Panel C. Natural Resource-based Industries

	Price	TFP	Globalization (Price + TFP)
Unskilled Labor Share (%)	-15.6762 (1.38)	3.7699 (0.54)	-11.9063 (0.90)
Skilled Labor Share (%)	0.3588** (2.73)	-0.0865 (1.07)	0.2724* (1.79)
Intermediate Input Share (%)	.0150 (1.62)	.0144** (2.53)	.0294** (2.74)
Constant	0.1310 (0.15)	-2.1585** (4.00)	-2.0275** (1.99)
Adj. R-sq	0.34	0.41	0.22
F-test	4.40	5.55	2.91
N	21	21	21

See notes in Panel A.

Panel D. Manufacturing-based Industries

	Price	TFP	Globalization (Price + TFP)
Unskilled Labor Share (%)	-6.3713**	1.9345**	-4.4367*
	(2.39)	(2.83)	(1.63)
Skilled Labor Share (%)	-0.0298	0.0062	-0.0236
	(1.49)	(1.21)	(1.15)
Intermediate Input Share (%)	-.0198*	.0147**	-.0052
	(1.76)	(5.10)	(0.45)
Constant	8.4121**	-1.8322**	6.5798**
	(8.64)	(7.36)	(6.61)
Adj. R-sq	0.16	0.31	0.08
F-test	5.67	12.31	3.10
N	77	77	77

See notes in Panel A.

Table 6. Fixed Effects Estimates of Factor Share Returns

Panel A. All Industries

	Price	TFP	Globalization (Price + TFP)
Unskilled Labor Share (%)	-5.9839** (3.22)	0.8899 (1.29)	-5.0940** (2.66)
Skilled Labor Share (%)	-0.0203 (1.19)	-0.0181** (2.83)	-0.0384** (2.18)
Intermediate Input Share (%)	-.0154** (2.28)	.0089** (3.54)	-.0065 (0.94)
Constant	6.2317** (8.56)	-0.9643** (3.56)	5.2674** (7.03)
F-test	4.89	13.83	4.25
R-sq	0.03	0.02	0.12
Rho	0.80	0.75	0.84
N	140	140	140

See notes in Table 4.

Panel B. Agricultural-based Industries

	Price	TFP	Globalization (Price + TFP)
Unskilled Labor Share (%)	2.5911 (0.64)	0.3143 (0.10)	2.9054 (0.60)
Skilled Labor Share (%)	0.0132 (0.70)	-0.0549* (3.77)	-0.0418* (1.85)
Intermediate Input Share (%)	.0057 (0.58)	-.0008 (0.11)	.0049 (0.42)
Constant	2.2600** (2.25)	0.5424 (0.70)	2.8024** (2.34)
F-test	0.24	8.75	3.30
R-sq	0.14	0.18	0.18
Rho	0.73	0.92	0.88
N	42	42	42

See notes in Table 4.

Panel C. Natural Resource-based Industries

	Price	TFP	Globalization (Price + TFP)
Unskilled Labor Share (%)	-10.0065*	-6.4069	-16.4134*
	(1.66)	(0.97)	(1.92)
Skilled Labor Share (%)	0.0605	-0.0714	-0.0109
	(0.85)	(0.92)	(0.11)
Intermediate Input Share (%)	.0029	.0033	.0062
	(0.53)	(0.54)	(0.79)
Constant	2.1383**	-0.9764	1.1619
	(3.68)	(1.53)	(1.41)
F-test	1.82	5.82	7.34
R-sq	0.04	0.28	0.01
Rho	0.91	0.64	0.89
N	21	21	21

See notes in Table 4.

Panel D. Manufacturing-based Industries

	Price	TFP	Globalization (Price + TFP)
Unskilled Labor Share (%)	-5.6620**	1.3441**	-4.3179*
	(2.29)	(2.17)	(1.77)
Skilled Labor Share (%)	-0.0397	-0.0101	-0.0498**
	(1.56)	(1.58)	(1.98)
Intermediate Input Share (%)	-.0350**	.0067**	-.0283**
	(2.83)	(2.18)	(2.32)
Constant	9.4284**	-0.8613**	8.5671**
	(7.46)	(2.73)	(6.88)
F-test	4.61	6.50	3.32
R-sq	0.17	0.15	0.09
Rho	0.38	0.52	0.44
N	77	77	77

See notes in Table 4.

Figure 1. Effects of Openness on Relative Wages: Two Traded Goods

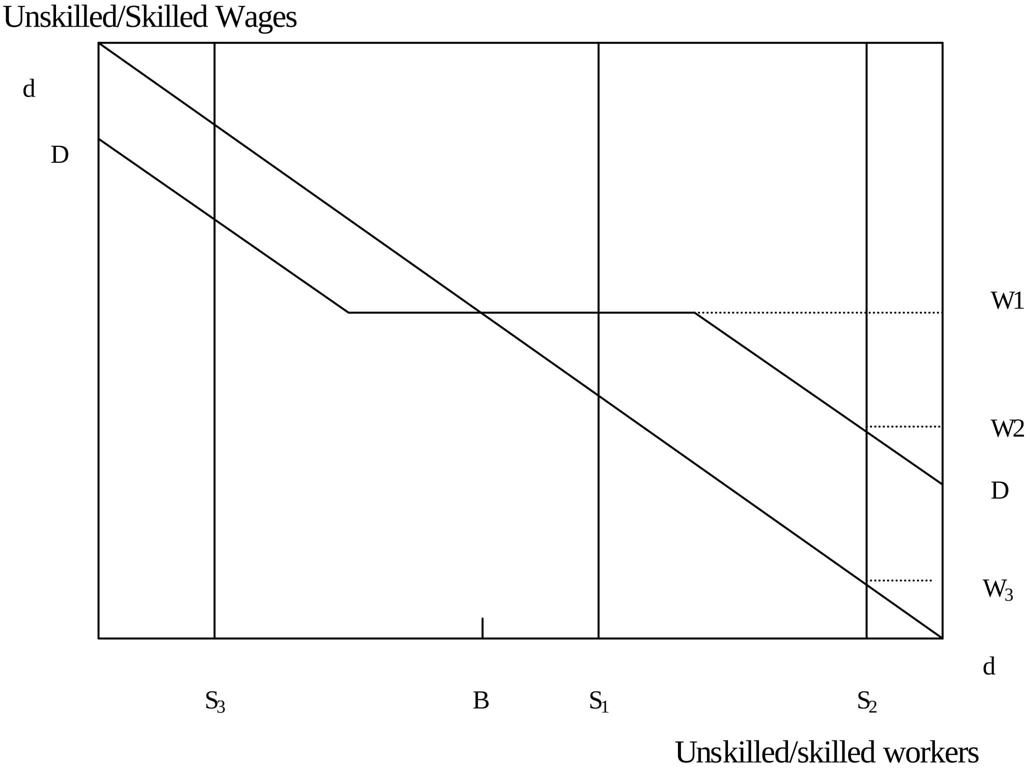


Figure 2. Effects of Openness on Relative Wages: Many Traded Goods

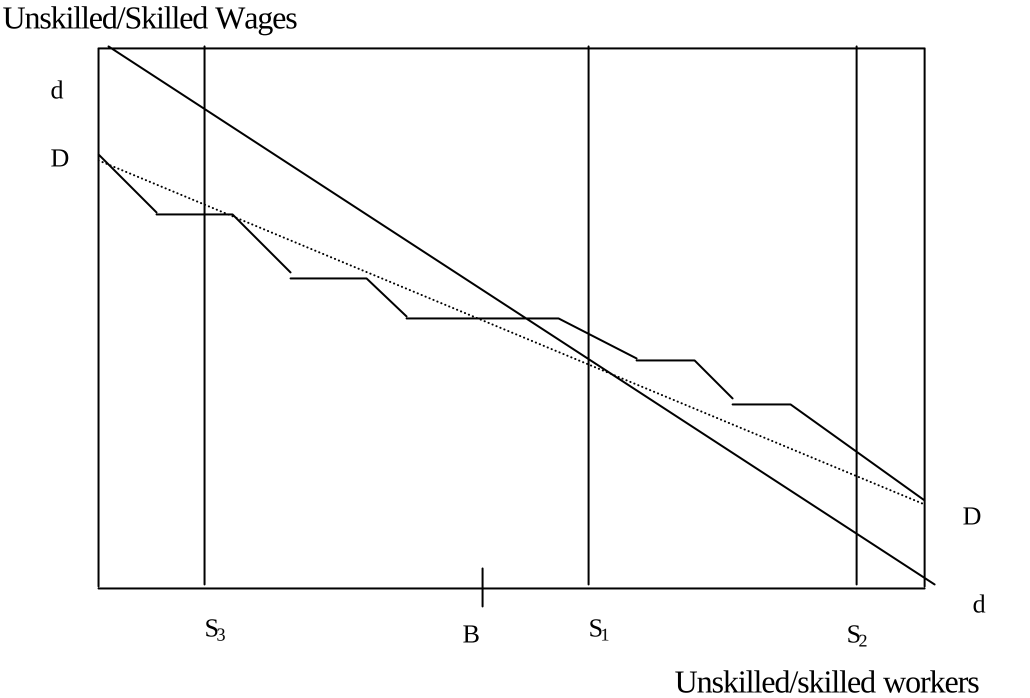
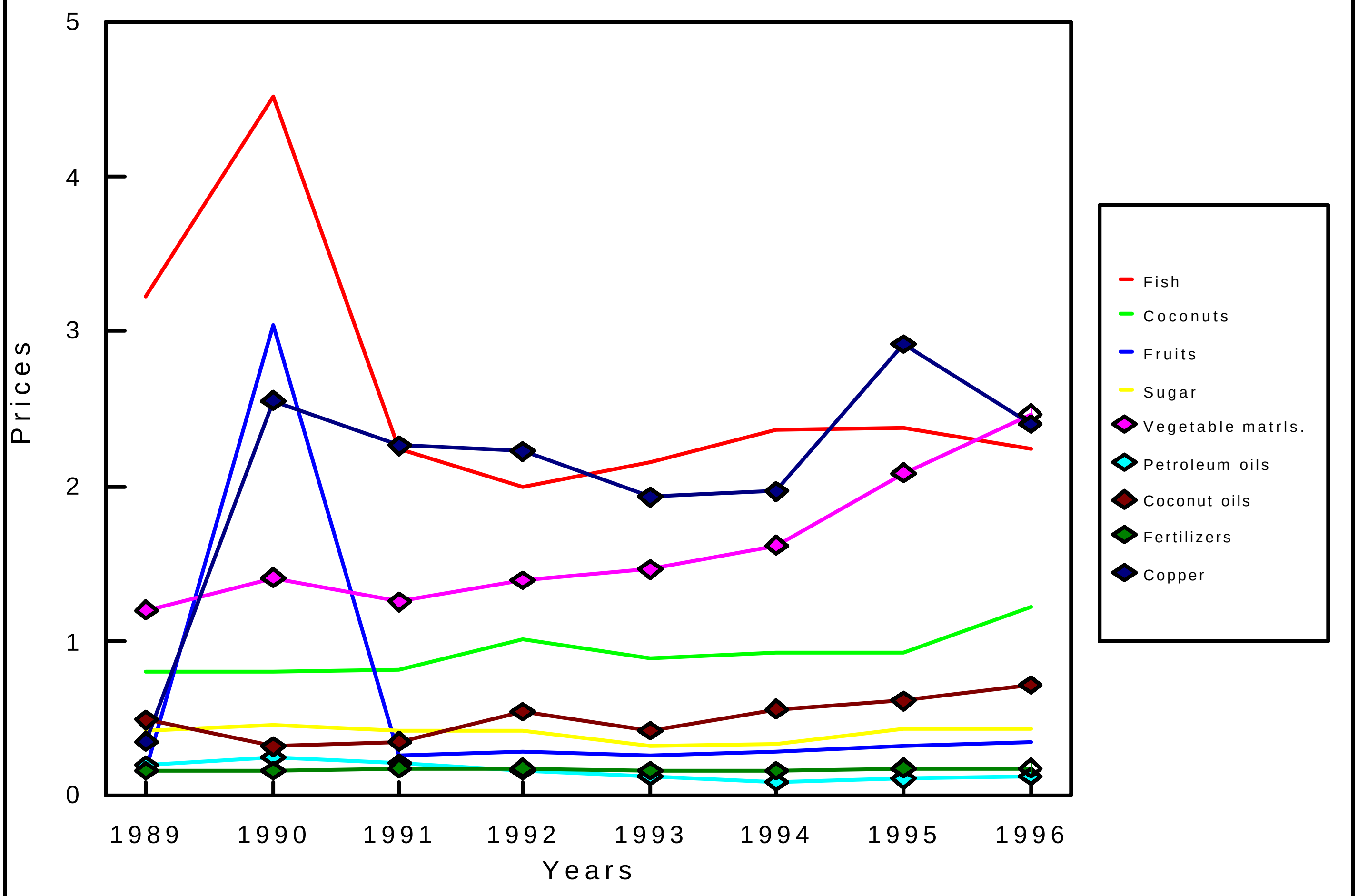


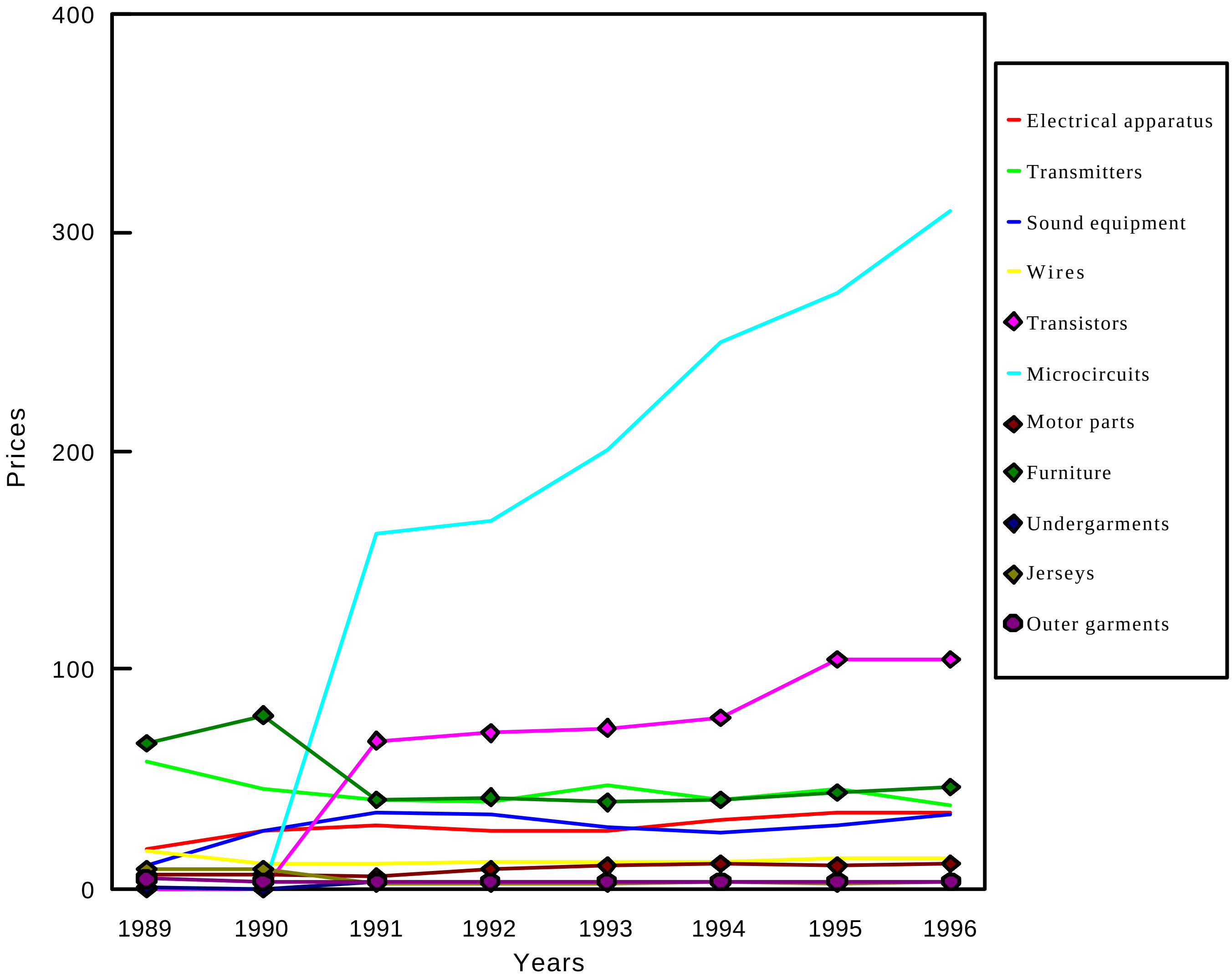
Figure 3

Estimated Prices of Top Non-Manufacturing Exportables, 1989-1996



Source: Philippine Foreign Trade Statistics, 1991-1997

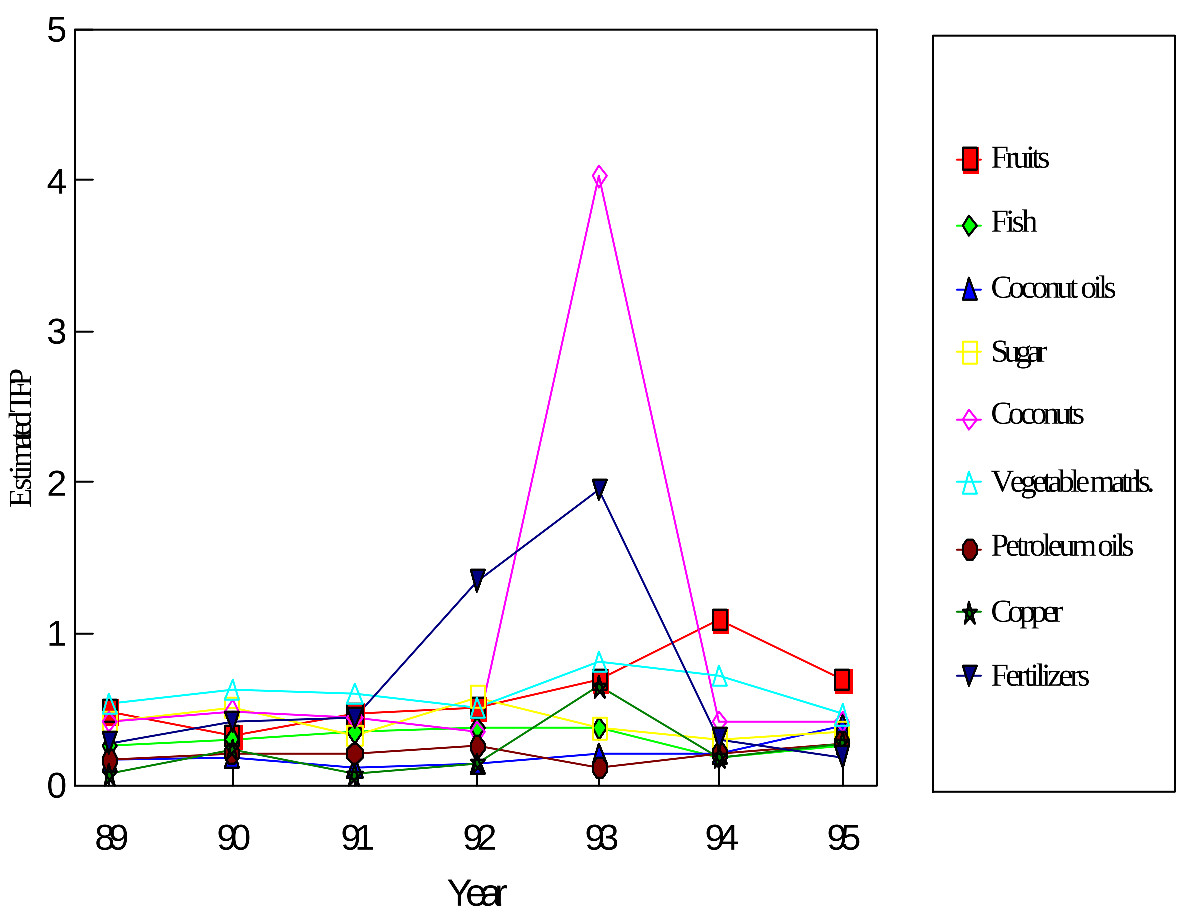
Figure 4
Prices of Top Manufacturing Exportables, 1989-1996



Source of basic data: Philippine Foreign Trade Statistics, 1991-1997

Table 5

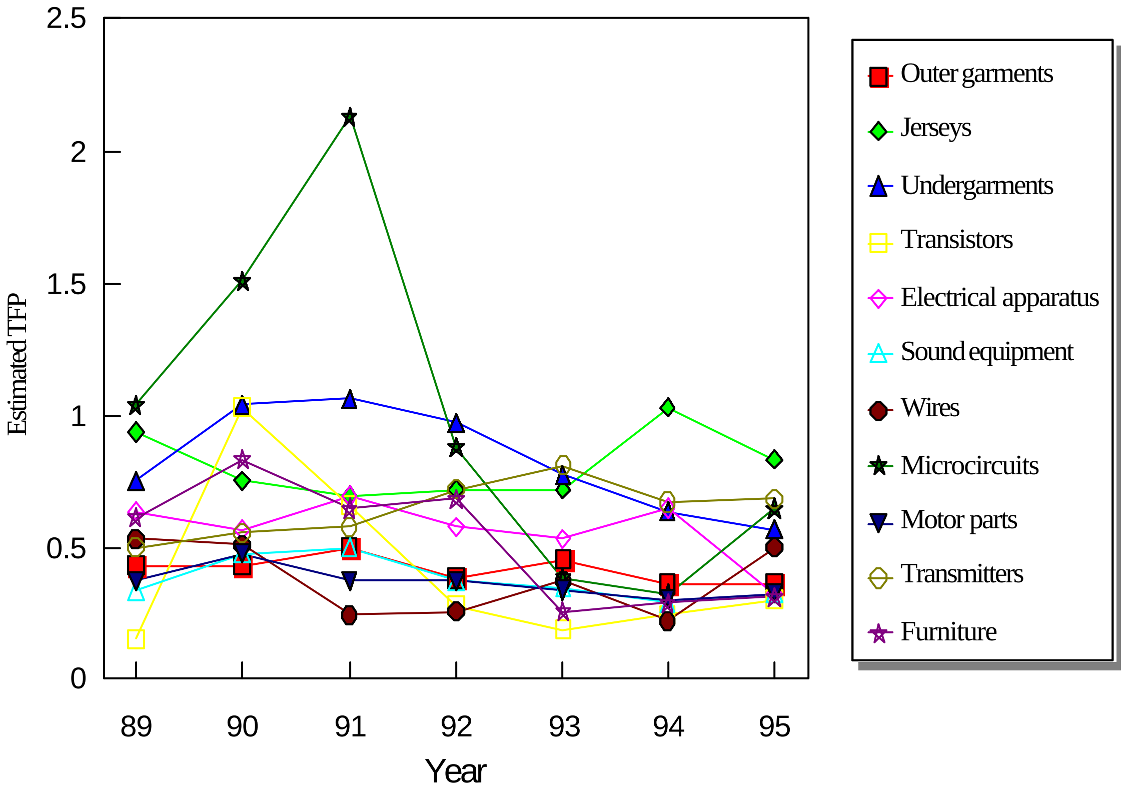
Estimated Total Factor Productivity of Non-Manufacturing Industries



Source of basic data: Annual Survey of Establishments, various years; author's calculations

Table 6

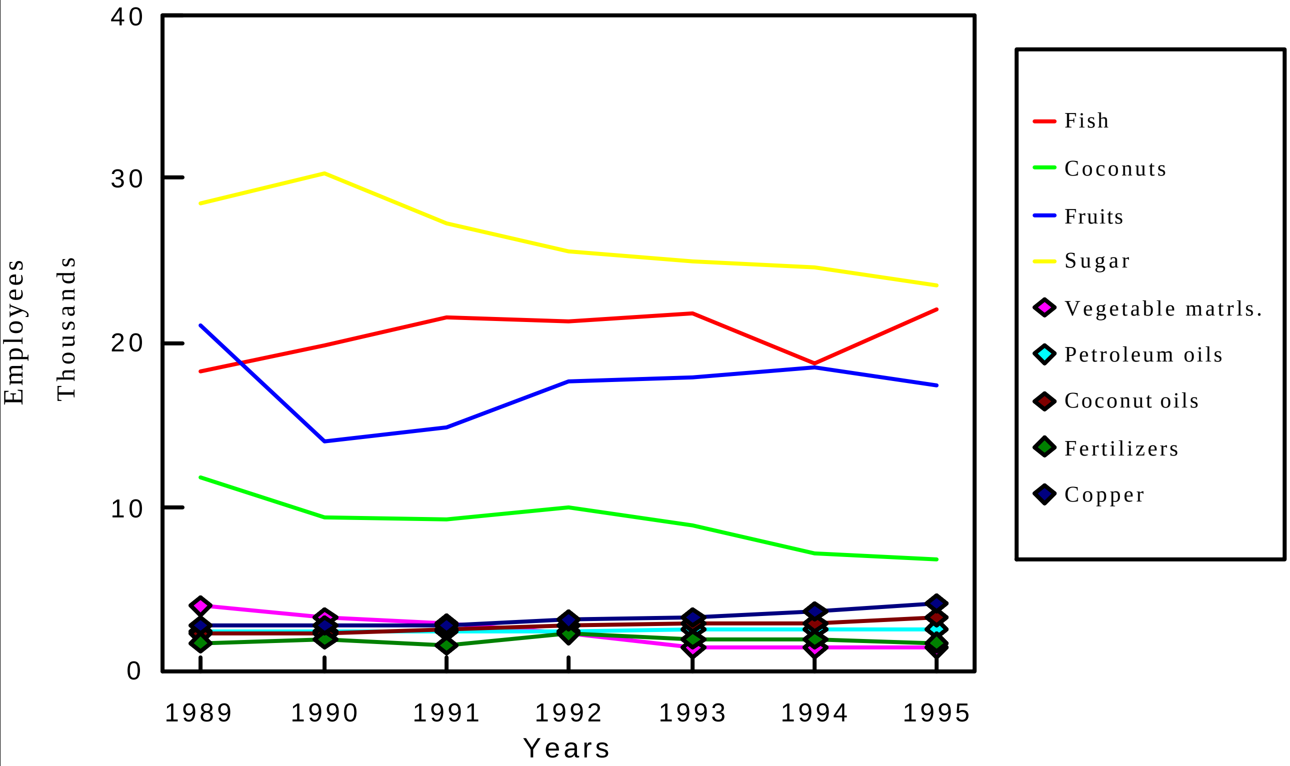
Estimated Total Factor Product Productivity of Manufacturing Industries



Source of basic data: Annual Survey of Establishments, various years; author's calculations

Figure 7

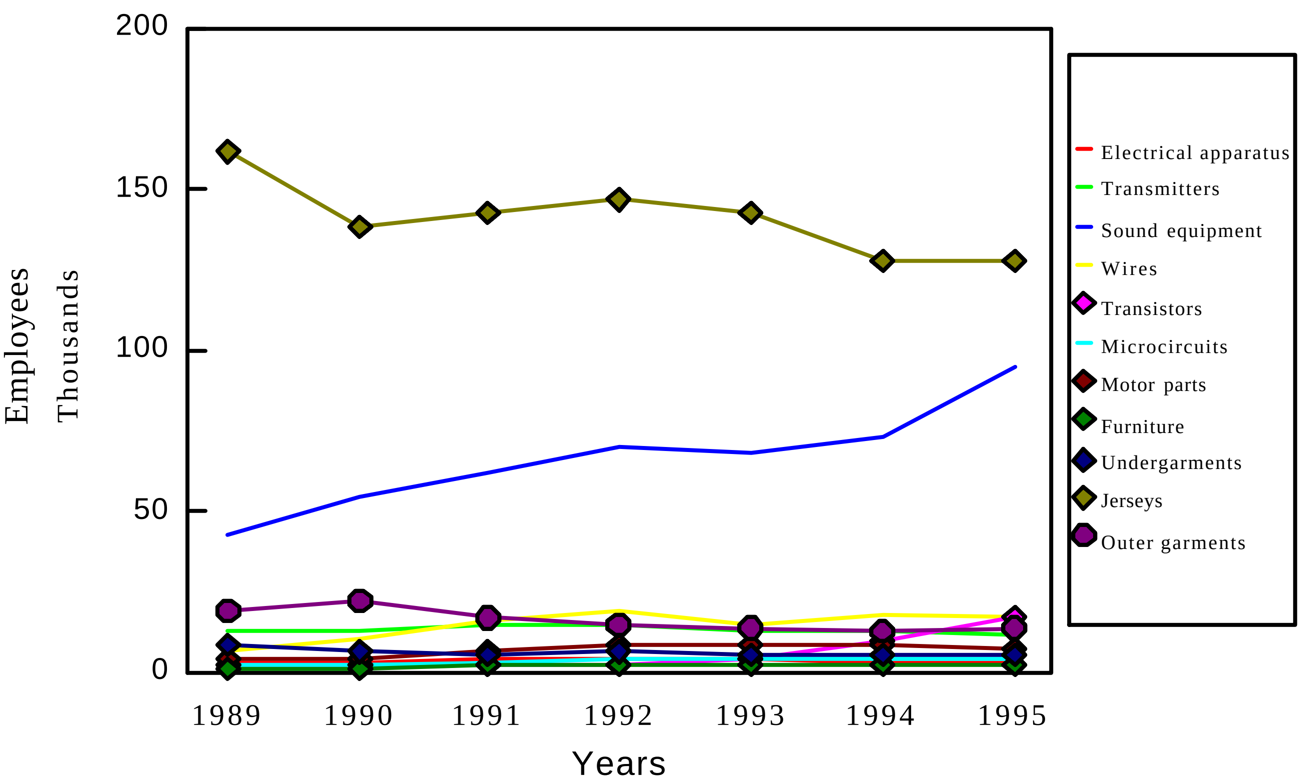
Number of Employees in Top Non-Manufacturing Exportables, 1989-1995



Source of basic data: Annual Survey of Establishments, 1989-1996

Figure 8

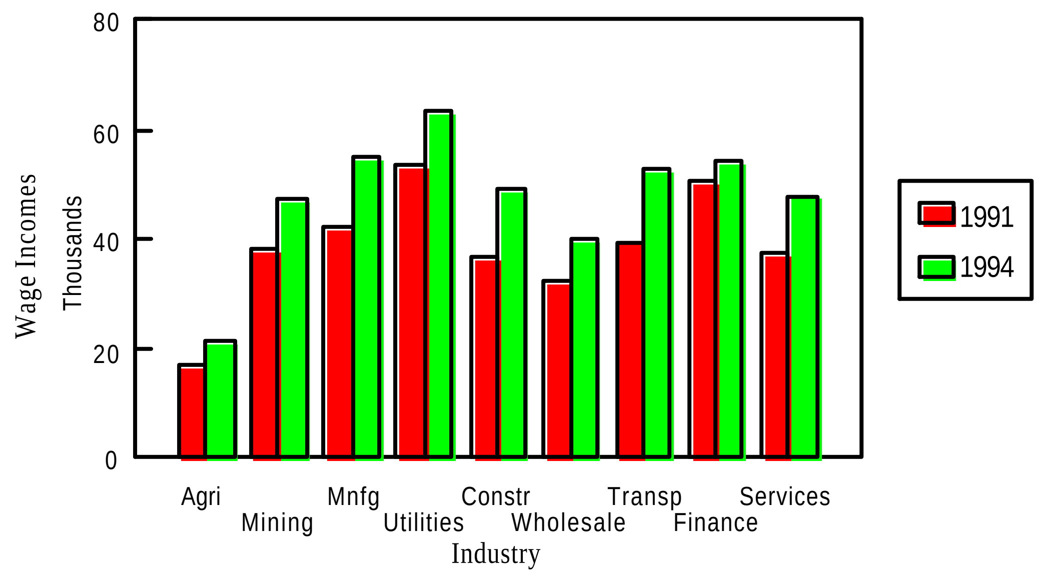
No. of Employees in Top Manufacturing Exportables, 1989-1995



Source of basic data: Annual Survey of Establishment, various years

Figure 9

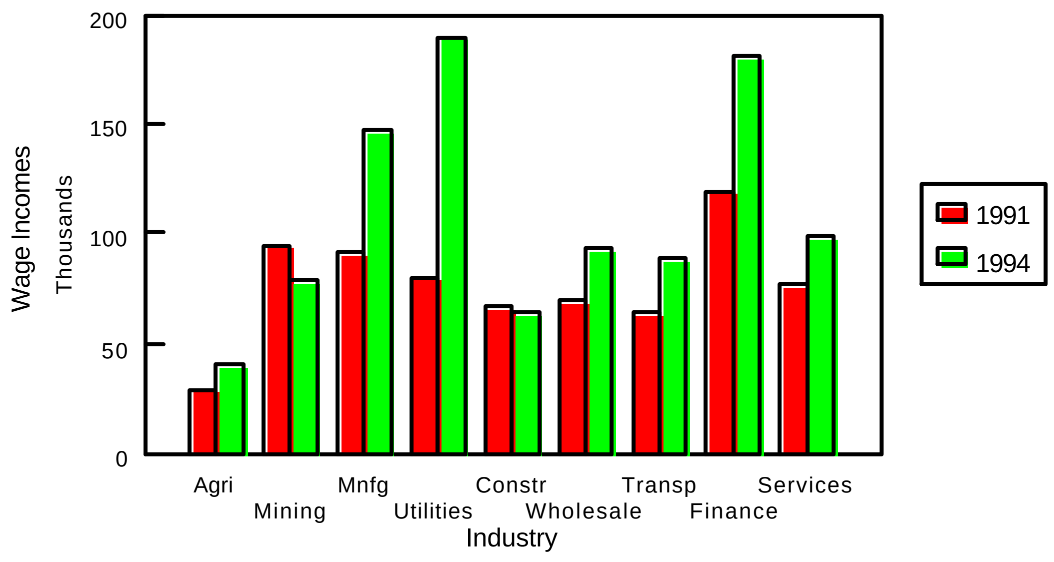
Wage Incomes of Households with Low Education, 1991 and 1994, By Industry



Source of basic data: Family, Income and Expenditure Survey, 1991-1994.

Figure 10

Wage Incomes of Households with High Education, 1991 and 1994,By Industry



Source of basic data: Family, Income and Expenditure Survey, 1991-1994

Note: May we request the layout artist to make the necessary changes to the equations, as indicated in the first edited draft? This editor tried to do so in the Word file, but to no avail.

Appendix

Similar to the Stolper-Samuelson theorem, the Leamer (1996) framework is based on a set of zero profit conditions **p** = **A'W** where **p** is a vector of product prices, **w** is the vector of factor costs and **A** is the matrix of input intensities, inputs per unit of output. Differentiating one of these zero-profit conditions produces the changes in product prices for sector i:

$$dp_i = \sum_k (A_{ik} dw_k + dA_{ik} w_k)$$
$$\hat{p}_i = dp_i / p_i = \sum_k [(A_{ik} w_k / p_i)(dw_k / w_k) + (dA_{ik} w_k / p_i)] = \sum_k q_{ik} \hat{w}_k + \sum_k q_{ik} \hat{A}_{ik} \qquad \textbf{(A.1)}$$

The input intensity, defined as $\mathbf{A_{ik}} = \mathbf{v_{ik}} / \mathbf{Q_k}$, can be differentiated as:

$$\hat{A}_{ik} = \hat{v}_{ik} - \hat{Q}_i$$

Substituting this into the standard measurement of the growth of total factor productivity, we obtain:

$$T\hat{F}P_i = \hat{Q}_i - \sum_k q_{ik} \hat{v}_{ik} = -\sum_k q_{ik} \hat{A}_{ik}$$

In which case, using (A.1), the change in product prices can be linked with factor cost changes and technology changes into the following:

$$\hat{p}_i = \sum_k q_{ik} \hat{w}_{ik} - T\hat{F}P_i = q_i \hat{w} - T\hat{F}P_i \qquad \textbf{(A.2)}$$

This then is the fundamental condition that serves as basis for decomposing the impact of globalization and technology on factor prices. To do this, the equation can be separated into parts: one part can be due to technology (t) and the other that is due to other factors (g), where g stands for globalization as well as encompassing demand shifts. Hence,

$$\hat{p}_i(t) + \hat{p}_i(g) = q_i \hat{w}(t) + q_i \hat{w}(g) - T\hat{F}P_i$$

where

$$\hat{p}_i(t) = q_i \hat{w}(t) - T\hat{F}P_i$$
$$\hat{p}_i(g) = q_i \hat{w}(g)$$
$$\hat{p}_i = \hat{p}_i(t) + \hat{p}_i(g)$$

In these equations, there are many values of the g-effect on wages that can be consistent with this set of equations, given the data on TFP growth and product price changes. The problem is that to disentangle the globalization effects from the technological effects on product prices, a world wide demand and supply model that allows for different elasticities in each sector will be needed. Since this will mean very large costs, Leamer suggests a more convenient alternative which assumes all sectors have the same “rate of technological pass-through” to product prices, i.e.,

$$\hat{p}_i(t) = -\,lT\hat{F}P_i$$

where λ, the pass-through rate, conceptually depends on the demand and supply. If world wide supply is completely fixed as is the case with fixed input technologies, the pass-through rate is determined on the demand side. A value of λ=1 means that that the technological improvements are exactly captured by the product price reductions, which is the appropriate response for a small sector Cobb-Douglas utility with fixed expenditure shares. Moreover, with λ=1, if supply is infinitely elastic, potential increases in supply due to technological improvements result in exactly offsetting reductions in product prices. In which case, further increases in supply are impeded by lower prices.

Given alternative values for λ, the expected changes in factor prices that are associated with technological change can be written as:

$$-\,lT\hat{F}P_i = q_i\hat{w}(t) - T\hat{F}P_i \qquad \textbf{(A.3)}$$

or equivalently,

$$T\hat{F}P_i(1-l) = q_i\hat{w}(t)$$

After allowing for the effects of technological change in product prices, the residual of the product price variability is the globalization effect:

$$\hat{p}_i(g) = \hat{p}_i - \hat{p}_i(t) = \hat{p}_i + lT\hat{F}P_i$$

To determine the impact of this globalization on wages, the product price changes are regressed with the factor input shares, as in the following:

$$\hat{p}_i + lT\hat{F}P_i = q_i\hat{w}(g) \qquad \textbf{(A.4)}$$