April, 2004

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# Global Economy Journal

*http://www.bepress.com/gej*

OFFICIAL JOURNAL OF THE INTERNATIONAL TRADE & FINANCE ASSOCIATION

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# Global Economy Journal

# Trade and Inequality: The Role of Vertical Specialization and Outsourcing

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# Trade and Inequality: The Role of Vertical Specialization and Outsourcing[*]

Robert C. Shelburne

## Abstract

This article considers how the process of outsourcing results in economic changes in factor usage and productivity in developed countries. Some scholars have incorrectly interpreted these observed changes as being the result of biased skilled-labor using technological change. This article examines the size and significance of vertical specialization, and describes how outsourcing contributes to increased inequality in developed nations. The effects of outsourcing on labor market outcomes in the developing world are also explored. The author describes the potential implications and significance of outsourcing services. The major conclusion is that the downward pressure on the wages of the unskilled is likely to continue.

**KEYWORDS:** Outsourcing, vertical specialization, inequality

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I. INTRODUCTION

Over the last several decades there has been a significant increase in the level of inequality in most of the developed economies. This has manifested itself as falling relative (and by some measures, real) wages for the unskilled in the United States and the other English speaking nations -- the U.K., Australia, and New Zealand. For most of the European nations, the relative wage decline has been more constrained (by labor market policies and regulations), but there has been increased unemployment especially for the unskilled. The extent to which these poor labor market outcomes (for the unskilled) can be attributed to the rapid increase in the openness to international trade has received considerable attention. A theoretical mechanism by which trade could be responsible for these labor market outcomes is well established by the Stolper-Samuelson (S-S) theorem -- a well-established axiom of international trade theory. Empirical tests, however, have found that some of the complementary predictions of this model, such as an increase in the intensity of unskilled labor used in the production of a given item or an overall fall in the prices of labor-intensive goods has not occurred. An alternative explanation, that this fall in demand for unskilled labor is due to biased skilled-labor using technological change, has been proposed as being more consistent with the evidence. Another noticeable inconsistency with the S-S explanation was the observation that trade should be associated with reduced inequality in the labor abundant developing countries. Increased trade for developing countries should raise the demand for unskilled labor and put upward pressure on unskilled wages; this will reduce inequality in these nations. However, numerous empirical tests have shown that increased trade in developing countries did not reduce but actually increased inequality there. Once again, however, the skilled-using technological change explanation is consistent with this observation. Primarily for these reasons, many economists initially came to believe that this increased inequality (in both the North and South) must be due to biased technological change.

Increasingly, however, many economists have expressed some skepticism about the technological change explanation. Given that technological progress has been occurring continuously for hundreds of years, the fact that this technological bias would suddenly and dramatically shift at exactly the same point in time that most countries' openness to trade expanded significantly, left many uncomfortable with the technology explanation and feeling that somehow trade must be part of the answer. There has therefore been a re-examination of this issue as attempts have been made to formulate a trade-related mechanism, different from or in addition to the S-S mechanism, that would be consistent with the empirical observations cited above. Several sophisticated arguments have been put forth that are consistent with these empirical observations. These include

mechanisms by which trade could alter demand patterns (see for example, Dinopoulos, Syropoulos, and Xu, 2001), endogenize technological change (Thoenig and Verdier, 2003), or lead to changes in institutional practices such as minimum wages or unionization. As an example of the latter, Ehrenberg (1994) has argued that given a union-nonunion wage differential, increased foreign competition through trade puts more pressure on unionized firms and ultimately leads to a decline in unionization by reducing employment in unionized sectors and by shifting employment within a sector from unionized to nonunionized firms.    There are a number of difficult theoretical and empirical issues surrounding these explanations; the possibility also exists that there are important interactions among them that make it even more difficult to isolate the influence of a given factor.

One particularly promising approach concerns the role of outsourcing or vertical specialization or vertical integration (sometimes also referred to as international fragmentation). This is the procedure by which the production process is broken up into smaller steps with each step located in a different geographical area depending on where each step can be produced at the lowest cost. Thus instead of the complete production process occurring where there is some overall comparative advantage, each step is produced where there is a comparative advantage for that step. In the analysis in this paper the terms vertical specialization and outsourcing are generally used interchangeably and refer to the more general concept of Balassa (1967) where the production process is broken up into different stages in different countries. Some authors such as Hummels, Rapoport, and Yi (1998) have given more precise definitions to several of these terms. For them, outsourcing implies that the production of the intermediate component has been relocated from where it was formally produced (along with the final steps) to a different country. Vertical specialization requires that the intermediate inputs are imported and that the final output is exported; and vertical integration implies production within a multinational corporation (MNC). From a simple theoretical view, the degree to which these steps are undertaken within a given MNC or are purchased from arms-length firms does not matter in assessing most of the economic effects. However, the existence of MNCs is quite important towards understanding the phenomena of outsourcing more generally. When the different steps in the production process are undertaken by separate companies, significant issues arise concerning co-ordination, proprietary information, quality assurances, risk distribution, and transaction prices. Production within a MNC can minimize or eliminate these types of problems and can move the production process closer to the idealized world of identical technology and complete information upon which most trade models are developed. The importance of MNCs is that they allow the production process to be divided up into ever-smaller

segments and in that way increase the amount of factor services (incorporated into goods) that can actually be traded.

The argument that outsourcing could be a significant factor in explaining wage patterns has previously been made by Feenstra and Hanson (1996; 2001) for the United States, Anderton and Breton (1999) for the United Kingdom, Strauss-Kahn (2002) for France, and Helg and Tajoli (2004) for Italy and Germany. Not all of the analysis has been supportive of this connection. Slaughter (2000) restricts his analysis to multinationals headquartered in the U.S. and does not find a significant effect. Berman, Bound and Machin (1998) conclude that outsourcing could directly account for no more than 16 percent of the decline in the production worker (unskilled labor) share of employment between 1973 and 1987. With the introduction of other imperfections in the goods and/or labor markets, Arndt (1997), Egger (2002), and Egger and Egger (2002) find that outsourcing may actually benefit unskilled labor by making capital-intensive sectors more competitive. This paper provides a logically consistent explanation of how the process of vertical specialization and outsourcing can explain the rise in inequality in both the developed and developing nations and is at the same time also consistent with these other empirical observations. The paper also provides some new diagrammatic devices that allow one to better conceptualize these issues. In section II the basic theoretical issues and empirical literature surrounding the wages and trade debate in the developed countries is discussed. Section III demonstrates how the empirical findings can be reconciled with the outsourcing and vertical integration hypothesis, and section IV discusses data on the amount of outsourcing that has occurred. Section V discusses what is unique and important about the outsourcing of service sector activities. Section VI discusses the empirical literature on wage inequality and trade in the developing world, while section VII demonstrates how these observations are consistent with the outsourcing hypothesis. The final section provides a summary.

## II. THE TRADE AND WAGES DEBATE

A major concern about globalization is that it has increased inequality and actually lowered real wages for some workers. Inequality increased quite measurably over the 1979-92 period in the U.S., leveled off in the mid-1990s, and has recently begun to reappear. According to CBO projections using inflation adjusted family incomes, the bottom 60 of families lost income between 1977 and 1992, the next 20 percent stayed approximately constant, while the richest 5 percent experienced a gain of over 50 percent, and the richest one percent experienced a gain of over 100 percent. Examining the changes in family income distribution by quintiles reveals that from 1970 to 1992, the bottom 60 percent of

families lost 3.85 percent of total national GNI to the top 40 percent.[1] Using the distribution of individual pre-tax income by quintiles reveals that from 1979 to 1997, the bottom 80 percent of individuals lost 7.2 per cent of national income to the top 20 percent.[2] Between 1979 and 1998, the bottom 95 percent lost 10.6 percent of total income to the top 5 percent (Piketty and Saez, 2001). Note that the ending dates for these comparisons are before the final leg of the 1990s financial bubble, and thus do not represent atypical values. According to Atkinson (2003) the share of gross income going to the top one percent more than doubled between 1978 and 2000, by increasing from 8 percent to 17 percent. Although these changes in family income demonstrate the extent of the increase in inequality, most of the focus in the trade literature has been on the wage earnings of workers. In 1979 college graduates earned on average 40 percent more than those with only a high-school degree, in 1997 this differential had increased to almost 67 percent. When the increased inequality is combined with the slow overall wage growth during this period, the result is a real wage decline for the unskilled. Inflation adjusted hourly wages for male high-school graduates fell by 17 percent between 1979 and 1997 (Mishel, Bernstein and Schmitt, 1999).

What is most apparent from looking at these wage changes in the different segments of the labor market is that they are not related to supply (endowment) changes.  In fact, the labor segments that grew the fastest are the same ones that experienced the largest wage growth (Katz and Murphy, 1992). Thus clearly there were changes in demand for the different segments that dominated these supply effects.

The reduction in wages of the unskilled is also responsible for a significant proportion of the observed decline in the labor market participation rate of less-educated and low-wage workers. The employment to population ratio for white male high school dropouts fell from 89 percent in 1967 to 75 percent in 1987; thus the percent of this group not working more than doubled from 11 percent to 25 percent in this 20-year period. The employment to population ratio for white college graduates only declined from 97 percent to 94 percent (Juhn, 1992). Many of the European countries also experienced significant declines in the employment rates of unskilled labor (OECD, 1989).

Although most of the analysis regarding trade and income inequality has focused on the increased wage differential between skilled and unskilled labor,

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[1] These estimates exclude households of unrelated individuals; data are from Cline (1997), Table 1.1. The bottom 60 percent of families went from 35.2 percent of national income in 1970 to 31.4 percent in 1992.

[2] Individual incomes are based upon comprehensive household income adjusted by the square root of household size. Data from CBO (2001), Appendix table G-1c, pp. 76-77.

there is also the possibility that trade has increased the relative return to capital and rents associated with land and natural resource holdings. In 1998 the top one percent of U.S. households owned 47 percent and the top ten percent owned 80 percent of all financial assets; thus any increase in the return to capital will show up primarily as income gains to the top income brackets (Wolff, 2000). Those gaining significant income over the 1979-98 period were those in the top ten percent. Although the capital share of national income remained relatively constant, the capital share, even excluding capital gains, of U.S. personal income increased from about 14.5 percent in 1979 to 19.5 percent in 1998 (Piketty and Saez, 2001, fig.10) and the after-tax profit rate has increased from 5.1 percent in 1979 to 7.0 percent in 1995.

Between 1970 and 1990, the developing nations' shares of manufacturing imports of the United States and Europe have more than doubled and accounted for one third of U.S. manufactured imports in 1990 (Davis, 1998). Although there has been an increase in North-South trade, its volume still remains relatively small when compared to the overall economies of the North. For example, Krugman and Lawrence (1993) calculate that U.S. manufactured imports from low-wage countries were only 2.8 percent of U.S. GDP in 1990. Since the increase in imports from labor-abundant nations and the growing wage inequality occurred during roughly the same period of time, and since the S-S theorem predicts that globalization would impact the labor market in a manner consistent with what has happened, globalization has became a prime suspect for these labor market changes. The logic of the S-S mechanism is that the increased competitiveness of developing countries in making labor-intensive articles results in a reduction in their price, which increases imports of these items into the developed countries; as a result, there is a decline in developed-country production of these items. The unskilled workers who are laid off are not completely absorbed by the expanding export sectors that are more skilled-labor intensive; these workers then have to compete with the unskilled workers in the rest of the economy and this lowers the wage of unskilled workers throughout the economy. Given that the S-S mechanism is a corollary of the widely used Heckscher-Ohlin (H-O) trade model that is the dominant theoretical trade model in use, it is the obvious place to start in attempting to connect trade with increased inequality. However, it is less than clear empirically as to what one needs to find in order to conclude that trade has been a factor in creating inequality. This is the case because empirical attempts to verify the implications of the H-O model have only been marginally successful. Generally trade models suggest a level of economic integration that is not present; national labor markets appear to be more segmented than is assumed in most models. For example, the factor-price-equalization result of the standard H-O model suggests that wages are determined globally, and a nation's endowments of labor factors only determines the industry mix of production and not their

respective prices. It is well established, however, that wages vary significantly across countries depending on national endowments. Thus the theoretical implications of these models do not generally hold and therefore one cannot derive the labor market implications of increased globalization from them since they obviously describe reality poorly. Hopefully, the models are at least able to provide insight into the direction to which trade flows are pulling labor markets.

The basic problem with the S-S trade explanation for increased inequality in the developed countries is shown in Figure 1. The axes represent the factors of production -- *S* for skilled labor and *L* for unskilled labor.  Point A represents the factor usage combinations in an initial period, perhaps 1979, and point B represents factor usage in a latter period such as 2000. The slope of the dotted lines through the two points represents the unskilled/skilled wage ratio in the two time periods (the flatter the wage line the lower the relative wage of unskilled labor). The two empirical facts that do not seem to be in dispute are that the *S/L* ratio used in production has increased (the solid lines from the origin have gotten steeper) and the relative wage ($W_L / W_S$) has fallen (the dotted lines have become flatter). There is simply no way to draw a normal shaped production function through these two points, if it is also assumed that the factors are getting their marginal products. Thus it would appear that the only way to describe what has happened would require that the production function has changed. Thus the appeal of the biased skilled-labor-using technological change argument since it would be the most obvious explanation. However as more time has passed, it has been recognized that there are other possible ways for the observed production function to change besides simply technological change.

Figure 1
Factor Usage and Relative Wages in Two Periods
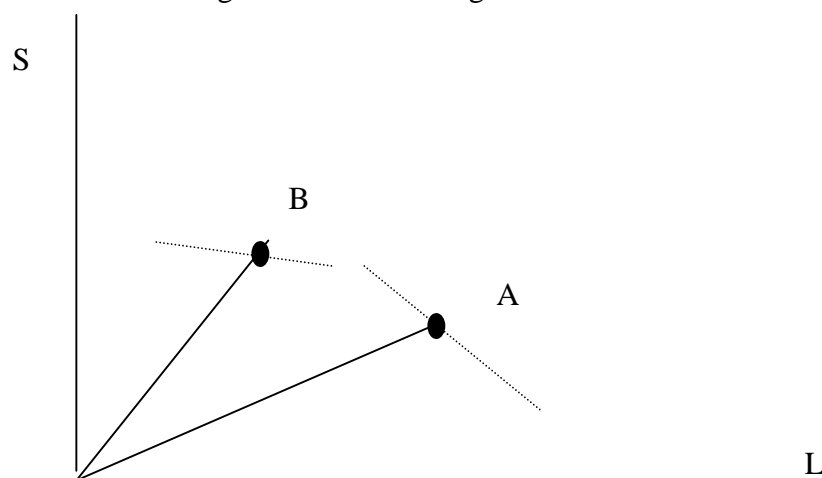
### III. OUTSOURCING AND INEQUALITY IN THE DEVELOPED COUNTRIES

This section demonstrates how the process of outsourcing of the labor-intensive parts of the production process can result in economic changes that might be interpreted to have been caused by biased technological change. However, and perhaps more importantly, it is demonstrated how outsourcing can result in increased inequality in the developed countries. Consider a production process described by the production function A in Figure 2. Skilled-labor-using biased technological change will shift it to a position such as the curve B-S. That is, at a given skilled-unskilled wage ratio, the quantity of skilled labor to unskilled labor (i.e., the *S/L* ratio) increases. Empirical analysis seems to find that production functions have shifted in this direction. Next consider how outsourcing affects the production function. Assume initially that the production of the good was really a two-stage process given by production functions B-S and B-L. This two-stage process, however, was unobserved in the data; the data only covered the entire process and thus could only be described by the production function A that covers the entire process. The company is now able to break up the production process and move the unskilled-labor stage offshore, leaving the skilled labor process domestically. The observed data for production by this firm is described by production function B-S. Thus the observed changes in production data for this firm will be the same for either biased technological change or outsourcing of the labor-intensive stages.

Figure 2
Production in the Developed Country
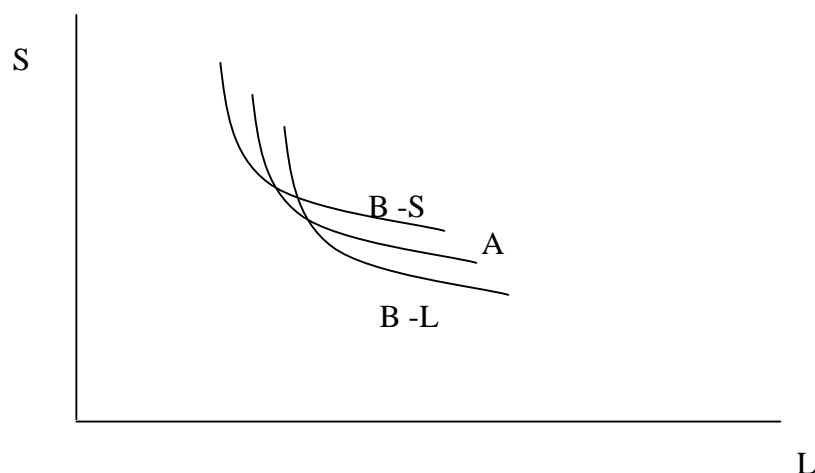
In addition to the factor biases, Gordon (2004) demonstrates how outsourcing results in an increase in Bureau of Labor Statistics calculations of labor productivity. Essentially their procedure calculates productivity as:

$$P = (S - M - C) / (NL + PL)$$

$P$ = Productivity, $S$ = Sales, $M$ = Materials, $C$ = Costs of Imported Final Product, $NL$ = Nonproduction Labor Costs, $PL$ = Production Labor Costs

Assuming total sales remains the same, and that material costs plus assembly costs are lower in the South than material costs in the North, i.e., $M>C$ per unit, outsourcing increases the numerator. Assuming nonproduction labor costs remain the same, and given that the costs of production labor in the South is not counted as part of $PL$, the denominator falls. The result is an increase in productivity. Even if Gordon's assumption about Southern production costs is relaxed so that material costs plus assembly costs in the South are greater than material costs in the North ($C>M$), the result is still likely to be an increase in calculated productivity. Also note that the ratio of $NL/PL$ increases. Thus what is observed in the statistics is skilled-labor-using technological progress although there is no actual technical progress. According to Gordon, the 2-digit SIC industries with the highest rate of calculated labor productivity growth between 1980 and 2000 were all labor-intensive industries that had transferred a large fraction of their production to the third world (the exception being measuring instruments). Most of the SIC industries that had the lowest productivity growth were industries that processed bulky and heavy materials and had transferred little of their production abroad. Thus outsourcing not only alters the skill mix of what's left but as explained by Thurow, "Moving all the low-productivity stuff from the American economy to China and India raises the productivity of what's left," (Cooper, 2004, p.152).

Gordon (2004) also argues that the establishment of foreign sales subsidiaries (or increased sales to them) also results in measured productivity growth as the parent charges the subsidiary higher prices (than sales to non-subsidiaries) in order to avoid foreign taxation.

## IV. MEASURING VERTICAL SPECIALIZATION AND OUTSOURCING

Having determined that outsourcing can alter factor usage and productivity in a manner consistent with the empirical evidence, the empirical question therefore arises as to whether the amount of outsourcing is sufficient to account for the magnitude of the observed changes. Unfortunately it is difficult to determine the amount of vertical integration that is taking place since there is

nothing in the trade or production data that specifically provides that information directly. However, there are two data sources that may provide useful but limited information. U.S. import statistics provide information on the amount of U.S. components incorporated into some imported items, and European export statistics often record whether an item is being exported to be assembled abroad. The U.S. offshore assembly provisions (OAP -- generally the HTS 9802 program –the old 806 and 807 programs) allow re-imported U.S. components to enter duty-free (while the foreign value added is tariffed at the usual rate). This includes those imports recorded in the U.S. trade data as reported by the U.S. census with special program indicators of 6 (for 9802.00.6000 – articles composed of U.S. manufactured metal), 7 (for 9802.00.8015 – textile article assembled abroad and entered under a special access program), and 8 – (for 9802.00.8065 – articles assembled abroad from U.S. components). Imports under these provisions report both the total customs value of the import and the reported value of U.S. components; the difference of these two is considered the foreign value added. In addition to these programs there are several other programs that allow the full value of the product to enter duty free if it contains a certain amount of U.S. components; therefore the U.S. Census reports the U.S. value of components in these imports as well. This includes imports with special program indicators of 2 (for 9802.00.8042 and 9802.008044 – apparel from CBTPA and ATPDEA countries using U.S. fabric), 3 (for 9802.00.8046 from CBTPA countries, or 9802.00.8048 from ATPDEA countries – textile luggage using U.S. fabric), 4 (for 9802.00.8055 –textile and apparel assembled in Mexico), 5 (for 9802.00.9000 – for textile or apparel assembled in Mexico using U.S. formed and cut fabric), 9 (for 9802.005010 --repaired items, and 9802.00.8040 – items assembled in a CBERA country using all U.S. components – the Section 222 program). The basic reason importing firms report the U.S. components (on the customs declaration) is to receive duty-free treatment for the product or at least the portion composed of U.S. components. Unfortunately, for items that can enter duty free under some other provision, such as those NTR-free (previously MFN-free) or free under some preferential trade agreement (CBERA, CBTPA, ATPA, ATPDEA, or GSP), or free under a free trade agreement (as with Canada, Mexico, Israel, Jordan, Singapore, Chile, and a growing list of nations) there may be no incentive to report the U.S. components. Also, for items with a small percentage of U.S. components, the administrative costs of applying for these programs may outweigh the tariff savings. Thus a significant proportion of imports containing U.S. components may not be reported. For example, in 1993, the year before NAFTA, 26 percent of U.S. imports from Mexico consisted of U.S. reported components; after the NAFTA, as more and more goods became duty-free, there was no reason to report the U.S. components and this percentage declined to 16 percent in 1998, 8 percent in 2000, and 5 percent in 2001. Although there may be

other reasons for this decline in U.S. components, the major factor for this reported decline is most likely a decline in their reporting and not a decline in the actual amount.

If the objective is to study vertical integration, instead of the U.S. outsourcing under the OAP, there are additional reasons not to rely on the HTS 9802 data. For example, if the U.S. initially imported computer components from Asia for assembly into computers in the U.S., and then decided to move the first stage of the assembly operations to Mexico before doing the final assembly in the U.S., this would clearly be a case of further vertical integration, but there would be no evidence of this in the HTS 9802 data. For these reasons, the HTS 9802 information provides some insight into the process of vertical integration and should be examined, but it must be recognized that this data only represents a portion, perhaps only a small portion, of the total amount of vertical integration going on and any results derived from this data should be interpreted skeptically.

Note that there is nothing in U.S. export statistics that allows one to measure the amount of exports destined for foreign assembly. Some European export statistics do specify if the export is for foreign assembly, and thus their statistics might be a useful source of information on outsourcing. The Comext database from Eurostat provides data on goods temporarily exported from the European Union (EU) for reasons of processing that are to be re-imported into the EU. However not all trade in goods for foreign processing is recorded in this database, and thus it is like the U.S. 9802 data in providing only a subset of the actual amount of vertical integration. Helg and Tajoli (2004) provide an analysis of outsourcing using this data and emphasize that re-imports (derived from outward processing trade in the Comext database from Eurostat) are a conservative proxy for the level of outsourcing.

Another piece of evidence on the magnitude of vertical integration has been to compare how trade has grown relative to production. It has generally been found that throughout the last several decades, trade has grown much faster than production. For example the world export to world production ratio has doubled and the manufactures trade to manufactures production ratio has quadrupled since 1950. Over the 1959-94 period, global GNP grew about 3.9 percent a year while global trade grew at an average annual rate of 11 percent; as a result, almost all countries have much higher trade to GNP ratios. For the United States, the trade (exports + imports/2) to GNP ratio has increased from 4.4 percent in 1959 to 11.6 percent in 2002 (CEA, 2004, table B1). Although this increase in economic integration has been a persistent trend throughout this period, the upward trend really began in the 1970s as this ratio was only 5.5 percent in 1971.

Many have taken this as evidence that the production process is being further sliced up into smaller and smaller steps with different parts of the production process that use different factor intensities being distributed to other

countries which have the appropriate factor endowments. Undoubtedly there are other important factors such as the increase in the trade of differentiated products, and the increase in "regular" trade likely from reductions in tariffs and transportation costs. Yi (2003) argues that falling trade barriers and falling transportation costs cannot explain this increase in the trade to GDP ratio. Instead, Yi (2003) and Hummels, Rapoport and Yi (1998) find that vertical specialization (even using their very restrictive definition where the amount of vertical specialization is the amount of the imported inputs which are ultimately exported multiplied by two) can account for one third of the growth in world trade over the last 20-30 years and approximately 20 to 25 percent of world trade today. Tariff reductions, besides increasing trade generally, are hypothesized to increase vertical specialization even more since for vertically integrated products the effective tariff is much higher than the nominal tariff. The rapid fall in the costs of international communications also encourages vertical specialization. These authors use input-output tables, which provide by sector the amount of imported intermediate inputs and the amount of exports, to calculate the amount of vertical specialization. They also find that small countries have a significantly higher percentage of vertical specialization than large countries; the United States, Germany and Japan (and uncharacteristically Australia) have the lowest share of vertical specialization while small countries like the Netherlands and Ireland have the highest. The sectors with the highest levels of vertical integration include motor vehicles, shipbuilding, aircraft, industrial chemicals, nonferrous metals, petroleum and coal products; sectors with the least include agriculture, mining, wood products, and paper products (Hummels, Rapoport and Yi, 1998).

Further evidence of the role of outsourcing as a source of "skill biased technological change" is found in an examination of the comparative skilled/unskilled labor ratios in the German and Italian apparel industry. In Germany the apparel industry has a skilled/unskilled labor ratio close to the average for manufacturing; German outsourcing in this industry began twenty years ago and re-imports accounted for more than 26 percent of German domestic production in 1996. In Italy re-imports account for less than 4 percent of domestic Italian apparel production and the skilled/unskilled labor ratio in apparel is half the average ratio in manufacturing (Helg and Tajoli, 2004). This pattern clearly suggests that the relative skill intensity of apparel production in Germany is not due to some technological difference but is due to the fact that the labor-intensive segments of production have been outsourced to low wage countries.

The subject of vertical integration has begun to create a number of models designed explicitly to treat the issue of outsourcing. Choi (2002) examines the issue by having a traded and a nontraded sector, and distinct skilled and unskilled labor in each sector. This model finds that greater outsourcing results in a reduction in the wage differential in the tradable industry and an increase in the

wage differential in the non-tradable industry. Nevertheless the basic conclusion is that in an economy with a large non-traded sector, global sourcing increases distributional conflicts.

## V. OUTSOURCING OF SERVICES

Recently the issue of outsourcing of services has gained public attention; for example the office of Senator Joe Lieberman has recently released a white paper on the subject (Lieberman, Koehler, and Hagigh, 2004). U.S. service jobs have been outsourced in a wide range of industries including financial services, telemarketing, credit card operations, and medical test analysis. These jobs have been outsourced to a number of countries; call center jobs went to the Philippines and Malaysia, billing and back office jobs went to Ireland and China, and software jobs went to India, Israel and Russia. The primary destination and the one that has raised the most interests appears to be India – a country with 150 million people whose primary language is English and where wages are often one tenth of U.S. wages for comparable occupations. There are estimates that more than 3.3 million U.S. service jobs are likely to be outsourced to foreign countries over the next decade (McCarthy, 2002). Although the U.S. is the largest importer an exporter of computing and business services, Amiti and Wei (2004) point out that as a percentage of GDP, the U.S. ranks very low as a trader of these services. They find that Angola, the Republic of Congo, Mozambique, and Ireland import far more of these services in terms of percentage of GDP. However, the U.S. is unique in the degree to which they import services from countries with extremely lower wages. For the same reason, comparisons between the U.S. and Western Europe of service import levels are somewhat questionable since intra-U.S. service outsourcing (from New York to Atlanta) do not appear in the data while intra-European outsourcing (Berlin to Paris) do. Given these considerations, the U.S. seems to be at the forefront of service sector outsourcing to low-wage countries; Western European firms, except perhaps U.K. firms, outsource services primarily to other European firms although they are beginning to look eastward towards lower wage Hungary, the Czech Republic, Poland and Slovakia.

Clearly the level of trade generally, and the ability to profitably outsource is dependent on exchange rates. The current overvaluation of the U.S. dollar has obviously been a contributing factor in encouraging the outsourcing of activities. This may perhaps be one minor reason that European firms have lagged behind the U.S. in outsourcing service operations. However, given the predicted growth trends of service-sector outsourcing, a fall in the dollar may only slow down, and not reverse, the future growth of outsourcing.

The degree to which the manufacturing process can be sliced up into ever-smaller slices is limited by transportation costs. Services outsourcing, however,

does not run into this constraint. Although other constraints will inevitability arise which will limit how thin a given service activity can be made, it would seem that services can be sliced up to a much greater degree than manufacturing.

Although the importation of services is not fundamentally different than the importation of goods (CEA, 2004), the outsourcing of services raises a number of additional issues and most significantly may involve a larger distributional shift. One obvious practical difference is that workers displaced by service outsourcing are not covered by trade adjustment assistance.[3] In theory, a developed country like the U.S. would specialize in and export high skill-intensive and capital-intensive goods and import low skill-intensive goods. A similar pattern might be expected for services. Urata and Kiyota (2000) find that the factor intensity of services differs and that observed trade in services is generally consistent with a Heckscher-Ohlin approach. Thus the U.S. would outsource low-skill call center jobs and export high-skilled engineering, computer programming, medical, and entertainment services. However, to the surprise of many, a number of the outsourced jobs appear to be rather high skilled. For example, Massachusetts General Hospital has outsourced to India radiologists jobs that had paid $450,000 a year; Microsoft and General Electric have outsourced not only low-skilled consumer service jobs but also very high-skilled research and development jobs (Cooper, 2004). This raises the question as to whether this endowment approach to services trade is the most appropriate framework for analyzing this issue.

As is the case with trade, relative endowments are likely to explain the pattern of trade only when their are no technological differences between countries, or if there is a overall difference it does not vary by sector in a consistent manner. However, if there is less of a technological difference between high-skilled service sectors and low-skilled service sectors, then the H-O pattern need not hold. In addition, if the technological differences between the service sectors and the goods sectors are not similar, then it is quite possible a country could end up mostly exporting or importing services. The current pattern whereby the U.S. imports high-skilled services from India could result from a situation where the technological differences between the two countries in the service sectors are less than in the goods sectors. In such a case the U.S. would import high-skilled services from India and export goods which might be relatively high skilled for goods but would still be less high skilled than the services being imported. Another possible explanation centers on the distinction between the physical definition of endowments versus the price definition. If there is demand reversal, it is quite possible that certain high-skilled services may not be

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[3] Rep. Adam Smith (D-Washington) has introduced HR 3881 and Sens. Max Baucus (D-Montana) and Norm Coleman (R-Minnesota) have introduced S 2157 to provide trade adjustment assistance for service industry workers displaced by outsourcing.

demanded significantly in India due to its low per capita income, and thus India would have a relative abundance of the high-skilled factors used in their production. For example, India produces 167,000 engineering and computer science graduates each year while the U.S. produces only 100,000 (Mukherjee, 2003); although India is proportionally much larger than this 1.67 ratio, it may still be the case that demand patterns in India simply can not absorb this number of science graduates and thus India is actually abundant (using the price definition) in science graduates.

Perhaps service sector outsourcing's most significant consequence is that it has the potential to significantly increase the number of sectors and workers whose prices and wages will be determined in global markets. A number of international economists (Lawrence, 1996; Lawrence and Evans, 1996; Deardorff and Courant, 1989) have downplayed the potential for trade to adversely affect wages in the developed world by arguing that complete specialization will occur long before the trade volumes are produced that would be necessary for factor price equalization. Thus the wages of the unskilled in the developed world become unhooked from global wages as the country fully specializes in nontraded goods and skill-intensive traded goods. Lawrence and Evans (1996) assume that nontraded goods account for 82.5 percent of consumption. The wage pressure creeping in from the traded sector is therefore limited by the small size of the traded sector. However, once it is realized that a significant portion of the so-called "nontraded service" sector is actually tradable, then this wage insulation from global forces falls away, and factor price equalization again raises its ugly head.

In order to examine more fully the economic implications of increased service sector trade, it is necessary to specify how productivity in services is related to the level of development. A critical assumption incorporated in the analysis here is that the inter-country productivity differences between the North and the South are less for services than for manufactures. This assumption is also the central assumption in the Harrod-Balassa-Samuelson (1933; 1964; 1964 respectively) explanation for deviations from purchasing power parity; the evidence for this assumption is mixed. Generally it is found that as per capita differences increase so do the relative differences in the price of tradeables to nontradables. There are two basic explanations as to why this price differential exists. Balassa and Samuelson, along with Kravis, Heston and Summers (1983) have argued that this is due to a systematic differential in productivity between services and manufactures. A recent study comparing U.S. and U.K. productivity (the U.K. has about two thirds of U.S. per capita income) found that U.S. had about 20 percent higher hourly productivity in the service sector but almost a 100 percent advantage in manufactures (Rowthorn, 2001). Zachariadis (2002) argues that the productivity difference between manufacturing and services is due to the

higher level of R&D in manufacturing. Samuelson (1984) suggested a "Darwinian-Toynbeean challenge process" where productivity improvements derive from the very fact that products are tradable and thus subject to intense competition. These productivity improvements keep the cross sectional differences large for manufactures. Most studies, including Bernard and Jones (1996) do find that productivity has grown much faster in the manufacturing than in the service sectors. Interestingly, if this is in fact the nature of the productivity differential, as services become tradable, the differential may increase. This hypothesis is supported by the evidence of Bernard and Jones (1996) who find a significant convergence of service sector productivity (both labor and multifactor) for the OECD countries from 1970-87 but no convergence of manufacturing sector productivity. As for a service-manufacturing sector comparison of cross-country levels, the productivity differences were similar in 1970 but service sector productivity across countries were much more similar by 1987. Thus data for the 1987 date is supportive of the Balassa-Samuelson hypothesis while data for 1970 is not. Ark, Monnikhof, and Mulder (1999) did not find a services/manufacturing productivity difference for the OECD countries for 1992.

There are not many studies that attempt to directly compare service sector productivity across countries. There are difficult measurement problems since it is much more difficult to determine the quantity of a service, its quality, or compare it generally. In addition, countries do not compile data on services to the degree that they do for manufactures (Ark, Monnikhof, and Mulder, 1999). Of the few studies that do attempt to make cross-country comparisons, they generally use developed nations with relatively similar per capita incomes and overall levels of productivity. As far as can be determined, there do not appear to be any studies that compare service sector productivity between the richer OECD countries and the developing countries which have been the destination for most of the outsourcing of services.

Bhagwati (1984) has argued that services are not cheaper due to a technological differential but due to services being very labor intensive, and developed and developing countries being in different McKenzie-Chipman cones of diversification with different relative factor prices. Some empirical support for this is found by Kravis, Heston and Summers (1983), who find that non-tradables average out to have a higher labor intensity than tradables. However, Bhagwati's argument would appear to imply that capital or skill intensive services are cheaper in the developed countries. The observed movement of medical, science, engineering, and computer jobs to the developing world would appear to be inconsistent with this view.

A more formal explanation and description of the implications of service sector outsourcing are presented in Figure 3 below. Assuming two goods, the most simple representation requires that since there is abundant evidence that

multi-factor productivity differences exist between the North and the South, that the Southern production functions (SCG-southern capital good and SLG-southern labor good) be further out than in the North (NCG-northern capital good and NLG-northern labor good). These are drawn assuming Hicks' neutral technological differences. If that were the only difference between the North and the South, trade would require that the wage/rental ratio be similar (although the absolute level would not be); however this ratio is not similar, so the most reasonable assumption would be either to assume complete specialization or to assume transportation costs and/or tariffs so that the wage-rental ratio need not be equal (the wage/rental ratio is smaller in the South). Thus the North specializes in the production of the capital-intensive good (NCG) and its wage/rental ratio is given by the tangent line labeled N. The South specializes fully in the labor-intensive good (SLG) and its lower wage-rental ratio is given by the tangent line labeled S. Next we assume that there are two service sectors (both a capital-intensive and a labor-intensive sector) with production functions similar to those of the two goods in the North. The South's service sector production functions are likely to be further out (lower multi-factor productivity) than those in the North but not as far out as the goods production functions (due to Harrod-Balassa-Samuelson) but as a simplifying assumption are assumed to be similar to those in the North; thus there is assumed to be a North-South productivity difference for goods but not for services. Initially services cannot be traded because of tariffs or transaction costs. Thus the North produces capital-intensive goods (which they also export) and both capital-intensive and labor-intensive services for domestic consumption. In the South, labor-intensive goods are produced (which are also exported) and both capital-intensive and labor-intensive services for domestic consumption. Next, assume that this barrier to services trade is eliminated. At initial prices, labor-intensive services are relatively cheaper in the South and capital-intensive services are cheaper in the North. Each country begins to specialize and export the service for which they have a comparative advantage.

       In the North, as production of labor intensive services falls and production of capital intensive services increases, more labor is released and more capital is demanded at the initial factor intensities so the *w/r* begins to fall to absorb the excess labor and conserve the scarce capital. In the South, the opposite occurs as production of labor-intensive services increases (and capital-intensive services falls) and the *w/r* ratio increases. The final equilibrium will depend on demand conditions, but one possibility would be that increases in service trade are

Figure 3
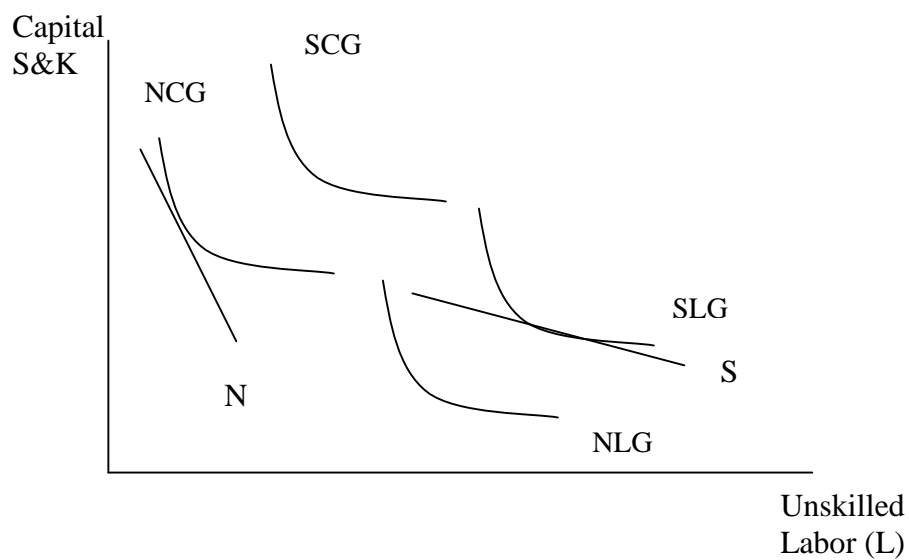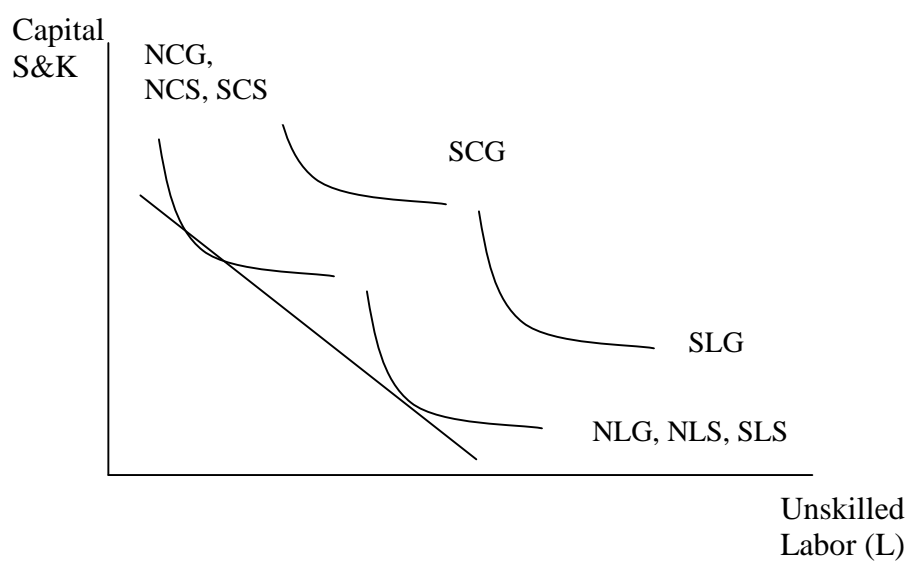Initial Conditions, No Traded Services

Capital
S&K

SCG

NCG

SLG

S

N

NLG

Unskilled
Labor (L)

Figure 4
Conditions With Tradable Services

Capital
S&K

NCG,
NCS, SCS

SCG

SLG

NLG, NLS, SLS

Unskilled
Labor (L)

sufficient to bring about (at least) relative factor price equalization. Assuming that the final *w/r* is such that the cost of producing all four goods in the North is the same, in this equilibrium, the North could end up producing and exporting both goods and the South could end up specializing solely in services. Thus the introduction of services has the effect in the North of lowering the *w/r* ratio and raising it in the South, but an additional tendency is for production of goods, even labor-intensive goods, to increase in the North (perhaps even exports of labor-intensive goods, possibly saving the manufacturing sector), and production of services, even capital-intensive (or human-capital intensive) services, to increase in the South. Thus the North ends up exporting some labor-intensive goods and the South exports capital-intensive services.

The pattern explained here results in essentially the outcome described by Bivens of the Economic Policy Institute where outsourcing primarily redistributes income to people who own stock in large companies while those dependent on labor income lose (Cooper, 2004). Since the gains in the North go primarily to capital with actual losses to labor, labor does not even get a net benefit from the trickle-down effect of lower services prices. Thus, when proposing trade liberalization (or trade expansion) for goods, it can generally be argued that many of the low-skilled jobs lost in the import-competing sector will be replaced with higher paying high-skilled jobs in the export sector. Unfortunately the displaced low-skilled workers may not be the ones getting the high-skilled jobs, but in terms of the national's profile of jobs, there are more high-skilled jobs relative to low-skilled jobs. However, the quandary presented by outsourcing of services, is that in terms of the nation's profile of actual jobs, the new jobs are likely to be lower skilled and lower paying than the old jobs. Nevertheless, the country is better off if judged by the compensation principle due to increased capital income.

The pattern above is based upon the usual full employment assumptions of real trade theory; due to labor market imperfections service sector outsourcing might increase unemployment for service sector workers. The current unemployment rate among science and engineering Ph.D.s is close to 10 percent (Cooper, 2004). Over 16 percent of cab drivers have some college education (NBC Nightly News, April 3, 2004). The above unemployment rates for scientists and engineers should make one skeptical of many of the enhanced education policy proposals being put forth to deal with service sector outsourcing; for example policies to increase science and math education is a central proposal of Senator Lieberman (Lieberman, Koehler, and Hagigh, 2004). The problem isn't the lack of domestic supply, it's the lack of domestic demand; and the reason is that foreign supply is so much cheaper.

## VI. TRADE AND INEQUALITY IN THE DEVELOPING NATIONS

Although there had been an underlying expectation that increased openness might increase inequality in the industrialized countries ever since Stolper-Samuelson, the expectation was that increased openness would lower inequality in the developing nations by increasing the demand for unskilled labor in order to produce labor-intensive exports. This seemed to be the case for the early post-World War II globalizers such as Korea, Taiwan, Singapore, and Malaysia (Krueger, 1983; Krueger, 1990).  However, more recent attempts to liberalize by many nations, especially those in Latin America during the 1980-2000 period, seem to have increased inequality (Szekely and Hilgert, 2002). Inequality increased after liberalizations in Argentina, Bangladesh, Chile, China, Colombia, Costa Rica, Mexico, and Uruguay (Torres, 2001; Wood, 1997; Zhang and Zheng, 1998; Robbins, 1994; Robbins, 1996; Robbins and Gindling, 1999; Beyer, Rojas and Vergara, 1999).

Several explanations have been put forth to explain the rise in inequality in the developing countries. Firstly, it has been suggested that these nations' true comparative advantage is in natural resources and not unskilled labor; thus increased openness has improved the incomes of resource owners, who are primarily the rich, and the workers required for their extraction, who are primarily skilled workers. A second hypothesis is that these nations liberalized not only their capital-intensive sectors but also their labor-intensive sectors and that with China's entry into the global market, the price of labor-intensive goods has fallen and taken the wage of unskilled labor in these developing nations with it (Wood, 1997). However, the doubling of the Gini coefficient in China between 1985 and 1995 for per capita wages in the industrial sector (Zhang and Zheng, 1998), as well as the general rise in inequality across all sectors in China (World Bank, 1997), suggest that trade from even lower wage nations can not be a full explanation of this phenomenon. A third suggestion is that the skilled-biased technological argument that has been offered as an explanation for increased inequality in the industrialized nations has also been operating in the developing nations: the result being an increased relative demand for skilled labor.  A fourth possibility is that the increased competition for multinational foreign direct investment has increased pressure on countries to increase labor market flexibility and lower labor protections, and this has ultimately lowered wages (ILO, 2004). A fifth possibility is that physical capital and skilled labor are complementary factors, and as countries liberalize capital inflows, this increases the demand for skilled labor. A final argument is that these nations have primarily been exporting items whose production has been outsourced from the industrialized nations and these operations are not particularly labor intensive. Thus the expansion of trade

has increased the demand for skilled, and not unskilled labor. It is also possible that outsourcing through FDI could also induce skilled biased technical progress (i.e., the third hypothesis) regardless of the sector (Wu, 2001b). This paper examines the role of outsourcing in contributing to inequality through these channels.

## VII. OUTSOURCING AND PRODUCTION IN DEVELOPING COUNTRIES

In order to visualize this explanation, consider the relationship between a developing nation's exports and the factor intensity of products. In figure 4 the skilled-labor ($S$) to unskilled-labor ($L$) factor intensity of products is placed along the horizontal axis, and the volume of consumption and production of each product is described by the vertical axis. Assuming many products and assuming that demand (consumption) is distributed evenly over the range of factor intensity, in the idealized multi-product Heckscher-Ohlin (H-O) model, production would be given by line P and consumption by the line C. When P>C, those products are exported and when P<C, those products are imported. As is well known, in this case a country specializes completely in a small segment of the market and imports everything else.

If a number of distortions are introduced such as tariffs and transportation costs, and these are assumed to be distributed evenly over the full range of factor intensities, production and consumption are likely to be described by the P and C lines in Figure 5.

One empirical observation that is consistently at variance the basic assumptions of the HO model is the assumption of identical technology. Developing nations have inferior technology; the exact nature of this technological difference has yet to be fully determined; most importantly is the question as to whether it is systematically related to the factor intensity of production. However, note in Figure 4 that a technological difference that is uniform across sectors will shift both the P and C lines in a roughly similar manner and therefore does not alter significantly which sectors are the export sector and which are the import sectors. More generally, a uniform technological difference does not alter sectoral comparative advantage.

For the explanation being developed in this paper, the basic assumption is that the outsourced operations are not particularly labor intensive relative to existing domestic developing country export sectors. These outsourced operations were previously performed in the developed countries where labor is relatively expensive; therefore the operations tend not to be extremely labor intensive. When the operations are moved to the developing countries, the existing technology is exported with only minor adjustment for the extremely low wages in the developing countries. This is due primarily to the "transaction" or "fixed

Figure 4
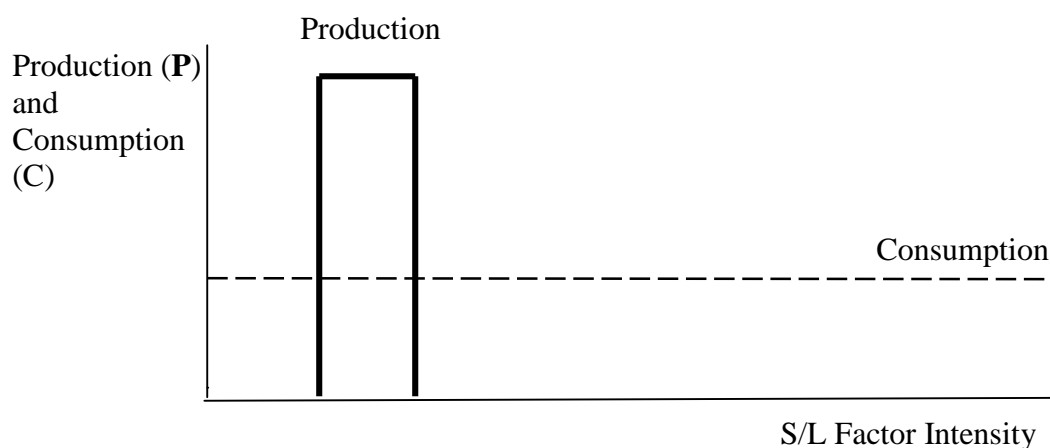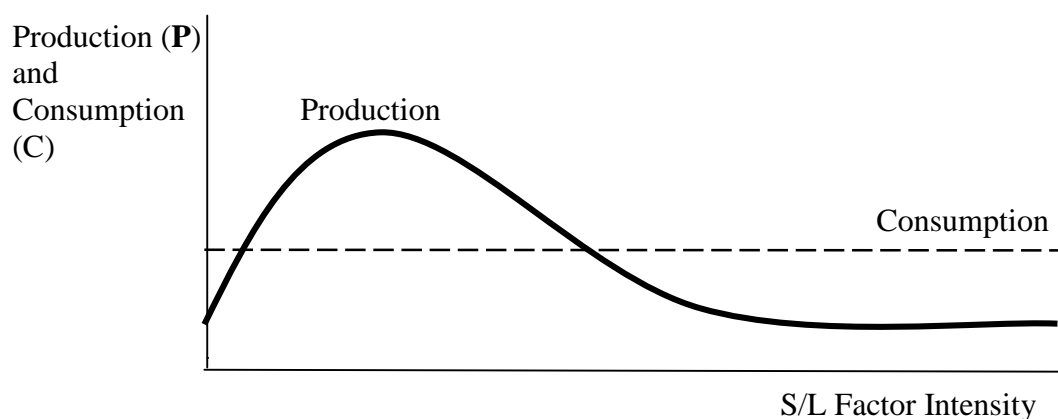Production and Consumption in a Developed Country in the Idealized H-O Multi-Commodity Model

Production (**P**)
and
Consumption
(**C**)

Production

Consumption

S/L Factor Intensity

Figure 5
Production and Consumption in a Developing Country in the Imperfect H-O Multi-Commodity Model

Production (**P**)
and
Consumption
(**C**)

Production

Consumption

S/L Factor Intensity

costs" of redesigning the operation and capital equipment for different factor costs. It is simply cheaper to use existing technology, although its factor allocations are inefficient, instead of undergoing an expensive redesign of the technology to optimize factor usage. This tendency for foreign direct investment to not be as labor intensive as might be optimal has been observed from the earliest post-World War II development studies. Several terminologies have been

used to describe this tendency, including "appropriate technology" or the "dual economy," such as in Eckaus (1955), Salter (1966), and Atkinson and Stiglitz (1969). Many economic development texts discuss this problem in detail such as in Stewart (1978). Borga and Lipsey (2004) discuss a number of industry studies conducted in the 1970s that found that items were often produced in the developing countries using essentially the same capital-intensive technology used in the developed countries. Recent treatments of this issue are provided by Basu and Weil (1998), and Acemoglu and Zilibotti (1999). The latter authors argue that a significant reason that productivity levels are lower in the developing nations is that the imported technology is inappropriate. A key to their argument is not just that firms must use a skill mix that is not Pareto optimal, but that given the lack of skilled workers, unskilled workers often have to perform jobs tasks designed (into the capital equipment) to be performed by skilled workers. Thus the equipment is not operated efficiently and lower productivity results. In addition, these authors argue that increased trade, by lowering the price and profitability of unskilled-labor intensive goods in the North, results in less investment in these sectors. As a result, there is less technological progress in unskilled-labor sectors, which further reduces the relative pay of unskilled workers, which further widens inequality in both the North and the South. Borga and Lipsey (2004) find that affiliates in developing countries use about one-half of the capital per worker that the parent uses; it is less clear whether this is due to the fact that the developing countries affiliates are producing the labor-intensive production steps (vertical integration), or whether it is due to their using a more labor-intensive process to produce a similar product.

Figure 6
Production and Consumption in a Developing Country in the Imperfect H-O
Multi-Commodity Model with Foreign Outsourcing
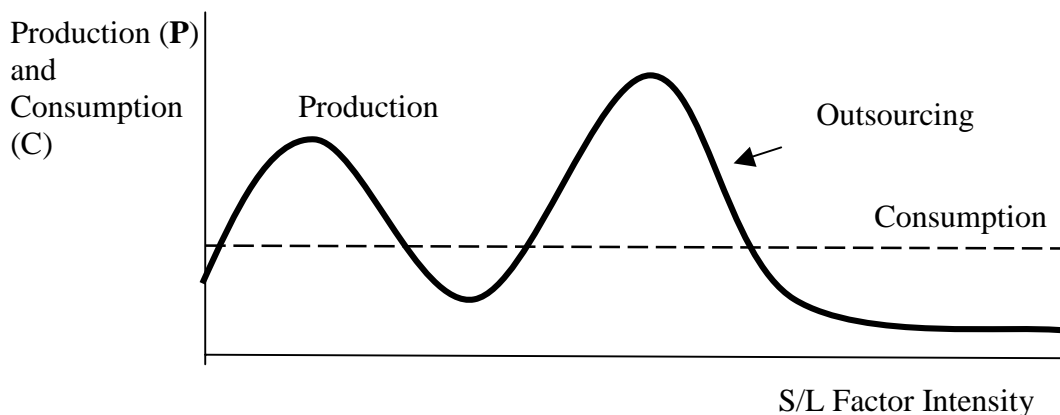
When firms outsource the more labor-intensive processes to the developing countries, the effect is to alter the production structure of the developing country from Figure 5 to look like Figure 6. The second hump of production of goods of intermediate S/L factor intensity represents the production and export of the outsourced processes. The competitiveness of this intermediate sector is due not to relative factor costs as emphasized by the H-O model but is due to the fact that this intermediate segment of products is produced with a technology that is imported and is less inferior (or closer to developed country levels) than the technology used for goods at either of the extreme ranges of factor intensity.

Clearly for this explanation to be valid it must be the case that developing countries export significant amounts of these intermediate factor intensities using foreign technology relative to their exports of traditional domestic labor-intensive goods as described by the first hump. Consider just a few cases. In 2001, more than 85 percent of the Dominican Republic's total exports came from free trade zones, and 95 percent of these were exported to the United States. Of the 512 enterprises in the FTZs in 2001, 344 were owned by foreigners including 262 from the U.S, 24 from Korea, and 7 from Chinese Taipei. Of the $1.3 billion in accumulated investment, the United States accounted for 56 percent while Dominican Republic ownership accounted for less then 29 percent (WTO, 2002). As these figures show, the Dominican Republic's exports are primarily items produced by U.S. multinationals and shipped back to the United States; exports by domestic firms of items produced using traditional labor-intensive techniques are quite minimal and consistent primarily of agricultural products. Hale and Hale (2003) find that foreign companies account for half of the exports of China, 45 percent of Malaysia, 38 percent of Singapore, and 31 percent of Mexico. In addition to the importance of foreign firms in exporting, the importance of outsourcing is revealed by the significance of components in imports that as destined to be re-exported. For example, over half of Asian exports to China are re-exported, 44 percent of U.S. exports to China, and 47 percent of Europe's exports to China (Hale and Hale, 2003). Wu (2001a) concludes that FDI into China from developed countries results in enterprises using more skilled-intensive technology (than local firms) and increases in the wage gap between skilled and unskilled labor; she also finds that this tendency increases with increases in intellectual property rights. Torres, Hayter, and Reinecke (2001) in examining the export structure of South Africa note how it is skewed toward capital-intensive sectors.

The labor market significant of the foreign investment of outsourced operations in the developing countries is that they increase the demand for relatively skilled labor, and reduce the demand for unskilled labor. The demand for unskilled labor is reduced because the increased exports of the intermediate

factor-intensity products alter the exchange rate and thus the competitiveness of the traditional labor-intensive export segments. In real trade theory terms, the technological advantage for the intermediate range products reduces the comparative advantage of the labor-intensive segments since comparative advantage is a relative measure and improvement in one reduces the relative advantage in the remaining sectors. The result is that the demand and the wage for unskilled labor falls in the developing countries, while the demand and the wage of skilled labor increases. This is the basic pattern of wage changes found in several countries with significant investment in outsourcing operations; Hanson and Harrison (1999) and Hanson (2003) document this process in Mexico after NAFTA.

An additional factor that has skewed the production structure of the developing countries away from unskilled-labor intensive goods is the existing structure of trade in agriculture products; there are two significant factors here. Firstly, there are the very significant industrialized country subsidies that have significantly reduced the competitiveness of developing countries in producing these products. It is estimated that the value of developed country agricultural subsidies and protections amount to $300 billion a year; the EU's direct production subsidies amount to $100 billion and the U.S. subsidies amount to $50 billion (World Bank, 2003). Failure of the developed countries to seriously negotiate these programs led to the breakdown of the WTO ministerial in Cancun, Mexico in September 2003. Secondly, empirical analysis has found a tendency for this sector to be subject to factor intensity reversals. Agriculture is very unskilled labor intensive in the developing countries, but is very capital intensive in the developed countries (Minhas, 1962). Since the industrialized countries are capital abundant, they have some natural competitive advantage in producing agricultural products, and this combined with the subsidies results in the contraction of agricultural production once developing countries liberalize trade. For example, with Mexico's trade liberalization under NAFTA, subsidized U.S. corn displaced small-scale Mexican corn farmers, which not only eliminated a significant unskilled-labor intensive sector from Mexico but also displaced significant numbers of farmers which then migrated into the urban areas lowering wages throughout Mexico.

In addition, as countries have liberalized their trade regimes, a number have found that their expected competitiveness in labor-intensive products has been undercut by the extremely low-wage countries such as China and India that have not only lower wages but superior technology for producing these labor-intensive products. As documented by the AFL-CIO 301 petition (AFL-CIO, 2004), China has also engaged in a number of labor practices that keep wages low in the export sector.

The combined effect of the technological transfer with outsourcing, which creates a competitive advantage in intermediate skilled products, and the effects of subsidized developed country agriculture and Chinese labor intensive production, which undermine competitiveness in unskilled-labor intensive production, is to produce a pattern of competitive advantage resembling Figure 7.

Figure 7
Actual Production and Consumption in a Developing Country
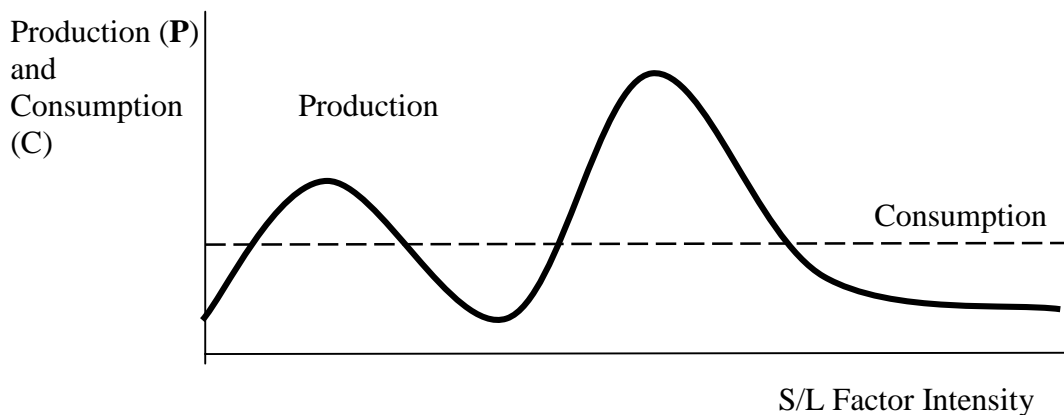


VIII. CONCLUSION

This paper describes how the process of outsourcing of labor-intensive segments of production to developing countries can increase inequality in both the developed as well as the developing nation. The economic changes produced by this process also mirror in many ways the changes that would be observed if there had been biased technological change favoring skilled labor. Thus it is being suggested that the empirical analysis that has concluded that the observed rising level of inequality is due to technological change and is not due to trade or globalization is fundamentally incorrect. Instead, this rising level of inequality is inherent in the process of globalization when production is outsourced.

Service sector outsourcing is significant for wage inequality in the developed nations for two important reasons: 1) the developing countries will be competitive not just in the low wage sectors, as with manufacturing, but in the high wage service sectors --thus it is not just low wage workers that need to be concerned, 2) by significantly increasing the portion of the economy that is open to foreign competition, the movement towards or the possibility of factor price equalization is increased. The very low wages in China and India, and their huge population sizes, and now the increasing number of sectors subject to foreign

competition, suggest that wages in the developed countries are going to be subject to significant downward wage pressure for years to come.

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