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Globalization and Wage Inequality in Indonesia: A CGE Analysis

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GLOBALIZATION AND WAGE INEQUALITY IN INDONESIA: A CGE ANALYSIS

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GLOBALIZATION AND WAGE INEQUALITY IN INDONESIA: A CGE ANALYSIS

Abstract

A multi-region computable general equilibrium model is developed in this study to examine Indonesia's trade regime and its labor markets. This model enables the labor market impacts of shocks to trade policy, the capital stock, and technology to be examined individually as well as collectively. The results suggest that the dominant factor in affecting wage inequality in Indonesia is total factor productivity growth. This strong role of productivity gains is distinctive, considering the prevailing view that East Asia's strong growth was driven primarily by capital accumulation. The model is also used to examine possible policy measures to reduce growth-induced wage inequality, including a return to some trade protection and the use of domestic taxes and subsidies. All are found to be costly to the economy as a whole and most to unskilled workers. The last piece of analysis addresses the Asian financial crisis and its effects on Indonesian labor markets. The effects of contractionary shocks prove the opposite of the growth-related shocks of the previous decade. All workers are made worse off, the unskilled less so. Raising the elasticity of skilled labor supply through education, training, and migration is seen as the best approach to addressing the inevitable wage inequality increase that will accompany Indonesia's eventual recovery.

Introduction

The effects of globalization on labor markets in developed countries have gained considerable attention recently. This is because two related phenomena have occurred in developed economies simultaneously with intensifying international economic ties. In countries with regulated labor markets, unemployment has increased among unskilled workers. In others, there has been a widening of wage inequality between skilled and unskilled workers (Davis, 1996). Increasing unemployment among unskilled labor has been typical in continental Europe, while a combination of increased unemployment and wage inequality has been observed in Australia, Canada, the United Kingdom and, most prominently, the United States (World Bank, 1995).

There is an ongoing debate as to the size of the contribution of openness and globalization in explaining the poor performance of unskilled workers in developed countries. One side of the debate puts the contribution of increasing trade with developing countries as very substantial (Leamer, 1994; Sachs and Shatz, 1994; Wood, 1994 and 1995). Their argument emphasizes standard international trade theory. Developed countries export goods, which are intensive in skilled labor and capital to developing countries, while developing countries export goods, which are intensive in unskilled labor to developed countries. In developed countries, as this trade expands, industries that are intensive in unskilled labor shrink, while industries which are intensive in relatively abundant skilled labor and capital expand. As a result, demand for unskilled labor decreases relative to skilled labor, pushing the skilled to unskilled wage ratio up. This explains the widening wage inequality between skilled and unskilled workers and, where unskilled labor wages are regulated above market clearing levels, the rise in unemployment.

The other side of the debate argues that spontaneous technological change is the main cause of the demise of unskilled labor, while the role of globalization is minimal (Baldwin, 1994; Berman *et al*, 1994; Johnson, 1997; Krugman and Lawrence, 1994; Lawrence and Slaughter, 1993). They believe that the reasons for the labor market problems in the developed countries lie mostly in their domestic economies. In their view, manufacturing employment is falling because companies are replacing workers with machines and making more efficient use of those they retain. Meanwhile, wages have stagnated because the rate of productivity growth in the economy as a whole has slowed, and unskilled labor in particular is suffering because a high-technology economy has less and less demand for its services. Similarly, other domestic factors, such as changes in demand for domestic goods and increases in unskilled labor productivity, have been much more important in influencing the changes in total domestic employment than substitution of imports for home products.

If globalization and technological change have important implications for developed countries, then they clearly have important implications for developing countries too. However, their effects on labor markets in the developing countries have not yet been well researched. In contrast to the substantial volume of analysis in the industrial country context, relatively little careful work has been done on these issues in developing countries (Diwan and Walton, 1997). The standard international trade theorems, derived from the Heckscher-Ohlin-Samuelson (HOS) model, predict that openness should be beneficial for unskilled labor in

developing countries. The decline of barriers to trade has allowed them to realize their comparative advantage in unskilled labor-intensive goods. The domestic terms of trade shifts in favor of unskilled labor-intensive sectors and so, by the virtue of Stolper-Samuelson theorem, the wage of unskilled labor rises relative to product prices and the wage of skilled labor.

Much of the empirical work on this subject (Diwan and Walton, 1997; González and McKinley, 1997; Pissarides, 1997; Robbins, 1996a and 1996b; Tan and Batra, 1997; Wood, 1997), however, shows mixed results on the labor market outcomes of openness in developing countries. Wood (1997), for example, finds that although trade liberalization in the East Asian countries during the 1960s and 1970s caused reduced wage equality between skilled and unskilled labor, the experience of the Latin American countries in the 1980s and early 1990s offers contradictory evidence. Using an empirical global computable general equilibrium (CGE) framework, this study offers a qualitative analysis of the effects of globalization on a developing economy labor markets, namely Indonesia, and of the effects of possible policy change.

Starting from the mid 1980s, in Indonesia there was a tendency for the wage ratio between skilled and unskilled labor to increase, while the corresponding employment ratio tended to decrease. At the same time, the economy experienced increasing trade openness, reflected in increasing export intensity as well as import penetration ratios. This increase in openness followed a balance of payments (BOP) crisis in the mid 1980s associated with the fall in oil prices, the relative price shifts it caused, and the subsequent deregulation policy. Also as a result of the deregulation policy, starting from the late 1980s, the economy experienced a surge in new investment and increased foreign participation, suggesting the likelihood that considerable technological change may have taken place in this sector (Suryahadi, 1998).

Indonesia has considerable ethnic diversity and socio-economic stratification, which makes the distribution of income and wealth always an important policy issue. Some studies, for example, note concerns among policy makers that labor has been left behind in the distribution of "national cake", especially in the deregulation period since the mid 1980s (Agrawal, 1996; Manning, 1994). In relation to this, the objectives of the analysis in this study are threefold. The first is to reproduce the effects of globalization on Indonesian labor markets by replicating observed shocks and using the results to apportion significance to each. The second is to assess various possible policy responses to globalization, particularly possible policy responses to increasing wage inequality between skilled and unskilled labor. The third addresses the Asian financial crisis and its effects on Indonesian labor markets.

The Model and Database

The formulation of the model used in this study is adapted from the GTAP (Global Trade Analysis Project) model, which is discussed in depth by Hertel (1997). The analytical structure of the model is described in Figures 1 and 2. The specification of demand side of the model is illustrated in Figure 1. Each region consists of a single household with a Cobb-Douglas utility function of three composites: private household expenditure, government

expenditure, and saving. Because the utility function is Cobb-Douglas, each of its components retains a constant share of regional income. The private household expenditure has a constant difference elasticity (CDE) function. This functional form permits non-homothetic preferences, so that marginal budget shares may vary with income (Hanoch, 1975). The government expenditure is specified as a Cobb-Douglas function of a composite of commodities. Saving is committed to the global composite commodity "capital goods", which is produced in turn from the identified goods and services. After the demand for each commodity is determined, the decomposition of traded goods into home goods and imports is implemented using the Armington approach (Armington, 1969). Imports are thereby differentiated from home produced goods via an elasticity of substitution that is different for each good.

The specification of supply side of the model is illustrated in Figure 2. Firms are perfectly competitive with constant returns to scale. In this supply structure, firms firstly determine a mix of unskilled labor and simple capital to create an unskilled composite and, simultaneously, determine a mix of skilled labor and sophisticated capital to create a skilled composite. Then firms determine the mix of the two composites to create the skilled-unskilled composite, which is then combined with land. Finally, they use a Leontief production function to combine this value added composite with a composite of intermediate. The composite of intermediates is derived from a constant elasticity of substitution (CES) production function (Arrow *et al*, 1961), as is the composite of primary factors. Intermediate demand for each traded commodity is also decomposed into home goods and imports using the Armington approach in line with the treatment of final demand.

The elasticity of substitution between unskilled labor and simple capital is set at 0.5 to make the two factors complementary to each other. The same complementarity applies to skilled labor and sophisticated capital. Meanwhile, the substitution elasticities between the skilled and unskilled composites are set at 1.5, which in effect makes the skilled and unskilled composites gross substitutes. The choice of these magnitudes for factor substitution elasticities based on the survey by Dixon *et al* (1992, p. 220).

Skilled and unskilled labor are region-specific factors that are imperfectly transformable. The overall labor supply is determined exogenously and the allocation of supply between types is determined according to a constant elasticity of transformation (CET) function. For the analysis discussed in this chapter, however, by specifying a negligible elasticity of transformation, such transformation is practically prohibited, implying exogenous supply of each type of labor.

The quantity of global investment is equal to global savings, which is the sum of all regional savings. The regional distribution of investment expenditure, however, need not be equal to the pattern of savings. The allocation of regional investment is governed by a closure, which requires the convergence of the expected rate of return on investment across regions. Expected rates of return diminish exponentially with the volume of investment. This means that returns on current fixed capital differ from those on investment whenever it is allocated unequally between the regions. Capital is therefore mobile internationally, but income from

fixed capital accrues only within region. The treatment of the total and disaggregated capital supplies within a region is analogous to that of labor.

The analysis uses real data in the form of intertemporal changes drawn from the GTAP global data base version 3, which represents the year 1992.[1] The model structure in terms of regions, industries, and primary factors is described in Table 1. The table also shows how this structure is aggregated or disaggregated from the GTAP data base. Because the GTAP data base does not differentiate between skilled and unskilled labor or between simple and sophisticated capital, a disaggregation of labor and capital payments was exercised based on Liu *et al* (1998). The disaggregation is assumed to be the same across regions, except for the developed countries. Table 2 shows the proportion of skilled labor payments from the total labor payments, which is assumed to be equal to the proportion of sophisticated capital payments from the total capital payments. The resulting distribution of value added in the data base for the Indonesian region is shown in Table 3.

The parameter values used in the simulations are also obtained from the GTAP data base version 3 and presented in Table A1 to A4 in the appendix. The exceptions are the import substitution elasticities presented in Table A3, which are doubled from the original GTAP values. This change accords with model validation experiments by Gehlhar (1997) and the analysis by Yang *et al* (1998).

The data base used includes interregional trade flows. Since the analysis concentrates on Indonesia, however, only Indonesian trade is discussed here. Table 4 summarizes Indonesia's direction of trade. It is clear from this table that Indonesian exports stem mostly from the primary and unskilled manufacturing sectors. From the total exports of around US$ 37 billion in 1992, primary and unskilled manufacturing commodities contribute almost 40 percent each. In terms of export destination, most of Indonesian exports are destined for East Asia and developed countries. Imports, on the other hand, are mostly skilled manufacturing products, sourced mostly also from the developed countries and East Asia.

Replicating the Effects of Globalization on Wage Inequality

The Heckscher-Ohlin-Samuelson (HOS) model predicts that openness will be beneficial for unskilled labor in developing countries. In this section, the effects on the Indonesian labor market of economic shocks associated with globalization are quantified. Three types of economic shocks are introduced: trade liberalization, capital accumulation, and technological change. The objectives of these simulations are to validate the model by comparing the results of these simulations on the Indonesian economy, particularly in the labor market, to the empirical evidence, and to decompose the aggregate change in the Indonesian labor market during the liberalization period from the mid 1980s. The latter analysis allow the apportionment of these effects across contributing shocks.

[1] Overview of the GTAP data base is provided in Gehlhar *et al* (1997).

Trade Liberalization

Trade liberalization was the most significant step taken by Indonesia when it shifted its development strategy from import substitution to export orientation in the mid 1980s. Using the model, the effects of this trade liberalization on real factor returns are examined in two simulations. The first imposes on the model the reduction in import tariffs between 1987 and 1992. The second exercise subjects it to further trade liberalization, reducing tariff equivalents according to commitments made by the government for the period to 2003. The changes in tariff structure between 1987 and 2003 are shown in Table 5. The tariff structure in 1987 is estimated based on Fane and Phillips (1991), the 1992 tariff structure is calculated from the data base, while the estimate for 2003 is based on Fane and Condon (1996).[2]

Comparing the 1987 with the 1992 tariff structure, it is clear that during the 1987-92 period trade liberalization in Indonesia took place mostly on skilled manufacturing commodity. Meanwhile, if the scheduled liberalization until the year 2003 is implemented, it will cover broader commodities. The results of the simulations for real factor returns and output are presented in Table 6.[3]

The table shows that trade liberalization in the 1987-92 period reduced real returns to skilled labor and sophisticated capital, but it increased returns to other factors. The greatest benefit, however, is obtained by land owners. This is not surprising considering that it was skilled manufacturing products that lost the most tariff protection during this period. Hence, output in the skilled manufacturing sector contracts by about a quarter, while all other sectors expand. The unskilled manufacturing sector expands the most. In terms of relative wages, because unskilled labor enjoyed an increase in its real wage while that of skilled labor decreased, the wage inequality was reduced. This is due to the fact that the skilled manufacturing sector, which is the most liberalized industry during this period, is relatively intensive in skilled labor.

Meanwhile, the simulation results for the 1992-2003 liberalization, given in the second column of Table 6, show that land will be the loser and capital of both types will gain the most. In terms of output, although skilled manufacturing industry will still continue to contract, now the primary industry will contract the most. The unskilled manufacturing industry, meanwhile, will continue to expand most rapidly. This reflects the fact that the scheduled liberalization covers commodities more broadly, including primary industry. The results, therefore, indicate that the scheduled trade liberalization will very slightly increase the relative wage of skilled labor.

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[2] Tariff here refers to tariff equivalent reflected in the differences between across border prices.

[3] Due to they way tariff specified in the model, it is the power of tariff, which is shocked to simulate the actual trade liberalisation. The term power of tariff refers to the ratio of the value of imports valued at domestic price to the value of imports valued at CIF price.

Capital Accumulation

Indonesia experienced a rapid increase in capital accumulation, starting in the late 1980s, due to investment liberalization in the mid 1980s. This is true for domestic as well as foreign direct investment. Calculated from the BPS manufacturing survey data base, the estimated increase in the manufacturing sector of simple capital stock during the 1986-92 period was around 15 percent, while the sophisticated capital stock grew by 14 percent. To examine the effects of capital accumulation on wage inequality, simulations representing the increases in both types of capital stock are carried out. The effects on real factor returns and output are presented in Table 7.

The changes in real factor rewards are consistent with intuition. Because the stocks of both simple and sophisticated capital are increased, the real returns to both factors decrease while the real returns to other factors increase. In terms of relative wage, the real wage of unskilled labor increases slightly more than that of skilled labor, resulting in a slight reduction in wage inequality. This is probably because the growth in simple capital is slightly higher than that of sophisticated capital. The table also shows that an increase in the overall capital stock induces all industries to expand, with both manufacturing industries expand the most.

Technological Change

Another aspect of globalization, which has featured predominantly is technological change. With globalization, technologies move easily across country boundaries. New technologies are embodied in the capital accumulated by developing countries. In this model, technological change can be analyzed as an autonomous factor, which can be controlled exogenously. Furthermore, the model can separate the neutral from biased technological change. A neutral technological change is a change in the productivity of all factors in a certain industry by the same proportion. A biased technological change, meanwhile, implies the augmentation of some factor relative to others.

Both types of technological change, as experienced by the Indonesian manufacturing sector during the 1986-92 period, are estimated from the manufacturing survey data base. For neutral technological change, the estimation is based on the Solow residual method, calculated as the growth in output, which is not accounted for by the growth in inputs (Solow, 1957).[4]

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[4] Assume an aggregate Cobb-Douglas production function: $Y = A \cdot \prod_i X_i^{\alpha_i}$, where Y is output, X_i are inputs, and A is an index of technology. Then impose $\sum_i \alpha_i = 1$ to get constant returns to scale. In proportional change form, this is: $y = a + \sum_i \alpha_i x_i$, where lower case y, x, and a are proportional changes in Y, X, and A, respectively. By rearranging this equation, total factor productivity growth can be estimated as: $a = y - \sum_i \alpha_i x_i$, which is the growth of output minus the average growth of inputs weighted by their cost shares.

The results of this growth accounting indicates that the unskilled manufacturing industry experienced a 14 percent increase in total factor productivity, while the skilled manufacturing industry experienced a productivity increase of 26 percent. This high total factor productivity growth in Indonesian manufacturing supports the finding by Ray (1995). It does, however, contradict the view that the East Asian economic growth is primarily driven by input growth with little efficiency improvement (Krugman, 1994).

Meanwhile, adapting from Arrow *et al* (1961), the biased technological change is estimated as the residual change in the employment ratio between skilled and unskilled labor after taking into account the change in their wage ratio. Assuming that the elasticity of substitution between skilled and unskilled labor is 1.5, it is estimated that the unskilled manufacturing industry experienced an unskilled labor using technological change of only 2 percent during 1986-92, while the skilled manufacturing industry experienced an unskilled labor saving technological change of 4 percent.[5] This very small bias is different from the findings in developed countries, which suggest that biased technological change is an important factor in the reduction of demand for unskilled labor (Berman *et al*, 1994).

To examine the effect of these technological changes on wage inequality, two simulations are conducted, addressing the neutral and biased components separately. The neutral technological change is simulated as a 14 percent increase in total factor productivity in the unskilled manufacturing industry and a 26 percent increase in total factor productivity in the skilled manufacturing industry. The biased technological change is simulated as follows. The unskilled manufacturing sector requires 2 percent more unskilled labor input, while the skilled manufacturing sector requires 4 percent less unskilled labor input. The simulated effects on factor rewards and output are summarized in Table 8.

These results show that the neutral technological change in manufacturing industries is beneficial for all factors except land, while the biased technological change in the same industries has very small effects on real factor returns. The latter seems due to the small magnitudes of the biased technological changes that appear to have occurred during the period. The neutral technological change increases output in manufacturing and services, but reduces the output of the primary sector. In a small open economy, an increase in productivity

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[5] The firms labour allocation problem is to minimise a wage cost function: $C = w_s L_s + w_u L_u$, subject to a labour value added production function: $Q = \left(\alpha_s^{-\rho} L_s^{-\rho} + \alpha_u^{-\rho} L_u^{-\rho} \right)^{-\frac{1}{\rho}}$, where C is wage cost, L_s and L_u are the employment of skilled and unskilled labour, w_s and w_u are their respective wages, Q is labour value added, while α_s and α_u are skilled and unskilled labour augmenting technology indices respectively. After solving the problem and defining $\sigma = -\frac{1}{1+\rho}$ as the elasticity of substitution between skilled and unskilled labour, the bias (with reference to unskilled labour) can be established from: $\frac{\alpha_u}{\alpha_s} = \left(\frac{L_u}{L_s} \right)^{\frac{1}{1+\sigma}} \left[\frac{w_u}{w_s} \right]^{-\frac{\sigma}{1+\sigma}}$.

Meanwhile, the choice of the value 1.5 for the elasticity of substitution is guided only by the broader literature on factor substitution (Dixon *et al*, 1992, p. 220). In further research, a formal estimate and some sensitivity analysis will be needed.

generally increases real factor returns because the increase in output induces no or very small changes in product prices, implying no or very small changes in returns to per unit of effective inputs. Since an increase in productivity is equal to an increase in effective units per unit of input, real factor returns increase.

In terms of wage inequality, the neutral technological change increases the real wage of skilled labor by more than the real wage of unskilled labor, so wage inequality rises. Meanwhile, the biased technological change has no effect on the real wage of skilled labor and only very slightly increases the real wage of unskilled labor, resulting in a very slight reduction in wage inequality. With neutral technological change, the relative wage of skilled labor increases because the skilled manufacturing industry, which is relatively intensive in skilled labor, experiences a much larger increase in productivity. With biased technological change, the relative wage of unskilled labor slightly increases because the increase in demand for unskilled labor in the unskilled manufacturing industry is offset by the slightly larger decrease in its demand in the skilled manufacturing industry.

The Cumulative Effects

The effects on real factor returns of globalization shocks, as shown by simulation results in Tables 6 to 8, show considerable variation. In this subsection, the effects of all the shocks are examined in combination. In particular, this exercise is conducted to compare the simulated change on wage inequality to the empirical evidence. The data suggest that the wage ratio between skilled and unskilled labor increased by 4.9 percent during the 1986-92 period.[6] The "cocktail" of shocks simulated here includes trade liberalization (as per 1987-92), capital accumulation, and both the neutral and biased technological changes.[7] The effects of this cocktail on real factor returns are presented in Table 9.

The results show that labor and capital of all types gain. Land owners lose, however. In terms of the relative wage, skilled labor enjoys a higher real wage increase than does unskilled labor. This increase in the relative wage of skilled labor is consistent with the observed increase in wage inequality during the period. Furthermore, the implied increase in the wage ratio by 1.4 percent is about 30 percent of the observed increase of 4.9 percent.[8] The observed increase in wage ratio is much higher than the implied increase because the simulation does not take into account developments in the non-manufacturing sectors.[9] However, using the

[6] Although this may seem small, the much touted US relative wage change was only 10 percent between 1979 and 1989 (Lawrence and Slaughter, 1993).

[7] Note that the technological change shocks are only in manufacturing and do not extend to the primary and services sectors.

[8] The implied change in the wage ratio is calculated as: (1.327/1.309) - 1 = 0.014.

[9] The actual increase in real wages during the 1986-92 period was 24.5 percent for unskilled wage and 33.4 percent for skilled wage. This means that the estimated increase in skilled real wage is close to the actual, but the estimated increase in unskilled real wage is too high compared to the actual.

model, it is possible to predict the contribution of each aspect of globalization to overall wage inequality. Table 10 summarizes the results from Table 6 through 9.

Table 10 shows that the cumulative effect of various shocks is not the same as the arithmetical summation of the effect of each shock individually. This is due to the non-linear nature of the model. To get the adding up effects of the cocktail shock components, each shock is imposed successively and the incremental increase in the effects are attributed to the added shock. Therefore, in the first run, only trade liberalization is imposed. All the effects that result are attributed to this shock alone. Then, in the second run, the combination of trade liberalization and capital accumulation are imposed. The effects of these two shocks minus the effects of the first are attributed to capital accumulation. The process is repeated by subsequently adding neutral and biased technological changes. The results of these incremental simulations are presented in Table 11.

From these results, it is possible, roughly, to estimate the proportional contribution of each shock to the cumulative effect. It is important to note that the cumulative results are robust to the order of incremental shocks, but the contributions of component shocks are path dependent. The path adopted here follows the historical sequence: trade reform, capital accumulation, technological changes. Nonetheless, it is clear from Tables 10 and 11 that one cause stands out in shaping the observed increase in wage inequality in Indonesia since the mid 1980s. This is the increase in total factor productivity in manufacturing. Trade liberalization has the opposite effect. It tends to reduce wage inequality. Capital accumulation has a large effect on the changes in real factor returns, but its effect on relative wage is small and it tends to reduce wage inequality. Meanwhile, the effect of the small amount of observed bias in technological change is negligible.

Possible Policy Responses to Globalization

The observed increase in wage inequality between skilled and unskilled labor in Indonesia since the mid 1980s has both social and economic implications. Though small as measured here, it reflects a more considerable separation of the tails of the wage distribution. Had the "Asian crisis" not occurred, this would have created social tensions, though obviously not on the scale observed in the late 1990s. Clearly, inequality is more tolerable when the economic pie is expanding than when it is contracting. Nonetheless, it remains relevant to ask the effects of policies proposed by some to mitigate the wage inequality associated with rapid growth. In this section, therefore, the analysis is concerned with whether policies designed to reduce wage inequality will be successful in achieving their objective and whether they have positive or negative overall welfare implications.

New Protectionism

As the results in the previous section indicate, the trade reforms introduced in Indonesia between the mid 1980s and early 1990s actually reduced wage inequality. Reforms considered since then, which would apply through the year 2003, may increase wage inequality, particularly if the liberalized industries are the unskilled labor-intensive industries. Hence, if such trade liberalization were viewed as responsible for disadvantaging unskilled

labor, pressures for a return to protectionism might have forced the government to back track on its reform agenda. In fact, the notion that a liberalized economy does not "fairly" benefit all the people has always been at the heart of the argument for a return to protectionism both in Indonesia and elsewhere.

To examine the possibility of a policy reversal on trade liberalization, a hypothetical policy under which the Indonesian government increases the tariffs on primary, unskilled manufacturing, or both industries is examined here. This is simulated as an increase in the power of tariffs by 10 percent in these industries. The effects on real factor returns, output, and income and utility are presented in Table 12.

The simulation results in Table 12 show that tariff reinstitution in the unskilled manufacturing industry reduces the real returns to all factors, while tariff reinstitution in the primary or both industries reduces the real returns to all factors except land. As a specific factor to primary sector, land benefits from tariff imposed on this sector. Furthermore, the results show that tariff reinstitution in the primary industry increases the output of this industry and tariff reinstitution in the unskilled manufacturing or both industries increases output in both industries, but output of other industries are depressed. By erecting barriers to import, a tariff induces domestic production substituting imports.

These results suggest that the new protectionism policy can reduce wage inequality between skilled and unskilled labor, but the reductions are small. In each tariff reinstitution scenario, the real wage of skilled labor is decreased by a slightly higher proportion than the corresponding reduction in the unskilled labor real wage. However, not only should this minimal achievement of the policy objective be weighted against the fall in both real wages of skilled and unskilled labor, but also against the fall in regional real income and utility as shown in the last rows of Table 12. Therefore, it can be concluded that a return to protectionism will not help unskilled workers. Instead, it will condemn them, as well as the economy as a whole, to be worse off.

Tax or Subsidy on Capital

The simulation results on capital accumulation in the previous section indicate that, if the new capital invested is a complement of skilled labor, then wage inequality will increase. If, on the other hand, the new capital invested is a complement of unskilled labor, then the effect on wage inequality is reversed. One policy response to this takes the form of a tax on the use of capital complementary with skilled labor, namely sophisticated capital. An alternative would be to subsidize the use of capital complementary with unskilled labor, namely simple capital.

To simulate these possible policy responses, two different capital tax and subsidy shocks are applied to the model. First, a tax of 10 percent is levied on the use of sophisticated capital in the unskilled labor-intensive industries, namely the primary and unskilled manufacturing industries. Second, a subsidy of 10 percent is applied to the use of simple capital in the same industries. The measured effects of these simulations on real factor returns and output are presented in Table 13.

The simulation results clearly show that both policies of taxing the use of sophisticated capital and subsidizing the use of simple capital cause the relative wage of skilled labor to increase. In the case of the tax, the real wage of unskilled labor actually declines. In the case of the subsidy, although the real wage of unskilled labor increases, the real wage of skilled labor still increases by a higher proportion. This means that instead of achieving its objective to reduce wage inequality between skilled and unskilled labor, both of these policies lead to an even higher wage inequality.

Labor Supply Response

Hitherto the model has been implemented with a closure, which fixes the supply of both skilled and unskilled labor. In the longer term, a widening of wage inequality between skilled and unskilled labor will invite a labor supply response where some unskilled workers will transform themselves into skilled workers. This, in effect, will increase the relative supply of skilled labor and, hence, lower their relative wage. The most common mode of labor transformation is through education and training. The government can enhance the labor supply response through, for example, a mass training program or an immigration policy, which emphasizes skilled migrants.

To analyze the effects of such labor supply responses, a cocktail shock is simulated to get the wage inequality widening effect.[10] Three different simulations are conducted. The first simulation only represents the cocktail shock, while the other two simulations are a combination of the cocktail shock with two different labor supply responses. The first labor supply response is an increase in the labor transformation elasticity from a negligible 0.0001 to 0.5, hence allowing labor supply to respond endogenously to the widening wage inequality. The second is an exogenous labor supply response. It is an increase in total labor supply by 1 percent, but all the new labor is of the skilled type. The measured effects of these changes on real factor returns, output, and labor supply are presented in Table 14.

A comparison of the first simulation results with the other two clearly indicates that a labor supply response has the potential to mitigate or even eliminate any increase in wage inequality. With the endogenous labor supply response, the effect on wage inequality of the cocktail shock becomes smaller. The reason is that, with endogenous labor supply response, more unskilled labor can be released from the contracting primary industry, but other industries can absorb less, because some of them are transformed into skilled labor, so that all industries can now employ more of skilled labor and less of unskilled labor.

With the exogenous labor supply response, the effect of the cocktail shock on wage inequality is almost eliminated. But, of course, this is determined by the magnitude of the exogenous increase in skilled labor supply. As shown by Table 14, the simulated shock of 1 percent increase in total supply of labor, where all of the additional supply is assumed as of the skilled type, turns out to be roughly equal to a 7 percent increase in total skilled labor

[10] The cocktail shock includes trade liberalisation, capital accumulation of the sophisticated type, and both neutral and biased technological change.

supply. This is quite a large increase in skilled labor supply compared to the endogenous response scenario, which only generates around 3 percent increase in the supply of skilled labor. The magnitude of the shock notwithstanding, the effect of an exogenous skilled labor supply increase is always to mitigate the wage inequality.

The results in this section indicate that enhancing the labor supply response to mitigate any increase in wage inequality is the most feasible policy option. Backtracking on economic reform or imposing a tax or subsidy to induce increased relative demand for unskilled labor are either ineffective or cause negative welfare consequences for unskilled labor and the economy as a whole.

Special Case: The Asian Economic Crisis

Starting in mid 1997, the East Asian region was assailed by a financial crisis and subsequent recession. The countries particularly hard hit were Thailand, Malaysia, South Korea, and Indonesia. The crisis began with a currency attack on Thailand's baht, which ultimately forced the Thai authority to float the baht on 2 July 1997. This floating of baht sent a warning to the Indonesian business community, which had accumulated relatively large short-term private foreign debt on the expectation of exchange rate stability, that they were facing an unhedged foreign exchange risk. In panic, they rushed to buy US dollars. The panic soon spread to the wider community, inducing wealthy Indonesians to transfer their financial assets abroad, while foreign investors followed suit later (Johnson, 1998; Soesastro and Basri, 1998).

This placed heavy pressure on the managed exchange rate regime, the then exchange rate policy in Indonesia. Having learned that market intervention by the Thai authority had little effect on the slide in the baht, the Indonesian central bank did not try to defend the rupiah value through intervention in the foreign exchange market. Instead, they opted to widen the intervention band from 8 percent to 12 percent on 11 July 1997. But the pressure on rupiah continued and the new intervention floor was soon reached, forcing the government to change to a free float on 14 August 1997. Massive capital flight caused a large depreciation in the value of rupiah. The nominal exchange rate, which was around Rp. 2,400 per US$ before the crisis, hit a record low of around Rp. 17,000 per US$ on 22 January 1998 (Soesastro and Basri, 1998). Unhedged debt denominated in US dollars was so widespread that this drove banks and vast numbers of other domestic firms into technical insolvency.

The effects of this financial crisis on the real sector of the Indonesian economy have been substantial. Not only have many firms with foreign exchange denominated debt been made insolvent, but also firms with imported materials face four fold rises in rupiah input costs. These negative effects on the real sector are made worse by the fact that the associated insolvency of banks has made it very difficult for firms to obtain financing for their activities. There has, therefore, been a substantial contraction in the real sector of the economy.

To examine the effects of the economic crisis on the Indonesian labor market, a set of economic shocks simulating the crisis are imposed on the model. The simulation is designed following Adams (1998). He simulates the effects of the crisis in the full GTAP model by

imposing two sets of shocks on the directly affected economies in the East Asian region. The first is a series of negative shocks to real investment, which represents the effects of the withdrawal of foreign investment and the flight of domestic savings. The second set of shocks is a series of negative "supply-side" shocks, reducing total factor productivity across all sectors in the affected countries. This latter set of productivity changes was based on observations of estimated national output contraction, but they were imposed uniformly across all sectors.

Aggregating from the original shocks used by Adams (1998), the negative investment shocks are -50 percent for Indonesia, -30 percent for ASEAN3, and -10 percent for East Asia, while the negative productivity shocks are -25 percent for Indonesia, -10 percent for ASEAN3, and -5 percent for East Asia. In light of some newer information available, some adjustments are made to the shocks imposed in this exercise. First, since there was practically no new investment in Indonesia between the mid 1997 and the mid 1998, the negative investment shock for Indonesia is doubled to -100 percent. Second, since there is evidence that the primary sector, in particular the Indonesian agricultural sector, has not contracted in response to the crisis, the primary industries in all regions are spared from the negative productivity shocks. Third, evidence in the press that insolvency in Indonesia has been prevalent amongst larger firms and that these are mostly in the skilled manufacturing industry, the negative productivity shock in Indonesia in the skilled manufacturing industry is increased by a half to -37.5 percent, while the same shock in the unskilled manufacturing sector is reduced by a half to -12.5 percent. The effects of these adjusted shocks on real factor returns and output are shown in Table 15.

The simulation results indicate that, because of the economic crisis, labor and owners of capital of all types suffered from a large decrease in real returns, but land owners gained. This reflects the fact that the primary industry does not suffer from the negative productivity shock. This is also reflected in the effects of the crisis on output. While all other industries experience a contraction in output, the primary industry expands its production. As has been observed, returns to land rise since labor is absorbed by agriculture and the relative scarcity of land increases. Since the skilled manufacturing industries experience most of the firm level insolvencies and, hence, the largest negative productivity shocks, this industry contracts the most.

In the labor market, it is clear that, because of the economic crisis, both skilled and unskilled workers suffer a large decrease in their real wages. In relative terms, however, the decrease in skilled labor real wage is greater than the decrease in unskilled labor real wage. Therefore, the economic crisis tends to reduce wage inequality between skilled and unskilled labor. This is related to the fact that the crisis hits the skilled manufacturing industry, which is relatively intensive in skilled labor, more than other industries. On the other hand, the primary industry, which is relatively intensive in unskilled labor, expands because of the crisis.

Conclusion

The analysis in the first section shows that the combined effects of various globalization shocks can increase wage inequality between skilled and unskilled workers in a

manner consistent with observed changes in Indonesia since the mid 1980s. The analysis of possible policy responses to globalization in the second section indicates that the feasible policy option for the government to mitigate widening wage inequality is through enhancing the labor supply response. Policy responses in the forms of a reversal of trade liberalization or tax and subsidy policy are either ineffective or reduce welfare both for labor and the economy as a whole.

The government can enhance the endogenous labor supply response by making it easier for households to transform unskilled labor into skilled labor. This could be done, for example,
by providing education and training schemes, or by supporting the on-the-job-training schemes provided by companies. Alternatively, the government can enhance the exogenous increase in the supply of skilled labor. This could be done, for example, by creating large scale training programs for new labor market entrants to produce a large supply of skilled labor. Alternatively, the government can allow for a larger in-migration of skilled labor, which will also increase the supply of skilled labor.

These issues have, however, been rendered a low priority by the advent of the Asian financial crisis. No longer is wage and more general inequality a mere side effect of rapid growth. Now, financial losses have reduced wealth and income amongst capital owners and an associated real contraction of the economy has made both skilled and unskilled workers worse off. Wage and more general inequality has been reduced, but at a considerable price.

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Table 1

Regions, Industries, and Primary Factors in the Model Structure

Model Structure	GTAP Global Data Base Version 3
Regions:	
Indonesia	Indonesia
ASEAN3	Malaysia; Thailand; Philippines
East Asia	Japan; Republic of Korea; China; Hong Kong; Taiwan; Singapore
Developed Countries	United States of America; Canada; Mexico; European Union 12; Australia; New Zealand
Rest of the World	India; Rest of South Asia; Central America and Caribbean; Argentina; Brazil; Chile; Rest of South America; Austria, Finland and Sweden; European Free Trade Area; Central European Associates; Former Soviet Union; Middle East and North Africa; Sub Saharan Africa; Rest of World
Industries:	
Primary	paddy rice; wheat; grains; non grain crops; wool; other livestock; forestry; fisheries; coal; oil; gas; other minerals
Unskilled manufacturing	processed rice; meat products; milk products; other food products; beverages and tobacco; textiles; wearing apparels; lumber; pulp paper etc; petroleum and coal; nonmetallic minerals; primary ferrous metals; nonferrous metals
Skilled manufacturing	leather etc; chemicals rubbers and plastics; fabricated metal products; transport industries; machinery equipment; other manufacturing
Services	electricity, water and gas; construction; trade and transport; other services (private); other services (government); ownerships of dwellings
Primary Factors:	
Land	Land
Unskilled labor	Labor
Skilled labor	
Simple capital	Capital
Sophisticated capital	

Table 2

Proportion of Skilled Labor Payments from the Total Labor Payments or Proportion of Sophisticated Capital Payments from the Total Capital Payments

Industry	Developed Countries		Other Regions	
	Typical Industry	Proportion of Payments	Typical Industry	Proportion of Payments
Primary	grains (Canada)	0.20	grains (Taiwan)	0.12
Unskilled manufacturing	wearing apparels (US)	0.20	wearing apparels (Korea)	0.12
Skilled manufacturing	transport equipment (US)	0.48	transport equipment (Korea)	0.27
Services	electricity, water and gas (US)	0.33	electricity, water and gas (Korea)	0.15

Source: Liu *et al* (1998)

Table 3:
Distribution of Value Added in Data Base for the Indonesian Region (%)

Factor of Production	Industry				
	Primary	Unskilled Manufacturing	Skilled Manufacturing	Services	Total
Agricultural land	26.8	0.0	0.0	0.0	8.9
Unskilled labor	24.2	23.7	24.6	31.5	27.4
Skilled labor	3.3	3.2	9.1	5.6	4.8
Simple capital	40.2	64.3	48.4	53.5	50.2
Sophisticated capital	5.5	8.8	17.9	9.4	8.7
Total (US$ billion)	39.3	16.4	9.6	53.2	118.6
Row percent of total	33.2	13.9	8.1	44.9	100.0

Source: Aggregated and disaggregated from GTAP Data Base version 3.

Table 4:
Indonesia's Direction of Trade, 1992 (%)

Commodity	Importing/Exporting Region				
	ASEAN3	East Asia	Developed Countries	Rest of World	Total
Exports:					
Primary	30.0	55.2	20.7	11.1	39.4
Unskilled manufacturing	48.4	31.0	41.4	59.1	37.3
Skilled manufacturing	20.8	10.3	25.7	20.1	16.5
Services	0.8	3.5	12.3	9.8	6.8
Total (US$ billion)	1.1	20.4	11.8	3.2	36.5
Row percent of total	3.0	55.9	32.3	8.8	100.0
Imports:					
Primary	18.9	1.7	7.3	33.2	8.6
Unskilled manufacturing	45.5	27.3	11.6	19.2	19.5
Skilled manufacturing	33.5	66.3	52.2	28.8	54.3
Services	2.2	4.6	29.0	18.8	17.7
Total (US$ billion)	0.9	12.0	14.7	3.7	31.4
Row percent of total	2.9	38.2	46.8	11.8	100.0

Source: GTAP Data Base version 3.

Table 5

Indonesia's Tariff Structure (%)

Commodity	1987	1992	2003
Primary	18	19	4
Unskilled manufacturing	14	14	3
Skilled manufacturing	40	14	3

Source: For 1987, Fane and Phillips (1991); for 1992, GTAP Data Base version 3; for 2003, Fane and Condon (1996).

Table 6:
Changes in Real Factor Returns and Output in Indonesia from Trade Liberalization (%)[a]

	1987-1992 shock	1992-2003 shock
Real Factor Returns:		
Land	6.2	-2.7
Unskilled labor	1.2	2.8
Skilled labor	-0.2	2.9
Simple capital	1.3	3.3
Sophisticated capital	-0.6	3.3
Output:		
Primary	2.9	-3.1
Unskilled manufacturing	5.3	3.1
Skilled manufacturing	-24.8	-1.4
Services	0.7	1.6

[a]Comparative static analysis using model based on 1992 data subjected to different tariff reduction shocks.

Source: Model simulations discussed in the text.

Table 7:
Changes in Real Factor Returns and Output in Indonesia from a 15 Percent Increase in Simple Capital Stock and a 14 Percent Increase in Sophisticated Capital Stock (%)

Factor of Production	Capital Accumulation Effect
Real Factor Returns:	
Land	9.8
Unskilled labor	17.9
Skilled labor	17.4
Simple capital	-13.1
Sophisticated capital	-11.2
Output:	
Primary	5.8
Unskilled manufacturing	12.7
Skilled manufacturing	16.4
Services	9.4

Source: Model simulation discussed in the text.

Table 8:
Changes in Real Factor Returns and Output in Indonesia from Technological Change in Manufacturing Industries (%)

Factor of Production	Technological Change Component	
	Neutral	Bias
Real Factor Returns:		
Land	-23.4	-0.01
Unskilled labor	13.9	0.04
Skilled labor	17.8	0.00
Simple capital	17.2	-0.02
Sophisticated capital	21.2	0.00
Output:		
Primary	-23.0	-0.01
Unskilled manufacturing	26.2	-0.01
Skilled manufacturing	73.7	-0.02
Services	2.1	0.00

Note: The neutral technological change is 14 and 26 percent increases in total factor productivity in the unskilled and skilled manufacturing industries respectively. The biased technological change is 2 percent more and 4 percent less unskilled labor input in the unskilled and skilled manufacturing industries respectively.

Source: Model simulations discussed in the text.

Table 9:
Changes in Real Factor Returns in Indonesia from Combination of Shocks (%)

Factor of Production	Combination of Shocks
Real Factor Returns:	
Land	-2.7
Unskilled labor	30.9
Skilled labor	32.7
Simple capital	8.2
Sophisticated capital	12.6
Wage Ratio	1.4

Source: Model simulation discussed in the text.

Table 10

The Effects of Trade Liberalisation, Capital Accumulation, Technological Change, and Their Combination on Changes in Real Factor Returns and Wage Inequality (%)

Factor of Production	Cumulative Effect	Trade Liberalisation	Capital Accumulation	Technological Change	
				Neutral	Biased
Land	-2.7	6.2	9.8	-23.4	-0.01
Unskilled labour	30.9	1.2	17.9	13.9	0.04
Skilled labour	32.7	-0.2	17.4	17.8	0.00
Simple capital	8.2	1.3	-13.1	17.2	-0.02
Sophisticated capital	12.6	-0.6	-11.2	21.2	0.00
Wage ratio	1.4	-1.4	-0.4	3.4	-0.04

Source: Model simulations discussed in the text.

Table 11
Contributions of Trade Liberalisation, Capital Accumulation, and Technological Change
on the Cumulative Changes in Real Factor Returns (%)

Factor of Production	Cumulative Effect	Trade Liberalisation	Capital Accumulation	Technological Change	
				Neutral	Biased
Land	-2.7	6.2	9.7	-18.6	0.00
	(100)	(-230)	(-359)	(689)	(0)
Unskilled labour	30.9	1.2	17.7	12.0	-0.02
	(100)	(4)	(57)	(39)	(0)
Skilled labour	32.7	-0.2	17.4	15.5	0.01
	(100)	(-1)	(53)	(47)	(0)
Simple capital	8.2	1.3	-13.0	19.9	0.01
	(100)	(16)	(-159)	(243)	(0)
Sophisticated capital	12.6	-0.6	-11.4	24.5	0.01
	(100)	(-5)	(-90)	(194)	(0)

Note: Numbers in parentheses are percentages of the cumulative effect.

Source: Model simulations discussed in the text.

Table 12:
Changes in Real Factor Returns, Output, and Income and Utility in Indonesia from a 10 Percent Increase in the Power of Tariff in Primary, Unskilled Manufacturing, and Both Industries (%)

Factor of Production	Protected Industry		
	Primary	Unskilled manufacturing	Both
Real Factor Returns:			
Land	1.7	-0.4	1.4
Unskilled labor	-0.3	-0.6	-0.9
Skilled labor	-0.3	-0.8	-1.2
Simple capital	-0.6	-0.3	-0.9
Sophisticated capital	-0.6	-0.6	-1.2
Output:			
Primary	1.1	0.1	1.2
Unskilled manufacturing	-1.9	2.9	1.1
Skilled manufacturing	-0.1	-3.6	-3.8
Services	-0.2	-0.3	-0.6
Income and Utility:			
Regional real income	-0.3	-0.3	-0.6
Per capita utility	-0.2	-0.1	-0.3

Source: Model simulations discussed in the text.

Table 13:

Changes in Real Factor Returns and Output in Indonesia from a 10 Percent Increase Tax on the Use of Sophisticated Capital and a 10 Percent Subsidy on the Use of Simple Capital in Primary and Unskilled Manufacturing Industries (%)

Factor of Production	Tax on Sophisticated Capital	Subsidy on Simple Capital
Real Factor Returns:		
Land	-0.4	1.3
Unskilled labor	-0.1	0.4
Skilled labor	0.1	0.6
Simple capital	0.0	5.3
Sophisticated capital	-3.2	-0.1
Output:		
Primary	-0.4	2.3
Unskilled manufacturing	-0.5	2.5
Skilled manufacturing	2.0	-10.0
Services	0.1	-0.7

Note: Changes in "power of" tax or subsidy is proportional changes in the ratio of prices upstream and downstream of the tax.

Source: Model simulations discussed in the text.

Table 14:
Changes in Real Factor Returns, Output, and Labor Supply in Indonesia from Labor Supply Responses to Increased Wage Inequality (%)

	Labor Supply Response		
Factor of Production	No Response	Endogenous	Exogenous
Real Factor Returns:			
Land	-14.9	-15.0	-14.5
Unskilled labor	17.0	17.5	17.1
Skilled labor	25.5	22.5	17.3
Simple capital	20.0	19.9	20.2
Sophisticated capital	14.7	15.7	17.5
Wage Ratio	7.3	4.3	0.2
Output:			
Primary	-20.4	-20.4	-20.1
Unskilled manufacturing	29.3	29.3	29.5
Skilled manufacturing	59.1	59.1	59.4
Services	4.0	4.0	4.3
Labor Supply:			
Unskilled labor	0.0	-0.4	0.0
Skilled labor	0.0	2.6	6.8

Note: Endogenous labor supply response is when unskilled labor can transform itself into skilled labor. Exogenous labor supply response is an exogenous increase in the supply of skilled labor.

Source: Model simulations discussed in the text.

Table 15:
Changes in Real Factor Returns and Output in Indonesia from the Asian Crisis (%)

Factor of Production	Asian Crisis Shocks
Real Factor Returns:	
Land	53.7
Unskilled labor	-34.5
Skilled labor	-40.0
Simple capital	-36.3
Sophisticated capital	-42.0
Output:	
Primary	58.5
Unskilled manufacturing	-10.9
Skilled manufacturing	-90.2
Services	-51.3

Note: The Asian crisis shocks are represented by a set of negative investment shocks and a series of negative productivity shocks.

Source: Model simulation discussed in the text.

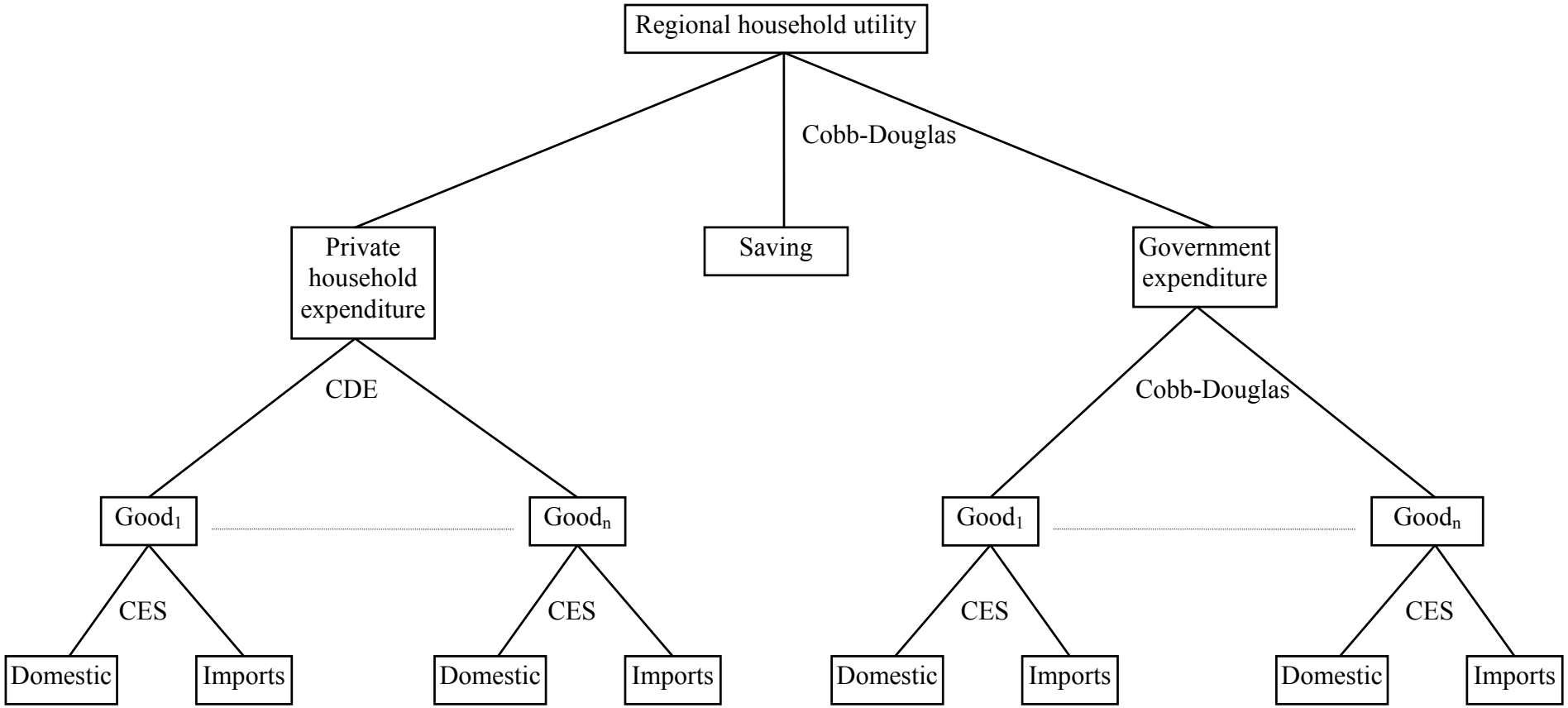

Figure 1:
Demand Structure

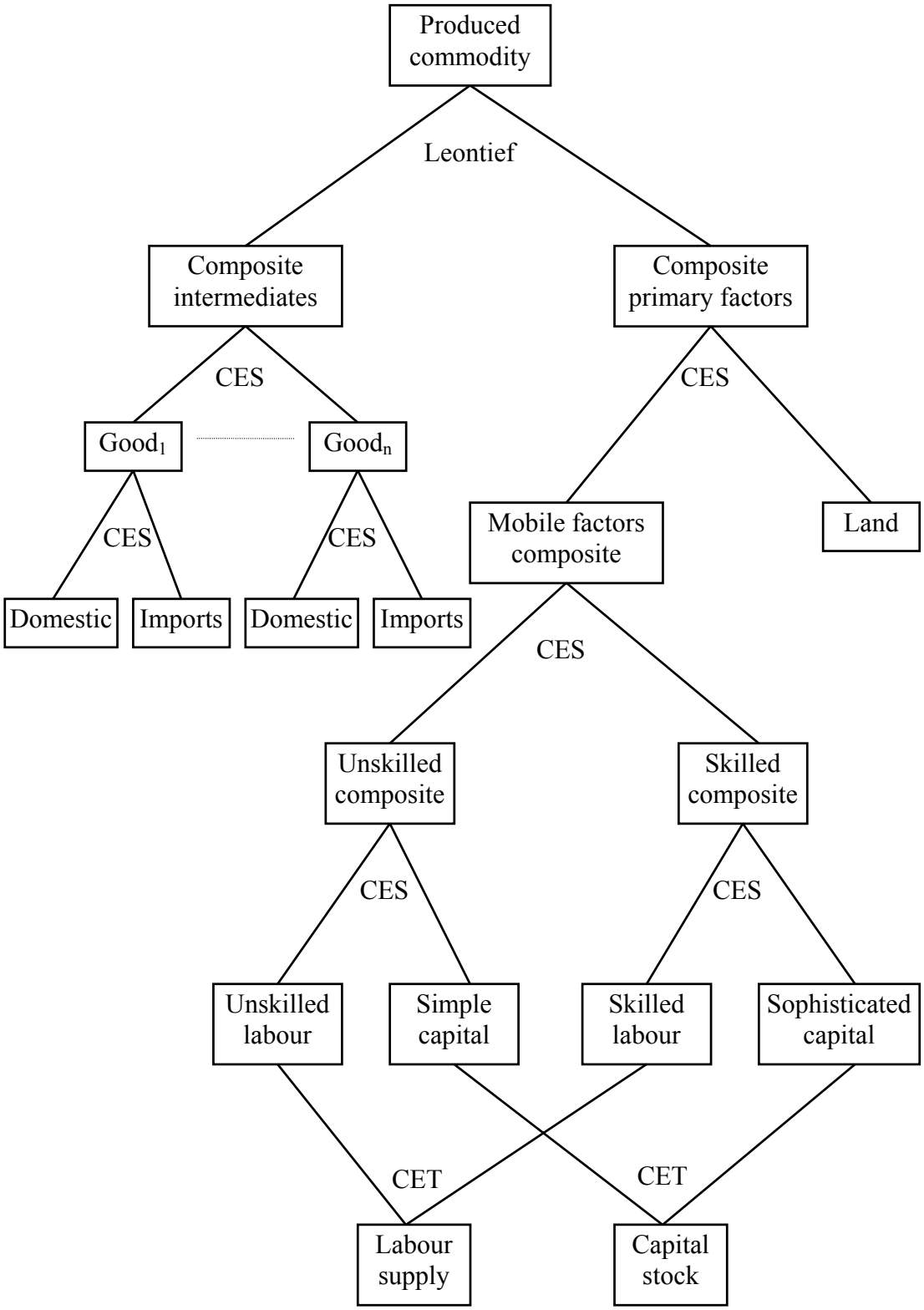

Figure 2:
Supply Structure

Appendix

Table A1:
Substitution Parameter in The CDE Minimum Expenditure Function

Commodity	Indonesia	ASEAN3	East Asia	Developed Countries	Rest of World
Primary	0.9	0.8	0.8	0.4	0.9
Unskilled manufacturing	0.9	0.9	0.6	0.6	0.8
Skilled manufacturing	0.7	0.5	0.2	0.1	0.6
Services	0.4	0.3	0.0	0.0	0.0

Table A2:
Expansion Parameter in The CDE Minimum Expenditure Function

Commodity	Indonesia	ASEAN3	East Asia	Developed Countries	Rest of World
Primary	0.6	0.7	0.5	0.8	0.4
Unskilled manufacturing	0.5	0.5	0.3	0.5	0.5
Skilled manufacturing	1.2	1.3	1.3	1.1	1.1
Services	1.4	1.3	1.2	1.1	1.4

Table A3:
Substitution Elasticities in Final and Intermediate Demand

Commodity	Import-Domestic	Import -Import
Primary	4.9	9.7
Unskilled manufacturing	5.5	11.3
Skilled manufacturing	6.1	12.7
Services	3.9	7.6

Table A4:
Substitution Elasticites in Production

Produced Commodity	Unskilled Commodities Substitution Elasticity	Skilled Commodities Substitution Elasticity	Skilled-Unskilled Composite Substitution Elasticity	Value Added Composite Substitution Elasticity
Primary	0.5	0.5	1.5	0.7
Unskilled manufacturing	0.5	0.5	1.5	1.2
Skilled manufacturing	0.5	0.5	1.5	1.3
Service	0.5	0.5	1.5	1.4
Capital goods	0.0	0.0	0.0	0.0