

7. TRADE, PRODUCTIVITY, AND EMPLOYMENT LINKAGES IN INDONESIAN AGRICULTURE

Acknowledgements

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7.1 INTRODUCTION

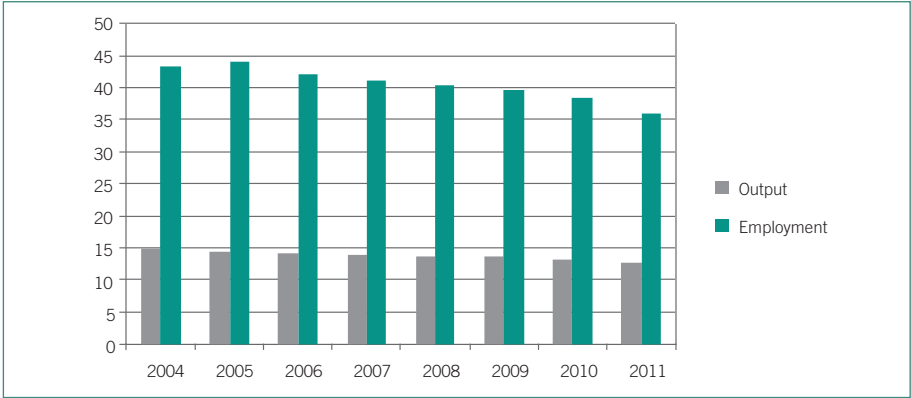
Informality characterizes agricultural employment in Indonesia, as in other developing countries. Informal labour markets tend to be marked by the absence of regulations, low productivity, and underemployment or disguised unemployment. The absence of regulations implies that minimum wage and labour standards are relatively ineffective, although agricultural wages move with wage rates in the non-agricultural sector. Unpaid family work and child labour are also features of the agricultural sector. In contrast to manufacturing, agricultural production is tied to land, and the product tends to be very substitutable with the products of competing exporters in other countries. These facts have implications for the impact of trade and trade liberalization on employment and wages.

This chapter reviews the linkages between trade and employment in Indonesian agriculture and quantifies these links. In particular, we are interested in whether trade liberalization might increase unemployment or decrease wages in the Indonesian agricultural sector and in how effectively different labour market policies might introduce complementary approaches to improve outcomes for rural workers. Rather than limiting trade in an attempt to protect jobs, complementary approaches seek to improve the productivity of labour or to enhance the skills of workers to make them more employable and better able to move from declining to expanding industries.

In the remainder of this section, we describe the characteristics of the Indonesian labour market in agriculture and review previous trade shocks and their impact on employment. In the next section we look at alternative methodologies to assess employment impacts of policy changes and describe the use of general equilibrium models to analyse trade and employment issues. We then apply these models to several scenarios and analyse the findings. In the final section we discuss implications. The general conclusion is that the Association of Southeast Asian Nations (ASEAN)–China Free Trade Agreement (ACFTA) and a likely Doha Round outcome have a small beneficial effect on employment in agriculture, although some producers will be disadvantaged. Programmes to enhance labour productivity and skills are likely to prove beneficial as well.

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Figure 7.1: Contribution of agricultural output and employment to the Indonesian economy (%)



Source: Indonesian Central Bureau of Statistics

The agricultural sector in Indonesia currently employs 36 per cent of the labour force, and yet in 2009 it produced only 14 per cent of the national output (CBS, 2010). Productivity remains low compared with other sectors in the economy, although in recent years agricultural output has been increasing faster than employment. In the years 2004 to 2009, agriculture’s share of national output fell from 15 to 13.6 per cent (figure 7.1), while employment in the agricultural sector remained relatively stagnant in absolute terms.

Indonesia is becoming increasingly integrated into the world economy. Unlike many other developing countries, Indonesia has maintained a trade surplus, although this surplus has declined since 2007 (figure 7.2). The global financial crisis in 2008

Figure 7.2: Indonesian trade performance, 2005–2010



Source: Indonesian Central Bureau of Statistics

reduced import demand from traditional markets such as the United States and the European Union, resulting in a massive decrease in the Indonesian trade balance. Afterwards, the global recovery and the implementation of ACFTA stimulated higher trade flows between ASEAN members and China. China is a significant source of imports to Indonesia. The bilateral data suggest that Indonesia faces a greater danger of a trade deficit than other ASEAN members, because of the large share of imports coming from China. Given Indonesia's current negative bilateral trade balance with China, it is feared that there will be an even bigger deficit as ACFTA is implemented, particularly in the agricultural sector. How the removal, through ACFTA, of protection on agricultural imports will affect the Indonesian agricultural sector has to be carefully assessed, given agriculture's crucial role in rural employment and poverty alleviation. A similar, although lesser, concern is the potential impacts of a Doha Round outcome.

When considering the likely employment effects of trade, one approach is to examine past episodes of liberalization and determine what happened to trade, employment, and wages. Econometric methods can help isolate cause and effect. However, varying lags make estimation difficult. Moreover, many variables are changing at the same time. These include foreign investment, technology, institutions, and macroeconomic shocks.

As industrial development progresses and the economy moves away from an agricultural to a more industrial and services-based economy, labour becomes scarce in the agricultural sector. The modern sector starts to absorb a significant share of the workforce, and, overall, real wages start to rise. There will be shifts from less to more capital- and skill-intensive industries, and at the same time the difference in wages between skilled and unskilled labour starts to narrow (Feridhanusetyawan, 1998). Studies showing a fall in employment in one sector are not very helpful. Policy-makers need to know the duration of unemployment and where the unemployed moved after leaving the declining industry.

Previous work on the response of the labour market in Indonesia to trade shocks relates to the Asian financial crisis of the late 1990s. Smith et al. (2002) use data from the National Labour Force Survey (SAKERNAS) and the Indonesian Family Life Survey (IFLS) to show that most of the adjustment in response to the large negative shock occurred through a fall in wages of between 35 and 40 per cent. This occurred for both males and females and for both rural and urban workers. By comparison, there was a relatively slight (0.3 per cent) fall in the number employed. The number of self-employed increased marginally, suggesting that wage earners who lost their jobs became self-employed. The average earnings of the self-employed also fell significantly – 67 per cent for urban males, although only 11 per cent for rural males. However, half of the self-employed males in the rural sector increased their earnings. Given the importance of the self-employed in the rural labour market, a focus on wage earners would be misleading. Smith et al. conclude that, contrary to commonly held views, the labour market proved remarkably flexible in response to the crisis. They do note, however, that the market appears more rigid for less skilled workers.

The Asian financial crisis was a large negative shock, affecting the whole economy. Trade shocks can equally well be positive, with an increase in demand for labour. In such circumstances it is interesting to know whether the adjustment occurs through higher wages or more employment. If full employment exists, the adjustment is likely to be through wages. If some unemployment exists, it is reasonable to expect adjustment primarily through quantity rather than prices.

Manning (2000) also concludes that flexible labour markets helped Indonesia deal with the 1997–98 crisis much better than anticipated. This flexibility meant that unemployment and the increase in poverty were much less than some had predicted. Manning also points to an increase in agricultural employment, driven by increasing prices for agricultural goods. Also, exportable commodities benefited from a dramatic fall in the exchange rate against most other countries.

Hill and Shiraishi (2007) note that today's labour market is in some respects less flexible than that of ten years ago. Minimum wages and severance pay entitlements have risen sharply, and employment regulations have become increasingly restrictive. Hill and Shiraishi contend that these developments have tended to encourage employment in the informal sector, where such requirements do not exist. Alisjahbana and Manning (2006) argue that the various measures to improve pay and conditions in the formal sector have had little impact on poverty. The poor are heavily concentrated in agriculture, which is largely informal and therefore little affected by such measures.

Meta-surveys of structural adjustment in the manufacturing sector (Matusz and Tarr, 1999) suggest that the one-off costs of adjustment are relatively low, especially in developing countries, where labour markets are more flexible. Akhmedov et al. (2005) sampled 53,000 enterprises in Russia and found that labour demand did not respond to the trade shocks that occurred between 1995 and 2002. They conclude, "Adjustment costs to expected trade liberalization in the form of changes in industrial labour demand should not be high" (p. 1). However, Francois et al. (2011) suggest that adjustment costs may be higher than previously thought. These studies focused on the industrial sector, however, rather than on agriculture, the sector of interest here.

Trade liberalization following the World Trade Organization (WTO), Asia-Pacific Economic Cooperation (APEC), and ASEAN Free Trade Area (AFTA) agreements caused some resource reallocations from primary sectors such as agriculture (paddy rice and other food crops) to manufacturing sectors (resource-based manufacturing), but these changes are difficult to discern amidst the rapid growth of the economy.

Policy-makers often think of employment as directly related to output. If this is correct, employment in agriculture can be predicted by looking at the effects of trade on output. Here the composition of trade matters. Employment will change if trade leads to a change in demand for labour-intensive versus capital-intensive goods.

A social accounting matrix (SAM) can be used to show the changes in demand for labour following a change in output. Table 7.1 shows the value of labour as a share of total output at market prices (excluding taxes and subsidies). For most primary

products labour contributes about 10–30 per cent of the costs. Notable exceptions are rubber and tea. Livestock production, an activity often associated with poverty, has a relatively low labour share. Bear in mind that wages are low in agriculture, so the shares tend to understate the number employed compared with such shares in other sectors. The processing sector – for example, rice, flour, and sugar processing – seems to have lower labour shares in output. These industries may use more capital, but their output value also includes the cost of raw materials, such as paddy and cane sugar.

Table 7.1: Labour shares in the Indonesian economy (% of total output)

Sector	% share	Sector	% share
Primary products		Processed products and services	
Paddy	13.02	Food products	8.00
Maize	10.42	Vegetable oils and fats	12.09
Other cereals	10.11	Rice	4.46
Vegetables, fruit, nuts	16.41	Flour	9.20
Other crops	10.06	Sugar	8.68
Rubber	34.00	Other processed agriculture	10.07
Sugar cane	23.72	Beverages and tobacco	12.03
Coconut	14.39	Textiles and apparel	12.26
Oilseeds	17.48	Wood and paper products	11.36
Tobacco	18.95	Fertilizer and pesticides	24.49
Coffee	15.70	Chemicals	9.48
Tea	30.30	Refinery oil	15.09
Cloves	17.74	Rubber and plastics	9.43
Fibre crops	12.44	Cement	11.68
Other estate crops	11.11	Metal manufactures	6.18
Other agriculture	23.94	Machinery	8.17
Livestock	16.55	Transport equip	13.48
Ruminant meat	11.96	Manufactures	16.90
Non-ruminant meat	19.70	Utilities	26.52
Forestry	16.94	Construction	13.67
Fishing	14.52	Trade	15.45
Petrol and coal products	9.82	Hotels and restaurants	16.24
Other mining	28.67	Transport and communications	16.37
		Business services	15.28
		Services not elsewhere specified	36.72

Source: IndoLab database, calculated from 2008 input–output tables and 2005 social accounting matrix.

7.2 METHODOLOGY

Productivity in agriculture is low because labour is relatively unskilled (table 7.2) and the amount of capital used with labour is small (table 7.3). The IndoLab computable general equilibrium (CGE) model contains data on labour use by industry and household type for each of four occupation groups, namely, farmers, operators, administrators, and professionals. These four types of occupations are categorized as either unskilled (farmer and operator) or skilled (administrator and professional). The skill category classification depends mainly on the level of education.

The share of total employment in the agricultural sector for each type of occupation is shown in table 7.2. The number of workers employed in each sector is calculated from the value of wages divided by the wage rate. The value of wages comes from the Indonesian 2008 input–output tables and the 2005 social accounting matrix, while the wage data come from the National Labour Force Survey (SAKERNAS). The SAKERNAS wage data cover only nine sectors: agriculture; mining and quarrying; manufacturing; electricity, gas, and water; trade; hotel and restaurant; transportation and communications; finance; real estate, rent, and corporate services; and other services. Moreover, the wage data are not classified by occupation. Hence, the wages of farmers and operators are assumed to be identical in every agricultural sub-sector. This is a reasonable approximation because farmers and operators are considered unskilled labour. The wages of administrators and professionals in agriculture are assumed to be equal to their wages in the manufacturing sector. With data on value and wage rates, employment in the agricultural sector by occupation (farmer, operator, administrator, and professional) can be determined. Subsequently, we transform the information on employment by occupation (persons) into shares of each type of occupation in the agricultural sector. Table 7.2 shows that the agriculture sector employs mostly unskilled labour.

The agricultural sector in Indonesia is still labour-intensive, with low levels of technology. Table 7.3 shows that, for agriculture-based commodities, labour contributes more than capital to total costs. For example, in paddy production, 45 per cent of total costs are accounted for by labour and only 1 per cent by capital.

The national accounts data contain information on the formal or informal nature of employment (table 7.4). These data show that informal employment characterizes the agricultural sector. Because it is informal, the sector contains surplus labour. This fact reflects labour market segmentation, where formal jobs are scarce and workers outside the formal labour market are queuing for jobs while working involuntarily in low-productivity, informal employment. Rather than being unemployed, many workers are underemployed or working with low intensity. There is a strong link between informality and poverty; most of the working poor in Indonesia work informally, whether self-employed or as wage earners. Many of these people lack basic social protection, and they are locked into low-productivity activities, with few opportunities for economic mobility. Table 7.4 shows that the higher concentration of informal labour in the Indonesian agricultural sector represents farmers, particularly in small rural holdings. The data suggest that agricultural productivity could be en-

Table 7.2: Occupation types by sector in Indonesian agriculture

Sector	Proportionate share of employment by occupation				Total employment ('000 persons)
	Farmer	Operator	Administrator	Professional	
1 Paddy	0.995	0.004	0.000	0.000	3 242
2 Maize	0.995	0.004	0.000	0.000	1 146
3 Other cereals	0.972	0.027	0.001	0.000	434
4 Vegetables, fruit, nuts	0.972	0.027	0.001	0.000	4 722
5 Other crops	0.972	0.027	0.001	0.000	26
6 Rubber	0.969	0.027	0.003	0.001	1 770
7 Sugarcane	0.969	0.027	0.003	0.001	355
8 Coconut	0.969	0.027	0.003	0.001	390
9 Oilseeds	0.969	0.027	0.003	0.001	1 957
10 Tobacco	0.969	0.027	0.003	0.001	108
11 Coffee	0.969	0.027	0.003	0.001	244
12 Tea	0.952	0.044	0.003	0.001	44
13 Cloves	0.882	0.113	0.003	0.001	75
14 Fibre crops	0.970	0.025	0.003	0.001	13
15 Other estate crops	0.969	0.027	0.003	0.002	314
16 Other agriculture	0.952	0.044	0.003	0.001	758
17 Livestock	0.879	0.113	0.006	0.002	1 766
18 Ruminant meat	0.966	0.026	0.005	0.003	1 398
19 Non-ruminant meat	0.946	0.044	0.007	0.003	3 007
20 Forestry	0.850	0.102	0.040	0.009	553
21 Fishing	0.955	0.025	0.016	0.004	1 376

Source: IndoLab database, calculated from 2008 input-output tables and 2005 social accounting matrix.

hanced by improving the quality of labour by increasing farmers' education and skills. These options are examined later.

Labour surplus economies often have a large endowment of unskilled labour and an absence of sufficient operating capital and land. Typically, the level of technology is low. In developing countries such surplus labour has traditionally been found largely in the agricultural sector, concentrated especially in subsistence agriculture. Family farms, in many different configurations but in all of which income or output shares are determined via bargaining, characterize subsistence agriculture. In other words, a principle of sharing determines wages. This practice reflects the fact that, when high labour-land ratios are part of the initial conditions, workers with low marginal productivity cannot be dismissed or otherwise eliminated. However, unemployment is not obvious because it is disguised. Workers are underemployed

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Table 7.3 Proportion of labour and capital in total input cost in Indonesian agriculture, 2008

Sector	Proportion of labour	Proportion of capital
1 Paddy	0.45	0.01
2 Maize	0.45	0.01
3 Other cereals	0.50	0.01
4 Vegetables, fruit, nuts	0.53	0.01
5 Other crops	0.49	0.01
6 Rubber	0.46	0.03
7 Sugarcane	0.41	0.04
8 Coconut	0.37	0.04
9 Oilseeds	0.32	0.03
10 Tobacco	0.29	0.02
11 Coffee	0.33	0.04
12 Tea	0.50	0.05
13 Cloves	0.43	0.05
14 Fibre crops	0.41	0.04
15 Other estate crops	0.34	0.03
16 Other agriculture	0.43	0.04
17 Livestock	0.41	0.09
18 Ruminant meat	0.26	0.06
19 Non-ruminant meat	0.30	0.07
20 Forestry	0.28	0.20
21 Fishing	0.21	0.08

Source: IndoLab database, calculated from 2008 input-output tables and 2005 social accounting matrix.

rather than unemployed. They would work more intensely or longer if there were more demand for their produce.

Finally, primary agricultural production is tied to land. For most types of production, land can be switched from one crop to another. Thus, a fall in sugar prices does not mean sugar producers become unemployed. They can switch to another crop, such as maize, within a season. Producers of tree crops such as rubber and coffee are not so flexible, however.

One approach to estimating changes in the use of labour in response to trade liberalization is to assume that labour use changes with output according to the share of labour in output. The labour-output ratios in table 7.4 are helpful in this regard. However, the limitation of this approach is that the labour-output ratios may not remain constant. If differential tariff changes lead to differing demand for labour-intensive and capital-intensive goods, the prices of capital and labour may change. In these circumstances it is reasonable to expect a change in the use of capital relative to labour. The question is: by how much? Estimates of the elasticity of substitution

Table 7.5 Elasticities of substitution

Product	Elasticity
Primary factors	0.5
Types of labour	0.0
Armington	Various (approximately 2)*

*The model uses the GTAP Armington estimates.
Source: IndoLab database.

between factors are shown in table 7.5.¹ An elasticity of 0.5 means that a 1 per cent change in the capital–labour price ratio leads to a one-half per cent change in the use of capital relative to labour. Low elasticity suggests that capital and labour ratios are not very sensitive to price, and, thus, changes in output are a good guide to changes in employment. There is no substitution between different types of labour; it is assumed that farmers do not become professionals or even operators, regardless of the changes in relative wages. This is indicated by the zero elasticity shown in table 7.5.

The Armington elasticity of substitution shows the willingness of consumers to switch between domestic and imported goods when import prices change. These estimates vary according to the extent to which products are differentiated, in the view of consumers, between countries of origin. Relatively homogeneous products such as sugar would be expected to be very substitutable and hence have a high Armington elasticity.

Given that use of capital and labour responds to some extent to changes in prices, it is useful to use a modelling approach that attempts to accommodate these changes. A computable general equilibrium (CGE) model is one such approach that combines input–output tables with responsiveness to prices.² It has several other advantages over simpler approaches. First, a CGE model is able to produce, factually and accurately, a more complete economic interpretation than a partial model can. For example, a rise in prices can turn a nominal wage increase into a real wage fall, reversing the policy implications. Second, it enforces consistency. For example, consumers cannot spend more than they earn, and producers cannot employ more workers than exist. Third, the impacts on various aspects, such as welfare, terms of trade, and the distribution of income and poverty, can be explored. The main disadvantage is the cost of developing the model and the loss in transparency. Since the authors have available a single-country CGE model with a focus on Indonesian agriculture, there is little reason to use a simpler approach. The model is described next.

¹ Unfortunately, these estimates are not specific to Indonesia but rather are those commonly used in general equilibrium modelling.

² A discussion of the relative merits of partial equilibrium modelling, social accounting matrices, and general equilibrium modelling approaches can be found in chapter 1 of this book.

7.2.1 *The IndoLab CGE model*

The Indonesian CGE model used here, IndoLab, is a variation of the well-known ORANI model, an updated version of the WAYANG general equilibrium model of the Indonesian economy (Warr, 1998), and INDOF, an Indonesian forecasting model (Oktaviani, 2001; Oktaviani, 2009). IndoLab expands the labour equation not only to include four types of labour (farmer, operator, administrator, and professional), but in addition each type of labour is further divided into paid and unpaid labour in rural and urban areas. It is important to include unpaid labour, especially for the agricultural sector. The model has recently been updated for this application.

The model is based on the 2008 Indonesian input–output (IO) tables and the 2005 social accounting matrix (SAM) published by the Indonesian Central Bureau of Statistics. Other data required for the general equilibrium model include various elasticity and other behavioural parameters. The elasticity parameters used in the model are the Armington elasticities, the substitution elasticities for labour and for primary factors, the export elasticities, and the demand–expenditure elasticities.

The SAM is used as base data for household and labour disaggregation. For labour data in particular, the IO data that cover all paid labour should be adjusted within the SAM to account for unpaid labour. This has been done by using the shares of paid labour, unpaid labour, and capital from the SAM to adjust the database. The IndoLab model includes 48 producer goods and services produced by 48 corresponding sectors. Of these, 25 sectors relate directly to agriculture. Many of the other sectors provide inputs into agricultural production. The microeconomic behaviour assumed is competitive profit maximization on the part of all firms and utility maximization by consumers. The markets for final outputs, intermediate goods, and factors of production are all assumed to clear at prices that are determined endogenously within the model.

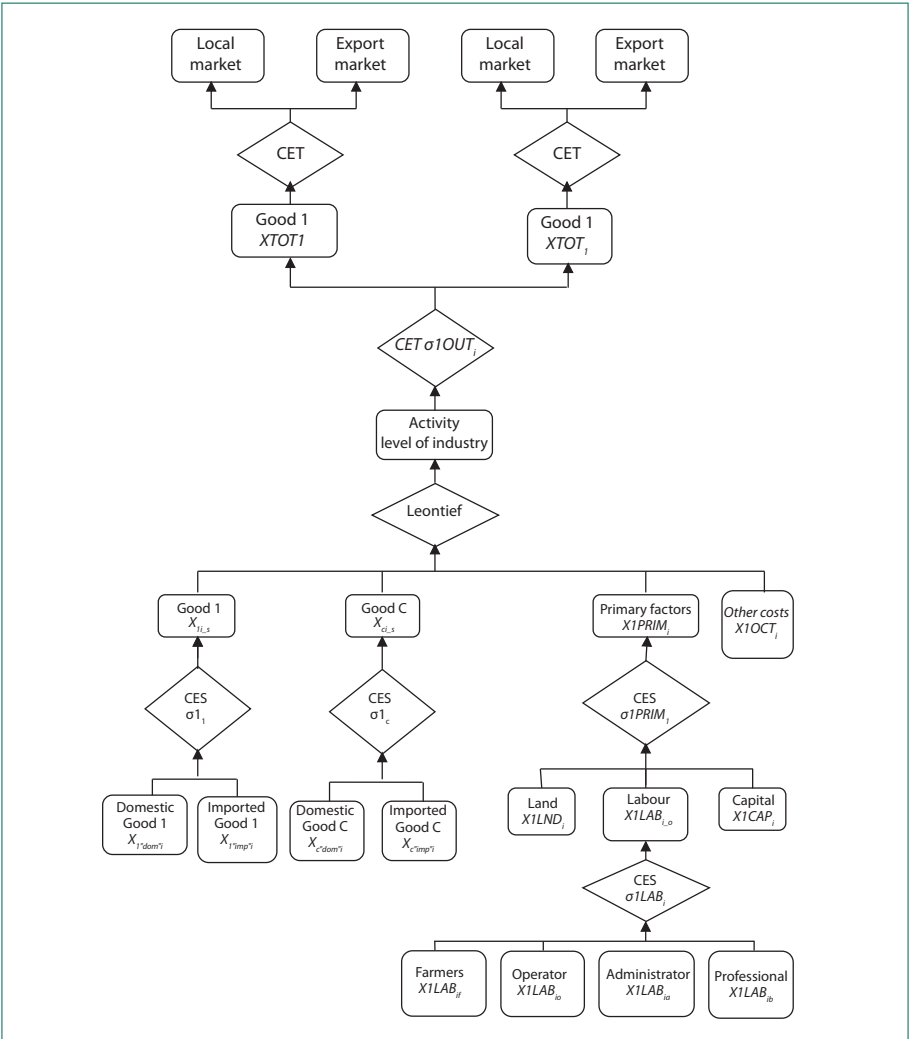
The nominal exchange rate between the rupiah and the US dollar can be thought of as being fixed exogenously. The role within the model of the exogenous nominal exchange rate is to determine, along with international prices, the nominal domestic price level. Exchange rates do not adjust to maintain a trade balance. Households are divided into ten different types (the same as in the SAM), and so implications about income distribution, poverty, and inequality can be drawn.

The structure of production in a given industry is depicted in figure 7.3. In the production process each industry can produce several commodities. Each industry selects inputs of primary factors (labour, capital, and land) and materials to minimize the cost of producing its output. Material (intermediate) inputs can be obtained domestically or imported. Key simplifying assumptions made in this production model include input–output separability and multi-stage decision-making. Producers first decide the level of output, then the level of inputs, and finally the source of inputs and the combinations of primary factors. Substitution between inputs is based on constant elasticity of substitution (transformation) production functions, except for the combining of intermediate goods and aggregate primary factors, a stage which uses the Leontief, or fixed proportions technology.

The assumption of input-output separability means that the production of a combination of products by an industry is not directly linked to the particular combination of inputs used (Blackorby et al., 1978). Similarly, product prices have no effect on input combinations except through their effect on the level of activity in the industry. This constitutes a substantial empirical simplification.

The multi-stage decision process implies that the demand for inputs at any given level can be expressed as a function of the prices of inputs at that level and need not be expressed as functions of the prices of inputs at lower levels in the

Figure 7.3: Production structure in the IndoLab CGE model



Note: CES=constant elasticity of substitution; CET= constant elasticity of transformation.

hierarchy. As indicated in figure 7.3, at the highest level of the input function, the commodity composites, a primary factor composite, and an “other cost” are combined using a Leontief, or fixed-proportions production function. In this production function there is no substitution among inputs. Detailed equations for each block can be seen in Wittwer (1999) and Oktaviani (2001).

This structure, together with further assumptions about firm behaviour and market structure, determines the demands for labour, other primary factors, and intermediate inputs and the supply of commodities by industry. The market structure is assumed to be competitive. That is, the representative firm for each industry/product has been modelled as if it were a price-taking, profit-maximizing firm, with prices determined so as to clear all markets. Production for own consumption, that is, self-sufficiency, can be treated as a farmer selling to himself or herself, but, if the transaction does not enter into the national accounts, it is not recorded. The demand for labour of a particular occupational type is proportional to the overall labour demand in the industry. It will depend on the price of the particular type of labour relative to the “average” price of labour in that industry. This occupational labour demand function is derived by minimizing the total cost of labour, subject to the CES aggregation function for labour (see Box 7.1).

Assumptions about factor mobility are important in CGE modelling. The equations and variables in the IndoLab CGE model, following the WAYANG model, allow labour and capital to be mobile between industries and the fixed quantity of land. The degree of mobility is determined by the elasticity of substitution between primary goods (labour and capital), which is assumed to be the same in all industries. This means that changes in wage rates and the price of capital will differ in different industries.

The model uses the standard closure that assumes that the supply of labour is fixed. This refers to the total supply of formal (paid) labour by households, the supply of informal (unpaid) labour supplied to agriculture sectors by household, and the supply of informal (unpaid) labour supplied to non-agricultural sectors by households.

In the trade liberalization scenarios, we first run a simulation with a global general equilibrium model, GTAP (Hertel, 1997), to determine the price changes that are then passed to the Indonesian general equilibrium model. This takes account of the interaction between Indonesia and the world economy. The GTAP model is linked with IndoLab, which is more detailed in terms of agricultural product, household, and labour aggregations. The concordance between the two models is shown in annex table A7.2.

We run two trade liberalization scenarios and four labour market policy scenarios. These are listed in table 7.6.

The first scenario is the ASEAN–China free trade agreement (ACFTA) with exemptions for highly sensitive products. In other words, all the existing 2007 tariffs on goods traded between ASEAN and China are removed, with the exception of the highly sensitive track tariffs, which are capped at 50 per cent. Each ASEAN member has a different list of exemptions. Indonesia has 47 exemptions, most notably

Box 7.1: Technical specification of demand for labour

Labour is classified into four occupations (farmer, operator, administrator, and professional). The equations for labour use (following Wittwer, 1999) are derived from the following optimization problem:

Choose inputs of occupation-specific labour, $X1LAB(i,o)$, to minimize total labour cost:

$$\sum(o, OCC, P1LAB(i,o)*X1LAB(i,o))$$

where $P1LAB(i,o)$ is the price of labour type o used in industry i , and $X1LAB(i,o)$ is the quantity of various types of labour. The combination of labour making up $X1LAB_O(i)$ is specified by a CES function:

$$X1LAB_O(i) = CES[All,o,OCC: X1LAB(i,o)]$$

Note that the problem is formulated in the levels of the variables. The solution of this problem, in percentage-change form, is given by the equations E_{x1lab} and E_{p1lab_o} . The first of the equations indicates that demand for labour type o is proportional to overall labour demand, $X1LAB_O$, and to a price term. In change form the price term is composed of an elasticity of substitution, $\Sigma 1LAB(i)$, multiplied by the percentage change in a price ratio, $[p1lab(i,o)-p1lab_o(i)]$, representing the wage of occupation o relative to the average wage for labour in industry i . Changes in the relative prices of the occupations induce substitution in favour of relatively low-cost occupations.

The percentage change in the average wage, $p1lab_o(i)$, is given by the second of the equations. This could be rewritten as:

$$p1lab_O(i) = \text{sum}\{o,OCC, S1LAB(i,o)*p1lab(i,o)\}$$

if $S1LAB(i,o)$ were the value share of occupation o in the total wage bill of industry i . In other words, $p1lab_O(i)$ is a Divisia index of the $p1lab(i,o)$.

It is worth noting that, if the individual equations of E_{x1lab} were multiplied by corresponding elements of $S1LAB(i,o)$ and then summed together, all price terms would disappear, giving:

$$x1lab_O(i) = \text{sum}\{o,OCC, S1LAB(i,o)*x1lab(i,o)\}$$

Hence, this is the percentage-change form of the CES aggregation function for labour.

Table 7.6: Trade liberalization and labour market scenarios

Scenario	Label	Description
1	FTA	ASEAN–China FTA, as negotiated
2	Doha	Likely Doha outcome
3a	Productivity Ag	Enhanced labour productivity in agricultural sector
3b	Productivity Non-Ag	Enhanced labour productivity in non-agricultural sector
4a	Skills Ag	Increased skilled labour force in agricultural sector
4b	Skills Non-Ag	Increased skilled labour force in non-agricultural sector

in chapters 10 (rice), 17 (sugar), 22 (alcohol), 64 (footwear), and 87 (motor vehicles) (ASEAN Secretariat, 2006). Indonesia is currently renegotiating its highly sensitive list. This involves removing some items and replacing them with others. Indonesia must obtain agreement from China before the list can be revised.³ The base and final tariffs are shown in table 7.7.

China has 101 items on its highly sensitive list. The main items are in chapters 10 (rice), 11 (maize), 15 (oils), 17 (sugar), 24 (tobacco), 40 (rubber), 44 (wood products), 48 (paper products), 52 (cotton), and 87 (motor vehicles). Tariffs on these items are reduced, but not to zero.

From the perspective of Indonesian agriculture, the most significant tariffs, on rice and sugar, remain unchanged as a result of the agreement. The most significant reductions occur in beverages and tobacco, and textiles.

The second scenario, Doha, uses a likely WTO Doha outcome to determine the effects on Indonesian agriculture. The Doha negotiations have not yet been completed. The reforms are taken from the chairman's draft modalities paper of December 2008 (WTO, 2008a; WTO, 2008b). For agriculture the modalities call for linear cuts within bands. For developing countries such as Indonesia, the bands are the following ranges of tariff rates: 1) 0 to 29 per cent, 2) 30 to 79 per cent, 3) 80 to 129 per cent, and 4) 130 per cent and above. Within these four bands, the cuts are 33, 38, 43, and 47 per cent, respectively, with the higher initial tariffs attracting higher percentage cuts. Countries can select four per cent of their products as sensitive, subject to a cut of only one-third of the formula. It is not known which products each of the WTO member countries might chose as sensitive. The approach used here to model the scenario is to select the four per cent of products that have the highest tariff revenue. Tariff revenue is the product of the applied tariff rate and the trade flow. For Indonesia the sensitive products of greatest significance include sugar (HS codes 170199, 170111, and 170112), mixtures of odoriferous substances (330210), food preparations not elsewhere specified (210690), rice (100630), spirits (220820), and wheat (100190). A more detailed list appears in annex table A7.1.

For non-agricultural products in the Doha Round, the modalities call for tariff reductions based on the so-called Swiss formula. This is a non-linear formula that reduces higher tariffs by a greater proportion than lower tariffs. The formula also specifies a maximum final tariff, which for developed countries is 8 per cent. For developing countries the choice is between maximum tariffs of 20, 22, and 25 per cent. Countries that choose the more stringent parameter, i.e. 20 or 22, can designate 5 or 10 per cent of their products for more lenient treatment of tariff reductions. Here, Indonesia is assumed to choose 22 per cent, and 10 per cent of its industrial tariffs are reduced by half the cuts specified in the formula.

³ To date, these negotiations have not been successful.

Table 7.7 Base and final Indonesian and Chinese bilateral tariffs

Sector	Indonesian tariffs on imports from China (%)		Chinese tariffs on imports from Indonesia (%)	
	Base	Final	Base	Final
Rice	20.0	20.0	0	0
Other cereals	1.2	0	0	0
Oilseeds	4.9	0	5.2	0
Vegetable oils and fats	0.7	0	2.6	0
Sugar	35.1	35.0	7.0	0
Vegetables, fruit ,and nuts	5.0	0	7.4	0
Other crops	4.7	0	7.2	0
Livestock	4.7	0.1	2.9	0
Forestry	5.1	0	5.8	0
Fishing	4.9	0	2.8	0
Petroleum and coal products	2.3	0	0.8	0
Ruminant meat	5.2	0.1	6.2	0
Non-ruminant meat	4.9	0	3.8	0
Other processed agriculture	5.8	0	6.8	0
Beverages and tobacco	28.3	2.3	11.6	0
Textiles and apparel	10.2	0.3	7.1	0
Chemicals	5.6	0.1	8.3	2.9
Metal manufactures	6.6	0.1	3.8	0
Wood and paper products	5.8	0.6	3.1	0.2
Manufactures	6.3	1.0	6.1	0

Source: GTAP version 7 database and authors' calculations.

The modified tariff reductions for sensitive agricultural and non-agricultural products are applied to all WTO members, not only Indonesia.

The trade liberalization scenarios involve reducing border prices taken from the GTAP simulation described earlier. The shocks to import and export prices for the two scenarios are shown in table 7.8.

Labour programmes that enhance skills may prove beneficial if there is increased demand for goods that require a large input of skilled labour. Such programmes may be ineffective, however, if tariff changes increase demand for goods that are produced primarily by unskilled labour. An alternative approach is to improve labour productivity. These programmes show beneficial effects, but the benefits do not accrue solely to the workers. Much of the benefit may go to owners of capital and land and to domestic and foreign consumers. In fact, the situation of some types of workers may worsen as a result.

The third scenario, Productivity, assumes a hypothetical 1 per cent increase in productivity of the Indonesian labour force (skilled and unskilled). This scenario is

Table 7.8: Relative changes to Indonesian border prices in trade liberalization scenarios

Sector	ACFTA Export price (% change)	Import price (% change)	Doha Export price (% change)	Import price (% change)
Rice	0.9	0.46	1.06	5.78
Other cereals	0.81	0.05	0.54	-0.27
Oilseeds	1	-1.98	0.96	1.68
Vegetable oils and fats	0.77	-0.16	0.14	0.28
Sugar	0.91	0	0.22	0
Vegetables, fruit, and nuts	0.86	-0.15	0.71	-0.03
Other crops	0.69	0	0.59	-0.39
Livestock	0.52	-0.28	0.48	-0.56
Forestry	0.78	-0.27	0.67	0.05
Fishing	1.14	0.09	1.13	0.24
Petroleum and coal products	0.20	-0.18	0.21	0.12
Ruminant meat	0.55	0	0.27	0
Non-ruminant meat	0.63	0.26	0.79	1.78
Other processed agriculture	0.44	-0.61	0.41	0.22
Beverages and tobacco	0.22	-0.57	0.24	-1.3
Textiles and apparel	-0.37	-3.18	-0.19	-0.45
Chemicals	0.29	-0.35	0.32	-0.02
Metal manufactures	0.22	-0.57	0.29	-0.07
Wood and paper products	-0.01	-1.19	0.23	0.01
Manufactures	-0.03	-0.81	0.15	-0.37

Source: GTAP simulation.

in two parts. The first, Productivity Ag, examines a labour productivity increase in the agricultural sector. The second, Productivity Non-Ag, focuses on the industrial sector; the intention here is to show how agricultural workers are affected by productivity changes outside their sector. In these two scenarios the source of the productivity improvement is not specified, but it could be driven by expenditure on research and development or by some technological improvement, such as mobile phones or genetically modified crops. It is assumed that the improvement is externally funded, for example, by an aid agency. Alternatively, it could be funded through foreign capital that introduces new technology.

The final two scenarios, Skills Ag and Skills Non-Ag, involve increasing the number of skilled workers by one per cent and decreasing the number of unskilled workers accordingly (-0.02 per cent for agriculture-only and -0.57 per cent for non-agriculture). The difference in the changes reflects the lesser number of skilled workers in the agricultural sector.

7.2.2 Analysis and findings

The macro results for the six scenarios are shown together in table 7.9. The first observation is that the changes in GDP are rather small in the trade liberalization scenarios – in fact, almost negligible. This is because these scenarios, as negotiated, involve very little liberalization of applied, as distinct from bound, tariff rates. However, the Doha scenario involves tariff reductions in many other countries, and this raises world prices and the cost of Indonesian imports. In the ACFTA scenario liberalization undertaken in each country drives the impacts to a greater extent. Second, in four scenarios, ACFTA, Productivity Ag, Productivity Non-Ag, and Skills Non-Ag, inflation (i.e. increase in the consumer price index) has an important impact on real, as opposed to nominal, GDP. In the trade liberalization scenarios, the changes in import and export prices drive the changes in inflation. The labour market scenarios increase GDP partly by reducing the costs of production, which has no impact on import prices. A programme of increasing productivity in the non-agricultural sector shows a much greater increase (0.27 per cent) in real GDP than the agricultural productivity scenario (0.04 per cent), merely because the productivity increase is applied to a much larger sector. The changes in GDP are positive because, by assumption, the productivity increase comes at no cost. Likewise, skills enhancement in the agricultural sector has no cost, in the modelling, at least. However, the impact on GDP, 0.00 per cent, is negligible because a reduction in unskilled labour offsets the increase in skilled labour.

The interest in each of these scenarios is in how different types of labour may be affected. Table 7.10 presents employment changes by sector for each scenario. The simulated price changes also produce results in terms of real wage changes. Weighted-average changes in real wages by type of occupation are summarized in table 7.11 for all scenarios. The real wage changes by type of occupation are not the same across sectors because of the assumption concerning the less than perfect mobility of labour.

Table 7.9: Changes in gross domestic product (GDP) and prices, all scenarios

Scenario	Real GDP (% change)	Consumer price index (% change)	Export price index (% change)	Import price index (% change)
ACFTA	0.02	-0.02	0.00	-0.29
Doha	0.00	0.13	0.08	0.01
Productivity Ag	0.04	-0.07	0.00	0.00
Productivity Non-Ag	0.27	-0.07	-0.11	0.00
Skills Ag	0.00	0.00	0.00	0.00
Skills Non-Ag	0.00	-0.04	0.00	0.00
ACFTA, including rice and sugar	0.02	-0.01	0.00	-0.29

Source: IndoLab model simulations.

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Table 7.10 Changes in Indonesian employment by sector, all scenarios

Sector	Baseline employment (persons)	FTA scenario	Doha scenario	Productivity Ag scenario	Productivity Non-Ag scenario	Skills Ag scenario	Skills Non- Ag scenario	FTA including rice and sugar
		%	%	%	%	%	%	%
Paddy	3,241,780	0.05	0.13	-0.47	0.00	0.00	0.00	0.06
Maize	1,146,245	0.03	-0.11	0.21	-0.10	-0.01	-0.02	0.03
Other cereals	434,155	0.06	-0.11	0.17	-0.07	-0.01	0.03	0.06
Vegetables, fruits and nuts	4,721,878	-0.36	0.19	0.35	-0.21	-0.01	0.04	-0.37
Other crops	26,179	0.01	-0.12	0.32	-0.20	-0.01	-0.01	0.00
Rubber	1,769,941	0.07	-0.08	-0.35	0.27	0.00	-0.06	0.07
Sugar cane	354,935	0.01	-0.20	0.14	0.08	0.00	-0.10	0.24
Coconut	390,133	0.17	-0.05	0.09	0.04	0.00	-0.04	0.17
Oilseeds	1,956,504	0.25	0.00	-0.04	0.23	0.00	-0.14	0.25
Tobacco	108,237	0.06	-0.13	-0.04	0.01	0.00	-0.04	0.06
Coffee	244,225	-0.01	-0.29	0.46	-0.31	0.00	-0.01	-0.02
Tea	44,294	-0.04	-0.06	-0.10	0.08	0.00	-0.06	-0.05
Cloves	75,422	0.08	-0.15	-0.01	0.16	0.01	-0.10	0.08
Fibre crops	12,880	-0.23	-0.39	0.46	-0.29	0.01	-0.07	-0.24
Other estate crops	313,784	-0.01	-0.31	0.40	-0.28	0.02	-0.04	-0.02
Other agriculture	758,169	0.05	0.02	-0.14	0.05	0.00	-0.02	0.05
Livestock	1,766,232	0.02	-0.13	0.17	-0.06	-0.01	0.01	0.01
Ruminant meat	1,398,080	0.01	-0.11	0.07	0.01	-0.01	0.08	0.00
Non-ruminant meat	3,007,255	0.08	-0.07	-0.15	0.10	0.00	0.09	0.07
Forestry	552,779	0.05	0.07	-0.22	0.42	0.02	-0.15	0.05
Fishing	1,376,457	0.11	-0.07	0.11	-0.10	0.00	0.02	0.10
Petrol and coal products	1,789,001	-0.03	0.04	-0.03	-0.07	0.02	-0.28	-0.03
Other mining	694,747	-0.03	-0.02	0.04	0.01	0.01	-0.35	-0.03
Food products	778,743	0.04	-0.17	0.24	-0.26	0.00	-0.33	0.03
Vegetable oils and fats	1,631,659	0.61	0.12	0.29	-0.23	-0.01	-0.31	0.60
Rice	732,297	0.08	0.17	0.15	-0.30	0.00	-0.25	0.10
Flour	649,622	0.07	-0.14	0.06	-0.21	0.00	-0.34	0.07
Sugar	135,360	0.03	-0.18	0.42	v0.29	0.00	-0.29	0.28
Other processed agriculture	1,185,472	-0.10	-0.01	0.24	-0.34	0.00	-0.24	-0.11
Beverages and tobacco	744,526	0.10	-0.10	0.06	-0.13	0.00	-0.33	0.09
Textiles and apparel	2,616,193	-0.93	-0.28	-0.08	0.05	0.00	-0.38	-0.94
Wood and paper products	2,624,251	0.18	0.15	-0.02	0.03	0.00	-0.44	0.17
Fertilizer and pesticides	795,518	0.03	0.05	-0.15	0.08	0.00	-0.33	0.04
Chemicals	1,756,761	-0.28	-0.05	0.00	0.00	0.00	-0.27	-0.28
Refinery oil	4,062,928	0.03	-0.06	-0.10	0.00	0.00	-0.40	0.03
Rubber and plastics	1,419,021	0.18	-0.06	0.13	-0.12	0.00	-0.20	0.18
Cement	273,438	0.03	0.01	0.02	0.08	0.00	-0.35	0.03
Metal manufactures	495,017	-0.53	0.10	-0.07	-0.01	0.00	-0.34	-0.53
Machinery	2,605,280	0.11	-0.03	-0.07	0.07	0.00	-0.32	0.11
Transport equipment	2,312,863	0.13	0.01	-0.10	0.10	-0.01	-0.18	0.13
Manufactures	3,541,688	-0.18	-0.11	-0.07	0.12	-0.01	-0.31	-0.18
Utilities	1,782,332	-0.08	-0.02	-0.01	-0.01	0.01	-0.09	-0.08
Construction	11,530,207	0.07	0.06	0.04	-0.07	0.00	-0.36	0.07
Trade	7,406,854	-0.04	0.01	-0.03	0.01	-0.01	0.54	-0.04
Hotel and restaurant	2,569,432	-0.03	-0.07	0.06	-0.11	-0.01	0.72	-0.03
Transport and communications	5,514,446	0.12	0.06	-0.07	0.25	0.00	0.02	0.12
Business services	3,966,073	-0.11	-0.03	-0.02	0.12	0.01	0.52	-0.11
Services nes	15,220,162	0.04	0.01	0.02	-0.03	0.01	0.18	0.04

nes=not elsewhere specified

Table 7.11 Changes in Indonesian real wages, all scenarios

Scenario	Farmer (% change)	Operator (% change)	Administrative (% change)	Professional (% change)
ACFTA	0.03	-0.16	0.09	1.51
Doha	0.28	-0.12	-0.28	1.14
Productivity Ag	-1.48	0.27	0.37	-0.91
Productivity Non-Ag	0.76	-0.60	-0.89	0.40
Skills Ag	0.04	0.02	0.08	-0.46
Skills Non-Ag	0.04	1.17	-1.78	3.83
ACFTA, including rice and sugar	0.04	-0.16	0.08	1.51

Source: IndoLab model.

Note: The real wage changes by occupation above are the weighted average real wage changes across sectors.

7.2.2.1 ACFTA scenario

In the ACFTA scenario Indonesia experiences a slight increase in GDP as a result of the liberalization that the free trade agreement undertakes. There is no gain in export prices, but import prices fall. This puts downward pressure on domestic producers who are competing with specific imports. However, the economy-wide effects are slight. With respect to agricultural labour markets, all four occupations experience a gain in real wages, although administrative and professional workers gain much more than farmers and operators. This reflects the differing extent to which these types of workers are used in the different industries.

7.2.2.2 Doha scenario

In the Doha simulation farmers, who make up the bulk of agricultural sector workers, are slightly better off in real terms. Under this scenario Indonesia makes few reductions in its agricultural tariffs because of its sensitive product provisions. In contrast to the ACFTA scenario, the main effect of Doha is to raise import costs as a result of cuts in protection in other countries. The import price index rises slightly (0.01 per cent) rather than falling, as in the ACFTA scenario. The consumer price index rises and converts nominal wage increases into real wage decreases under this scenario. Farm wages rise because of increases in the output of sugar cane and refined sugar. However, the change in demand for labour in the sugar sector is -0.2 per cent. As table 7.8 showed, there is no change in import prices for sugar because the 35 per cent tariff remains unchanged, as sugar is classified as a sensitive product.

7.2.2.3 Productivity scenarios

A programme that increases productivity in the agricultural sector by one per cent generally increases output in each agricultural sector and increases real GDP. However, the simulation results show that increased output drives down the output price, and the fall in prices more than offsets the increase in output. In the simulation results,

as the value of agricultural production falls, the wages of farmers fall with it by 1.48 per cent. Falls in paddy and rubber prices drive this reduction. Farmers have limited scope for other activities, and the increase in productivity of agricultural labour effectively drives down their wages. In addition, the increase in labour productivity is associated with a fall in employment of farmers in primary agriculture. For other types of labour, real wages increase.

Declining returns following a supply increase stem from the low elasticity of demand. This is the intuition behind cartels or so-called “commodity agreements”, in which countries hold back supply to maintain prices. This negative result might seem to suggest that farmers should not seek to improve productivity, as returns tend to fall if consumers are not very responsive to price falls. Over time, however, it is important to maintain productivity growth. Otherwise, costs and prices will rise, and consumers will eventually seek alternative sources (i.e. imports) or substitutes (e.g. synthetic rubber).

A programme of increasing productivity in the non-agricultural sector has the opposite effect on output prices and wages. In most sectors agricultural output prices rise rather than fall. This increases the value of production with little change in inputs. In the simulation results, the demand for most types of labour falls, with a reduction in real wages. However, the real wages of farmers increase. Increases in productivity in downstream processing raise the demand for raw materials – coffee (0.42 per cent) and fibre crop (0.32 per cent), in particular. Because these products are labour-intensive, farmers producing these crops benefit from real wage increases of 0.49 and 0.46 per cent, respectively.

The two productivity scenarios illustrate that, while productivity gains are beneficial to the economy as a whole, the gains are not totally captured by producers. Furthermore, the situations of some groups in society will worsen as a result.

7.2.2.4 Skills scenarios

Increasing the number of skilled labourers has little impact on real GDP, and improving skills in the agricultural sector alone has no perceptible impact at the national level. Improving skills has effects like those of a productivity improvement, as modelled in the Productivity Ag and Productivity Non-Ag scenarios. In the skills scenarios, however, the benefits go to producers using skilled intensive labour as opposed to unskilled labour. In fact, there is a decrease in unskilled labour. At the macro level the increased productivity lowers the cost of production but not necessarily the consumer price index, as shown in table 7.9.

At the sectoral level the increase in skilled labour and the decrease in unskilled labour affect different industries to different degrees, depending on their use of these factors. Agriculture employs a high share of unskilled workers, and, as a result, output in most agricultural industries falls. Most industries in the industrial sector also experience a slightly decreased output, although the negative impact is somewhat less than in the agricultural sector. The beneficiaries are in the services sector, such as hotels and restaurants, and in “other services”, which tend to employ more skilled labour.

Table 7.12 Baseline and changes in Indonesian employment following trade liberalization, ACFTA and Doha scenarios

	Farmer	Operator	Administrative	Professional
Baseline number employed	22,756,000	47,508,000	29,045,000	3,224,000
Change under ACFTA	1.371%	3.860%	0.826%	0.124%
Change under Doha	1.339%	1.804%	0.330%	0.049%

Source: IndoLab model.

The impact on real wages of improving skills is mixed. The additional supply of skilled workers leads to a decline of 0.46 per cent in the real wages of professional workers (table 7.11). Aggregate payments to these skilled workers fall slightly, even though the number of skilled workers has increased. Operator and farmer wages rise slightly, and aggregate payments also rise.

7.2.2.5 Changes in employment

Changes in employment between sectors following trade liberalization are shown in table 7.12. Total (baseline) employment by type of labour is assumed to be fixed. In each case the total churn is less than one per cent. The Doha scenario generates only half the structural change of the ACFTA, although farmers are affected to a similar degree.

7.3 IMPLICATIONS AND CONCLUSIONS

Labour use tends to move in line with output, so the effects of changes in trade on output are a fairly reliable guide to employment changes. However, the effects of trade on real wages depend also on the rate of inflation. Thus, a general equilibrium model is valuable because it captures some of these macroeconomic effects. In some instances real and nominal effects can have opposite signs, reversing the policy implications. Changes in employment also depend on the assumed rates of substitution between factors of production. Primary agriculture has the advantage of high substitutability between various crops. Annual crops, such as either rice or maize, can be grown on the same land.

The trade liberalization scenarios predict only a limited impact on Indonesian agricultural wages and sectoral output and employment, principally because tariffs on rice and sugar are exempt from reductions.

A problem for policy-makers is how to increase labour productivity without inducing a reduction in employment or real wages. A productivity gain, for example due to a technological improvement, should always be beneficial for the economy. Increases in agricultural productivity are considered particularly beneficial because they increase the income of the rural poor. However, the distributional effects of in-

creasing productivity are uncertain, as some of the benefits flow to consumers and owners of land and capital rather than to producers. Consumers capture some of the benefits of increased productivity of agriculture because increasing production lowers prices. With a low elasticity of demand, the fall in prices more than offsets the revenue gained from an increase in production, and the returns to farmers may fall, as illustrated in the productivity scenarios. This raises the question of where productivity improvements should be focused – on farm production, on processing agriculture production, or at the marketing end of the chain. The distribution of the benefits depends on the exact nature of the improvement – for example, whether it is labour-saving or capital-saving. If technology favours skilled workers, the gap in wages between the skilled and the unskilled will increase over time. Furthermore, some of the benefits may flow to overseas consumers.

Increasing productivity in the non-agricultural sector benefits farmers by lowering the cost of their purchases. Hence, real wages increase.

Training that enhances skills has complex consequences. While raising the productivity of the individuals involved, it also increases the supply of skilled workers, putting downward pressures on the real wages of all workers in this category. At the same time, there is upward pressure on the real wages of unskilled workers. In other words, the benefits are not limited to those undergoing the training.

Our data are not sufficiently detailed to predict where skills shortages might occur, certainly not in response to trade liberalization likely to take place in the medium term. The ongoing transformation of the Indonesian economy towards services implies that skills training in these areas is likely to be beneficial.

The estimated changes in employment, along with other results presented here, are based on a static analysis, which ignores the time period over which the tariff or productivity changes would be phased in. Over that time the Indonesian economy would grow considerably, perhaps by 30 per cent over six years. This implies that contractions in output shown in some sectors would be more than offset by continued growth. Adjustment in a growing economy is much easier to accommodate than in a constant or shrinking one. Thus, the costs of adjustment may be less than these static results suggest. Nonetheless, if the products are divided finely enough, there are bound to be some producers who will be made worse off by trade liberalization in spite of the growth in the economy.

One aspect of the picture that could be usefully explored is the degree of substitution of labour between alternative occupations, industries, and regions. The modelling uses an elasticity of 0.5. Further work would show, first, whether the results are sensitive to this elasticity, and econometric work trying to measure it could be undertaken. Certainly, the key to structural adjustment is the ability to switch capital and labour from one sector to another. It is easy to see that greater mobility has an advantage, but mobility comes at a cost. This cost relates to the degree of specialization. While it is more productive to use specialized labour working with specialized equipment, this can be a disadvantage if the demand for the output is falling, as the cost of acquiring skills may not be rewarded.

One limitation of the analysis is unobserved variations in the intensity of effort that are not measured in the data. A farmer can work longer hours or more intensely for the same number of hours when there is an increase in demand for labour. These changes go unobserved because of disguised unemployment, but they reflect a reality at odds with our assumption of a fixed supply of labour. This implies that the changes in wages we report may be overestimated, because some of the adjustment occurs in unobserved changes in the supply of labour.

Modification of the closures might also be revealing. The standard closure assumes the total supply of formal labour by households, informal labour supply to agriculture by households, and informal labour supply by households to non-agriculture are fixed, and so all the adjustment occurs in relative wages. An alternative assumption is that wages are fixed, or at least that they cannot fall, and, thus, the adjustment occurs in the level of total employment. This modification is not undertaken here, but, given that in some agricultural industries 80 per cent or more of workers are informally employed, it would be reasonable to assume that the supply of labour is not as fixed as our simulations assume.

The model could also be used as a recursive dynamic model to capture not only the investment growth and capital accumulation of each sector, but also the employment growth. The implication of training programmes could be analysed in the model for specific types of workers, such as farmers, rather than for all workers in a sector, as undertaken here.

REFERENCES

- Akhmedov, A.; Bessonova, E.; Cherkashin, I.; Denisova, I.; Grishina, E.; Nekipelov, D. 2005. *Adjustment costs of trade liberalization: Estimations for the Russian labour market* (Washington, DC, World Bank).
- Alisjahbana, A.S.; Manning, C. 2006. "Labour market dimensions of poverty in Indonesia", in *Bulletin of Indonesian Economic Studies*, Vol. 42, No. 2, pp. 235–261.
- Association of Southeast Asian Nations (ASEAN) Secretariat. 2006. *Protocol to amend the agreement on trade in goods of the framework agreement on comprehensive economic co-operation between ASEAN and the People's Republic of China* (Jakarta).
- Blackorby, C., Primont, D. and Russell, R.R. 1978. *Duality, Separability, and Functional Structure: Theory and Economic Application*. (Amsterdam, North-Holland)
- CBS. 2010. *Report of the Agricultural Census 2009* (Jakarta, Central Bureau of Statistics).
- Feridhanusetyawan, T. 1998. "The impact of trade liberalization on welfare and employment in ASEAN", *ACLAR Indonesia Research Project Working Paper* (Adelaide, Centre for International Economic Studies, University of Adelaide).
- Francois, J.; Jansen, M.; Peters, R. 2012. "Trade adjustment costs and assistance: The labour market dynamics", in M. Jansen, R. Peters and J.M. Salazar–Xirinachs (eds.): *From myths to facts* (Geneva, International Labour Office).
- Hertel, T.W. (ed.) 1997. *Global trade analysis: Modeling and applications* (Cambridge, Cambridge University Press).
- Hill, H.; Shiraishi, T. 2007. "Indonesia after the Asian crisis", in *Asian Economic Policy Review*, Vol. 2, pp. 123–141.
- Manning, C. 2000. "Labour market adjustment to Indonesia's economic crisis: Context, trends and implications", in *Bulletin of Indonesian Economic Studies*, Vol. 36, No. 1, pp. 105–136.
- Matusz, S.J.; Tarr, D.G. 1999. "Adjusting to trade policy reform", *World Bank Policy Research Working Paper*, No. 2142. Available at <http://ssrn.com/abstract=597268> [26 Sept. 2012].
- Oktaviani, R. 2001. *The impact of APEC trade liberalization on Indonesian economy and Its agricultural sector*, PhD Thesis (Sydney, University of Sydney).
- Oktaviani, R. 2009. *Impact of APEC trade liberalization on Indonesian economy* (Saarbrücken, Germany, Lambert Academic Publishing).
- Smith, J.P.; Thomas, D.; Frankenberg, E.; Beegle, K.; Teruel, G. 2002. "Wages, employment and economic shocks: Evidence from Indonesia", in *Journal of Population Economics*, Vol. 15, No. 1, 161–193.
- Warr, P.G. 1998. *WAYANG, an empirically-based applied general equilibrium model of the Indonesian economy* (Canberra, Department of Economics, Research School of Pacific and Asia Studies, Australian National University).
- Wittwer, G. 1999. (adapted from Horridge, Parmenter, and Pearson. 1998.) *WAYANG: A general equilibrium model adapted for the Indonesian economy*, Prepared for ACLAR Project no. 9449 (Adelaide, Centre for International Economic Studies).
- World Integrated Trade System (WITS). 2011. Available at <http://wits.worldbank.org/wits/> [26 Sept. 2012].
- World Trade Organization. 2008a. *Revised draft modalities for agriculture* TN/AG/W/4/Rev.4 (Geneva). Available at http://www.wto.org/english/tratop_e/agric_e/agchairtxt_dec08_a_e.pdf.
- . 2008b. *Fourth revision of draft modalities for non–agricultural market access*, TN/MA/W/103/Rev.3 (Geneva). Available at http://www.wto.org/english/tratop_e/markacc_e/namachairtxt_dec08_e.pdf.

ANNEX

Table A7.1: Indonesian sensitive products in Doha negotiations

HS code	Description	Imports (in \$m)
170199	Cane or beet sugar and chemically pure sugar	76.384
330210	Mixtures of odoriferous substances	72.444
210690	Food preparations nes	41.690
170111	Raw cane sugar excluding added flavouring	33.819
170112	Raw beet sugar excluding added flavouring	16.671
100630	Semi-milled or wholly milled rice	14.648
220820	Spirits obtained by distilling grape wine	14.213
100190	Wheat and meslin excluding durum wheat	13.942
220421	Wine of fresh grapes including fortified wine	11.436
220830	Whiskies	10.082
040210	Milk and cream in solid form	7.833
100640	Broken rice	7.639
240120	Tobacco partly or wholly stemmed	6.217
110100	Wheat or meslin flour	5.522
220410	Sparkling wine of fresh grapes	5.178
070320	Garlic fresh or chilled	4.842
220890	Ethyl alcohol of an alcoholic strength	4.703
040221	Milk and cream in solid forms of a fat	4.660
080810	Fresh apples	4.206
220300	Beer made from malt	3.888
180100	Cocoa beans whole, or broken raw, or roasted	2.926
170191	Refined cane or beet sugar	2.890
240110	Tobacco not stemmed or stripped	2.744
020230	Boneless frozen meat of bovine animals	2.600
010290	Live bovine animals excluding pure bred	2.556
220860	Vodka	2.469
220850	Gin and genever	2.439
230310	Residues of starch manufacture and similar	2.403

Source: Authors' calculations derived from the TASTE database.

7: Trade, Productivity, and Employment Linkages in Indonesian Agriculture

Table A7.2: Concordance between GTAP and IndoLab

GTAP primary products	Indolab	GTAP processed products and services	Indolab
Rice	Rice	Other processed agriculture	Food products
	Rice, processed		Flour
Other cereals	Maize	Manufactures	Other processed agriculture
	Other cereals		Refinery oil
Oilseeds	Oilseeds		Rubber and plastic
Vegetables, fruit, and nuts	Vegetables, fruit, and nuts		Manufactures
Other crops	Other crops	Wood and paper products	Wood and paper products
	Rubber	Metal manufactures	Metal manufactures
	Sugar cane		Machinery
	Coconut		Transportation equipment
	Tobacco		Textiles and apparel
	Coffee	Chemicals	Pesticides
	Tea	Business services	Chemicals
	Cloves		Construction
	Fibre crops		Trade
	Other estate crops		Hotels & restaurants
	Other agriculture		Business services
Vegetable oils and fats	Vegetable oils and fats	Transport and communications	Transport and communications
Fishing	Fishing	Services and activities nes	Utilities
Forestry	Forestry		Services nes
Livestock	Livestock		
Petroleum and coal products	Cement		
	Petroleum and coal products		
	Other mining		
Sugar	Sugar		
Non-ruminant meat	Non-ruminant meat		
Ruminant meat	Ruminant meat		
Beverages and tobacco	Beverages and tobacco		

nes=not elsewhere specified