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Trade and employment linkages in Indonesian Agriculture

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Abstract

Trade negotiators are concerned about the possible negative effects of trade liberalisation on employment in specific sectors. The agricultural sector has characteristics that make it different from industrial or service sectors. These are an informal labour force, low productivity, relative absence of regulations and a tie to land. These characteristics help the sector adjust to trade shocks.

In this application, a global computable general equilibrium model is used to determine trade shocks that are passed to a single country general equilibrium model to analyse employment and wage effects for four skills levels in Indonesian agriculture. Employment tends to move with output in the primary agricultural sector where capital-labour substitution is relatively low. However, factor substitution appears to be greater in the processed agricultural sector. The employment effects of trade shocks are quite small, with the possible exception of the highly protected sugar sector. Implications for trade and labour market policies are drawn.

JEL subject codes F16, Q17.
Key words: Indonesia, agriculture, trade, employment

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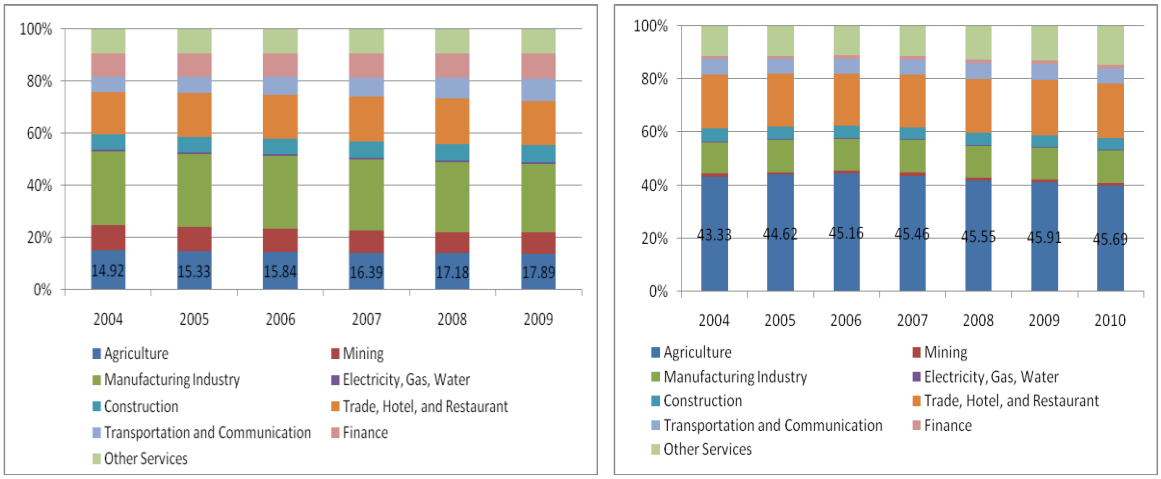
Introduction

The workforce in the Indonesian agriculture sector, as in other developing countries, is characterised by absence of regulations, low productivity, informality and surplus labour. In contrast to manufacturing, agricultural production is tied to land and the product tends to be very substitutable with the produce of competing exporters. This has implications for the impact of trade and trade liberalisation on employment and wages.

The absence of regulations implies there are effectively no minimum wage or labour standards. This means that agricultural wages are flexible downwards as well as upwards.

The agricultural sector in Indonesia employs 46 per cent of the labour force yet produces only 18 per cent of the national output in 2009 (CBS, 2010). The inconsistency between the contribution of agricultural output and employment to the economy indicates that the labour absorption has been slowly responded only slowly with the expansion of output in agriculture. Productivity is low because labour is relatively unskilled and the amount of capital used with the labour is small.

Figure 1 The Contribution of Indonesian Agricultural Output and Employment to the Indonesian Economy



(a) Sectoral Output (b) Sectoral Employment

Source: CBS, 2010

Because of the informal nature of the sector, it contains surplus labour. However, unemployment is not obvious because it is disguised. Workers are underemployed rather than unemployed. They would work more intensely or longer if there was demand for their produce.

Finally, primary agricultural production is tied to land. For most types of production the 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 within a season. Producers of tree crops such as rubber and coffee are not so flexible.

Given these characteristics, the purpose of this paper is to review the linkages between trade and employment in agriculture and discuss methods of quantifying the links. In particular, we are interested to know whether trade liberalisation might lead to unemployment or falling wages in the Indonesian agricultural sector.

Several labour market policies can assist adjustment to trade shocks. Improving the flexibility of the labour market reduces adjustment costs by keeping workers employed, reducing wage increases and lowering the costs of exports. Labour programs which enhance skills may prove beneficial if there is increased demand for skilled labour intensive goods. However, such policies may be ineffective if the tariff changes increase demand for goods that are produced primarily by unskilled labour. An alternative approach is to improve labour market productivity. These programs 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. We use a general equilibrium model to assess the potential impacts of these labour market policies on employment and wages in the Indonesian agricultural sector following the reduction of tariffs after the implementation of the China-ASEAN FTA.

One approach is to examine past episodes of liberalisation and determine what happened to trade, employment and wages. Econometric methods can help isolate cause and effect. Varying lags make estimation more difficult. Moreover, many variables are changing at the same time. These include foreign investment, technology, institutions and macroeconomic shocks.

Case studies can also be useful. Trade liberalisation following the WTO, APEC and AFTA agreements will cause resource reallocations from primary sectors such as agriculture (paddy rice and other food crops) to manufacturing sectors (resource based manufacturing). The result is related to the concept of labour market transformation from the agricultural to manufacturing sectors, and from labour surplus to labour scarcity. As the industrial development progresses and the economy moves away from 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 then the 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 the skilled and unskilled labour starts to narrow (Feridhanusetyawan, 1998). However, studies showing a fall in employment in one sector are not very helpful. Policymakers need to know the duration of unemployment and where the unemployed moved to after leaving the declining industry.

Meta-surveys of structural adjustment in the manufacturing sector (Matusz and Tarr 1999) suggest that the one-of costs of adjustment are relatively low, especially in developing countries where labour markets are more flexible.

In the minds of policy makers, it is common to think of employment being directly related to output. If this is correct, employment in agriculture can be predicted by looking at the effects of trade 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 can be used to show the changes in demand for labour following a change in output. The ratio shows the value of labour in total output at market prices (excluding taxes and subsidies). For most primary products labour contributes about 30-40 per cent of the costs. Bear in mind that wages are low in agriculture, so the ratios tend to understate the number employed.

If differential tariff changes lead to differing demand for labour intensive or 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. Estimates for the elasticity of substitution between factors are shown in table 2. However, these estimates are common across all regions and are not specific to Indonesia. The low elasticity for primary agriculture suggests capital and labour ratios are not sensitive to price and thus changes in output are a good guide to changes in employment. This conclusion doesn't hold for processed agriculture, where there is greater scope for flexibility.

Table 1 Labour output ratios in Indonesian agriculture

Sector	%	Sector	%
Paddy	13.02	Vegetable oils and fats	12.09
Maize	10.42	Rice	4.46
Other cereals	10.11	Flour	9.20
Vegetables, fruit and nuts	16.41	Sugar	8.68
Other crops	10.06	Other processed agriculture	10.07
Rubber	34.00	Beverages and tobacco	12.03
Sugar cane	23.72	Textiles and apparel	12.26
Coconut	14.39	Wood and paper products	11.36
Oilseeds	17.48	Fertiliser and pesticides	24.49
Tobacco	18.95	Chemicals	9.48
Coffee	15.70	Refinery oil	15.09
Tea	30.30	Rubber and plastics	9.43
Cloves	17.74	Cement	11.68
Fibre crops	12.44	Metal manufactures	6.18
Other estate crops	11.11	Machinery	8.17
Other agriculture	23.94	Transport equip	13.48
Livestock	16.55	Manufactures	16.90
Ruminant meat	11.96	Utilities	26.52
Non-ruminant meat	19.70	Construction	13.67
Forestry	16.94	Trade	15.45
Fishing	14.52	Hotels and restaurants	16.24
Petrol and coal products	9.82	Transport and communications	16.37
Other mining	28.67	Business services	15.28
Food products	8.00	Services nes	36.72

Source: IndoLab database.

Table 2 Elasticities of substitution

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

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

To illustrate, we run a trade liberalisation scenario with different labour market assumptions. The scenario is the ASEAN-China FTA with exemptions for highly sensitive products. In other words, all the existing 2007 tariffs on goods trade 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 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. It must get agreement with China before the list can be revised.

China has 101 items in its highly sensitive list. The main items are 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).

Table 3 Base and final Indonesian and Chinese bilateral tariffs

	Indonesian tariffs on imports from China		China tariffs on imports from Indonesian	
Sector	**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 & 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 & paper products	5.8	0.6	3.1	0.2
Manufactures	6.3	1.0	6.1	0

Source: GTAP version 7 database and author's calculations.

From the perspective of 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. We vary the standard China-ASEAN FTA scenario with different shocks and closures to illustrate several points about labour market policies.

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 way the interaction between Indonesia and the world economy is taken into account. In this instance the feedback is rather small. For example, the changes in prices for Indonesian exports are less than one per cent for all sectors.

Table 4 Alternative scenarios

Scenario	Description
1. FTA	FTA as negotiated with standard labour market closure
2. Productivity	FTA with enhanced labour productivity in primary agricultural sector

The first scenario, FTA, uses the standard neo-classical closure in which it is assumed all factors of production are employed, or at least, not subject to change as a result of a change in tariffs or trade. The second scenario, Productivity, assumes a one per cent increase in productivity of the Indonesian unskilled and skilled labour force. In both scenarios, labour is assumed mobile across the whole economy, not only agriculture.

The IndoLab CGE model

The Indonesian CGE model used here, IndoLab, is a variation of the well-known ORANI model, and an updated version of the *Wayang* general equilibrium model of the Indonesian economy (Warr 1998) and INDOF (Oktaviani 2001). The model expands the labour equation to include not only four type of labour (farmer, operator, administrator and professional) but also the paid and unpaid labour. It is important to include unpaid labour especially for the agricultural sector.

The model is based on the 2008 Indonesian *Input-output Tables* (IO) and the 2005 *Social Accounting Matrix* (SAM) published by the Indonesian Central Bureau of Statistics. The SAM is used as a based data for household and labour disaggregation. Especially for labour data, the IO data that contains all paid labour should be adjusted with SAM that to capture the unpaid labour. It has been done by using the share of paid labour, unpaid labour and capital from SAM to the database. The IndoLab model contains 48 producer goods and services produced by 48 corresponding industries. Of these, 25 relate directly to agriculture. Many of the other sectors provide inputs into agricultural production. The microeconomic behaviour assumed within it is competitive profit maximisation on the part of all firms and competitive utility maximisation on the part of 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. Variations to this assumption are possible. For example, the possibility of unemployment can be introduced by varying the closure to make either real or nominal wages exogenous, thereby allowing the level of employment to be endogenously determined by demand. 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. The disaggregation

feature in the model also equipped with ten different household types (the same as in the SAM), and four labour types, namely:

(i) administrative;
(ii) farmer;
(iii) operator; and
(iv) professional.

The structure of production assumes each industry can produce several commodities using both intermediate and primary factor inputs. Each intermediate input can be source domestically or imported. Factor inputs for each industry are labour, capital and land. Key simplifying assumptions made in this production model include input-output separability and the multi-stage, hierarchal structure based always 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.

This structure together with further assumptions about firm behaviour and market structure determines the demands for labour, other primary factors and intermediate input and the supply of commodities by the industry. The demand for labour of a particular occupational type is proportional to the overall labour demand in the industry and depends 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 from minimizing the total labour cost of labour subject to the CES aggregator function for labour.

The scenario involves shocking border prices taken from the GTAP simulation described earlier. Some judgement is required to match the different sectors in the two models. The shocks are shown in table 5. In this application the standard closure is used, implying no change in total employment.

After the price changes have worked through, the resulting changes in agricultural wages by type occupation are shown in table 6. The changes are small, less than one per cent, as are the initial shocks. The wage changes are greatest in the unprocessed products that are more labour intensive. The impact on wages in the processed sectors is much reduced. For farmers, the change in wages are similar across crops, livestock, forestry and fishing, whereas for the other occupational groups, the higher wage increases are in field crops rather than forestry and fisheries.

Table 5 Shocks to Indonesian border prices

Sector	%	Sector	%
Paddy	0.45	Vegetable oils and fats	0
Maize	0	Rice	0.02
Other cereals	0.04	Flour	0
Vegetables, fruit and nuts	-1.97	Sugar	0.26
Other crops	-0.16	Other processed agriculture	-0.84
Rubber	0	Beverages and tobacco	-1.39
Sugar cane	0	Textiles and apparel	-3.18
Coconut	0	Wood and paper products	-0.35
Oilseeds	0	Fertiliser and pesticides	0
Tobacco	0	Chemicals	-0.58
Coffee	0	Refinery oil	0
Tea	0	Rubber and plastics	0
Cloves	0	Cement	0
Fibre crops	0	Metal manufactures	-1.21
Other estate crops	0	Machinery	0
Other agriculture	0	Transport equip	0
Livestock	-0.15	Manufactures	-0.81
Ruminant meat	0	Utilities	0
Non-ruminant meat	-0.28	Construction	0
Forestry	-0.27	Trade	0
Fishing	0.11	Hotel and restaurant	0
Petrol and Coal products	-0.18	Transport and communications	0
Other mining	0	Business services	0
Food products	0	Services nes	0

Source. From GTAP simulation

Table 6 Change in Indonesian labour use, FTA scenario

	Farmer	Operator	Administrative	Professional
	%	%	%	%
Paddy	0.051	0.119	-0.007	-0.022
Maize	0.011	0.078	-0.047	-0.064
Other cereals	0.048	0.115	-0.01	-0.027
Vegetables, fruit and nuts	-0.36	-0.293	-0.418	-0.433
Other crops	-0.024	0.044	-0.082	-0.098
Rubber	0.072	0.114	-0.008	0.004
Sugar cane	0.238	0.278	0.154	0.167
Coconut	0.16	0.203	0.076	0.086
Oilseeds	0.214	0.255	0.13	0.143
Tobacco	0.011	0.051	-0.072	-0.059

Coffee	-0.011	0.029	-0.096	-0.084
Tea	-0.106	-0.065	-0.191	-0.179
Cloves	0.007	0.049	-0.077	-0.067
Fibre crops	-0.226	-0.165	-0.292	-0.283
Other estate crops	-0.002	0.046	-0.082	-0.076
Other agriculture	0.04	0.08	-0.045	-0.032
Livestock	0.015	0.046	-0.071	-0.072
Ruminant meat	0.015	0.047	-0.07	-0.072
Non-ruminant meat	0.096	0.127	0.01	0.008
Forestry	0.04	0.091	-0.045	-0.027
Fishing	0.109	0.144	0.034	0.041
Petrol and coal products	0.031	0.064	-0.055	-0.05
Other mining	0.009	0.033	-0.069	-0.053
Food products	-0.02	0.007	-0.099	-0.092
Vegetable oils and fats	0.518	0.545	0.437	0.444
Rice	0.045	0.069	-0.03	-0.023
Flour	0.052	0.078	-0.028	-0.022
Sugar	0.25	0.278	0.17	0.176
Other processed agriculture	-0.248	-0.222	-0.327	-0.32
Beverages and tobacco	-0.003	0.023	-0.083	-0.077
Textiles and apparel	-1.008	-0.98	-1.091	-1.081
Wood and paper products	0.12	0.145	0.037	0.063
Fertiliser and pesticides	0.001	0.031	-0.083	-0.073
Chemicals	-0.307	-0.278	-0.391	-0.38
Refinery oil	0.007	0.035	-0.076	-0.058
Rubber and plastics	0.168	0.197	0.084	0.097
Cement	0	0.029	-0.084	-0.071
Metal manufactures	-0.576	-0.548	-0.66	-0.636
Machinery	0.098	0.125	0.015	0.041
Transport equip	0.08	0.108	-0.004	0.019
Manufactures	-0.225	-0.2	-0.306	-0.28
Utilities	-0.052	-0.02	-0.138	-0.131
Construction	0.032	0.048	-0.033	-0.036
Trade	0.031	0.046	-0.034	-0.037
Hotel and restaurant	0.056	0.072	-0.009	-0.012
Transport and communications	0.088	0.12	0.013	0.035
Business services	0.018	0.05	-0.047	-0.051
Services nes	0.174	0.203	0.089	0.094

Source. IndoLab model.

Table 7 Change in Indonesian agricultural wages, both scenarios

	Administrative %	Farmer %	Operator %	Professional %
FTA	0.19	0.01	-0.02	0.18
Productivity	0.31	-0.78	0.13	0.30

Source. Indolab model.

Table 7 shows the changes in wage rates from both scenarios. The changes are generally positive although small. From the FTA, administrative and professional workers gain at the expensive of operators. Farmers are marginally better off. This reflects the use of these types of workers in the different industries. A program of increasing productivity by one per cent in the agricultural sector generally increases real wages, although the wage of farmers decreases significantly. This is because farmers have limited scope for other activities, and the increase in supply of this type of labour effectively drives down their wage. In general, the increase in labour productivity is associated with fall in employment in primary agriculture.

Implications

Labour use tends to move in line with output, so the effects of trade on output are a fairly reliable guide to employment changes. This depends on the assumed rates of substitution between factors of production. However, primary agriculture has the advantage of high substitutability between various crops. Annual crops such as rice and maize can be grown on the same land.

The China-ASEAN FTA is predicted to have only a limited impact of agricultural wages and sectoral output and employment, principally because changes in tariffs on rice and sugar are exempt. Nonetheless, maintaining a flexible labour force has benefits in increasing employment while constraining wage rates. This enables competitiveness to be maintained. This is beneficial because the particular tariff changes lead to an increase in the demand for labour intensive goods.

A productivity gain, perhaps due to a technological improvement, is also beneficial, although some of the benefits flow to consumers and owners of land and capital. The assumption here is that a productivity improvement can be obtained without cost. This is obviously unrealistic. The benefits must be weighed against the cost of research and extension necessary to bring about an improvement. 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, a gap in wages will develop over time.

Expenditure on enhancing productivity is also likely to provide positive returns. Agricultural productivity is particularly beneficial because it enhances the income of the rural poor. Note, however, that some of the benefits of productivity enhancing improvements are captured by consumers as well as producers because increased production results in lower prices. Benefits flow up and down the production chain. This raises the interesting question of where research funds should be spent, at the production or marketing end of the chain.

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