Trade Liberalization and Employment in Indonesia: A CGE Analysis

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Abstract

Computable General Equilibrium (CGE) models of trade liberalization often invoke the assumption of frictionless labor markets and full employment for simplification. This prevents a proper analysis of the interaction between labor market institutions and the opening up of an economy. This paper develops a national CGE model of trade liberalization with specifications of different labor-market institutions such as union activity, efficiency wages, and a minimum wage. The CGE model is applied to the case of Indonesia in order to simulate the aggregate and sectoral effects (i.e., changes in employment and wages of different categories of labor) of a potential free trade agreement (FTA) with the European Union. The model is calibrated to the official Indonesian Social Accounting Matrix (SAM) from 2008. Certain structural parameter values are obtained by calibration or imputation from the literature. The paper shows that labor market frictions, particularly union activity, can result in aggregate and sectoral economic effects that are different from models with frictionless labor markets. The paper quantifies the difference caused by each labor market friction vis-à-vis a benchmark model with no labor market frictions. In addition, the paper sheds some light on the distributional consequences of trade liberalization in the presence of these labor market frictions.

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1. Introduction

In both the theoretical and empirical literature, the economic impact of trade liberalization is frequently analyzed without explicit consideration of labor-market frictions. It is well-known that actual labor markets , particularly in developing countries, are fraught with deviations from the standard competitive model (caused by, for example, search and matching, imperfect mobility, incomplete contracts, bargaining, etc.) and rigidities induced by labor-market policies and institutions. The prevalence of these labor-market frictions constrains an economy from fulfilling all Pareto-optimal conditions. It is likely that, for a given policy, the optimal change would be different in the presence of these frictions than without them as per the Theory of the Second Best (Lipsey and Lancaster, 1956 -1957).

The interest in trade impact assessment is, no doubt, due to the fact that many countries have become more open as a result of unilateral trade liberalization or in fulfillment of their multilateral or regional commitments to trade agreements. Furthermore, many countries are still in the process of implementing their commitments and even negotiating future liberalization with their trade partners. For political reasons, a key outcome for any country is the effect of a (potential) trade agreement on employment. While there has been much progress in Computable General Equilibrium (CGE) modeling of trade liberalization, the treatment of labor markets and the analysis of employment outcomes have been rudimentary because of the strong often-used working assumption that the labor supply is fixed and labor markets are frictionless (Boeters and Savard, 2012).[1] These assumptions make unemployment a non-issue and limit employment changes simply to inter-sectoral reallocation.

This paper develops a national CGE model of trade liberalization with specifications of different labor-market institutions such as union activity, efficiency wages, and a minimum wage. Our paper is closest in motivation to the study by Maechler and Roland-Holst (1995), who study the effects of trade liberalization in Mexico in a CGE model with different labor-market specifications, and the same in subject matter to the duo of papers by Sugiyarto, Blake, and Sinclair (2003, 2004), who conduct CGE analyses of the welfare effects of Indonesian unilateral trade liberalization with labor-market distortions. The national CGE model that we develop is also applied to the case of Indonesia in order to simulate the aggregate and sectoral effects (i.e., changes in employment and wages of different categories of labor) of a potential free trade agreement (FTA) with the European Union. We, therefore, distinguish our work from that of Sugiyarto, Blake, and Sinclair by modeling a bilateral trade agreement, which requires us to operationalize not only the trade policy shocks implemented by the country in focus but also of its trade partner. We do this by linking our national CGE model with the GTAP (Global Trade Analysis Project) model.

[1] This point is also made by Kurzweil (2002), who models the effects of trade liberalization between the EU and African countries given a minimum wage for unskilled labor and imperfect mobility.

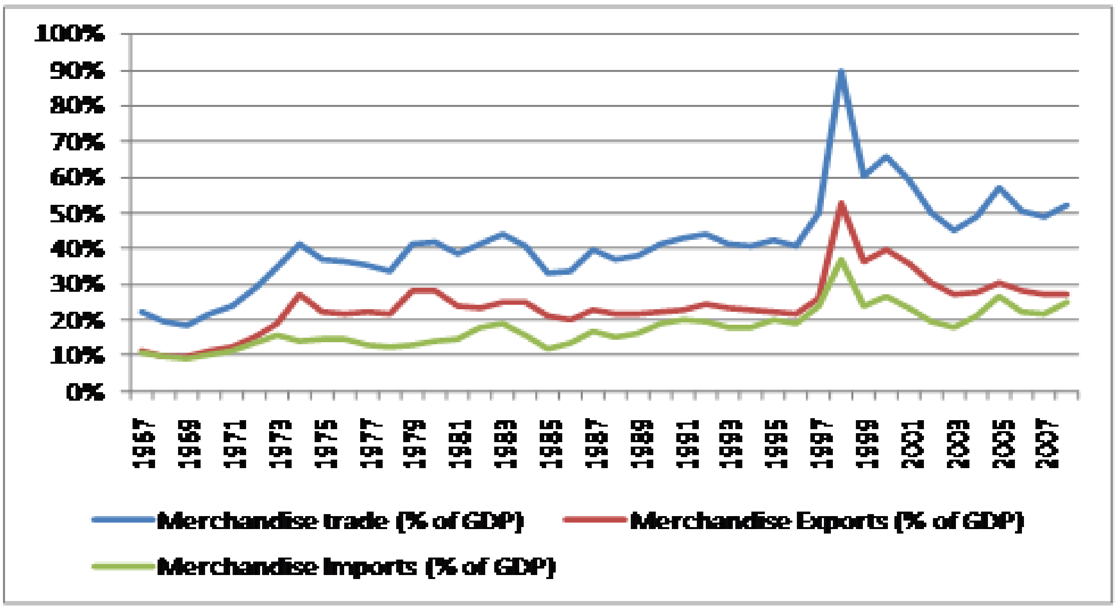
We have chosen to work on the case of Indonesia for several reasons. First, we want to study a developing country given that labor-market frictions manifest themselves more prominently in developing countries. Second, Indonesian data for the implementation of our CGE analysis is available, reliable, and relatively up-to-date. Third, Indonesian trade liberalization, which began in the mid-1980s, is now being pursued mainly through bilateral and regional negotiations. The trade scenario that we model in this paper, i.e., an FTA between Indonesia and the European Union, is a potential agreement that is actually being negotiated in talks regarding a Comprehensive Economic Partnership (see the background document produced by the Joint Indonesia-EU Vision Group, 2011). Our paper is organized as follows: following this Introduction, Section 2 describes current trends and patterns in Indonesian trade and employment; Section 3 elaborates on our National CGE model and the three different labor-market specifications that we use; Section 4 provides details on the trade liberalization scenario that we model; Section 5 presents and discusses our simulation results with some sensitivity analysis; and Section 6 draws conclusions and policy implications from our analysis.

2. Trends and Patterns in Indonesian Trade and Employment

2.1 Indonesian Trade

Indonesia is one of the top 30 countries in the world in terms of the value of its trade. In 2008, its merchandise exports and imports amounted to US$140 billion and US$127 billion respectively. As a share of GDP, its trade in 2008 was 52%. As Figure 1 shows, Indonesia's trade as a share of GDP rose rapidly in the 1960s from 20% to 40% and remained there until the Asian Financial Crisis struck. During the Crisis, a large depreciation of the rupiah caused Indonesia's US dollar-denominated trade to peak at 90% as a share of GDP. Since then, Indonesia's trade has moved back towards its pre-Crisis share of GDP. Since 1967, Indonesia has maintained a trade surplus of between 0.2% (in 1968) and 16% (in 1998) of GDP. From 2000 to 2008, the average annual growth of Indonesia's exports and imports were 12% and 17% respectively with a contraction in 2001.

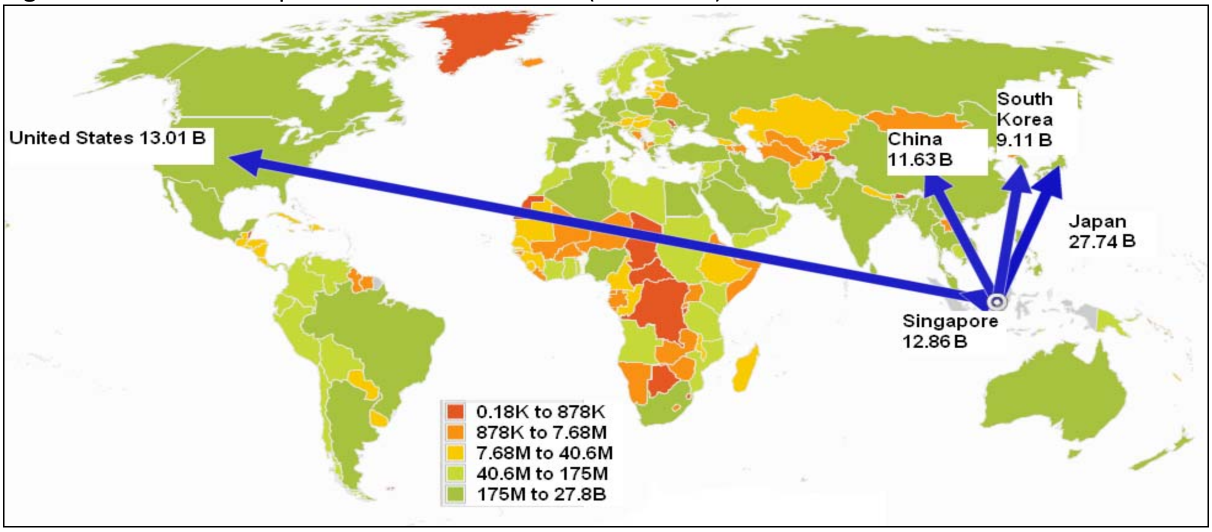
Figure 1: The Evolution of Indonesian Merchandise Trade from 1967 to 2007.



Source: World Development Indicators 2011, World Bank

As shown in Figure 2, Indonesia exported to almost all countries in the world in 2008. Its largest export destination in value terms was Japan with US$ 27.4 billion. The United States, Singapore, China, and South Korea were second to fifth respectively. However, if the European Union (27 countries) were considered to be a single export destination, then it would be Indonesia's second largest trade partner in terms of export value with US$19.9 billion.

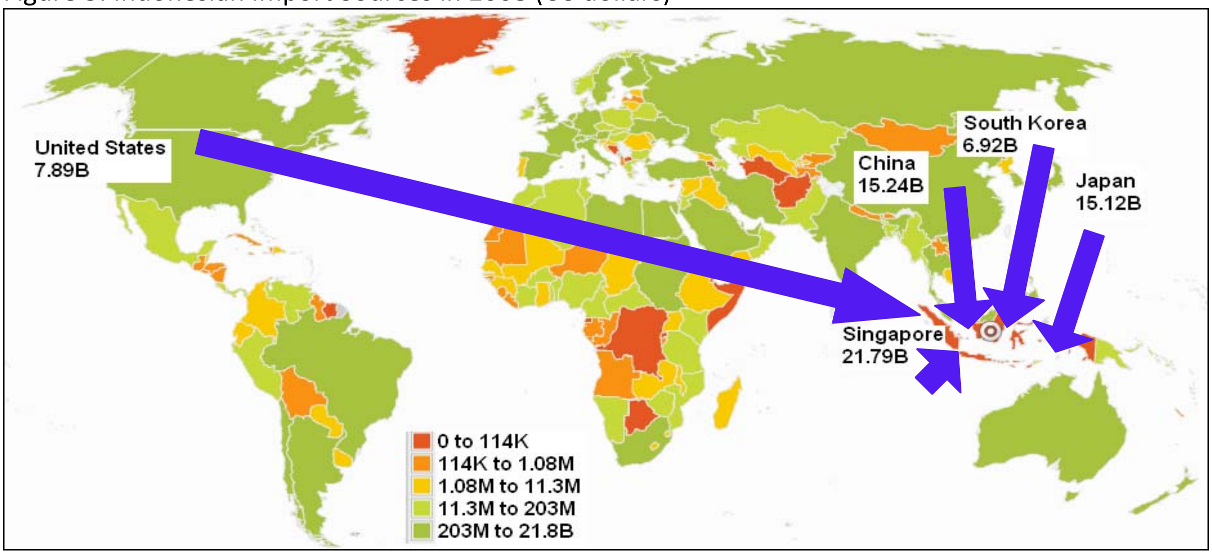
Figure 2: Indonesian Export Destinations in 2008 (US dollars)



Source: UNComtrade

Figure 3 shows Indonesia's import sources and its largest trade partners in terms of import value. In 2008, Singapore was Indonesia's largest source given imports from it of US$21.79 billion. The second largest import source in 2008 was China with US$15.24 billion. Hence, Indonesia ran trade deficits with both these countries in 2008. With Japan, the United States, and South Korea, Indonesia registered trade surpluses in the same year. Indonesia's imports from the European Union (27 countries) in 2008 amounted to US$8.7 billion, resulting in a positive trade balance of US$11.02 billion.

Figure 3: Indonesian Import Sources in 2008 (US dollars)



Source: UNComtrade

2.1.1 Tariffs, Non-Tariff Measures, and Free Trade Agreements

To estimate sectoral tariff rates, we take the ratio between import tariff revenue and import value in each sector. This ratio yields the import-weighted average tariff of all tariff lines that are classified in a given sector.[2] By this measure, the top three most protected sectors in 2008 were the Milling, textile, clothing, and leather sector; Plantations; and the Food, beverage, and tobacco industry as shown in Table 1. The Chemical, fertilizer, clay products, and cement sector had sectoral import-tariffs of 26 trillion rupiah but also received import subsidies of 41 trillion rupiah, hence its net import tariff rate was -3.83% in 2008. Table 1 also shows that there were no import tariffs on all services imports. Tariffs are not the only barriers to imports into Indonesia. Non-tariff measures such as import licensing, import bans, and monopoly rights to state-trading enterprises also restrict the country's imports (Hufbauer and Sjamsu, 2007).

Table 1: Indonesian Tariff Barriers by Sector in 2008

	Imports (billion Rupiah)	Import Tariff Revenue/ Imports (%)
Food crop agriculture	38,035	9.503%
Plantations	11,071	21.753%
Livestock and its products	4,509	8.772%
Forestry and hunting	578	7.279%
Fishery	192	7.188%
Coal, ore and natural oil mining	134,407	0.417%
Mining and other excavations	6,260	13.398%
Food, beverage and tobacco industry	59,270	14.042%
Milling industry, textile, clothing and leather	16,973	32.006%
Timber industry and wooden products	3,873	6.873%
Paper industry, printing, transportation means and metal products and other industries	494,481	12.069%
Chemical, fertilizer, clay products and cement industry	389,625	-3.830%
Electricity, gas and clean water	-	0.000%
Construction	-	0.000%
Trading	-	0.000%
Restaurant	8,556	0.000%
Hotels	16,241	0.000%
Land transportation	1,414	0.000%
Air and water transportation and communication	65,160	0.000%
Transportation supporting services, and storage	11,776	0.000%
Bank and insurance	9,842	0.000%
Real estate and company service	50,849	0.000%
Government and defence, education, health, film and other social services	14,290	0.000%
Individual service, household and other services	10,354	0.00%

Source: Indonesian SAM 2008 (National Statistical Office, BPS)

[2] The classification of sectors follows the Indonesian Social Accounting Matrix (SAM) of 2008. These sectoral tariff rates account for all applied tariffs on imported products except tariffs that are prohibitive.

Indonesia is involved in several bilateral and regional free trade agreements. It is a member of the Association of South East Asian Nations (ASEAN), whose program for regional trade integration (AFTA) has resulted in zero tariff rates on virtually all merchandise trade among members. Members of ASEAN, including Indonesia, have negotiated bilaterally with Australia, China, India, Japan, New Zealand, and South Korea and established FTAs since 2010 with each of these countries. Indonesia is currently negotiating an FTA with the European Union to be called a Comprehensive Economic Partnership Agreement (CEPA) for increased bilateral market access through trade and investment liberalization.

2.2 Indonesian Employment

Available employment statistics from Indonesia show that its labor force in 2008 comprised just fewer than 112 million people. Of this, as shown in Table 2, around 103 million were employed, so Indonesia's unemployment rate in 2008 was about 8%.

Table 2: Indonesian Employment Statistics by Sector in 2008

	Employment (thousands of persons)	Sectoral Share of Total Employment (%)	Share of Paid Employment (%)	Average Annual Wages and Earnings of Paid Labor (Thousands of Rupiah)
Food crop agriculture	29,943	29%	16%	13,487
Plantations	6,249	6%	30%	22,198
Livestock and its products	3,319	3%	44%	29,405
Forestry and hunting	564	1%	48%	32,673
Fishery	1,688	2%	35%	45,217
Coal, ore and natural oil mining	398	0%	100%	151,017
Mining and other excavations	723	1%	42%	77,719
Food, beverage and tobacco industry	2,901	3%	55%	53,019
Milling industry, textile, clothing and leather	2,898	3%	75%	16,514
Timber industry and wooden products	2,457	2%	46%	18,142
Paper industry, printing, transportation means and metal products and other industries	2,642	3%	65%	81,227
Chemical, fertilizer, clay products and cement industry	1,735	2%	69%	108,900
Electricity, gas and clean water	201	0%	82%	90,089
Construction	5,440	5%	82%	37,754
Trading	17,745	17%	21%	41,375
Restaurant	3,329	3%	26%	53,475
Hotels	228	0%	77%	42,613
Land transportation	3,901	4%	30%	40,664
Air and water transportation and communication	1,797	2%	49%	54,817
Transportation supporting services, and storage	733	1%	41%	37,952
Bank and insurance	631	1%	93%	87,907
Real estate and company service	830	1%	69%	58,717
Government and defence, education, health, film and other social services	8,066	8%	90%	35,977
Individual service, household and other services	5,034	5%	52%	26,522
All Sectors	103,451	100%	39%	39,538

Source: National Statistical Office Indonesia (BPS)

In the 2000s, Indonesia's unemployment rate averaged at almost 9% with a peak of 11.2% in 2005, after which the unemployment rate declined a little. The unemployed tend to be young (15 to 24 years old), female, and with only a primary-school education. Employment is distributed unevenly across economic sectors. The sector with the largest share of employment is agriculture with 35% of total employed. Most agricultural workers are engaged in the production of food crops. The next largest sectors in terms of employment shares are trading (17%) and industry (13%, which is the sum of rows 8 to 12 in the second column of Table 2). Although employment is still predominantly in agriculture, the current share is much less than it was in 1990 (56%) and lower than in 2000 (45%).[3] While the employment share of agriculture has shrunk over the last two decades, the share of services employment has expanded. The share of industrial employment has also grown but less so than that of services employment.

Around 60% of Indonesia's workers are self-employed while 40% are wage or salary workers. The sectors that are the largest employers, i.e., agriculture and trading, also happen to have the lowest rates of paid employment. This reflects the fact that informality is widespread in these sectors. The shares of paid employment are highest in Coal, ore, and natural mining; Banking and insurance; and the Public sector. On average, the highest paid workers are in the Coal, ore, and natural mining sector and the Chemical, fertilizer, clay products, and cement industry. The lowest average wages and earnings are in Food crop agriculture and the Milling industry, textile, clothing and leather.

3. A National CGE Model and Labor-Market Specifications

3.1 The Base CGE Model

The base CGE model on which we build different labor-market specifications is the static PEP model version 1-1. This is a relatively standard CGE model for the study of a national economy, and it is fairly easy to implement because of its flexible structure, comprehensive documentation, and free public access to the model's code (in GAMS).[4]

On the production side, the PEP version 1-1 model uses nested functions to capture producer behavior. In each industry, a representative firm maximizes profits subject to a production technology. At the uppermost level, sectoral output follows a Leontief production function that combines the sector's value added with intermediates. Each sector's value added consists of composite labor and composite capital according to a Constant Elasticity of Substitution (CES) function. Composite labor and composite capital are themselves CES functions of different categories of labor and capital. In our implementation, there are three categories of labor (i.e.,

[3] These statistics are from the World Development Indicators (2011) database.

[4] The GAMS code for the PEP 1-1 model and a technical description of the model can be downloaded at: http://www.pep-net.org/programs/mpia/pep-standard-cge-models/pep-1-1-single-country-static-version/

informal labor, formal-unskilled labor, and formal-skilled labor) and only one category of capital. Intermediate inputs are combined following a Leontief production function.

The PEP version 1-1 model allows each industry to produce multiple commodities, but, in our implementation, for data reasons each industry produces a single product. The output of each sector is shared between domestic and export markets using a Constant Elasticity of Transformation (CET) function, which describes the ease of switching from one market to another. In relation to export sales, the PEP version 1-1 model departs from the small-country hypothesis. It assumes that a local producer can have an increased share of the world market by offering a price that is advantageous relative to the exogenous world price. In addition, the PEP version 1-1 model allows the simulation of an exogenous change in world demand for a country's exports. On world markets, buyers are treated symmetrically to producers in that it is assumed that local products are imperfect substitutes for imports.

As agents, the PEP 1-1 model has households, firms, the government, and the rest of the world. Household income comes from labor income, capital income, and transfers received from other agents. Our application of the PEP 1-1 model to the case of Indonesia includes eight types of households: 1) Agricultural Workers, 2) Agricultural Employers, 3) Non-Agricultural Rural Low-Income Households, 4) Non-Agricultural Rural Households that are not in the labor force, 5) Non-Agricultural Rural High-Income Households, 6) Non-Agricultural Urban Low-Income Households, 7) Non-Agricultural Urban Households that are not in the labor force, and 8) Non-Agriculture Urban High-Income Households. Each household type receives a fixed share of the earnings of each type of labor, and, similarly, total capital income is distributed between agents, including households, in fixed proportions. Household income net of income taxes is the household's disposable income, of which household savings are a linear function.[5] Corporate income consists of a share of total capital income and of transfers received from other agents, and on this business income taxes are paid. The government draws its income from household and business income taxes; taxes on consumption, exports, and imports; and other taxes on production; part of the payment of capital; and transfers from other agents. The current government budget surplus or deficit (positive or negative savings) is the difference between its revenue and its expenditures. The latter consist of transfers to agents and current expenditures on goods and services. The rest of the world receives payments for the value of imports, part of the income of capital, and transfers from domestic agents. Foreign spending in the domestic economy consists of the value of exports, and transfers to domestic agents. The difference between foreign receipts and spending is the amount of rest-of-the-world savings, which is equal in absolute value but of the opposite sign to the current account balance.[6]

The demand for goods and services, whether domestically produced or imported, consists of household consumption demand, investment demand, demand by government, and demand as

[5] In the PEP-1 model, income taxes are distinguished from transfers from household to government (e.g., social security payments). The Indonesian SAM only has direct taxes from households to government, and we interpret these taxes as income taxes. Hence, there are no transfers from households to government.

[6] Transfers between agents in the PEP 1-1 model are treated as neutrally as possible.

reflected in transport or trade margins. It is assumed that households have Stone-Geary utility functions, which results in a linear expenditure system. Investment demand includes both gross fixed capital formation (GFCF) and changes in inventories. As in any CGE model, the PEP model version 1-1 requires that there is equilibrium between supply and demand in all commodity and factor markets.

The closure of the PEP model version 1-1 model consists of making the following variables exogenous: the current account balance, the minimum consumption of each commodity by each type of household, government expenditures on goods and services, each type of labor supply, world import and export prices expressed in foreign currency, and the volume of inventory changes. The numéraire in our implementation is the consumer price index. Our application of the PEP model to the case of Indonesia is based on the Social Accounting Matrix (SAM) constructed by the Indonesian National Statistics Office (BPS) for the year 2008. This SAM serves as a consistent and comprehensive database for our simulation exercises. We obtain structural parameter values for our application of the PEP model version 1-1 to the case of Indonesia by imputation from the literature or calibration. These values are described in the Appendix.

3.2 Labor Market Specifications

3.2.1 Sectoral Union Activity

We specify union behavior according to the passive union model used by de Melo and Tarr, (1992) and Devarajan et al. (1997), where the firms retain the right to manage. In this specification, the union maximizes its utility over wages and employment by choosing a wage differential (or wage premium for composite labor) subject to the firm's labor demand function. The union behaves passively as it takes the firm's labor demand as given. Specifically, the objective function of the passive union is:

$$Max\, U_j = (wc_j \Phi_j - wc_j^{\min})^{\mu} (LDC_j - LDC_j^{\min})^{(1-\mu)}$$

$$w.r.t.\, \Phi_j$$

$$s.t. \quad LDC_j = \left[\frac{\beta_j^{VA}}{1-\beta_j^{VA}} \frac{rc_j}{wc_j \Phi_j} \right]^{\sigma} KDC_j$$

where:

wc_j = the non-unionized wage rate of composite labor in industry *j*

Φ_j = the union wage differential in industry *j*

$wc_j^{\min}$ = the minimum wage rate of composite labor in industry *j* acceptable to the union

LDC_j =Industry j demand for composite labor

$LDC_j^{\min}$ =the fixed minimum level of employment acceptable to the union

KDC_j = industry *j* demand for composite capital

rc_j =return to composite capital in industry *j*

β_j^{VA} =the share parameter in the value-added function

σ =the elasticity of substitution between composite capital and composite labor

μ = the weight given by the union to the supernumerary wage

We assume that wc_j is equal to $wc_j^{\min}$, and, replacing the labor demand expression in the utility function and maximizing utility with respect to Φ_j, we obtain the following expression:

$$\frac{(\Phi_j - 1)}{\Phi_j} = \frac{\mu}{(1-\mu)\sigma} \frac{(LDC_j - LDC_j^{\min})}{LDC_j}$$

To introduce this equation into our model, we first fix the wage differential Φ_j and the weight given to the supernumerary wage μ and we calibrate the minimum level of employment $LDC_j^{\min}$. The fixed wage differential is also used in the calibration of equations related to labor demand and household labor income where the calibration related to wage rate w_l, where l stands for the different categories of labor, is replaced by $w_l \Phi_j$.[7] For the weight on the supernumerary wage, de Melo and Tarr (1993) consider three options: 1) A high weight on wages = 0.8, 2) A medium weight on wages = 0.5, and 3) A low weight on wages = 0.2. In our benchmark specification of our model with union activity, we use a high weight (i.e., $\mu = 0.8$).

Table 3: Average Sectoral Wages and Wage Differentials (from National Average) in Indonesia, 2008.

	Average Annual Wages and Earnings of Paid Labor (Thousands of Rupiah)	Wage Differential (%)
Food crop agriculture	13,487	0%
Plantations	22,198	0%
Livestock and its products	29,405	0%
Forestry and hunting	32,673	0%
Fishery	45,217	14%
Coal, ore and natural oil mining	151,017	282%
Mining and other excavations	77,719	97%
Food, beverage and tobacco industry	53,019	34%
Milling industry, textile, clothing and leather	16,514	0%
Timber industry and wooden products	18,142	0%
Paper industry, printing, transportation means and metal products and other industries	81,227	105%
Chemical, fertilizer, clay products and cement industry	108,900	175%
Electricity, gas and clean water	90,089	128%
Construction	37,754	0%
Trading	41,375	5%
Restaurant	53,475	35%
Hotels	42,613	8%
Land transportation	40,664	3%
Air and water transportation and communication	54,817	39%
Transportation supporting services, and storage	37,952	0%
Bank and insurance	87,907	122%
Real estate and company service	58,717	49%
Government and defence, education, health, film and other social services	35,977	0%
Individual service, household and other services	26,522	0%
All Sectors	39,538	0%

Source: National Statistical Office Indonesia (BPS)

[7] In our model, there are several wage rates. The wage of composite labor wc_j is a weighted sum (by labor demand in industry j) of the wage rates w_l, where l stands for the different categories of labor.

Union activity is introduced into our model only in sectors where the sectoral average wage rate is higher than the national average wage rate according to data from 2008. As shown in Table 3, a positive wage differential exists in 14 out of the 24 sectors with the highest wage premia in Coal, ore and natural mining; Chemical, fertilizer, clay products and cement industry; and Electricity, gas and clean water. We assume that labor productivity differences and sectoral compensating differentials explain only part of the higher average wages in these sectors, and union activity contributes to raising these sectors' wages against those of other sectors. To calibrate the minimum levels of employment in sectors with positive wage differentials, we simply use the percentage difference between the average sectoral wage and the average national wage as a measure of the sector's wage premium. These premia are shown in Table 3. In each of these sectors, the wage premia are applied to all three categories of labor (i.e., informal labor, formal-unskilled labor, and formal-skilled labor).

3.2.2 Efficiency Wages

We incorporate efficiency wages into our base model by using the model devised by Shapiro and Stiglitz (1984) and by following Annabi (2003). The specification of efficiency wages allows our model to feature involuntary unemployment. Efficiency wages, in a context of imperfect and costly monitoring of workers, leads firms to pay higher wages in order to induce a larger penalty on workers who are caught shirking and dismissed. In equilibrium, the higher wages paid by firms and the resulting pool of unemployment deter workers from shirking as the threat of job loss from shirking becomes credible. To model the worker's decision of whether to shirk, we need equations that describe the worker's utility when shirking, when not shirking, and when unemployed. The expected lifetime utility of a shirking worker (U_s) is

$$rU_s = w - (q+b)(U_s - U_u) \qquad (1)$$

where:

q = the probability of being caught shirking

b = the exogenous quit rate

r = the discount rate

w = the wage rate

U_u = the utility of an unemployed worker.

The expected lifetime utility of a non-shirker (U_n) is

$$rU_n = w - e - b(U_n - U_u) \qquad (2)$$

where $e \geq 0$ represents the disutility of effort. It is assumed that a shirking worker makes no effort at all, and so e equals zero. The expected lifetime utility of an unemployed worker is

$$rU_u = \overline{w} + a(U_{eu} - U_u) \qquad (3)$$

where:

$\overline{w}$ = unemployment benefits

a = the probability of being hired

U_{eu} = the expected utility of being employed

A worker decides to not shirk if $U_s \le U_n$. Inserting the corresponding expressions for U_s and U_n from (1) and (2) respectively yields the non-shirking condition:

$$w \ge rU_u + \frac{e(r+b+q)}{q} \qquad (4)$$

In an equilibrium where all workers do not shirk, the expected utility of being employed is equal to the expected utility of the non-shirker, i.e., $U_{eu} = U_n$.[8] From (2), (3), and (4), we can derive the equilibrium wage, which is:

$$w = \overline{w} + e + \frac{e(a+b+r)}{q} \qquad (5)$$

This equation shows that, in equilibrium, the efficiency wage is increasing with respect to the exogenous quit rate b, the probability to be hired a, the discount rate r, unemployment benefits $\overline{w}$, and the disutility of effort e, and decreasing with respect to the probability of being caught q.

The equilibrium is a steady state, so the flow into the unemployment pool is equal to the flow out of the pool, i.e., $bL = a(LS - L)$, where LS is the total labor force and L is the number of employed workers which is equal to labor demand. The unemployment rate is, therefore, $u = \frac{LS - L}{LS}$. This implies that $a = b\left(\frac{1-u}{u}\right)$, which when substituted into (5) yields the equilibrium wage w^* :

$$w^* = \overline{w} + e + \frac{e}{q}\left(\frac{b}{u} + r\right) \qquad (6)$$

This equation defines the negative relationship between the equilibrium wage and the unemployment rate. Intuitively, this is the equilibrium wage because raising wages is pointless given that workers are making a positive effort and the firm can get all the labor it wants at w*, and lowering wages would induce shirking. In our model of the Indonesian economy, we apply the efficiency-wages specification only to formal-skilled labor based on the fact that this category of workers earns higher average wages than other categories. We assume that the formal-skilled wage premium may be explained by, besides higher intrinsic worker productivity, the need to use efficiency wages in the face of high monitoring and turnover costs for formal-skilled workers. Equation 6 is entered into our base model for formal-skilled workers with the following parameter values:

(i) b = the exogenous quit rate = 0.07. Brusentsev et al (2012) find that the job separation rate in Indonesia was between 6% to 8%, and we take the middle of this range.

(ii) q = the probability of being caught shirking = 0.37. We follow Azam and Lesueur (1997) who, for the case of the Ivory Coast, impute this probability by taking the ratio of supervisors to workers as the probability of detecting shirking. For Indonesia, we take the number of upper-class workers to workers from other classes (Table 6A in BPS, 2011), which yields 0.37.

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[8] This equilibrium outcome is consistent with involuntary unemployment. If there was full employment, then all workers would shirk given that any worker who was dismissed for shirking would be immediately rehired. In other words, shirking is inconsistent with full employment.

(iii) r = the discount rate =0.1. Empirical estimates of individual discount rates range widely from 1% to 1000% (Coller and Williams, 1999). We follow Bovenberg et al. (2000) who use 10% for a Dutch CGE model.
(iv) $u =$ the unemployment rate =0.08. This is the Indonesian 2008 unemployment rate.
The disutility of effort, e, is calibrated given these parameter values.

3.2.3 A Minimum Wage

We apply a minimum wage to the category of labor that is formal and unskilled. This choice is based on the fact that Indonesian minimum wage laws apply mainly to unskilled or semi-skilled workers in the formal sector. Further, we consider the prevailing average wage rate for formal-unskilled workers in 2008 to be the level of the minimum wage. In an examination of minimum-wage legislation in several developing countries, including Indonesia, Saget (2008) states that, "in a number of cases the minimum wage is not really a minimum wage, but rather the effective wage paid to most unskilled or semi-skilled workers". Although Indonesia has multiple minimum wages and there are issues of coverage and compliance, our specification of the minimum wage considers that all formal-unskilled workers are paid the minimum wage or higher.[9] We also consider that the minimum wage is binding and it results in an 8% initial unemployment rate among formal-unskilled workers. As in our base model, the categories of labor are segregated and it is not possible for a formal-unskilled worker to move to the informal labor market and vice versa.

4. Trade Liberalization Scenario

The trade liberalization scenario that we simulate is a potential bilateral free trade agreement between the European Union (27 members) and Indonesia. The import tariffs of the European Union and Indonesia vis-à-vis each other on merchandise trade are reduced to zero. We do not consider changes in other trade policy instruments and we also ignore measures on services trade.

In our two-step approach, we first use the GTAP model (Version 7 database) to simulate bilateral merchandise import tariff reductions to zero by the European Union and Indonesia. This step yields percentage changes by sector in: (i) trade-weighted (by partner) average import tariffs, and (ii) volumes and prices of Indonesian exports. In the second step, we use the GTAP results from the first step to compute the corresponding proportionate changes in sectoral Indonesian import tariffs and shifts in world demand for Indonesia's exports to feed the National CGE model described in Section 3.1.[10] We follow the approach in Horridge and Fan Zhai (2005) of shocking a single-country CGE model with export-related results from a global model. The computed increases (decreases) in world

[9] In Indonesia, minimum wages are set by sector and at several geographic levels: national, provincial, and district. There are also certain occupational minimum wages.

[10] We compute the changes in sectoral Indonesian import tariffs for the National CGE model by assuming that the relative impact on domestic prices of imported goods is the same as implied by the GTAP changes in import tariffs. To compute shifts in world demand for Indonesia's exports, we use GTAP Armington demand elasticities (ESUBM).

demand for Indonesia's exports translate into higher (lower) world export prices and, therefore, relatively lower (higher) Indonesian export prices.

Table 4 shows the results from the GTAP simulation and the derived shocks in Indonesian import tariffs and world export prices used for the simulations within our Indonesian CGE model. The GTAP simulation results show that EU-Indonesian bilateral trade liberalization raises world export prices of products from (in order of size of relative percentage change): (i) the Milling industry, textile, clothing and leather; (ii) Food, beverage, and tobacco; and (iii) Plantations. Table 4 also shows the changes in Indonesia's import tariffs as a consequence of an EU-Indonesia FTA in goods. Import tariffs in all goods-producing sectors fall with the largest reductions in: (i) the Paper industry, printing, transportation means and metal products and other industries; (ii) the Chemical, fertilizer, clay products and cement industry; and (iii) the Food, beverage and tobacco industry.

Table 4: World Export Price and Indonesian Import Tariff Shocks from GTAP Simulation and for Indonesian National CGE Model

Sectors	World Export Prices (% Changes)	Indonesian Import Tariffs (% Point Changes)
Food crop agriculture	0.431%	-0.019%
Plantations	0.617%	-0.071%
Livestock and its products	0.385%	-0.029%
Forestry and hunting	0.133%	-0.008%
Fishery	0.435%	-0.001%
Coal, ore and natural oil mining	-0.012%	0.000%
Mining and other excavations	0.062%	-0.138%
Food, beverage and tobacco industry	1.568%	-2.225%
Milling industry, textile, clothing and leather	3.024%	-0.517%
Timber industry and wooden products	0.546%	-0.170%
Paper industry, printing, transportation means and metal products and other industries	0.248%	-7.667%
Chemical, fertilizer, clay products and cement industry	0.167%	-5.059%
Electricity, gas and clean water	-0.007%	0%
Construction	-0.005%	0%
Trading	-0.008%	0%
Restaurant	0.000%	0%
Hotels	0.000%	0%
Land transportation	0.000%	0%
Air and water transportation and communication	0.003%	0%
Transportation supporting services, and storage	0.000%	0%
Bank and insurance	-0.006%	0%
Real estate and company service	-0.007%	0%
Government and defence, education, health, film and other social services	-0.006%	0%
Individual service, household and other services	0.000%	0%

Source: GTAP and Authors' computations.

The scenario of an EU-Indonesia free trade agreement in goods is simulated in each of the following:
Model (1) Base National CGE model
Model (2) Base National CGE model plus the labor-market specification of union activity as in Section 3.2.1.
Model (3) Base National CGE model plus the labor-market specification of efficiency wages as in Section 3.2.2.
Model (4) Base National CGE model plus the labor-market specification of a minimum wage as in Section 3.2.3.

5. Aggregate and Sectoral Results of Experiments

Before discussing the results of our trade liberalization simulations, we note certain important differences in the initial conditions of our four CGE model specifications. Compared to the base model, the inclusion of union activity in certain sectors results in higher wages and reduced labor demand in the same sectors. Labor demand is reduced by the same factor as the union wage premium. However, there is no resulting unemployment. Compared to the base model, the model with efficiency wages for formal-skilled workers results in an increase in labor supply to yield an unemployment rate among these workers of 8%. Labor supply increases by (1/1-0.08) = 8.7%. Compared to the base model, the model with a minimum wage for formal-unskilled workers also results in unemployment of 8% in this category of workers. Other variables (for example, output, imports, and exports) are unaffected when either unions, efficiency wages, or a minimum wage are specified.

5.1 Aggregate Results

The aggregate results of our simulations are shown in Table 5 and described below:

- Regarding trade, the EU-Indonesia bilateral FTA is predicted to raise imports by between 3.24% to 3.34% and exports from 2.72% to 2.84%. Furthermore, the models with labor-market frictions show larger increases in total imports and total exports than the base model with the largest trade increases occurring in the union model.

- Concerning employment, aggregate labor demand does not change in the base model and the one with unions because neither model results in unemployment. In the model with efficiency wages, there is an increase in the demand of formal-skilled workers by 0.13%, which reduces their unemployment rate from 8% to 7.87%. In the model with a minimum wage, there is an increase in the demand of formal-unskilled workers by 0.32%, which reduces their unemployment rate from 8% to 7.68%.

- In relation to wages, the EU-Indonesia bilateral FTA is expected to raise the wages of all three categories of Indonesian labor in models (1) to (3). The highest relative wage increases are anticipated for informal labor (between 1.16% to 1.27%). Formal-unskilled wages are projected to rise the least (between 0.48% to 0.68%). The wage gap between informal and formal workers should close, but that between formal-skilled and formal-unskilled workers is predicted to widen. Union activity and efficiency wages appear to augment the formal unskilled wage increase relative to the base model. In the minimum-wage model, there are wage increases for informal and formal-skilled labor (which are very close to the wage changes in the base model) but no change in the formal-unskilled wage as it remains binding.

- Real GDP is expected to grow by between 0.5% to 1% (depending on the model) with the smallest growth predicted by the union model.

- Real household income is predicted to rise for all eight types of Indonesian households in all four models, with the largest increases in the minimum-wage model. The non-agricultural high-income households (both rural and urban) stand to gain relatively the most while households of agricultural workers are expected to gain the least.

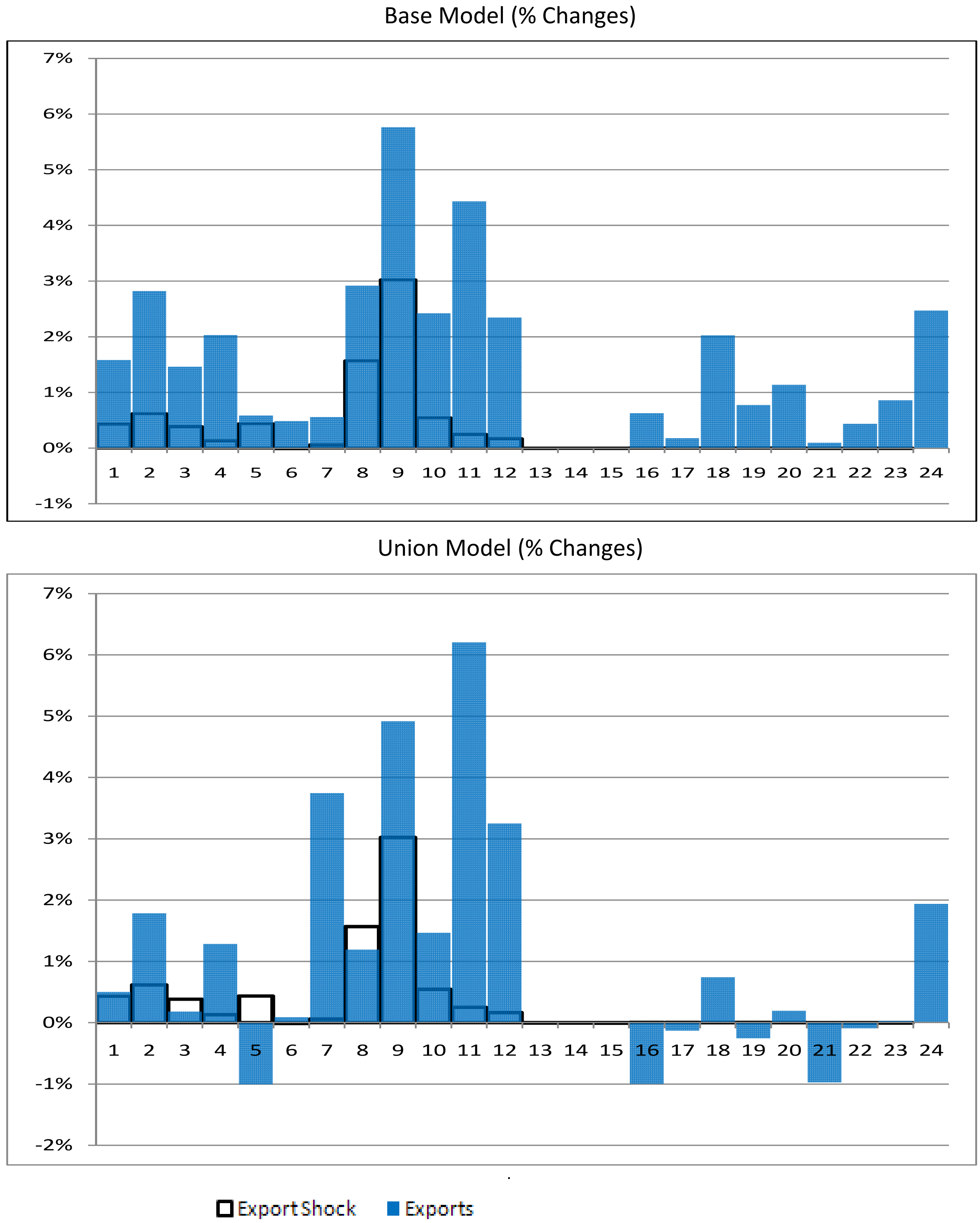
Table 5: Aggregate Results from Simulation of EU-Indonesia Free Trade Agreement

	Base Model (1)	Base + Unions (2)	Base + Eff. Wages (3)	Base + Min. Wage (4)
Total Imports	3.24%	3.34%	3.25%	3.34%
Total Exports	2.72%	2.84%	2.73%	2.83%
Labor Demand				
Informal Labor	0.00%	0.00%	0.00%	0.00%
Formal Unskilled Labor	0.00%	0.00%	0.00%	0.32%
Formal Skilled Labor	0.00%	0.00%	0.13%	0.00%
Wages				
Informal Labor	1.26%	1.16%	1.27%	1.27%
Formal Unskilled Labor	0.48%	0.68%	0.49%	0.00%
Formal Skilled Labor	1.12%	1.14%	1.01%	1.16%
Real GDP growth	0.81%	0.62%	0.84%	0.91%
Household Income				
1) Agricultural Workers	0.54%	0.37%	0.55%	0.63%
2) Agricultural Employers	0.86%	0.75%	0.87%	0.92%
3) Non-Agricultural Rural Low-Income Households	0.70%	0.53%	0.72%	0.79%
4) Non-Agricultural Rural Households that are not in the labor force	0.80%	0.68%	0.81%	0.87%
5) Non-Agricultural Rural High-Income Households	0.93%	0.85%	0.95%	1.00%
6) Non-Agricultural Urban Low-Income Households	0.71%	0.52%	0.73%	0.82%
7) Non-Agricultural Urban Households that are not in the labor force.	0.77%	0.62%	0.78%	0.86%
8) Non-Agricultural Urban High-Income Households	0.98%	0.93%	1.00%	1.04%

5.2 Sectoral Results on Trade

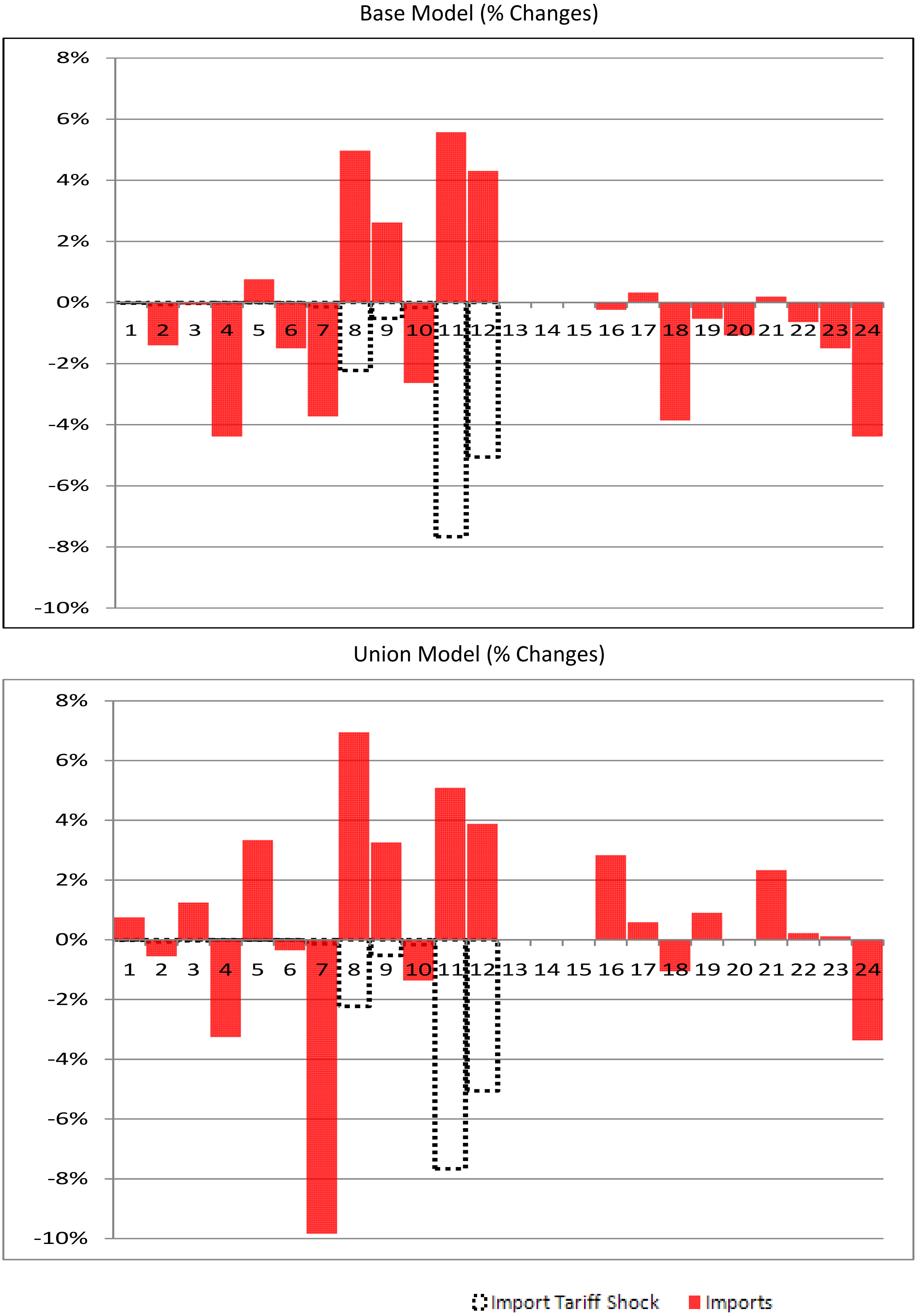
Because the sectoral results from the efficiency wages and minimum-wage models are very similar to those of the base model, we only provide an analysis of the results from the base and union models (detailed results for all models are provided in Table A1 of the Appendix). The simulation results on trade from the base and union models are illustrated in Figures 4 and 5 below.

Figure 4: Simulation Results on Exports by Sector for the Base and Union Models



Sector	Description	Sector	Description	Sector	Description
1	Food crop agriculture	9	Milling industry, textile, clothing and	17	Hotels
2	Plantations	10	Timber industry and wooden	18	Land transportation
3	Livestock and its products	11	Paper industry, printing,	19	Air and water transportation
4	Forestry and hunting	12	Chemical, fertilizer, clay products	20	Transportation supporting
5	Fishery	13	Electricity, gas and clean water	21	Bank and insurance
6	Coal, ore and natural oil mining	14	Construction	22	Real estate and company
7	Mining and other excavations	15	Trading	23	Government and defence,
8	Food, beverage and tobacco industry	16	Restaurant	24	Individual service, household

Figure 5: Simulation Results on Imports by Sector for the Base and Union Models



Sector	Description	Sector	Description	Sector	Description
1	Food crop agriculture	9	Milling industry, textile, clothing and	17	Hotels
2	Plantations	10	Timber industry and wooden	18	Land transportation
3	Livestock and its products	11	Paper industry, printing,	19	Air and water transportation
4	Forestry and hunting	12	Chemical, fertilizer, clay products	20	Transportation supporting
5	Fishery	13	Electricity, gas and clean water	21	Bank and insurance
6	Coal, ore and natural oil mining	14	Construction	22	Real estate and company
7	Mining and other excavations	15	Trading	23	Government and defence,
8	Food, beverage and tobacco industry	16	Restaurant	24	Individual service, household

As the base model results in Figures 4 and 5 show, unsurprisingly, the size of export shocks is positively correlated with changes in export value while import tariff reductions are negatively correlated with changes in import value. All sectors experience export growth according to the base model with the largest increases in: (i) the Milling industry, textile, clothing and leather, (ii) the Paper industry, printing, transportation means and metal products and other industries, and (iii) the Food, beverage and tobacco industry. In the base model, only 8 of the 24 sectors show an increase in imports with the biggest expansions in: (i) the Paper industry, printing, transportation means and metal products and other industries, (ii) the Food, beverage and tobacco industry, and (iii) the Chemical, fertilizer, clay products and cement industry. The first two industries, as mentioned above, also see the highest growth in exports, which indicates a high degree of openness and intra-industry trade in these two sectors.

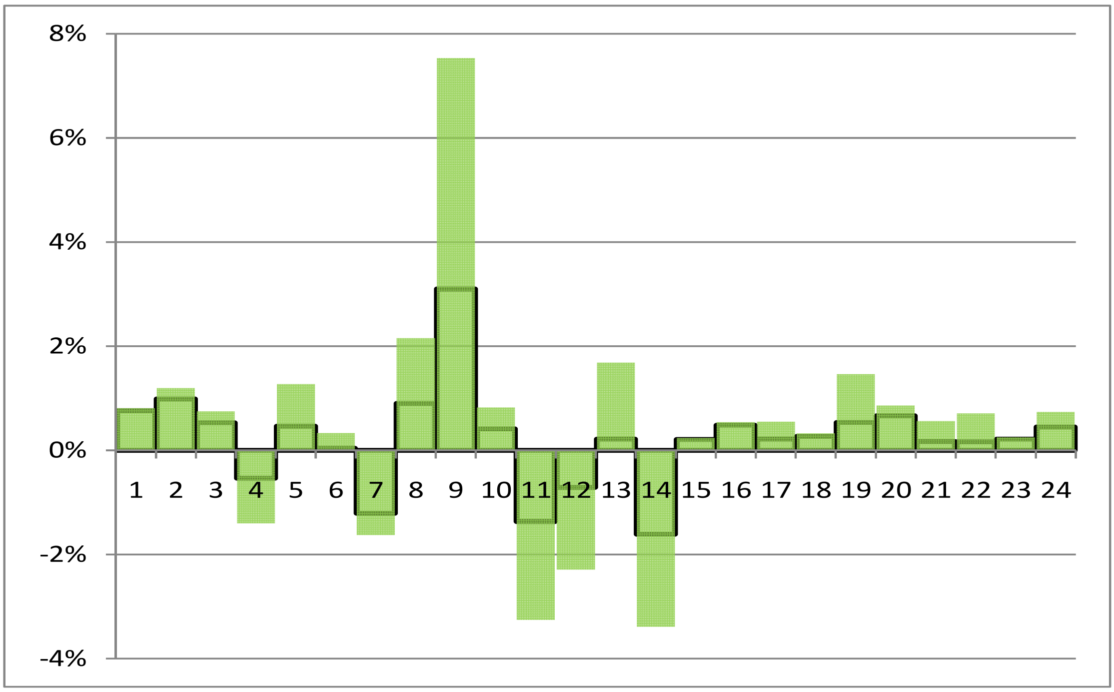
In the model with union activity, the changes in trade often have the same signs as those in the base model but the magnitudes are quite different. Except for 3 sectors (i.e., Mining and other excavations; the Paper industry, printing, transportation means and metal products and other industries; and the Chemical, fertilizer, clay products and cement industry), exports in the union model do not grow as much as in the base model or even fall. As for imports, the union model results in larger increases or smaller reductions in each sector compared to the base model except for the same 3 anomalous sectors in the case of exports. Two of these sectors (i.e., the Paper industry, printing, transportation means and metal products and other industries; and the Chemical, fertilizer, clay products and cement industry) together accounted for more than 60% of Indonesia's exports and 40% of Indonesia's imports in 2008. The high degree of intra-industry trade in these sectors may be an explanation for the different trade outcomes compared to other sectors. In addition, the introduction of wage premia in these 3 sectors – although not the highest across sectors – and the changes to initial labor demand and sectoral labor efficiency could be behind these results.

5.3 Sectoral Results on Output and Employment

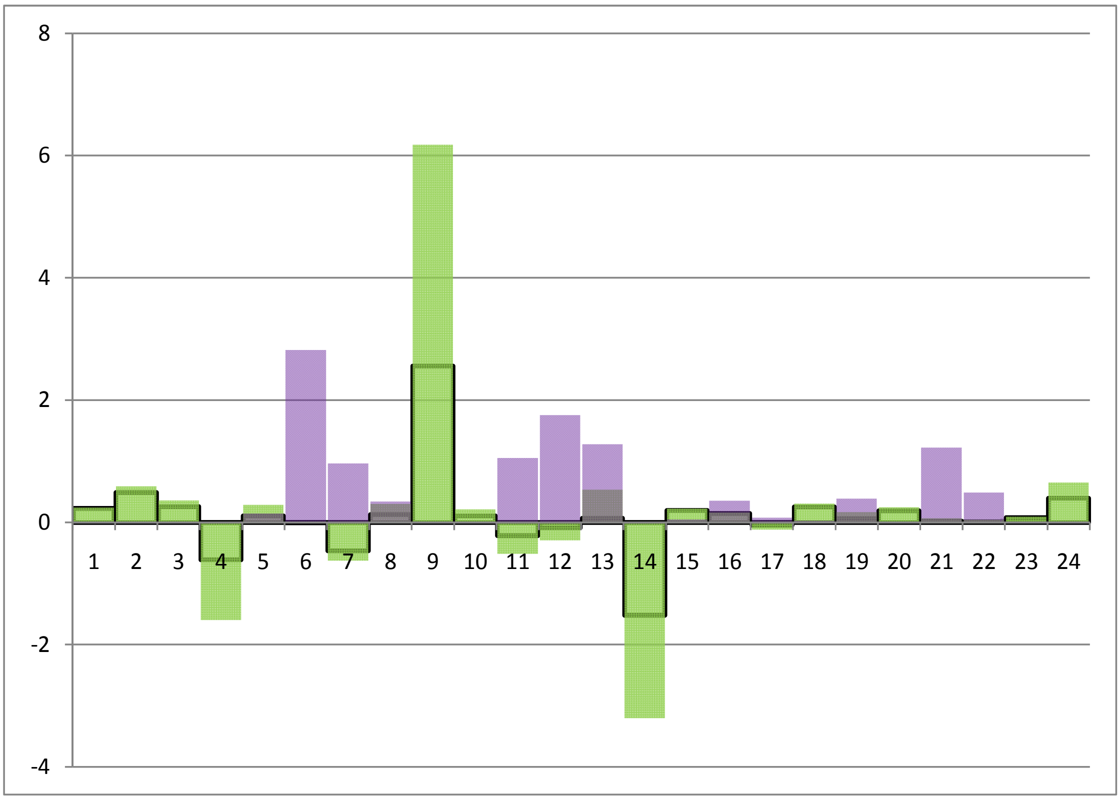
Figure 6 shows our results on sectoral output and employment changes. Again, we find that the results from the base, efficiency wages, and minimum-wage models are very similar, but they differ from the results from the union model. In the base model, the three sectors whose output expands relatively the most are: (i) the Milling industry, textile, clothing and leather; (ii) Plantations; and the (iii) Food, beverage and tobacco industry. The largest relative employment gains, in the base model, are in (i) and (iii) but also in the Utilities sector (i.e., electricity, gas and water). The sectors with the largest relative output contractions are: the Construction sector; the Paper industry, printing, transportation means and metal products and other industries; and Mining and other excavations. The bottom two ranking for relative employment contraction follows that of output except that the third sector is the Chemical, fertilizer, clay products and cement industry. This indicates an imperfect rank correlation between output and employment. However, the signs on sectoral output and employment changes are consistent. Figure 6 also shows that, in the base and union models, the sectoral employment changes almost always outweigh the output changes, implying sectoral output elasticities of employment that are more than 1.

Figure 6: Simulation Results on Output and Employment by Sector for the Base and Union Models

Base Model (% Changes)



Union Model (Output and Employment in % Changes; Wage Premium in Multiples of National Average Wage)



Output Employment Wage Premium

Sector	Description	Sector	Description	Sector	Description
1	Food crop agriculture	9	Milling industry, textile, clothing and	17	Hotels
2	Plantations	10	Timber industry and wooden	18	Land transportation
3	Livestock and its products	11	Paper industry, printing,	19	Air and water transportation
4	Forestry and hunting	12	Chemical, fertilizer, clay products	20	Transportation supporting
5	Fishery	13	Electricity, gas and clean water	21	Bank and insurance
6	Coal, ore and natural oil mining	14	Construction	22	Real estate and company
7	Mining and other excavations	15	Trading	23	Government and defence,
8	Food, beverage and tobacco industry	16	Restaurant	24	Individual service, household

In general, the union model yields output and employment changes that are mitigated (i.e., smaller in absolute value) than the base-model results.[11] The sectoral rank correlation of output changes between the base and union models is weak. This is also the case for employment changes. The different sectoral impact of the FTA in the union model is most likely due to the distribution of wage premia. Figure 6 shows that sectors with higher wage premia in the union model often have more negative output and employment responses compared to the base model.

Further, in the results from each of the four models, we find a very weak correlation between sectoral imports and employment (with correlation coefficients of around 0.06 for the base, efficiency-wages, and minimum-wage models respectively but 0.24 for the union model), also weak correlation coefficients between sectoral exports and employment (with correlation coefficients of 0.32 to 0.35 for the base, efficiency-wages, and minimum-wage models), and almost perfect correlation between sectoral changes in employment and output (with correlation coefficients of close to 1 for all models).

Table A2 in the Appendix contains our simulation results on sectoral employment changes in the three labor categories. In general, we find again that the efficiency wage and minimum-wage models produce results that are close to the base model results. However, in the sectors where total employment contracts, the efficiency wage and minimum-wage models tend to show smaller reductions compared to the base model. This mitigated job destruction is evident for formal-unskilled labor in the minimum-wage model and formal-skilled workers in the efficiency wages model. For formal-skilled workers, relatively more job opportunities are created, according to our base model results, in: the Milling industry, textile, clothing and leather; the Food, beverage and tobacco industry; and the Utilities sector (i.e., electricity, gas and water). These are sectors where total employment expands the most in our base model. For informal employment, our base model results show that the sectors with the largest reductions are: Construction; the Paper industry, printing, transportation means and metal products and other industries; and the Chemical, fertilizer, clay products and cement industry. The first two sectors are where total employment shrinks the most in our base model.

5.4 Sensitivity Analysis

It is well acknowledged in CGE analysis that the results may be sensitive to certain parameters. Being aware of this problem, we conduct a sensitivity analysis that concentrates on three key parameters in our model: the price elasticities of the world demand for exported goods, the elasticity of substitution between domestic and imported goods, and the weight on the supernumerary wage in our union model.

When we double and halve the price elasticities of the world demand for exported goods and the elasticity of substitution between domestic and imported goods, the changes in all the variables are very small. The largest absolute deviation for our results on imports and exports is 0.67% and the largest deviation in wages is 0.21% for the wages of formal-unskilled workers (these arise in the

[11] The four exceptions are: Forestry and hunting; the Timber industry and wooden products; Trading; and Land transportation.

union model). The minimum-wage model has the biggest deviation for household incomes, which is 0.14% for the income of non-agricultural urban high-income households. We consider these deviations to be insignificant and, therefore, that our simulation results are robust to changes in the elasticity parameter values.

When we reduce the weight on the supernumerary wage in the union model, we find that our simulation results are fairly identical down to a medium weight on wages (from $\mu = 0.8$ to $\mu = 0.5$). The largest difference is 0.14% for the wages of formal-unskilled labor. However, if the weight on the supernumerary wage for union is set to a lower value (e.g., $\mu = 0.2$), then the simulation results change considerably. We believe, nevertheless, that medium to high weights are more plausible.

Conclusions and Policy Implications

This paper has developed a national CGE model of trade liberalization with specifications of different labor-market institutions: union activity, efficiency wages, and a minimum wage. The CGE model is applied to the case of Indonesia in order to simulate the aggregate and sectoral effects (i.e., changes in employment and wages of different categories of labor) of a potential free trade agreement (FTA) with the European Union. Our main findings are that: (i) the simulation results differ overall when we use a union model compared to a base model with no labor-market frictions, (ii) there are negligible differences in the simulation results from our efficiency-wages and minimum-wage models compared to our base model, iii) the results are not sensitive to changes in the price elasticities of export demand and the Armington elasticities, and (iv) the results are sensitive to changes in the weight on the wage differential in the union model.

For Indonesia, the subject of our study, the simulation results show that pursuing an FTA with the European Union will expand trade by around 3% and raise workers' wages and households' incomes. In all models, the simulations predict a small rise in real GDP of less than 1%. It is, however, predicted that the FTA will have an uneven impact on different sectors of the Indonesian economy in terms of output, total employment, and employment by labor category. In addition, the FTA is likely to worsen the distribution of income among different households. This paper identifies the sectors and households that are expected to experience relatively significant changes so that suitable policies can be devised to enhance preparation for and facilitate adjustment to the FTA in question.

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Appendix

Tables with Detailed Simulation Results by Sector

Table A1: Simulation Results on Trade and Output by Sector

Sectors	Imports				Exports				Output			
	Base	Base + Union	Base + Eff.Wage	Base + Min.Wage	Base	Base + Union	Base + Eff.Wage	Base + Min.Wage	Base	Base + Union	Base + Eff.Wage	Base + Min.Wage
Food crop agriculture	0.00%	0.75%	0.01%	-0.09%	1.58%	0.50%	1.60%	1.80%	0.76%	0.23%	0.78%	0.89%
Plantations	-1.40%	-0.55%	-1.39%	-1.58%	2.82%	1.78%	2.84%	3.12%	0.99%	0.49%	1.01%	1.15%
Livestock and its products	-0.07%	1.24%	-0.07%	-0.27%	1.46%	0.18%	1.48%	1.73%	0.53%	0.25%	0.54%	0.61%
Forestry and hunting	-4.38%	-3.26%	-4.34%	-4.25%	2.03%	1.28%	2.03%	2.14%	-0.54%	-0.61%	-0.52%	-0.39%
Fishery	0.76%	3.33%	0.80%	0.63%	0.59%	-1.00%	0.58%	0.74%	0.47%	0.11%	0.48%	0.55%
Coal, ore and natural oil mining	-1.50%	-0.35%	-1.48%	-1.35%	0.49%	0.09%	0.49%	0.48%	0.04%	0.00%	0.05%	0.07%
Mining and other excavations	-3.73%	-9.84%	-3.71%	-3.86%	0.56%	3.75%	0.57%	0.77%	-1.21%	-0.46%	-1.19%	-1.03%
Food, beverage and tobacco industry	4.97%	6.95%	4.98%	4.89%	2.92%	1.19%	2.94%	3.11%	0.90%	0.13%	0.92%	1.03%
Milling industry, textile, clothing and leather	2.62%	3.26%	2.63%	2.59%	5.76%	4.92%	5.78%	5.98%	3.10%	2.55%	3.12%	3.26%
Timber industry and wooden products	-2.64%	-1.36%	-2.62%	-2.64%	2.42%	1.47%	2.43%	2.62%	0.41%	0.11%	0.43%	0.56%
Paper industry, printing, transportation means and metal products and other industries	5.57%	5.09%	5.59%	5.66%	4.43%	6.20%	4.45%	4.59%	-1.37%	-0.21%	-1.35%	-1.23%
Chemical, fertilizer, clay products and cement industry	4.30%	3.88%	4.33%	4.42%	2.34%	3.25%	2.35%	2.43%	-0.71%	-0.09%	-0.70%	-0.61%
Electricity, gas and clean water	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.21%	0.07%	0.23%	0.29%
Construction	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-1.61%	-1.52%	-1.59%	-1.44%
Trading	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.21%	0.20%	0.23%	0.32%
Restaurant	-0.24%	2.83%	-0.30%	-0.28%	0.63%	-1.00%	0.68%	0.74%	0.49%	0.14%	0.51%	0.57%
Hotels	0.32%	0.59%	0.32%	0.40%	0.18%	-0.13%	0.23%	0.20%	0.22%	-0.05%	0.26%	0.25%
Land transportation	-3.86%	-1.05%	-3.89%	-3.97%	2.03%	0.74%	2.06%	2.20%	0.27%	0.25%	0.29%	0.38%
Air and water transportation and communication	-0.53%	0.90%	-0.54%	-0.40%	0.77%	-0.25%	0.81%	0.79%	0.54%	0.06%	0.56%	0.60%
Transportation supporting services, and storage	-1.07%	0.03%	-1.12%	-1.03%	1.14%	0.19%	1.20%	1.24%	0.66%	0.19%	0.71%	0.77%
Bank and insurance	0.19%	2.33%	0.09%	0.66%	0.10%	-0.97%	0.17%	-0.03%	0.17%	0.02%	0.20%	0.24%
Real estate and company service	-0.64%	0.23%	-0.63%	-0.34%	0.43%	-0.09%	0.45%	0.36%	0.16%	0.01%	0.18%	0.21%
Government and defence, education, health, film and other social services	-1.50%	0.11%	-1.67%	-1.51%	0.86%	0.03%	0.98%	0.91%	0.21%	0.08%	0.26%	0.26%
Individual service, household and other services	-4.39%	-3.37%	-4.45%	-4.37%	2.47%	1.94%	2.53%	2.57%	0.45%	0.39%	0.47%	0.54%

Table A2: Simulation Results on Employment by Sector and Labor Category

Sectors	Total Sectoral Employment				Informal Employment				Formal Unskilled Employment				Formal Skilled Employment			
	Base	Base + Union	Base + Eff.Wage	Base + Min.Wage	Base	Base + Union	Base + Eff.Wage	Base + Min.Wage	Base	Base + Union	Base + Eff.Wage	Base + Min.Wage	Base	Base + Union	Base + Eff.Wage	Base + Min.Wage
Food crop agriculture	0.81%	0.24%	0.83%	0.94%	0.60%	0.12%	0.62%	0.60%	1.78%	0.83%	1.78%	2.52%	0.81%	0.15%	1.01%	0.77%
Plantations	1.20%	0.59%	1.22%	1.40%	0.76%	0.33%	0.79%	0.68%	1.94%	1.04%	1.95%	2.61%	0.98%	0.36%	1.18%	0.85%
Livestock and its products	0.75%	0.36%	0.77%	0.87%	0.24%	0.06%	0.26%	0.05%	1.41%	0.77%	1.42%	1.97%	0.45%	0.09%	0.65%	0.22%
Forestry and hunting	-1.40%	-1.60%	-1.36%	-1.03%	-1.98%	-1.94%	-1.94%	-1.96%	-0.83%	-1.24%	-0.81%	-0.08%	-1.77%	-1.91%	-1.56%	-1.79%
Fishery	1.27%	0.29%	1.31%	1.49%	0.67%	-0.07%	0.71%	0.52%	1.85%	0.64%	1.87%	2.44%	0.88%	-0.04%	1.10%	0.69%
Coal, ore and natural oil mining	0.33%	-0.01%	0.40%	0.60%	0.00%	0.00%	0.00%	0.00%	0.82%	0.33%	0.79%	1.49%	-0.13%	-0.34%	0.02%	-0.25%
Mining and other excavations	-1.63%	-0.63%	-1.60%	-1.38%	-2.15%	-0.94%	-2.12%	-2.22%	-1.00%	-0.24%	-0.99%	-0.35%	-1.94%	-0.91%	-1.74%	-2.06%
Food, beverage and tobacco industry	2.16%	0.30%	2.20%	2.47%	1.48%	-0.09%	1.51%	1.39%	2.67%	0.62%	2.68%	3.33%	1.70%	-0.06%	1.90%	1.56%
Milling industry, textile, clothing and leather	7.53%	6.18%	7.57%	7.94%	6.69%	5.69%	6.71%	6.60%	7.94%	6.44%	7.95%	8.64%	6.92%	5.72%	7.13%	6.78%
Timber industry and wooden products	0.83%	0.21%	0.86%	1.13%	0.22%	-0.15%	0.25%	0.15%	1.39%	0.56%	1.41%	2.07%	0.43%	-0.12%	0.64%	0.32%
Paper industry, printing, transportation means and metal products and other industries	-3.25%	-0.52%	-3.20%	-2.92%	-3.93%	-0.92%	-3.91%	-3.99%	-2.80%	-0.21%	-2.80%	-2.15%	-3.72%	-0.89%	-3.53%	-3.83%
Chemical, fertilizer, clay products and cement industry	-2.29%	-0.30%	-2.24%	-1.96%	-2.94%	-0.68%	-2.93%	-2.98%	-1.81%	0.03%	-1.81%	-1.13%	-2.73%	-0.65%	-2.55%	-2.82%
Electricity, gas and clean water	1.69%	0.53%	1.80%	2.25%	1.15%	0.27%	1.17%	1.47%	2.33%	0.98%	2.34%	3.42%	1.36%	0.30%	1.57%	1.65%
Construction	-3.39%	-3.20%	-3.34%	-3.04%	-4.23%	-3.71%	-4.19%	-4.40%	-3.11%	-3.02%	-3.09%	-2.57%	-4.03%	-3.68%	-3.82%	-4.24%
Trading	0.24%	0.22%	0.26%	0.36%	0.12%	0.18%	0.09%	0.22%	1.29%	0.89%	1.25%	2.14%	0.34%	0.21%	0.48%	0.39%
Restaurant	0.54%	0.16%	0.57%	0.64%	0.43%	0.13%	0.38%	0.53%	1.60%	0.85%	1.54%	2.46%	0.64%	0.16%	0.77%	0.70%
Hotels	0.55%	-0.12%	0.67%	0.64%	0.34%	-0.17%	0.32%	0.43%	1.51%	0.54%	1.48%	2.35%	0.55%	-0.14%	0.71%	0.59%
Land transportation	0.33%	0.31%	0.35%	0.46%	-0.16%	0.03%	-0.16%	-0.31%	1.01%	0.74%	1.00%	1.60%	0.05%	0.06%	0.23%	-0.14%
Air and water transportation and communication	1.47%	0.17%	1.54%	1.64%	1.13%	0.02%	1.11%	1.17%	2.31%	0.73%	2.28%	3.11%	1.34%	0.05%	1.51%	1.35%
Transportation supporting services, and storage	0.86%	0.25%	0.92%	1.00%	0.59%	0.12%	0.57%	0.63%	1.77%	0.83%	1.74%	2.56%	0.80%	0.15%	0.97%	0.80%
Bank and insurance	0.57%	0.07%	0.65%	0.78%	0.32%	0.01%	0.25%	0.56%	1.50%	0.72%	1.41%	2.48%	0.54%	0.04%	0.64%	0.73%
Real estate and company service	0.71%	0.04%	0.80%	0.92%	0.42%	-0.07%	0.41%	0.56%	1.60%	0.64%	1.57%	2.48%	0.64%	-0.04%	0.80%	0.73%
Government and defence, education, health, film and other social services	0.25%	0.09%	0.30%	0.30%	-0.01%	0.02%	-0.10%	0.04%	1.17%	0.73%	1.06%	1.96%	0.21%	0.05%	0.29%	0.21%
Individual service, household and other services	0.74%	0.65%	0.78%	0.89%	0.34%	0.46%	0.29%	0.34%	1.52%	1.18%	1.44%	2.26%	0.55%	0.49%	0.67%	0.51%

Data and Calibration of Parameter Values in Base Model

In the Constant Elasticity of Substitution (CES) composite labor function, for the substitution elasticity between different types of labour, we use the value 1.5. For the US, Katz and Murphy (1992) estimate the elasticity at 1.41 and Krussel et al. (2000) at 1.67. For Ghana, Akay, Gokhan H. & Yuksel, Mutlu (2009) estimate a value of 1.58.

In the CES composite capital function, the elasticity of substitution between different types of capital is redundant as there is only one type of capital in our base model.

In the CES commodity demand function, for the substitution elasticity between domestic and imported commodities, we use a value of 3. Warr (2005) estimates the substitution elasticity for the Indonesian rice market and finds values of 2.6 to 4.1.

In the CES composite value-added function, for the substitution elasticity between composite labor and capital, we use the value 0.9. For Ghana, Akay and Yuksel (2009) find substitution elasticities between labor and capital from 0.7 to 0.9 while Behrman (1982) in a sample of more than 70 countries, finds that this elasticity is close to one (Cobb Douglas), but lower for less-developed countries and those with low capital intensity of production.

In the Constant Elasticity of Transformation (CET) commodity supply function, for the elasticity of transformation between exports and local sales, we use a value of 2. For France, Bermany et al (2011) estimate a value of between 0.1 to 0.5 for this parameter, but Warr and Lapiz (1994) use Thai data to find estimates of 0.3 to 2.7.

In the CET composite commodity function of each industry, the elasticity of transformation between different commodities is redundant as there is only one commodity produced by each industry in our CGE implementation.

For the price elasticity of the world demand for exports of each commodity, we use the GTAP elasticities of substitution among sources of imports in the Armington aggregation (ESUBM). For services trade, we use an elasticity value of 2. Table A3 below provides the values used for the price elasticity of world demand for Indonesian exports.

In the households' consumption demand functions, the values used for the income elasticity of consumption for each commodity are as shown in Table A3. These are close to the values estimated by Azis and Mansury (2003), which range between 0.9 to 1.1. The income elasticity for each commodity is the same across households.

For the Frisch parameter, Hertel et al (1997) estimate a value of -5.42, which we use.

With the Indonesian 2008 SAM data and imputed values from the literature, we calibrate the following variables and parameters in our model:
a) income- and savings- related variables and parameters
b) investment and government spending shares
c) direct tax rates
d) other tax rates, prices, margins and volumes

e) transfers and transfer parameters
f) parameters related to the Leontief, CES, and CET functions
g) the income elasticities of demand (as the assigned values of income elasticities may not result in consumption shares that add up to 1)
h) variables related to gross domestic product.

Table A3: Data used for the price elasticities of world demand for Indonesian exports (GTAP ESUBM) and the income elasticites of household consumption.

Commodity	Elasticity of World Demand for Indonesian Exports	Income Elasticity of Household Consumption
Food crop agriculture	4.629	1.1
Other crop agriculture	6.184	0.7
Livestock and its products	7.186	0.7
Forestry and hunting	5.000	0.7
Fishery	2.500	0.7
Coal, ore and natural oil mining	13.873	1.1
Mining and other excavations	1.800	1.1
Food, beverage and tobacco industry	4.329	1.1
Milling industry, textile, clothing and leather	7.572	1.1
Timber industry and wooden products	6.800	1.1
Paper industry, printing, transportation means and metal products and other industries	7.574	1.1
Chemical, fertilizer, clay products and cement industry	6.078	1.1
Electricity, gas and clean water	5.600	1.05
Construction	3.800	1.05
Trading	3.800	1.05
Restaurant	3.800	1.05
Hotels	3.800	1.05
Land transportation	3.800	1.05
Air and water transportation and communication	3.800	1.05
Transportation supporting services, and storage	3.800	1.05
Bank and insurance	3.800	1.05
Real estate and company service	3.800	1.05
Government and defence, education, health, film and other social services	3.800	1.05
Individual service, household and other services	3.800	1.05