GRIPS Discussion Paper 22-08

Intended and Unintended Impacts of Minimum Wage Change: The Pivotal Role of Migration in the Philippines

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June 2022

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Abstract

Minimum wage is used as a support for low-wage workers, but it is expected to increase unemployment and cause deterioration of the welfare of the unemployed. While earlier studies identify negative side effects of minimum wage, that may not be the case in the Philippines, where many workers migrate and send home large remittances. This study uses a computable general equilibrium model to examine the impacts of an increase in the domestic minimum wage on unemployment, migration, and output, as well as on welfare and inequality, in the Philippines. Our simulation results show that a minimum wage increase would indeed reduce domestic labor demand and prompt many unemployed workers to migrate out, leaving relatively few unemployed at home. While an increased volume of remittances would improve household welfare, it would also have some unintended effects, such as currency appreciation; decreased domestic production in labor-intensive and export-oriented industries; greater income disparity; and tax base erosion.

Keywords: Minimum wage, International Migration, Remittances, Income Inequality

[*] The authors gratefully acknowledge the financial support of JSPS KAKENHI (No. 19K01622). The usual disclaimers apply.

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1. Introduction

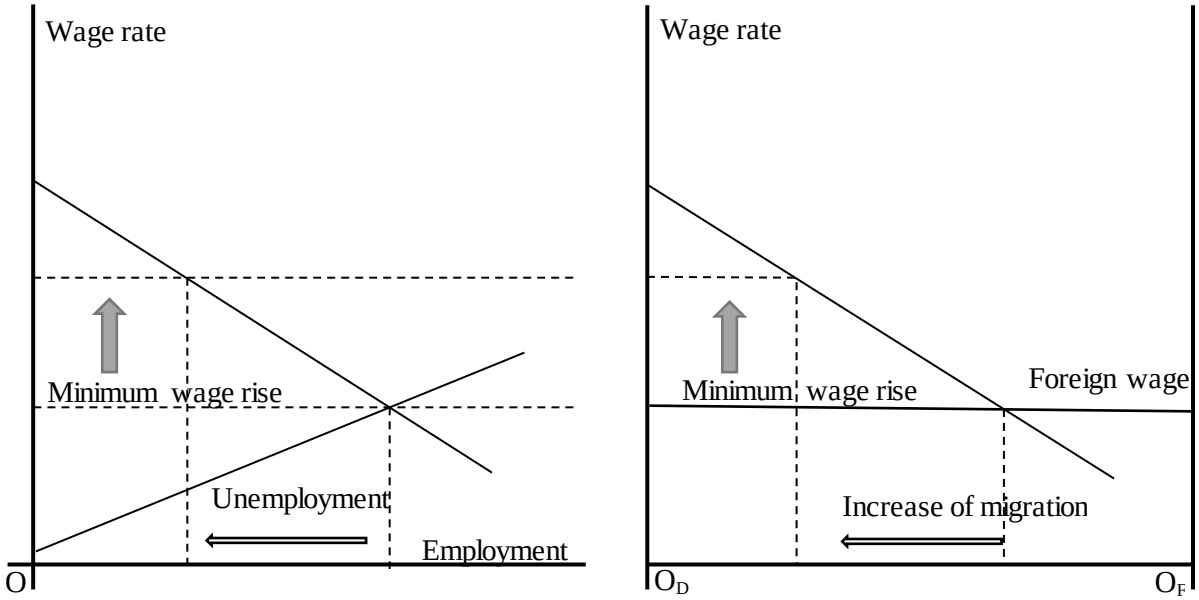
Many developing countries such as the Philippines are richly endowed with labor. The comparative advantage in labor-intensive industries would suggest that the Philippines suffers from low wages, accompanied by poverty and income inequality. The Philippine government uses a minimum wage as a policy intervention tool to mitigate these problems, rather than tools such as direct cache transfers or wage subsidies, which would incur fiscal costs. The (nominal) minimum wage is set every year with reference to the poverty threshold, prevailing average wages, and socio-economic indicators such as the consumer price index (CPI) and regional gross domestic product (GDP) (Department of Labor and Employment, n.d.). The minimum wage was raised by 3.4 percent during the period 2011–2018, or around one percent per annum in real terms.

The minimum wage increases are usually accompanied by unintended effects. Minimum wage increases have been found to induce little to no impact on unemployment in the case of developed countries (e.g., Metcalf, 2008 for the U.K.; Schmitt, 2015 for the U.S.A.), but they have depressed labor demand and increased unemployment in the Philippines, as has been the case in other developing countries (Broecke et al., 2017; Paqueo et al., 2016). The impacts of minimum wage increases are larger in labor-intensive firms (Lanzona, 2014) and cover a wide range of workers, not only minimum wage earners but also those earning up to 50 percent more than the minimum wage (Canales, 2014). Sicat (2004) provides evidence that this kind of government intervention has favored the welfare of currently-employed workers rather than promoting total employment in the Philippine economy; the unemployment rate in the Philippines reached 5.3 percent in 2018.

In a closed economy model, an increase in unemployment gives rise to losses in labor income (see the left panel of Figure 1). By contrast, under the Harris & Todaro (1970) model setup wherein domestic and foreign employment are measured from the origins of O_D and O_F respectively (the right panel of Figure 1), unemployed workers can migrate and earn wages to send to their families at home.

Lost domestic wages are largely compensated by remittances; domestic employed workers can enjoy higher wages. The result is a net income gain.

Figure 1. Minimum wage impacts on labor markets with and without a migration option.



The migration option is readily available for many Filipinos, who go abroad seamlessly with strong support from the government. They send back large remittances, which reached 9.4 percent of the country's GDP in 2021. Migration is driven by a lack of domestic employment opportunities (Organization of Economic Co-operation and Development/Scalabrini Migration Center, 2017), and by the level of domestic wages and/or foreign wages (Pholphirul, 2019; Tabuga, 2018). Bertoli et al. (2016) and Mckenzie et al. (2014) find evidence that migration is driven by foreign minimum wages, but these studies do not consider the effects of domestic minimum wages.

Table 1. Household labor income, capital income and remittance receipts in 2012 [Unit: Billion PHP and as percentage of per capita household income in parentheses].

Household	Labor Income				Capital Income	Remittance	Total	Total [per capita, PHP]
	Professional	Technical	Clerical	Unskilled				
NCR	373	187	204	92	904	149	1,909	148,227
	(20)	(10)	(11)	(5)	(47)	(8)	(100)	
Luzon	539	341	254	426	2,427	500	4,488	100,641
	(12)	(8)	(6)	(9)	(54)	(11)	(100)	
Visayas	185	120	89	180	1,018	167	1,759	90,790
	(11)	(7)	(5)	(10)	(58)	(9)	(100)	
Mindanao	253	137	117	262	1,009	119	1,896	78,559
	(13)	(7)	(6)	(14)	(53)	(6)	(100)	
Total	1,350	786	663	959	5,358	935	10,052	
	(13)	(8)	(7)	(10)	(53)	(9)	(100)	

Source: Authors' calculations using the 2012 Philippine SAM and population census.

Note: Some values are not exactly equal to the total due to rounding errors.

NCR: National Capital Region.

The Philippines suffers from significant income inequality (Table 1). The National Capital Region (NCR) hosts major companies and their headquarters, and thrives on professional labor income, while Mindanao benefits relatively more from unskilled labor and attains only half of the per capita income that NCR does. Income composition is similar for Luzon and Visayas. Remittances constitute a sizable share, comparable to that of non-professional labor incomes; migration and remittances influence these households significantly and unevenly. In fact, Gorodzeisky & Semyonov (2014) find an almost two-fold per capita income differential between Filipino households with migrants and those without. The distribution of remittance income between wage earners and entrepreneurs would also affect economic growth rates (Bahadir et al., 2018).

While remittances can improve the livelihood of households, they can also have unintended effects on the macroeconomy. Tradable sectors are particularly affected by remittance inflows through currency appreciation, a.k.a. the Dutch disease phenomenon, where tradable sectors face

cheaper imports and disadvantageous terms of trade for exports, and non-tradable sectors attract more resources (Lartey et al., 2012; Tuaño-Amador et al., 2007). Because of remittances, the economy becomes more consumption-oriented (Adams, 2011; Basnet et al., 2019; Chami et al., 2008). At the aggregate level, Seriño (2012) finds a negative impact of remittances in the short run but a positive impact on GDP in the long run. Bayangos & Jansen (2011) use a New Keynesian model and predict that a remittance increase would hit the economy not only by triggering an appreciation but also by initiating a labor supply reduction and migration, where the latter is assumed to be an exogenous shock.

On the fiscal side, as remittance income is not taxable in the Philippines, a shift from domestic labor income to remittance income erodes a major tax base. While remittances can provide fiscal space (Chami et al., 2008; Ebeke, 2008), the abovementioned shift in industrial structure toward non-tradable sectors dominated by informal sectors and thus less taxable, could split another major tax base on industries. Studies on migration driven by differences in personal income tax rates usually focus on high-income earners in developed countries (Kleven et al., 2020) although only a few examined migration in the Philippine context. Pomp (1989) discusses the complexity of taxing nonresident Filipinos and analyzes a taxation scheme against brain drain proposed by Bhagwati & Dellalfar (1973). Clarete & Diokno (2000) use a computable general equilibrium (CGE) model to simulate a fiscal reform involving a shift from border taxes to domestic taxes in line with the 1986 tax reform.

The studies summarized above mostly examine either minimum wages, endogenous migration decision, or Dutch disease effects on industries and households. Although the minimum wage and migration are major features of labor markets in the Philippines, their roles and linkages with other macro- and microeconomic variables have not been studied comprehensively in a general equilibrium framework. That gap in the literature could be filled using a structural macroeconomic model that can elucidate the pivotal role of migration in the economy using a so-called structuralist

CGE model featuring unemployment and wage rigidity such as that used by Taylor (1990). However, this type of model does not consider migration; thus, we extend it by incorporating a migration option for workers, à la Hossain & Hosoe (2020). Simulating a minimum wage increase, we find that a minimum wage increase would primarily promote migration with small voluntary unemployment and would improve welfare of all households as a result of the increased remittances. The overall welfare improvements, however, would be accompanied by some unintended effects, since welfare impacts vary among households; the Gini coefficient indicates a slight deterioration of income inequality mainly as a result of letting the largest welfare gains accrue to the richest household group. The remittance increase would lead to an appreciation of the domestic currency, which causes Dutch disease and tax base erosion due to an increase in untaxable remittance income and changes in industrial structure toward non-tradable sectors.

The remainder of the paper is organized as follows. Section 2 describes our CGE model and the data used to estimate it, section 3 describes the simulation scenario and presents the results, and section 4 draws conclusions and indicates directions for extension of this research.

2. Methodology and Data

2.1. Basic Features of the CGE model

We develop a static CGE model, based on the standard CGE model of Hosoe et al. (2010), to simulate a domestic minimum wage increase in a general equilibrium setup and examine the impacts of that increase on domestic production, migration, and welfare and inequality among the four types of households (the NCR, Luzon, Visayas, and Mindanao). In our model, markets are perfectly competitive. All factors allocated to domestic markets are mobile across industrial sectors. While demand prices of the three types of workers are fixed by the government, their supply prices along with other factor prices are flexibly adjusted for factor market equilibrium.

Table 2. Sectoral, factor and household aggregation.

Sector	Factor
Agriculture	Labor
Other primary sector	Professional
Food and beverages	Technical
Manufacturing	Clerical
Petroleum	Unskilled
Services	Capital
Wholesale and retail trade	Domestic
Transportation and storage	Foreign
Finance	

Source: Authors' aggregation.

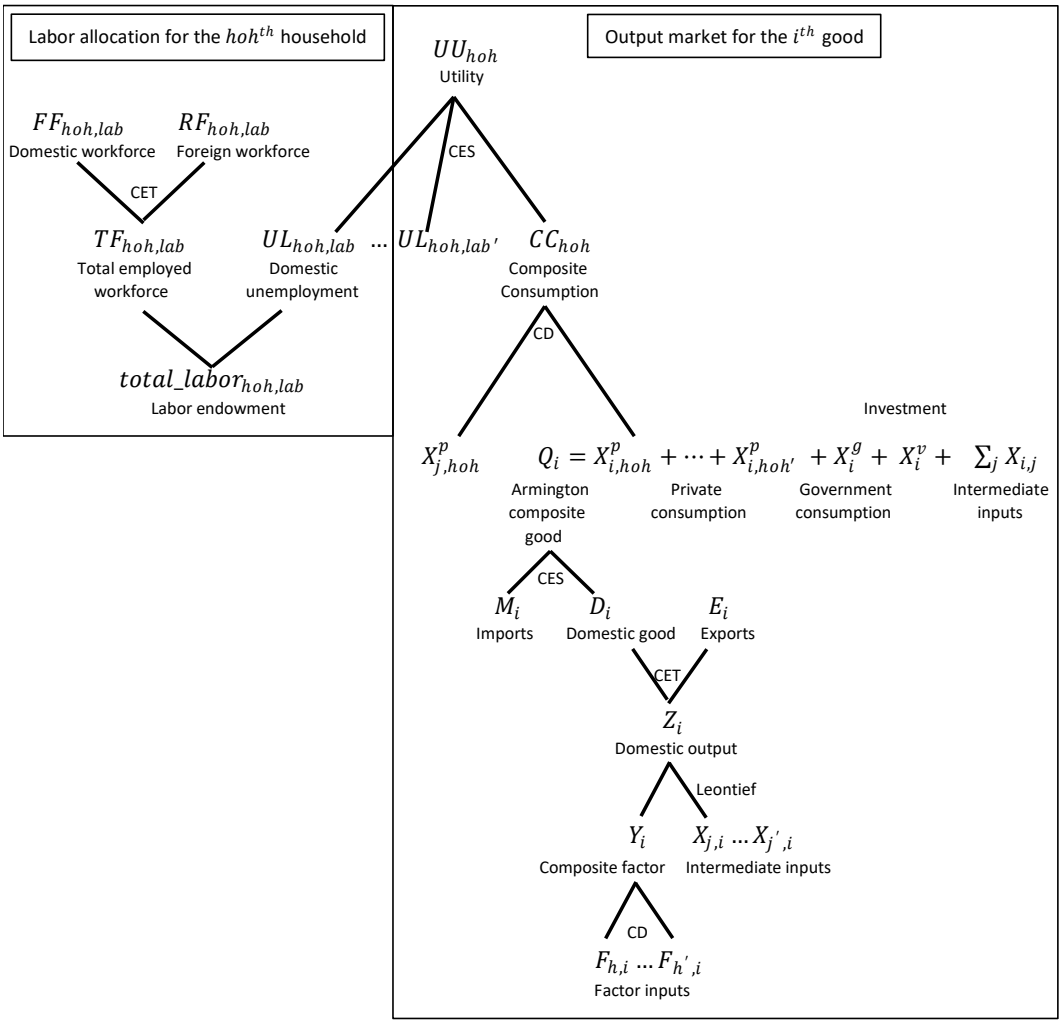
The production process starts from the bottom of Figure 2. A composite factor is formed by employing domestic labor and capital, along with foreign capital through a Cobb-Douglas (CD) production function. Combining intermediate inputs with the composite factor, producers generate the domestic output using a Leontief production function. A constant elasticity of transformation (CET) function converts domestic output into domestic goods or exports, while a constant elasticity of substitution (CES) function generates the Armington (1969) composite good from domestic goods and imports. Armington's composite goods are used for household and government consumption, investment and intermediate inputs; the Armington elasticities of substitution are adopted from the Global Trade Analysis Project (GTAP) database (version 10A).[1] Composite consumption consists of

[1] To check for robustness of our simulation results, we conduct a sensitivity analysis with respect to critical parameters assumed in the model, i.e., elasticity in CES/CET functions. The results indicate no qualitative differences in our conclusion. Details are provided in the Appendix.

various consumption goods with a CD aggregation function. Household utility depends on composite consumption as well as leisure consumption (explained later).

We employ a small-country assumption; international prices, including migrants' wage rates, are given for this economy in U.S. dollar terms. Foreign savings, or current account deficits, are kept unchanged in U.S. dollar terms, while the exchange rate is flexibly adjusted to achieve external balance.

Figure 2. Structure of the CGE model for the $\mathbf{i^{th}}$ sector/ the $\mathbf{hoh^{th}}$ household.



2.2. Model Extensions

We extend the standard CGE model with three fundamental assumptions. *First*, households are assumed to endogenously determine the supply of four types of labor as the residual of labor endowment not consumed for leisure (the left panel of Figure 2). We assume a CES function for the household utility function dependent on the composite consumption and leisure consumption, with an elasticity of substitution value of 0.25, following McNelis et al. (2009).

Second, we consider a migration option for workers. The total employed workforce is further allocated between the domestic and foreign labor markets by means of a CET function considering relative wages between these two markets. The extent of cross-border workforce mobility is represented by a CET function with an elasticity of six, based on the estimate by Bertoli et al. (2016). This large elasticity reflects the seamless mobility of Filipino migrant workers. Domestic households earn from domestic labor and capital, and also from migrant remittances. Once the workers migrate out, they are fully employed by the external sector at given wage rates under the small-country assumption. The industrial sectors employ two types of capital: domestic and foreign. The returns on the former and the latter are captured by the domestic households and the external sector, respectively.

Third, the government is assumed to set minimum wage rates for all but professional labor. While the choice of a numeraire does not affect the solutions of a standard Walrasian general equilibrium model, it is not the case in our structuralist CGE model with wage fixity (Hosoe, 2000). For the numeraire price, we choose the CPI, which is used as a major reference indicator in the determination of minimum wages. All prices are expressed as prices relative to this chosen numeraire price.

Our model is calibrated to the 2012 Philippine Social Accounting Matrix (SAM), based on the balance of payments, national account tables and 2012 input-output table by the Philippine Statistics Authority (PSA). We elaborate the original SAM accounts with additional data. To assess income

inequality, the original household account in the input-output table is split into four, using the Family Income and Expenditure Survey data by region. Sectoral foreign capital input is estimated using the Philippine Stock Exchange Foreign Ownership Level report. Migration and remittance accounts are elaborated based on the Survey of Overseas Filipinos report, while domestic unemployment is estimated from the unemployment rates reported by the PSA.

3. Simulation scenario and results

3.1. Simulation Scenario

To quantify the impact of a minimum wage increase, we assume that the minimum wage rate applies to three types of workers (technical, clerical, unskilled; but not professional). While, historically, minimum wage rates have been raised by only one percent per annum in real terms, we assume a more aggressive rise of two percent.[2] Note that the real minimum wage rise employed here is a rise against the numeraire price or the CPI.

When we examine the impacts of minimum wages, some arguments emerge for its coverage, enforcement, and compliance because a minimum wage does not necessarily determine the wages of all workers, whose productivity can vary widely. Many empirical studies examine the case of marginal workers, whose earnings are likely to be as low as the minimum wage (e.g., Card, 1992). Contrary to these concerns, Canales (2014) finds that the adjustment of the minimum wage can impact a wider range of workers in the Philippines. Inspection by the Department of Labor and Employment finds that the rate of compliance was 88 percent in 2020. Therefore, we assume that minimum wage is a

[2] We also have alternative assumptions of one and three percent for the magnitude of the minimum wage increase. The results are reported in the Appendix as part of our sensitivity analysis.

significant factor for determination of market wage rates for the three types of non-professional workers.

3.2. Effects on Industry and Employment

The change in the minimum wage of technical, clerical, and unskilled workers would affect domestic production. Table 3 shows sectoral output changes, ranked from most affected sector to least. Theory predicts that sectors with more (non-professional) labor-intensive technology would be affected more strongly. The predicted output changes are generally consistent with the non-professional labor intensity (the first column of Table 3). However, manufacturing and other primary sectors, the sectors generating the highest output, have much lower labor intensity than the agriculture sector. A general equilibrium perspective enhances understanding of those results. The minimum wage increase would promote migration and increase remittance inflows (discussed in detail later). This in turn would give rise to the Dutch disease, wherein remittances make the home currency appreciate and tend to discourage exports. As these two sectors are export-oriented, they would be hit hard.

Table 3. Sector profile and Impacts on output due to a 2 percent minimum wage increase.

Sector	Non-professional labor intensity* [%]	Simulation Results [Change from the Base, %]		
		Output	Exports	Imports
Manufacturing	23.0	-2.2	-3.1	0.3
Other primary sector	17.0	-1.1	-1.9	-0.0
Agriculture	45.0	-0.8	-2.5	1.2
Wholesale and retail trade	21.3	-0.6	-1.0	-0.0
Food and beverages	14.0	-0.5	-1.2	0.3
Petroleum	12.7	-0.5	-0.9	-0.1
Services	25.4	-0.3	-0.9	0.4
Transportation and storage	6.7	-0.3	-0.6	0.1
Finance	18.2	-0.3	-0.2	-0.4

* Intensity of technical, clerical and unskilled workers in sectoral value added, computed from the 2012 SAM.
Source: Column 2 is based on data, while columns 3, 4 and 5 are the authors' simulation results.

The non-professional labor intensity of the service sector is comparable to that of the most affected manufacturing sector, and yet the service sector falls under the least affected group. The latter is partly because the Dutch disease would induce reallocation of more resources to the non-tradable sector (i.e., the service sector), and partly because remittances would increase household income, a large part of which is spent on service consumption (Tabuga, 2008), which would mitigate the service output decline.

A minimum wage rise would reduce domestic labor demand and consequently would hamper domestic employment. With the same rise in minimum wages, the three types of workers would experience loss of domestic jobs in a similar scale; but only a few workers in those groups would

become unemployed (Table 4). Professional labor would suffer slight collateral damage because the other types of labor hired to complement professional labor would lose jobs in the economy. Notably, the affected domestic workers would almost fully migrate. Workers in Luzon and Visayas would be slightly more inclined to migrate than those in the other two regions.

Table 4. Impacts on domestic labor employment, unemployment and migration due to a 2 percent minimum wage increase [Unit: Changes of employment and unemployment in percent of total labor endowment for each labor type].

	Professional labor			Technical labor			Clerical Labor			Unskilled labor		
Household	Emp	Unemp	Mig	Emp	Unemp	Mig	Emp	Unemp	Mig	Emp	Unemp	Mig
NCR	-0.02	0.01	0.02	-0.36	0.01	0.34	-0.33	0.02	0.31	-0.42	0.02	0.40
Luzon	-0.03	0.00	0.03	-0.45	0.01	0.45	-0.56	0.01	0.55	-0.57	0.01	0.55
Visayas	-0.03	0.00	0.03	-0.49	0.00	0.48	-0.42	0.01	0.41	-0.39	0.01	0.37
Mindanao	-0.02	0.00	0.02	-0.36	0.01	0.35	-0.39	0.01	0.38	-0.38	0.01	0.36
Total	-0.10	0.01	0.09	-1.67	0.03	1.62	-1.69	0.04	1.64	-1.75	0.05	1.68

Source: Authors' simulation results.

Note: Some values are not exactly equal to the total due to rounding errors.

3.3. Effects on Household Welfare and Unintended Outcomes

As predicted in the right panel of Figure 1, the minimum wage rise would increase household income, in turn increasing expenditure on consumption of goods and leisure. The welfare measurement of equivalent variations (EVs) is computed based on that increase (Table 5). The welfare impacts differ widely across the four households. The NCR would gain the most, as large as 217 PHP, which is comparable to three days' worth of minimum wage at that time. The second largest gains

would be by Mindanao, the poorest region, followed by the gains of Luzon and Visayas. Income inequality among these three non-capital regions would be narrowed. However, as the NCR outperforms these three regions, nationwide inequality would be exacerbated. The Gini coefficient, computed with per capita expenditure, would rise slightly to 0.7023 from 0.7021.

Household gains can be anatomized by scrutinizing changes in income by source. Across all four regions, the major driver is remittances. The NCR would have the largest gains in remittances but also the largest losses in income from professional labor and domestic capital, both of which are outside the scope of the government intervention by minimum wages. By contrast, Mindanao's second largest welfare gains can be attributed to the smallest losses in professional labor and capital income and moderate gains in the other three labor income, despite the smallest gains from remittances. Luzon and Visayas would receive the second and third largest remittance income gains, achieved by mobilizing their domestic non-professional workers abroad, more than those of the NCR and Mindanao (Table 4). However, those gains bring relatively larger losses in domestic labor incomes (Table 5). The expenditure gains—larger than the income gains—are mostly attributable to decreases in payments of a direct tax, which is not levied on remittance income.[3]

[3] The Appendix shows changes in savings and direct tax payments.

Table 5. Impacts on household welfare and income due to a 2 percent minimum wage increase.

	Welfare in EV		Per capita income change (PHP)						
	Per capita (PHP)	% of initial income	Professional labor	Technical labor	Clerical labor	Unskilled labor	Capital	Remittance	Total
NCR	217	0.17	-146	-21	39	-16	-423	685	118
Luzon	60	0.08	-67	-73	-79	-100	-328	665	18
Visayas	35	0.05	-52	-99	-10	10	-317	468	-0
Mindanao	108	0.16	-50	2	1	20	-252	376	98

Source: Authors' simulation results.

Note: Changes in total expenditure and income do not perfectly match due to direct tax payments and savings as well as the difference of measurements between EVs (based on expenditure function with Laspeyres prices) and income (deflated by CPI).

Behind the positive welfare improvements driven by remittances, the minimum wage rise has negative impacts on the government budget. The shift from domestic wage income to migrant remittance income would erode one of the major tax bases, since remittance income is not subject to direct tax. Moreover, migration reduces domestic labor resources and in turn domestic production, leading to losses in taxes levied on industries. The income tax loss and production tax loss would reach 0.5 and 0.6 percent of tax revenues on industries, respectively. Although a minimum wage rise does not impose any fiscal costs, these unintended revenue losses should be considered part of the policy costs of enforcing higher minimum wages.

4. Conclusion

A minimum wage is often used as a policy intervention tool to mitigate low income and inequality without incurring fiscal costs. Using a structural CGE model featuring endogenous migration we simulate a minimum wage increase in the Philippines to examine the impact of such an increase on macro- and microeconomic variables, and to elucidate the pivotal role of migration in a macroeconomy. The migration option allows households to gain from a minimum wage increase; however, migration would have some unintended consequences. A key consequence would be currency appreciation, which would harm domestic industries. Under a minimum wage increase, the Philippine economy would become more consumption-oriented and more dependent on remittances. Remittances would improve the livelihood of all household groups but would impact them differently: household inequality would be intensified because the richest group would gain the most from the minimum wage increase. The government should not let the rich become far richer without sharing the benefits of policy interventions with other groups. The tax structure should be reformed so that remittances are also subject to income tax, in order to mitigate the disparity between households with migrants and those without. Since a minimum wage increase incurs indirect fiscal costs in the form of tax base erosion, the government should consider less distortionary interventions such as direct transfers to low-income groups.

There are some limitations to our study. First, due to data limitations, we consider only four types of household in our linking of the micro household survey data to the macro SAM. Second, we do not include the informal sector in the model since it cannot be accounted for at this time. It can be considered when some data emerges in the future.

Some valuable extensions of this study are apparent. It would be of practical value to elaborate on the four household types used here to improve our examination of inequality among heterogeneous households. Moreover, shocks in foreign labor markets and cross-border labor mobility, such as the recent fall in labor demand and restrictions on labor mobility resulting from the

impact of COVID-19, could be good policy experiments. While the Philippines has seen many workers migrate out, it has also accumulated a large amount of foreign capital as the result of the recent development of global value chains, which point to the importance of analyzing the interaction between foreign capital and migration, applying the framework used here.

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Appendix

A.1 Sensitivity Analysis

A.1.1 Varying Magnitude of Domestic Minimum Wage Increase

In our simulation, we assumed a two percent increase in domestic minimum wages. To check the robustness of the results with respect to this assumption, we conducted the same policy experiments with minimum wages raised and lowered by one percentage point. The simulation outcomes in output (Table A.1), welfare (Table A.2), and employment (Table A.3) become proportionately larger/smaller with a larger/smaller shock in all indicators. These findings are qualitatively robust.

Table A.1. Impacts on sectoral output change with one percent lower/higher percentage change cases [Unit: Percentage change from the base].

Sector	1% Minimum Wage Increase	2% Minimum Wage Increase (Baseline Case)	3% Minimum Wage Increase
Agriculture	-0.40	-0.80	-1.19
Other Primary Sector	-0.57	-1.13	-1.67
Food and Beverages	-0.26	-0.52	-0.78
Manufacturing	-1.13	-2.23	-3.30
Petroleum	-0.27	-0.54	-0.81
Services	-0.17	-0.33	-0.50
Wholesale and retail Trade	-0.28	-0.55	-0.82
Transportation and storage	-0.14	-0.27	-0.41
Finance	-0.14	-0.28	-0.42

Table A.2. Impacts on household welfare with one percent lower/higher percentage change cases [Unit: EV per capita in PHP].

Household	1% Minimum Wage Increase	2% Minimum Wage Increase (Baseline Case)	3% Minimum Wage Increase
NCR	112	217	315
Luzon	33	60	80
Visayas	19	35	46
Mindanao	56	108	156

Table A.3. Impacts on employment, unemployment and migration with one percent lower/higher percentage change cases [Unit: EV per capita in PHP].

Labor	1% Minimum Wage Increase			2% Minimum Wage Increase (Baseline Case)			3% Minimum Wage Increase		
	Emp	Unemp	Mig	Emp	Unemp	Mig	Emp	Unemp	Mig
Professional	-0.05	0.01	0.04	-0.10	0.01	0.09	-0.15	0.02	0.13
Technical	-0.84	0.02	0.82	-1.67	0.03	1.62	-2.47	0.04	2.40
Clerical	-0.85	0.02	0.83	-1.69	0.04	1.64	-2.52	0.06	2.43
Unskilled	-0.88	0.03	0.85	-1.75	0.05	1.68	-2.60	0.07	2.48

A.1.2 Armington Elasticity

The outcome of a CGE analysis is strongly influenced by the assumption of some key parameter values, such as the Armington elasticities of substitution/transformation (σ/ϕ). To test the robustness of our simulation results, we performed a sensitivity analysis with a 30 percent lower elasticity and a 30 percent higher elasticity value than the baseline case. Sectoral output is affected only marginally by the assumed elasticity parameters (Table A.4), while higher elasticity tends to increase welfare outcomes, as found in numerous trade policy CGE analyses (Table A.5). Even though higher elasticity causes larger reductions in trade due to the Dutch disease effect and thus tends to have larger impact on employment, it will have a smaller impact on unemployment, since the labor resource consists of employed and unemployed (Table A.6).

Table A.4. Impacts on sectoral output change with 30 percent lower/higher elasticity cases [Unit: Percentage change from the base].

Sector	30 Percent Lower Armington Elasticity Case	Baseline Case	30 Percent Higher Armington Elasticity Case
Agriculture	-0.74	-0.80	-0.86
Other Primary Sector	-1.18	-1.13	-1.05
Food and Beverages	-0.50	-0.52	-0.54
Manufacturing	-2.16	-2.23	-2.28
Petroleum	-0.56	-0.54	-0.52
Services	-0.33	-0.33	-0.34
Wholesale and retail Trade	-0.54	-0.55	-0.55
Transportation and storage	-0.28	-0.27	-0.27
Finance	-0.28	-0.28	-0.28

Table A.5. Impacts on household welfare with 30 percent lower/higher elasticity cases [Unit: EV per capita in PHP].

Household	30 Percent Lower Armington Elasticity Case	Baseline Case	30 Percent Higher Armington Elasticity Case
NCR	203	217	227
Luzon	52	60	64
Visayas	31	35	37
Mindanao	104	108	110

Table A.6. Impacts on employment, unemployment and migration with 30 percent lower/higher elasticity cases [Unit: Changes of employment and unemployment in percent of total labor endowment for each labor type].

Labor	30 Percent Lower Armington Elasticity Case			Baseline Case			30 Percent Higher Armington Elasticity Case		
	Emp	Unemp	Mig	Emp	Unemp	Mig	Emp	Unemp	Mig
Professional	-0.06	0.01	0.04	-0.10	0.01	0.09	-0.13	0.01	0.12
Technical	-1.65	0.04	1.60	-1.67	0.03	1.62	-1.67	0.03	1.64
Clerical	-1.69	0.05	1.61	-1.69	0.04	1.64	-1.70	0.03	1.65
Unskilled	-1.73	0.06	1.63	-1.75	0.05	1.68	-1.77	0.04	1.72

A.1.3 Elasticity of Transformation between Domestic-Foreign Labor Market Allocation

Other than the Armington elasticities of substitution/transformation (σ/ϕ), the findings of a CGE analysis could be influenced by the assumed value of elasticity $\boldsymbol{\nu}$ used in the CET function that allocates labor between domestic and foreign markets. In our sensitivity analysis, we alternatively assume 3.34 and 8.57, which are the lower and upper bound estimates, respectively, set by Bertoli et al. (2016). Sectoral output is marginally affected (Table A.7), while welfare estimates are found to be smaller/larger in lower/higher elasticity cases, respectively, because a higher/lower elasticity represents a decrease/increase of friction in mobility (Table A.8). Moreover, a higher elasticity allows more flexible adjustment between domestic and foreign labor markets. Thus, their employment tends to show larger changes (Table A.9).

Table A.7. Impacts on sectoral output change with 30 percent lower/higher elasticity cases [Unit: Percentage change from the base].

Sector	Lower Labor Transformation Elasticity Case ($\boldsymbol{\nu}$=3.34)	Baseline Case ($\boldsymbol{\nu}$=6)	Higher Labor Transformation Elasticity Case ($\boldsymbol{\nu}$=8.57)
Agriculture	-0.80	-0.80	-0.80
Other Primary Sector	-1.11	-1.13	-1.14
Food and Beverages	-0.52	-0.52	-0.52
Manufacturing	-2.19	-2.23	-2.26
Petroleum	-0.54	-0.54	-0.55
Services	-0.33	-0.33	-0.33
Wholesale and retail Trade	-0.54	-0.55	-0.55
Transportation and storage	-0.28	-0.27	-0.28
Finance	-0.28	-0.28	-0.28

Table A.8. Impacts on household welfare with 30 percent lower/higher elasticity Cases [Unit: EV per capita in PHP].

Household	Lower Labor Transformation Elasticity Case (ν=3.34)	Baseline Case (ν=6)	Higher Labor Transformation Elasticity Case (ν=8.57)
NCR	210	217	221
Luzon	56	60	61
Visayas	33	35	35
Mindanao	105	108	109

Table A.9. Impacts on employment, unemployment and migration with 30 percent lower/higher elasticity cases [Unit: Changes of employment and unemployment in percent of total labor endowment for each labor type].

Labor	Lower Labor Transformation Elasticity Case (ν=3.34)			Baseline Case (ν=6)			Higher Labor Transformation Elasticity Case (ν=8.57)		
	Emp	Unemp	Mig	Emp	Unemp	Mig	Emp	Unemp	Mig
Professional	-0.08	0.01	0.06	-0.10	0.01	0.09	-0.12	0.01	0.10
Technical	-1.66	0.04	1.60	-1.67	0.03	1.62	-1.67	0.02	1.64
Clerical	-1.69	0.06	1.61	-1.69	0.04	1.64	-1.69	0.03	1.65
Unskilled	-1.75	0.08	1.64	-1.75	0.05	1.68	-1.75	0.04	1.70

A.1.4 Elasticity of Labor Supply

Similarly, labor supply elasticity υ, or leisure-goods substitution elasticity in a CES sub-utility function, is a key parameter in our CGE model. We conduct a sensitivity analysis by halving and doubling the baseline parameter value of 0.25 used by McNelis et al. (2009). Our simulation results are only slightly affected by these alternative assumptions. To illustrate, a minimum wage increase is expected to induce a fall in the supply price of labor (i.e., wages without a minimum wage premium). Although a higher labor supply elasticity leads to a larger increase in voluntary unemployment (Table A.12), this effect, even with doubled elasticity, is not large enough to induce significant changes in welfare or output results (Table A.10, Table A.11, Table A.12).

Table A.10. Impacts on sectoral output change with lower/higher labor supply elasticity cases [Unit: Percentage change from the base].

Sector	Lower Labor Supply Elasticity Case (υ=0.125)	Baseline Case (υ=0.25)	Higher Labor Supply Elasticity Case (υ=0.5)
Agriculture	-0.8	-0.8	-0.8
Other Primary Sector	-1.1	-1.1	-1.1
Food and Beverages	-0.5	-0.5	-0.5
Manufacturing	-2.2	-2.2	-2.2
Petroleum	-0.5	-0.5	-0.5
Services	-0.3	-0.3	-0.3
Wholesale and retail Trade	-0.5	-0.5	-0.5
Transportation and storage	-0.3	-0.3	-0.3
Finance	-0.3	-0.3	-0.3

Table A.11. Impacts on household welfare with lower/higher labor supply elasticity cases [Unit: EV per capita in PHP].

Household	Lower Labor Supply Elasticity Case (υ=0.125)	Baseline Case (υ=0.25)	Higher Labor Supply Elasticity Case (υ=0.5)
NCR	218.89	217.16	209.74
Luzon	59.04	59.50	59.70
Visayas	33.87	34.57	35.53
Mindanao	107.91	107.69	106.47

Table A.12. Impacts on employment, unemployment and migration with lower/higher elasticity cases [Unit: Changes of employment and unemployment in percent of total labor endowment for each labor type].

Labor	Lower Labor Supply Elasticity Case (υ=0.125)			Baseline Case (υ=0.25)			Higher Labor Supply Elasticity Case (υ=0.5)		
	Emp	Unemp	Mig	Emp	Unemp	Mig	Emp	Unemp	Mig
Professional	-0.10	0.01	0.09	-0.10	0.01	0.09	-0.10	0.02	0.09
Technical	-1.67	0.02	1.63	-1.67	0.03	1.62	-1.67	0.05	1.60
Clerical	-1.70	0.02	1.65	-1.70	0.04	1.64	-1.70	0.07	1.61
Unskilled	-1.75	0.03	1.70	-1.75	0.05	1.68	-1.76	0.09	1.65

A.2 Alternative Scenarios with Smaller and Larger Minimum Wage Increases

When we alternatively assume one percent and three percent minimum wage increases, the simulation results in household welfare and income become proportionately smaller and bigger, respectively (Table A.13, Table A.14).

Table A.13. Welfare and income changes under alternative magnitude scenarios [Unit: Per capita in PHP].

	EV	Income						Total Income	Savings	Direct Tax
		Professional labor	Technical labor	Clerical labor	Unskilled labor	Capital	Remittance			
Smaller Shock: 1% Minimum Wage Increase										
NCR	108	-73	-11	20	-8	-213	347	62	1	-41
Luzon	33	-34	-37	-40	-50	-165	339	13	2	-18
Visayas	20	-26	-50	-5	5	-159	238	2	1	-13
Mindanao	55	-25	1	1	11	-127	191	51	5	-6
Baseline Shock: 2% Minimum Wage Increase										
NCR	217	-146	-21	39	-16	-423	685	118	3	-81
Luzon	60	-67	-73	-79	-100	-328	665	18	3	-36
Visayas	35	-52	-99	-10	10	-317	468	-0	-0	-27
Mindanao	108	-50	2	1	20	-252	376	98	9	-13
Larger Shock: 3% Minimum Wage Increase										
NCR	315	-218	-31	57	-24	-631	1014	167	4	-121
Luzon	80	-100	-109	-117	-148	-489	979	16	3	-53
Visayas	46	-77	-147	-16	14	-472	690	-8	-2	-40
Mindanao	156	-75	3	2	30	-375	558	142	12	-19

Note: Changes in total expenditure and income do not perfectly match because minor elements (e.g., direct tax and savings) and substitution effects are omitted on the income side.

Table A.14. Domestic labor employment, unemployment and migration changes under alternative magnitude scenarios [Unit: Percentage change over total labor type].

	Professional labor			Technical labor			Clerical Labor			Unskilled labor		
Household	Emp	Unemp	Mig	Emp	Unemp	Mig	Emp	Unemp	Mig	Emp	Unemp	Mig
	Smaller Shock: 1% Minimum Wage Increase											
NCR	-0.01	0.00	0.01	-0.18	0.01	0.17	-0.17	0.01	0.16	-0.21	0.01	0.20
Luzon	-0.02	0.00	0.01	-0.23	0.00	0.23	-0.28	0.00	0.28	-0.29	0.01	0.28
Visayas	-0.01	0.00	0.01	-0.25	0.00	0.25	-0.21	0.00	0.21	-0.19	0.01	0.19
Mindanao	-0.01	0.00	0.01	-0.18	0.00	0.18	-0.19	0.00	0.19	-0.19	0.00	0.18
Total	-0.05	0.01	0.04	-0.84	0.02	0.82	-0.85	0.02	0.83	-0.88	0.03	0.85
	Baseline Shock: 2% Minimum Wage Increase											
NCR	-0.02	0.01	0.02	-0.36	0.01	0.34	-0.33	0.02	0.31	-0.42	0.02	0.40
Luzon	-0.03	0.00	0.03	-0.45	0.01	0.45	-0.56	0.01	0.55	-0.57	0.01	0.55
Visayas	-0.03	0.00	0.03	-0.49	0.00	0.48	-0.42	0.01	0.41	-0.39	0.01	0.37
Mindanao	-0.02	0.00	0.02	-0.36	0.01	0.35	-0.39	0.01	0.38	-0.38	0.01	0.36
Total	-0.10	0.01	0.09	-1.67	0.03	1.62	-1.69	0.04	1.64	-1.75	0.05	1.68
	Larger Shock: 3% Minimum Wage Increase											
NCR	-0.03	0.01	0.02	-0.54	0.02	0.51	-0.49	0.02	0.46	-0.63	0.03	0.59
Luzon	-0.05	0.00	0.04	-0.67	0.01	0.66	-0.83	0.01	0.80	-0.84	0.01	0.81
Visayas	-0.04	0.00	0.04	-0.73	0.01	0.71	-0.62	0.01	0.60	-0.57	0.01	0.55
Mindanao	-0.03	0.00	0.02	-0.54	0.01	0.52	-0.58	0.01	0.56	-0.56	0.01	0.54
Total	-0.15	0.02	0.13	-2.47	0.04	2.40	-2.52	0.06	2.43	-2.60	0.07	2.48

Some values are not exactly equal to the total due to rounding errors.

A.3 Model Equations

Variable and Parameter Symbol List:

Sets

i, j	all sectors
h, k	factors of production
lab	all labor inputs (professional, technical, clerical, unskilled)
cap	all capital inputs (domestic and foreign)
w_all,n_all	all households (domestic and foreign)

Endogenous variables

Y_j	composite factor (value added)
$F_{h,j}$	factor input used by all sectors
$X_{i,j}$	intermediate inputs
Z_j	gross domestic output
$X^p_{i,hoh}$	household consumption
X^v_i	investment demand
X^g_i	government consumption
E_i	exports
M_i	imports
Q_i	Armington composite goods
D_i	domestic goods
$TF_{hoh,lab}$	total employed workforce
$FF_{w\_all,lab}$	domestic workforce
$RF_{hoh,lab}$	foreign workforce
pfd_k	labor demand price
pfs_k	labor supply price
ι_k	gap between labor demand and supply price
$pRF_{hoh,lab}$	price of foreign labor
$pTF_{hoh,lab}$	price of total employed labor workforce

py_j	price of composite factor
pz_j	supply price of gross domestic output
pq_i	price of Armington composite good
pe_i	price of exports in domestic currency
pm_i	price of imports in domestic currency
pd_i	price of domestic good
pcc_{hoh}	price of household composite consumption good
ϵ	foreign exchange rate (domestic currency / foreign currency)
S^p_{hoh}	household private savings
S^g	government savings
T^d_{hoh}	lump-sum direct tax revenue
T^z_i	production tax revenue
T^m_i	import tariff
CC_{hoh}	composite consumption foods (or felicity)
$UL_{hoh,lab}$	domestic unemployment
UU_{hoh}	household utility

Exogenous variables

S^f	foreign saving in foreign currency
p^{We}_i	export price in foreign currency

p_i^{Wm}	import price in foreign currency
CPI	consumer price index
$total\_labor_{hoh,lab}$	total labor endowment
τ_{hoh}^{d}	household share of direct tax
τ_j^z	production tax rates
τ_i^m	import tariff rates

Parameters

$ax_{i,j}$	input requirement coefficients of intermediate inputs
ay_j	input requirement coefficients of composite goods
$\alpha_{i,hoh}$	share parameters in composite consumption production function
aaa_{hoh}	scale parameter in composite consumption function
$\alpha 1_{hoh}$	share parameter in utility function (for composite consumption)
$\alpha 2_{hoh,lab}$	share parameter in utility function (for domestic unemployment)
$\beta_{h,j}$	share parameter in production function
b_j	scale parameter in production function
μ_i	share parameter of government consumption
λ_i	share parameter of investment demand
δ_m, δ_d	input share parameter in the Armington composite goods production function

γ_i	scale parameter in the Armington composite goods production function
σ_i	elasticity of substitution in the Armington composite good production function
η_i	parameter defined by the Armington elasticity of substitution
$\xi d_i, \xi e_i$	share parameter in the gross domestic output transformation function
θ_i	scale parameter in the gross domestic output transformation function
$\omega^{FF}_{hoh,lab}, \omega^{RF}_{hoh,lab}$	share parameter in the labor transformation function
$\kappa_{hoh,lab}$	scale parameter in the labor transformation function
ψ_i	elasticity of transformation in the gross domestic output transformation function
ϕ_i	parameter defined by the elasticity of transformation of gross domestic output
$\nu_{hoh,lab}$	elasticity of transformation in the labor transformation function
$\chi^{hoh,lab}$	parameter defined by the elasticity of transformation in the labor transformation function
υ_{hoh}	price elasticity of labor supply
ρ_{hoh}	parameter defined by the price elasticity of labor supply
ss^p_{hoh}	average propensity for household savings
ss^g	average propensity for government savings

Model equations

i. Domestic Production Block

$$Y_j = b_j \prod_h F_{h,j}^{\beta_{h,j}}$$

$$F_{h,j} = \frac{\beta_{h,j} py_j}{pfd_h} Y_j$$

$$X_{i,j} = ax_{i,j} Z_j$$

$$Y_j = ay_j Z_j$$

$$pz_j = ay_j py_j + \sum_i ax_{i,j} pq_i$$

ii. Government

$$T_{hoh}^d = \tau_{hoh}^d \left(\sum_{lab} pfd_{lab} FF_{hoh,lab} + pfd_{lcap} FF_{hoh,lcap} \right)$$

$$T_j^z = \tau_j^z pz_j Z_j$$

$$T_i^m = \tau_i^m pm_i M_i$$

$$X_i^g = \frac{\mu_i}{pq_i} \left(\sum_{hoh} T_{hoh}^d + \sum_j T_j^z + \sum_j T_j^m - S^g \right)$$

iii. Investment and Savings

$$X_i^v = \frac{\lambda_i}{pq_i} \left(\sum_{hoh} S_{hoh}^p + S^g + \epsilon S^f \right)$$

$$S_{hoh}^p = ss_{hoh}^p \left(\sum_{lab} pfd_{lab} FF_{hoh,lab} + pfd_{lcap} FF_{hoh,lcap} + \sum_{lab} pRF_{lab} \epsilon RF_{hoh,lab} \right)$$

$$S^g = ss^g\left(\sum_{hoh} T^d_{hoh} + \sum_j T^z_j + \sum_j T^m_j\right)$$

iv. Household

$$X^p_{i,hoh} = \frac{\alpha_{i,hoh}}{pq_i} pcc_{hoh} CC_{hoh}$$

$$CC_{hoh} = aaa_{hoh} \prod_i X^p_{i,hoh}{}^{\alpha_{i,hoh}}$$

$$CC_{hoh} = \left(\frac{\alpha 1_{hoh}}{pcc_{hoh}}\right)^{\upsilon_{hoh}} \left[\frac{FactorIncome - T^d_{hoh} - S^p_{hoh}}{\alpha 1^{\upsilon}_{hoh} pcc^{1-\upsilon}_{hoh} + \alpha 2^{\upsilon}_{hoh} pTF^{1-\upsilon}_{hoh}}\right]$$

$$UL_{hoh} = \left(\frac{\alpha 2_{hoh,lab}}{pTF_{hoh,lab}}\right)^{\upsilon_{hoh}} \left[\frac{FactorIncome - T^d_{hoh} - S^p_{hoh}}{\alpha 1^{\upsilon}_{hoh} pcc^{1-\upsilon}_{hoh} + \alpha 2^{\upsilon}_{hoh} pTF^{1-\upsilon}_{hoh}}\right]$$

$$FactorIncome = \sum_{lab} pfd_{lab} FF_{hoh,lab} + \sum_{lab} pTF_{hoh,lab} UL_{hoh,lab} + \sum_{lab} pRF_{lab} \epsilon RF_{hoh,lab} + pfd_{lcap} FF_{hoh,lcap}$$

v. Export and Import Prices and Balance of Payments Constraint

$$pe_i = \epsilon p^{We}_i$$

$$pm_i = \epsilon p^{Wm}_i$$

$$\sum_i p^{We}_i E_i + S^f + \sum_{hoh,lab} pRF_{lab} RF_{hoh,lab} = \sum_i p^{Wm}_i M_i + \frac{pfd_{lcap}}{\epsilon} FF_{EXT,fcap}$$

vi. Substitution between Imports and Domestic Goods

$$Q_i = \gamma_i \left(\delta^m_i M^{\eta_i}_i + \delta^d_i D^{\eta_i}_i\right)^{\frac{1}{\eta_i}}$$

$$M_i = \left(\frac{\gamma^{\eta_i}_i \delta^m_i pq_i}{(1+\tau^m_i) pm_i}\right)^{\frac{1}{1-\eta_i}} Q_i$$

$$D_i = \left(\frac{\gamma_i^{\eta_i}\delta_i^d pq_i}{pd_i}\right)^{\frac{1}{1-\eta_i}} Q_i$$

vii. Transformation between Exports and Domestic Goods

$$Z_i = \theta_i\left(\xi_i^e E_i^{\phi_i} + \xi_i^d D_i^{\phi_i}\right)^{\frac{1}{\phi_i}}$$

$$E_i = \left(\frac{\theta_i^{\phi_i}\xi_i^e(1-\tau_i^z)pz_i}{pe_i}\right)^{\frac{1}{1-\phi_i}} Z_i$$

$$D_i = \left(\frac{\theta_i^{\phi_i}\xi_i^d(1-\tau_i^z)pz_i}{pd_i}\right)^{\frac{1}{1-\phi_i}} Z_i$$

viii. Transformation between Migrant Workers and Domestic Workers

$$TF_{hoh,lab} = \kappa_{hoh,lab}\left(\omega_{hoh,lab}^{RF} RF_{hoh,lab}^{\chi_{hoh,lab}} + \omega_{hoh,lab}^{FF} FF_{hoh,lab}^{\chi_{hoh,lab}}\right)^{\frac{1}{\chi_{hoh,lab}}}$$

$$FF_{hoh,lab} = \left(\frac{\kappa_{hoh,lab}^{\chi_{hoh,lab}}\omega_{hoh,lab}^{FF} pTF_{hoh,lab}}{pfs_{lab}}\right)^{\frac{1}{1-\chi_{hoh,lab}}} TF_{hoh,lab}$$

$$RF_{hoh,lab} = \left(\frac{\kappa_{hoh,lab}^{\chi_{hoh,lab}}\omega_{hoh,lab}^{RF} pTF_{hoh,lab}}{pfs_{lab}}\right)^{\frac{1}{1-\chi_{hoh,lab}}} TF_{hoh,lab}$$

ix. Good and Factor Market Clearing Conditions

$$Q_i = \sum_{hoh} X_{i,hoh}^p + X_i^g + X_i^v + \sum_j X_{i,j}$$

Domestic factor market

$$\sum_j F_{h,j} = \sum_{w\_all} F_{w\_all,h}$$

Domestic labor supply determination (endowment less voluntary unemployment)

$$TF_{hoh,lab} = total\_labor_{hoh,lab} - UL_{hoh,lab}$$

x. Price Equalization Conditions

$$pfd_h = pfs_h + \iota_h$$

xi. Price index used as a numeraire

$$\sum_{hoh,i} X^{p0}_{i,hoh} = \sum_{hoh,i} pq_i X^{p0}_{i,hoh}$$

xii. Utility Function

$$UU_{hoh} = \left(\alpha 1_{hoh} CC^{\rho_{hoh}}_{hoh} + \sum_{lab} \alpha 2_{hoh,lab} UL^{\rho_{hoh}}_{hoh,lab} \right)^{\frac{1}{\rho_{hoh}}}$$