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The Effects of Taxation on Migration: Some Evidence for the ASEAN and APEC Economies*

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Abstract

This paper investigates the effects of taxation on migration. It develops a stylized, two-country model to examine the impact of taxation on labor mobility. The theoretical prediction that taxation affects migration decisions is supported by some empirical evidence for the ASEAN and APEC economies. Average tax rates are found to have a larger impact on migration choices than marginal rates. Moreover, the results suggest that educated migrants are more responsive to taxation than migrants with no education. Average tax rates are most important for migrants with secondary education, while marginal rates have a greater influence on the decisions of migrants with tertiary education than secondary educated migrants. The finding that taxation affects migration decisions, in particular of educated migrants, has important policy implications.

JEL-Classification: F22, H24, H31
Keywords: International migration, taxation

1 Introduction

Do taxes affect people's migration decisions? This question will become an important policy issue in the wake of the global financial crisis as government deficits and rising debt levels are putting upward pressure on taxation. Throughout history, people have moved from one region of the world to another and migration has been extensively studied.[1] But the literature to date has largely ignored the effects of taxation on the spatial mobility of people.[2] This paper develops a stylized, two-country model to examine the impact of taxation on labor migration. Some supportive empirical evidence that taxation affects migration choices is provided for the economies of the Association of Southeast Asian Nations (ASEAN) and the Asia-Pacific Economic Cooperation (APEC).

International migration has been rising rapidly since the 1960s (OECD, 2008). This trend is likely to continue as countries may increasingly rely on migrants to ease the economic and budgetary impact of declining and ageing populations. The movement of people between countries has important economic consequences for both receiving and origin countries (Coppel *et al*, 2001). Inward migration raises the labor force size of receiving countries and tends to increase per capita output. For source countries, the outflow of people reduces the number of workers and may change the composition of skills within the labor force. A fall in labor supply tends to lower per capita output. The decline in output may be exacerbated further if mainly skilled workers emigrate and aggregate productivity falls. For developing countries, the outflow of people could potentially have a positive impact on economic development and raise per capita output if remittances provide capital to source countries that otherwise would not be available.

People's decisions to move from one country to another are thought to be influenced by the after tax income they can earn. In this case, the effective average tax rate, which measures the total income tax paid (net of government transfer payments) as a percent

[1] See, for example, Ghatak and Levine (1996), Hatton and Williamson (2002), Hatton and Williamson (2005) and references therein.

[2] An exception is Kleven *et al* (2010), who analyze the impact of taxation on the international migration of top soccer players in Europe.

of total income, is the relevant variable influencing choices. People may also consider prospective future earnings and the rate at which an additional dollar of income earned is taxed. In this case, migration decisions would be affected by people's effective marginal tax rate.

The paper is organized as follows. Section 2 investigates the impact of taxation on labor migration in a stylized, two-country model. Section 3 provides some supportive empirical analysis that taxation affects migration decisions for the ASEAN and APEC economies and the last section summarizes and concludes.

2 A two-country model with labor migration

This section derives a stylized, two-country model with labor migration. It describes the features of one of the economies. In the baseline model, both countries, denoted by a and b, are identical and the conditions of the other country are analogously defined. The effects of taxation on labor migration are then examined.

2.1 Overview of the model

There are four agents in the two countries: households, firms, a government and a monetary authority. Households are mobile or immobile. Immobile households always remain in their home country, while mobile households may migrate to live and work in the other country. There are no costs incurred when moving. Both mobile and immobile households provide labor to firms and consume. They own the firms in the country they live in. Households also hold domestic bonds and foreign bonds that are issued by the rest of the world. To purchase consumption goods households must hold demand deposits.

Firms are monopolistic competitors. They produce output of consumption goods by hiring immobile and mobile labor. They also use commodity inputs, which they import at the beginning of each period from the rest of the world. At the end of each period,

firms pay dividends to households.

The government collects tax revenue on households' labor, dividend and interest income. It also imposes a goods and services or value added tax. The monetary authority has an explicit consumer price inflation target that it maintains by adjusting the nominal rate of interest paid on domestic bonds.

2.2 Households

2.2.1 Mobile households

Mobile households, denoted by subscript m, are infinitely lived and a typical mobile household values streams of consumption and leisure according to

$$j \in \arg \max_{j} E_t \sum_{k=0}^{\infty} (\beta_m)^k \left[\left(C^j_{m,t+k} \right)^{\mu} + \gamma \left(1 - N^j_{m,t+k} \right)^{\mu} \right]^{\frac{1}{\mu}} \tag{1}$$

where $j = a,\ b$ denotes the country of residence of a mobile household. $\gamma,\ \mu > 0$ are parameters and $\beta_m \in (0,1)$ is the mobile household's discount factor. E_t is a conditional expectations operator with respect to information available at time t and $C^j_{m,t}$ is an index of mobile households' consumption in period t. The time endowment is normalized to one. Mobile households' labor supply in country j is thus given by $N^j_{m,t}$ and $\left(1 - N^j_{m,t}\right)$ is leisure. Households' period utility function, $U\left(C^j_{m,t},\ N^j_{m,t}\right)$, is given by

$$U\left(C^j_{m,t},\ N^j_{m,t}\right) = \left[\left(C^j_{m,t} \right)^{\mu} + \gamma \left(1 - N^j_{m,t} \right)^{\mu} \right]^{\frac{1}{\mu}} \tag{2}$$

Each household consumes many goods, all of which are domestically produced. $C^j_{m,t}$ is the quantity consumed in period t of an index of these goods with $C^j_{m,t} = \left[\int_0^1 C^j_{m,t}(i)^{\left(\theta^j - 1\right)/\theta^j} di \right]^{\theta^j/\left(\theta^j - 1\right)}$, where $C^i_{m,t}(i)$ denotes the mobile household's period t consumption of good i and $\theta^j > 0$ is the price elasticity of demand.[3] The price

[3] The immobile household's and government consumption indexes (discussed below) are given accordingly.

of consumption good i is given by $P_t^j(i)$ and the aggregate price level, P_t^j, is an index given by $P_t^j = \left[\int_0^1 P_t^j(i)^{1-\theta^j}\, di\right]^{1/\left(1-\theta^j\right)}$.

Households derive income from three sources. First, they earn income from supplying labor, $N_{m,t}^j$, at wage rate $W_{m,t}^j$. Second, they receive dividend payments, $\Omega_{m,t}^j$, from firms and third, they earn income from holding domestic bonds issued by the government, $B_{m,t}^j$, and foreign bonds, $B_{m,t}^{*j}$ issued by the rest of the world. Domestic bonds, $B_{m,t}^j$, earn a nominal return (in terms of domestic currency) of I_t^j and the nominal rate of interest paid on foreign bonds, $B_{m,t}^{*j}$, is given by I_t^*. Households also hold demand deposits, $D_{m,t-1}^j$, to purchase consumption goods. Demand deposits do not earn any interest.

Households pay taxes on their earned income. The income tax rate imposed by the government is given by τ^j. For simplicity, capital gains from exchange rate movements are not taxed. The government also imposes a goods and services tax, τ_{GST}^j.

The typical household's budget constraint is given by

$$\begin{aligned}&\left(1-\tau^j\right)W_{m,t}^j N_{m,t}^j + \left(1+\left(1-\tau^j\right)I_t^j\right)B_{m,t}^j + \left(1+\left(1-\tau^j\right)I_t^*\right)S_t^j B_{m,t}^{j*}\\&+\left(1-\tau^j\right)\Omega_{m,t}^j + D_{m,t-1}^j - \left(1+\tau_{GST}^j\right)P_t^j C_{m,t}^j - B_{m,t+1}^j - S_t^j B_{m,t+1}^{j*}\\&-D_{m,t}^j = 0\end{aligned} \tag{3}$$

where the nominal exchange rate S_t^j measures the price of the rest of the world currency in units of country j's currency.

The mobile household's deposit-in-advance constraint is given by

$$\left(1+\tau_{GST}^j\right)P_t^j C_{m,t}^j \leq D_{m,t-1}^j \tag{4}$$

It holds as an equality at an optimum if $I_t^j > 0$. Using equation (4), the household's budget constraint can then be re-written in real terms as

$$\begin{aligned}&\left(1-\tau^j\right)\hat{W}_{m,t}^j N_{m,t}^j + \frac{\left(1+\left(1-\tau^j\right)I_t^j\right)\hat{B}_{m,t}^j}{1+\Pi_t^j} + \frac{\left(1+\left(1-\tau^j\right)I_t^*\right)Q_t^j\hat{B}_{m,t}^{j*}}{1+\Pi_t^*} + \left(1-\tau^j\right)\hat{\Omega}_{m,t}^j\\&-\hat{B}_{m,t+1}^j - Q_t^j\hat{B}_{m,t+1}^{j*} - \left(1+\Pi_{t+1}^j\right)\left(1+\tau_{GST}^j\right)C_{m,t+1}^j = 0\end{aligned} \tag{5}$$

The real wage is given by $\hat{W}^j_{m,t}$ and $\hat{B}^j_{m,t}$, $\hat{B}^{j*}_{m,t}$ and $\hat{\Omega}^j_{m,t}$ are the mobile household's domestic and foreign bond holdings and dividend payments from firms in real terms.[4] Q^j_t denotes the real exchange rate with $Q^j_t = S^j_t P^*_t / P^j_t$ and P^*_t is the price level in the rest of the world. Π^j_t is the inflation rate with $\Pi^j_t = P^j_t / P^j_{t-1} - 1$ and the inflation rate in the rest of the world is given by $\Pi^*_t = P^*_t / P^*_{t-1} - 1$.

The mobile household's optimization problem consists of choosing $\{C^j_{m,t}, N^j_{m,t}, \hat{B}^j_{m,t+1}, \hat{B}^{j*}_{m,t+1}\}$ for all $t \in [0, \infty)$ to maximize utility (equation (2)) subject to equation (5). Dividends are paid at the end of each period and do not affect households' optimization problem. Mobile households' first-order conditions are given by

$$\frac{\left(1-N^j_{m,t}\right)^{1-\mu}}{\gamma\left(C^j_{m,t}\right)^{1-\mu}} - \frac{\left(1+\left(1-\tau^j\right)I^j_t\right)}{\frac{\left(1-\tau^j\right)}{\left(1+\tau^j_{GST}\right)}\hat{W}^j_{m,t}} = 0 \tag{6}$$

and

$$E_t\left[\frac{Q^j_{t+1}}{Q^j_t}\frac{1+\left(1-\tau^j\right)I^*_{t+1}}{1+\Pi^*_{t+1}} - \frac{1+\left(1-\tau^j\right)I^j_{t+1}}{1+\Pi^j_{t+1}}\right] = 0 \tag{7}$$

Equation (6) shows that, at an optimum, mobile households' after tax labor income is a function of the income tax rate, τ^j, and the GST rate, τ^j_{GST}. Moreover, the marginal rate of substitution between consumption and leisure is equal to the relative price of consumption; that is, the ratio of the effective price of consumption and the after tax real wage rate. The effective price of consumption is the sum of its market price (equal to unity) and the opportunity cost of having to hold demand deposits to purchase consumption goods, $(1-\tau^j)\, I^j_t$. Further, in equilibrium after tax real rates of return from holding domestic and foreign bonds are equal (equation (7)).

2.2.2 Immobile households

Immobile households, denoted by subscript im, do not migrate but always remain in their home country. They are infinitely lived and a typical immobile household values

[4] Domestic and foreign bond holdings and dividend payments from firms are attributed to mobile and immobile households based on their labor share.

streams of consumption according to

$$E_t \sum_{k=0}^{\infty} (\beta_{im})^k \left(C^j_{im,t+k}\right) \tag{8}$$

where $j = a,\ b$ denotes the immobile household's home country and $\beta_{im} \in (0,1)$ is the immobile household's discount factor. Immobile households derive labor, dividend and interest income and must hold demand deposits to purchase consumption goods. Their budget constraint in real terms is given by

$$\begin{aligned}&(1-\tau^j)\,\hat{W}^j_{im,t}N^j_{im,t} + \frac{\left(1+\left(1-\tau^j\right)I^j_t\right)\hat{B}^j_{im,t}}{1+\Pi^j_t} + \frac{\left(1+\left(1-\tau^j\right)I^*_t\right)Q^j_t\hat{B}^{*j}_{im,t}}{1+\Pi^*_t} + (1-\tau^j)\,\hat{\Omega}^j_{im,t}\\ &-\hat{B}^j_{im,t+1} - Q^j_t\hat{B}^{j*}_{im,t+1} - \left(1+\Pi^j_{t+1}\right)\left(1+\tau^j_{GST}\right)C^j_{im,t+1} = 0\end{aligned} \tag{9}$$

Immobile households' labor supply is assumed to be inelastic, i.e. they do not respond to tax rate changes.

2.3 Firms

Firms are owned by mobile and immobile households. They are monopolistic competitors and specialize in production. A typical firm in country j produces output of consumption good i, $Y^j_t(i)$ under a constant elasticity of substitution (CES) technology by hiring mobile and immobile household labor, $L^j_{m,t}(i)$ and $L^j_{im,t}(i)$, and using commodity inputs, $M^j_t(i)$.[5] Production inputs are purchased in competitive factor markets. Commodity inputs are imported at the beginning of each period. Firms' production function is thus given by

$$\begin{aligned}Y^j_t(i) = &\left(\eta^j_m\left(Z^j_t(i)\,L^j_{m,t}(i)\right)^{\nu^j} + \eta^j_{im}\left(Z^j_t(i)\,L^j_{im,t}(i)\right)^{\nu^j}\right.\\ &\left.+\left(1-\eta^j_m-\eta^j_{im}\right)\left(M^j_t(i)\right)^{\nu^j}\right)^{\frac{1}{\nu^j}}\end{aligned} \tag{10}$$

where $\eta^j_m,\ \eta^j_{im} \in (0,1]$ are parameters and $\nu^j < 1$; that is, the marginal return to each input is diminishing. Z^j_t denotes aggregate productivity and the elasticity of substitution

[5] Mobile and immobile households provide different types of labor and hence are modelled as separate production inputs.

in production is given by $1/\left(1-\nu^{j}\right)$.

Each firm sells its output of good, $Y_t^j(i)$, to households and the government. Firms also export to the rest of the world.[6] Aggregate exports, X_t^j, are a function of the real exchange rate, Q_t^j, i.e. the real price of foreign currency in units of country j's currency, and foreign demand for country j's output, Y_t^{j*},

$$X_t^j = \left(Q_t^j\right)^{\kappa^j} \left(Y_t^{j*}\right)^{\varsigma^j} \tag{11}$$

where κ^j, $\varsigma^j > 0$ are the price and foreign demand elasticities of exports.

Each firm chooses $\left\{P_t^j(i),\ L_{m,t}^j(i),\ L_{m,t}^j(i),\ M_t^j(i)\right\}$ to maximize profits subject to its production function (10) and demand function, $Y_t^j(i) = \left(P_t^j(i)/P_t^j\right)^{-\theta^j} Y_t^j$, i.e.

$$\begin{aligned} &\left[P_t^j(i)\,Y_t^j(i) - W_{m,t}^j L_{m,t}^j(i) - W_{im,t}^j L_{im,t}^j(i) - S_t^j P_t^* M_t^j\right] \\ &= \left[P_t^j(i) - P_t^j MC_t^j\right]\left(\frac{P_t^j(i)}{P_t^j}\right)^{-\theta^j} Y_t^j \end{aligned} \tag{12}$$

where MC_t^j denotes the real marginal cost. In a symmetric equilibrium, all firms charge the same relative price, hire the same labor and use the same commodity inputs. Their first-order conditions are thus given by

$$MC_t^j = \frac{1}{\frac{\theta^j}{\theta^j-1}} \tag{13}$$

$$\hat{W}_{m,t}^j = \frac{\eta_m^j\left(Z_t^j\right)^{\nu^j}\left(\frac{Y_t^j}{L_{m,t}^j}\right)^{1-\nu^j}}{\frac{\theta^j}{\theta^j-1}} \tag{14}$$

[6] With monopolistic competition in the goods market each firm treats the price in domestic currency, $P_t^j(i)$, of the good i it produces as a choice variable, while taking the domestic aggregate price level, P_t^j, the nominal exchange rate, S_t^j, and the foreign price level, P_t^*, as given. Having chosen $P_t^j(i)$, the firm then produces the quantity of output demanded at that price. Firms may not price discriminate and the price of good i sold to foreign consumers (denominated in foreign currency) is given by $P_t^j(i)/S_t^j$. The demand functions for good i are given by $C_{m,t}^j(i) = \left(P_t^j(i)/P_t^j\right)^{-\theta^j} C_{m,t}^j$, $C_{im,t}^j(i) = \left(P_t^j(i)/P_t^j\right)^{-\theta^j} C_{im,t}^j$, $G_t^j(i) = \left(P_t^j(i)/P_t^j\right)^{-\theta^j} G_t^j$ and $X_t^j(i) = \left(P_t^j(i)/P_t^j\right)^{-\theta^j} X_t^j$. $C_{m,t}^j(i)$, $C_{im,t}^j(i)$, $G_t^j(i)$ and $X_t^j(i)$ are the quantities of good i demanded by a typical mobile and immobile household, the government and a typical foreign consumer. $C_{m,t}^j$, $C_{im,t}^j$, G_t^j and X_t^j denote total consumption by mobile and immobile households, government consumption and aggregate exports.

$$\hat{W}^j_{im,t} = \frac{\eta^j_{im}\left(Z^j_t\right)^{\nu^j}\left(\frac{Y^j_t}{L^j_{im,t}}\right)^{1-\nu^j}}{\frac{\theta^j}{\theta^j-1}} \tag{15}$$

$$Q^j_t = \frac{\left(1-\eta^j_m-\eta^j_{im}\right)\left(\frac{Y^j_t}{M^j_t}\right)^{1-\nu^j}}{\frac{\theta^j}{\theta^j-1}} \tag{16}$$

Equations (14) to (16) show that firms sell their output of consumption goods at a mark-up over production costs and factor prices are below their marginal products. Under price flexibility the mark-up is constant and equal to $\theta^j/\left(\theta^j-1\right)$. The mark-up gives rise to economic profits of $\left(\theta^j-1\right)Y^j_t/\theta^j$, which firms pay to mobile and immobile households as dividends, $\hat{\Omega}^j_{m,t}$ and $\hat{\Omega}^j_{im,t}$, at the end of each period.

2.4 Government

The government collects taxes on households' income and consumption. It uses the revenue to purchase an index of consumption goods, G^j_t, from firms. For simplicity, the government's budget constraint is assumed to balance in each period

$$\begin{aligned}&\tau^j\left(\hat{W}^j_{m,t}L^j_{m,t}+\hat{W}^j_{im,t}L^j_{im,t}+\frac{I^j_t\left(\hat{B}^j_{m,t}+\hat{B}^j_{im,t}\right)}{1+\Pi^j_t}+\frac{I^*_tQ^j_t\left(\hat{B}^{j*}_{m,t}+\hat{B}^{j*}_{im,t}\right)}{1+\Pi^*_t}+\hat{\Omega}^j_{m,t}+\hat{\Omega}^j_{im,t}\right)\\&+\tau^j_{GST}\left(C^j_{m,t}+C^j_{im,t}\right)-G^j_t=0\end{aligned} \tag{17}$$

i.e. there is no debt financing.[7]

2.5 Monetary authority

The monetary authority has an explicit consumer price inflation target, $\bar{\Pi}^j$. To maintain this target it adjusts the nominal rate of interest paid on domestic bonds, I^j_t. The central bank's reaction function is given by a Taylor rule (Taylor, 1993). It depends on deviations of inflation from target and deviations of output from long-run, full capacity output. The interest reaction is constrained to be linear in the logs of the relevant arguments and

[7]No debt financing implies that $\hat{B}^j_{m,t}=\hat{B}^j_{im,t}=0$ for all t. The assumption does not change the conclusions.

given by

$$\ln\left(\frac{1+I_t^j}{1+\bar{I}^j}\right) = \mu_\pi^j \ln\left(\frac{1+\Pi_t^j}{1+\bar{\Pi}^j}\right) + \mu_y^j \ln\left(\frac{Y_t^j}{\bar{Y}^j}\right) \tag{18}$$

where μ_π^j, $\mu_y^j > 0$ are parameters and $\bar{I}^j$ and $\bar{Y}^j$ denote the steady state interest rate and long-run, full capacity output.

2.6 Market clearing and equilibrium conditions

The clearing conditions for the labor and goods markets are given by

$$L_{m,t}^j = N_{m,t}^j \tag{19}$$

$$N_{m,t}^j + N_{m,t}^i = N_{m,t} \tag{20}$$

where $N_{m,t}$ denotes the total labor supply of mobile households, which is fixed.

$$L_{im,t}^j = N_{im,t}^j \tag{21}$$

$$Y_t^j = C_{m,t}^j + C_{im,t}^j + G_t^j + X_t^j \tag{22}$$

All households' bond holdings are assumed to be in the form of foreign securities and the foreign sector clearing condition is determined by

$$\frac{(1+I_t^*)Q_t^j\left(\hat{B}_{m,t}^{j*}+\hat{B}_{im,t}^{j*}\right)}{1+\Pi_t^*} + X_t^j - Q_t^j M_t^j - Q_t^j\left(\hat{B}_{m,t+1}^{j*} + \hat{B}_{im,t+1}^{j*}\right) = 0 \tag{23}$$

The current account is given by

$$CA_t^j - \left(X_t^j - Q_t^j M_t^j\right) = 0 \tag{24}$$

$$1 + (1-\tau^j)\, I_t^j = E_t\left[\left(1 + (1-\tau^j)\, I_t^*\right)\frac{S_{t+1}^j}{S_t^j}\right] \tag{25}$$

The real exchange rate evolves according to

$$E_t\left[\frac{Q^j_{t+1}}{Q^j_t}\right] = E_t\left[\frac{\frac{S^j_{t+1}}{S^j_t}\frac{P^*_{t+1}}{P^*_t}}{\frac{P^j_{t+1}}{P^j_t}}\right] \tag{26}$$

and the sequences of foreign interest rates, prices, inflation and foreign demand for country j's goods $\{I^*_t,\, P^*_t,\, \Pi^*_t,\, Y^{j*}_t\}$ are given to the small, open economy.

2.7 Parameterization of the model

A period in the model corresponds to one quarter. Details of the parameterization are contained in Appendix A1. Parameter values are chosen so that the steady state of the baseline model is broadly consistent with typical assumptions made in the literature. The steady state equations are listed in Appendix A2.

2.8 Impact of taxation on labor migration

To examine the effects of taxation on labor migration we consider two scenarios. In the first scenario, one of the countries lowers the income tax rate from 30 to 25 percent. In the second scenario, one of the countries lowers the GST rate from 15 to 10 percent. Both tax rate changes are financed by adjusting government consumption. The results are contained in Tables 1 and 2.

2.8.1 Baseline model

Columns (1a) and (1b) in Table 1 report the steady state of the baseline model for country a and country b. In the baseline model both countries are assumed identical and hence their steady state values are the same. Both mobile and immobile households supply labor to firms in equal proportions. The steady state ratios of household and government consumption to output are 48.45 and 31.55 percent respectively.

2.8.2 Reduction in country b's income tax rate

Columns (2a) and (2b) in Table 1 report the steady states for country a and country b following a 5 percentage point reduction in the income tax rate from 30 to 25 percent by country b. The percent (percentage point) differences between the baseline model and the lower income tax rate model are given in columns (3a) and (3b).

The results show that a reduction in country b's income tax rate leads to outward migration of mobile households from country a to country b. This raises labor supply in country b and increases output and firms' profits. Imports, which are a production input, rise with output, leading to a small increase in the current account deficit and foreign bond holdings. Moreover, the increase in labor supply by mobile households in country b lowers their wage rate, while immobile households' wages rise with the increase in output. In country a, the outflow of mobile households following the decline in the income tax rate in country b lowers labor supply, output, imports and firms' profits. The fall in imports results in a small decline in the current account deficit and lowers foreign bond holdings. Furthermore, the drop in labor supply by mobile households relative to immobile households raises the wage rate of mobile households, while the wage rate of immobile households declines due to the fall in output.

Overall, the 5 percentage point reduction in country b's income tax rate raises the after tax income of mobile and immobile households in country b by more than 14 percent while consumption increases by about 7.4 percent. The reduction in tax revenue lowers government consumption by about 11 percent. In country a, after tax income and consumption of mobile and immobile households and tax revenue and hence government consumption decline following the outward migration of mobile households and reduction in output.

2.8.3 Reduction in country b's GST rate

Next, a decline in the GST rate is considered. Columns (2a) and (2b) in Table 2 give the steady state values following a 5 percentage point reduction in the GST rate from 15 to 10 percent by country b. To facilitate comparisons, the baseline values are replicated from Table 1 in columns (1a) and (1b). The percent (percentage point) differences between the baseline model and the lower GST rate model are reported in columns (3a) and (3b).

The results show that the decline in taxation leads to outward migration of mobile households from country a to country b. The impact in both countries following the reduction in country b's GST rate is similar to the income tax rate reduction. But the magnitude of the effects of a 5 percentage point decline in the GST rate is smaller than the impact of a 5 percentage point reduction in the income tax rate for two main reasons. First, goods and services (value added) taxes are less distortionary than income taxes. This is because they do not alter decisions between current and future consumption, i.e. savings and investment choices.[8] As a result, the economic gains from reducing the GST rate are smaller than those from lowering the income tax rate. Second, the benefits of a reduction in the GST rate are smaller than the same percentage point reduction in the income tax rate because the GST rate is lower than the income tax rate. The economic costs of taxation tend to rise with the tax rate. That is, the higher the tax rate the larger the distortionary impact of taxation and hence the larger the economic benefits of a reduction.

Overall, in country b mobile and immobile households' after tax income rises slightly due to increased output. Tax revenue and hence government consumption fall by 6.9 percent and household consumption increases by 4.7 percent following the reduction in the GST rate. In country a, the outward migration of mobile households leads to a decline in output, after tax income, household consumption, tax revenue and government

[8]For recent reviews of the advantages of good and services (value added) taxes relative to income taxes see, for example, Auerbach (2008) and Banks and Diamond (2010).

consumption.

3 Empirical analysis

To test the theoretical prediction that taxation affects migration decisions we use data from the Organisation for Economic Co-operation and Development (OECD) database on immigrants in OECD countries (DIOC). We consider migrants with different education levels (no education, secondary education and tertiary education) because the level of education has been found to influence people's decisions to migrate.[9] This section discusses the data and estimation and presents some results.

3.1 Data and estimation

The migration database we use is a 23×28 matrix whose ij's cell gives the number of migrants from ASEAN or APEC economy i living in OECD country j around the year 2000.[10] Six countries are members of both APEC and the OECD which leads to a total sample size of 638 $(= 23 \cdot 28 - 6)$ observations.[11] Appendix B1 lists the economies and the data sources for the explanatory variables are given in Appendix B2.

To investigate the impact of taxation on migration the following equation is estimated by ordinary least squares (OLS)

$$y = x'\beta + \varepsilon \tag{27}$$

where y denotes the proportion of migrants from ASEAN or APEC economy i living in OECD country j, x is a vector of regressors, β is a vector of parameters and ε is a disturbance term. To evaluate the effects of taxation for migrants with different levels of education, equation (27) is estimated for migrants with no education, secondary and

[9] Migration by education level is only available into OECD countries.

[10] When compiling the dataset, the OECD aimed at 2000 data but this was not possible for all economies and the nearest available data were used; see OECD (2008) Table A.

[11] No emigrants data are available by education for the Republic of Korea.

Table 1: Steady state results: A lower income tax rate in one country

		baseline steady state		country b lowers income tax rate steady state		change	
		country a (1a)	country b (1b)	country a (2a)	country b (2b)	country a (3a)	country b (3b)
$\bar{C}^j_m$	mobile household's consumption	0.076888	0.076888	0.076780	0.082587	-0.1 %	7.4 %
$\bar{C}^j_{im}$	immobile household's consumption	0.076888	0.076888	0.076795	0.082571	-0.1 %	7.4 %
$\bar{G}^j$	government consumption	0.100111	0.100111	0.099966	0.089073	-0.1 %	-11.0 %
$\bar{X}^j$	exports	0.063472	0.063472	0.063472	0.063472	0.0 %	0.0 %
$\bar{Y}^j$	output	0.317358	0.317358	0.317012	0.317703	-0.1 %	0.1 %
$\bar{L}^j_m$	mobile household's labor	0.500000	0.500000	0.498912	0.501088	-0.2 %	0.2 %
$\bar{L}^j_{im}$	immobile household's labor	0.500000	0.500000	0.500000	0.500000	0.0 %	0.0 %
$\bar{M}^j$	imports	0.069202	0.069202	0.069127	0.069278	-0.1 %	0.1 %
$\bar{W}^j_m$	mobile household's wage rate	0.195262	0.195262	0.195513	0.195013	0.1 %	-0.1 %
$\bar{W}^j_{im}$	immobile household's wage rate	0.195262	0.195262	0.195012	0.195512	-0.1 %	0.1 %
$\bar{\Omega}^j_m+\bar{\Omega}^j_{im}$	firms' profits	0.052893	0.052893	0.052835	0.052950	-0.1 %	0.1 %
$\bar{B}^{j*}_m+\bar{B}^{j*}_{im}$	foreign bond holdings	0.593064	0.593064	0.585268	0.600850	-1.3 %	1.3 %
$\bar{I}^j$	domestic interest rate	6.000000	6.000000	6.000000	6.000000	0.0 p.p.	0.0 p.p.
$\bar{I}^*$	foreign interest rate	6.000000	6.000000	6.000000	6.000000	0.0 p.p.	0.0 p.p.
$\bar{Q}^j/\bar{Q}^i$	real exchange rate	1.000000	1.000000	1.000000	1.000000	0.0 %	0.0 %
$\bar{CA}^j$	current account	-0.005731	-0.005731	-0.005655	-0.005806	-1.3 %	1.3 %
mobile household's after tax income		0.089900	0.089900	0.089755	0.102909	-0.2 %	14.5 %
immobile household's after tax income		0.089900	0.089900	0.089776	0.102885	-0.1 %	14.4 %
household consumption to output		48.45 %	48.45 %	48.44 %	51.98 %	0.0 p.p.	3.5 p.p.
government consumption to output		31.55 %	31.55 %	31.53 %	28.04 %	0.0 p.p.	-3.5 p.p.
current account to output		-1.81 %	-1.81 %	-1.78 %	-1.83 %	0.0 p.p.	0.0 p.p.

Note: Letters with a " $\bar{}$ " indicate steady state values. All variables are reported at quarterly rates, except for the interest rates, which are annualised. The superscripts i and j denote countries a and b. Colums (3a) and (3b) present the differences between the baseline and alternative tax policy models in percent (%) or percentage points (p.p.).

Table 2: Steady state results: A lower GST rate in one country

		baseline steady state		country b lowers GST rate steady state		change	
		country a (1a)	country b (1b)	country a (2a)	country b (2b)	country a (3a)	country b (3b)
$\bar{C}_m^j$	mobile household's consumption	0.076888	0.076888	0.076792	0.080483	-0.1 %	4.7 %
$\bar{C}_{im}^j$	immobile household's consumption	0.076888	0.076888	0.076805	0.080469	-0.1 %	4.7 %
$\bar{G}^j$	government consumption	0.100111	0.100111	0.099981	0.093242	-0.1 %	-6.9 %
$\bar{X}^j$	exports	0.063472	0.063472	0.063472	0.063472	0.0 %	0.0 %
$\bar{Y}^j$	output	0.317358	0.317358	0.317049	0.317665	-0.1 %	0.1 %
$\bar{L}_m^j$	mobile household's labor	0.500000	0.500000	0.499030	0.500970	-0.2 %	0.2 %
$\bar{L}_{im}^j$	immobile household's labor	0.500000	0.500000	0.500000	0.500000	0.0 %	0.0 %
$\bar{M}^j$	imports	0.069202	0.069202	0.069135	0.069269	-0.1 %	0.1 %
$\bar{W}_m^j$	mobile household's wage rate	0.195262	0.195262	0.195486	0.195040	0.1 %	-0.1 %
$\bar{W}_{im}^j$	immobile household's wage rate	0.195262	0.195262	0.195039	0.195485	-0.1 %	0.1 %
$\bar{\Omega}_m^j + \bar{\Omega}_{im}^j$	firms' profits	0.052893	0.052893	0.052842	0.052944	-0.1 %	0.1 %
$\bar{B}_m^{j*} + \bar{B}_{im}^{j*}$	foreign bond holdings	0.593064	0.593064	0.586110	0.600010	-1.2 %	1.2 %
$\bar{I}^j$	domestic interest rate	6.000000	6.000000	6.000000	6.000000	0.0 p.p.	0.0 p.p.
$\bar{I}^*$	foreign interest rate	6.000000	6.000000	6.000000	6.000000	0.0 p.p.	0.0 p.p.
$\bar{Q}^j/\bar{Q}^i$	real exchange rate	1.000000	1.000000	1.000000	1.000000	0.0 %	0.0 %
$\bar{CA}^j$	current account	-0.005731	-0.005731	-0.005664	-0.005798	-1.2 %	1.2 %
mobile household's after tax income		0.089900	0.089900	0.089771	0.090029	-0.1 %	0.1 %
immobile household's after tax income		0.089900	0.089900	0.089789	0.090011	-0.1 %	0.1 %
household consumption to output		48.45 %	48.45 %	48.45 %	50.67 %	0.0 p.p.	2.2 p.p.
government consumption to output		31.55 %	31.55 %	31.53 %	29.35 %	0.0 p.p.	-2.2 p.p.
current account to output		-1.81 %	-1.81 %	-1.79 %	-1.83 %	0.0 p.p.	0.0 p.p.

Note: Letters with a " $\bar{}$ " indicate steady state values. All variables are reported at quarterly rates, except for the interest rates, which are annualised. The superscripts i and j denote countries a and b. Colums (3a) and (3b) present the differences between the baseline and alternative tax policy models in percent (%) or percentage points (p.p.).

tertiary education. Each of the three equations (migrants with no education, secondary and tertiary education) contain the same explanatory variables.

The non tax explanatory variables chosen are the following: distance from the equator of the ASEAN or APEC economy, life expectancy, the log of real GDP per capita, the log of population, an interaction term of the log of real GDP per capita and the log of population and two dummy variables. The first is a colonizer dummy variable that equals one if OECD country j colonized ASEAN or APEC economy i and is zero otherwise. The second is a common colonizer dummy variable that is one if ASEAN or APEC economy i and OECD country j were colonized by the same country and equals zero otherwise. Distance from the equator, life expectancy, the logs of real GDP per capita and population and the two dummy variables are included because they have been shown to be significant in the literature and are available for all countries. The interaction term of the log of real GDP per capita and the log of population is included to capture a "US effect". The United States, a relatively large (in terms of population) and high income country, is the most popular destination of migrants for 13 of the 23 APEC or ASEAN economies. Life expectancy and the logs of real GDP per capita and population are measured by the differences between the life expectancy and the logs of real GDP per capita and population in the home (ASEAN or APEC economy) and the corresponding variables in the OECD country of migration.

Furthermore, we include the difference between government expenditure on health and education as a percent of GDP in the home and migration country in the estimation. This is to capture that some government expenditure, e.g. on infrastructure, health, education, has been found to be "productive" and contributing to economic growth (Barro, 1990). Taxation that finances productive government spending may have less adverse disincentive effects and may in fact reduce outward migration.

The tax variables chosen are total tax to GDP and the personal top marginal income tax rate plus the goods and services tax (GST) or value added tax (VAT) rate. Ideally effective average and effective marginal tax rates that take into account government

transfer payments and the rate at which these payments are reduced as income rises would be used. But these rates are not readily available for non OECD countries. Total tax as a percent GDP is instead used as a proxy for the effective average tax rate, while the personal top marginal income tax rate plus the GST/VAT rate is a proxy for the rate at which an additional dollar of labor income earned is taxed. The two tax variables are included separately in equation (27).

3.2 Estimation results

Equation (27) was estimated in GAUSS 6.0. The coefficients of interest are those on the tax variables (total tax to GDP and the personal top marginal income tax plus GST/VAT rate), while all other parameter estimates are nuisance parameters. Table 3 reports the estimation results for total tax as a percent of GDP, while Table 4 presents the findings for the personal top marginal income tax plus GST/VAT rate. As the explanatory variables (except for distance to the equator and the two dummy variables) are expressed in differences of source minus receiving country, a positive parameter estimate on the tax variable means a positive relationship between taxation and outward migration. In other words, a positive estimate on total tax to GDP or the personal top marginal income tax plus GST/VAT rate suggests that the higher tax burden, the larger outflow of people.[12]

Tables 3 and 4 show that the parameter estimates on both tax variables are positive, i.e. taxation affects migration decisions, with the coefficient on total tax as a percent of GDP being larger than the coefficient on the personal top marginal income tax plus GST/VAT rate. The finding of a larger coefficient on total tax to GDP suggests that migrants are more responsive to average tax rates than marginal rates. That is, the total net tax paid as a percent of income has a greater influence than the rate at which an additional dollar of income earned is taxed.

[12] All nuisance parameters display the expected sign. The positive sign on life expectancy likely captures the economic development of countries. More developed countries, with a higher life expectancy, tend to have higher migration than less developed countries.

The results also suggest that taxation has a larger impact on the location choices of educated migrants than for migrants with no education, i.e. the parameter estimates on both tax variables are larger for migrants with secondary and tertiary education than for migrants with no education. This finding is in line with country evidence that people's responsiveness to taxation increases with income (Saez *et al*, 2009).

Interestingly, the coefficient on total tax to GDP is larger for migrants with secondary education than for migrants with tertiary education, while for migrants with tertiary education the parameter estimate on the personal top marginal income tax plus GST/VAT rate is higher than for migrants with secondary education. The finding that migrants with secondary education are more responsive to effective average tax rates may reflect that lower and middle income people, in particular families with children, tend to receive larger government transfer payments than higher income people. These transfer payments can substantially reduce the net tax paid and hence the effective average tax rate. The result that migrants with tertiary education are more responsive to marginal tax rates than less educated migrants may indicate that more educated migrants earn higher incomes and are hence more likely to be paying the personal top marginal income tax rate.

3.2.1 Diagnostic tests

Diagnostic tests indicate that the disturbances in all equations are not normally distributed. One driver of the non-normality is the presence of leptokurtosis. This is likely due the relatively high number of extreme values in the dataset, such as, for example the number of Russians in Germany or the number of Chinese nationals living in Canada. Despite the non-normality in the errors, the parameter estimates are still expected to be unbiased but less confidence should be placed on the test statistics.

3.2.2 Main findings

To summarize, four main findings arise from the empirical application. First, the empirical results support the theoretical prediction that taxation affects migration decisions. Second, average tax rates seem to have a larger impact than marginal rates. Third, educated migrants tend to be more responsive to taxation than migrants with no education. Fourth, average tax rates seem to have a greater influence on the location choices of migrants with secondary education than tertiary educated migrants, while for tertiary educated migrants marginal rates are more important. These four findings are robust to different specification of the empirical model, discussed next.

3.2.3 Sensitivity analysis[13, 14]

The results in Tables 3 and 4 deleted missing values of migration between economies i and j. Setting missing values to zero, instead of deleting them, lowered the parameter estimates on both tax variables for all three migrant groups. But our four main findings continued to hold.

We also estimated equation (27) without Germany. This was because Germany has a particularly large number of missing and extreme values.[15] The overall results were robust to excluding Germany. Excluding Germany lowered the parameter estimate on total tax to GDP but raised the coefficient on the personal top marginal income tax plus GST/VAT rate. Setting missing values to zero rather than deleting them and excluding Germany lowered the parameter estimates on both tax variables except for the coefficient on total tax to GDP of migrants with tertiary education, which was marginally higher.

Finally, we included a dummy variable for the United States. In those estimations

[13] Results are not reported but available from the corresponding author on request.

[14] Changes in the parameter estimates of the nuisance parameters were small unless otherwise noted.

[15] The large number of missing values for Germany is likely due to incomplete adjustments. For Germany the available data source is an annual Microcensus, which is a large scale household sample survey. (The last German census was conducted in 1987.) The Microcensus records nationality and whether or not a person was born in Germany. But it does not record the place of birth. As a result, adjustments were needed to compile the data on expatriates for Germany. See Dumont and Lemaître (2005) for details.

the disturbances were still not normally distributed but the R^2 was higher. Both tax variables and the three dummy variables (for colonizer, common colonizer and United States) were significant for migrants with secondary and tertiary education. All other explanatory variables were insignificant at conventional levels – bearing in mind the non-normally distributed errors. For migrants with no education only the colonizer and US dummy variables and the interaction term of GDP per capita and population were significant.

4 Concluding remarks

Migration has been extensively studied in economics but the effects of taxation on migration have largely been ignored. This paper attempted to fill part of this gap. It investigated the impact of taxation on labor migration using a stylized, two-country model. The results showed that a reduction in taxation leads to outward migration of mobile workers from the higher tax country to the country with a lower tax burden. This outflow (inflow) of migrants in turn lowers (increases) output and after tax income.

The theoretical prediction that taxation affects migration decisions was supported by some empirical evidence for the ASEAN and APEC economies. The results from the empirical application also suggested that educated migrants are more responsive to taxation than migrants with no education. Overall, average tax rates tend to have a larger impact on location choices than marginal rates. That is, the total net tax paid as a percent of income is more important than the rate at which an additional dollar of income earned is taxed. Secondary educated migrants seem to be the most responsive to average tax rates. This may reflect that lower and middle income people, in particular families with children, in some countries, receive substantial government transfer payments that lower their average effective tax rate. Tertiary educated migrants tend to be more responsive to marginal tax rates than secondary educated migrants. This

Table 3: Estimation results: Total tax to GDP

	no education				secondary education				tertiary education			
	coeff	White adjusted			coeff	White adjusted			coeff	White adjusted		
		std dev	t-stat	prob		std dev	t-stat	prob		std dev	t-stat	prob
constant	0.439	0.430	1.020	0.308	0.986	0.522	1.890	0.060	0.832	0.495	1.680	0.094
dist	0.021	0.012	1.710	0.088	0.022	0.016	1.370	0.172	0.020	0.014	1.380	0.169
le	0.273	0.093	2.940	0.003	0.325	0.084	3.890	0.000	0.300	0.078	3.850	0.000
gdp	-2.510	0.759	-3.310	0.001	-2.640	0.657	-4.010	0.000	-2.260	0.570	-3.970	0.000
pop	-0.355	0.129	-2.740	0.006	-0.574	0.160	-3.590	0.000	-0.512	0.146	-3.500	0.000
gdp pop	0.343	0.124	2.750	0.006	0.257	0.099	2.580	0.010	0.169	0.067	2.530	0.012
g	-0.194	0.076	-2.580	0.010	-0.277	0.084	-3.290	0.001	-0.236	0.073	-3.240	0.001
d1	5.010	1.500	3.330	0.001	6.020	1.830	3.290	0.001	7.540	1.960	3.850	0.000
d2	2.150	0.775	2.770	0.006	3.550	1.020	3.470	0.001	4.530	1.080	4.200	0.000
tax gdp	0.055	0.018	2.990	0.003	0.086	0.023	3.770	0.000	0.071	0.022	3.190	0.002
R^2				0.195				0.275				0.308
adjusted R^2				0.180				0.262				0.296
F-stat (prob)				0.000				0.000				0.000
Durbin-Watson stat				2.030				2.010				1.860
Jarque-Bera (prob)				0.000				0.000				0.000

Note: dist = distance from equator$_i$; le = life expectancy$_i$−life expectancy$_j$; gdp = ln(real GDP per capita$_i$)−ln(real GDP per capita$_j$); pop = ln(population$_i$)−ln(population$_j$); gdp pop = (ln(real GDP per capita$_i$)−ln(real GDP per capita$_j$))(ln(population$_i$)−ln(population$_j$)); g = government expenditure on health and education as a percent of GDP$_i$−government expenditure on health and education as a percent of GDP$_j$; d1 = colonizer dummy variable$_{ij}$; d2 = common colonizer dummy variable$_{ij}$; tax gdp = total tax revenue as a percent of GDP$_i$−total tax revenue as a percent of GDP$_j$

Table 4: Estimation results: Personal top marginal income tax plus VAT/GST rate

	no education				secondary education				tertiary education			
	coeff	White adjusted			coeff	White adjusted			coeff	White adjusted		
		std dev	t-stat	prob		std dev	t-stat	prob		std dev	t-stat	prob
constant	0.306	0.526	0.582	0.561	0.644	0.507	1.270	0.205	0.786	0.413	1.900	0.057
dist	0.028	0.012	2.240	0.026	0.034	0.017	2.050	0.041	0.027	0.014	1.960	0.051
le	0.255	0.085	3.000	0.003	0.300	0.080	3.750	0.000	0.267	0.074	3.640	0.000
gdp	-2.250	0.666	-3.380	0.001	-2.270	0.622	-3.650	0.000	-1.820	0.532	-3.420	0.001
pop	-0.415	0.134	-3.100	0.002	-0.674	0.166	-4.060	0.000	-0.600	0.152	-3.960	0.000
gdp pop	0.314	0.120	2.620	0.009	0.211	0.097	2.180	0.029	0.122	0.066	1.860	0.063
g	-0.105	0.061	-1.720	0.087	-0.131	0.064	-2.050	0.041	-0.126	0.055	-2.270	0.024
d1	5.090	1.530	3.320	0.001	6.100	1.870	3.250	0.001	7.650	1.960	3.890	0.000
d2	2.230	0.769	2.910	0.004	3.710	1.000	3.700	0.000	4.650	1.040	4.460	0.000
tax rate	0.034	0.014	2.390	0.017	0.045	0.010	4.560	0.000	0.048	0.010	4.880	0.000
R^2				0.201				0.283				0.324
adjusted R^2				0.186				0.270				0.312
F-stat (prob)				0.000				0.000				0.000
Durbin-Watson stat				2.010				1.950				1.800
Jarque-Bera (prob)				0.000				0.000				0.000

Note: dist = distance from equator$_i$; le = life expectancy$_i$−life expectancy$_j$; gdp = ln(real GDP per capita$_i$)−ln(real GDP per capita$_j$); pop = ln(population$_i$)−ln(population$_j$); gdp pop = (ln(real GDP per capita$_i$)−ln(real GDP per capita$_j$))(ln(population$_i$)−ln(population$_j$)); g = government expenditure on health and education as a percent of GDP$_i$−government expenditure on health and education as a percent of GDP$_j$; d1 = colonizer dummy variable$_{ij}$; d2 = common colonizer dummy variable$_{ij}$; tax rate = personal top marginal income tax plus GST/VAT rate$_i$−personal top marginal income tax plus GST/VAT rate$_j$

may reflect that higher educated migrants earn higher incomes and are hence more likely to be paying the personal top marginal income tax rate than less educated migrants.

The finding that taxation affects migration decisions, in particular of educated migrants, has important policy implications. Government deficits and rising debt levels in the wake of the global financial crisis are putting upward pressure on taxation. Higher tax rates would increase the economic costs of taxation and lower the productive capacity of economies. The decline in output and economic activity following higher tax rates would be exacerbated if higher rates were to accelerate the outward migration of people.

A Theoretical model

A.1 Parameterization

Mobile households' discount factor, β_m, equals 0.994745 and leads to an annual nominal, steady state domestic interest rate of 6 percent. The coefficient on leisure, γ, in mobile households' utility function is chosen so that their work effort accounts for half of their time endowment in steady state the same as for immobile households. The intertemporal elasticity of substitution between consumption and leisure, $1/(1-\mu)$, is set to 1.1.

Labor-augmenting productivity, $\bar{Z}^j$ is normalized to 1 in steady state. The elasticity of substitution between production inputs, $1/(1-\nu^j)$, is set to 0.85. The coefficients on mobile and immobile labor, η_m^j and η_{im}^j, in firms' production function are 0.4. Firms' mark-up in steady state is 20 percent ($\theta^j/\left(\theta^j-1\right)=1.2$), i.e. $\theta^j=6$.

The annual domestic steady state inflation rate, $\bar{\Pi}^j$, is 2 percent. The income tax rate, τ^j, is set to 30 percent and the steady state GST rate, τ_{GST}^j, is 15 percent. The steady state foreign inflation rate, $\bar{\Pi}^*$, and nominal bond rate, $\bar{I}^*$, are assumed to be the same as for the two countries. The price and foreign demand elasticities of exports, κ^j and ς^j, are equal to unity, while foreign demand is chosen to yield a steady state ratio of exports to output of 20 percent.

A.2 Steady state

The steady state model is solved in Mathematica 6.0 with Newton's method. A residual is calculated to ensure that the model "nearly" solves. The system of steady state equations for country j is given by

$$\begin{aligned}&\left(1-\tau^j\right)\bar{W}_m^j\bar{L}_m^j+\left(1-\tau^j\right)\bar{\Omega}_m^j+\frac{\left(1+\left(1-\tau^j\right)\bar{I}^*\right)\bar{Q}^j\bar{B}_m^{j*}}{1+\bar{\Pi}^*}-\bar{Q}^j\bar{B}_m^{j*}-\left(1+\tau_{GST}^j\right)\bar{C}_m^j\\&+residual=0\end{aligned}$$

$$\left(1-\tau^j\right)\bar{W}_{im}^j\bar{L}_{im}^j+\left(1-\tau^j\right)\bar{\Omega}_{im}^j+\frac{\left(1+\left(1-\tau^j\right)\bar{I}^*\right)\bar{Q}^j\bar{B}_{im}^{j*}}{1+\bar{\Pi}^*}-\bar{Q}^j\bar{B}_{im}^{j*}-\left(1+\tau_{GST}^j\right)\bar{C}_{im}^j=0$$

$$\frac{\left(1-\bar{L}_m^j\right)^{1-\mu}}{\gamma\left(\bar{C}_m^j\right)^{1-\mu}}-\frac{\left(1+\left(1-\tau^j\right)\bar{I}^j\right)}{\frac{\left(1-\tau^j\right)}{\left(1+\tau_{GST}^j\right)}\bar{W}_m^j}=0$$

$$\beta_m\left(\frac{1+\left(1-\tau^j\right)\bar{I}^j}{1+\bar{\Pi}^j}\right)-1=0$$

$$\bar{Y}^j-\bar{W}_m^j\bar{L}_m^j-\bar{W}_{im}^j\bar{L}_{im}^j-\bar{Q}^j\bar{M}^j-\bar{\Omega}^j=0$$

$$\bar{W}_m^j=\frac{\eta_m^j\left(\bar{Z}^j\right)^{\nu^j}\left(\frac{\bar{Y}^j}{\bar{L}_m^j}\right)^{1-\nu^j}}{\frac{\theta^j}{\theta^j-1}}$$

$$\bar{W}_{im}^j=\frac{\eta_{im}^j\left(\bar{Z}^j\right)^{\nu^j}\left(\frac{\bar{Y}^j}{\bar{L}_{im}^j}\right)^{1-\nu^j}}{\frac{\theta^j}{\theta^j-1}}$$

$$\bar{Q}^j=\frac{\left(1-\eta_m^j-\eta_{im}^j\right)\left(\frac{\bar{Y}^j}{\bar{M}^j}\right)^{1-\nu^j}}{\frac{\theta^j}{\theta^j-1}}$$

$$\begin{aligned}&\bar{Y}^j-((\eta_m^j\left(\bar{Z}^j\bar{L}_m^j\right)^{\nu^j}+\eta_{im}^j\left(\bar{Z}^j\bar{L}_{im}^j\right)^{\nu^j}\\&+\left(1-\eta_m^j-\eta_{im}^j\right)\left(\bar{M}^j\right)^{\nu^j})^{\frac{1}{\nu^j}}=0\end{aligned}$$

$$\frac{\left(1+\left(1-\tau^j\right)\bar{I}^*\right)\bar{Q}^j\left(\bar{B}_m^{j*}+\bar{B}_{im}^{j*}\right)}{1+\bar{\Pi}^*}+\bar{X}^j-\bar{Q}^j\bar{M}^j-\bar{Q}^j\left(\bar{B}_m^{j*}+\bar{B}_{im}^{j*}\right)=0$$

$$\bar{CA}^j-\left(\bar{X}^j-\bar{Q}^j\bar{M}^j\right)=0$$

$$\bar{X}^j-0.2\cdot\bar{Y}^j=0$$

$$\bar{Y}^j-\bar{C}_m^j-\bar{C}_{im}^j-\bar{G}^j-\bar{X}^j=0$$

$$\bar{L}_m^j+\bar{L}_m^i-1=0$$

$$\begin{aligned}&\tau^j\left(\bar{W}_m^j\bar{L}_m^j+\bar{W}_{im}^j\bar{L}_{im}^j+\bar{\Omega}_m^j+\bar{\Omega}_{im}^j+\frac{\bar{I}^*\bar{Q}^j\left(\bar{B}_m^{j*}+\bar{B}_{im}^{j*}\right)}{1+\bar{\Pi}^*}\right)\\&+\tau_{GST}^j\left(\bar{C}_m^j+\bar{C}_{im}^j\right)-\bar{G}^j=0\end{aligned}$$

$$\left(1+\left(1-\tau^j\right)\bar{I}^*\right)\left(1+\bar{\Delta S}^j\right)-\left(1+\left(1-\tau^j\right)\bar{I}^j\right)=0$$

$$1+\bar{\Delta Q}^j-\frac{\left(1+\bar{\Delta S}^j\right)\left(1+\bar{\Pi}^*\right)}{1+\bar{\Pi}^j}=0$$

$\bar{L}_m^j - 0.5 = 0, \quad \bar{L}_{im}^j - 0.5 = 0, \quad 1 + \bar{\Pi}^j - (1 + 0.02)^{\frac{1}{4}} = 0, \quad 1 + \bar{I}^j - (1 + 0.06)^{\frac{1}{4}} = 0,$
$\frac{1}{1-\mu} - 1.1 = 0, \quad \bar{Z}^j - 1 = 0, \quad \eta_m^j - 0.4 = 0, \quad \eta_{im}^j - 0.4 = 0, \quad \frac{1}{1-\nu^j} - \frac{1}{1.1} = 0,$
$\frac{\theta^j}{\theta^j - 1} - 1.2 = 0, \quad \bar{\Pi}^j - \bar{\Pi}^* = 0$ and $\quad \bar{I}^j - \bar{I}^* = 0$

In the baseline model, both countries are assumed to be identical and the steady state equations for the other country are given accordingly.

B Data

B.1 Economies

The dataset contains 23 ASEAN and APEC economies:

Australia; New Zealand; Papua New Guinea; China; Hong Kong; Japan; Republic of Korea; Indonesia; Malaysia; Philippines; Singapore; Thailand; Viet Nam; Brunei Darussalam; Cambodia; Lao People's Democratic Republic; Myanmar; Canada; United States of America; Mexico; Peru; Chile and Russian Federation.

The OECD economies are:

Australia; New Zealand; Japan; Canada; United States of America; Mexico; Austria; Belgium; Denmark; Finland; France; Germany; United Kingdom; Greece; Ireland; Italy; Luxembourg; Netherlands; Portugal; Spain; Sweden; Switzerland; Norway; Czech Republic; Hungary; Poland; Slovakia and Turkey.

No emigrants data are available by education for Iceland and the Republic of Korea.

B.2 Data sources

All migration data are sourced from the OECD. The explanatory variables are sourced from: Asian Development Bank (ADB); Center for International Comparisons at the University of Pennsylvania; Central Intelligence Agency (CIA); International Monetary Fund (IMF); Mobilgistix; OECD; PricewaterhouseCoopers (PwC); TMF Group; United Nations Educational, Scientific and Cultural Organization (UNESCO); United

States Council for International Business (USCIB); U.S. Census Bureau; World Bank and World Health Organization.

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