

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

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This paper investigates the effects of taxation on migration. It develops a stylized, two-country model to examine the impact of taxes on labor mobility. The theoretical predictions that taxes affect migration decisions and that educated workers are more responsive to taxation are supported by some empirical evidence for the economies of the Association of Southeast Asian Nations and the Asia-Pacific Economic Cooperation. The empirical application also shows that average tax rates have a larger impact on migration choices than marginal rates. 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 compared to secondary-educated migrants. The finding that taxation affects migration decisions, in particular of educated migrants, has important policy implications.

JEL classification: F22, H24, H31

I. 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 place 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

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

²An exception is Kleven, Landais, and Saez (2010), who analyzed the impact of taxation on the international migration of top soccer players in Europe.

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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).

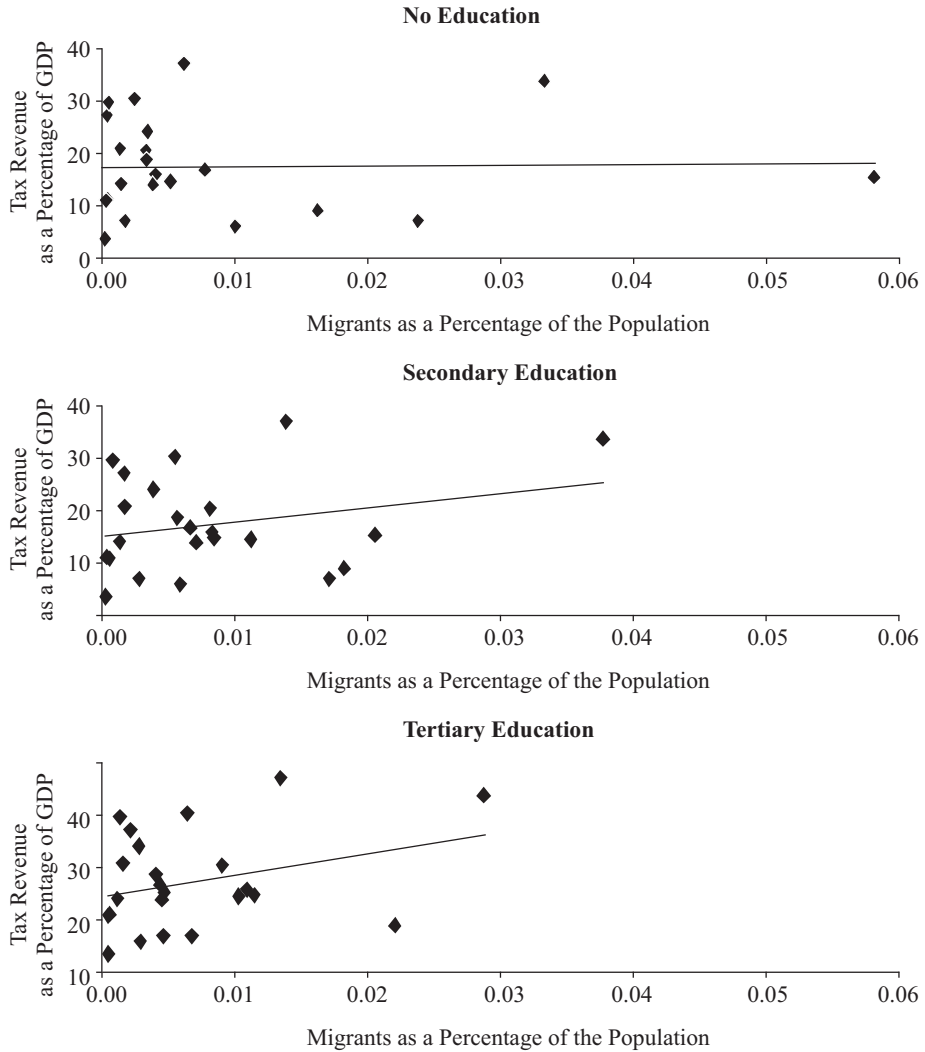
International migration has been rising rapidly since the 1960s (OECD 2008). This trend is likely to continue as countries may increasingly rely on migrants to ease the economic and budgetary impact of declining and ageing populations. The movement of people between countries has important economic consequences for both receiving and origin countries (Coppel, Dumont, and Visco 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 income or capital to source countries that would not otherwise 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 percentage 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.

Figure 1 plots the emigration rates for the ASEAN and APEC economies against total tax revenue as a percentage of gross domestic product (GDP). The emigration rates are calculated using data from the Organisation for Economic Co-operation and Development's (OECD) database on immigrants in OECD countries (DIOC). These rates refer to the number of migrants (defined as the number of home nationals living in OECD countries) as a percentage of the home population. Total tax revenue as a percentage of GDP is used as a proxy measure for the effective average tax rate. Migrants with different education levels (i.e., no education, secondary education, and tertiary education) are considered because level of education has been found to influence people's decisions to migrate.³

³ Migrants with no education include migrants with completed primary and uncompleted secondary education (Dumont, Spielvogel, and Widmaier 2010).

Figure 1. Tax and Emigration Rates



Source: See Appendix 2.

Figure 1 suggests a positive relationship between emigration rates and total tax revenue, that is, economies with a larger tax burden tend to have a larger outflow of people. It also seems to indicate that people with secondary and tertiary education are more responsive to taxes than people with no education, i.e., the trend lines fitted through the data are steeper for secondary- and tertiary-educated migrants than for migrants with no education.

The paper is organized as follows. Section II investigates the impact of taxation on labor migration in a stylized, two-country model. Section III provides

some supportive empirical analysis that taxation affects migration decisions for the ASEAN and APEC economies and the last section summarizes and concludes.

II. A TWO-COUNTRY MODEL WITH LABOR MIGRATION

This section presents 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 in each country are analogously defined. The effects of taxation on labor migration are then examined.

A. Overview of the Model

There are four agents in each of the two countries: households, firms, government, and monetary authority. Households are either uneducated or educated. Uneducated households earn lower incomes than educated households. The education wage gap arises because firms' production technology requires more skilled than unskilled labor. Both uneducated and educated households are mobile and may migrate to live and work in the other country. There are no costs incurred when moving. Households provide labor to firms and purchase consumption goods. They own the firms in the country they live in. Moreover, they can 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 labor from uneducated and educated households. Firms 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, they pay dividends to households.

The government collects tax on households' labor income, 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.

B. Households

Both uneducated and educated households are infinitely lived and a typical household values streams of consumption and leisure according to

$$\max E_t \sum_{k=0}^{\infty} \beta^k \left[(C_{h,t+k}^j)^\mu + \gamma_h (1 - N_{h,t+k}^j)^\mu \right]^\frac{1}{\mu} \quad (1)$$

The subscript $h = u, e$ denotes whether the household is uneducated or educated, respectively, and the superscript $j = a, b$ denotes the household's country of residence. $\gamma_h, \mu > 0$ are parameters and $\beta \in (0, 1)$ is the household's discount factor. E_t is a conditional expectations operator with respect to information available at time t and $C_{h,t}^j$ is an index of households' consumption in period t . The time endowment is normalized to 1. Households' labor supply in country j is thus given by $N_{h,t}^j$, and $(1 - N_{h,t}^j)$ is leisure. Households' period utility function, $U(C_{h,t}^j, N_{h,t}^j)$, is given by

$$U(C_{h,t}^j, N_{h,t}^j) = \left[(C_{h,t}^j)^\mu + \gamma_h (1 - N_{h,t}^j)^\mu \right]^{\frac{1}{\mu}} \quad (2)$$

Each household consumes many goods, all of which are domestically produced. The household consumption index, $C_{h,t}^j = \left[\int_0^1 C_{h,t}^j(i)^{(\theta^j-1)/\theta^j} di \right]^{\theta^j/(\theta^j-1)}$, is the quantity of goods consumed in period t by a typical household, where $C_{h,t}^j(i)$ denotes the typical household's period t consumption of good i and $\theta^j > 0$ is the price elasticity of demand.⁴ The price of consumption good i is given by $P_t^j(i)$ and the aggregate price level, P_t^j , is an index given by $P_t^j = \left[\int_0^1 P_t^j(i)^{1-\theta^j} di \right]^{1/(1-\theta^j)}$.

Households derive income from three sources. First, they earn income from supplying labor, $N_{h,t}^j$, at wage rate $W_{h,t}^j$. Uneducated and educated households provide different types of labor, and educated households earn higher wages because of greater demand by firms for skilled workers. Second, uneducated and educated households receive dividend payments, $\Omega_{h,t}^j$ from firms and third, they earn income from holding domestic bonds issued by the government, $B_{h,t}^j$, and foreign bonds, $B_{h,t}^{j*}$, issued by the rest of the world. Domestic bonds, $B_{h,t}^j$, earn a nominal return of I_t^j in terms of domestic currency and the nominal rate of interest paid on foreign bonds, $B_{h,t}^{j*}$, is given by I_t^* . Households also hold demand deposits, $D_{h,t-1}^j$, to purchase consumption goods. Demand deposits earn no 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

⁴The government consumption index (discussed below) is given accordingly.

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

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

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 typical household's deposit-in-advance constraint is given by

$$(1 + \tau_{GST}^j)P_t^j C_{h,t}^j \leq D_{h,t-1}^j \quad (4)$$

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

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

where the real wage is given by $\hat{W}_{h,t}^j$, and $\hat{B}_{h,t}^j$, $\hat{B}_{h,t}^{j*}$, and $\hat{\Omega}_{h,t}^j$ are the household's domestic and foreign bond holdings and dividend payments from firms in real terms.⁵ Q_t^j denotes the real exchange rate with $Q_t^j = S_t^j P_t^* / P_t^j$ and P_t^* is the price level in the rest of the world. Π_t^j is the inflation rate with $\Pi_t^j = (P_t^j / P_{t-1}^j) - 1$ and the inflation rate in the rest of the world is given by $\Pi_t^* = (P_t^* / P_{t-1}^*) - 1$.

The optimization problem of households consists of choosing $\{C_{h,t}^j, N_{h,t}^j, \hat{B}_{h,t+1}^j, \hat{B}_{h,t+1}^{j*}\}$ 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. The first-order conditions are given by

⁵Domestic and foreign bond holdings and dividend payments from firms are attributed to uneducated and educated households based on their labor share.

$$\frac{(1 - N_{h,t}^j)^{1-\mu}}{\gamma_h (C_{h,t}^j)^{1-\mu}} - \frac{(1 + (1 - \tau^j) I_t^j)}{(1 + \tau_{GST}^j) \hat{W}_{h,t}^j} = 0 \quad (6)$$

and

$$E_t \left[\frac{Q_{t+1}^j}{Q_t^j} \frac{1 + (1 - \tau^j) I_{t+1}^*}{1 + \Pi_{t+1}^*} - \frac{1 + (1 - \tau^j) I_{t+1}^j}{1 + \Pi_{t+1}^j} \right] = 0 \quad (7)$$

Equation (6) shows that, at an optimum, households' after-tax labor income is a function of the income tax rate, τ^j , and the goods and services tax (GST) rate, τ_{GST}^j . 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, $(1 - \tau^j) I_t^j$. Further, in equilibrium, after-tax real rates of return from holding domestic and foreign bonds are equal (equation (7)).

C. Firms

Firms are owned by uneducated and educated households. They are monopolistic competitors and specialize in production. A typical firm in country j produces output of consumption good i , $Y_t^j(i)$, under a constant elasticity of substitution (CES) technology by hiring uneducated and educated household labor, $L_{u,t}^j(i)$ and $L_{e,t}^j(i)$, and using commodity inputs, $M_t^j(i)$. Production inputs are purchased in competitive factor markets. Commodity inputs are imported at the beginning of each period. Firms' production function is given by

$$Y_t^j(i) = (\eta_u^j (Z_t^j L_{u,t}^j(i))^{\nu^j} + \eta_e^j (Z_t^j L_{e,t}^j(i))^{\nu^j} + (1 - \eta_u^j - \eta_e^j) (M_t^j(i))^{\nu^j})^{\frac{1}{\nu^j}} \quad (8)$$

where $\eta_u^j, \eta_e^j \in (0, 1]$ are parameters and $\nu^j < 1$, that is, the marginal return to each input is diminishing. The production of output requires more skilled than unskilled labor and $\eta_u^j < \eta_e^j$. Z_t^j denotes aggregate productivity and the elasticity of substitution in production is given by $1/(1 - \nu^j)$.

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*} ,

$$X_t^j = (Q_t^j)^{\kappa^j} (Y_t^{j*})^{\zeta^j} \quad (9)$$

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

Each firm chooses $\{P_t^j(i), L_{u,t}^j(i), L_{e,t}^j(i), M_t^j(i)\}$ to maximize profits subject to its production function (8) and demand function, $Y_t^j(i) = (P_t^j(i) / P_t^j)^{-\theta^j} Y_t^j$, i.e.,

$$\begin{aligned} & \left[P_t^j(i) Y_t^j(i) - W_{u,t}^j L_{u,t}^j(i) - W_{e,t}^j L_{e,t}^j(i) - S_t^j P_t^* M_t^j \right] \\ & = \left[P_t^j(i) - P_t^j MC_t^j \right] \left(\frac{P_t^j(i)}{P_t^j} \right)^{-\theta^j} Y_t^j \end{aligned} \quad (10)$$

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

$$MC_t^j = \frac{1}{\frac{\theta^j}{\theta^j - 1}} \quad (11)$$

$$\hat{W}_{u,t}^j = \frac{\eta_u^j (Z_t^j)^{\nu^j} \left(\frac{Y_t^j}{L_{u,t}^j} \right)^{1-\nu^j}}{\frac{\theta^j}{\theta^j - 1}} \quad (12)$$

⁶With monopolistic competition in the goods market, each firm treats the price of the good it produces, $P_t^j(i)$, 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 is given by $P_t^j(i) / S_t^j$. The demand functions for good i are given by $C_{u,t}^j(i) = (P_t^j(i) / P_t^j)^{-\theta^j} C_{u,t}^j$, $C_{e,t}^j(i) = (P_t^j(i) / P_t^j)^{-\theta^j} C_{e,t}^j$, $G_t^j(i) = (P_t^j(i) / P_t^j)^{-\theta^j} G_t^j$ and $X_t^j(i) = (P_t^j(i) / P_t^j)^{-\theta^j} X_t^j$. $C_{u,t}^j(i)$, $C_{e,t}^j(i)$, $G_t^j(i)$ and $X_t^j(i)$ are the quantities of good i demanded by a typical uneducated and educated household, the government and a typical foreign consumer. $C_{u,t}^j$, $C_{e,t}^j$, G_t^j and X_t^j denote total consumption by uneducated and educated households, the government, and the international market (i.e., exports).

$$\hat{W}_{e,t}^j = \frac{\eta_e^j (Z_t^j)^{\nu^j} \left(\frac{Y_t^j}{L_{e,t}^j} \right)^{1-\nu^j}}{\theta^j} \quad (13)$$

$$Q_t^j = \frac{(1 - \eta_u^j - \eta_e^j) \left(\frac{Y_t^j}{M_t^j} \right)^{1-\nu^j}}{\theta^j} \quad (14)$$

Equations (12) to (14) 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 $\theta^j / (\theta^j - 1)$. The mark-up gives rise to economic profits of $(\theta^j - 1)Y_t^j / \theta^j$, which firms pay to uneducated and educated households as dividends, $\hat{\Omega}_{u,t}^j$ and $\hat{\Omega}_{e,t}^j$, at the end of each period. Equations (12) and (13) also show that if uneducated and educated households supply the same amount of labor, uneducated households earn lower wages because $\eta_u^j < \eta_e^j$.

D. Government

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

$$\tau^j \left(\hat{W}_{u,t}^j L_{u,t}^j + \hat{W}_{e,t}^j L_{e,t}^j + \frac{I_t^j (\hat{B}_{u,t}^j + \hat{B}_{e,t}^j)}{1 + \Pi_t^j} + \frac{I_t^* Q_t^j (\hat{B}_{u,t}^{j*} + \hat{B}_{e,t}^{j*})}{1 + \Pi_t^*} + \hat{\Omega}_{u,t}^j + \hat{\Omega}_{e,t}^j \right) + \tau_{GST}^j (C_{u,t}^j + C_{e,t}^j) - G_t^j = 0 \quad (15)$$

i.e., there is no debt financing.⁷

E. Monetary Authority

The monetary authority has an explicit consumer price inflation target, $\bar{\Pi}_t^j$. To maintain this target it adjusts the nominal rate of interest paid on domestic bonds, I_t^j . 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

⁷No debt financing implies that $\hat{B}_{u,t}^j = \hat{B}_{e,t}^j = 0$ for all t . This assumption does not change the conclusions.

from long-run, full capacity output. The interest reaction is constrained to be linear in the logs of the relevant arguments and is given by

$$\ln\left(\frac{1+I_t^j}{1+\bar{I}^j}\right) = \mu_\pi^j \ln\left(\frac{1+\Pi_t^j}{1+\bar{\Pi}^j}\right) + \mu_y^j \ln\left(\frac{Y_t^j}{\bar{Y}^j}\right) \quad (16)$$

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

F. Market Clearing and Equilibrium Conditions

The clearing conditions for the labor and goods markets are given by equations (17) to (19).

$$L_{h,t}^j = N_{h,t}^j \quad (17)$$

$$N_{h,t}^j + N_{h,t}^i = N_{h,t} \quad (18)$$

where $N_{h,t}$ with $h = u, e$ denotes the total labor supply of uneducated and educated households, which is fixed.

$$Y_t^j = C_{u,t}^j + C_{e,t}^j + G_t^j + X_t^j \quad (19)$$

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

$$\frac{(1+I_t^*)Q_t^j(\hat{B}_{u,t}^{j*} + \hat{B}_{e,t}^{j*})}{1+\Pi_t^*} + X_t^j - Q_t^j M_t^j - Q_t^j(\hat{B}_{u,t+1}^{j*} + \hat{B}_{e,t+1}^{j*}) = 0 \quad (20)$$

The current account and uncovered interest rate parity are given by

$$CA_t^j - (X_t^j - Q_t^j M_t^j) = 0 \quad (21)$$

$$1 + (1 - \tau^j)I_t^j = E_t \left[(1 + (1 - \tau^j)I_t^*) \frac{S_{t+1}^j}{S_t^j} \right] \quad (22)$$

The real exchange rate evolves according to

$$E_t \left[\frac{Q_{t+1}^j}{Q_t^j} \right] = E_t \left[\frac{\frac{S_{t+1}^j P_{t+1}^*}{S_t^j P_t^*}}{\frac{P_{t+1}^j}{P_t^j}} \right] \quad (23)$$

and the sequences of the foreign interest rate, prices, inflation, and foreign demand for country j 's goods $\{I_t^*, P_t^*, \Pi_t^*, Y_t^{j*}\}$ are given to the small, open economy.

G. Parameterization of the Model

A period in the model corresponds to one quarter. Details of the parameterization are contained in Appendix 1. 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 also listed in Appendix 1.

H. Impact of Taxation on Labor Migration

To examine the effects of taxation on labor migration two scenarios are considered. 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 reductions are financed by lower government consumption. The results are contained in Tables 1 and 2.

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 uneducated and educated households supply labor to firms in equal proportions but educated households earn higher wages because firms' production technology requires more skilled than unskilled labor. The steady state ratios of household and government consumption to output are 48.5 and 31.5 percent, respectively.

Table 1. Steady State Results: A Lower Income Tax Rate in One Country

		Baseline		Country <i>b</i> Lowers the Income Tax Rate			
		Steady State		Steady State		Change	
		Country <i>a</i> (1a)	Country <i>b</i> (1b)	Country <i>a</i> (2a)	Country <i>b</i> (2b)	Country <i>a</i> (3a)	Country <i>b</i> (3b)
\bar{C}_u^j	Uneducated household's consumption	0.05460	0.05460	0.05423	0.05900	-0.683%	8.052%
\bar{C}_e^j	Educated household's consumption	0.09917	0.09917	0.09856	0.10702	-0.623%	7.907%
\bar{G}^j	Government consumption	0.10011	0.10011	0.09939	0.08958	-0.718%	-10.519%
\bar{X}^j	Exports	0.06347	0.06347	0.06347	0.06347	0.000%	0.000%
\bar{Y}^j	Output	0.31736	0.31736	0.31565	0.31907	-0.539%	0.538%
\bar{L}_u^j	Uneducated household's labor	0.50000	0.50000	0.49750	0.50250	-0.500%	0.500%
\bar{L}_e^j	Educated household's labor	0.50000	0.50000	0.49722	0.50278	-0.556%	0.556%
\bar{M}^j	Imports	0.06920	0.06920	0.06883	0.06957	-0.538%	0.538%
\bar{W}_u^j	Uneducated household's wage rate	0.12204	0.12204	0.12198	0.12209	-0.045%	0.044%
\bar{W}_e^j	Educated household's wage rate	0.26849	0.26849	0.26854	0.26843	0.020%	-0.020%
$\bar{\Omega}_u^j + \bar{\Omega}_e^j$	Firm's profits	0.05289	0.05289	0.05261	0.05318	-0.538%	0.538%
$\bar{B}_u^{j*} + \bar{B}_e^{j*}$	Foreign bond holdings	0.59306	0.59306	0.55451	0.63162	-6.501%	6.500%
\bar{I}^j	Domestic interest rate	6.00000	6.00000	6.00000	6.00000	0.000%	0.000%
\bar{I}^*	Foreign interest rate	6.00000	6.00000	6.00000	6.00000	0.000%	0.000%
\bar{Q}^j / \bar{Q}^i	Real exchange rate	1.00000	1.00000	1.00000	1.00000	0.000%	0.000%
\bar{CA}^j	Current account	-0.00573	-0.00573	-0.00536	-0.00610	-6.502%	6.500%

continued.

Table 1—Continued

	Baseline		Country <i>b</i> Lowers the Income Tax Rate			
	Steady State		Steady State		Change	
	Country <i>a</i> (1a)	Country <i>b</i> (1b)	Country <i>a</i> (2a)	Country <i>b</i> (2b)	Country <i>a</i> (3a)	Country <i>b</i> (3b)
Uneducated household's after-tax income	0.06427	0.06427	0.06375	0.06942	-0.816%	8.017%
Educated household's after-tax income	0.11553	0.11553	0.11472	0.12464	-0.698%	7.891%
Household consumption to output	48.5%	48.5%	48.4%	52.0%	-0.1 p.p.	3.5 p.p.
Government consumption to output	31.5%	31.5%	31.5%	28.1%	0.0 p.p.	-3.4 p.p.
Exports to output	20.0%	20.0%	20.1%	19.9%	0.1 p.p.	-0.1 p.p.
Current account to output	-1.8%	-1.8%	-1.7%	-1.9%	0.1 p.p.	-0.1 p.p.

Note: Variables with a “—” indicate steady state values. All variables are reported at quarterly rates, except for the interest rates, which are annualized. The superscripts *i* and *j* denote countries *a* and *b*. Columns 3a and 3b present the differences between the baseline and alternative tax policy models in percentage (%) or percentage points (p.p.).

Source: Authors' calculations.

Table 2. **Steady State Results: A Lower Goods and Services Tax Rate in One Country**

		Baseline		Country <i>b</i> Lowers the GST Rate			
		Steady State		Steady State		Change	
		Country <i>a</i> (1a)	Country <i>b</i> (1b)	Country <i>a</i> (2a)	Country <i>b</i> (2b)	Country <i>a</i> (3a)	Country <i>b</i> (3b)
\bar{C}_u^j	Uneducated household's consumption	0.05460	0.05460	0.05432	0.05738	-0.517%	5.085%
\bar{C}_e^j	Educated household's consumption	0.09917	0.09917	0.09871	0.10417	-0.468%	5.036%
\bar{G}^j	Government consumption	0.10011	0.10011	0.09957	0.09363	-0.541%	-6.475%
\bar{X}^j	Exports	0.06347	0.06347	0.06347	0.06347	0.000%	0.000%
\bar{Y}^j	Output	0.31736	0.31736	0.31607	0.31865	-0.406%	0.406%
\bar{L}_u^j	Uneducated household's labor	0.50000	0.50000	0.49804	0.50196	-0.392%	0.392%
\bar{L}_e^j	Educated household's labor	0.50000	0.50000	0.49794	0.50206	-0.412%	0.412%
\bar{M}^j	Imports	0.06920	0.06920	0.06892	0.06948	-0.406%	0.406%
\bar{W}_u^j	Uneducated household's wage rate	0.12204	0.12204	0.12202	0.12206	-0.016%	0.016%
\bar{W}_e^j	Educated household's wage rate	0.26849	0.26849	0.26851	0.26847	0.007%	-0.007%
$\bar{\Omega}_u^j + \bar{\Omega}_e^j$	Firm's profits	0.05289	0.05289	0.05268	0.05311	-0.406%	0.406%
$\bar{B}_u^{j*} + \bar{B}_e^{j*}$	Foreign bond holdings	0.59306	0.59306	0.56400	0.62213	-4.901%	4.901%
\bar{I}^j	Domestic interest rate	6.00000	6.00000	6.00000	6.00000	0.000%	0.000%
\bar{I}^*	Foreign interest rate	6.00000	6.00000	6.00000	6.00000	0.000%	0.000%
\bar{Q}^j / \bar{Q}^i	Real exchange rate	1.00000	1.00000	1.00000	1.00000	0.000%	0.000%
\bar{CA}^j	Current account	-0.00573	-0.00573	-0.00545	-0.00601	-4.902%	4.900%

continued.

Table 2—Continued

	Baseline		Country <i>b</i> Lowers the GST Rate			
	Steady State		Steady State		Change	
	Country <i>a</i> (1a)	Country <i>b</i> (1b)	Country <i>a</i> (2a)	Country <i>b</i> (2b)	Country <i>a</i> (3a)	Country <i>b</i> (3b)
Uneducated household's after-tax income	0.06427	0.06427	0.06388	0.06467	-0.617%	0.617%
Educated household's after-tax income	0.11553	0.11553	0.11492	0.11614	-0.525%	0.525%
Household consumption to output	48.5%	48.5%	48.4%	50.7%	-0.1 p.p.	2.2 p.p.
Government consumption to output	31.5%	31.5%	31.5%	29.4%	0.0 p.p.	-2.1 p.p.
Exports to output	20.0%	20.0%	20.1%	19.9%	0.1 p.p.	-0.1 p.p.
Current account to output	-1.8%	-1.8%	-1.7%	-1.9%	0.1 p.p.	-0.1 p.p.

Note: Variables with a “–” indicate steady state values. All variables are reported at quarterly rates, except for the interest rates, which are annualized. The superscripts *i* and *j* denote countries *a* and *b*. Columns 3a and 3b present the differences between the baseline and alternative tax policy models in percentage (%) or percentage points (p.p.).

Source: Authors' calculations.

2. Reduction in Country *b*'s Income Tax Rate

Columns 2a and 2b in Table 2 report the steady state 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 percentage or 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 households from country *a* to country *b* with a larger outflow of educated than uneducated workers. Educated households are more responsive to taxation because they have higher incomes and the tax rate reduction has a larger impact on their after-tax income. The migration of workers 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 relatively larger rise in labor supply by educated households leads to a small decline in educated households' wage rate, while uneducated households' wages rise with the increase in output.

In country *a*, the outflow of 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, a larger drop in labor supply by educated households relative to uneducated households raises the wage rate of educated households, while the wage rate of uneducated households declines due to the fall in output.

Overall, the 5 percentage-point reduction in country *b*'s income tax rate increases the after-tax income and consumption of uneducated and educated households in country *b* by about 8 percent. The reduction in tax revenue lowers government consumption by just over 10 percent. In country *a*, after-tax income and consumption of uneducated and educated households and tax revenue, and hence government consumption, decline following the outward migration of labor and reduction in output.

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 percentage or 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 households from country *a* to country *b* with a larger outflow of educated than

uneducated workers. 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*, uneducated and educated households' after-tax income rises slightly due to increased output. Tax revenue and hence government consumption fall by just over 6 percent, and household consumption increases by about 5 percent following the reduction in the GST rate. In country *a*, the outward migration of both uneducated and educated households leads to a decline in output, after-tax income, household consumption, tax revenue and government consumption.

III. EMPIRICAL ANALYSIS

To test the theoretical predictions that taxation affects migration decisions and that educated workers are more responsive to taxation than uneducated workers, data from the OECD's DIOC database is used. Migrants with no education, secondary, and tertiary education from the ASEAN and APEC economies to OECD countries are considered.⁹ This section discusses the data and estimation and presents some results.

A. Data and Estimation

The migration database used in this paper is a 23×28 matrix whose ij 's cell gives the number of migrants from ASEAN or APEC economy *i* living in OECD

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

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

country j around the year 2000.¹⁰ No data on the number of migrants by education living in Iceland and the Republic of Korea are available and six of the ASEAN or APEC economies are members of the OECD. This leads to a total sample size of 638 ($=23*28-6$) observations. Appendix 2 lists the economies and the data sources for the explanatory variables.

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

$$y = x' \beta + \varepsilon \quad (24)$$

where y denotes the proportion of migrants from ASEAN or APEC economy i living in OECD country j , x is a vector of regressors consisting of a constant, a tax variable and some control variables. 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 (24) is estimated for migrants with no education, secondary, and tertiary education. Each of the three equations (migrants with no education, secondary, and tertiary education) contains the same explanatory variables. This means that OLS estimates for each equation are identical to the generalized least squares (GLS) estimates for a seemingly unrelated regression (SUR) model comprising all three equations.

The choice of control variables is based on significance identified in the literature and data availability for all countries. Typically, economic, geographical, demographic, and cultural reasons are associated with migration. The log of real GDP per capita is included because it is identified in most studies as an important economic driver of migration (e.g., Mayda 2010, Ortega and Peri 2009, Hatton and Williamson 2005). Moreover, there is some evidence that emigration initially rises with development before falling once a threshold has been reached (see, for example, Ram 1997, Redding and Schott 2003, and articles cited in Easterly and Levine 2003). Distance to the equator and life expectancy are included as general proxies for the level of development. Distance to the equator should also capture geographical factors that may be influencing migration decisions. The demographic variable used here is the log of population. The United States (US), 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. An interaction term of the economic and demographic variables, i.e., the log of real GDP per capita and the log of population, is included to capture a “US effect”.

People often locate to countries that have the same or similar language and that have a similar cultural background. Colonial past often proxies cultural and

¹⁰ Only one year of data is currently available in the DIOC. When compiling the data set, 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).

language ties as colonization has been a driving force in homogenizing language and culture (e.g., Letouzé et al. 2009, Lewer and Van den Berg 2008). Colonial past is represented by two dummy variables. The first is a colonizer dummy variable that equals 1 if OECD country j colonized ASEAN or APEC economy i and is 0 otherwise. The second is a common colonizer dummy variable that is 1 if ASEAN or APEC economy i and OECD country j were colonized by the same country, and equals 0 otherwise.¹¹

Furthermore, government expenditure on health and education as a percentage of GDP is included. This is because some government expenditure, e.g., on infrastructure, health, and 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 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 percentage of 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. Total tax to GDP and the personal top marginal income tax plus GST/VAT rate are included separately in equation (24).

All explanatory variables, except for distance to the equator and the two dummy variables, are expressed in differences of the home (ASEAN or APEC) economy minus the OECD country of migration.

B. Estimation Results

Equation (24) 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 percentage of GDP, while Table 4 presents the findings for the personal top marginal income tax plus GST/VAT rate. As all 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

¹¹ A number of studies have found a positive relationship between immigration and GDP growth. This means that some endogeneity is likely present in the estimations. The presence of endogeneity bias is acknowledged, but considered small as migration is not the dominant driver of countries' GDP growth.

GST/VAT rate suggests that the higher the tax burden, the larger the 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 as predicted by the theoretical model. The empirical results also support the theoretical prediction that taxation has a larger impact on the location choices of educated migrants than for migrants with no education. That is, the parameter estimates on both tax variables are larger for migrants with secondary and tertiary education than for migrants with no education.

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.¹³

Overall, the coefficients on total tax as a percentage of GDP are larger than the coefficients 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 percentage of income has a greater influence than the rate at which an additional dollar of income earned is taxed.

¹²All nuisance parameters display the expected sign. The positive sign on distance from the equator and life expectancy capture the fact that emigration initially rises with development. The coefficients of per capita GDP and population are both negative and the sign of the coefficient of the interaction term between the two variables is positive. The negative coefficients suggest that an increase in per capita GDP or population in the home country, all else equal, lowers outward migration. Increased government expenditure on health and education in the home country relative to the migration country also reduces the outflow of migrants. The positive sign on the colonizer dummy variables suggests that people migrate to countries with similar cultural background.

¹³Including the GST/VAT rate and the personal top marginal income tax rate separately leads to the following results. The GST/VAT rate is highly significant for all three migrant groups with the coefficient for tertiary-educated (secondary-educated) migrants exceeding that for migrants with secondary (no) education. The personal top marginal income tax rate is significant for tertiary-educated migrants at the 98 percent confidence level, at 73 percent for secondary-educated migrants, and insignificant for migrants with no education.

Table 3. Estimation Results: Total Tax to Gross Domestic Product

	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

dist = distance from equator; le = life expectancy_{*t*} - life expectancy_{*j*}; gdp = ln(real GDP per capita_{*t*}) - ln(real GDP per capita_{*j*}); pop = ln(population_{*t*}) - ln(population_{*j*}); gdp pop = (ln(real GDP per capita_{*t*}) - ln(real GDP per capita_{*j*}))(ln(population_{*t*}) - ln(population_{*j*})); g = government expenditure on health and education as a percentage of GDP_{*t*} - government expenditure on health and education as a percentage of GDP_{*j*}; d1 = colonizer dummy variable_{*t*}; d2 = common colonizer dummy variable_{*t*}; tax gdp = total tax revenue as a percentage of GDP_{*t*} - total tax revenue as a percentage of GDP_{*j*}.

Source: Authors' calculations.

Table 4. Estimation Results: Personal Top Marginal Income Tax Rate Plus Goods and Services/Value Added Tax 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

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 percentage of GDP_{*i*}-government expenditure on health and education as a percentage 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*}.

Source: Authors' calculations.

C. 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, for example, the number of Russians in Germany or the number of nationals of the People's Republic of China 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.

D. Main Findings

To summarize, three main findings arise from the empirical application. First, the empirical results support the theoretical predictions that taxation affects migration decisions and that educated migrants are more responsive to taxation than migrants with no education. Second, average tax rates appear to have a larger impact than marginal rates. Third, 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 findings are robust to different specification of the empirical model, discussed next.

E. Sensitivity Analysis^{14,15}

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 the three main findings continue to hold.

Equation (24) is also estimated without Germany. This was because Germany has a particularly large number of missing and extreme values.¹⁶ 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.

¹⁴Results are not reported but available on request.

¹⁵Changes in the parameter estimates of the nuisance parameters were small unless otherwise noted.

¹⁶The 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 Lemaitre (2005) for details.

Finally, a dummy variable for the US is included. In those estimations 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 the US) 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.

IV. CONCLUDING REMARKS

Migration has been extensively studied in economics but the effects of taxation on migration have largely been ignored. This paper attempts to fill 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 from the higher tax country to the country with a lower tax burden. Moreover, educated workers were found to be more responsive to taxation than workers with no education. The movement of people between the two countries has important macroeconomic consequences. The outflow (inflow) of migrants lowers (raises) output, after-tax income, and consumption in the source (receiving) country.

The theoretical predictions that taxes affect migration decisions and that educated workers are more responsive to taxation than uneducated workers were supported by some empirical evidence for the ASEAN and APEC economies. The results from the empirical application also suggested that average tax rates tend to have a larger impact on location choices than marginal rates. That is, the total net tax paid as a percentage 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 may reflect the fact 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.

APPENDIX 1. THEORETICAL MODEL

Parameterization

Households' discount factor, β , equals 0.9947 and leads to an annual nominal, steady state domestic interest rate of 6 percent. The coefficient on leisure, γ_u and γ_e in uneducated and educated households' utility function is chosen so that their work efforts account for half of their time endowment in the baseline steady state. The intertemporal elasticity of substitution between consumption and leisure, $1 / (1 - \mu)$, is set to 1.2.

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 uneducated and educated household labor, η_u^j and η_e^j , in firms' production function are 0.25 and 0.55. Firms' mark-up in steady state is 20 percent ($\theta^j / (\theta^j - 1) = 1.2$), 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{T}^* , are assumed to be the same as for the two countries. The price and foreign demand elasticities of exports, κ^j and ζ^j , are equal to unity, while foreign demand is chosen to yield a steady state ratio of exports to output of 20 percent.

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 baseline system of steady state equations for country j is given by

$$(1 - \tau^j)\bar{W}_u^j\bar{L}_u^j + (1 - \tau^j)\bar{\Omega}_u^j + \frac{(1 + (1 - \tau^j)\bar{T}_t^*)\bar{Q}^j\bar{B}_u^{j*}}{1 + \bar{\Pi}^*} - \bar{Q}^j\bar{B}_u^{j*} - (1 + \tau_{GST}^j)\bar{C}_u^j + residual = 0$$

$$(1 - \tau^j)\bar{W}_e^j\bar{L}_e^j + (1 - \tau^j)\bar{\Omega}_e^j + \frac{(1 + (1 - \tau^j)\bar{T}_t^*)\bar{Q}^j\bar{B}_e^{j*}}{1 + \bar{\Pi}^*} - \bar{Q}^j\bar{B}_e^{j*} - (1 + \tau_{GST}^j)\bar{C}_e^j = 0$$

$$\frac{(1 - \bar{L}_u^j)^{1-\mu}}{\gamma_u(\bar{C}_u^j)^{1-\mu}} - \frac{(1 + (1 - \tau^j)\bar{T}^j)}{(1 + \tau_{GST}^j)\bar{W}_u^j} = 0$$

$$\frac{(1 - \bar{L}_e^j)^{1-\mu}}{\gamma_e(\bar{C}_e^j)^{1-\mu}} - \frac{(1 + (1 - \tau^j)\bar{T}^j)}{(1 + \tau_{GST}^j)\bar{W}_e^j} = 0$$

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

$$\bar{Y}^j - \bar{W}_u^j\bar{L}_u^j - \bar{W}_e^j\bar{L}_e^j - \bar{Q}^j\bar{M}^j - \bar{\Omega}_u^j + \bar{\Omega}_e^j = 0$$

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

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

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

$$\begin{aligned} \bar{Y}^j - (\eta_u^j (\bar{Z}^j \bar{L}_u^j)^{\nu^j} + \eta_e^j (\bar{Z}^j \bar{L}_e^j)^{\nu^j}) + (1 - \eta_u^j - \eta_e^j) (\bar{M}^j)^{\nu^j} &= 0 \\ \frac{(1 + (1 - \tau^j) \bar{I}^*) \bar{Q}^j (\bar{B}_u^{j*} + \bar{B}_e^{j*})}{1 + \bar{\Pi}^*} + \bar{X}^j - \bar{Q}^j \bar{M}^j - \bar{Q}^j (\bar{B}_u^{j*} + \bar{B}_e^{j*}) &= 0 \end{aligned}$$

$$\bar{C}A^j - (\bar{X}^j - \bar{Q}^j \bar{M}^j) = 0$$

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

$$\bar{Y}^j - \bar{C}_u^j + \bar{C}_e^j + \bar{G}^j + \bar{X}^j = 0$$

$$\bar{L}_u^j + \bar{L}_e^j - 1 = 0$$

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

$$\tau^j \left(\bar{W}_u^j \bar{L}_u^j + \bar{W}_e^j \bar{L}_e^j + \bar{\Omega}_u^j + \bar{\Omega}_e^j + \frac{\bar{I}^* \bar{Q}^j (\bar{B}_u^{j*} + \bar{B}_e^{j*})}{1 + \bar{\Pi}^*} \right)$$

$$+ \tau_{GSR}^j (\bar{C}_u^j + \bar{C}_e^j) - \bar{G}^j = 0$$

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

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

$$\bar{L}_u^j - 0.5 = 0, \bar{L}_e^j - 0.5 = 0, 1 + \bar{\Pi}^j - (1 + 0.02)^{\frac{1}{4}} = 0, 1 + \bar{I}^j - (1 + 0.06)^{\frac{1}{4}} = 0,$$

$$\frac{1}{1 - \mu} - 1.2 = 0, \bar{Z}^j - 1 = 0, \eta_u^j - 0.25 = 0, \eta_e^j - 0.55 = 0, \frac{1}{1 - \nu^j} - \frac{1}{1.1} = 0$$

$$\frac{\theta^j}{\theta^j - 1} - 1.2 = 0, \bar{\Pi}^j - \bar{\Pi}^* = 0 \text{ and } \bar{I}^j - \bar{I}^* = 0.$$

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

APPENDIX 2. DATA

Economies

The data set contains the following 23 ASEAN and APEC economies:

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

The 28 OECD economies are:

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

Data on emigrants are not available by education for Iceland and the Republic of Korea.

Data Sources

All migration data are collected from the OECD. The explanatory variables are from: Asian Development Bank; Center for International Comparisons, University of Pennsylvania; Central Intelligence Agency (CIA); International Monetary Fund (IMF); Mobilgistics; OECD; PricewaterhouseCoopers (PwC); TMF Group; United Nations Educational, Scientific and Cultural Organization (UNESCO); United States Council for International Business (USCIB); US Census Bureau; World Bank; and World Health Organization.

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