**Immigration within Regional Blocs, and the Long-Run Economic Implications**


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## Introduction

This report examines the long-run economic implications associated with immigration policies in regional blocs. The Association of Southeast Asian Nations (ASEAN) is a regional bloc, founded in 1967, that was established to promote the social, economic, and political cooperation among its members. The member countries are Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam. We model how gross domestic product (GDP) per capita is affected in a benchmark country within the ASEAN, under the conditions of different immigration policy. For this study, Malaysia will be the benchmark country experiencing immigration and Thailand will serve as the country undergoing emigration to model intra-regional migration. Moreover, this study will serve as a policy brief on migration within the ASEAN and how countries can enact the most effective immigration policy for economic growth.

Immigration in the context of the ASEAN is a significant issue due to changing demographics as the population ages and youth enter the labour force. Immigration has the potential to address any supply shortages in labour markets and allows for the reduction of *Dutch Disease*[1]. Much of the debate over immigration among the general population and policy makers focuses on the effects of different skilled labour. In this study, high-skilled labour consists of workers with higher human capital, while low-skilled labour is defined as those with low human capital. Generally, high-skilled immigration is associated with stable, long-term, economic growth (Card, 2005). However, according to Borjas, immigration can also allow for a decrease in domestic wages of the population as a result of the immigrant labour acting as a perfect substitute to the native labour force (2003).

## Literature Review

The need for the union was strengthened as a result of the East Asian financial crisis, which led to the realization that regionalism and regional integration are integral for further development. Moreover, China's growing regional and global economic power created the need for regional integration in East Asia to promote stability in the region (De Grauwe & Zhang, 2016). The ASEAN maintains regional integration through the free flow of goods, services, investment, financial capital, enhanced connectivity and labour migration (Asian Development Bank, 2015).

Labour mobility between the ASEAN nations is motivated by a country's degree of development, stability and labour demand and supply (Asian Development Bank, 2015). Most migration between the ASEAN member states is that of low-skilled workers and occurs generally from low-income countries (Guelser & Heal, 2014). Significant differences in income and demographics will continue to motivate intra-ASEAN migration in the coming years with three structural factors driving the intra-ASEAN migration of labour: (1) demographic transitions, (2) income differentials and (3) the ease of migration (Tuccio, 2017). Significantly, an estimated 68.2 million young men and women are projected to enter the labour force in the region from 2010 to 2025 (Asian Development Bank, 2015).

Immigration within the ASEAN is quite varied. Among ASEAN nations, Brunei, Malaysia, Singapore and Thailand are all labour receiving economies, whereas, Cambodia, Indonesia, Laos, the Philippines and Vietnam are labour sending economies (Tuccio, 2017). Logically, migration will continue to occur up until the point where wages converge between the countries in a regional bloc (Tuccio, 2017). Moreover, this tends to coalesce with the assumptions of the Harris-Todaro migration model of rural-urban migration (1970). The labour force of foreign workers in Malaysia grew substantially from 250, 000 (1990) to 2 million (2007) and five percent of documented foreign workers in the country are from Thailand (Pasadilla, 2011).

[11] The phenomenon whereby the development in a particular sector in a countries economy grows while simultaneously leading to a decrease in another sector as a direct result of the increase in the latter.

Immigration can play an important role in a country's development. An influx of both low-skilled and high-skilled labour influences a country's gross domestic product. These effects are different among the two skill groups. When a country's population increases due to low-skilled immigration, the wages of all low-skilled workers decrease as shown by Borjas (2003). Conversely, an increase in the high-skilled worker population raises the wages for low-skilled workers on a real per-capita basis (Chiswick, 2011). This process can be observed where high-skilled labourers contribute to greater long-run growth because of their impact on the *total factor productivity*[2].

Immigration policy and the mobility of labour have not been treated with the same priority as other regional issues. With the introduction of the ASEAN Economic Community in 2015, the regional bloc has committed to taking steps that will facilitate the migration of skilled labour. Leaders of the countries involved need to contribute to supporting mutual understanding, trust and cooperation (Zhao & Zhang, 2016). This study looks to address the impact of immigration for the long-term growth for a country through a variety of different assumptions that we use to derive a model in MATLAB.

**Methodology**

This study looks at how the GDP in Thailand and Malaysia are affected by immigration between the two countries. Membership in a regional bloc allows for easier immigration between member states. Migration can be described as the result of poor living conditions that motivate an individual or family to migrate (Tapinos, 2000). Because immigration tends to occur from lower income countries to higher income countries this paper will model immigration from Thailand to Malaysia on the basis that Malaysia has a higher GDP per capita than Thailand. We use GDP per capita as a representation of wages in our model.

Malaysia is an ASEAN member that has a comparative advantage in oil and gas resources (Zhao & Zhang, 2016). Due to Malaysia's large natural resource endowment and high GDP per capita, we select it as the host country benchmark for this study. Thailand was selected as the developing economy due to its low GDP per capita and its proximity to Malaysia. The proximity of both countries selected is of significance because the closer geographical location of the countries provides for low migration costs.

In order to examine the impact of immigration, we create a two-country model using the framework of the Harris-Todaro model of rural-urban migration (1970). The Harris-Todaro model assumes that migration occurs on the basis that "prospective rural migrants behave as maximizers of *expected* utility" (1970, p. 127). We adjust this model so that the two factors become the host country and home country, and assume that like migration, immigration occurs on the same basis. However, we assume no unemployment and that wages are represented by the country's GDP per capita.

Using the assumptions of the Solow model, the production function can be written as:

$$Y = Af(K, N) \quad (1)$$

We assume that wage received in a period for a country can be represented as the GDP per capita:

$$\frac{Y}{N} = \frac{K}{N} * \frac{N}{N} \quad (2)$$

Using the framework of the Harris-Todaro model, immigration occurs on the basis of utility maximization. So, immigration will occur until the following condition is satisfied which is consistent with the causality research on immigration done by Morley (2006):

$$\frac{Y_a}{N_a} = \frac{Y_b}{N_b} \quad (3)$$

where:
a = the host country
b = the home country

[2] This is the total unexplained output from growth. Typically this can be attributed to technological growth in a country resulting in greater efficiency for workers.

Simultaneously, the utility of an individual consumer can be represented as:

$$\mu = \log\left[\frac{Y_x}{Y_x}\right] \quad (4)$$

And the formula for the *long-run equilibrium wage*[3] can be represented as:

$$W^* = \frac{\left[\frac{Y_a}{N_a} + \frac{Y_b}{N_b}\right]}{[N_a + N_b]} \quad (5)$$

For our model, total factor productivity is assumed to be influenced by the level of skilled workers an economy possesses. Therefore, the population of a country is separated into a vector representing different skill groups:

$$N_x = \begin{bmatrix} N_0 \\ N_1 \\ N_2 \\ N_3 \\ \dots \end{bmatrix} \quad (6)$$

Where:
$N_0$ = little to no education
$N_1$ = primary education
$N_2$ = secondary education
$N_3$ = tertiary education

Low-skilled workers can be represented within the lower distribution of the vector i.e., $N_0$ and $N_1$, and higher-skilled workers within the upper-limits of the distribution i.e., $N_3 \dots N_n$. It is assumed that the higher the skill, the greater the contribution to the A factor in the production function.

Therefore, the A term, through time, can be derived as such in our model:

$$A^* = \int_0^\infty \{N_0^a + N_1^b + N_2^c + N_3^d\} \mathrm{dt} \quad (7)$$

Where the exponents a, b, c and d represent the contribution that each worker plays with their impact on the total factor productivity and:

$$a < b < c < d \dots < n^4 \quad (8)$$

***Stochastic Time-Series Modeling***

In order to examine how these economies evolve over time and the impacts of different immigration policies, we compiled these formulas into a time-series model using stochastic aspects to show the long-run implications of different immigration policies.

The model begins by allowing the primary exogenous parameters to be set for each country at t=0 and evolve through time. Exogenous parameters include:

GDP[5]
Population[6]
Capital Stock[7]
Population Education Vector[8]
Population Education Exponents Vector[9]

After this initial process setting the exogenous parameters in our MATLAB model, we create a stochastic process for both population and capital stock using historic data to interpolate for future inputs into the model. We also assume decreasing returns to scale on these factors which allow for a long-run steady-state for both capital stock and population which is consistent with observations by Espenshade, Bouvier & Arthur (1982).

For the production function, our model assumes:

$$Y = Ak^{2/3}N^{1/3} \quad (9)$$

This is used as the primary formula for determining the A parameter shown in the tables below:

**3** The long-run equilibrium wage will take place in which both countries have the exact same wage due to immigration taking place on a utility maximizing basis.
**4** For the use of our model we assume that: 8a = 4b = 2c = d
**5** the starting GDP for each country at the beginning of the simulation
**6** the starting population for each country at the beginning of the simulation
**7** the starting Capital Stock for each country at the beginning of the simulation
**8** the distribution of the population that has attained different levels of education
**9** the impact that each level of education plays on the total factor productivity of a country

**Table 1: Malaysia Input Statistics**

| Year | Population | Capital Stock | GDP | Derived A |
|---|---|---|---|---|
| 2010 | 28,119,500 | 1,465,085.63 | 255,016.60 | 6.5011559 |
| 2011 | 28,572,970 | 1,544,556.13 | 268,516.70 | 6.5733039 |
| 2012 | 29,021,940 | 1,652,246.25 | 283,216.30 | 6.5941615 |
| 2013 | 29,465,372 | 1,771,366.50 | 296,507.40 | 6.5573134 |
| 2014 | 29,901,997 | 1,894,159.13 | 314,333.90 | 6.615259 |
| 2015 | 30,331,007 | 2,025,463.84 | 329,952.50 | 6.6090568 |

**Source:** *World Bank*

**Table 2: Thailand Input Statistics**

| Year | Population | Capital Stock | GDP | Derived A |
|---|---|---|---|---|
| 2010 | 66,692,500 | 3,188,433.50 | 341,000 | 3.881597244 |
| 2011 | 66,902,958 | 3,291,630.75 | 344,000 | 3.829445815 |
| 2012 | 67,164,130 | 3,417,899.75 | 369,000 | 4.000746384 |
| 2013 | 67,451,422 | 3,530,017.50 | 379,000 | 4.015974388 |
| 2014 | 67,725,979 | 3,622,972.50 | 382,000 | 3.972844566 |
| 2015 | 67,959,359 | 3,718,375.26 | 392,000 | 4.002218832 |

**Source:** *World Bank*

Historic data and inputs for our model can be seen in Tables 3-6 in the appendix, which is then used as an input for the MATLAB script shown in the appendix.

Using this data we ensure that the model parameters match the calculations from 2010 – 2015 and allow the model to grow using the historic growth rates of population and capital and allow for the determination of the total factor productivity.

For the stochastic process for K and N we use:

$$x_t = x_{t-1} * (1 + norminv(rand, g, v))^{\beta} \quad (10)$$

where:
$x_t =$ *the capital or population at a time step*
$g =$ *the growth rate of the variable*
$v =$ *the historic variance in growth*
$\beta =$ *the efficiency scaling perameter*

Using this process, we account for the exogenous growth in a country and our model accounts for K and N through time steps in the production function, however to account for total factor productivity we use an alternative approach that takes into account the impact of education.

Using formula 6, we account for the distribution of education in a country. Each worker is classified into the $N_x$ vector based on their education levels. This vector is then used as an input for the integral used to determine $A^*$ which is the total factor productivity aspect of the production function. This also allows for a time-series interpolation of the GDP of a country under different assumptions and allows for us to model out the impact of different immigration policies.

**Results**

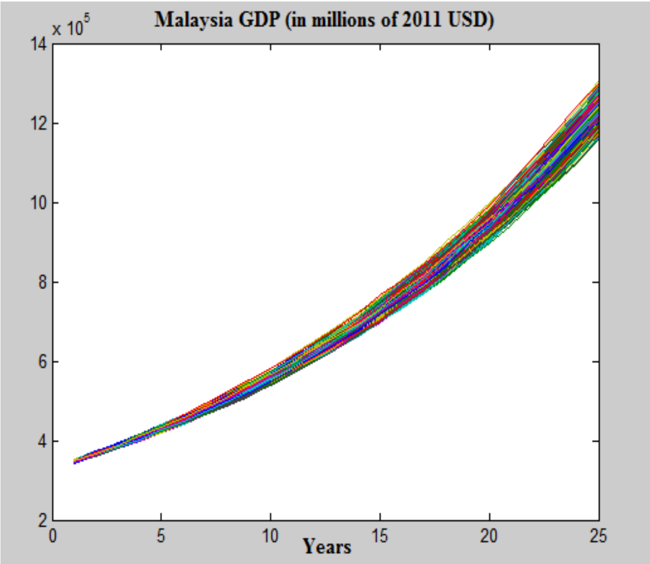
The results of our model show that as more high-skilled labourers immigrate to a country, total output tends to increase in the long-run. However, countries experiencing emigration have a decrease in their potential long-run economic growth due to *brain drain*[10]. Therefore, immigration has both benefits and consequences. Brain drain is beneficial for the labour receiving country but is harmful to long-run growth in the labour sending country. Countries should take steps to alleviate the effects of brain drain.

This model can be adapted to suit various economic conditions. It can also be expanded into a more comprehensive model. This would allow for a more in depth analysis and potentially have a reaching impact on immigration policy.

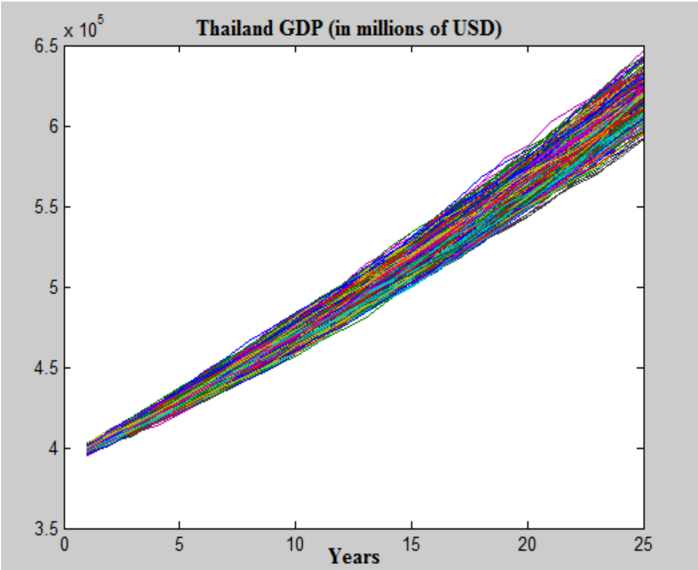
**10** This occurs when highly skilled laborers in a country immigrate to another country decreasing the stock of human capital.

***Current Immigration Policy***

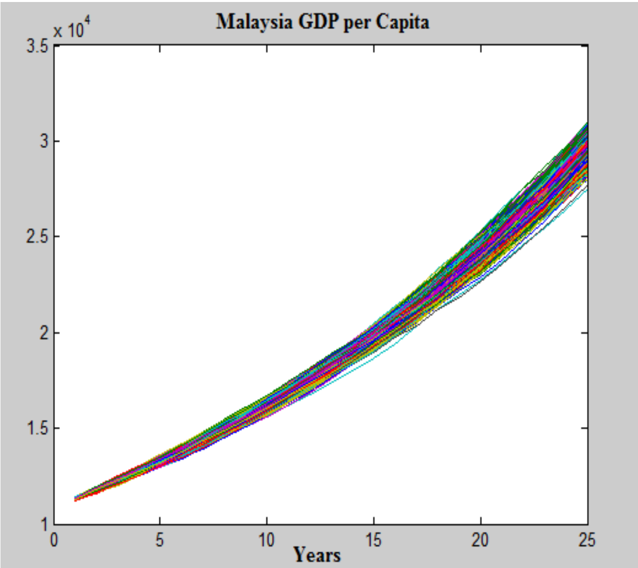
Results of our model using current immigration and population growth statistics in Malaysia:



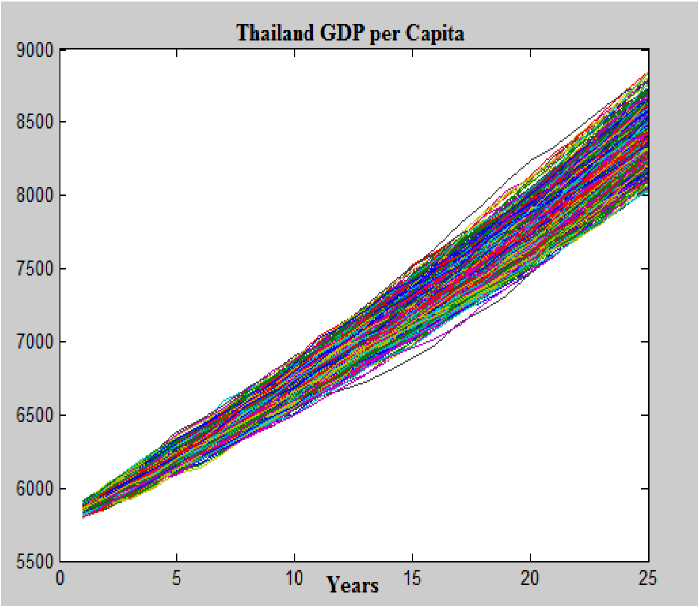

Under the current circumstances of immigration, this output shows growth in Malaysian GDP over the long-run.




This is GDP growth in Thailand under current immigration policy.




This output displays the per capita GDP growth under current immigration policy.

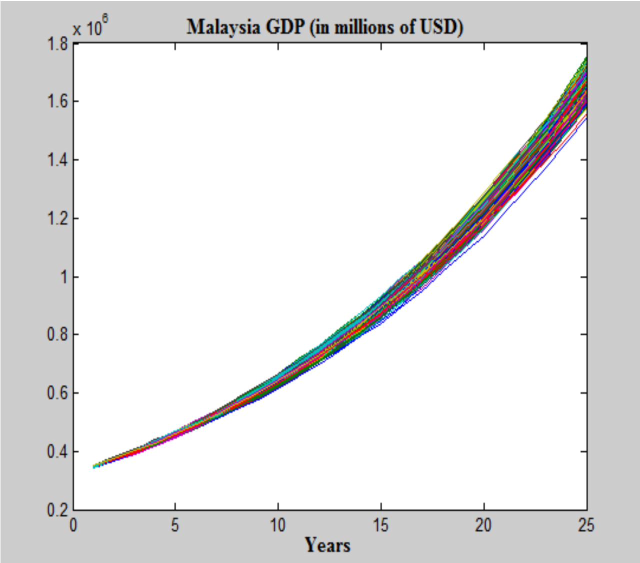



This output displays the growth in per capita income in current immigration policy.

***Increased High-Skilled Immigration Policy allowing 300,000 immigrants from Thailand***

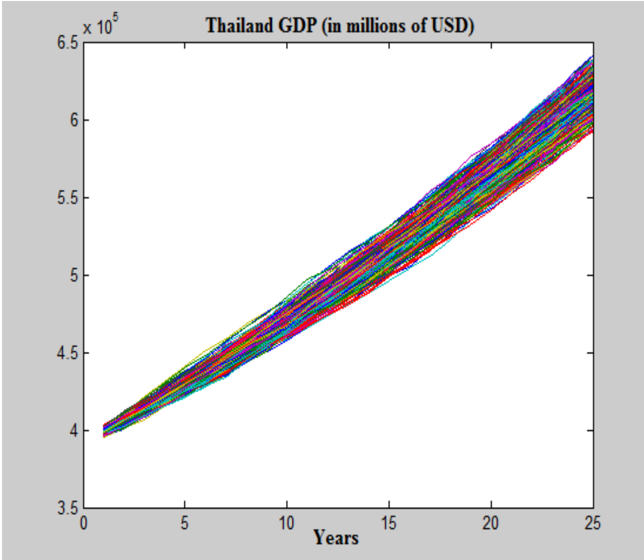
Results of our model using increased immigration policy:

***Malaysia***

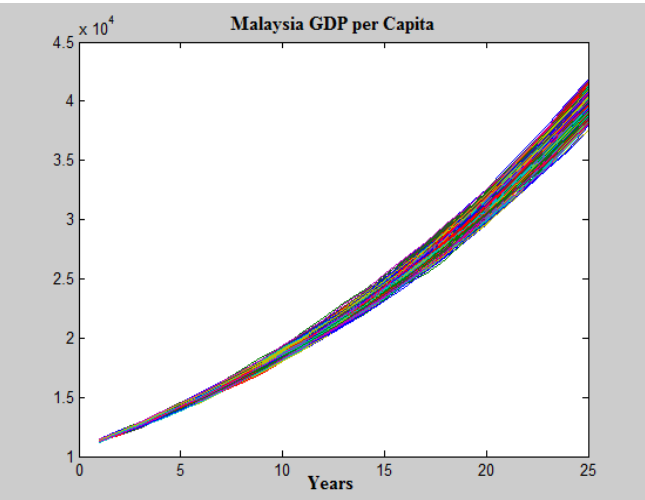



This display shows the growth in Malaysian GDP as a result of high-skilled immigration from Thailand. In comparison to the output of Malaysia GDP under current immigration policy, this output shows a larger growth in GDP.

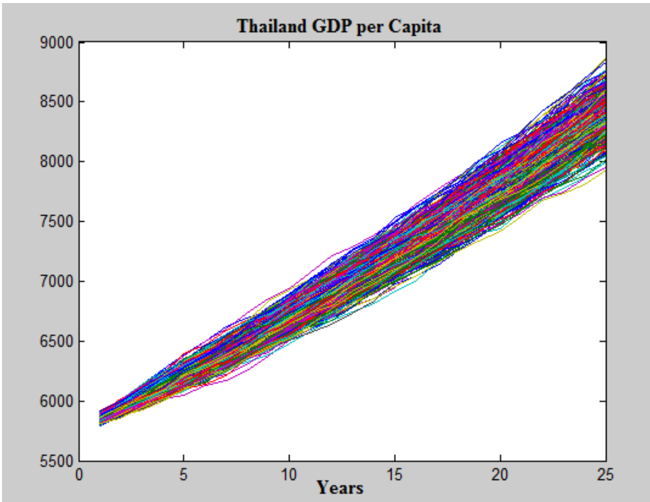
***Thailand***




This output displays the growth in GDP in Thailand with the emigration of high-skilled workers to Malaysia. Growth in GDP is less under these parameters than growth under current immigration policy.




This output displays the growth in Malaysian GDP per capita with high-skilled immigration from Thailand. Again, compared to the growth in per capita GDP under the current immigration policy, growth is larger under these parameters.




This output displays the growth in GDP per capita in Thailand with the emigration of high-skilled labour to Malaysia. In comparison to growth in GDP per capita under current immigration policy, growth in GDP per capita under these parameters contracts.

The situations observed in Thailand under the emigration of high-skilled labour is a result of brain drain, as the more educated workers emigrate to a higher GDP country.

## Policy Recommendations

- Low-skilled immigration is necessary for short-run growth. Because of this, governments should incentivize low-skilled individuals to immigrate, to satisfy demand for low-skilled labour as the ASEAN region undergoes industrialization.
- The industries that employ low-skilled labour are susceptible to low switching costs in the short run. Countries cannot depend on low-skill employing industries for continued economic success. For long-run growth, we propose measures that ease immigration for high-skilled individuals. If wages become increasingly high, low-skill employing firms are able to move their business to a lower wage area. The same cannot be said for high-skilled industries.
- Member states could implement a criteria based immigration system, similar to Canada's point system, on a country by country basis. This would allow for individual countries to select the in demand labourers for their economies.
- The next policy move for ASEAN governments is to liberalize and regularize immigration between member states (Tuccio, 2017), and target immigration from outside the regional bloc as they develop their own human capital stock.
- To limit the effects of "brain drain" we propose that ASEAN governments incentivize high-skilled labour to immigrate from outside the regional bloc and expedite their worker visas.
- This can be done if ASEAN commits to (1) facilitating visas and employment passes, (2) mutual recognition agreements (MRAs), (3) greater mobility for academics and (4) creating a consensus of qualifications to aid in high-skilled migration (Guelser & Heal, 2014).
- However, for long-run growth ASEAN should invest in educating the population to build up their stock of high-skilled labour and therefore increase total factor productivity of the ASEAN population. This will make countries less dependent on non-ASEAN high-skilled labour.

**References**


Asian Development Bank. (2015). ASEAN Community 2015: Managing integration for better jobs and shared prosperity. Retrieved from https://www.adb.org/sites/default/files/publication/42818/asean-community-2015-managing-integration.pdf

Chiswick, Barry R. *Immigration: high skilled vs. low skilled labor?* No. 28. IZA Policy Paper, 2011.

Borjas, G. (2003). The Labor Demand Curve is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market. doi:10.3386/w9755

Card, D. (2005). Is the new immigration really so bad? *The Economic Journal, 115*(507). Retrieved from 10.1111/j.1468-0297.2005.01037

De Grauwe, P. & Zhang, Z. (2016). The rise of China and regional integration in East Asia. *Scottish Journal of Political Economy, 63*(1), pp. 1-6. Retrieved from 10.1111/sjpe.12107

Guelser, S. & Heal, A. (2014). *Moving freely? Labour mobility in ASEAN Policy Brief No. 40.* United Nation Economic and Social Commission for Asia and the Pacific.

Harris, J., & Todaro, M. (1970). Migration, Unemployment and Development: A Two-Sector Analysis. *The American Economic Review, 60*(1), 126-142. Retrieved from http://www.jstor.org/stable/1807860

Latif, E. (2015). The relationship between immigration and unemployment: Panel data evidence from Canada. Economic Modelling,50, 162-167. doi:10.1016/j.econmod.2015.06.013

Lee, G. & Jeong, J. (2016). An investigation of global and regional integration of ASEAN economic community stock market: Dynamic risk decomposition approach. *Emerging Markets Finance & Trade, 52*(9), pp. 2069-2086.

Oreopoulos, P. (2009). Why Do Skilled Immigrants Struggle in the Labor Market? A Field Experiment with Six Thousand Resumes. doi:10.3386/w15036

Pasadilla, G. O. (2011). *Social security and labor migration in ASEAN Research Policy Brief 34.* Asian Development Bank.

Tai, W. P., & Soong, J.J. (2014). Trade relations between China and Southeast Asia strategy and challenge. *The Chinese Economy*, 47(3), 23–39. doi:10.2753/ces1097-1475470302

Tapinos, George P. (2000). Globalisation, regional integration, international migration. *International Social Science Journal, 52*(165), pp. 297-306.

Tuccio, M. (2017). Determinant of intra-ASEAN migration. *Asian Development Review, 34*(1), pp. 144-166

Zhao, S. & Zhang, Z. (2016). The political economy of energy resources between China and ASEAN states: Opportunities and challenges. *The Chinese Economy,* (49), pp. 456-466.

# Appendix

## Script 1: Immigration Model MATLAB Code

```
clear
clc
close all %-- Closes any old graphs from a previous run

%=== Immigration Model Code ===%
%=== Malaysia = Rich | Thailand = Poor Country ===%

N = 100;   %this is the number of traces for the simulation
t = 25;  %this is the number of years in which the simulation will occur

for N = 1:N

      %=== Malaysia Start Parameters ===%
      Malaysia_GDP              = 329952.5;
%in millions of 2011 USD
      Malaysia_Population       = 30331007;
%starting population per trace
      Malaysia_CapStock         = 2025463.8386922;
%in milllions of 2011 USD
      Malaysia_GDPCapita        = (Malaysia_GDP*1000000)/Malaysia_Population;
      %GDP per Capita
      Malaysia_Vector           = [879599, 10100225, 13102995, 6248187];
      %Vector for each education level contributing to TFP
      Malaysia_Exponents        = [5.36927E-08, 1.07385460816391E-07, 2.09771E-07,
4.09542E-07];     %the exponents for each vector's impact on TFP

      %=== Thailand Start Parameters ===%
      Thailand_GDP              = 392474.6;
      Thailand_Population       = 67959359;
      Thailand_CapStock         = 3718375.259;
      Thailand_GDPCapita        = (Thailand_GDP*1000000)/Thailand_Population;
      Thailand_Vector           = [19929082, 26860937, 10516711, 10652630];
      Thailand_Exponents        = [2.10580831747597E-08, 4.02828330161862E-08,
7.8732332699039E-08, 1.55631332064745E-07];
      for t = 1:t

%=== Malaysia Population/CapStock/GDPGrowth parameters ===%
      Malaysia_Population       =
Malaysia_Population*(1+norminv(rand(),0.015141447350899,(0.000693852030943015)))^0.85;
%Population growth parameters (expected 41.9m), POWER^0.85 FOR DECREASING RETURNS TO
SCALE
      Malaysia_Pop(t)           = Malaysia_Population;

      %=== Malaysia Vector Delta's ===%
      if t == 1
            Malaysia_Vector(1)   =
Malaysia_Vector(1)+(Malaysia_Vector(1)./sum(Malaysia_Vector)).*(Malaysia_Pop(t)-
30331007);
            else
            Malaysia_Vector(1)   =
Malaysia_Vector(1)+(Malaysia_Vector(1)./sum(Malaysia_Vector)).*(Malaysia_Pop(t)-
Malaysia_Pop(t-1));
      end

      if t == 1
```

```
          Malaysia_Vector(2)  =
Malaysia_Vector(2)+(Malaysia_Vector(2)./sum(Malaysia_Vector)).*(Malaysia_Pop(t)-
30331007);
          else
          Malaysia_Vector(2)  =
Malaysia_Vector(2)+(Malaysia_Vector(2)./sum(Malaysia_Vector)).*(Malaysia_Pop(t)-
Malaysia_Pop(t-1));
      end

      if t == 1
          Malaysia_Vector(3)  =
Malaysia_Vector(3)+(Malaysia_Vector(3)./sum(Malaysia_Vector)).*(Malaysia_Pop(t)-
30331007);
          else
          Malaysia_Vector(3)  =
Malaysia_Vector(3)+(Malaysia_Vector(3)./sum(Malaysia_Vector)).*(Malaysia_Pop(t)-
Malaysia_Pop(t-1));
      end

      if t == 1
          Malaysia_Vector(4)  =
Malaysia_Vector(4)+(Malaysia_Vector(4)./sum(Malaysia_Vector)).*(Malaysia_Pop(t)-
30331007);
          else
          Malaysia_Vector(4)  =
Malaysia_Vector(4)+(Malaysia_Vector(4)./sum(Malaysia_Vector)).*(Malaysia_Pop(t)-
Malaysia_Pop(t-1));
      end

      %=== Malaysia CapStock + GDP Growth ===%
      Malaysia_CapStock        =
Malaysia_CapStock*(1+norminv(rand(),0.0647770085226806,0.00676911672718816))^0.85;
%Capital Stock rate of growth
      Malaysia_GDP             =
(((sum(Malaysia_Vector.*Malaysia_Exponents))*(Malaysia_CapStock.^(2/3))*(Malaysia_Popu
lation.^(1/3)))/100);  %in millions of 2011 $USD
      Malaysia_GDPCapita(t)  = (Malaysia_GDP*1000000)/Malaysia_Population;

%=== Thailand Population/CapStock/GDPGrowth parameters ===%
      Thailand_Population      =
Thailand_Population*(1+norminv(rand(),0.00376347238384463,(0.00376347238384463)))^0.85
; %Population growth parameters (expected 74.1m), POWER^0.85 FOR DECREASING RETURNS TO
SCALE
      Thailand_Pop(t)          = Thailand_Population;

      %=== Thailand Vector Delta's ===%
        if t == 1
          Thailand_Vector(1)  =
Thailand_Vector(1)+(Thailand_Vector(1)./sum(Thailand_Vector)).*(Thailand_Vector(t)-
67959359);
          else
          Thailand_Vector(1)  =
Thailand_Vector(1)+(Thailand_Vector(1)./sum(Thailand_Vector)).*(Thailand_Pop(t)-
Thailand_Pop(t-1));
      end

      if t == 1
```

```
            Thailand_Vector(2)  =
Thailand_Vector(2)+(Thailand_Vector(2)./sum(Thailand_Vector)).*(Thailand_Pop(t)-
67959359);
            else
            Thailand_Vector(2)  =
Thailand_Vector(2)+(Thailand_Vector(2)./sum(Thailand_Vector)).*(Thailand_Pop(t)-
Thailand_Pop(t-1));
      end

      if t == 1
            Thailand_Vector(3)  =
Thailand_Vector(3)+(Thailand_Vector(3)./sum(Thailand_Vector)).*(Thailand_Pop(t)-
67959359);
            else
            Thailand_Vector(3)  =
Thailand_Vector(3)+(Thailand_Vector(3)./sum(Thailand_Vector)).*(Thailand_Pop(t)-
Thailand_Pop(t-1));
      end

      if t == 1
            Thailand_Vector(4)  =
Thailand_Vector(4)+(Thailand_Vector(4)./sum(Thailand_Vector)).*(Thailand_Pop(t)-
67959359);
            else
            Thailand_Vector(4)  =
Thailand_Vector(4)+(Thailand_Vector(4)./sum(Thailand_Vector)).*(Thailand_Pop(t)-
Thailand_Pop(t-1));
      end

      %=== Thailand CapStock + GDP Growth ===%
      Thailand_CapStock       =
Thailand_CapStock*(1+norminv(rand(),0.030751416892047,0.00490766117690275))^0.85;
%Capital Stock rate of growth
      Thailand_GDP            =
(((sum(Thailand_Vector.*Thailand_Exponents))*(Thailand_CapStock.^(2/3))*(Thailand_Popu
lation.^(1/3)))/100);  %in millions of 2011 $USD
      Thailand_GDPCapita(t)   = (Thailand_GDP*1000000)/Thailand_Population;

      Malaysia_GDPCapitaGraph(t,N) = Malaysia_GDPCapita(t);
      %figure(1) %-- use these to see it graph each iteration
      %plot(Thailand_GDPCapitaGraph) %-- use these to see it graph each iteration

%=== Immigration Parameters ===% EXTREME VETTING ONLY VECTOR 4
      Immigration_Max = 250000;
      Vector_Vetting  = 4;

      if Malaysia_GDPCapita>Thailand_GDPCapita
      if Thailand_Vector(Vector_Vetting)>Immigration_Max

Malaysia_Vector(Vector_Vetting)=Malaysia_Vector(Vector_Vetting)+Immigration_Max;
             Thailand_Vector(Vector_Vetting)=Thailand_Vector(Vector_Vetting)-
Immigration_Max;
      else
             Malaysia_Vector(Vector_Vetting)=Malaysia_Vector(Vector_Vetting)
             Thailand_Vector(Vector_Vetting)=Thailand_Vector(Vector_Vetting)
      end
      end
  end
end
```

```
figure(1)
plot(Malaysia_GDPCapitaGraph)
```

**Table 3: Malaysia Education Estimates**

**Where: 1 = none, 2 = primary, 3 = secondary and 4 = tertiary**

| Vector | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 2010 | 1,012,302 | 4,639,718 | 15,662,562 | 6,804,919 |
| 2011 | 885,762 | 4,828,832 | 15,857,998 | 7,000,378 |
| 2012 | 870,658 | 4,875,686 | 16,194,243 | 7,081,353 |
| 2013 | 854,496 | 9,811,969 | 12,729,041 | 6,069,867 |
| 2014 | 777,452 | 9,419,129 | 13,037,271 | 6,668,145 |
| 2015(est) | 879,599 | 10,100,225 | 13,102,995 | 6,248,187 |

**Source:** *Team Calculations*

**Table 4: Malaysia Estimated Educational Exponent impact on TFP**

| Exponents | 1 [a] | 2 [b] | 3 [c] | 4 [d] |
|---|---|---|---|---|
| Exp 2010 | 5.1037E-08 | 1.0207E-07 | 2.0415E-07 | 4.083E-07 |
| Exp 2011 | 5.39466E-08 | 1.0789E-07 | 2.0579E-07 | 3.9157E-07 |
| Exp 2012 | 4.99369E-08 | 9.9874E-08 | 1.9975E-07 | 3.995E-07 |
| Exp 2013 | 5.77507E-08 | 1.155E-07 | 2.21E-07 | 4.2201E-07 |
| Exp 2014 | 5.28756E-08 | 1.0575E-07 | 2.115E-07 | 4.23E-07 |
| Exp 2015 | 5.66096E-08 | 1.1322E-07 | 2.1644E-07 | 4.1288E-07 |
| Average | 5.36927E-08 | 1.0739E-07 | 2.0977E-07 | 4.0954E-07 |

**Source:** *Team Calculations*

**Table 5: Thailand Education Estimates**

***where: 1 = none, 2 = primary, 3 = secondary and 4 = tertiary***

| Vector | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 2010 | 21,074,830 | 25,743,305 | 9,203,565 | 10,670,800 |
| 2011 | 20,338,499 | 25,891,445 | 9,433,317 | 11,239,697 |
| 2012 | 19,611,926 | 26,328,339 | 9,738,799 | 11,485,066 |
| 2013 | 17,604,821 | 28,059,792 | 13,153,027 | 8,633,782 |
| 2014 | 19,860,643 | 26,768,693 | 10,480,595 | 10,616,047 |
| 2015(est) | 19,929,082 | 26,860,937 | 10,516,711 | 10,652,630 |

**Source:** *World Bank*

**Table 6: Thailand Estimated Educational Exponent impact on TFP**

| Exponents | 1 [a] | 2 [b] | 3 [c] | 4 [d] |
|---|---|---|---|---|
| Exp 2010 | 2.65073E-08 | 4.30147E-08 | 7.60293E-08 | 1.42059E-07 |
| Exp 2011 | 1.98342E-08 | 3.86683E-08 | 7.63367E-08 | 1.51673E-07 |
| Exp 2012 | 1.9698E-08 | 3.9396E-08 | 7.87919E-08 | 1.57584E-07 |
| Exp 2013 | 2.05519E-08 | 4.11037E-08 | 8.22075E-08 | 1.64415E-07 |
| Exp 2014 | 1.98395E-08 | 3.96791E-08 | 7.93582E-08 | 1.58716E-07 |
| Exp 2015 | 1.99176E-08 | 3.98352E-08 | 7.96704E-08 | 1.59341E-07 |

**Source:** *Team Calculations*