

## Immigration and Native Wages: An S-curve Relationship

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### Abstract

This paper presents a tractable theoretical model in which native wages and the number of migrants exhibit an s-curve relationship. In this model, with a very small or with a very large number of migrants, more migrants depress native wages. However, with an intermediate number of migrants, native wages are increasing in the number of migrants. Whether natives can benefit from migrants, and native wages can rise above its pre-migration level or not depends on the productivity difference between natives and migrants, and the size of the sector in which migrants have a comparative advantage.

### บทคัดย่อ

บทความนี้นำเสนอแบบจำลองทางทฤษฎีเพื่อแสดงความสัมพันธ์ระหว่างค่าจ้างของแรงงานท้องถิ่นกับจำนวนแรงงานต่างชาติที่มีลักษณะรูปตัวเอส นั่นคือ ในกรณีที่แรงงานต่างชาติมีจำนวนน้อย และในกรณีที่ มีจำนวนมาก แรงงานต่างชาติจะมีผลให้ค่าจ้างของแรงงานท้องถิ่นลดต่ำลง แต่ในกรณีที่แรงงานต่างชาติมีอยู่จำนวนปานกลาง แรงงานต่างชาติจะทำให้ค่าจ้างของแรงงานท้องถิ่นเพิ่มสูงขึ้นได้ ทั้งนี้ การที่แรงงานท้องถิ่นจะได้รับประโยชน์จากการเข้ามาของแรงงานต่างชาติ (หรือค่าจ้างของแรงงานท้องถิ่นจะเพิ่มสูงขึ้นเมื่อเทียบกับกรณีที่ไม่มีแรงงานต่างชาติ) หรือไม่นั้น ก็ขึ้นอยู่กับความ

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แตกต่างในผลิตภาพระหว่างแรงงานท้องถิ่นกับแรงงานต่างชาติ และขนาดของภาคการผลิตที่แรงงานต่างชาติมีความได้เปรียบโดยเปรียบเทียบ

## 1. Introduction

The booming Thai economy in 1980s has become a magnet for migrants from neighboring countries. Recent surveys and estimates indicate that up to two million migrants, equal to about 6 percent of the Thai labor force, work as undocumented labor in Thailand. The percentage increase in labor supply to low-skilled occupations and industries is even greater because most of the immigrants are relatively unskilled. Up to 90 percent of the migrant workers are from Myanmar. They escape political and economic difficulties and uncertainties. While migrants from Myanmar comprise most of the migrants in Thailand, there are also sizable, though comparatively small, migrant groups from Cambodia and Lao P.D.R. seeking jobs in Thailand.

Immigration became a public debate during the economic crisis in 1997 when the unemployment rate rose markedly. Amid the present economic downturn in Thailand, immigration has again been a public concern. The availability of cheap migrant labor was viewed as a factor reducing the opportunities for employment of native workers and their wages. In a recent poll for the ILO, 59 percent of Thais said their governments should admit no more foreign workers, and only 10 percent thought more should come (*The Economist* January 18<sup>th</sup>, 2007). Pitayanon (2001) documents that “employers prefer migrants to native workers since migrants accept wages lower than the minimum wages required by law”.

Despite popular belief, the assertion that immigrants have a large adverse impact on the wages and employment opportunities of native workers has not been empirically supported especially in the United States and European countries (see Borjas (1994), Friedberg and Hunt (1995), and LaLonde and Topel (1997) for reviews). In general, the estimated impacts of immigration on unemployment are statistically insignificant. Although the effect of immigration on wages is found to be negative and statistically significant in some studies, it is small. For example, Borjas (1987), Altonji and Card (1991) and LaLonde and Topel (1991) have found that a 1-percent increase in the

number of migrants over the number of natives in the U.S. labor market reduces native wages by 0.1 percent at most.

In the case of Thailand, using a computable general equilibrium (CGE) model the Thailand Development Research Institute (TDRI) found that the presence of 700,000 unauthorized migrants in 1995 decreased the wages of Thai workers with primary or lower level of education by 3.5 percent relative to a counterfactual of no migrants. Martin (2004) reports that the National Economic and Social Development Board (NESDB) used another CGE model and found that the real income of the poorest 60 percent of households fell by 0.4 percent as a result of migrant labor, while the real income of the richest 40 percent rose by 0.3 percent. But these findings depend on assumptions of the simulation models. For a given elasticity of substitution between native and migrant workers, the CGE approach mechanically predicts the effects of a supply shock. Lacking firm empirical support, the quality of these CGE-based finding is also in doubt. Exploiting geographic variation in migrant concentrations, Kulkolkarn and Potipiti (2007) find that immigration does not reduce the wages of Thai workers. Using the similar method, and Bryant and Rukumnuaykit (2007) find that the negative impact of immigration on the wages of Thai worker is very small; however, the effect is stronger than normally observed in developed countries.

In theoretical standard migration models, the relationship between native wages and immigration are monotonic. Migrants and natives are either assumed complements or substitutes in production. Immigration increases (respectively decreases) native wages if they are complements (respectively substitutes)<sup>1</sup>. For example, consider the two following production functions:  $f^1(n, m) = n^{\phi_n} m^{\phi_m}$  and  $f^2(n, m) = (n + m)^\phi$  where  $n$  and  $m$  are natives and migrants, and  $\phi$ 's are positive constant in  $(0, 1)$ . Migrants and natives are complements in the first production function but are substitutes in the second.

In this paper, we propose a simple model in which complementarity and substitutability between migrants and natives depending on the number of migrants. We find that native wages and migrants exhibit an *s*-curve relationship. In this paper, a simple model in which complementarity and substitutability between migrants and natives depend on the number of migrants is proposed. With a

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<sup>1</sup> For example, see Borjas (1994) and Ethier (1985)

small or large number of migrants, migrants and natives are substitutes. However, with an intermediate number, migrants and natives are complements. In addition, we show that whether natives can gain from immigration or not depends also on the difference between natives and migrants and the size of the sector in which migrants have comparative advantage over natives.

## 2. The Model

The economy produces one final good ( $y$ ) from the following CES production function:

$$y = (K^\theta + \phi_H H^\theta + \phi_L L^\theta)^{1/\theta}$$

where  $K$  is the amount of capital endowed in the economy. The terms  $H$  and  $L$  are, respectively, high-tech and low-tech goods which are intermediate goods for the final good production. The parameter  $\theta$  is less than 1. The other parameters are all positive.

The intermediate goods  $H$  and  $L$  use only labor in their production. Initially, the economy is endowed with  $n$  homogenous native workers and no migrants. Each native worker can produce 1 unit of  $H$  or 1 unit of  $L$ . Each worker gets a wage equal to the price of the intermediate good he produces. In competitive equilibrium, obviously both  $H$  and  $L$  are produced. The wage each native gets is  $w = p_H = p_L$ , where  $p_i = \frac{dy}{di}$  is the price of good  $i \in \{H, L\}$  in units of  $y$ . Using the  $p_H = p_L$  condition together with the labor market clearing condition:  $L + H = n$ , it is straightforward to show

that in equilibrium  $L = \frac{n}{\gamma + 1}$  and  $H = \frac{\gamma}{\gamma + 1}n$  where  $\gamma \equiv \left(\frac{\phi_L}{\phi_H}\right)^{\frac{1}{1-\theta}}$ . It follows that

$$y = \left[ K^\theta + \left( \phi_H \frac{\gamma^\theta}{(\gamma + 1)^\theta} + \phi_L \frac{1}{(\gamma + 1)^\theta} \right) n^\theta \right]^{1/\theta}$$

This equation shows that the production function of the final good is in fact a CES production function of capital and native workers.

Now,  $m$  migrants enter the economy. Each migrant can work in the low-tech sector and produce one unit of  $L$  or work in the high-tech sector and produce  $\lambda < 1$  unit of  $H$ . Migrants who work in the low-tech sector and the high-tech sector therefore get wage equal to  $p_L$  and  $\lambda p_H$ ,

respectively. However, they are as productive as natives in producing the low-tech good. Migrants are less productive than natives in producing the hi-tech good because they lack language and cultural skills. The smaller the value of  $\lambda$ , the more the difference between migrants and natives. Migrants and natives are identical for production if  $\lambda = 1$ .

When  $\lambda < 1$ , natives have comparative advantage in high-tech production, and some natives always work in the high-tech sector to produce the high-tech good. Similarly, some migrants always work in the low-tech sector. Given such conditions, there are 4 equilibrium cases to consider.

First, we consider the case where natives work in both intermediate good sectors but migrants only work in the low-tech sector. Such equilibrium requires that

$$n = n_L + n_H, H = n_H, L = n_L + m, p_H = p_L, \lambda p_H \leq p_L$$

where  $n_i$  and  $m_i$ , respectively, denote the number of natives and migrants in sector  $i$ . The last condition implies that it is optimal for migrants to work in the low-tech sector. In this equilibrium

$$n_L = \frac{n - \gamma m}{1 + \gamma} \text{ and } n_H = \frac{\gamma}{1 + \gamma} (n + m) \text{ and}$$

$$y = \left[ K^\theta + \left( \phi_H \frac{\gamma^\theta}{(\gamma + 1)^\theta} + \phi_L \frac{1}{(\gamma + 1)^\theta} \right) (n + m)^\theta \right]^{1/\theta}$$

From the condition  $\lambda p_H \leq p_L$ , such an equilibrium exists if  $m \leq \frac{n}{\gamma}$ .

Next, we consider the equilibrium in which all natives work in the high-tech sector and migrants work in both sectors. Such equilibrium requires that

$$m = m_L + m_H, H = n + \lambda m_H, L = m_L, p_L = \lambda p_H, p_H \geq p_L$$

Solving this, we get  $m_L = \frac{n + \lambda m}{\lambda(1 + \gamma)}$  and  $m_H = \frac{\lambda \gamma m - n}{\lambda(1 + \gamma)}$

$$y = \left[ K^\theta + \left( \phi_H \frac{\gamma^\theta}{(\gamma + 1)^\theta} + \phi_L \frac{1}{(\lambda(\gamma + 1))^\theta} \right) (n + \lambda m)^\theta \right]^{1/\theta}$$

This equilibrium holds if  $m \geq \frac{n}{\lambda \gamma}$ .

The third case to consider is the case where all natives work in the hi-tech sector and all migrants work in the low-tech sector:

$$H = n, L = m, p_H \geq p_L, \lambda p_H \leq p_L$$

Obviously, in such a case

$$y = (K^\theta + \phi_H n^\theta + \phi_L m^\theta)^{1/\theta}.$$

Such an equilibrium exists if  $m \in [\frac{n}{\gamma}, \frac{n}{\lambda\gamma}]$ .

The last case to consider is the case where both natives and migrants work in both sectors. This equilibrium requires that  $p_L = p_H$  and  $\lambda p_H = p_L$ . Clearly, the two conditions are contradictory and such equilibrium does not exist.

The result from this section can be summarized in the following proposition.

**PROPOSITION 1:** *The final good as a function of  $n$  and  $m$  is:*

$$y = \left[ K^\theta + \left( \phi_H \frac{\gamma^\theta}{(\gamma+1)^\theta} + \phi_L \frac{1}{(\gamma+1)^\theta} \right) (n+m)^\theta \right]^{1/\theta} \quad \text{for } m \in [0, \frac{n}{\gamma}]$$

$$y = (K^\theta + \phi_H n^\theta + \phi_L m^\theta)^{1/\theta} \quad \text{for } m \in [\frac{n}{\gamma}, \frac{n}{\lambda\gamma}]$$

$$y = \left[ K^\theta + \left( \phi_H \frac{\gamma^\theta}{(\gamma+1)^\theta} + \phi_L \frac{1}{(\lambda(\gamma+1))^\theta} \right) (n + \lambda m)^\theta \right]^{1/\theta} \quad \text{for } m \geq \frac{n}{\gamma}$$

where  $\gamma \equiv \left( \frac{\phi_L}{\phi_H} \right)^{1/(1-\theta)}$

Using this proposition, one can show that the native wage  $w \equiv \frac{dy}{dn}$  has the following properties:

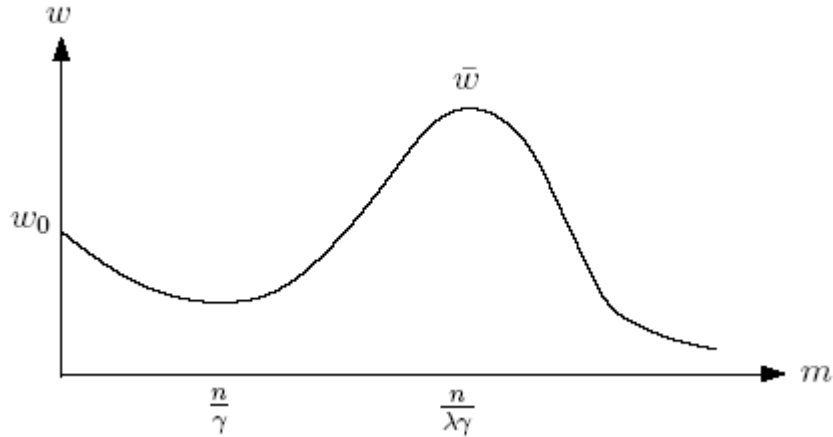


Figure 1: Number of Immigrants and Native Wages

**Corollary 1:** *The native wage ( $w$ ) and the number of migrants ( $m$ ) have the following relationship:*

i) for  $m < \frac{n}{\gamma}$ ,  $dw/dm < 0$  ii) for  $m \in (\frac{n}{\gamma}, \frac{n}{\lambda\gamma})$ ,  $dw/dm > 0$  iii) for  $m > \frac{n}{\lambda\gamma}$ ,  $dw/dm < 0$ .

Figure 1 shows Corollary 1, graphically<sup>2</sup>. For a small or large number of migrants ( $m < \frac{n}{\gamma}$  or  $m > \frac{n}{\lambda\gamma}$ ), migrants and natives are substitutes. For an intermediate number of migrants ( $m \in (\frac{n}{\gamma}, \frac{n}{\lambda\gamma})$ ), they are complements.

### 3. When Can Native Workers Gain from Migration?

In this section, we derive the conditions in which migration can be beneficial for native wages. From Corollary 1, the native wage are maximized either when  $m = 0$  or  $m = m^* \equiv \frac{n}{\lambda\gamma}$ .

Define

$$w_0 \equiv \left. \frac{dy}{dn} \right|_{m=0} \quad \text{and} \quad \bar{w} \equiv \left. \frac{dy}{dn} \right|_{m=m^*}$$

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<sup>2</sup> A non-monotonic relationship between migrants and native wages is also found in Carter (1999) and Muller (2003). Their models are, however, based on the Shapiro-Stiglitz efficiency wage model and are more complicated than our model.

where  $w_0$  is the native wage in the absence of migrants and  $\bar{w}$  is the maximum native wage in the presence of migrants. Native workers can gain from migration if  $\frac{\bar{w}}{w_0} > 1$ .

It is straightforward to show that as  $\lambda$  or  $\phi_L$  approaches 0,  $m^*$ ,  $\phi_L m^{*\theta}$  and  $\bar{w}$  approach infinity. On the other hand, as  $\lambda$  or  $\phi_L$  approaches 1,  $w_0$  approaches some constant which is a function of  $n$ . Therefore,  $\bar{w}/w_0 > 1$  if  $\lambda$  or  $\phi_L$  is sufficiently small. Conversely,  $\frac{\bar{w}}{w_0} < 1$  if  $\lambda$  is sufficiently close to 1 or  $\phi_L$  is sufficiently large. The following proposition summarizes this result.

**PROPOSITION 2:** *Native workers can gain (resp. not) from migration if natives and migrants are very different in productivity, or if the sector in which migrants have comparative advantage is sufficiently small (resp. large).*

#### 4. Conclusion and Policy Implication

This paper analyzes the effect of immigration on labor markets in a host economy. It focuses in particular on how immigrants substitute for and complement native workers in host country job markets. The effects of immigration on the wages of native workers depend crucially on this substitution.

In this paper, migrants are different from natives in their capacity for productive work. Native workers are superior because they possess skills that brings them comparative advantage in jobs for which skill is necessary. A language barrier, for example, can prevent immigrants from taking jobs in which native language competence is necessary. In this case, immigrants are sorted into the jobs in which native language skills are less important. Cleaning and working in the kitchen are examples of these types of jobs. Immigrants have comparative advantage in jobs for which skill is not necessary.

We find that the impact of immigration on wages depends on how many immigrants are in the country. In particular, native wages and the number of migrants exhibit an s-curve relationship. When there are few migrants, they take jobs in a sector in which they have comparative advantage

and compete with native workers in the same sector. They harm all native workers by depressing wages. This results in a reallocation of native workers, who move away from the jobs that migrants take. When further immigration occurs, labor markets eventually become completely segmented<sup>3</sup>. Now immigrant workers become complements to native workers. Additional migrant inflow can increase native wages to higher than the pre-immigration level. Thus, a large migrant inflow can benefit the host-country workers through the efficiency gain from the division of labor between native and migrant workers. However, too many immigrants can harm natives as they start to enter and compete for jobs in another sector.

In addition, whether or not native wage will be higher than before immigration depends on how different migrants are from natives in term of productivity, and the technology of production. In particular, when immigrants are not very different from natives in their ability to work, they tend to compete with natives for jobs in any sectors. In this case, immigrants are likely to harm native workers by depressing their wages. As for technology of production, when the output elasticity of one type of intermediate good is very high<sup>4</sup>, most (native and migrant) labor will concentrate in production of this good. As a result, migrants and natives compete, rather than complement, with each other in this case. In other words, if the sector in which migrants have comparative advantage is sufficiently small, migrants and natives will tend to work in different sectors. That is, natives work in the sector they have comparative advantage. Migrants work in the sector they have comparative advantage. Consequently, they complement and natives can earn higher wage than pre-immigration level.

Because native workers can gain when the labor market is completely segmented, a policy implication in favor of native workers is that admitting immigrants who are very different in terms of skill or education level is superior to allowing those with similar skill or education level. This is

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<sup>3</sup> In this paper, segmentation or the kinds of jobs that people get – the pay and conditions – depends on their individual characteristics (education) and the technology of using labor to produce output. Unlike in the efficiency wage models, it does not depend on the demand-side of the market, the nature and strategy of the employers. However, future research should take both the demand and supply-side stories into consideration.

<sup>4</sup> In other words, the output is very sensitive in the use of unskilled labor.

consistent with a policy that allows immigration into low-wage agricultural sectors but not into higher wage sectors. As suggested by Carter (1999), “one can call such policies ‘enforcement by sorting’, because the main effect is not to keep migrants out of the country but to influence their sorting...”.

This is similar to current policies in the U.S. and Europe (Carter 1999, 2005, Muller 2003). It is also similar to the very first immigration policies in Thailand, adopted in 1996. It allowed employers of illegal immigrants in seven sectors to register their migrants. These sectors include agriculture, fisheries, construction, mining, coal, transportation, and manufacturing. It was extended to 18 sectors in 1999 and however to all sectors in 2001. Nevertheless, according to data from the 2001 registration, immigrants in Thailand are still concentrated in low wage jobs. The three major industries in which migrants were registered in 2001 were farming (24% of migrants), fishing (18%), and domestic service (14%). In addition, it is reported that farmers in Tak province growing more traditional crops such as corn, beans, and garlic or onions hire migrants seasonally. Almost 100 percent of the unskilled hired farm workers for pre-harvest activities and harvesting are Burmese migrants and only the supervisors are Thais. This example seems to suggest that Thai and migrant workers do different types of jobs and they are complements.

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