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Abstract

Freeman (2006) suggested that auctioning immigration visas and redistributing the revenue to native residents in the host country would increase migration from low-income to high-income countries. The effect of the auctioning of immigration visas, in the Ricardian model from Findlay (1982), on the optimal level of immigration for the host country is considered. It is shown that auctioning immigration visas will lead to a positive level of immigration only if the initial wage difference between the host country and the source country is substantial. The cost of the immigration visa is more than half the earnings of the immigrant worker.

Keywords: Immigration; migration; international trade.

JEL classification: F22, F12, J61.

1. Introduction

In the world economy, there is almost free trade in goods as tariffs are generally low, and there are very few barriers to capital mobility. Of course, there are exceptions with some sectors such as agriculture still heavily protected, and the widespread use of anti-dumping regulations is a threat to world trade. However, as many commentators have observed, for example, Freeman (2006) and Hatton (2007), there are now significant barriers to labour migration especially from low-wage to high-wage countries, and these barriers do not seem to be falling. Freeman (2006) notes that the dispersion of wage rates between countries is much larger than the dispersion of the prices of goods or the cost of capital, which suggests that labour market integration, has not matched the integration of the goods market and the capital market in the world economy. The potential scale of labour migration, when the free movement of labour is permitted, can be seen from the United Kingdom experience after the European Union expanded from 15 to 25 countries in 2004.¹ The UK, unlike most of the other EU member states, allowed unrestricted immigration from the new member states in eastern Europe. As a result, despite the government predicting that the number would be thirteen thousand, approximately half a million immigrants came to the UK from the new member states in eastern Europe especially Poland.²

Although there are substantial benefits to the world economy from labour migration, these benefits accrue mainly to the migrant workers. As Hatton (2007) argues this makes it difficult to liberalise labour mobility by international negotiations, as there is little or no basis for reciprocity. This is because labour migration, which is driven by absolute advantage, flows from low-wage to high-wage countries unlike international trade where there is a two

¹ For a discussion of the immigration policies of the EU member states, see Boeri and Brücker (2005).

² The UK did not continue with its liberal policy when Romania and Bulgaria joined the EU in 2007 and the number of unskilled immigrants from these countries was limited to 20,000.

way flow of goods driven by comparative advantage. Freeman (2006) argues that because the benefits of migration accrue mainly to the migrant workers and since there may be losses for the host country then a ‘radically economic policy’ such as the auctioning of immigration visas may be required. The revenue from the auctioning of immigration visas could then be redistributed to the native residents of the host country to make immigration a welfare improving or politically acceptable policy for the host country.

A model of labour migration where immigration has an undoubtedly negative effect on the welfare of native residents in the host country is the Ricardian model employed by Findlay (1982).³ In the Ricardian model, immigration expands the export industry in the host country thereby worsening its terms of trade and reducing the welfare of native residents.⁴ Davis and Weinstein (2002) used an extension of the Ricardian model as the basis for their estimates of the effects of immigration on the United States and they claimed that the terms of trade loss amounted to \$72billion or 0.8% of GDP for the USA.

This paper will consider the effects of the auctioning of immigration visas in the Ricardian model of Findlay (1982) to assess whether the redistribution of the revenue from the auctioning of the immigration visas can offset the negative terms of trade thereby making immigration a welfare improving policy for the host country.

2. The Ricardian Model

The analysis uses the standard Ricardian model employed by Findlay (1982) in his article on migration. There are two countries (labelled *A* and *B*) with \bar{L}_A (\bar{L}_B) native

³ Although, it should be stressed that Findlay (1982) used distributive justice to argue the case for free labour migration.

⁴ As there is only one factor in the Ricardian model, there is no immigration surplus as in Borjas (1995) so the only effect on welfare is through the terms of trade.

worker/consumers in country A (B), each endowed with one unit of labour. By assumption, and without loss of generality, the wage in country A will be higher than in country B . The labour can be used to produce two goods that are labelled X and Y . Labour is perfectly mobile between these two industries, but initially it is assumed to be internationally immobile. In country A , the labour input requirement to produce one unit of good X is a_x and to produce one unit of Y is a_y . Similarly, in country B , the labour input requirements are b_x and b_y . Country A is assumed to have a comparative advantage in the production of good X ; therefore, the opportunity cost of producing X is lower in country A than in country B so $a_x/a_y < b_x/b_y$. Findlay (1982) assumes that neither country has an absolute advantage in the production of both goods, but that assumption is not required here, as free labour migration will not be considered.

The preferences of the worker/consumers are identical and homothetic in the two countries, and can be represented by the Cobb-Douglas utility function: $u_A = u_B = x^\gamma y^{1-\gamma}$ where $\gamma \in (0,1)$ is the proportion of income spent on good X . The price of good X is p_X and the price of good Y is p_Y . The wage in country A is w_A and in country B is w_B and each worker/consumer is endowed with one unit of labour. The income of a worker in country A is m_A and in country B is m_B . Therefore, the Marshallian demands of a worker/consumer in country A are $x_A^D = \gamma m_A / p_X$ and $y_A^D = (1-\gamma) m_A / p_Y$, and in country B are $x_B^D = \gamma m_B / p_X$ and $y_B^D = (1-\gamma) m_B / p_Y$. Since preferences are identical and homothetic, the aggregate demands will be functions of total income so the aggregate demand for good X in country A is $X_A^D = \gamma (m_A \bar{L}_A) / p_X$ and in country B is $X_B^D = \gamma (m_B \bar{L}_B) / p_X$. These demands have the Mill-Graham property that a constant fraction of income γ is spent on good X and $1-\gamma$ is spent on good Y .

Under free trade, assuming complete specialisation in production in both countries, since country A has a comparative advantage in the production of good X , it will produce $X_A^S = \bar{L}_A/a_X$ units of good X while country B will produce $Y_B^S = \bar{L}_B/b_Y$ units of good Y . The wage in country A is given by the marginal product of labour in the X industry so $w_A = p_X/a_X$ and the wage in country B is given by the marginal product of labour in the Y industry so $w_B = p_Y/b_Y$. For simplicity, normalise the price of good Y at unity so $p_Y = 1$ therefore the wage in country B is $w_B = 1/b_Y$, which is a constant. Since each worker is endowed with one unit of labour, the income of a worker in country A is $m_A = w_A$ and in country B is $m_B = w_B$. Therefore, since preferences are identical and homothetic, the world demand for good X is given by the aggregate demand function: $X^D = \gamma(w_A\bar{L}_A + w_B\bar{L}_B)/p_X$ while the world supply of good X is given by the supply of country A : $X^S = X_A^S = \bar{L}_A/a_X$. Equating demand and supply in the world market yields the equilibrium free trade price of good X :

$$p_X^T = \frac{\gamma}{1-\gamma} \frac{a_X}{b_Y} \frac{\bar{L}_B}{\bar{L}_A} \quad (1)$$

For complete specialisation, the equilibrium free trade price must be between the autarky prices (opportunity costs) of the two countries so $a_X/a_Y < p_X < b_X/b_Y$. This implies that for complete specialisation the labour endowment of country A relative to the labour endowment of country B must be in the range:

$$\frac{\gamma}{1-\gamma} \frac{a_X}{b_X} < \frac{\bar{L}_A}{\bar{L}_B} < \frac{\gamma}{1-\gamma} \frac{a_Y}{b_Y} \quad (2)$$

Since wages are equal to the marginal products of labour, the wage in country A relative to the wage in country B is:

$$\left(\frac{w_A}{w_B}\right)^T = \frac{p_X/a_X}{p_Y/b_Y} = \frac{\gamma}{1-\gamma} \frac{\bar{L}_B}{\bar{L}_A} > 1 \quad (3)$$

This must be greater than one as country A is assumed, without loss of generality, to be the country with the higher wage, and this will be the case if $\bar{L}_A/\bar{L}_B < \gamma/(1-\gamma)$.

3. Immigration

With restricted immigration, a limited number of workers can move from the low-wage country B to the high-wage country A . As in Findlay (1982), when workers move to a country they acquire the productivity of the host country so immigrants from country B are just as productive as the native workers in country A . The number of workers in country A becomes L_A with the immigration of $(L_A - \bar{L}_A)$ workers while the number of workers in country B becomes L_B with the emigration of $(\bar{L}_B - L_B)$ workers, and the total labour force in the world is unchanged, $L_A + L_B = \bar{L}_A + \bar{L}_B$ so $(L_A - \bar{L}_A) = (\bar{L}_B - L_B)$. Since country A has a comparative advantage in the production of good X , the immigrant workers will work in the X industry thereby increasing the supply of good X in country A so $X_A^S = L_A/a_X$. Assuming that the $(L_A - \bar{L}_A)$ immigration visas are allocated by country A without the immigrants workers having to pay for the visas then the income of an immigrant worker is the same as a native worker in country A so $m_A = w_A$. Therefore, since preferences are identical and homothetic, the world demand for good X is given by the aggregate demand function: $X^D = \gamma(w_A L_A + w_B L_B)/p_X$ while the world supply of good X is given by the supply of country A : $X^S = X_A^S = L_A/a_X$. Equating demand and supply in the world market yields the equilibrium price and relative wage with immigration:

$$p_X^i = \frac{\gamma}{1-\gamma} \frac{a_X}{b_Y} \frac{L_B}{L_A} \quad (4)$$

Since wages are equal to the marginal products of labour, and immigration is restricted so wages are not equalised in the two countries, the relative wage and the wage difference between the two countries are:

$$\left(\frac{w_A}{w_B}\right)^I = \frac{\gamma}{1-\gamma} \frac{L_B}{L_A} > 1 \quad w_A - w_B = \frac{\gamma(L_A + L_B) - L_A}{b_Y L_A (1-\gamma)} > 0 \quad (5)$$

Immigration increases the labour force in country A and decreases the labour force in country B by the same number of workers so $dL_B/dL_A = -1$. Thus, the effect of immigration on the equilibrium price and wage is:

$$\begin{aligned} \frac{dp_X}{dL_A} &= \frac{\partial p_X}{\partial L_A} + \frac{\partial p_X}{\partial L_B} \frac{dL_B}{dL_A} = \frac{-a_X(L_A + L_B)\gamma}{b_Y L_A^2 (1-\gamma)} < 0 \\ \frac{dw_A}{dL_A} &= \frac{1}{a_X} \frac{dp_X}{dL_A} = \frac{-(L_A + L_B)\gamma}{b_Y L_A^2 (1-\gamma)} < 0 \end{aligned} \quad (6)$$

An increase in immigration reduces the price of good X thereby worsening the terms of trade of country A that exports good X. It also reduces the wage in country A as the reduction in the price of good X reduces the marginal product of labour.

The welfare of a native worker/consumer in country A can be represented using the indirect utility function: $v_A = v_A(p_X, m_A)$. The effect of immigration on the welfare of a native worker/consumer in country A is obtained by differentiating the indirect utility function and using Roy's identity:

$$\frac{dv_A}{dL_A} = \frac{\partial v_A}{\partial m_A} \left(\frac{1}{a_X} - \frac{\gamma w_A}{p_X} \right) \frac{dp_X}{dL_A} \quad (7)$$

Substituting (4), (5) and (6) into (7) yields the effect of immigration on a native worker/consumer:

$$\frac{dv_A}{dL_A} = \frac{\partial v_A}{\partial m_A} \frac{1-\gamma}{a_X} \frac{dp_X}{dL_A} = -\frac{\partial v_A}{\partial m_A} \frac{\gamma(L_A + L_B)}{b_Y L_A^2} < 0 \quad (8)$$

Due to the negative terms of trade effect, the effect of immigration on the welfare of a native worker/consumer in country A is unambiguously negative. This is similar to the negative terms of trade effect with immiserizing growth in Bhagwati (1958). Therefore, for country A , concerned about the welfare of its native workers, the optimal level of immigration is zero.

The welfare of a worker that remains in country B is given by the indirect utility function: $v_B = v_B(p_X, m_B)$. The effect of emigration of workers from country B to country A on the worker/consumers that remain in country B is obtained by differentiating the indirect utility function and using Roy's identity:

$$\frac{dv_B}{dL_A} = \frac{\gamma w_B}{p_X} \frac{\partial v_B}{\partial m_B} \frac{dp_X}{dL_A} = \frac{\partial v_B}{\partial m_B} \frac{\gamma(L_A + L_B)}{b_Y L_A L_B} > 0 \quad (9)$$

The worker/consumers that remain in country B unambiguously gain from emigration due to the positive terms of trade effect. The migrant workers obviously gain as they are moving from the low-wage country to the high-wage country and they face the same prices in both countries.

Since all worker/consumers have identical and homothetic preferences (and the marginal utility of income is identical since they all face the same prices) then world welfare can be measured as the sum of the utilities of all the worker/consumers. Hence, world welfare is $W = L_A v_A + L_B v_B$, and the effect of migration from country B to country A on world welfare is:

$$\frac{dW}{dL_A} = v_A + v_B \frac{dL_B}{dL_A} + L_A \frac{dv_A}{dL_A} + L_B \frac{dv_B}{dL_B} = v_A - v_B > 0 \quad (10)$$

Migration from the low-wage country B to the high-wage country A increases world welfare as the utility of a worker/consumer is higher in country A than in country B as $v_A > v_B$ so there is an efficiency gain for the world. The terms of trade effects on the two countries cancel out to leave just the efficiency gain. As Findlay (1982) showed free labour migration that equalises wages in the two countries brings about a Pareto-efficient outcome for the world.

4. Auctioning Immigration Visas

Although free migration is Pareto-optimal for the world economy, the native workers in country A will lose from immigration, and if the government in country A maximises the welfare of the native residents then immigration will be prohibited. Freeman (2006) suggests that a ‘radically economic policy’ such as the auctioning of immigration visas is required so that the native workers in country A will receive some of the benefits from immigration. If country A auctions a number of immigration visas then the immigrant workers will be prepared to pay the amount of the wage difference between the two countries, $w_A - w_B$. The revenue from the auction of the immigration visas could then be redistributed to the native workers in country A . With $(L_A - \bar{L}_A)$ immigrant workers each paying $(w_A - w_B)$ for an immigration visa, each native worker in country A would receive $(w_A - w_B)(L_A - \bar{L}_A)/\bar{L}_A$ so the income of each native worker is $m_A = w_A + (w_A - w_B)(L_A - \bar{L}_A)/\bar{L}_A$ whereas each immigrant worker has the same income as a worker that remains in country B that is $m_B = w_B$. This redistribution of income from the immigrant workers to the native workers in

country A does not affect the aggregate demands for the two goods since preferences are identical and homothetic. Therefore, the equilibrium prices and wages are unaffected and are given by (4) and (5).

With the auctioning of immigration visas, the effect of immigration on the welfare of a native worker/consumer in country A is obtained by differentiating the indirect utility function and using Roy's identity:

$$\frac{dv_A}{dL_A} = \frac{\partial v_A}{\partial m_A} \left[\left(\frac{1}{a_X} - \frac{\gamma m_A}{p_X} \right) \frac{dp_X}{dL_A} + \frac{L_A - \bar{L}_A}{\bar{L}_A} \frac{1}{a_X} \frac{dp_X}{dL_A} + \frac{w_A - w_B}{\bar{L}_A} \right] \quad (11)$$

The first term in square brackets is the terms of trade effect of immigration, which is negative. The second term is the effect of immigration on the revenue from each immigration visa, $(w_A - w_B)$, which is negative as the reduction in the price of good X reduces the wage in country A . The third effect is the extra revenue from the marginal immigrant worker, which is positive provided the wage in country A is higher than the wage in country B . Substituting (4) (5) and (6) into (11) yields:

$$\frac{dv_A}{dL_A} = \frac{\partial v_A}{\partial m_A} \left[\frac{(L_A + L_B)(L_A - \bar{L}_A + L_B)\gamma^2 - (L_A + L_B)(L_A - \bar{L}_A)\gamma - L_A L_B}{(1 - \gamma)b_Y L_A \bar{L}_A L_B} \right] \quad (12)$$

The sign of the derivative depends upon the numerator of the expression in square brackets. First, consider the possibility of a corner solution where the optimal level of immigration is zero. This will be the case if the derivative is negative when evaluated at where there is no immigration so when $L_A = \bar{L}_A$ and $L_B = \bar{L}_B$. Then, the numerator in square brackets becomes $(\bar{L}_A + \bar{L}_B)\bar{L}_B\gamma^2 - \bar{L}_A\bar{L}_B$ and this will be negative if:

$$\left(\frac{w_A}{w_B} \right)^T = \frac{\gamma}{1 - \gamma} \frac{\bar{L}_B}{\bar{L}_A} < \frac{1 + \gamma}{\gamma} \in (2, \infty) \quad (13)$$

When immigration visas are auctioned, immigration will only increase the welfare of the native worker/consumers in country A if the wage under free trade (when there is no immigration) is substantially higher in country A than in country B . For example, if $\gamma = 1/3$, then the optimal level of immigration will be zero even if the wage in country A is up to four-times the wage in country B . This leads to the following proposition:

Proposition 1: *When immigration visas are auctioned, the optimal level of immigration is zero if $(w_A/w_B)^T < (1+\gamma)/\gamma \in (2, \infty)$.*

Secondly, if the wage under free trade (when there is no immigration) is substantially higher in country A than in country B , $(w_A/w_B)^T > (1+\gamma)/\gamma$, then the optimal level of immigration is positive. The relative wage at the optimum can be obtained by setting the derivative (12) equal to zero. Rearranging the numerator of the expression in square brackets, it can be shown that the relative wage at the optimum is:

$$\left(\frac{w_A}{w_B}\right)^* = \frac{\gamma}{1-\gamma} \frac{L_B}{L_A} = \frac{1+\gamma}{\gamma} + \frac{(L_A + L_B)(L_A - \bar{L}_A)}{L_A L_B} > \frac{1+\gamma}{\gamma} \in (2, \infty) \quad (14)$$

The optimal level of immigration will be such that the wage difference between the two countries is still substantial. The cost of the immigration visa to the immigrant worker as a proportion of the wage in country A is:

$$\left(\frac{w_A - w_B}{w_A}\right)^* > \frac{1}{1+\gamma} \in \left(\frac{1}{2}, 1\right) \quad (15)$$

The immigrant worker has to pay at least half of the wage in country A for the immigration visa. For example, if $\gamma = 1/3$, then the relative wage at the optimal level of immigration will be greater than four, and the cost of the immigration visa will be more than

three-quarters of the earnings of the immigrant worker. These results lead to the following proposition:

Proposition 2: *When immigration visas are auctioned, if $(w_A/w_B)^T > (1+\gamma)/\gamma$, then the relative wage at the optimal level of immigration will be: $(w_A/w_B)^* > (1+\gamma)/\gamma \in (2, \infty)$.*

When immigration visas are auctioned, the utility of a migrant worker will be the same as the utility of a worker that remains in country B since both have the same income and face the same prices. The effect of emigration on the welfare of a worker that remains in country B is still given by (9), since workers that remain in country B are unaffected by the auction of immigration visas. Therefore, when immigration occurs with auctioned immigration visas, it is a Pareto-improvement since the native workers in country A gain, the migrant workers gain and the workers that remain in country B gain. Hence, the auctioning of immigration visas has a beneficial effect when the wage difference between the two countries is substantial.

5. Conclusions

This paper has considered the effects of the auctioning of immigration visas in the Ricardian model employed by Findlay (1982) to analyse migration. In the absence of the auctioning of immigration visas, the optimal level of immigration is zero for the host country. It was shown that when there is a substantial wage difference between the two countries then the auctioning of immigration visas will mean that a positive level of immigration is optimal for the host country. At the optimal level of immigration, the wage in the host country is at least twice the wage in the source country, and the cost of the immigration visa is equal to more than half the earnings of the immigrant workers. Immigration leads to a Pareto improvement since the native workers in the host country, the migrant workers and the

workers remaining in the source country all gain. Therefore, the auctioning of immigration visas has the beneficial effect on the level of immigration suggested by Freeman (2006). Clearly, when the wage difference between the two countries is substantial, the potential welfare gains from migration for the world economy will also be substantial. However, when the wage difference between the two countries is not substantial, the optimal level of immigration is zero for the host country and the auctioning of immigration visas has no effect.

In other models, there may be potential benefits from immigration for the host country. For example, Collie (2007) adds external economies of scale to the Ricardian model so immigration has a positive productivity effect as well as a negative terms of trade effect. In such a model, the auctioning of immigration visas is more likely to be an effective policy for encouraging immigration than in the Ricardian model, which may be the toughest test for the suggested policy of Freeman (2006).

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