Preliminary—Comments Welcome

FREE TRADE AGREEMENTS IN A MODEL OF TRADE, MIGRATION AND POLITICS

by

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ABSTRACT: This paper using a probabilistic voting model to investigate voting for a free-trade agreement between a labor-abundant country and a capital-abundant country. Immigration from the labor-abundant country to the capital-abundant country increases the probability of a free-trade agreement, with lower migration costs leading to more immigration and a higher free-trade probability. On the other hand, if a lower probability of free trade is caused by an increased voter bias against free-trade candidates, then there is less immigration. A dynamic extension of the model is also investigated.

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1. Introduction

The purpose of this paper is to use a political economy approach to investigate a classic question in international trade: Are goods and factor trade complements or substitutes? The modern literature on this question starts with Mundell (1957), who extends the Heckscher-Ohlin trade model to include capital mobility and concludes that goods trade and factor mobility are substitutes. In particular, Samuelson's factor price equalization theorem implies that costless trade equalizes factor prices, which eliminates incentives for capital to relocate from one country to another. Mundell's contribution led to an outpouring of research that sought to endogenize capital mobility in the standard trade models, and Richard Brecher has been a leader in this area, with important contributions including Brecher (1983), Brecher and Feenstra (1983) and Brecher and Findlay (1983). Markusen (1983) considers specifically Mundell's claim that goods and factor trade are substitutes and argues that there can be a complementary relation, particularly in settings where trade is based on scale economies or differences in production technologies, rather than factor-endowment differences. Wong (1995) provides an extended discussion of the literature on this issue, and Neary (1995) uses a specific-factors framework to argue that goods and factor trade "are likely to be substitutes…given that internationally mobile capital is used in a country's import competing sector" (p. S20), though the results are reversed when capital is used in the export sector. [1] More recently, Antras and Caballero (2009) modify a North-South Heckscher-Ohlin model by assuming that capital investment in one of the goods is limited in the "South" by financial frictions. International trade

[1] See also Svensson (1984) and Markusen and Svensson (1985), and Wong (1986). Wong (1995) describes the different meanings of substitutability and complementarity. Throughout this paper, we use these terms in a volume-of-trade sense.

allows the South to import the good from the North. As a result, the return on capital rises in the South, implying a complementary relation between trade and net capital flows.

The analysis in the current paper also uncovers a complementary relation between goods trade and factor mobility, but the model also produces a type of substitute relationship, depending on what causes variations in goods trade and factor movements. Unlike the literature reviewed above, this relation is not dependent on modifying or replacing the Heckscher-Ohlin model. Rather, we supplement this model with a political economy model, in which citizens vote on whether to allow free trade.[2] The model uses the 2-country, Heckscher-Ohlin framework developed by Levy (1997) to study the political economy of free-trade agreements (FTAs). In his model, a trade agreement is implemented when a majority of the citizens vote to approve it. The assumptions of the median voter theorem hold, so the policy most preferred by the median voter receives the majority of votes. We instead use a probabilistic voting model.[3] Indeed, once we introduce factor mobility into the model, uncertain decisions on free trade agreements become a critical aspect of the model.[4]

The particular factor mobility analyzed in this paper is immigration from a low-wage, labor-abundant country to a high-wage, capital-abundant country. This immigration is costly, and can be interpreted as illegal immigration, since it is not subject to immigration

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[2] See Conconi (2012) for a recent empirical analysis of the politics of trade and migration. Facchini (2004) surveys the theory on the political economy of trade and factor mobility.

[3] The model is a simplified version of the probabilistic voting model described in Perrson and Tabellini

[4] Our paper builds on Yilmaz (2005, 2006), which is based on his Ph.D. thesis. But he uses a median voter model. This framework is not entirely satisfactory, because an equilibrium requires uncertainty in the outcome of the vote. The median voter will vote randomly if he is indifferent between the policy alternatives, but it is difficult to justify why his voting probabilities are those that satisfy the equilibrium conditions for the model. The probabilistic voting model provides a mechanism by which the equilibrium voting probabilities are achieved.

restrictions. As a result, there must be a positive benefit to offset this cost. We link the decisions of voters in the capital-abundant country to immigration from the labor-abundant country (which always prefers an FTA). The basic argument is that this immigration hurts enough voters under autarky to increase the probability that free trade wins the vote. Moreover, free trade causes immigration to stop, since it leads to the equalization of factor prices between countries.

The analysis demonstrates that more immigration, modeled as the result of reduced migration costs, causes more goods trade, suggesting a complementary relation between goods trade and immigration. A similar result is obtained by Maggi and Rodriguez-Claire (2007), but they use a model with lobbying, and factor mobility in the form of capital movements occurs only after the trade agreement has been approved. The basic idea is that capital mobility affects incentives to lobby. Voting is not explicitly modeled. [5]

We also show, however, that a lower probability of free trade, caused by an increased bias among voters for candidates who are opposed by free trade, leads to more immigration. The reason is that immigrants decide that it is more likely that the factor-price-equalizing effects of free trade will occur. This result suggests a substitute relation between goods trade and factor mobility: less trade leads to more factor mobility. Thus, the relation between goods and factor trade depends on what is causing them to vary.

Our analysis sheds light on some important policy questions. For example, if the Mexican immigration had not occurred over the years before NAFTA, and if there were no threat of further (illegal) immigration, would NAFTA get enough support in the United

[5] Facchini and Testa (2009) uses a median voter framework to model why countries join a free trade area, and they also emphasize the importance of factor flows in FTA decisions, but these flows also occur only after the agreement.

States? In the European Union context, could the possibility of possible further unwanted migration from Eastern Europe be one of the reasons some of these countries have joined the EU and others remain candidates for membership? Our model suggests that immigration at least helps facilitate these free trade agreements.

The plan of this paper is as follows. In the next section, we describe the basic model. Section 3 contains the main results. Section 4 extends the model to include dynamic considerations, and shows how immigration affects the time lag before free trade occurs. Section 5 provides conclusions and discusses other extensions.

2. The Model

The model consists of two countries, "high-income" and "low-income," denoted by symbols *H* and *L*. Each country has fixed capital and labor endowments. The high-income country is capital-abundant and the low-income-country is labor-abundant, where abundance is measured by relative factor endowments. Following the Heckscher-Ohlin model, competitive firms in each country use capital and labor to produce two goods, a labor-intensive good, *X*, and a capital-intensive good, *Y*. The production technology for each good exhibits constant returns to scale in labor and capital, and this technology is identical between countries. Both countries are incompletely specialized in the production of X and Y. Consumer utility functions contain *X* and *Y* as arguments, and are homothetic and identical between countries. Good *Y* is the numeraire. The relative price of *X* is p_H in the high-income country and p_L in the low-income country. Under an autarky equilibrium, p_H exceeds p_L, since the labor-abundant, low-income country produces more

X relative to *Y*. As a result, the Stolper-Samuelson theorem implies that the real wage in the high-income country exceeds the real wage in the low-income country.

Following Levy (1997), we assume that there is no trade in the absence of a free-trade agreement. In other words, effective tariff rates are prohibitive in the absence of free trade. With an agreement, the factor-price equalization theorem implies that free trade equalizes not only product prices, but also factor prices. By the Heckscher-Ohlin theorem, the low-income country imports *Y* from the high-income country and exports *X* to the high-income country. We shall sometimes refer to free trade in goods as economic integration, but the equalization of factor prices implies that free factor mobility would have no real effects following a free-trade agreement.

Individuals in each country possess different endowments of labor and capital and therefore have different views about the desirability of free trade. For simplicity, assume that all individuals supply one unit of labor but differs in their ownership of capital. The utility of an individual *i* with a capital endowment k^i is a function of income, $w + rk^i$, and the relative product price *p*: $V(w + rk^i, p)$. However, factor prices are determined by *p* in the Heckscher-Ohlin model (assuming no factor-intensity reversals), and the equilibrium *p* is determined by the economy's capital-labor ratio, *k*, where the relevant economy is either the country of residence in the case of autarky or the "integrated economy" in the case of free trade. The resulting utility function can therefore be defined, $v(k^i, k) = V(w(k) + r(k)k^i, p(k))$. Levy (1997) proves that this function is strictly quasi-convex in k and has a unique minimum where $k = k^i$ (see Figure 1). In other words, an individual benefits from being in an economy with a capital-labor ratio further from his capital endowment.

Before considering immigration, let us introduce the probabilistic voting model. The vote is between candidate (or party) *F*, who supports free trade and candidate *A*, who desires autarky. Under free trade, factor and product prices will be determined by the capital-labor ratio for the entire free trade area, which we call the "integrated economy." Let k_I denote this ratio. Thus, individual *i* will obtain utility $v(k^i, k_I)$ from his consumption of *X* and *Y* under free trade, regardless of where he resides. Again, we are applying the factor-price equalization theorem: free trade in goods equalizes factor prices. Let k_H and k_L denote the capital-labor ratios for the low-income and high-income countries, respectively. Under autarky, individual *i* obtains utility $v(k^i, k_H)$ if he resides in the high-income country, and $v(k^i, k_L)$ if he resides in the low-income country.

Voters not only have preferences between free trade and autarky, but they also have preferences between the two candidates that are unrelated to trade. Normalize these preferences so that $v(k^i, k_I)$ is the utility if the free-trade candidate is elected, but $v(k^i, k_j) + \varepsilon$ is the utility in country *j* if the autarky candidate is elected. Consequently, individual *i* votes for the free-trade candidate only if

$$v(k^i, k_I) \geq v(k^i, k_j) + \varepsilon. \qquad (1)$$

Voting is probabilistic because ε is a random variable and its realized value is determined only when voting occurs. For simplicity, assume that ε is uniformly distributed with mean zero over the interval $[-\delta/2, \delta/2]$. In this case, the probability that individual *i* in country *j* will vote for a free trade agreement is

$$\beta^i = 0 \;\; if \;\; \frac{v(k^i, k_f) - v(k^i, k_j)}{\delta} \; - ½ \; < 0; \tag{2a}$$

$$\beta^i = 1 \;\; if \;\; \frac{v(k^i, k_f) - v(k^i, k_j)}{\delta} \; - ½ \; > 1; \tag{2b}$$

$$\beta^i = \frac{v(k^i, k_f) - v(k^i, k_j)}{\delta} \; - ½ \quad otherwise. \tag{2c}$$

As δ goes to zero, the votes become deterministic, as described by (2a) and (2b). Under deterministic voting, the median voter theorem applies, since preferences are single-peaked. We later discuss a bias against free trade.

Using this model, we will show how immigration affects the probabilities that a free-trade agreement passes. Events unfold in three stages. First, countries vote for free trade. If free trade passes in both countries, then a free-trade agreement is implemented, causing factor prices to equalize, and no migration occurs. But to isolate the positive effects of migration on free trade, we assume that free trade loses the vote in the high-income country, although it is favored in the low-income country. We therefore have a second stage, in which workers migrate. In the third stage, countries vote for free trade again. In equilibrium, potential immigrants correctly anticipate the probability of a free-trade agreement, and the number of actual immigrants depends on this probability.

Consider the first-stage vote for free trade in the low-income country. Figure 1 depicts the median voter's utility, $v(k_L'^M, k)$, as a function of the economy's capital-labor ratio, k. Let $k_{L,0}$ denote the low-income country's capital-labor ratio prior to any immigration. We assume that $k_L'^M < k_{L,0}$, reflecting the skewed distributions of income that are observed in practice. As shown in Figure 1, the median voter prefers free trade over autarky. If we now introduce uncertainty in the outcome of the vote, then the vote will still

be in favor of free trade with certainty, if the parameter δ is not too large. The reason is that each voter's choice becomes certain as δ goes to zero, except for voters who are indifferent between free trade and autarky. These voters form a set of measure zero, with a capital endowment k' between $k_{L,0}$ and k_I. All voters with k^i less than k' prefer free trade. With k_L^M less than k', it follows that free trade wins with 100 percent probability if δ is sufficiently small. We make this assumption, while noting that uncertain voter outcomes will later emerge when there is migration, regardless of the positive value of δ.

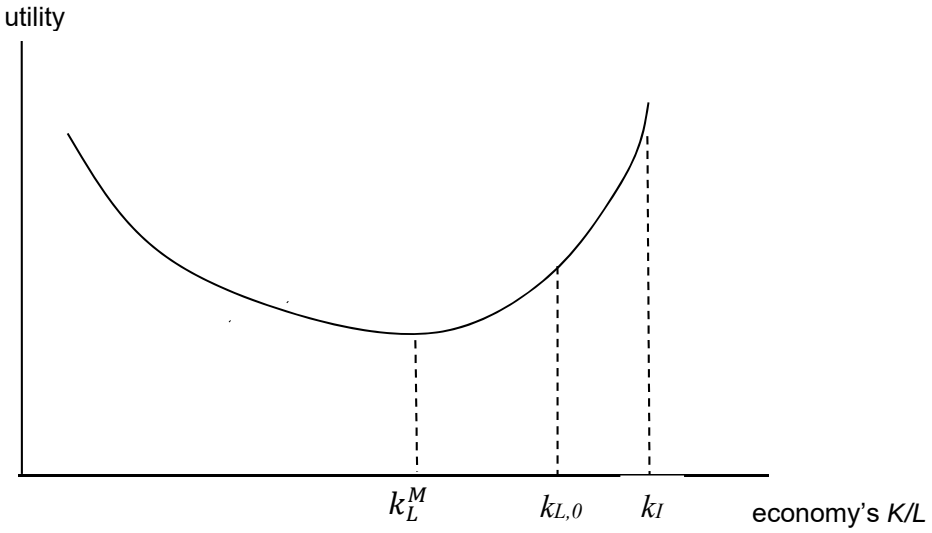

Figure 1: The relation between the utility for the median voter in the low-income country and the relevant economy's capital-labor ratio.

We are interested in the case where the high-income country turns down free trade in the absence of migration. This situation is illustrated in Figure 2 below, which depicts the utility function for the median voter in the high-income country. This voter's capital-labor ratio is k_H^M, $k_{H,0}$ is the high-income country's initial capital-labor ratio, and k_I again denotes the capital-labor ratio for the integrated economy. In addition, $\tilde{k}_H$ now represents

the capital-labor ratio that would have to exist in the high-income country for its median voter to be indifferent between autarky and free-trade. As shown,

$$k_I < k_H^M < \widetilde{k}_H < k_{H,0}. \tag{3}$$

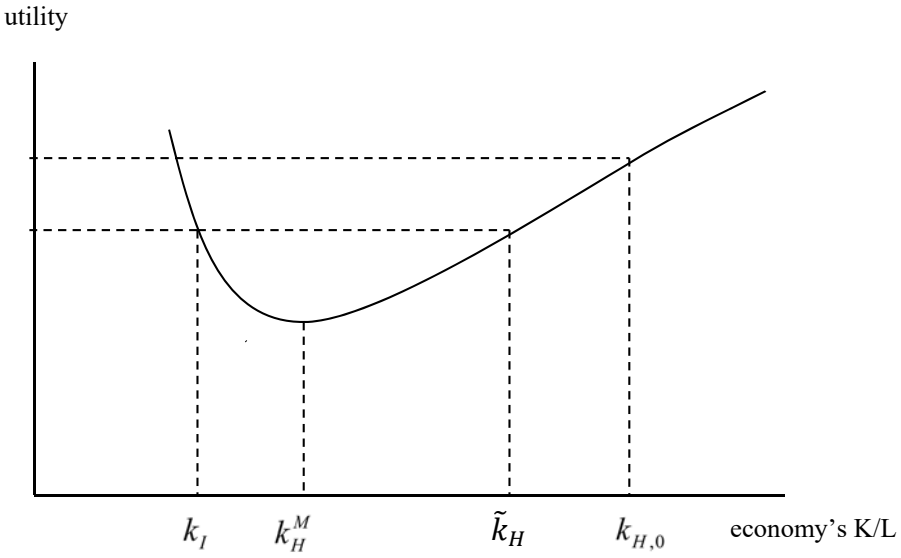

Figure 2: Utility of the median voter in the high-income country when $k_I < k_H^M < \widetilde{k}_H < k_{H,0}$.

For the first inequality, we make the reasonable assumption that the high-income country's median voter has more capital than the average capital possessed by individuals in both countries combined.[6] The first inequality then implies the second equality, since the utility function is u-shaped. For the last inequality, we assume that the median voter prefers autarky over free trade in the absence of migration. Following the previous arguments, we may again ensure that the free-trade candidate is defeated with certainty by assuming a

[6] Despite the relative capital abundance of the high-income country, this assumption could be violated if this abundance was the resulted from the capital holdings from only a small number of wealthy residents there.

sufficiently small value of δ. With this setup, we will demonstrate that migration changes this vote so that the free-trade candidate now has a positive probability of winning.

Consider now the migration stage. With no free trade agreement, residents of the low-income country may now have an incentive to immigrate to the high-income country to take advantage of the higher real wage there. This incentive depends on the cost of immigration, which we denote by *C*. Let us interpret this cost as a payment to smugglers or facilitators in *H*.[7] By treating the cost as an income transfer, we avoid unnecessary complications involving the withdrawal of real resources from productive uses.[8] Moreover, it seems appropriate to interpret migration as illegal for two reasons. First, the majority of voters in the high-income country do not want immigration. Second, we assume that immigrants from the low-income country do not posses voting rights in the high-income country. An alternative interpretation would be to allow costly legal migration but assume that voting rights are granted only after a lengthy delay. For simplicity, assume also that all potential migrants are endowed only their unit of labor but no capital.

Immigration reduces the capital-labor ratio in the high-income country from $k_{H,0}$ to a lower level denoted $k_{H,1}$. Similarly, the capital-labor ratio in the low-income country rises from $k_{L,0}$ to a higher level, $k_{L,1}$. Thus, migration raises the real wage in the migrant's home country and lowers the real wage in the foreign country, assuming no goods trade.

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[7] Naturally, the level of *C* would depend on the enforcement activities that the high-income country uses to detect and prevent migration. For models of border and internal enforcement policies, see Ethier (1986), Bond and Chen (1987), Bucci and Tenorio (1996) and Yoshida (2000). Since we are not interested in the welfare effects of various enforcement policies, we work with this reduced-form specification of illegal immigration.

[8] An alternative interpretation of C would be that it represents a "psychic cost" of migration, as in Sjaastad (1962).

But migration can never equalize factor prices, because then there would be no benefit of migration to offset the cost *C*. In particular, $k_{L,1}$ stays below k_I. For this reason, the median voter in the low-income country will continue to favor free trade, as illustrated in Figure 1, and the low-income country will then vote with certainty for free trade if δ is sufficiently low.

Consider now the final vote in the high-income country. If free trade were implemented with certainty, then factor prices would be equalized. Migrants would have incurred the cost of migrating, but with no gain. On the other hand, if autarky were implemented with certainty, then factor prices would remain unequal. We then see that migration either does not occur, due to high migration costs, or C is low enough for migration to occur to the point where the vote for free trade generates a probability of free trade that leaves migrants indifferent about migrating. Thus, for low enough *C,* the vote will be uncertain, regardless of how close δ is to zero.

We now derive the equilibrium level of migration and probability of a favorable free-trade vote. Letting β denote this probability, migration occurs unit expected utilities are equated between the two countries:

$$\begin{aligned}&(1-\beta)V(w(k_{L,1}),p(k_{L,1}))+\beta V(w(k_I),p(k_I))\\&=(1-\beta)V(w(k_{H,1})-C,p(k_{H,1}))+\beta V(w(k_I)-C,p(k_I))\end{aligned} \tag{4}$$

This equilibrium level of migration is declining in the probability of free trade, given that there is no benefit from migration under free trade. We therefore have the downward-sloping "migrant supply curve," labeled *T(β)* in Figure 3.

To summarize, as the probability of free trade falls, the benefit of migration rises, thereby increasing the number of migrants until the expected utilities at home and abroad

are equated. At the vertical intercept for the migrant supply curve, there is no migration, because the probability of free trade is 100 percent, implying factor-price equalization. At the horizontal intercept, autarky occurs with certainty, and migration brings the capital-labor ratios for the two countries close enough to equate the migrants' expected utilities.

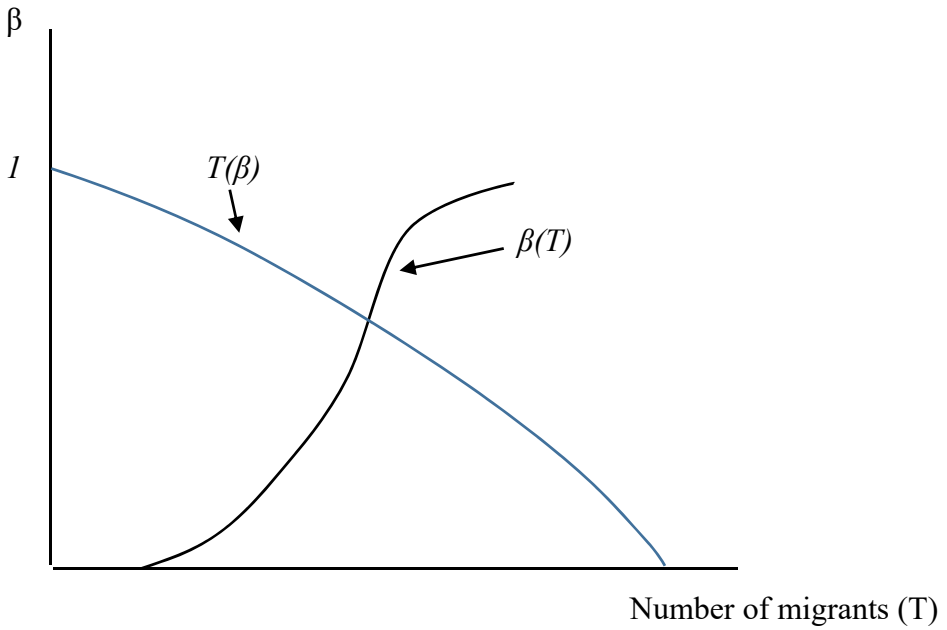

Figure 3: Migrant supply and voting curves.

We can also derive an "voting curve," labeled *β(T)* in Figure 3. In the median voter model with no uncertainty, the middle portion of this curve would be vertical. Referring to Figure 2, migration would occur until the capital-labor ratio dropped to $\tilde{k}_H$, at which point the median voter would be indifferent between free trade and autarky, implying that the outcome of the vote would be determined by tie-breaking rules. In the probabilistic voting model, this discontinuous jump in the free-trade probability from zero to one becomes continuous. Before migration rises to the point where the median voter becomes

completely indifferent between free trade and autarky, he first starts to vote randomly, as do some of the other voters, given their random preferences between the two candidates. Thus, the probability rises smoothly, and it reaches 100 percent with the capital-labor ratio between K_H^M and $\tilde{k}_H$ in the high-income country, assuming again that δ is sufficiently small (see Figure 2). But once the number of migrants reaches the level where β =1, additional increases in this number will cause factor-price equalization to be approached. Thus, *β(T)* must eventually fall (not shown), since the vote between free trade and autarky would be random under factor price equalization, regardless of δ. We can therefore not rule out additional equilibria, where the voting curve falls below the migrant supply curve. Such equilibria will not occur, however, for low values of δ, which is the case considered here.

3. The Relation Between Migration and Trade

We now consider variations in migration and trade created by changes in either migration costs or preferences towards the free-trade and autarky candidates.

Once *C* falls below the maximum level consistent with migration, further reductions in *C* shift up the migrant supply curve in Figure 3, increasing the probability of free trade. Note that as C converges to zero, the horizontal intercept of the migrant supply curve, *T(β),* converges to the level of migration that produces factor-price equalization. But the curve still slopes down, and *β = 1* still implies no migration, as long as *C* is positive. Thus, a reduction in *C* shifts right the horizontal intercept, but not the vertical intercept,

Lett *β(C)* denote the equilibrium probability of free trade. We have proved:

Proposition 1. *There exists a C* > 0, such that β(C) is positive and decreasing in C for 0 < C < C*, β(C) = 0 for C > C*, and β(C) converges to 1 as C goes to zero.*

With this proposition, we have established a political connection between free trade and migration: The lower the cost of migration, the more likely is a free trade agreement. In this sense, migration and free trade are complements.

But can we go in the reverse direction, where less free trade implies less migration, once again representing a complementary relation? In particular, suppose that instead of varying migration costs, we vary preferences for the free-trade and autarky candidates, independently of migration. This can be done by changing shifting the distribution of preferences for the free-trade candidate from *[-δ/2, δ/2]* to [*b - δ/2, b + δ/2]*. Then (2) becomes

$$\beta^i = 0 \quad if \quad \frac{v(k^i, k_f) - v(k^i, k_j) - b}{\delta} - \tfrac{1}{2} < 0; \qquad (2a')$$

$$\beta^i = 1 \quad if \quad \frac{v(k^i, k_f) - v(k^i, k_j) - b}{\delta} - \tfrac{1}{2} > 1; \qquad (2b')$$

$$\beta^i = \frac{v(k^i, k_f) - v(k^i, k_j) - b}{\delta} - \tfrac{1}{2} \quad otherwise. \qquad (2c')$$

Then a positive *b* indicates a bias against free trade. In particular, if a voter's free-trade and autarky utilities are equal, the voter will vote for the free-trade candidate with a probability less than one-half. In terms of Figure 3, a small bias against free trade shifts down the voting curve where *β* is between zero and one, causing the equilibrium probability of free trade to decline, but also causing the amount of migration to increase. This suggest

a substitute relation between free trade and migration: less free trade, brought on by an increased bias against free trade, leads to more migration:

Proposition 2. *Assume that migration cost C is sufficiently low for migration to occur in equilibrium when there is no bias for or against free trade. Then introducing a bias against free trade raises the equilibrium level of migration.*

This result can be simply explained. At any given level of migration, the bias against free trade makes it less likely that voters will elect the free-trade candidate. But then the expected benefit of migration rises, since it is more likely that the economy remains in autarky, where factor prices fail to equalize. As can be seen by shifting the voting curve in Figure 3, migration increases, which reduces, but does not eliminate, the bias-induced fall in the probability of a free-trade agreement.

4. A Dynamic Extension

In the previous model, free trade is never certain because there would then be no incentive to migrate. But another way to restore such incentives would be through an increase in the time needed to obtain a positive vote. Building on the previous model, we now present this analysis.

The setting of this dynamic model is similar to the one on the previous model. The main difference is the modeling of migration costs. Now it is assumed that they are increasing in the amount of migration that occurs in any given time period: $C = C(M(t)), dC/dM > 0$, where $M(t)$ is the total number of immigrants entering the high-income country at time t, where time is treated as a continuous variable. With C again treated as an income

transfer, the interpretation here is that as the number of migrants rises, higher payments are required to get across the border. In other words, there is an upward-sloping supply of smuggling services in any given time period. One interpretation is that more migration requires more smugglers, which requires higher payments to smugglers. Alternatively, more migration increases the risks of being caught, and existing smugglers demand higher payments as compensation.[9]

In this continuous-time model, there is also the issue of when these migration costs are paid. We could model migrants as saving funds for the purpose of financing their migration, but this needlessly complicates the algebra. Instead, we rather artificially assume that the funds are effectively borrowed and then a constant fraction, αC, is paid back each period once the migrant reaches the high-income country.

The description of autarky remains unchanged, and once again, free trade requires an affirmative vote in both countries. But now migration occurs over time. As before, the median voter in the high-income country prefers autarky over free trade in the initial time period, $t = 0$. For a low enough value of $C(0)$, some positive number of workers then moves from the low-income country to the high-income country, with $M(t)$ set so that the cost of moving, $C(M(t))$, equals the present value of their expected benefits from immigration, where future benefits are discounted at a fixed rate of time preference. As t rises continuously above zero, voting occurs in each instant of time. We again use the probabilistic voting setup from the previous model. If and when a majority of the

[9] In Yilmaz (2005), it is assumed that the costs of migration are psychic costs. The interpretation of rising costs is that more illegal immigrants in the host country might cause locals to have more racist-xenophobic-antagonistic feelings towards these newcomers. With this interpretation, we would need to assume that these psychic costs are felt primarily at the time of immigration, before immigrants will get used to the host country.

population votes for free trade, the agreement is immediately established, equalizing product and factor prices between the two countries. As before, we consider the case where the parameter δ in (2) is small enough to ensure that the high-income country rejects free trade with certainty when migration is zero or small, whereas the low-income country votes in favor of free trade with certainty.

The equilibrium may be described as follows. Starting at time $t = 0$, migration occurs in each time period to equate the cost $C(M(t))$ to the expected discounted benefits of immigration. Until time $t = t^*$, the probability of free trade is zero. However, M(t) must decline with t between $t = 0$ and $t = t^*$ because the expected time until free trade is implemented gets shorter. After $t = t^*$, the number of immigrants moves into the range where the high-income country moves up the voting curve depicted in Figure 3. However, the level of migration at any given time, $M(t)$, continues to decline, so that $C(M(t))$ can decline and stay equated to the diminishing expected benefits of migration. If the free-trade candidate wins at any given time, migration ceases because factor prices are equalized. Otherwise, migration continues to occur at a diminishing rate over time, either until it reaches zero, or the free-trade candidate wins. If migration ceases, then we have reached the point where any further immigration would raise the probability of free trade occurring in each future time period beyond the point where the expected discounted benefits of migration are equal or exceed the cost $C(0)$.

The equilibrium condition for $M(t)$ can be stated in symbols by introducing ρ as the discount factor and then writing the dynamic equivalent to the condition for equilibrium migration given by (4):

$$\int_t^{\infty} e^{-\rho(s-t)} \left[\left(1-\beta(s)\right) V\left(w\left(k_L(s)\right), p\left(k_L(s)\right)\right) + \beta(s)\left(w\left(k_I(s)\right), p\left(k_I(s)\right)\right)\right] ds$$

$$= \int_t^{\infty} e^{-\rho(s-t)} \left[\left(1-\beta(s)\right) V\left(w\left(k_H(s)\right) - \alpha C(M(t)), p\left(k_H(s)\right)\right)\right.$$

$$\left. + \beta(s)\left(w\left(k_I(s)\right) - C(M(t)), p\left(k_I(s)\right)\right)\right] ds \qquad (5)$$

In words, migration *M(s)* at each time period $s > t$ implies a migration cost *C(M(t))* such that a migrant's expected discounted welfare from remaining in the low-income country from period *t* onward equals his expected discounted welfare from moving to the high-income country in period *t*. As previously explained, the probability of a free trade agreement passing at any given time *s*, $\beta(s)$, starts at zero but becomes positive when enough immigrants are residing in the high-income country, and continues to rise until M(s) drops to zero.

Comparative statics are more complicated because the timing of migration depends on the properties of the migration function *C(M),* rather than a single cost parameter, *C.* However, we may parameterize the function by re-writing it as $\gamma C(M)$ for the parameter $\gamma > 0$. Given the function *C(M),* migration requires that γ be sufficiently low, and further drops in γ can be expected to result in higher levels of migration at each period t where *M(t)* is positive, thereby reducing the expected time to free trade. In this sense, migration and trade again appear to be complements: reduced migration costs shorten expected time to free trade. On the other hand, introducing a bias against free trade (i.e., variable "*b*" in eq. (2')) can be expected to reduce the amount of migration in any given period where it is positive, while also lengthening the expected time to free trade.

5. Concluding Remarks

To conclude, introducing politics into a standard Heckscher-Ohlin trade model with factor mobility produces a complex relation between factor movements and free trade. Lower migration costs facilitate free trade agreements, suggesting that more migration is associated with a greater probability of free trade. But a bias against candidates who support free trade leads a lower probability of free trade but more migration. On the one hand, more migration appears to cause more free trade. On the other hand, less free trade appears to cause more migration. Clearly, the relation between trade and migration is sensitive to what is causing the levels of trade and migration to vary.

A useful extension would be to model a world with more than two countries, allowing us to investigate which countries are more likely to form free trade agreements in a world with limited amounts of migration. We could also revisit Levy's (1997) question of whether bilateral agreements inhibit multilateral agreements.

Another extension would be to allow immigrants to send remittances back to the home country. Intuitively, remittances might increase the wage differences needed to offset the cost of migration, if those individuals left behind in the low-income country benefit anyway through the receipt of these remittances.[10] As a result, it might be less likely that enough migration would occur to produce a favorable free-trade vote in the high-income country.

A dynamic model that included delays in adjustments to a long-run equilibrium would also be useful. In the current model, a free trade agreement leads immediately to

[10] The final effect would depend on how we specify immigrant preferences for giving remittances. Note, also, that impediments to trade in the absence of a free-trade agreement would also impede the transfer of remittances.

factor-price equalization, eliminating incentives to migrate. If, however, factor prices remain unequal for some period of time after the agreement, then its passage might occur more quickly. In particular, incentives to migrate might be maintained without the need for a time delay between the entrance of the last immigrant and the passage of an agreement, since the immigrant could now receive wage gains after the agreement. The experience with NAFTA has shown that incentives to migrate have remained high. Martin (2001) draws attention to this increase in migration after the free trade agreement, noting that loosening the assumption that the adjustment to changes in international markets is instantaneous can produce a migration hump, meaning that, when migration flows are charted over time, migration first increases with closer economic integration and then decreases.

Adding population growth to the model would also raise some interesting possibilities. For example, if the illegal immigrants grow faster than the native population in the capital-abundant country, this increases the rate at which the capital-labor ratio decreases in the capital-abundant country and consequently hastens the time to economic integration. On the other hand, if immigrants are given voting rights, they will vote against economic integration in order to further enjoy high wages in the capital- abundant country. This might cause economic integration to occur at a later time or even prevent it altogether. However, if we assume that the immigrants and their descendants vote nationalistically (i.e. for economic integration with their original country), rather than economically (i.e. against economic integration with their original country), then the time of economic integration would be sooner.

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