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THE POLITICAL ECONOMY OF TRADE AND LABOR MOBILITY IN A RICARDIAN WORLD

Sebastian Galiani
Gustavo Torrens

Working Paper 21274
http://www.nber.org/papers/w21274

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
June 2015

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NBER Working Paper No. 21274
June 2015, Revised March 2016
JEL No. F13,F22

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Sebastian Galiani
Department of Economics
University of Maryland
3105 Tydings Hall
College Park, MD 20742
and NBER
galiani@econ.umd.edu

Gustavo Torrens
Department of Economics
Indiana University
Wylie Hall, 100 S Woodland Ave
Bloomington, IN 47405-7104
gtorrens@indiana.edu

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Sebastian Galiani*
University of Maryland and NBER

Gustavo Torrens†
Indiana University

First version: November 2015 - This version: March 2016

Abstract

We explore the political economy of trade and labor mobility in a Ricardian world. We combine a Ricardian economy with a simple international political economy model as a basis for the determination of trade and labor mobility policies. We show that free trade can induce partial convergence, divergence or even a reversal of fortune in terms of the well-being of workers in every country, while free trade and free labor mobility lead to full convergence. We also show that free trade and no labor mobility is a Nash equilibrium of the political game, but free trade and free labor mobility is not. Thus, in a Ricardian world, the lack of convergence in levels of well-being across countries can be attributed to an international political equilibrium that blocks free labor mobility. We verify our main results under several variants of a Ricardian economy, including different assumptions about the set of goods, preferences and the number of countries involved. We also study two extensions of our model in which free trade and at least partial labor mobility is a Nash equilibrium of the political game. One extension introduces increasing returns to scale while the other an extractive elite. Finally, we go beyond a Ricardian world by developing a multifactor model with a non-tradeable sector and establish conditions under which workers in both countries support free trade, but workers in the rich country oppose international labor mobility.

JEL classification codes: D78, F13, F22

Keywords: International Trade, Labor Mobility, Trade Policy, Migration Policy, Covergence.

1 Introduction

There are three basic stylized facts about international trade and labor mobility: (i) wages vary significantly across locations that engage in trade but not in labor mobility; (ii) wages do not vary a great deal across locations that engage in trade and labor mobility; and (iii) international labor mobility is much more limited than international trade in goods is. We show that a Ricardian economy, augmented with a simple international political economy model for the determination of trade and labor mobility policies, can explain these facts. The logic is as follows. In a Ricardian world, free trade does not produce real wage equalization because countries use different production technologies. However, if countries that engage in trade also allow free labor mobility, workers will move from poor to rich countries until real

*E-mail: galiani.umd.edu
†E-mail: gtorrens@indiana.edu

wages are equalized. Finally, free trade and no labor mobility is a Nash equilibrium of the political economy game that we studied, but free trade and free labor mobility is not. Two features of a Ricardian economy are behind this result. First, in a Ricardian world, trade is not a source of conflict because everybody gains when countries specialize in their comparative advantages and engage in international trade. Second, in a Ricardian world, under free trade, labor mobility reduces wages in rich countries. As a consequence, workers from rich countries prefer to block migration flows.

We show that this logic applies not only to a simple Ricardian model, but also to more complex Ricardian economies, including those with a continuum of goods (as in Dornbusch, Fischer and Samuelson, 1977), non-homothetic preferences (as in Matsuyama, 2000) and multiple countries (as in Eaton and Kortum, 2002). We also explore two alternative ways of supporting trade and labor mobility as a Nash equilibrium within a Ricardian framework. First, we introduce differentiated products, monopolistic competition and increasing returns to scale in one industry. In this environment workers from rich countries may prefer to allow migration flows, at least for a certain range of the population, because a bigger labor force induces an expansion of the number of varieties produced and a reduction in the price of each variety. Second, we study a change in the political environment by incorporating the presence of an extractive elite in each country. In this case, immigrants could be a new source of income for the elite of a rich country. Finally, we show that a Ricardian world is by no means the unique economic environment in which political interactions lead to free trade and no labor mobility. In particular, we illustrate this point employing a model with two countries, three sectors and three factors. In the poor country, which specializes in the natural resource-intensive good, workers are employed in the non-tradeable sector. They support free trade because it increases the demand of the non-tradeable good and, hence, wages. In the rich country, which is diversified, workers are employed in the capital-intensive manufacturing sector and in the non-tradeable sector. They support free trade because it expands the demands for the manufactured good and the non-tradeable good, inducing higher wages. However, workers in the rich country prefer to block immigration because any increase in the domestic labor force reduces their wages and deteriorates the country's terms of trade.

In section 2 we develop an international political economy model for the determination of trade and labor mobility policies in a Ricardian world. First, all countries simultaneously decide on their trade and migration policies. In order to keep things as simple as possible, we assume that only a fraction of the labor endowment of each country is mobile and that trade and migration policies can adopt only two values: free trade and no trade, and free labor mobility and no labor mobility. In the case of two countries, no trade is equivalent to complete autarky and no labor mobility implies that mobile workers must stay in their countries of origin. In the multi-country case, each country must select its trade and labor mobility partners. In other words, the trade policy of any given country can be described as the set of countries with which that country agrees to engage in free trade. The situation with respect to migration policy is analogous. Second, mobile workers decide where they will reside and work. Finally, countries engage in trade, production and consumption.

In section 3, we begin studying trade and labor mobility in a very simple setting: a Ricardian economy with only two countries, two tradeable goods and one non-tradeable good. We also assume that only a fraction of the labor endowment of each country is mobile and that consumers' preferences are Cobb-Douglas. In this setting, there is a standard procedure for proving that free trade increases the well-being of all (mobile and immobile) workers in both countries. As a consequence, free trade and no labor mobility is a Nash equilibrium of the international political game. However, trade alone is not enough to produce full convergence of the levels of well-being of workers across the world. Indeed, we show that free trade can produce partial wage convergence (the difference in real wages between the two countries is smaller under free trade than under autarky), divergence (the difference in real wages is larger under free trade than under autarky) and even a reversal of fortune (the low-wage country under autarky becomes the high-wage country under free trade). The reason is that, while under autarky, the difference in real wages is determined only by relative aggregate productivity, under free trade, it is instead determined by relative labor abundance, expenditure shares and relative productivity levels in the non-tradeable sector, but not by relative levels of productivity in the tradeable sectors. Regardless of what effect trade has on relative wages, we show that the combination of free trade and free labor mobility lead to full convergence in real wages. The reason is that any difference in the well-being of workers located in different countries will induce mobile workers to move to the high-wage country. This will produce a reduction in real wages in the high-wage country and an increase in real wages in the low-wage country. If free labor mobility is allowed, the process will continue until real wages are equalized, at which point no mobile worker will have an incentive to migrate. However, workers in high-wage countries will not quietly accept a decrease in their real wages. In other words, free trade and free labor mobility are not a Nash equilibrium of the political game.

In section 4, we consider three types of robustness checks. First, we make various changes in the set of goods. We introduce a finite set of tradeable and/or non-tradeable goods and also consider a continuum of goods (Dornbusch, Fischer and Samuelson, 1977). In this latter setting, we study the case of exogenous non-tradeable goods as well as endogenous non-tradeable goods induced by iceberg transportation costs. None of these changes produce any significant modification in the results derived from our baseline model because the basic features of the simple Ricardian model are preserved. For example, with a continuum of goods, it is still the case that: all agents gain from free trade; free trade alone does not produce real wage convergence; and, under free trade, labor mobility produces a reduction (increase) of real wages in the high- (low-) wage country.

A second source of concern is the assumption of Cobb-Douglas preferences. Note, however, that none of the key features of the simple Ricardian model rely on this assumption. More general homothetic preferences would only add notation without any qualitative change in the results. It is more interesting to explore trade and labor mobility when preferences are non-homothetic. In point of fact, the importance of non-homothetic preferences in explaining trade and development patterns has been growing steadily over the last few decades (see, for example, Mitra and Trindade, 2005, and Reimer and Hertel, 2010). Thus, it is useful to verify whether our results persist when we depart from the standard homothetic preferences assumption. In particular, we consider a Ricardian model of north-south trade with non-homothetic preferences, following Matsuyama (2000), and show that all the results for our baseline model are robust to this modeling assumption.

A third restriction in our baseline model is the two-country assumption. For example, in a two-country model we cannot investigate the conditions under which fully integrated areas (free trade and free labor mobility) form in equilibrium. We study the determination of trade and labor mobility policies in a multi-country Ricardian model with a continuum of goods, as in Eaton and Kortum (2002). We show that complete free trade and no labor mobility is a Nash equilibrium for the world, but that free trade and any pattern of migration policy other than a complete ban on international labor flows is not a Nash equilibrium. Thus, fully integrated areas do not emerge in equilibrium. The reason is that, within a set of countries that accept free trade, each country prefers to block labor mobility from countries with lower wages.

In a nutshell, we confirm the basic results obtained using the simple Ricardian model under several variations in the model's assumptions (set of goods, preferences, and set of countries). For each Ricardian model, we also deduce the conditions under which free trade induces partial convergence, full divergence and a reversal of fortune in terms of the well-being of workers in each country. In all cases, free trade and free labor mobility lead to full convergence, but this is never a Nash equilibrium of the political game. Thus, in a Ricardian world, the lack of convergence in levels of well-being across countries can be attributed to an international political equilibrium that blocks free labor mobility.

Although, nowadays, international labor mobility is comparatively more restricted than international trade in goods is, there have been other historical periods in which migration was much less restricted. For example, mass migration to the relatively rich countries in the Americas occurred in the 19th century. Simple extensions of our baseline Ricardian world can explain these episodes of free labor mobility, however. In section 5, we explore two possible explanations. First, we change the economy by introducing increasing returns to scale in the production of one of the tradeable goods. Second, we study a change in the political environment by incorporating an extractive elite into each country.

Suppose that we introduce differentiated products, monopolistic competition and increasing returns to scale, à la Krugman (1978, 1980) and Helpman (1981), in one of the tradeable sectors. Then, allowing migration could be optimal for workers in a scarcely populated rich country. The reason is that more varieties of the differentiated good can be produced with a bigger labor force, which can offset the negative effect of immigration flows on wages in the rich country. Indeed, we deduce conditions under which free trade and some, but not full, free international labor mobility is a Nash equilibrium of the political economy game. This may help to explain why immigration policies in the U.S. were very liberal until the end of the 19th century, but then became much more restrictive in the early 20th century.

Another way of generating free labor mobility within a Ricardian world is to introduce an elite that extracts income from workers as in Acemoglu and Robinson (2012). In particular, we show that, if the extractive elite in the rich country is powerful enough, then free labor mobility is possible. The reason for this is that, although the extractive elite in the rich country is hurt by the reduction in wages induced by an inflow of workers, immigrants are also a new source of income for the elite (more workers to extract from). Hence, if the second effect outweighs the first one and the elite is relatively powerful, then the rich country will permit an inflow of workers. Trade, however, is not a source of conflict between workers and the elite because, in a Ricardian world, everybody gains from trade. In other words, workers in a rich country only care about wages, while the extractive elite cares about total labor income. This produces a conflict of interest between workers and the elite in regard to labor mobility but not with regard to trade policy.

Finally, an interesting question is whether our results can be extended beyond a Ricardian framework where free trade is not always Pareto superior. Although we do not fully explore this issue, in section 6 we develop a multifactor model in which our results hold. Specifically, building on Galiani, Heymann and Magud (2010), Galiani and Somaini (2015) and Galiani, Schofield and Torrens (2014), we develop a model with two countries, two tradeable goods (rural products and manufactures), one non-tradeable good and three factors of production (capital, labor and natural resources). Rural products are produced with natural resources and capital, manufactures with capital and labor and the non-tradeable good with labor. We show that, under free trade and proper restriction in the parameter space, the poor country specializes in the rural product, while the rich country produces rural products and manufactures. As a consequence, workers in the poor country are employed in the non-tradeable sector, while workers in the rich country are employed in the exporting sector (i.e., manufactures) and in the non-tradeable sector. Workers in both countries support free trade. In the poor country this is due to the fact that the demand of the non-tradeable good is proportional to the value of the tradeable output, which is maximized when the country engages in free trade. This is also the case in the rich country. Additionally, in the rich country, free trade expands the demand of labor in the manufacturing sector. Regarding international labor mobility, workers in the poor country clearly support free labor mobility because they want to be able to migrate to the rich country. Even if some workers are immobile, they will also support free labor mobility since a reduction in the labor force of the poor country will increase wages and improve the terms of trade. However, workers in the rich country will block free labor mobility. An expansion of the labor force reduces their wages and deteriorates the terms of trade of the country.

The economic and political economy literature has devoted much less attention to migration than to international trade in both theoretical and empirical terms (Facchini, 2004, and Facchini, Mayda and Mishra, 2007). Nevertheless, there is a very interesting body of literature on labor mobility, migration policies and the political economy of migration. First of all, there is a well-established body of literature on international factor mobility and, in particular, on the determinants and effects of migration (see, among others, Mundell 1957, Markusen 1983, Grossman 1983, and Wong 1995).

Second, several works have shed light on the crucial role played by international labor mobility in the convergence of living standards between Europe and America during the 19th and early 20th centuries (e.g., Taylor and Williamson, 1997, and O'Rourke and Sinnott, 2003). These studies suggest that international labor mobility has a strong influence on cross-country convergence of levels of well-being.[1] Numerous authors have documented the fact that migration policies became much more restrictive in the 20th century and that, nowadays, international labor markets are much less integrated than international markets of commodities are.[2] Freeman (2006) examines the degree of international economic integration

[1]Taylor and Williamson (1997) find that international real wage dispersion declined by 28% from 1870 to 1910, but that without the mass migrations that occurred during this period, wage dispersion would have increased by 7%. In the same vein, O'Rourke (2004) reports that wages rose in emigration countries during the late 19th and early 20th centuries, converging with countries of immigration (see also Hatton and Williamson, 2005). O'Rourke and Sinnott (2003) argue that "One hundred years ago mass emigration raised living standards significantly in countries such as Ireland, Italy and Sweden, enabling them to converge on the core countries of the day, Britain and the U.S. Indeed, mass migration can account for as much as 70% of the convergence in living standards worldwide which occurred during the late 19th century."

[2]O'Rourke (2004) and Hatton and Williamson (2007) show that liberal policies on immigration during the 19th century came to an end in the early 20th century, when many popular destination countries began imposing severe restrictions on immigration. "The United States, which was once a nation of immigrants, only began to restrict immigration at the federal level in 1875, and then restrictions were limited to those who were destitute, engaged in immoral activities, or physically handicapped. However, the late nineteenth century was still a period of effectively liberal policies toward migration. Roughly 60 million Europeans immigrated to the New World between 1820 and 1914. This liberalism ended in the imposition of country of origin quotas during the early twentieth century." O'Rourke (2004) Moreover, they document that these restrictions have remained in place even after many restrictions on the movement of goods have been eliminated. "During the early twentieth century, many popular destination states began to establish restrictions on immigration. During the past sixty years, global society has made important strides toward free movement of goods, money, and even some types of services. Yet human migration for economic and noneconomic reasons remains broadly constrained." O'Rourke (2004) "The biggest difference between the two global centuries, however, lies in immigration policy. In the 19th century, host economies encouraged immigration, either through their open door policies or explicitly through subsidies. Openness ended in 1920 with quotas on immigration and the first great policy backlash against it. The restrictions on international migration that arose all around the world have remained in place since then. Indeed, in many respects they have become even more prohibitive, especially since the 1970s." Hatton and Williamson (2007)

in labor compared with other factors and concludes that the labor market is the least developed facet of globalization. In line with this view, Rodrik (2002) argues that price wedges in international commodity and financial markets rarely exceed a ratio of 2:1, while wages of similarly qualified individuals in advanced and low-income countries differ by a factor of 10 or more. Clements (2011) estimates that the restrictions on labor mobility from poor to rich countries is the largest distortion in the world economy. He estimates that free labor mobility could increase world GDP by between 50% and 150%.

Third, although the political economy of labor mobility has not been fully explored, several works have discussed different economic and political determinants of migration policies. Foreman-Peck (1992) develops a simple political economy model of factor mobility focused on the receiving country. He shows that if the government of the receiving country gives a great deal of weight to the interests of landowners (workers) and if land and labor are complements, then immigration policies will tend to be open (restrictive). Along the same lines, Benhabib (1996) shows that, under majority voting, immigrants with skills that are complementary with those of the median voter will be selected. Razin and Sadka (1999) study the political economy of immigration when the receiving country has a pay-as-you-go pension system, and Razin, Sadka, and Swagell (2000) investigate how unskilled immigration affects redistribution policies in the host country. Hatton and Williamson (2007) emphasize that trade is based on comparative advantage, while migration is based on absolute advantage. They also mention the spread of democracy and the decline of empires as an explanation for the change in migration policies in the 20th century. Mayda (2007), in line with our multifactor model, attributes the observed differences in attitudes toward trade and immigration (today, people are more pro-trade than pro-immigration) to the influence exerted by individuals working in non-tradeable sectors. However, to the best of our knowledge, there is no formal international political economy model that explains the existence of very few restrictions on international trade in conjunction with severe restrictions on international labor mobility. In this paper we develop a simple but formal model of trade and labor mobility policies employing a Ricardian model for the economy. In other words, we try to go as far as we can in explaining trade and migration policies within the limits of a Ricardian world.

The rest of this paper is organized as follows. Section 2 presents an international political economy model for the determination of trade and labor mobility policies. Sections 3 through 5 characterize the equilibrium of the model for different Ricardian economies, as follows. Section 3 studies a simple Ricardian economy with only two countries and two tradeable goods. Section 4 considers several robustness checks. Section 4.1 deals with different assumptions about the set of goods; Section 4.2 introduces non-homothetic preferences, and Section 4.3 investigates the case of multiple countries. Section 5 develops two extensions of the simple model in which free trade and at least some labor mobility are a Nash equilibrium. Section 5.1 introduces monopolistic competition, differentiated products and economies of scale in one of the sectors of the simple Ricardian model. Section 5.2 introduces an extractive elite in the political economy model. Section 6 goes beyond the Ricardian world, extending the results to a multifactor model. Section 7 concludes.

2 Trade and Labor Mobility Policies in a Ricardian World

In this section we present a model of international trade and labor mobility in a Ricardian world. All the models in the paper are particular cases of this framework.

Countries, Endowments, Technologies and Preferences. Consider a world integrated by $j = 1, ..., J$. Each country is characterized by its labor endowment $\bar{L}^j$ and linear technologies for the production of a set of goods Z. Let Q_z^j indicate the aggregate production of good $z \in Z$ in country j and L_z^j the labor employed in industry z in country j. All agents have the same utility function $u\left(c^j\right)$, where c^j is the consumption plan of an agent in country j. The associated indirect utility is denoted by v^j. Finally, C_z^j indicates the aggregate consumption of good z in country j.

Labor Mobility. Only a fraction $m \in [0,1]$ of the labor endowment of each country is mobile at zero cost. The rest is completely immobile. Let $\mathbf{J}_M$ be a partition of J. A set $J_M \in \mathbf{J}_M$ is a subset of countries that allow labor mobility among them, but do not allow it with the rest of the world. Then, for each $j \in J_M$, the labor force of country j, denoted by L^j, is given by $L^j = (1-m)\,\bar{L}^j + \theta^j m \sum_{i \in J_M} \bar{L}^i$, where θ^j is the proportion of the mobile labor force in J_M that selects to locate in country j. Naturally, $\theta^j \in [0,1]$ and $\sum_{i \in J_M} \theta^i = 1$. Mobile workers locate in the country in which they get a higher utility. Thus, choice-of-location decisions come from selecting $\left(\theta^i\right)_{i \in J_M}$ in order to maximize $\sum_{i \in J_M} \theta^i v^i$, where v^i is the indirect utility of a worker located in country i. Although all workers located in country j will earn the same utility v^j, not all workers originally from country j necessarily get the same utility. For this reason, we will denote by $v^{j,m}$ ($v^{j,im}$) the indirect utility of a mobile (immobile) worker originally from country j.

Trade. Let $Z_T \subset Z$ be the set of tradeable goods and $Z_N \subset Z$ the set of non-tradeable goods. Logically, $Z_T \cup Z_N = Z$. Let $\mathbf{J}_T$ be a partition of J. A set $J_T \in \mathbf{J}_T$ is a subset of countries that allow trade among themselves, but do not allow it with the rest of the world. p_z^j denotes the price of good z in country j. Then, for $z \in Z_T$, $p_z^i = p_z$ for $i \in J_T$ and $\sum_{i \in J_T} Q_z^i = \sum_{i \in J_T} C_z^i$, and for $z \in Z_N$, $Q_z^j = C_z^j$.

Polity. In each country there is a government which selects trade and migration policies in order to maximize the welfare of its native citizens (mobile and immobile workers of the country). When we refer to the "trade and labor mobility policies" of a country, we are talking about whether the country allows international trade and labor mobility with each of the other countries in the world or not. When we refer to the "welfare of native citizens", we are saying that the government of country selects its trade and labor mobility policies with the aim of maximizing the utilitarian social welfare function $W_G^j = mv^{j,m} + (1-m)\,v^{j,im}$ that gives exactly the same weight to every native-born citizen (mobile and immobile) and no weight at all to foreign immigrants. The implicit assumption is that potential foreign immigrants do not have political power to influence domestic decisions on trade and labor mobility. The timing of events is as follows:

1. Collective Decisions: Governments simultaneously determine trade and labor mobility policies.

2. Labor Mobility: Mobile workers choose their location.

3. Production, Trade and Consumption: Given the labor force of each country, countries produce, trade and consume.

Equilibrium. We define the equilibrium as a combination of market equilibrium[3] for the economy and Nash equilibrium for policy decisions. Formally, an equilibrium is: (i) a pair of partitions of the set of countries $(\mathbf{J}_T, \mathbf{J}_M)$; (ii) for each $(\mathbf{J}_T, \mathbf{J}_M)$, a distribution of the labor force into countries $\left(L^j\right)_{j \in J}$; and

[3]For homogenous goods, market equilibrium equates with perfect competition, while in the case of differentiated goods, it equates with monopolistic competition.

(iii) for each $(\mathbf{J}_T, \mathbf{J}_M)$ and $\left(L^j\right)_{j\in J}$, prices and an allocation of the labor force to sectors $\left(p_z^j, L_z^j\right)_{z\in Z, j\in J}$ such that:

1. Collective Decisions. For all $j \in J$, $W_G^j(\mathbf{J}_T, \mathbf{J}_M) \geq W_G^j\left(\mathbf{J}_T^j, \mathbf{J}_M^j\right)$ for all $\left(\mathbf{J}_T^j, \mathbf{J}_M^j\right)$ obtained by a unilateral deviation of $j's$ policy decisions from $(\mathbf{J}_T, \mathbf{J}_M)$.

2. Labor Mobility. For each pair of partitions $(\mathbf{J}_T, \mathbf{J}_M)$, $\left(L^j\right)_{j\in J}$ such that no mobile worker can be better off by changing his or her location.

3. Production, Trade and Consumption. For each $\left(L^j\right)_{j\in J}$, $\left(p_z^j, L_z^j\right)_{z\in Z, j\in J}$ is a market equilibrium.

3 A Simple Ricardian Economy

Consider an economy with two countries ($J = 2$), two tradeable goods ($Z_T = \{1, 2\}$) and one non-tradeable good ($Z_N = \{3\}$). Production functions are $Q_z^j = L_z^j / a_{L,z}^j$, where $a_{L,z}^j > 0$ is the unit labor requirement in industry z in country j. Let $A_z = a_{L,z}^2 / a_{L,z}^1$ and assume $A_1 > A_2$, i.e., country 1 has a comparative advantage in good 1. Let $\bar{L}^j$ and L^j be the labor endowment and the labor force of country j, respectively. Only a fraction $m \in [0, 1]$ of $\bar{L}^j$ is mobile. All agents have the same preferences, given by $u\left(c^j\right) = \sum_{z\in Z} \alpha_z \ln\left(c_z^j\right)$, with $\alpha_z > 0$ and $\sum_{z\in Z} \alpha_z = 1$. Let w^j and p_z^j denote the wage rate and the price of good z in country j, respectively. Thus, the indirect utility function is given by $v^j = C + \sum_{z\in Z} \alpha_z \ln\left(w^j / p_z^j\right)$, where $C = \sum_{z\in Z} \alpha_z \ln(\alpha_z)$.

Under autarky all goods must be produced domestically and, hence, $p_z^j = w^j a_{L,z}^j$ for all $z \in Z$ and $j = 1, 2$. The indirect utility of a worker who owns one unit of labor in country j is given by:

$$v^j = C + T^j,$$

where $T^j = -\sum_{z\in Z} \alpha_z \ln\left(a_{L,z}^j\right)$ is a measure of the aggregate productivity of country j. If labor mobility is allowed, all mobile workers go to or stay in the country with the highest aggregate productivity T^j.

Under free trade, if $A_1 > \alpha_1 L^2 / \alpha_2 L^1 > A_2$, then country j specializes in good $z = j \in \{0, 1\}$. Thus, $p_1 = w^1 a_{L,1}^1$, $p_2 = w^2 a_{L,2}^2$, $p_3^j = w^j a_{L,3}^j$ and the balanced trade condition is $\alpha_2 w^1 L^1 = \alpha_1 w^2 L^2$. Therefore, the indirect utility of a worker who owns one unit of labor in country j is given by:

$$v^1 = C + T^1 + \alpha_2 \ln\left(\frac{\alpha_1 L^2}{A_2 \alpha_2 L^1}\right)$$
$$v^2 = C + T^2 + \alpha_1 \ln\left(\frac{A_1 \alpha_2 L^1}{\alpha_1 L^2}\right)$$

If labor mobility is not allowed, then $L^j = \bar{L}^j$. If labor mobility is allowed, mobile workers will go to or stay in the country with the highest v^j. Since v^1 is decreasing in L^1/L^2 while v^2 is increasing in L^1/L^2, if there are enough mobile workers, they will relocate until $v^1 = v^2$. This implies $L^2/L^1 = (\alpha_2/\alpha_1)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$

and, hence:

$$v^1 = v^2 = C + T^1 - \alpha_2 \ln(A_2) - \frac{\alpha_2\alpha_3}{\alpha_1+\alpha_2}\ln(A_3)$$
$$= C + T^2 + \alpha_1 \ln(A_1) + \frac{\alpha_1\alpha_3}{\alpha_1+\alpha_2}\ln(A_3)$$

Moreover, there will be migrations to country 1 whenever $\bar{L}^2/\bar{L}^1 > (\alpha_2/\alpha_1)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$ and migrations to country 2 whenever $\bar{L}^2/\bar{L}^1 < (\alpha_2/\alpha_1)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$. Finally, the distribution of mobile workers between the countries does not violate either $L^j \in \left[(1-m)\bar{L}^j, \bar{L}^j + m\bar{L}^{-j}\right]$ or $A_1 > \alpha_1 L^2/\alpha_2 L^1 > A_2$, provided that the following assumption holds.

Assumption 1 (Simple Ricardian Economy). *Regardless of migration flows, if countries trade, country j specializes in good $z = j$ for $j = 1, 2$. Moreover, under free trade labor mobility induces full wage convergence. Formally*

$$A_1 > \frac{\alpha_1\left(\bar{L}^2 + m\bar{L}^1\right)}{\alpha_2(1-m)\bar{L}^1} > (A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}} > \frac{\alpha_1(1-m)\bar{L}^2}{\alpha_2\left(\bar{L}^1 + m\bar{L}^2\right)} > A_2$$

Lemma 1 characterizes the effects of trade and labor mobility on the relative well-being of workers in both countries.[4] Let $v^j(\lambda_T, \lambda_M)$ be the utility of a worker located in country j, where $\lambda_T = 1$ if $\mathbf{J}_T = \{\{1,2\}\}$ and $\lambda_T = 0$, otherwise, and $\lambda_M = 1$ if $\mathbf{J}_M = \{\{1,2\}\}$ and $\lambda_M = 0$, otherwise. Thus, $\lambda_T = 1$ indicates that both countries accept free trade, while $\lambda_T = 0$ indicates that at least one country refuses to trade and, hence, both countries operate under autarky. $\lambda_M = 1$ indicates that both countries accept free labor mobility, while $\lambda_M = 0$ indicates that at least one country does not accept free labor mobility and, hence, mobile workers are forced to remain in their own country.

Lemma 1 (Simple Ricardian Economy). *Let $T^j = -\sum_{z\in Z}\alpha_z \ln\left(a^j_{L,z}\right)$ be the average productivity of country j and assume $T^1 > T^2$. Define:*

$$\Delta = (\alpha_1+\alpha_2)\ln\left(\frac{\alpha_1\bar{L}^2}{\alpha_2\bar{L}^1}\right) + \left(T^1_N - T^2_N\right),$$

where $T^j_N = -\alpha_3 \ln\left(a^j_{L,3}\right)$ is the productivity of country j in the production of non-tradeable goods. Suppose that assumption 1 holds.

1. *If $\Delta > T^1 - T^2$, then trade produces divergence in real wages, but trade and labor mobility undo the divergence, inducing complete convergence. Formally:*

$$v^1(1,0) - v^2(1,0) > v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0$$

[4]Since mobile workers receive the same wage as immobile workers in the country where they are located, for the purpose of making cross-country comparisons, it is enough to compare immobile workers.

2. *If $0 < \Delta < T^1 - T^2$, then trade produces convergence in real wages, and trade and labor mobility produces complete convergence. Formally:*

$$v^1(0,0) - v^2(0,0) > v^1(1,0) - v^2(1,0) > v^1(1,1) - v^2(1,1) = 0$$

3. *If $\Delta < 0$, then trade produces a reversal of fortune but trade and labor mobility undo this reversal inducing complete convergence in real wages. Formally:*

$$v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0 > v^1(1,0) - v^2(1,0)$$

Proof*: see online appendix.* ■

Under free trade, labor mobility induces complete convergence in real wages. The reason for this is that mobile workers migrate from the poor country to the rich country until real wages are the same in both places. There are two implicit assumptions behind this result. First, there must be a sufficient number of mobile workers. Otherwise, even if all mobile workers in the poor country migrate to the rich country, real wages will not be fully equalized. Second, real wages must be equalized before the rich country starts producing both tradeable goods. Assumption 1 ensures that both conditions are satisfied. Trade alone has a positive effect on the well-being of everybody, but an ambiguous effect in terms of convergence. While, under autarky, differences in real wages depend only on relative aggregate productivity (real wages are higher in country 1 when $T^1 > T^2$), under free trade, they depend on relative labor abundance, expenditure shares and relative levels of productivity in the non-tradeable sector, but not on relative levels of productivity in the tradeable sector (real wages are higher in country 1 when $\Delta = (\alpha_1 + \alpha_2)\ln\left(\frac{\alpha_1 \bar{L}^2}{\alpha_2 \bar{L}^1}\right) + \left(T_N^1 - T_N^2\right) > 0$). That is, under free trade, country 1 is relatively richer than country 2 if it is relatively labor-scarce, it specializes in a good with a relatively high expenditure share and it is relatively more productive in the non-tradeable sector. Indeed, it is even possible for trade to produce a reversal of fortunes if the country with higher aggregate productivity is relatively labor-abundant, it specializes in a good with a low expenditure share and productivity differences in the non-tradeable sector are small.

Figure 1 illustrates the equilibrium in a simple Ricardian economy under free trade when there is no labor mobility and when there is free labor mobility. Notice that real wages in country 1 are higher than in country 2 under free trade and no labor mobility, but under free trade and free labor mobility, real wages converge.[5]

Figure 1: Trade and Labor Mobility in a Simple Ricardian Economy

Let $W_G^j(\lambda_T, \lambda_M)$ denotes the social welfare function of country j when trade and migration policies are (λ_T, λ_M). Proposition 1 characterizes the political equilibrium.

Proposition 1 (Simple Ricardian Economy). *Suppose that assumption 1 holds, $T^1 > T^2$ and $\Delta \neq 0$. Then, the trade and labor mobility game has three Nash equilibria: (i) neither trade nor labor mobility; (ii) no trade and free labor mobility; and (iii) free trade and no labor mobility. Moreover:*

[5] Figure 1 assumes $A_1 = 4$, $A_2 = 0.5$, $T_N^1 = 0$, $T_N^2 = \alpha_3 \ln\left(\frac{1}{1.25}\right)$, $\alpha_1 = \alpha_2 = 0.25$, $\alpha_3 = 0.50$, $\bar{L}^1 = 1, \bar{L}^2 = 1.75$, $m = 0.45$.

1. $W_G^1(1,0) > W_G^1(0,1) = W_G^1(0,0)$, *i.e., for country 1, free trade and no labor mobility is better than no trade and free labor mobility or no trade and no labor mobility;*

2. $\left\{W_G^2(1,0), W_G^2(0,1)\right\} > W_G^2(0,0)$, *while* $W_G^2(1,0) > W_G^2(0,1)$ *if and only if:*

$$\alpha_1 \ln\left(\frac{A_1\alpha_2\bar{L}^1}{\alpha_1\bar{L}^2}\right) > m\left(T^1 - T^2\right), \tag{2}$$

In other words, for country 2, free trade and no labor mobility and no trade and free labor mobility are better than no trade and no labor mobility, while free trade and no labor mobility are better than no trade and free labor mobility when productivity differences are not too great.

Proof*: see online appendix.* ■

No trade and no labor mobility is a Nash equilibrium because if one country decides to isolate itself, there is nothing that the other country can do to change the political equilibrium. This is a very unlikely equilibrium, however. In fact, free trade and no labor mobility is also a Nash equilibrium, and it is strictly preferred to complete isolation by both countries.[6] No trade and free labor mobility is also a Nash equilibrium. If one country decides to restrict trade, free trade is impossible no matter what policy is chosen by the other country. In such circumstances, domestic workers in the rich country and immobile workers in the poor country do not worry about immigration because real wages are fully determined by domestic productivity and do not depend on labor endowments. Mobile workers in the poor country are eager to migrate to the rich country because productivity and, hence, real wages are higher there. For the rich country, this equilibrium is always dominated by free trade and no labor mobility. For the poor country, the comparison between the two equilibria is ambiguous (condition (2)). On the one hand, free trade generates gains from trade for all citizens. On the other hand, free labor mobility generates an increase in real wages for mobile workers equal to the aggregate productivity differences between the countries. Note, however, that no trade and free labor mobility is not a robust equilibrium. For example, if workers in the rich country have a slight aversion to immigration, then no trade and free labor mobility ceases to be a Nash equilibrium. Finally, free trade and free labor mobility is not a Nash equilibrium. Under free trade, domestic workers in a rich country (a labor-scarce country that specializes in the production of tradeable goods with a high expenditure share and with high productivity in the non-tradeable sector) are opposed to labor mobility because the flow of immigrants would reduce their real wages. Proposition 1, in conjunction with Lemma 1, suggests that part of the lack of convergence in real wages among countries can be attributed to a political equilibrium that allows trade but bans migration.

4 Extension I: Complex Ricardian Economies

In this section we show that essentially the same results hold for several variants of the Ricardian model. In particular, we explore three changes in the economy. First, we briefly discuss various changes in the set

[6] Bagwell and Steiger (1999) study a two-country game in which governments simultaneously select their tariffs. They show that Nash equilibrium tariffs are inefficient because neither government internalizes the negative terms-of-trade effect that an increase in its import duties has on the other country. They also show how trade agreements could partially resolve this problem, inducing a Pareto improvement from the Nash equilibrium. We can reinterpret autarky in our model as the equilibrium without a trade agreement (high tariffs) and free trade as the equilibrium with a trade agreement (low tariffs).

of goods. Introducing more tradeable and/or non-tradeable goods does not affect the results regardless of whether we are dealing with a continuum of goods with exogenous non-tradeable goods or endogenous non-tradeable goods induced by iceberg transportation costs (Dornbusch, Fischer and Samuelson, 1977). Second, we consider a Ricardian model with non-homothetic preferences, following Matsuyama (2000). Finally, we study the determination of trade and labor mobility policies in a multi-country Ricardian model with a continuum of goods, along the lines of Eaton and Kortum (2002).

4.1 Multiple Goods (Dornbusch, Fischer and Samuelson, 1977)

The results obtained in section 3 can easily be extended to a finite set of tradeable and non-tradeable goods (see the online appendix for details). The key complication is that, under free trade, the marginal tradeable good in the chain of comparative advantage may or may not be produced by both countries. If, under no labor mobility in the trading equilibrium, each country produces a different set of tradeable goods, then labor mobility increases real wages in the poor country and decreases them in the rich one. As a consequence, workers in the rich country are opposed to free labor mobility. Conversely, if, under no labor mobility in the trading equilibrium, both countries are producing the marginal good, then small changes in the country-allocation of mobile workers do not affect either the set of goods produced by each country or real wages in either country. As a consequence, the rich country will be willing to allow some immigrants to enter. However, once the poor country stops producing the marginal good and that good's production is fully relocated to the rich country, real wages in the rich country start decreasing and, hence, workers in the rich country no longer accept labor mobility.

A more elegant way of introducing multiple goods is to consider a continuum of goods as in Dornbusch, Fischer and Samuelson (1977) (see the online appendix for details). Indeed, in this setting, it is always the case that, under free trade, any reallocation of mobile workers to other countries changes the marginal industry and, as a consequence, increases real wages in one country and decreases them in the other. This holds in the case of exogenous non-tradeable goods and also in the case of endogenous non-tradeable goods induced by iceberg transportation costs. Hence, with a continuum of goods, under free trade, labor mobility always reduces real wages in the rich country, which implies that workers in the rich country are opposed to labor mobility.

Figure 2 illustrates the equilibrium in a Dornbusch-Fischer-Samuelson economy with exogenous non-tradeable goods under free trade when there is no labor mobility and when there is free labor mobility. Notice that real wages in country 1 are higher than in country 2 under free trade and no labor mobility, but under free trade and free labor mobility, real wages converge.[7]

Figure 2: Trade and Labor Mobility in a Dornbusch-Fischer-Samuelson Economy

4.2 Non-Homothetic Preferences (Matsuyama, 2000)

Until this point, we have assumed Cobb-Douglas preferences. It is well-known that many trade and development patterns can be explained much more accurately when using non-homothetic preferences. In order to verify that our results are consistent with those preferences, in this section we consider a Ricardian economy with non-homothetic preferences as in Matsuyama (2000).

[7]Figure 2 assumes $A_z = 2.5e^{-3.75z}$, $T_N^1 = 1.15$, $T_N^2 = 1$, $\alpha_z = 1$, $\bar{L}^1 = 1$, $\bar{L}^2 = 2$, $m = 0.75$.

Consider an economy with two countries ($J = \{1, 2\}$) and a continuum of tradeable goods $Z = [0, \infty)$ indexed by z (in order to stress the role of non-homothetic preferences we assume that all goods are tradeable.) Country 1 has a comparative advantage in higher indexed goods. Specifically, assume that $A_z = a^2_{L,z}/a^1_{L,z}$ is a continuously differentiable strictly increasing function, $A_0 < 1$ and $\lim_{z\to\infty} A_z > 1$. Each agent owns 1 unit of labor and is either mobile or immobile. Goods come in discrete units and each agent can consume unit or no unit of each good. Specifically, the utility function is given by $u\left(c^j\right) = \int_0^\infty b_z c^j_z dz$, where $b_z > 0$ is the utility weight of good z and $c^j_z = 1$ if good z is consumed and $c^j_z = 0$ if it is not. Moreover, $b_z/a^j_{L,z}$ is a decreasing function of z for each j.

Under autarky, all goods must be produced domestically. Hence, if good z is produced, $p^j_z = a^j_{L,z} w^j$, where w^j is the wage rate in country j. A worker in country j tries to maximizes $u\left(c^j\right) = \int_0^\infty b_z c^j_z dz$ subject to $\int_0^\infty p^j_z c^j_z dz = w^j$. Since $b_z/a^j_{L,z}$ is decreasing, the worker selects $c^j_z = 1$ for $z \in \left[0, \tilde{v}^j\right]$ and $c^j_z = 0$ for $z \in \left(v^j, \infty\right)$, where $\tilde{v}^j$ is the unique solution of $\int_0^{\tilde{v}^j} a^j_{L,z} dz = 1$. Therefore, the indirect utility function of a worker in country j is:

$$v^j = \int_0^{\tilde{v}^j} b_z dz$$

If labor mobility is allowed mobile workers will go to or stay in the country with the highest v^j.

Under free trade $p_z = \min\left\{a^1_{L,z}w^1, a^2_{L,z}w^2\right\}$. Since A_z is continuous and strictly increasing, in the trading equilibrium country 1 produces high-indexed goods $z \in [\bar{z}, \infty)$ and country 2 produces low-indexed goods $z \in [0, \bar{z}]$. The marginal industry is given by $A_{\bar{z}} = w^1/w^2$. A worker in country j tries to maximizes $u\left(c^j\right) = \int_0^\infty b_z c^j_z dz$ subject to $\int_0^\infty p_z c^j_z dz = w^j$. Since $b_z/a^j_{L,z}$ is decreasing for each j, it must be the case that for any w^1 and w^2, b_z/p_z is decreasing in z. Hence, a worker in country j selects $c^j_z = 1$ for $z \in \left[0, \bar{v}^j\right]$ and $c^j_z = 0$ for $z \in \left(\bar{v}^j, \infty\right)$, where $\bar{v}^1$ and $\bar{v}^2$ are given by (assuming that $\bar{v}^j > \bar{z}$):

$$\frac{1}{A_{\bar{z}}}\int_0^{\bar{z}} a^2_{L,z} dz + \int_{\bar{z}}^{\bar{v}^1} a^1_{L,z} dz = 1 = \int_0^{\bar{z}} a^2_{L,z} dz + A_{\bar{z}} \int_{\bar{z}}^{\bar{v}^2} a^1_{L,z} dz$$

The supply of good $z \in [0, \bar{z}]$ is $Q^2_z = L^2_z/a^2_{L,z}$. Since $\bar{v}^j > \bar{z}$, each agent demands 1 unit of $z \in [0, \bar{z}]$, which implies that the aggregate demand of z is $C^1_z + C^2_z = L^1 + L^2$. Since $\int_0^{\bar{z}} L^2_z dz = L^2$, we obtain:

$$\int_0^{\bar{z}} a^2_{L,z} dz = \frac{L^2}{L^1 + L^2}$$

Once we have determined $\bar{z}$, relative wages are given by $w^1/w^2 = A_{\bar{z}}$, while $\bar{v}^1$ and $\bar{v}^2$ are the solutions of $\int_{\bar{z}}^{\bar{v}^1} a^1_{L,z} dz = 1 - \left[L^2/A_{\bar{z}}\left(L^1 + L^2\right)\right]$ and $\int_{\bar{z}}^{\bar{v}^2} a^1_{L,z} dz = L^1/A_{\bar{z}}\left(L^1 + L^2\right)$, respectively. Note that $\bar{v}^2 > \bar{z}$ because $L^1/A_{\bar{z}}\left(L^1 + L^2\right) > 0$, $\bar{v}^1 > \bar{z}$ if and only if $A_{\bar{z}} > L^2/L^1 + L^2$.The indirect utility of a worker is given by:

$$v^j = \int_0^{\bar{v}^j} b_z dz$$

If labor mobility is not allowed, then $L^j = \bar{L}^j$. If labor mobility is allowed, then mobile workers will go to or stay in the country with the highest v^j (equivalently the highest $\bar{v}^1$). If $A_{\bar{z}} > 1$, then $\bar{v}^1 > \bar{v}^2$ and, hence, mobile workers will move from country 2 to 1. As a consequence, $\bar{v}^1$ will decrease and v^2 will increase. Conversely, if $A_{\bar{z}} < 1$, then $\bar{v}^1 > \bar{v}^2$ and, hence, mobile workers will move from country 1 to 2. As a consequence, v^2 will decrease and v^1 will increase.[8] Therefore, provided that there are enough

[8]For a formal proof, see the proof given for Proposition 2.

mobile workers, they will relocate until $v^1 = v^2$, which implies $\bar{v}^1 = \bar{v}^2 = \hat{v}$ and $A_{\hat{z}} = w^1/w^2 = 1$. Once we have determined $\hat{z}$, the country-allocation of mobile workers is given by $L^2 = \left(\bar{L}^1 + \bar{L}^2\right) \int_0^{\hat{z}} a^2_{L,z} dz$. The indirect utility of a worker is given by:

$$v^1 = v^2 = \int_0^{\hat{v}} b_z dz,$$

where $\hat{v}$ and $\hat{z}$ are implicitly given by $\int_{\hat{z}}^{\hat{v}} a^1_{L,z} dz = 1 - \int_0^{\hat{z}} a^2_{L,z} dz$ and $A_{\hat{z}} = 1$. Finally, we must verify that the distribution of mobile workers between the countries does not violate $L^j \in \left[(1-m)\,\bar{L}^j, \bar{L}^j + m\bar{L}^{-j}\right]$. In order to avoid such a situation and to ensure that it will always be the case that $\bar{v}^1 > \bar{z}$, we impose the following assumption.

Assumption 2 (Non-Homothetic Preferences). *Labor mobility induces full wage convergence. Formally:*

$$\frac{\bar{L}^2 + m\bar{L}^1}{\bar{L}^1 + \bar{L}^2} > \int_0^{\hat{z}} a^2_{L,z} dz > \frac{(1-m)\,\bar{L}^2}{\bar{L}^1 + \bar{L}^2},$$

where $A_{\hat{z}} = 1$. Moreover, define z_L and z_H by $\int_0^{z_L} a^2_{L,z} dz = (1-m)\,\bar{L}^2 / \left(\bar{L}^1 + \bar{L}^2\right)$ and $\int_0^{z_H} a^2_{L,z} dz = \left(\bar{L}^2 + m\bar{L}^1\right) / \left(\bar{L}^1 + \bar{L}^2\right)$, respectively. Then, assume $A_z > \int_0^z a^2_{L,z} dz$ for $z \in [z_L, z_H]$.

Lemma 2 characterizes the effects of trade and labor mobility on relative wages in the countries.

Lemma 2 (Non-Homothetic Preferences). *Suppose that Assumption 2 holds and $\tilde{v}^1 > \tilde{v}^2$, where $\int_0^{\tilde{v}^j} a^j_{L,z} dz = 1$. Then:*

1. *If $A_{\bar{z}} > 1$ and $\int_{\tilde{v}^1}^{\bar{v}^1} b_z dz > \int_{\tilde{v}^2}^{\bar{v}^2} b_z dz$, then trade leads to divergence in the well-being of the two countries but trade and labor mobility undo the divergence, inducing complete convergence. Formally:*

$$v^1(1,0) - v^2(1,0) > v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0$$

2. *If $A_{\bar{z}} > 1$ and $\int_{\tilde{v}^1}^{\bar{v}^1} b_z dz < \int_{\tilde{v}^2}^{\bar{v}^2} b_z dz$, then trade induces convergence in the well-being of the two countries and trade and labor mobility induce complete convergence. Formally:*

$$v^1(0,0) - v^2(0,0) > v^1(1,0) - v^2(1,0) > v^1(1,1) - v^2(1,1) = 0$$

3. *If $A_{\bar{z}} < 1$, then trade induces a reversal of fortune but trade and labor mobility undo this reversal, inducing complete convergence in well-being. Formally:*

$$v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0 > v^1(1,0) - v^2(1,0)$$

Proof: *see online appendix.* ■

Trade and labor mobility induce full convergence because workers move from the poor country under free trade to the rich country under free trade until the level of well-being in the two countries is equalized. When $w^1/w^2 = A_{\bar{z}} > 1$, under free trade, country 1 is richer than country 2 and, hence, some workers will migrate to country 2. Since we are assuming that country 1 is the rich country under autarky, $A_{\bar{z}} > 1$

implies that free trade will no alter the countries' relative positions. However, it is possible that free trade will reduce or amplify the difference between the countries' levels of well-being. Without specifying b_z, it is difficult to determine when trade will induce convergence beyond the general condition that the gains from trade in the rich country must be lower than in the poor country ($\int_{\tilde{v}^1}^{\bar{v}^1} b_z dz < \int_{\tilde{v}^2}^{\bar{v}^2} b_z dz$). For example, if $b_z = 1/z$, then there will be convergence whenever $\bar{v}^1/\tilde{v}^1 < \bar{v}^2/\tilde{v}^2$, i.e., if free trade leads to a higher percentage increase in the range of goods consumed by the poor country than it does in the rich country. If we also specify $a^1_{L,z}$ and $a^2_{L,z}$, we can characterize the conditions for convergence in greater detail. Assume $a^2_{L,z} = 1$ for all z, $a^1_{L,z} = \gamma/e^z$ with $1 < \gamma < e/(e-1)$. Then $A_z = e^z/\gamma$, $\tilde{v}^1 = \ln\left[\frac{\gamma}{\gamma-1}\right]$, $\tilde{v}^2 = 1$, $\bar{z} = \bar{L}^2/\left(\bar{L}^1 + \bar{L}^2\right)$, $\bar{v}^1 = \ln\left[\frac{\gamma e^{\bar{z}}}{\gamma(1+\bar{z}) - e^{\bar{z}}}\right]$, $\bar{v}^2 = \ln\left[\frac{e^{\bar{z}}}{\bar{z}}\right]$, $\hat{z} = \ln(\gamma)$, $\hat{v} = \ln\left(\frac{\gamma}{\hat{z}}\right)$.[9] Therefore, free trade will induce convergence in real wages if and only if $\gamma < e^{\bar{z}}$ and $\ln\left[\frac{\gamma e^{\bar{z}}}{\gamma(1+\bar{z}) - e^{\bar{z}}}\right] < \ln\left[\frac{\gamma}{\gamma-1}\right] \ln\left[\frac{e^{\bar{z}}}{\bar{z}}\right]$.

Proposition 2 characterizes the political equilibrium.

Proposition 2 (Non-Homothetic Preferences). *Suppose that Assumption 2 holds and $\tilde{v}^1 > \tilde{v}^2$, where $\int_0^{\tilde{v}^j} a^j_{L,z} dz = 1$. Then, the trade and labor mobility game has three Nash equilibria: (i) neither trade nor labor mobility; (ii) no trade and free labor mobility; and (iii) free trade and no labor mobility. Moreover:*

1. $W^1_G(1,0) > W^1_G(0,1) = W^1_G(0,0)$, *i.e., for country 1, free trade and no labor mobility are better than no trade and free labor mobility or no trade and no labor mobility;*

2. $\left\{W^2_G(1,0), W^2_G(0,1)\right\} > W^2_G(0,0)$, *while* $W^2_G(1,0) > W^2_G(0,1)$ *if and only if*

$$\int_{\tilde{v}^2}^{\bar{v}^2} b_z dz > m \int_{\tilde{v}^2}^{\tilde{v}^1} b_z dz \tag{3}$$

   i.e., for country 2, free trade and no labor mobility and no trade and free labor mobility are better than no trade and no labor mobility, while free trade and no labor mobility are better than no trade and free labor mobility when productivity differences are not to great.

Proof*: see online appendix.* ■

Proposition 2 suggests that our results continue to hold even when preferences are non-homothetic. Free trade and free labor mobility is not a Nash equilibrium because workers in the rich country under free trade prefer to block labor mobility. All other outcomes are Nash equilibria. For the rich country under autarky (country 1), free trade and no labor mobility prevail over all other possible equilibria. For the poor country under autarky (country 2), free trade and no labor mobility prevail over no trade and free labor mobility when condition (3) holds, i.e., when the gains from trade ($\int_{\tilde{v}^2}^{\bar{v}^2} b_z dz$) are greater than the productivity gains under autarky for mobile workers ($m \int_{\tilde{v}^2}^{\tilde{v}^1} b_z dz$).

[9] We are also implicitly assuming that Assumption 2 holds, which requires that $z_L < \ln(\gamma) < z_H$ and $z < \frac{e^z}{\gamma} < 1 + z$ for $z \in [z_L, z_H]$, where $z_L = (1-m)\bar{L}/\left(\bar{L}^1 + \bar{L}^2\right)$ and $z_H = \left(\bar{L}^2 + m\bar{L}^1\right)/\left(\bar{L}^1 + \bar{L}^2\right)$.

4.3 Multiple Countries (Eaton and Kortum, 2002)

In this section, we introduce multiple countries. We base our analysis on the Ricardian model developed by Eaton and Kortum (2002). Consider an economy with a finite set of countries J countries, indexed by $j = 1, ..., J$, and a continuum of tradeable goods, $Z_T = [0,1]$ indexed by z. Assume there are no geographic barriers that limit the mobility of tradeable goods, i.e., we consider the zero-gravity case. However, as in previous sections, not all workers are mobile. Let $\bar{L}^j$ and L^j be the labor endowment and the labor force of country j, respectively. Only a fraction $m \in [0,1]$ of $\bar{L}^j$ is mobile. Preferences are identical for all agents in every countries. Specifically, $u\left(c^j\right) = \left[\int_0^1 \left(c_z^j\right)^\rho dz\right]^{\frac{1}{\rho}}$, where $\sigma = (1-\rho)^{-1} > 1$. Let $a_{L,z}^j$ be the unit labor requirement of good z in country j. Labor productivity is a random draw from a Frechet distribution, i.e., the cumulative distribution function of $a_{L,z}^j$ is given by $\Pr\left(a_{L,z}^j \leq a\right) = 1 - e^{-T^j a^\theta}$, where $T^j > 0$ and $\theta > \sigma - 1$. These distributions are independent across goods and countries.

Given $a_{L,z}^j$, if good z is produced in country j, its price will be $p_z^j = a_{L,z}^j w^j$, where w^j is the wage rate in country j. Thus, if good z is produced in country j, its price distribution will be $G_z^j(p) = \Pr\left(p_z^j \leq p\right) = 1 - e^{-T^j\left(\frac{p}{w^j}\right)^\theta}$. Under autarky, all goods can only be produced domestically and, hence, the price distribution of good z in country j is $G_z^j(p) = 1 - e^{-T^j\left(\frac{p}{w^j}\right)^\theta}$. For the CES utility function, the exact price index is given by $P^j = \left[\int_0^1 \left(p_z^j\right)^\rho dz\right]^{\frac{1}{\rho}} = \left[\int_0^\infty (p)^\rho dG_z^j(p)\right]^{\frac{1}{\rho}} = \gamma\left(T^j\right)^{-\frac{1}{\theta}} w^j$, where $\gamma = \left[\Gamma\left(\frac{\theta+1-\sigma}{\theta}\right)\right]^{\frac{1}{1-\sigma}}$, Γ is the Gamma function and $1 + \theta > \sigma$. Hence, the real wage rate in country j is $w^j/P^j = \left(T^j\right)^{\frac{1}{\theta}}/\gamma$ or, equivalently, the indirect utility function of a worker in country j is:

$$v^j = -\ln(\gamma) + \frac{1}{\theta}\ln\left(T^j\right)$$

As a consequence, if migration is allowed, all mobile workers will go to or stay in the country with the highest T^j.

Under complete free trade, consumers will buy from the less expensive producer. The lowest price is lower than p unless each country is selling at a higher price. Therefore, the price-distribution that consumers actually face for good z is $G_z(p) = 1 - \prod_{j=1}^J\left[1 - G_z^j(p)\right] = 1 - e^{-\sum_{j=1}^J T^j\left(\frac{p}{w^j}\right)^\theta}$. The probability that country j is the lowest cost supplier of good z is $q_z^j = \int_0^\infty \prod_{i\neq j}\left[1 - G_z^i(p)\right] dG_z(p) = T^j\left(\frac{\gamma w^j}{P}\right)^{-\theta}$, where $P = \left[\int_0^1 (p_z)^\rho dz\right]^{\frac{1}{\rho}} = \left[\int_0^\infty (p)^\rho dG_z(p)\right]^{\frac{1}{\rho}} = \gamma\left(\sum_{j=1}^J T^j\left(w^j\right)^{-\theta}\right)^{-\frac{1}{\theta}}$ is the exact price index. Since there is a continuum of goods, q_z^j is also the fraction of goods that each country buys from j. Thus, the balanced trade conditions are given by $w^j L^j = q_z^j \sum_{i=1}^J w^i L^i$ for $j = 1, ..., J$. Solving these equations, we obtain $w^k/w^j = \left(\frac{T^k}{L^k}/\frac{T^j}{L^j}\right)^{\frac{1}{1+\theta}}$. Hence, the real wage rate in country j is $w^j/P = (1/\gamma)\left(T^j/L^j\right)^{\frac{1}{1+\theta}}\left[\sum_{i=1}^J\left(T^i\right)^{\frac{1}{1+\theta}}\left(L^i\right)^{\frac{\theta}{1+\theta}}\right]^{\frac{1}{\theta}}$ or, equivalently, the indirect utility of a worker in country j is:

$$v^j = -\ln(\gamma) + \frac{1}{1+\theta}\ln\left(\frac{T^j}{L^j}\right) + \frac{1}{\theta}\ln\left[\sum_{i\in J}\left(T^i\right)^{\frac{1}{1+\theta}}\left(L^i\right)^{\frac{\theta}{1+\theta}}\right]$$

If migration is not allowed, then $L^j = \bar{L}^j$ for all $j \in J$. If migration is allowed and enough workers are mobile, the equilibrium allocation of workers will be $L^j = \left(T^j / \sum_{i \in J} T^i\right)\left(\sum_{i \in J} \bar{L}^i\right)$. Then, regardless of the location of a given worker, the indirect utility of that worker under free trade and free labor mobility will be given by:

$$v^j = -\ln(\gamma) + \frac{1}{\theta} \ln\left(\sum_{i \in J} T^i\right)$$

Finally, we must verify that the distribution of mobile workers across countries satisfies $L^j \geq (1-m)\,\bar{L}^j$ for all $j \in J$, i.e., we need to impose the following assumption.

Assumption 3 (Multiple Countries). *Complete labor mobility induces full wage convergence. Formally:*

$$\min_{i \in J} \left\{ \frac{T^i}{(1-m)\,\bar{L}^i} \right\} \geq \frac{\sum_{i \in J} T^i}{\sum_{i \in J} \bar{L}^i}$$

Lemma 3 characterizes the effects of trade and labor mobility on the relative wages.

Lemma 3 (Multiple Countries). *Suppose that Assumption 3 holds and $T^j > T^k$. Then:*

1. *If $\ln\left(\bar{L}^j / \bar{L}^k\right) < \left(1 - \theta - \theta^2\right) \ln\left(T^j / T^k\right)$, then trade induces divergence in real wages between countries j and k, but trade and labor mobility undo the divergence, inducing complete convergence. Formally:*
$$v^j(1,0) - v^k(1,0) > v^j(0,0) - v^k(0,0) > v^j(1,1) - v^k(1,1) = 0$$

2. *If $\left(1 - \theta - \theta^2\right) \ln\left(T^j / T^k\right) < \ln\left(\bar{L}^j / \bar{L}^k\right) < \ln\left(T^j / T^k\right)$, then trade induces convergence in real wages between countries j and k and trade and labor mobility induce complete convergence. Formally:*
$$v^j(0,0) - v^k(0,0) > v^j(1,0) - v^k(1,0) > v^j(1,1) - v^k(1,1) = 0$$

3. *If $\ln\left(\bar{L}^j / \bar{L}^k\right) > \ln\left(T^j / T^k\right)$, then trade induces a reversal of fortune between countries j and k but trade and labor mobility undo this reversal, inducing complete convergence in real wages. Formally:*
$$v^j(0,0) - v^k(0,0) > v^j(1,1) - v^k(1,1) = 0 > v^j(1,0) - v^k(1,0)$$

Proof: *see online appendix.* ■

Under free trade, labor mobility induces full convergence in real wages in all of the countries in the world. The reason is that mobile workers migrate from the relatively poor countries under free trade (those with low $T^i/\bar{L}^i$) to the relatively rich countries under free trade (those with high $T^i/\bar{L}^i$) until real wages are the same in all locations. There is only one implicit condition behind this result: There must be enough mobile workers in poor countries so that migration from poor to rich countries is sufficient to fully equalize T^i/L^i in all countries. Assumption 3 ensures that this is the case even for the poorest country in the world (lowest $T^i/\bar{L}^i$). Formally, Assumption 3 implies that, if all the mobile workers in the poorest country in the world decide to migrate to other countries, the real wage of a worker in that country will be higher than in the rest of world. Trade alone has an ambiguous effect on convergence. While, under autarky, differences in real wages depend only on relative levels of productivity (real wages are higher in country j than in country k when $T^j > T^k$), under free trade, they also depend on relative labor abundance (real wages are higher in country j than in country k when $T^j/\bar{L}^j > T^k/\bar{L}^k$). Since it is perfectly possible that $T^j > T^k$, but $T^j/\bar{L}^j < T^k/\bar{L}^k$, trade can lead to a reversal of fortune if the country with a higher aggregate level of productivity is relatively labor-abundant.

So far, we have considered polar cases, i.e., "free trade" means that all countries are allowing free trade and "autarky" means that there is no trade at all. The same is true of our consideration of labor mobility. However, it is possible that countries are trading only with some countries. Similarly, countries may accept labor mobility only with a restricted group of countries. Proposition 3 characterizes the political equilibrium when each country can decide to trade or not and can decide to allow labor mobility or not with each other country. The only restriction that we impose is that if country i accepts free trade (labor mobility) with country j and country j accepts free trade (labor mobility) with country k, then country i must accept free trade (labor mobility) with country k.

Proposition 3 (Multiple Countries). *Suppose that Assumption 3 holds and assume that $T^j \neq T^k$ and $T^j/\bar{L}^j \neq T^k/\bar{L}^k$ for all $j, k \in J$ and $j \neq k$. Then:*

1. *No trade and any pattern of labor mobility is a Nash equilibrium. Moreover, among those equilibria, no trade and complete free labor mobility prevail over the other equilibria for all countries.*

2. *No labor mobility and any pattern of trade is a Nash equilibrium. Moreover, among those equilibria, no labor mobility and complete free trade dominates the other equilibria for all countries.*

3. $W_G^j(1,0) > W_G^j(0,1)$ *if and only if:*

$$\ln\left[\frac{\sum_{i\in J}\left(T^i\right)^{\frac{1}{1+\theta}}\left(\bar{L}^i\right)^{\frac{\theta}{1+\theta}}}{\left(T^j\right)^{\frac{1}{1+\theta}}\left(\bar{L}^j\right)^{\frac{\theta}{1+\theta}}}\right] > m\ln\left(\frac{\max_{i\in J}\left\{T^i\right\}}{T^j}\right) \tag{4}$$

   In other words, if the above condition holds, then for country j, complete free trade and no labor mobility are better than complete free factor mobility and no trade.

4. *Any pattern of trade policy other than complete autarky and any pattern of labor mobility policy within the countries that trade with each other other than no labor mobility are not a Nash equilibrium. In particular, complete free trade and any pattern of labor mobility policy other than no mobility are not a Nash equilibrium.*

Proof*: see online appendix.* ■

Proposition 3 confirms our main results in a multi-country setting. Although there are many equilibria, note that complete free trade is incompatible with any form of labor mobility. The reason for this is that, under free trade, workers in a relatively rich country always prefer to block labor mobility from relatively poor countries. This produces a cascade effect. The richest country does not want to accept labor mobility. Then, the second-richest country also prefers to block labor mobility and so on until labor mobility is completely blocked. Moreover, it is not possible to divide the world into zones that allow free trade and free labor mobility within the zone but do not allow trade or labor mobility with the rest of world. The problem is that each free trade zone is a miniature version of the world under complete free trade. Hence, the richer countries within the zone will prefer to block intra-zone labor mobility.

Proposition 3 also extends our results concerning how countries rank different equilibria. If there is no trade at all, then all countries will be at least as well off with full labor mobility as with any other equilibrium that restricts labor mobility. Mobile workers will relocate to the most productive country in the world, while immobile workers all over the world and all workers in the most productive country in the world will not be affected by migration flows, since their wages are only determined by the level of productivity. If there is no labor mobility at all, then all countries are better off with complete free trade rather than with any other equilibrium that imposes restrictions on trade. This is a standard gains-from-trade argument in a Ricardian model. The larger the set of countries that engage in free trade, the larger the gains from comparative advantage and trade. Finally, we can compare free trade and no labor mobility with no trade and free labor mobility. Equation (4) is the key condition. The left-hand side of (4) represents the gains for country j associated with moving from complete autarky to complete free trade. The right-hand side of (4) represents the gains for country j associated with moving from no labor mobility to full labor mobility (all the while under autarky). Note that, for the richest country in the world under autarky (the country with the highest T^j), condition (4) always holds because gains from trade are positive, while labor mobility under autarky does not have any effect on the country. In general, in this model, gains from trade are relatively high for an sparsely populated country with low productivity ($\left(T^j\right)^{\frac{1}{1+\theta}}\left(\bar{L}^j\right)^{\frac{\theta}{1+\theta}}$ low), while gains from labor mobility under autarky are relatively high for a country with low productivity (T^j low). Since some very poor countries are also very populous, it is not clear which countries will prefer free trade and no labor mobility to no trade and free labor mobility.

5 Extension II: Increasing Returns to Scale and Extractive Elites

Motivated by the episodes of mass migration to America in the 19th century, in this section we explore two possible extensions that lead to free labor mobility within a Ricardian framework. First, we make a major change in the economy and a minor modification in the international political game. In particular, following Krugman (1979, 1980) and Helpman (1981), we introduce product differentiation, monopolistic competition and economies of scale in one of the sectors of the simple Ricardian economy. We also allow for partial restrictions to labor mobility, i.e., countries can accept a limited number of immigrants. Except for these two important changes, the rest of the model is the same as in section 3. Second, keeping the economic environment of Section 3 fixed, we explore a change in the political game. In particular, following Acemoglu and Robinson (2012), we introduce an extractive elite in each country.

5.1 Increasing Returns to Scale (Krugman 1978)

There are two countries ($J = 2$), two tradeable goods ($Z_T = \{1, 2\}$) and one non-tradeable good ($Z_N = \{3\}$). Goods 2 and 3 are homogenous products, but good 1 is a differentiated product. All agents have the same preferences given by $u\left(c^j\right) = \sum_{z\in Z}\alpha_z \ln\left(c_z^j\right)$ and $c_1^j = \left[\int_0^n c_1^j\left(i\right)^\rho di\right]^{\frac{1}{\rho}}$, where $\alpha_z \in (0, 1)$, $\sum_{z\in Z}\alpha_z = 1$, $\rho \in (0, 1)$, and $c_1^j\left(i\right)$ indicates the quantity of variety $i \in [0, n]$ that is consumed. Given this utility function, demands are $C_1^j\left(i\right) = \alpha_1\left(G^j\right)^{\sigma-1} p_1^j\left(i\right)^{-\sigma} Y^j$ for $i \in [0, n]$, $p_2^j C_2^j = \alpha_2 Y^j$, $p_3^j C_3^j = \alpha_3 Y^j$, where Y^j is aggregate income and $G^j = \left[\int_0^n p_1^j(i)^{1-\sigma}\right]^{\frac{1}{1-\sigma}}$ is the exact price index for good 1, $p_1^j(i)$ is the price of variety i, p_z^j is the price of good z and $\sigma = (1-\rho)^{-1}$. The production function in sector 1 is $L_1^j(i) = a_{L,1}^j Q_1^j(i) + f$, where $L_1^j(i)$ is the labor employed in the production of variety i of good 1, $Q_1^j(i)$ is the production of variety i of good 1, $f > 0$ is the fixed cost of producing a variety of good 1. Production functions in sectors 2 and 3 are as in the simple Ricardian model, i.e., $L_2^j = a_{L,2}^j Q_2^j$, $L_3^j = a_{L,3}^j Q_3^j$. Then, $\int_0^{n^j} L_1^j(i)\,di + L_2^j + L_3^j = L^j$, where L^j is the labor force of country j. As in previous sections, $\bar{L}^j$ indicates the labor endowment of country j and only a fraction $m \in [0,1]$ of $\bar{L}^j$ is mobile. Let $A_z = a_{L,z}^2/a_{L,z}^1$ and assume $A_1 > A_2$, i.e., country 1 has a comparative advantage in good 1.

Let w^j denote the wage rate. The profits of a firm that produces variety i of good 1 are given by $\pi_1^j(i) = \left[p_1^j(i) - w^j a_{L,1}^j\right] Q_1^j(i) - w^j f$, which implies that the price that maximizes profits is $p_1^j(i) = \sigma(\sigma-1)^{-1} w^j a_{L,1}^j$. Moreover, free entry implies that in equilibrium $\pi_1^j(i) = 0$ and, hence, $L_1^j(i) = \sigma f$. Therefore, the labor allocation $\left(n^j, L_2^j, L_3^j\right)$ is the solution of maximizing $(\sigma-1)\,p_1^j n^j f/a_{L,1} + \sum_{z=2,3}\left(p_z^j L_z^j/a_{L,z}^j\right)$ subject to $n^j\sigma f + L_2^j + L_3^j = L^j$ and the wage rate is given by $w^j = \max\left\{(\sigma-1)\,p_1^j/\sigma a_{L,1}^j, p_2^j/a_{L,2}^j, p_3^j/a_{L,2}^j\right\}$.

Under autarky all goods must be produced domestically. Hence, $p_1^j = w^j a_{L,1}^j \sigma/(1-\sigma)$, $p_z^j = w^j a_{L,z}^j$ for $z = 2,3$, $n^j\sigma f = \alpha_1 L^j$, $L_2^j = \alpha_2 L^j$ and $L_3^j = \alpha_3 L^j$. Then, the indirect utility of a worker in country j is given by:

$$v^j = C + T^j + \frac{\alpha_1}{\sigma-1}\ln\left(\frac{\alpha_1 L^j}{f}\right),$$

where $C = \sum_z \alpha_z \ln(\alpha_z) - \alpha_1(\sigma-1)^{-1}\ln\left[(\sigma)^\sigma(\sigma-1)^{(\sigma-1)}\right]$ and $T^j = -\sum_{z\in Z}\alpha_z \ln\left(a_{L,z}^j\right)$. Note that v^j is increasing in L^j. As a consequence, if labor mobility is allowed, there are three possible situations. If $T^1 - T^2 > [\alpha_1/(\sigma-1)]\ln\left[\frac{\bar{L}^2 + m\bar{L}^1}{(1-m)\bar{L}^1}\right]$, then all mobile workers will go to or stay in country 1 because, for any allocation of mobile workers to countries, we have $v^1 > v^2$. If $[\alpha_1/(\sigma-1)]\ln\left[\frac{(1-m)\bar{L}^2}{\bar{L}^1 + m\bar{L}^2}\right] < T^1 - T^2 < [\alpha_1/(\sigma-1)]\ln\left[\frac{\bar{L}^2 + m\bar{L}^1}{(1-m)\bar{L}^1}\right]$, then there are two equilibria, in each of which all mobile workers go to or stay in only one country. Finally, if $T^1 - T^2 < [\alpha_1/(\sigma-1)]\ln\left[\frac{(1-m)\bar{L}^2}{\bar{L}^1 + m\bar{L}^2}\right]$, then all mobile workers go to or stay in country 2 because $v^2 > v^1$ for any allocation of mobile workers to countries. The intuition is straightforward. Due to the existence of increasing returns to scale in sector , under autarky the indirect utility of workers increases in step with the labor endowment of the country (a higher labor endowment implies that more varieties of good are produced in the autarky equilibrium). As a consequence, once mobile workers start moving to one country, the indirect utility of workers in the recipient country goes up, which reinforces migration flows in the same direction.

Suppose there is free trade and $A_1 > \alpha_1 L^2/\alpha_2 L^1 > A_2$. Then, country 1 specializes in good 1 and country 2 specializes in good 2. Thus, $w^1 = (\sigma-1)\,p_1/\sigma a_{L,1}^1 = p_3/a_{L,3}^1$, $w^2 = p_2/a_{L,1}^2 = p_3/a_{L,3}^2$, $n^1 = n = (1-\alpha_3)\,L^1/\sigma f$, $n^2 = 0$ and the balanced trade condition implies $\alpha_2 w^1 L^1 = \alpha_1 L^2 w^2$. Then, the indirect utility functions are given by:

$$v^1 = C + T^1 + \alpha_2 \ln \left(\frac{a^1_{L,2}\alpha_1 L^2}{a^2_{L,2}\alpha_2 L^1} \right) + \frac{\alpha_1}{\sigma - 1} \ln \left[\frac{(1-\alpha_3) L^1}{f} \right]$$
$$v^2 = C + T^2 + \alpha_1 \ln \left(\frac{a^2_{L,1}\alpha_2 L^1}{a^1_{L,1}\alpha_1 L^2} \right) + \frac{\alpha_1}{\sigma - 1} \ln \left[\frac{(1-\alpha_3) L^1}{f} \right]$$

If labor mobility is not allowed, then $L^j = \bar{L}^j$. Under free labor mobility, mobile workers will go to or stay in the country with higher v^j. Note that, although v^1 can be increasing or decreasing in L^1, $v^1 - v^2$ is always decreasing in L^1 and increasing in L^2, as in the simple Ricardian model. Therefore, and, provided that there is enough mobile workers, they will relocate until $v^1 = v^2$, which implies $L^2/L^1 = (\alpha_2/\alpha_1)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$. Moreover, there will be migration to country 1 whenever $\bar{L}^2/\bar{L}^1 > (\alpha_2/\alpha_1)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$ and migration to country 2 whenever $\bar{L}^2/\bar{L}^1 < (\alpha_2/\alpha_1)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$. The intuition is straightforward. Under free trade, country 1 specializes in the production of good 1, the sector that operates under increasing returns to scale. Therefore, the number of varieties of good produced in the trading equilibrium and consumed by both countries only depends on the size of country 's labor force. This implies that the effect that the allocation of mobile workers has on the varieties of good that are produced affects both countries symmetrically. Finally, the distribution of mobile workers between the countries does not violate either $L^j \in \left[(1-m)\bar{L}^j, \bar{L}^j + m\bar{L}^{-j}\right]$ or $A_1 > \alpha_1 L^2/\alpha_2 L^1 > A_2$, provided that Assumption 1 holds.

Next, we introduce the possibility that countries place partial restrictions on labor mobility. Suppose that each country can choose among three migration policies. As in previous sections, let $\lambda_M = 0$ indicate that at least one country does not accept labor mobility and, hence, mobile workers are forced to stay in their country. Let $\lambda_M = 1$ indicate that both countries accept complete free labor mobility. Let $\lambda_M = \bar{\lambda}_M < 1$ indicate that the recipient country accepts, at most, no more than a fraction $\bar{\lambda}_M$ of the mobile workers from the other country, while the country of origin allows at least some portion $\bar{\lambda}_M$ of the mobile workers of that country to emigrate. As in previous sections, trade policy can be no trade ($\lambda_T = 0$) or complete free trade ($\lambda_T = 1$). In order to characterize the political equilibrium, we impose Assumptions 4 and 5.

Assumption 4 (Increasing Returns to Scale). *Regardless of migration flows, under autarky, country* 1 *is richer than country* 2.

$$T^1 - T^2 > \frac{\alpha_1}{\sigma - 1} \ln \left[\frac{\bar{L}^2 + m\bar{L}^1}{(1-m)\bar{L}^1} \right]$$

Under free trade, with $\lambda_M = 0, \bar{\lambda}_M$, *country* 1 *is richer than country* 2.

$$\frac{\alpha_1 \left(1 - \bar{\lambda}_M m\right) \bar{L}^2}{\alpha_2 \left(\bar{L}^1 + \bar{\lambda}_M m \bar{L}^2\right)} > (A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$$

The first part of Assumption 4 ensures that, under autarky, country 1 is richer than country 2 no matter where mobile workers decide to go. This allows us to avoid dealing with multiple economic equilibria. If complete or partial labor mobility is allowed, mobile workers will always decide to go to or stay in country 1.[10] The second part of Assumption 4 deals with the effects of labor mobility under free trade. It rules out uninteresting cases in which partial labor mobility is not binding because even when $\lambda_M = \bar{\lambda}_M$, enough workers can move to equalize real wages in the countries. In order to simplify the analysis, it also rules out the possibility of a reversal of fortune. Thus, under free trade, it always the case that $L^2/L^1 \geq (\alpha_2/\alpha_1)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$, which implies that country 1 is never poorer than country 2.

Assumption 5 (Increasing Returns to Scale). *Immobile workers in country 2 are better off under free trade and partial labor mobility than under autarky and no labor mobility.*

$$\alpha_1 \ln\left[\frac{A_1\alpha_2\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}{\alpha_1\left(1-\bar{\lambda}_M m\right)\bar{L}^2}\right] > \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\alpha_1\bar{L}^2}{(1-\alpha_3)\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}\right]$$

Moving from autarky and no labor mobility to free trade and partial labor mobility has two effects on immobile workers in country 2. The first term captures the standard gains from trade coming from specialization in the sector with a comparative advantage. Moreover, migration to country 1 only reinforces this effect. Second, the second term captures the effects on the number of varieties produced in equilibrium. Under autarky and no labor mobility, country 2 produces $n^2 = \alpha_1\bar{L}^2/\sigma f$ varieties of good 1, while under free trade and partial labor mobility in the trading equilibrium, $n = (1-\alpha_3)\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)/\sigma f$ varieties are produced. If $n \geq n^2$, Assumption 5 holds trivially. If $n < n^2$, Assumption 5 simply means that the comparative advantage effect always prevails over the variety effect.

Proposition 4 characterizes the political equilibrium.

Proposition 4 (Increasing Returns to Scale). *Suppose that Assumptions 1, 4 and 5 hold. Then:*

1. *No trade and no labor mobility is a Nash equilibrium.*
2. *No trade and partial labor mobility is a Nash equilibrium if and only if:*

$$\bar{\lambda}_M\left\{T^1 - T^2 + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\bar{L}^1+\bar{\lambda}_M m\bar{L}^2}{\left(1-\bar{\lambda}_M m\right)\bar{L}^2}\right]\right\} \geq -\frac{\alpha_1}{\sigma-1}\ln\left(1-\bar{\lambda}_M m\right)^{\frac{1}{m}}$$

Moreover, if no trade and partial labor mobility are an equilibrium, then $W_G^j\left(0,\bar{\lambda}_M\right) \geq W_G^j(0,0)$ for $j = 1,2$.

[10] It is possible to relax this assumption to $T^1 - T^2 > \frac{\alpha_1}{\sigma-1}\ln\left[\frac{(1-m)\bar{L}^2}{\bar{L}^1+m\bar{L}^2}\right]$, provided that we assume that, when there are two equilibria, all mobile workers decide to go to or stay in country 1. In other words, the cost of relaxing this condition is the imposition of an equilibrium selection assumption.

3. *No trade and free labor mobility is a Nash equilibrium if and only if:*

$$\bar{\lambda}_M \left\{ T^1 - T^2 + \frac{\alpha_1}{\sigma - 1} \ln \left[\frac{\bar{L}^1 + \bar{\lambda}_M m \bar{L}^2}{\left(1 - \bar{\lambda}_M m\right) \bar{L}^2} \right] \right\} \leq \left(T^1 - T^2\right) + \frac{\alpha_1}{\sigma - 1} \ln \left[\frac{\left(\bar{L}^1 + m\bar{L}^2\right)(1-m)^{\frac{1}{m}}}{(1-m)\,\bar{L}^2 \,(1 - \bar{\mu} m)^{\frac{1}{m}}} \right]$$

Moreover, if no trade and free labor mobility is an equilibrium, then $W_G^j(0,1) \geq \max\left\{W_G^j(0,0), W_G^j(0,\bar{\mu})\right\}$ *for* $j = 1, 2$.

4. *Free trade and no labor mobility is a Nash equilibrium if and only if:*

$$\left(\frac{1 - \alpha_3}{\alpha_2}\right)^{\frac{1}{\sigma}} (A_1)^{\frac{\sigma-1}{\sigma}} > \frac{\alpha_1 \bar{L}^2}{\alpha_2 \bar{L}^1}$$

5. *Suppose that the following condition holds:*

$$\left(\bar{L}^1 + \bar{\lambda}_M m \bar{L}^2\right)^{\frac{\alpha_1 - \alpha_2(\sigma-1)}{\sigma-1}} \left[\left(1 - \bar{\lambda}_M m\right) \bar{L}^2\right]^{\alpha_2} > \max\left\{ \left(\bar{L}^1\right)^{\frac{\alpha_1 - \alpha_2(\sigma-1)}{\sigma-1}} \left(\bar{L}^2\right)^{\alpha_2}, \left(L^1\right)^{\frac{\alpha_1 - \alpha_2(\sigma-1)}{\sigma-1}} \left(L^2\right)^{\alpha_2} \right\},$$

where $L^2/L^1 = (\alpha_2/\alpha_1)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$*. Then, free trade and partial labor mobility is a Nash equilibrium, but free trade and free labor mobility is not a Nash equilibrium.*

Proof*: see online appendix.* ■

As in previous sections, no trade and no labor mobility is always a Nash equilibrium because there is no way that a country can change the world equilibrium with a unilateral move in policy. No trade and partial (free) labor mobility is also a Nash equilibrium. The intuition is as follows. Under autarky, country 1 favors labor mobility because this brings more workers to the country and, hence, more varieties of good 1 can be produced in equilibrium. Under autarky, immobile workers in country 2 are opposed to labor mobility because mobile workers will leave the country, thereby reducing the varieties of good that can be produced in equilibrium. Conversely, mobile workers in country 2 support labor mobility because they are better off if they relocate to country 1. The condition in part 2 (3) assures that the gains from partial (free) labor mobility enjoyed by mobile workers in country 2 more than compensate for the losses sustained by immobile workers. Note also that, when these equilibria exist, the less restrictive equilibrium always dominates more restrictive one.

Free trade and no labor mobility is always a Nash equilibrium. Due to Assumption 1, country 1 specializes in the sector that operates under increasing returns to scale. Thus, in addition to the standard gains from trade coming from the specialization in the sector with a comparative advantage, free trade allows country 1 to further exploits economies of scale in sector 1. For country 2, free trade has two effects. First, country 2 also enjoys the standard gains from trade. Second, under autarky, country 2 produces $n^2 = \alpha_1 \bar{L}^2 / \sigma f$ varieties of good 1, while in the trading equilibrium $n = (1 - \alpha_3)\, \bar{L}^1 / \sigma f$ varieties are produced. The condition in part 4 ensures that the comparative advantage effect prevails over the variety effect.

The key result in proposition 4 is part 5. Free trade and partial labor mobility is a Nash equilibrium, but free trade and complete free labor mobility is not. The intuition is as follows. Under free trade, labor mobility has two effects on country 1. First, there is a terms-of-trade effect. As workers move to country 1, L^1 increases and L^2 decreases, which leads to a deterioration in the terms of trade of country 1. Second, there is a scale effect. As L^1 increases, more varieties of good 1 are produced in the trading equilibrium. Thus, under free trade, labor mobility has an ambiguous effect in terms of the level of well-being in country 1. The condition in part 5 of the proposition simply states that the scale effect prevails over the terms-of-trade effect when country 1 allows partial labor mobility, but the opposite is true when there is completely free labor mobility.

5.2 Extractive Elite (Acemoglu and Robinson, 2012)

In this section, we introduce an elite group into the simple Ricardian model. Consider an economy with two countries ($J = 2$), two tradeable goods ($Z_T = \{1, 2\}$) and one non-tradeable good ($Z_N = \{3\}$). Production functions, endowments and preferences are as in section 3. The novelty is that each of the countries is populated by two types of agents: L^j workers, each of whom owns one unit of labor, and E^j elite members. The elite is a purely extractive one with no productive role in society (Acemoglu and Robinson, 2012). The elite simply appropriates a fraction $\beta^j \in (0, 1)$ of L^j. Moreover, expropriation is socially costly. A fraction $\delta \in (0, 1)$ of each unit expropriated by the elite is lost in the process. Formally, after expropriation, each worker keeps $\left(1 - \beta^j\right)$ units of labor and each member of the elite gets $\delta\beta^j L^j/E^j$ units of labor. Thus, the effective labor force of country j is $\tilde{L}^j = B^j L^j = \left[1 - \beta^j (1 - \delta)\right] L^j$. As in previous sections, only a fraction $m \in [0, 1]$ of the labor force of each country is mobile at zero cost. The rest of the labor force and elite members are immobile.

Each government selects trade and migration policies in order to maximize an utilitarian welfare function W_G^j, whose weight depends on the size of each group as well as on how influential they are in the political process. In particular, we assume that each government maximizes

$$W_G^j = \frac{\bar{L}^j \left[(1 - m)\, v^{j,im} + m v^{j,m}\right] + E^j \left(1 + \varphi^j\right) v^{j,e}}{\bar{L}^j + E^j \left(1 + \varphi^j\right)},$$

where $v^{j,im}$, $v^{j,m}$, $v^{j,e}$ are the indirect utility functions of an immobile worker, a mobile worker and a member of the elite, respectively.[11] $\varphi^j \in [-1, \infty]$ is a measure of the political power of the elite. If $\varphi^j = -1$ ($\varphi^j = \infty$), then the government is a perfect agent for domestic workers (the elite). φ^j can also be considered a measure of how unequal political institutions are (Acemoglu and Robinson, 2012). Note also that W_G^j takes into account the welfare of emigrants, but not the welfare of immigrants. The reason for this is that immigrants tend to have much less political influence than domestic workers do, particularly with regard to immigration policies. The timing of events is as in previous sections, and we assume that the elite groups collect their shares after migration has taken place but before production, trade and consumption decisions have been made.

Let $T^j = -\sum_{z \in Z} \alpha_z \ln\left(a_{L,z}^j\right)$ be the productivity of country j. In order to highlight the role of the elite, assume $T^1 = T^2 = T$. Then, under autarky, the indirect utilities of a worker and a member of the

[11] Grossman and Helpman (2001, 2002) provide several sets of micro-foundations for a welfare function of this type, including a combination of a probabilistic voting model with a lobby model.

elite are given by:

$$
\begin{aligned}
v^{j,h} &= C + T + \ln\left(1-\beta^{j}\right), \\
v^{j,e} &= C + T + \ln\left(\delta\beta^{j}\right) + \ln\left(L^{j}/E^{j}\right)
\end{aligned}
$$

If labor mobility is not allowed, then $L^j = \bar{L}^j$. If labor mobility is allowed, then all mobile workers go to or stay in the country with the lowest β^j.

Under free trade, if $A_1 > \alpha_1\tilde{L}^2/\alpha_2\tilde{L}^1 > A_2$, then country j specializes in good $z = j \in \{1, 2\}$. Thus, $p_1 = w^1 a^1_{L,1}$, $p_2 = w^2 a^2_{L,2}$, $p^j_3 = w^j a^j_{L,3}$, and the balanced trade condition is $\alpha_2 w^1\tilde{L}^1 = \alpha_1 w^2\tilde{L}^2$. Therefore, the indirect utility of a worker in country j is given by:

$$
\begin{aligned}
v^{1,h} &= C + T + \alpha_2 \ln\left(\frac{\alpha_1 B^2 L^2}{A_2\alpha_2 B^1 L^1}\right) + \ln\left(1-\beta^1\right) \\
v^{2,h} &= C + T + \alpha_1 \ln\left(\frac{A_1\alpha_2 B^1 L^1}{\alpha_1 B^2 L^2}\right) + \ln\left(1-\beta^2\right)
\end{aligned}
$$

The indirect utility of an elite member in country j is given by:

$$
\begin{aligned}
v^{1,e} &= C + T + \alpha_2 \ln\left(\frac{\alpha_1 B^2 L^2}{A_2\alpha_2 B^1 L^1}\right) + \ln\left(\delta\beta^1\right) + \ln\left(L^1/E^1\right) \\
v^{2,e} &= C + T + \alpha_1 \ln\left(\frac{A_1\alpha_2 B^1 L^1}{\alpha_1 B^2 L^2}\right) + \ln\left(\delta\beta^2\right) + \ln\left(L^2/E^j\right)
\end{aligned}
$$

If labor mobility is not allowed, then $L^j = \bar{L}^j$. If labor mobility is allowed, mobile workers will go to or stay in the country with the highest v^j. Since v^1 is decreasing in L^1/L^2 while v^2 is increasing in L^1/L^2, if there are enough mobile workers, they will relocate until $v^1 = v^2$. This implies $L^2/L^1 = \left(\alpha_2\Gamma^2/\alpha_1\Gamma^1\right)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$, where $\Gamma^j = \left(1-\beta^j\right)^{\frac{1}{\alpha_1+\alpha_2}} / \left[1-\beta^j(1-\delta)\right]$. Moreover, there will be migration to country 1 whenever $\bar{L}^2/\bar{L}^1 > \left(\alpha_2\Gamma^2/\alpha_1\Gamma^1\right)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$ and migration to country 2 whenever $\bar{L}^2/\bar{L}^1 < \frac{\alpha_2\Gamma^2}{\alpha_1\Gamma^1}(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$. Finally, the distribution of mobile workers between the countries does not violate either $L^j \in \left[(1-m)\bar{L}^j, \bar{L}^j + m\bar{L}^{-j}\right]$ or $A_1 > \alpha_1\tilde{L}^2/\alpha_2\tilde{L}^1 > A_2$, provided that the following assumption holds.

Assumption 6 (Extractive Elite). *Regardless of migration flows, if countries trade, country j specializes in good $z = j$ for $j = 1, 2$. Moreover, under free trade labor mobility induces full wage convergence. Formally:*

$$
\left(\frac{B^1}{B^2}\right)A_1 > \frac{\alpha_1\left(\bar{L}^2 + m\bar{L}^1\right)}{\alpha_2(1-m)\bar{L}^1} > \left(\frac{1-\beta^2}{1-\beta^1}\right)^{\frac{1}{\alpha_1+\alpha_2}}(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}} > \frac{\alpha_1(1-m)\bar{L}^2}{\alpha_2\left(\bar{L}^1 + m\bar{L}^2\right)} > A_2\left(\frac{B^1}{B^2}\right)
$$

In order to simplify the characterization of the political equilibrium, we also impose the following assumption.

Assumption 7 (Extractive Elite). *Gains from trade are sufficiently high. Formally:*

$$\alpha_2 \ln\left(\frac{\alpha_1 B^2 L^2}{A_2\alpha_2 B^1 L^1}\right) > \ln\left(\frac{\bar{L}^1 + m\bar{L}^2}{L^1}\right)$$
$$\alpha_1 \ln\left(\frac{A_1\alpha_2 B^1 L^1}{\alpha_1 B^2 L^2}\right) > m\ln\left(\frac{1-\beta^1}{1-\beta^2}\right),$$

where $L^2/L^1 = \left(\alpha_2\Gamma^2/\alpha_1\Gamma^1\right)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$ *and* $L^1 + L^2 = \bar{L}^1 + \bar{L}^2$*.*

The first part of Assumption 7 ensures that the elite of the rich country under autarky (country 1) prefers free trade and free labor mobility to autarky and free labor mobility. Intuitively, for the elite of country 1, when there is free labor mobility, gains from trade prevail over the negative effect that trade liberalization has on the size of the labor force of country 1. The second part of Assumption 7 states that workers in the poor country under autarky (country 2) prefer free trade and free labor mobility to autarky and free labor mobility. Intuitively, the gains from trade for all workers in country 2 are higher than the productivity gains under autarky for mobile workers.

The following proposition characterizes the political equilibrium.

Proposition 5 (Extractive Elite). *Suppose that Assumptions 6 and 7 hold and* $\beta^1 < \beta^2$*. Assume* $\bar{L}^2/\bar{L}^1 \neq \left(\alpha_2\Gamma^2/\alpha_1\Gamma^1\right)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$*. Then:*

1. *No trade and no labor mobility is always a Nash equilibrium.*
2. *Free trade and no labor mobility is always a Nash equilibrium. Moreover,* $W_G^j(1,0) \geq W_G^j(0,0)$ *for* $j = 1, 2$*.*
3. *No trade and free labor mobility is a Nash equilibrium if and only if* $1 + \varphi^2 \leq \frac{m\bar{L}^2 \ln\left(\frac{1-\beta^1}{1-\beta^2}\right)}{-E^2\ln(1-m)}$*.*
4. *If* $\bar{L}^2/\bar{L}^1 > \left(\alpha_2\Gamma^2/\alpha_1\Gamma^1\right)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$*, free trade and free labor mobility is a Nash equilibrium if and only if:*

   (a) $\left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2} > \left(\bar{L}^1\right)^{(1-\alpha_2)}\left(\bar{L}^2\right)^{\alpha_2}$ *and*

   $$1 + \varphi^1 > \bar{\varphi}^1 = \frac{\bar{L}^1\alpha_2\ln\left(\frac{L^1\bar{L}^2}{\bar{L}^1L^2}\right)}{E^1\ln\left[\frac{\left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2}}{\left(\bar{L}^1\right)^{(1-\alpha_2)}\left(\bar{L}^2\right)^{\alpha_2}}\right]}$$

   (b) $\left(L^1\right)^{\alpha_1}\left(L^2\right)^{1-\alpha_1} > \left(\bar{L}^1\right)^{\alpha_1}\left(\bar{L}^2\right)^{1-\alpha_1}$ *or* $\left(L^1\right)^{\alpha_1}\left(L^2\right)^{1-\alpha_1} < \left(\bar{L}^1\right)^{\alpha_1}\left(\bar{L}^2\right)^{1-\alpha_1}$ *and*

   $$1 + \varphi^2 < \bar{\varphi}^2 = \frac{-\bar{L}^2\alpha_1\ln\left(\frac{L^1\bar{L}^2}{\bar{L}^1L^2}\right)}{E^2\ln\left[\frac{\left(L^1\right)^{\alpha_1}\left(L^2\right)^{1-\alpha_1}}{\left(\bar{L}^1\right)^{\alpha_1}\left(\bar{L}^2\right)^{1-\alpha_1}}\right]}$$

5. *If* $\bar{L}^2/\bar{L}^1 < \left(\alpha_2\Gamma^2/\alpha_1\Gamma^1\right)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$*, free trade and free labor mobility is a Nash equilibrium if and only if:*

   (a) $\left(L^1\right)^{\alpha_1}\left(L^2\right)^{1-\alpha_1} > \left(\bar{L}^1\right)^{\alpha_1}\left(\bar{L}^2\right)^{1-\alpha_1}$ *and* $1+\varphi^2 > \bar{\varphi}^2$;

   (b) $\left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2} > \left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2}$ *or* $\left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2} < \left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2}$ *and* $1+\varphi^1 < \bar{\varphi}^1$.

Proof: *see online appendix.* ■

No trade and no labor mobility is always a Nash equilibrium because, if one country decides to isolate itself, there is nothing that the other country can do to change the political equilibrium. This is also a very unlikely equilibrium, however. In fact, free trade and no labor mobility is also always a Nash equilibrium which dominates complete isolation. No trade and free labor mobility is a Nash equilibrium when workers in the poor country under autarky (country 2) are politically powerful (φ^2 low). The intuition is straightforward. If one country decides to restrict trade, free trade is impossible no matter what policy is chosen by the other country. Under autarky, workers in country 1 and immobile workers in country 2 do not worry about immigration because real wages do not depend on labor endowments. Mobile workers in country 2 are eager to migrate to country 1 because real wages are higher there. The elite in country 1 favors labor mobility because it brings more workers to the country. The only group that will oppose free labor mobility is the elite in country 2, which would not be able to extract resources from mobile workers anymore. As a consequence, autarky and free labor mobility is an equilibrium if the elite in country 2 do not have sufficient political power.

Free trade and free labor mobility is a Nash equilibrium when the elite of the high-wage country under free trade and the workers in the low-wage country under free trade are politically powerful.[12] The intuition behind this result is straightforward. Domestic workers in a high-wage country under free trade are opposed to labor mobility because the flow of immigrants would reduce their wages. The extractive elite is also hurt by the reduction in the wage rate, but immigrants are also a new source of income (more workers to extract resources from). If the second effect outweighs the first, then the elite is in favor of labor mobility. As a consequence, labor mobility will be allowed only when the elite is powerful enough to impose its views. Domestic workers in a low-wage country under free trade are in favor of labor mobility because the flow of emigrants would increase their wages. Higher wages also benefit the extractive elite, but as mobile workers migrate to the other country, the elite has a smaller domestic labor force to extract resources from. If the second effect outweighs the first one, the elite is opposed to free labor mobility. Therefore, labor mobility will be allowed only when workers are powerful enough to impose their views. Thus, labor mobility can be a major source of conflict between workers and the elite. In the high-wage country, workers prefer to block labor mobility, while the elite prefer to allow it. Conversely, in the low-wage country, workers prefer to allow labor mobility, while the elite prefer to block it. Trade, on the other hand, is not a source of conflict between workers and the elite. The main reason for this is that, in the Ricardian model, there is only one factor of production and, hence, free trade makes it possible

[12] Real wages in country 1 are higher than in country 2 under free trade if and only if $\left(\alpha_1\Gamma^1\bar{L}^2/\alpha_2\Gamma^2\bar{L}^1\right)(A_3)^{\frac{\alpha_3}{\alpha_1+\alpha_2}} > 1$, i.e., when country 1 has a relative shortage of labor ($\bar{L}^2/\bar{L}^1$ high), it has a relatively less extractive elite (Γ^1/Γ^2 high), it specializes in goods with a high expenditure share (α_1/α_2 high) and it has relatively high level of productivity in non-tradeable goods (A_3 high).

to exploit the gains from specialization and trade without generating any redistributive effect. Recall, however, that labor mobility produces different effects under autarky and free trade and, hence, the elite of country 1 and workers in country 2 might prefer autarky and free labor mobility to free trade and free labor mobility, which is ruled out under Assumption 7.

Proposition 5 shows that, if we introduce a powerful elite that cares about aggregate income (wL), then free trade and free labor mobility could be a Nash equilibrium. More generally, all we need is a mechanism through which the payoff for each citizen in the rich country depends on aggregate income. For example, eliminate the extractive elite and suppose that rich countries charge an entry fee to foreign mobile workers, which is then distributed among domestic workers. In that case, the payoff for each worker in the rich country depends on the wage rate, but also on aggregate income.

6 Extension III: Beyond the Ricardian World

In this section we study trade and labor mobility in a model with multiple factors of production. In a Ricardian economy, trade policy is not a source of conflict because everybody gains when countries engage in international trade. It is Pareto superior. On the contrary, in a multiple factors economy, potentially, there are winners and losers from international trade. Moreover, in standard trade models, such as the Ricardo-Vinner specific factors model or the Hercksher-Ohlin model, if one factor is the winner in one country, then it will immediately be the loser in the other country. This implies that the only way to support free trade is to empower a different factor in each country. For example, in a simple two factors Hercksher-Ohlin model the abundant factor in each country must dominates domestic politics. This, however, is not necessarily the case once we introduce a non-tradeable sector in the scene. Indeed, in the context of a single small open economy, Galiani, Heymann and Magud (2010), Galiani and Somaini (2015) and Galiani, Schofield and Torrens (2014) develop several versions of multi-sectors models, in which workers employed in the non-tradeable sector do not support protectionist policies. We build on these models, extending them to the case of two economies that could potentially engage in trade of goods as well as into labor mobility between them. We find a region of the parameter space in which workers in both countries support free trade, but in which workers in rich country block international labor mobility.

Consider an economy with two countries ($J = 2$), two tradeable goods (a rural good F and manufactures M), one non-tradeable good (services N) and three factors of production (capital K, natural resources F and labor L). Production functions are given by

$$
\begin{aligned}
Q_F^j &= A_F^j \left(F^j\right)^b \left(K_F^j\right)^{1-b}, \\
Q_M^j &= A_M^j \left(L_M^j\right)^b \left(K_M^j\right)^{1-b}, \\
Q_N^j &= A_N^j L_N^j,
\end{aligned}
$$

where A_z^j is total factor productivity in sector $z = F, M, N$ in country j, F^j is the quantity of natural resources employed in sector F in country j, K_z^j is the quantity of capital employed in sector $z = F, M$ in country j, L_z^j is the quantity of labor employed in sector $z = M, N$ in country j, and $b \in (0, 1)$.[13]

[13] We could have easily assumed different coefficients in the production function of each tradeable sector. Qualitative results do not depend on this simplification. For a small open economy, see Galiani and Somaini (2015).

Factor endowments in country j are $\left(\bar{F}^j, \bar{K}^j, \bar{L}^j\right)$. All agents have the same preferences, given by $u\left(c^j\right) = \prod_{z \in Z}\left(c_z^j\right)^{\alpha_z}$, with $\alpha_z > 0$ and $\sum_{z \in Z} \alpha_z = 1$. Finally, suppose that each government selects trade and migration policies in order to maximize the utility of domestic workers. For example, this could be the case of two democracies, where workers are the majority of the voters.

In the appendix we fully characterize the equilibrium under autarky and free trade. Moreover, we prove that when the following assumption holds, country 1 has a comparative advantage in manufactures and country 2 specializes in rural products.

Assumption 8 (Multiple Factors). *Under free trade, country* 1 *is diversified and country* 2 *specializes in good* F. *Formally:*

$$\left(\frac{\bar{K}^1}{\bar{K}^2}\right) > \left[K\left(\frac{\bar{L}^1}{\bar{L}^2}, 1\right)\right]^{\frac{1}{1-b}},$$

$$\alpha_N \alpha_F \left(\frac{\bar{L}^1}{\bar{L}^2}\right) > (1-\alpha_N)(\alpha_N + b\alpha_M)\left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}}\left(\frac{\bar{F}^1}{\bar{F}^2}\right),$$

where $K\left(\frac{L^1}{L^2}, D\right) = \dfrac{\alpha_M\left[(1-\alpha_N)b+\alpha_N\right]^b (D)^b \left[\alpha_N + D(1-\alpha_N)b\left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}}\left(\frac{L^2 \bar{F}^1}{L^1 \bar{F}^2}\right)\right]^{1-b}\left(\frac{A_M^2}{A_M^1}\right)\left(\frac{L^2}{L^1}\right)^b}{\left[\alpha_N\alpha_F - D(1-\alpha_N)(\alpha_M b+\alpha_N)\left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}}\left(\frac{L^2 \bar{F}^1}{L^1 \bar{F}^2}\right)\right]}.$

The following proposition characterizes the political equilibrium.

Proposition 6 (Multiple Factors and Non-Tradeable Goods). *Suppose that assumption 8 holds. Assume that the following conditions hold*

$$\left(\frac{\bar{K}^1}{\bar{K}^2}\right) > \left[K\left(\frac{\bar{L}^1}{\bar{L}^2}, D\right)\right]^{\frac{1}{1-b}}, \text{ where } D = \left(\frac{\alpha_F + \alpha_M}{\alpha_F}\right)^{\frac{\alpha_F}{\alpha_M}}\left(\frac{\alpha_N + b\alpha_M}{\alpha_N}\right)^{\frac{\alpha_F + (1-b)\alpha_M}{\alpha_M b}},$$

$$\left(\frac{A_N^1}{A_N^2}\right)^{\frac{\alpha_N}{\alpha_M + \alpha_F}} > \frac{\alpha_N\alpha_F\left(\frac{\bar{L}^1}{\bar{L}^2}\right) - (\alpha_M b + \alpha_N)(1-\alpha_N)\left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}}\left(\frac{\bar{F}^1}{\bar{F}^2}\right)}{\alpha_M\left[(1-\alpha_N)b + \alpha_N\right]}.$$

Then, the trade and labor mobility game has only two Nash equilibria: no trade and no labor mobility and free trade and no labor mobility. Moreover, $v_L^j(1,0) > v_L^j(0,0)$ *for* $j = 1, 2$, *where* $v_L^j(\lambda_T, \lambda_M)$ *is the utility of a worker in country* j *under trade and labor mobility regime* (λ_T, λ_M). **Proof**: *see online appendix.* ■

As in previous sections no trade and no labor mobility is a Nash equilibrium. Nothing can be done if one country decides to fully isolate itself. Free trade and no labor mobility is a Nash equilibrium because workers in both countries gain from free trade. Workers in country 1 are better off accepting international trade than under autarky for two reasons. First, in country 1 free trade leads to an expansion of the manufacturing sector and a contraction of the rural sector. This induces an increase in the demand of labor. Second, free trade expands the aggregate income in the tradeable sectors, which increases the demand of the non-tradeable good and, hence, the demand of labor. Both effects operate in the same direction, pushing wages up. The situation for workers in country 2 is more complicated. On the one hand, free trade produces a contraction in the manufacturing sector and an expansion in the rural sector. This leads to a decrease in labor demand. On the other hand, free trade expands the demand of the non-tradeable good and, therefore, labor demand. This effect is bigger the higher the equilibrium terms of trade. The first condition in proposition 6 assures that the equilibrium terms of trade are high enough for the second effect to be dominant.

The second condition in proposition 6 implies that workers in country 1 are richer than workers in country 2. Thus, if international labor mobility is allowed, there will be migrations to country 1. This will lead to an increase in the labor supply of country 1, depressing domestic wages. In addition, the increase in the labor supply will expand the production of manufactures, inducing export-biased growth in country 1 and a corresponding decline in the terms of trade of country 1. In order to avoid these effects, workers in country 1 will oppose international labor mobility. As a consequence, free trade and free labor mobility is not a Nash equilibrium. No trade and free labor mobility is not a Nash equilibrium either. The workers in the high-wage country under autarky will block migration flows because any increase in the domestic labor force depresses wages.

Proposition 6 clearly illustrates that the results in sections 2-4 can be extended to a multifactor model. Moreover, the logic behind proposition 6 applies beyond the particular model we studied in this section. Workers employed in the non-tradeable sector gain from free trade because the demand of non-tradeable goods is maximized when the country engages in international trade. If workers in the non-tradeable sector are an important proportion of the labor force, as it is the case in many postindustrial economies, in each country there is a solid majority that supports free trade. International labor mobility, however, increases labor supply in high-wage countries, pushing wages down. As a consequence, workers in high-wage countries oppose massive immigration.

7 Conclusions

We have shown that, by combining a Ricardian economy with a simple international political economy model, we can explain the salient stylized facts about international trade and labor mobility. In a Ricardian world, countries use different technologies and, as a consequence, there is no wage equalization under free trade. This wedge in real wages opens the door to migration flows, which, combined with free trade, induce full wage convergence. However, workers in rich countries block immigration in order to protect their high wages. In contrast, nobody is willing to block free trade because, in a Ricardian world, everybody gains from international trade. Thus, our model naturally explains the present world equilibrium: few restrictions on international trade in goods and very restrictive barriers to international labor mobility. In two extensions of our model, we have also shown that it is possible to induce free trade and free labor mobility within a Ricardian framework. One possibility is to introduce increasing returns to scale. Then, workers in a sparsely populated rich country might prefer, at least during one phase in the development process, to allow immigration because a bigger labor force increases the number of varieties of the differentiated good that can be produced in equilibrium, which can offset the negative effect of immigration flows on wages. Another possibility is to introduce an extractive elite that prefers to have a bigger labor force to extract resources from. In a third extension we have explored trade and labor mobility beyond a Ricardian world. In a multifactor model with a non-tradeable sector we have also established conditions under which workers in both economies support free trade, but workers in rich countries oppose labor mobility.

Apart from explaining broad patterns of trade and migration policies, this study points to profound implications for the political economy of development. First, according to our model, workers in rich countries constitute a very conservative force worldwide. Does this imply that less inclusive political institutions in rich countries could be beneficial for the world as a whole? A naive interpretation of our extension involving an extractive elite would lead us to conclude that this is the case. Indeed, as the extractive elite in the rich country becomes more powerful (φ increases), it is more likely that, in equilibrium, there will be free trade and free labor mobility, which would induce full convergence in the levels of well-being of workers across the world. An important limitation of this interpretation, however, is that it fails to take into account the endogenous link between political and economic institutions. As the extractive elite in the rich country becomes more powerful, we should expect to see economic institutions deteriorate (β increases) (see, for instance, North and Thomas, 1973, and Acemoglu, Johnson and Robinson, 2005). In other words, our model highlights the fact that a socioeconomic group can play a very progressive internal role by favoring inclusive domestic economic institutions and, at the same time, a very conservative role in terms of worldwide equilibrium by supporting policies that restrict cross-country convergence in levels of well-being.

Second, the model illustrates a more general principle. Institutional differences combined with no factor mobility induce large differences in economic development across locations, while institutional differences and free factor mobility are associated with smaller or no differences in economic development across locations and a greater concentration of resources in locations that have properly functioning institutions. Thus, institutional differences point to a theory of differential development under no factor mobility, while they point to a theory of concentration of economic activity under free factor mobility. However, it is worth noting that, even when there is free factor mobility, better institutions in any location induce better economic outcomes. In other words, under free factor mobility, the quality of institutions does not account for differences in economic development across locations, but institutional change could still be a key determinant of global economic development over time.

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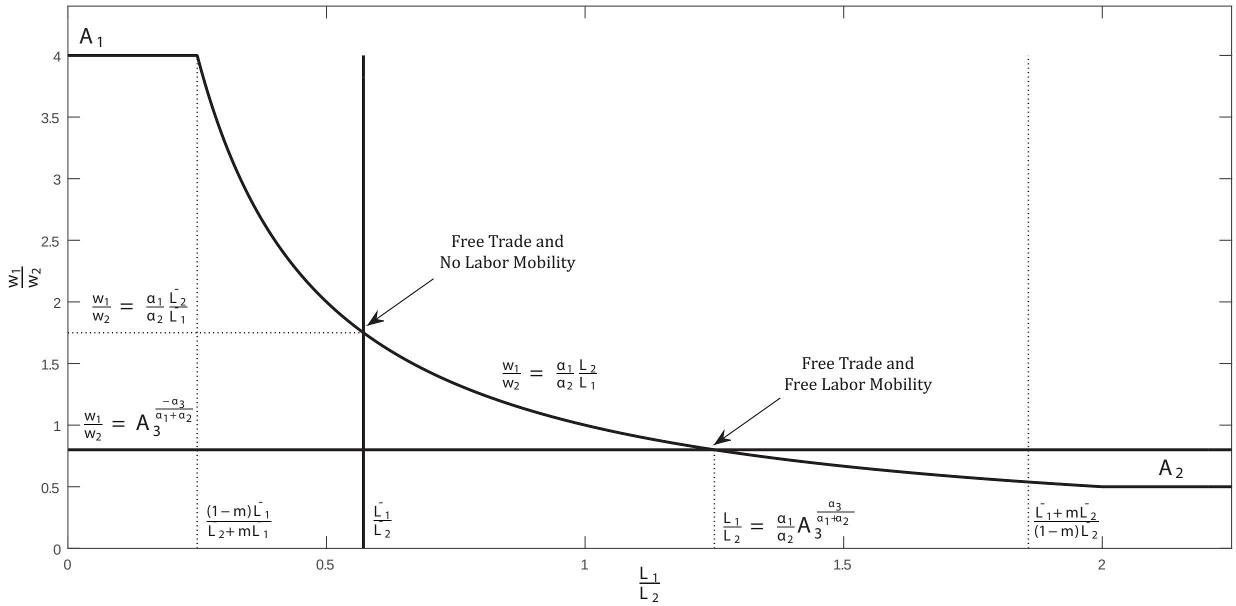

Figure 1: Trade and Labor Mobility in a Simple Ricardian Economy

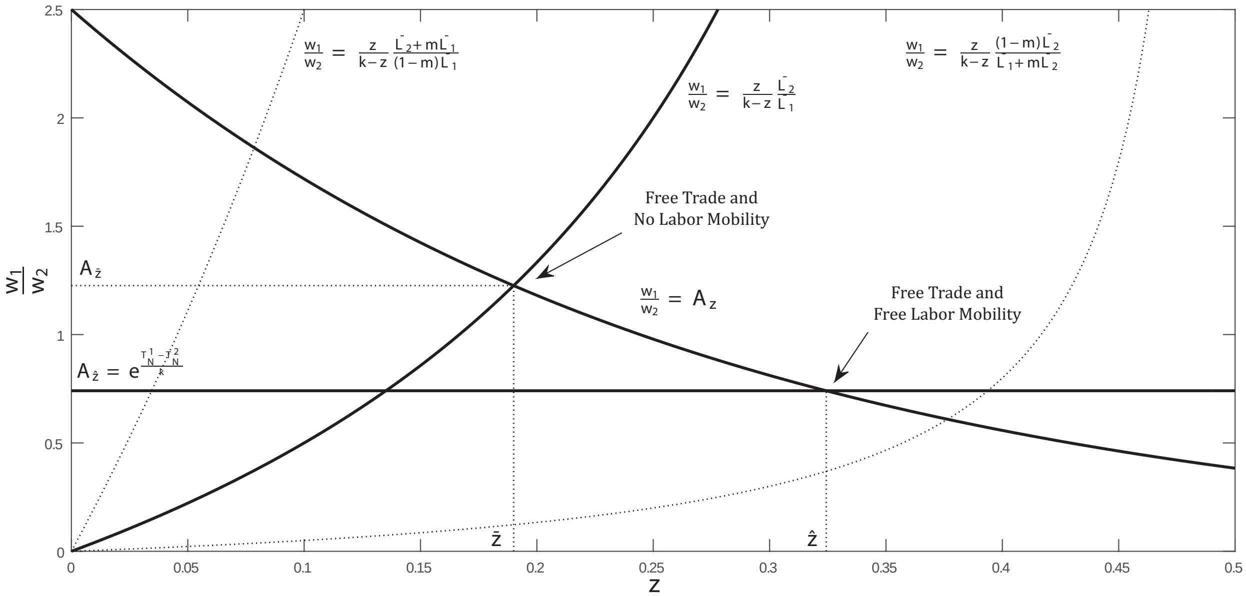

Figure 2: Trade and Labor Mobility in a Dornbusch-Fischer-Samuelson Economy

Online Appendix to The Political Economy of Trade and Labor Mobility in a Ricardian World

Sebastian Galiani * — University of Maryland and NBER
Gustavo Torrens† — Indiana University

First version: June 2015 - This version: March 2016

Abstract

In this appendix we prove all the lemmas and propositions discussed in the paper. We also provide a more detailed picture of the results briefly dicussed in Section 4.1.

A.1 A Simple Ricardian Economy

Lemma 1 (Simple Ricardian Economy). *Let $T^j = -\sum_{z\in Z}\alpha_z \ln\left(a^j_{L,z}\right)$ and assume $T^1 > T^2$. Define $\Delta = (\alpha_1+\alpha_2)\ln\left(\alpha_1\bar{L}^2/\alpha_2\bar{L}^1\right) + \left(T^1_N - T^2_N\right)$, where $T^j_N = -\alpha_3 \ln\left(a^j_{L,3}\right)$. Suppose that assumption 1 holds.*

1. *If $\Delta > T^1 - T^2$, then $v^1(1,0) - v^2(1,0) > v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0$.*
2. *If $0 < \Delta < T^1 - T^2$, then $v^1(0,0) - v^2(0,0) > v^1(1,0) - v^2(1,0) > v^1(1,1) - v^2(1,1) = 0$.*
3. *If $\Delta < 0$, then $v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0 > v^1(1,0) - v^2(1,0)$.*

Proof: Under autarky, regardless of the mobile workers' location decision, $v^j(0,\lambda_M) = C + T^j$. Thus, $v^1(0,0) - v^2(0,0) = T^1 - T^2$, which is positive by assumption. Under free trade, assumption 1 implies $v^1(1,\lambda_M) = C + T^1 + \alpha_2 \ln\left(\alpha_1 L^2/A_2\alpha_2 L^1\right)$ and $v^2(1,\lambda_M) = C + T^2 + \alpha_1 \ln\left(A_1\alpha_2 L^1/\alpha_1 L^2\right)$. If $\lambda_M = 0$, then $L^2/L^1 = \bar{L}^2/\bar{L}^1$ and, hence, $v^1(1,0) - v^2(1,0) = T^1_N - T^2_N + (\alpha_1+\alpha_2)\ln\left(\alpha_1\bar{L}^2/\alpha_2\bar{L}^1\right)$. If $\lambda_M = 1$, then $L^2/L^1 = \alpha_2/\alpha_1 (A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$ (by assumption 1 $\left(\bar{L}^2 + m\bar{L}^1\right)/(1-m)\bar{L}^1 > L^2/L^1 > (1-m)\bar{L}^2/\left(\bar{L}^1 + m\bar{L}^2\right)$), which implies $v^1(1,1) - v^2(1,1) = 0$. Simple comparisons complete the proof of the lemma. ■

Proposition 1 (Simple Ricardian Economy). *Suppose that assumption 1 holds, $T^1 > T^2$ and $\Delta \neq 0$. Then, the trade and labor mobility game has three Nash equilibria: (i) $(\lambda_T,\lambda_M) = (0,0)$; (ii) $(\lambda_T,\lambda_M) = (0,1)$; and (iii) $(\lambda_T,\lambda_M) = (1,0)$. Moreover:*

*E-mail: galiani@umd.edu
†E-mail:gtorrens@indiana.edu

1. $W_G^1(1,0) > W_G^1(0,1) = W_G^1(0,0)$;

2. $\{W_G^2(1,0), W_G^2(0,1)\} > W_G^2(0,0)$, *while* $W_G^2(1,0) > W_G^2(0,1)$ *if and only if* $\alpha_1 \ln\left[\left(A_1\alpha_2\bar{L}^1\right)/\left(\alpha_1\bar{L}^2\right)\right] > m\left(T^1 - T^2\right)$.

Proof: Government 1 payoffs are given by $W_G^1(0,0) = W_G^1(0,1) = C + T^1$, $W_G^1(1,0) = C + T^1 + \alpha_2 \ln\left(\alpha_1\bar{L}^2/A_2\alpha_2\bar{L}^1\right)$, and $W_G^1(1,1) = C + T^1 - \alpha_2 \ln A_2 - \frac{\alpha_2}{\alpha_1+\alpha_2}\left(T_N^1 - T_N^2\right)$. Government 2 payoffs are given by $W_G^2(0,0) = C + T^2$, $W_G^2(0,1) = C + mT^1 + (1-m)T^2$, $W_G^2(1,0) = C + T^2 + \alpha_1 \ln\left[\left(A_1\alpha_2\bar{L}^1\right)/\left(\alpha_1\bar{L}^2\right)\right]$ and $W_G^2(1,1) = C + T^2 + \alpha_1 \ln A_1 + \left[\alpha_1/(\alpha_1+\alpha_2)\right]\left(T_N^1 - T_N^2\right)$. (These calculations are implicitly based on Assumption 1.)

$(\lambda_T, \lambda_M) = (0,0)$ is always a Nash equilibrium because, if both countries are selecting no trade and no labor mobility, then, conditionally on the decision of the other country, there is no policy that can move the economy toward free trade or toward free labor mobility. Thus, any unilateral deviation will not change the payoff for any player.

$(\lambda_T, \lambda_M) = (1,0)$ is a Nash equilibrium when $W_G^1(1,0) \geq W_G^1(0,0)$ and $W_G^2(1,0) \geq W_G^2(0,0)$. From assumption 1 $\left(\alpha_1\bar{L}^2/\alpha_2\bar{L}^1\right) > A_2$, which implies $W_G^1(1,0) - W_G^1(0,0) = \alpha_2 \ln\left(\alpha_1\bar{L}^2/A_2\alpha_2\bar{L}^1\right) > 0$. From assumption 1 $A_1 > \left(\alpha_1\bar{L}^2/\alpha_2\bar{L}^1\right)$, which implies $W_G^2(1,0) - W_G^2(0,0) = \alpha_1 \ln\left(A_1\alpha_2\bar{L}^1/a_{L,1}^1\alpha_1\bar{L}^2\right) > 0$.

$(\lambda_T, \lambda_M) = (0,1)$ is a Nash equilibrium when $W_G^1(0,1) \geq W_G^1(0,0)$ and $W_G^2(0,1) \geq W_G^2(0,0)$. $W_G^1(0,0) = W_G^1(0,1)$, while $W_G^2(0,1) - W_G^2(0,0) = m\left(T^1 - T^2\right)$, which is positive by assumption.

$(\lambda_T, \lambda_M) = (1,1)$ is not a Nash equilibrium, provided that $\Delta = (\alpha_1+\alpha_2)^{-1}\left(T_N^1 - T_N^2\right) - \ln\left(\alpha_2\bar{L}^1/\alpha_1\bar{L}^2\right) \neq 0$. Note that $W_G^1(1,1) - W_G^1(1,0) = -\alpha_2\Delta$ and $W_G^2(1,1) - W_G^2(1,0) = \alpha_1\Delta$, which implies that either $W_G^1(1,1) - W_G^1(1,0) < 0$ (when $\Delta > 0$) or $W_G^1(1,1) - W_G^1(1,0) < 0$ (when $\Delta < 0$).

We have already proved that $W_G^1(1,0) > W_G^1(0,1) = W_G^1(0,0)$ and $\{W_G^2(1,0), W_G^2(0,1)\} > W_G^2(0,0)$. Finally, note that $W_G^2(1,0) - W_G^2(0,1) = \alpha_1 \ln\left(A_1\alpha_2\bar{L}^1/\alpha_1\bar{L}^2\right) - m\left(T^1 - T^2\right) > 0$ if and only if $\alpha_1 \ln\left(A_1\alpha_2\bar{L}^1/\alpha_1\bar{L}^2\right) > m\left(T^1 - T^2\right)$, which completes the proof of the proposition. ■

A.2 Multiple Goods

A Finite Set of Goods. Assume $Z_T = \{1, 2, ...z_T\}$, $Z_N = \{z_{T+1}, ..., z_{T+N}\}$ and $Q_z^j = L_z^j/a_{L,z}^j$. Let $A_z = a_{L,z}^2/a_{L,z}^1$ be strictly decreasing for $z \in Z_T$ with $A_1 > 1$ and $A_{z_T} < 1$. Under autarky, $p_z^j = w^j a_{L,z}^j$ for all $z \in Z$ and $j = 1, 2$. The indirect utility of a worker who owns one unit of labor in country j is $v^j = C + T^j$, where $T^j = -\sum_{z \in Z}\alpha_z \ln\left(a_{L,z}^j\right)$. If labor mobility is allowed, all mobile workers will go to or stay in the country with the highest T^j.

Under free trade, there exists $\bar{z} \in Z_T$, such that $p_z = w^1 a_{L,z}^1$ for $z = 1, ..., \bar{z} - 1$, $p_z = w^2 a_{L,z}^2$ for $z = \bar{z} + 1, ..., z_T$, and $p_z^j = w^j a_{L,z}^j$ for $z \in Z_N$. In order to determine $\bar{z}$ and w^1/w^2, it is useful to define the following function. $F(x) = A_z$ if $\left[\left(\sum_{k=1}^{k=z-1}\alpha_k\right)/\left(\sum_{k=z}^{k=z_T}\alpha_k\right)A_z\right] \leq x \leq \left[\left(\sum_{k=1}^{k=z}\alpha_z\right)/\left(\sum_{k=z+1}^{k=z_T}\alpha_z\right)A_z\right]$, while $F(x) = \left(\sum_{k=1}^{k=z}\alpha_k\right)/\left(\sum_{k=z+1}^{k=z_T}\alpha_k\right)x$ if $\left[\left(\sum_{k=1}^{k=z}\alpha_k\right)/\left(\sum_{k=z+1}^{k=z_T}\alpha_k\right)A_z\right] < x < \left[\left(\sum_{k=1}^{k=z}\alpha_k\right)/\left(\sum_{k=z+1}^{k=z_T}\alpha_k\right)A_{z+1}\right]$. $F(x)$ is a decreasing and continuous function of x. In the trading equilibrium $w^1/w^2 = F(L_1/L_2)$ and $\bar{z}$ is such that $A_{\bar{z}} \geq w^1/w^2 > A_{\bar{z}+1}$. Moreover, $1 < \bar{z} < z_T$ if and only if $A_1 > F(L_1/L_2) > A_{z_T}$, which we assume holds. Also note that if $\left[\left(\sum_{k=1}^{k=\bar{z}-1}\alpha_k\right)/\left(\sum_{k=\bar{z}}^{k=z_T}\alpha_k\right)A_{\bar{z}}\right] \leq$

$L^1/L^2 \leq \left[\left(\sum_{k=1}^{k=\bar{z}}\alpha_k\right)/\left(\sum_{k=\bar{z}+1}^{k=z_T}\alpha_k\right)A_{\bar{z}}\right]$, then both countries produce good $\bar{z}$, $w^1/w^2 = F\left(L^1/L^2\right) = A_{\bar{z}}$, and $p_{\bar{z}} = w^1 a^1_{L,\bar{z}} = w^2 a^2_{L,\bar{z}}$; while if $\left[\left(\sum_{k=1}^{k=\bar{z}}\alpha_k\right)/\left(\sum_{k=\bar{z}+1}^{k=z_T}\alpha_k\right)A_{\bar{z}}\right] < L^1/L^2 < \left[\left(\sum_{k=1}^{k=\bar{z}}\alpha_k\right)/\left(\sum_{k=\bar{z}+1}^{k=z_T}\alpha_k\right)A_{\bar{z}+1}\right]$, then only country 1 produces good $\bar{z}$, $w^1/w^2 = F\left(L^1/L^2\right) = \left[\left(\sum_{k=1}^{k=\bar{z}}\alpha_k\right)/\left(\sum_{k=\bar{z}+1}^{k=z_T}\alpha_k\right)\right]\left(L^2/L^1\right)$ and $p_{\bar{z}} = w^1 a^1_{L,\bar{z}}$. The indirect utility of a worker who owns one unit of labor is given by:

$$v^1 = C + T^1 + \sum_{z=\bar{z}+1}^{z=z_T}\alpha_z \ln\left(\frac{F\left(L^1/L^2\right)}{A_z}\right)$$
$$v^2 = C + T^2 + \sum_{z=1}^{z=\bar{z}}\alpha_z \ln\left(\frac{A_z}{F\left(L^1/L^2\right)}\right)$$

where $\bar{z}$ is such that $A_{\bar{z}} \geq w^1/w^2 = F\left(L^1/L^2\right) > A_{\bar{z}+1}$.

If labor mobility is not allowed, then $L^j = \bar{L}^j$, which implies $\bar{z}$ is such that $A_{\bar{z}} \geq w^1/w^2 = F\left(\bar{L}^1/\bar{L}^2\right) > A_{\bar{z}+1}$. If labor mobility is allowed, mobile workers will go to or stay in the country with the highest v^j. If there are enough mobile workers, they will relocate until $v^1 = v^2$. As a consequence, $\ln\left(w^1/w^2\right) = -\left(1-\alpha_N\right)^{-1}\left(T^1_N - T^2_N\right)$, where $T^j_N = -\sum_{z\in Z_N}\alpha_z \ln\left(a^j_{L,z}\right)$ is the productivity of country j in non-tradeable goods and $\alpha_N = \sum_{z\in Z_N}\alpha_z$ is the expenditure share in non-tradeable goods. Thus:

$$\begin{aligned} v^1 = v^2 &= C + T^1 - \left(1-\alpha_N\right)^{-1}\left(T^1_N - T^2_N\right)\left(\sum_{z=\hat{z}+1}^{z=z_T}\alpha_z\right) - \sum_{z=\hat{z}+1}^{z=z_T}\alpha_z \ln\left(A_z\right) \\ &= C + T^2 + \sum_{z=1}^{z=\hat{z}}\alpha_z \ln\left(A_z\right) + \left(1-\alpha_N\right)^{-1}\left(T^1_N - T^2_N\right)\left(\sum_{z=1}^{z=\hat{z}}\alpha_z\right) \end{aligned}$$

In order to determine the marginal industry $\hat{z}$ and the labor allocation L_1/L_2 under free labor mobility, we need to consider two possible cases.

(a) Suppose there exists $z \in (1, z_T)$, such that $\ln\left(A_z\right) = -\left(1-\alpha_N\right)^{-1}\left(T^1_N - T^2_N\right)$. Then, the marginal industry is determined by $\ln\left(A_{\hat{z}}\right) = -\left(1-\alpha_N\right)^{-1}\left(T^1_N - T^2_N\right)$, both countries produce $\hat{z}$, and L^1/L^2 is such that $\left[\left(\sum_{z=1}^{z=\hat{z}-1}\alpha_z\right)/\left(\sum_{z=\hat{z}}^{z=z_T}\alpha_z\right)A_{\hat{z}}\right] \leq L^1/L^2 \leq \left[\left(\sum_{z=1}^{z=\hat{z}}\alpha_z\right)/\left(\sum_{z=\hat{z}+1}^{z=z_T}\alpha_z\right)A_{\hat{z}}\right]$ and $\left(\bar{L}^2 + m\bar{L}^1\right)/\left(1-m\right)\bar{L}^1 \leq L^1/L^2 \leq \left(1-m\right)\bar{L}^2/\left(\bar{L}^1 + m\bar{L}^2\right)$.

(b) Suppose there is no $z \in (1, z_T)$, such that $\ln\left(A_z\right) = -\left(1-\alpha_N\right)^{-1}\left(T^1_N - T^2_N\right)$. Then, the marginal industry is $\hat{z}$ such that $\ln\left(A_{\hat{z}}\right) > -\left(1-\alpha_N\right)^{-1}\left(T^1_N - T^2_N\right) > \ln\left(A_{\hat{z}+1}\right)$ and the labor allocation is given by $\left(L^1/L^2\right) = \left[\left(\sum_{z=1}^{z=\hat{z}}\alpha_z\right)/\left(\sum_{z=\hat{z}+1}^{z=z_T}\alpha_z\right)\right]\left(w^2/w^1\right)$ where $\ln\left(w^1/w^2\right) = -\left(1-\alpha_N\right)^{-1}\left(T^1_N - T^2_N\right)$.

Finally, the distribution of mobile workers between the countries does not violate either $L^j \in \left[\left(1-m\right)\bar{L}^j, \bar{L}^j + m\bar{L}^{-j}\right]$ or $A_1 > F\left(L_1/L_2\right) > A_{z_T}$, provided that the following assumption holds.

Assumption 1 (Finite Set of Goods). *Labor mobility induces full wage convergence. Formally:*

$$A_1 > F\left(\frac{\left(1-m\right)\bar{L}^1}{\bar{L}^2 + m\bar{L}^1}\right) > \prod_{z\in Z_N}\left(A_z\right)^{\frac{-\alpha_z}{1-\alpha_N}} > F\left(\frac{\bar{L}^1 + m\bar{L}^2}{\left(1-m\right)\bar{L}^2}\right) > A_{z_T}$$

Lemma 1 characterizes the effects of trade and labor mobility on the countries' relative wages.

Lemma 1 (Finite Set of Goods). *Let* $T^j = -\sum_{z\in Z}\alpha_z \ln\left(a^j_{L,z}\right)$ *and assume* $T^1 > T^2$. *Define* $\Delta = (1-\alpha_N)\ln\left(F\left(\bar{L}^1/\bar{L}^2\right)\right) + \left(T^1_N - T^2_N\right)$, *where* $T^j_N =$. *Suppose that Assumption 1 holds.*

1. *If* $\Delta > T^1 - T^2$, *then* $v^1(1,0) - v^2(1,0) > v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0$.
2. *If* $0 < \Delta < T^1 - T^2$, *then* $v^1(0,0) - v^2(0,0) > v^1(1,0) - v^2(1,0) > v^1(1,1) - v^2(1,1) = 0$.
3. *If* $\Delta < 0$, *then* $v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0 > v^1(1,0) - v^2(1,0)$.

Proof: Under autarky, regardless of mobile workers' location decisions, $v^j(0,\lambda_M) = C + T^j$. Thus, $v^1(0,0) - v^2(0,0) = T^1 - T^2$, which is positive by assumption. Under free trade and no labor mobility, $v^1(1,0) = C + T^1 + \ln\left(F\left(\bar{L}^1/\bar{L}^2\right)\right)\left(\sum_{z=\bar{z}+1}^{z=z_T}\alpha_z\right) - \sum_{z=\bar{z}+1}^{z=z_T}\alpha_z\ln(A_z)$, and $v^2(1,0) = C + T^2 + \sum_{z=1}^{z=\bar{z}}\alpha_z\ln(A_z) - \ln\left(F\left(\bar{L}^1/\bar{L}^2\right)\right)\left(\sum_{z=1}^{z=\bar{z}}\alpha_z\right)$, where $\bar{z}$ is such that $A_{\bar{z}} \geq F\left(\bar{L}^1/\bar{L}^2\right) > A_{\bar{z}+1}$. Thus, $v^1(1,0) - v^2(1,0) = (1-\alpha_N)\ln\left(F\left(\bar{L}^1/\bar{L}^2\right)\right) + \left(T^1_N - T^2_N\right)$. Under free trade and free labor mobility, assumption 1 implies $v^1(1,1) = v^2(1,1) = C + T^1 - (1-\alpha_N)^{-1}\left(T^1_N - T^2_N\right)\left(\sum_{z=\hat{z}+1}^{z=z_T}\alpha_z\right) - \sum_{z=\hat{z}+1}^{z=z_T}\alpha_z\ln(A_z)$. Simple comparisons complete the proof of the lemma. ■

Proposition 1 characterizes the political equilibrium.

Proposition 1 (Finite Set of Goods). *Suppose that Assumption 1 holds,* $T^1 > T^2$ *and* $\Delta \neq 0$. *Then, the trade and labor mobility game has three Nash equilibria: (i)* $(\lambda_T, \lambda_M) = (0,0)$*; (ii)* $(\lambda_T, \lambda_M) = (0,1)$*; and (iii)* $(\lambda_T, \lambda_M) = (1,0)$. *Moreover:*

1. $W^1_G(1,0) > W^1_G(0,1) = W^1_G(0,0)$;
2. $\left\{W^2_G(1,0), W^2_G(0,1)\right\} > W^2_G(0,0)$, *while* $W^2_G(1,0) > W^2_G(0,1)$ *if and only if* $\sum_{z=1}^{z=\bar{z}}\alpha_z\ln\left(A_z/F\left(\bar{L}^1/\bar{L}^2\right)\right) > m\left(T^1 - T^2\right)$.

Proof: Government 1 payoffs are given by $W^1_G(0,0) = W^1_G(0,1) = C + T^1$, $W^1_G(1,0) = C + T^1 + \ln\left(F\left(\bar{L}^1/\bar{L}^2\right)\right)\left(\sum_{z=\bar{z}+1}^{z=z_T}\alpha_z\right) - \sum_{z=\bar{z}+1}^{z=z_T}\alpha_z\ln(A_z)$, and $W^1_G(1,1) = C + T^1 - (1-\alpha_N)^{-1}\left(T^1_N - T^2_N\right)\left(\sum_{z=\hat{z}+1}^{z=z_T}\alpha_z\right) - \sum_{z=\hat{z}+1}^{z=z_T}\alpha_z\ln(A_z)$. Government 2 payoffs are given by $W^2_G(0,0) = C + T^2$, $W^2_G(0,1) = C + mT^1 + (1-m)T^2$, $W^2_G(1,0) = C + T^2 + \sum_{z=1}^{z=\bar{z}}\alpha_z\ln(A_z) - \ln\left(F\left(\bar{L}^1/\bar{L}^2\right)\right)\left(\sum_{z=1}^{z=\bar{z}}\alpha_z\right)$ and $W^2_G(1,1) = C + T^2 + \sum_{z=1}^{z=\hat{z}}\alpha_z\ln(A_z) + (1-\alpha_N)^{-1}\left(T^1_N - T^2_N\right)\left(\sum_{z=1}^{z=\hat{z}}\alpha_z\right)$. (These calculations are implicitly based on Assumption 1).

$(\lambda_T, \lambda_M) = (0,0)$ is always a Nash equilibrium.

$(\lambda_T, \lambda_M) = (1,0)$ is a Nash equilibrium when $W^1_G(1,0) \geq W^1_G(0,0)$ and $W^2_G(1,0) \geq W^2_G(0,0)$. $W^1_G(1,0) - W^1_G(0,0) = \sum_{z=\bar{z}+1}^{z=z_T}\alpha_z\ln\left(F\left(\bar{L}^1/\bar{L}^2\right)/A_z\right)$, where $A_{\bar{z}} \geq F\left(\bar{L}^1/\bar{L}^2\right) > A_{\bar{z}+1}$. Since $F\left(\bar{L}^1/\bar{L}^2\right) > A_z$ for all $z = \bar{z}+1, ..., z_T$, and since Assumption 1 implies $1 < \bar{z} < z_T$, it must be the case that $W^1_G(1,0) - W^1_G(0,0) > 0$. $W^2_G(1,0) - W^2_G(0,0) = \sum_{z=1}^{z=\bar{z}}\alpha_z\ln\left(A_z/F\left(\bar{L}^1/\bar{L}^2\right)\right)$, where $A_{\bar{z}} \geq F\left(\bar{L}^1/\bar{L}^2\right) > A_{\bar{z}+1}$. Since $A_z > F\left(\bar{L}^1/\bar{L}^2\right)$ for all $z = 1, ..., \bar{z}$, and since Assumption 1 implies $1 < \bar{z} < z_T$, it must be the case that $W^2_G(1,0) - W^2_G(0,0) > 0$.

$(\lambda_T, \lambda_M) = (0,1)$ is a Nash equilibrium when $W^1_G(0,1) \geq W^1_G(0,0)$ and $W^2_G(0,1) \geq W^2_G(0,0)$. $W^1_G(0,0) = W^1_G(0,1)$, while $W^2_G(0,1) - W^2_G(0,0) = m\left(T^1 - T^2\right)$, which is positive by assumption.

$(\lambda_T, \lambda_M) = (1,1)$ is not a Nash equilibrium, provided that $\Delta \neq 0$. Note that:

$$W_G^1(1,1) - W_G^1(1,0) = \sum_{z=\hat{z}+1}^{z=z_T} \alpha_z \ln\left(\frac{F\left(L^1/L^2\right)}{A_z}\right) - \sum_{z=\bar{z}+1}^{z=z_T} \alpha_z \ln\left(\frac{F\left(\bar{L}^1/\bar{L}^2\right)}{A_z}\right)$$

$$W_G^2(1,1) - W_G^2(1,0) = \sum_{z=1}^{z=\hat{z}} \alpha_z \ln\left(\frac{A_z}{F\left(L^1/L^2\right)}\right) - \sum_{z=1}^{z=\bar{z}} \alpha_z \ln\left(\frac{A_z}{F\left(\bar{L}^1/\bar{L}^2\right)}\right)$$

where L^1/L^2 is the labor allocation under free trade and free labor mobility. Suppose that $\Delta > 0$. Then $v^1(1,0) > v^2(1,0)$ and $L_1/L_2 > \bar{L}^1/\bar{L}^2$. Since F is decreasing and $\Delta > 0$, $F\left(\bar{L}^1/\bar{L}^2\right) > F\left(L^1/L^2\right)$ and, hence, $\hat{z} \geq \bar{z}$. Finally, $F\left(\bar{L}^1/\bar{L}^2\right) > A_z$ for $z = \bar{z}+1, ..., z_T$. Thus, $W_G^1(1,1) - W_G^1(1,0) < 0$. Suppose that $\Delta < 0$. Then $v^1(1,0) < v^2(1,0)$ and $L_1/L_2 < \bar{L}^1/\bar{L}^2$. Since F is decreasing and $\Delta < 0$, $F\left(\bar{L}^1/\bar{L}^2\right) < F\left(L^1/L^2\right)$. Hence, $\hat{z} \leq \bar{z}$. Finally, $F\left(\bar{L}^1/\bar{L}^2\right) < A_z$ for $z = 1, ...\bar{z}$. Thus, $W_G^2(1,1) - W_G^2(1,0) < 0$. Note, however, that if $F\left(\bar{L}^1/\bar{L}^2\right) = A_{\bar{z}}$, a small reallocation of mobile workers does not change the marginal industry and, as consequence, there is no effect on w^1/w^2. In other words, $\Delta \neq 0$ implies that $(\lambda_T, \lambda_M) = (1,1)$ is not a Nash equilibrium, but if $F\left(\bar{L}^1/\bar{L}^2\right) = A_{\bar{z}}$ free trade and partial labor mobility can be a Nash equilibrium.

We have already proved that $W_G^1(1,0) > W_G^1(0,1) = W_G^1(0,0)$ and $\left\{W_G^2(1,0), W_G^2(0,1)\right\} > W_G^2(0,0)$. Finally, note that $W_G^2(1,0) - W_G^2(0,1) = \sum_{z=1}^{z=\bar{z}} \alpha_z \ln\left(A_z/F\left(\bar{L}^1/\bar{L}^2\right)\right) > m\left(T^1 - T^2\right)$ if and only if $\sum_{z=1}^{z=\bar{z}} \alpha_z \ln\left(A_z/F\left(\bar{L}^1/\bar{L}^2\right)\right) > m\left(T^1 - T^2\right)$, which completes the proof of the proposition. ■

A Continuum of Goods. Assume $Z_T = [0,k)$, $Z_N = [k,1]$ and $Q_z^j = L_z^j/a_{L,z}^j$. Let $A_z = a_{L,z}^2/a_{L,z}^1$ be a continuously differentiable strictly decreasing function for $z \in [0,k)$ that satisfies $A_0 > 1$ and $A_k < 1$. All agents have the same preferences, given by $u\left(c^j\right) = \int_0^1 \alpha_z \ln\left(c_z^j\right) dz$, with $\int_0^1 \alpha_z dz = 1$. Thus, the indirect utility function is given by $v^j = C + \int_0^1 \alpha_z \ln\left(w^j/p_z^j\right) dz$, where $C = \int_0^1 \alpha_z \ln(\alpha_z)\, dz$.

Under autarky, all goods must be produced domestically and, hence, $p_z^j = w^j a_{L,z}^j$ for all $z \in Z$ and $j \in J$. The indirect utility of a worker who owns one unit of labor in country j is given by:

$$v^j = C + T^j,$$

where $T^j = -\int_0^1 \alpha_z \ln\left(a_{L,z}^j\right) dz$ is a measure of the productivity of country j. If labor mobility is allowed, all mobile workers go to or stay in the country with the higher T^j.

Under free trade, in the trading equilibrium country 1 produces lower-indexed tradeable goods $z \in [0,\bar{z}] \subset Z_T$ and non-tradeable goods $z \in Z_N = [k,1]$ and country 2 produces higher-indexed tradeable goods $z \in [\bar{z},k)$ and non-tradeable goods $z \in Z_N = [k,1]$. The marginal tradeable industry $\bar{z}$ is given by $A_{\bar{z}} = w^1/w^2$. The balanced trade condition is $w^1/w^2 = [\alpha(\bar{z})/(1-\alpha_N-\alpha(\bar{z}))]\left(L^2/L^1\right)$, where $\alpha_N = \int_k^1 \alpha_z dz$ is the portion of income spent on non-tradeable goods and $\alpha(z) = \int_0^z \alpha_z dz$ is the portion of world income spent on tradeable goods in the range $[0,z]$. There exists a unique $\left(\bar{z}, w^1/w^2\right)$, with $\bar{z} \in (0,k)$ and $w^1/w^2 > 0$, that simultaneously satisfies the marginal tradeable industry condition and the balanced trade condition.[1] Since $p_z = w^1 a_{L,z}^1$ for $z \in [0,\bar{z}]$, $p_z = w^2 a_{L,z}^2$ for $[\bar{z},k)$, $p_z^j = w^j a_{L,z}^j$ for

[1] It is simple to verify that there exists a unique $\bar{z} \in (0,k)$ that satisfies $A_{\bar{z}} = [\alpha(\bar{z})/(1-\alpha_N-\alpha(\bar{z}))]\left(L^2/L^1\right)$. A_z is a continuous and strictly decreasing function and $A_0 > 0$. $B(z) = [\alpha(z)/(1-\alpha_N-\alpha(z))]\left(L^2/L^1\right)$ is a continuous and strictly increasing function, $B(0) = 0$ and $\lim_{z\to k} B(z) = \infty$.

$z \in [k,1]$ and $j=1,2$, the indirect utility of a worker who owns one unit of labor is given by:

$$v^1 = C + T^1 + \int_{\bar{z}}^{k} \alpha_z \ln\left(\frac{A_{\bar{z}}}{A_z}\right) dz,$$
$$v^2 = C + T^2 + \int_{0}^{\bar{z}} \alpha_z \ln\left(\frac{A_z}{A_{\bar{z}}}\right) dz,$$

where $A_{\bar{z}} = \left[\alpha(\bar{z}) / (1-\alpha_N-\alpha(\bar{z}))\right] \left(L^2/L^1\right)$. If labor mobility is not allowed, then $L^j = \bar{L}^j$. If labor mobility is allowed, mobile workers will go to or stay in the country with higher v^j. If $v^1 > v^2$, then mobile workers will move from country 2 to 1, v^1 will decrease and v^2 will increase. Analogously, if $v^2 > v^1$, then mobile workers will move from country 1 to 2, v^2 will decrease and v^1 will increase. Therefore, and, provided that there are enough mobile workers, they will relocate until $v^1 = v^2$, which implies $\ln\left(w^1/w^2\right) = -\left(1-\alpha_N\right)^{-1}\left(T_N^1 - T_N^2\right)$, where $T_N^j = -\int_k^1 \alpha_z \ln\left(a_{L,z}^j\right) dz$ is the average productivity of country j in the production of non-tradeable goods. This expression determines the ratio w^1/w^2 which makes mobile workers indifferent to the possibility of settling in one country or the other. It depends only on the productivity differences in the non-tradeable industries. Once we know w^1/w^2, we can use $A_{\hat{z}} = w^1/w^2$ to determine the marginal tradeable industry $\hat{z}$. Then, the balanced trade condition implies $L^2/L^1 = A_{\hat{z}}\left(1-\alpha_N-\alpha(\hat{z})\right)/\alpha(\hat{z})$. The utility of a worker who owns one unit of labor is given by:

$$v^1 = v^2 = C + T^1 + \int_{\hat{z}}^{k} \alpha_z \ln\left(\frac{A_{\hat{z}}}{A_z}\right) dz = C + T^2 + \int_{0}^{\hat{z}} \alpha_z \ln\left(\frac{A_z}{A_{\hat{z}}}\right) dz,$$

where $\left(1-\alpha_N\right)\ln\left(A_{\hat{z}}\right) = -\left(T_N^1 - T_N^2\right)$. Moreover, there will be migration to country 1 whenever $\bar{L}^2/\bar{L}^1 > A_{\hat{z}}\left(1-\alpha_N-\alpha(\hat{z})\right)/\alpha(\hat{z})$ and migration to country 2 whenever $\bar{L}^2/\bar{L}^1 < A_{\hat{z}}\left(1-\alpha_N-\alpha(\hat{z})\right)/\alpha(\hat{z})$. Finally, we must verify that the distribution of mobile workers between the countries does not violate $L^j \in \left[(1-m)\bar{L}^j, \bar{L}^j + m\bar{L}^{-j}\right]$. In order to avoid such a situation, we impose the following assumption.

Assumption 1 (Continuum of Goods). *Labor mobility induces full wage convergence. Formally:*

$$\frac{\bar{L}^2 + m\bar{L}^1}{(1-m)\bar{L}^1} > \frac{A_{\hat{z}}\left(1-\alpha_N-\alpha(\hat{z})\right)}{\alpha(\hat{z})} > \frac{(1-m)\bar{L}^2}{\bar{L}^1 + m\bar{L}^2}$$

where $\hat{z}$ is implicitly given by $\left(1-\alpha_N\right)\ln\left(A_{\hat{z}}\right) = -\left(T_N^1 - T_N^2\right)$.

Lemma 1 characterizes the effects of trade and labor mobility on relative wages.

Lemma 1 (Continuum of Goods). *Let $T^j = -\int_0^1 \alpha_z \ln\left(a_{L,z}^j\right) dz$ be the average productivity of country j and assume $T^1 > T^2$. Define $\Delta_{\bar{z}} = \left(1-\alpha_N\right)\ln\left(A_{\bar{z}}\right) + \left(T_N^1 - T_N^2\right)$, where $A_{\bar{z}} = \left[\alpha(\bar{z}) / (1-\alpha_N-\alpha(\bar{z}))\right]\left(\bar{L}^2/\bar{L}^1\right)$ and $T_N^j = -\int_k^1 \alpha_z \ln\left(a_{L,z}^j\right) dz$ is the average productivity of country j in the production of non-tradeable goods. Suppose that assumption 2 holds. Then:*

1. *If $\Delta_{\bar{z}} > \left(T^1 - T^2\right)$, then $v^1(1,0) - v^2(1,0) > v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0$.*
2. *If $0 < \Delta_{\bar{z}} < \left(T^1 - T^2\right)$, then $v^1(0,0) - v^2(0,0) > v^1(1,0) - v^2(1,0) > v^1(1,1) - v^2(1,1) = 0$.*

3. *If* $\Delta_{\bar{z}} < 0$, *then* $v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0 > v^1(1,0) - v^2(1,0)$.

Proof: Under autarky, regardless of mobile workers' location decisions, $v^j(0, \lambda_M) = C + T^j$. Thus, $v^1(0,0) - v^2(0,0) = T^1 - T^2$, which is positive by assumption. Under free trade, if there is no labor mobility $v^1(1,0) = C + T^1 + \int_{\bar{z}}^{k} \alpha_z \ln(A_{\bar{z}}/A_z)\, dz$ and $v^2(1,0) = C + T^2 + \int_0^{\bar{z}} \alpha_z \ln(A_z/A_{\bar{z}})\, dz$. Hence, $v^1(1,0) - v^2(1,0) = T_N^1 - T_N^2 + (1-\alpha_N)\ln(A_{\bar{z}})$. Under free trade, if there is free labor mobility $v^1(1,1) = C + T^1 + \int_{\hat{z}}^{k} \alpha_z \ln(A_{\hat{z}}/A_z)\, dz$ and $v^2(1,1) = C + T^2 + \int_0^{\hat{z}} \alpha_z \ln(A_z/A_{\hat{z}})\, dz$. Hence $v^1(1,1) - v^2(1,1) = T_N^1 - T_N^2 + (1-\alpha_N)\ln(A_{\hat{z}})$. Provided that assumption 1 holds, we have $\ln(A_{\hat{z}}) = \ln(w^1/w^2) = -(1-\alpha_N)^{-1}(T_N^1 - T_N^2)$ and, hence, $v^1(1,1) - v^2(1,1) = 0$. Simple comparisons complete the proof of the lemma. ■

As in the simple Ricardian model, under free trade, labor mobility leads to a complete convergence in real wages. The reason for this is that mobile workers move from the poor country to the rich country until they equalize real wages (with Assumption 1 ensuring that there are enough mobile workers to make this happen). Trade alone has an ambiguous effect on convergence. While, under autarky, the wage difference depends on the average productivity differential (real wages are higher in country 1 when $T^1 > T^2$), under free trade, it depends on the productivity differential in the marginal tradeable industry as well as on the average productivity differential in non-tradeable industries (real wages are higher in country 1 when $\Delta_{\bar{z}} = (1-\alpha_N)\ln(A_{\bar{z}}) + (T_N^1 - T_N^2) > 0$). In turn, the productivity differential in the marginal industry $(A_{\bar{z}})$ is high when country 1 is relatively labor-scarce and expenditure shares in low-indexed tradeable goods are high. Note that we can interpret $\Delta_{\bar{z}}$ as a measure of the productivity differential under free trade. When it is higher than the average productivity differential, free trade induces divergence; when it is positive but lower than the average productivity differential, free trade induces partial convergence; and when it is negative, free trade leads to a reversal of fortune.

Proposition 1 characterizes the political equilibrium.

Proposition 1 (Continuum of Goods). *Suppose that Assumption 1 holds,* $T^1 > T^2$, *and* $\Delta_{\bar{z}} \neq 0$. *Then, the trade and labor mobility game has three Nash equilibria: (i)* $(\lambda_T, \lambda_M) = (0,0)$*; (ii)* $(\lambda_T, \lambda_M) = (0,1)$*; and (iii)* $(\lambda_T, \lambda_M) = (1,0)$*. Moreover:*

1. $W_G^1(1,0) > W_G^1(0,1) = W_G^1(0,0)$*;*
2. $\{W_G^2(1,0), W_G^2(0,1)\} > W_G^2(0,0)$, *while* $W_G^2(1,0) > W_G^2(0,1)$ *if and only if* $\int_0^{\bar{z}} \alpha_z \ln(A_z/A_{\bar{z}})\, dz > m(T^1 - T^2)$.

Proof*:* Government 1 payoffs are given by $W_G^1(0,0) = W_G^1(0,1) = C + T^1$, $W_G^1(1,0) = C + T^1 + \int_{\bar{z}}^{k} \alpha_z \ln(A_{\bar{z}}/A_z)\, dz$, and $W_G^1(1,1) = C + T^1 + \int_{\hat{z}}^{k} \alpha_z \ln(A_{\hat{z}}/A_z)\, dz$. Government 2 payoffs are given $W_G^2(0,0) = C + T^2$, $W_G^2(0,1) = C + mT^1 + (1-m)T^2$, $W_G^2(1,0) = C + T^2 + \int_0^{\bar{z}} \alpha_z \ln(A_z/A_{\bar{z}})\, dz$ and $W_G^2(1,1) = C + T^2 + \int_0^{\hat{z}} \alpha_z \ln(A_z/A_{\hat{z}})\, dz$. (These calculations are implicitly based on Assumption 1.)

$(\lambda_T, \lambda_M) = (0,0)$ is always a Nash equilibrium.

$(\lambda_T, \lambda_M) = (0,1)$ is a Nash equilibrium when $W_G^1(0,1) \geq W_G^1(0,0)$ and $W_G^2(0,1) \geq W_G^2(0,0)$. $W_G^1(0,1) = W_G^1(0,0) = C + T^1$, while $W_G^2(0,1) - W_G^2(0,0) = m(T^1 - T^2) > 0$, which is positive by assumption.

$(\lambda_T, \lambda_M) = (1,0)$ is a Nash equilibrium when $W_G^1(1,0) \geq W_G^1(0,0)$ and $W_G^2(1,0) \geq W_G^2(0,0)$. $A_z > A_{\bar{z}}$ for $z \in [0, \bar{z}]$ while $A_z < A_{\bar{z}}$ for $z \in [\bar{z}, k]$. Then $W_G^1(1,0) - W_G^1(0,0) = \int_{\bar{z}}^{k} \alpha_z \ln(A_{\bar{z}}/A_z)\, dz > 0$ and $W_G^2(1,0) - W_G^2(0,0) = \int_0^{\bar{z}} \alpha_z \ln(A_z/A_{\bar{z}})\, dz > 0$.

$(\lambda_T, \lambda_M) = (1,1)$ is not a Nash equilibrium (provided that $\Delta_{\bar{z}} = (1-\alpha_N)^{-1}\left(T_N^1 - T_N^2\right) - \ln\left[(1-\alpha_N - \alpha(\bar{z}))\, \bar{L}^1/\alpha(\bar{z})\, \bar{L}^2\right] \neq 0$). In order to prove this, note that $W_G^1(1,1) - W_G^1(1,0) = \int_{\hat{z}}^{k} \alpha_z \ln(A_{\hat{z}}/A_z)\, dz - \int_{\bar{z}}^{k} \alpha_z \ln(A_{\bar{z}}/A_z)\, dz$ and $W_G^2(1,1) - W_G^2(1,0) = \int_0^{\hat{z}} \alpha_z \ln(A_z/A_{\hat{z}})\, dz - \int_0^{\bar{z}} \alpha_z \ln(A_z/A_{\bar{z}})\, dz$. If $\hat{z} > \bar{z}$, then $A_{\hat{z}} < A_{\bar{z}}$ and, hence, $\ln(A_{\hat{z}}/A_z) < \ln(A_{\bar{z}}/A_z)$. Therefore, $W_G^1(1,1) - W_G^1(1,0) < 0$. If $\hat{z} < \bar{z}$, then $A_{\hat{z}} > A_{\bar{z}}$ and, hence, $\ln(A_z/A_{\hat{z}}) < \ln(A_z/A_{\bar{z}})$. Therefore, $W_G^2(1,1) - W_G^2(1,0) < 0$. If $\hat{z} = \bar{z}$, then $A_{\hat{z}} = A_{\bar{z}}$ and, hence, $W_G^1(1,1) = W_G^1(1,0)$ and $W_G^2(1,1) = W_G^2(1,0)$. However, $\hat{z} = \bar{z}$ if and only if $(1-\alpha_N)^{-1} \int_k^1 \alpha_z \ln(A_z)\, dz + \ln\left[(1-\alpha_N - \alpha(\bar{z}))\, \bar{L}^1/\alpha(\bar{z})\, \bar{L}^2\right] = 0$, i.e., whenever $\Delta_{\bar{z}} = 0$, which we rule out by assumption.

We have already proved that $W_G^1(1,0) > W_G^1(0,1) = W_G^1(0,0)$ and $\left\{W_G^2(1,0), W_G^2(0,1)\right\} > W_G^2(0,0)$. Finally, note that $W_G^2(1,0) - W_G^2(0,1) = \int_0^{\bar{z}} \alpha_z \ln(A_z/A_{\bar{z}})\, dz - m\left(T^1 - T^2\right) > 0$ if and only if $\int_0^{\bar{z}} \alpha_z \ln(A_z/A_{\bar{z}})\, dz > m\left(T^1 - T^2\right)$, which completes the proof of the proposition. ■

Proposition 1 (Continuum of Goods) is the analogous of Proposition 1 (Finite Set of Goods) when there is a continuum of goods. Other than free trade and free labor mobility, any other outcome is a Nash equilibrium. As in the previous section, free trade and free labor mobility are not a Nash equilibrium because workers in the rich country under free trade prefer to block labor mobility (since the inflow of labor reduces real wages). Free trade and no labor mobility always dominates other Nash equilibria for the rich country under autarky (country 1). The same is true for the poor country under autarky (country 2) when $\int_0^{\bar{z}} \alpha_z \ln(A_z/A_{\bar{z}})\, dz > m\left(T^1 - T^2\right)$ holds. The logic behind this result is as follows. Under autarky, labor mobility does not affect workers in country 1 because their wages are fully determined by the aggregate productivity of the country and they will not relocate even if they have the chance to do so. Since all workers in country 1 gain from trade, free trade and no labor mobility dominates other equilibria for country 1. Under autarky, mobile workers in country 2 will relocate to country 1. Compared with a situation in which there is no trade and no labor mobility, this will produce a gain of $\left(T^1 - T^2\right)$ per mobile worker. Compared with a situation in which there is no trade and no labor mobility, free trade will produce a gain of $\int_0^{\bar{z}} \alpha_z \ln(A_z/A_{\bar{z}})\, dz$ for each worker in country 2. Thus, country 2 prefers free trade and no labor mobility to autarky and free labor mobility when gains from trade for all (mobile and immobile) workers are higher than the productivity gains for mobile workers.

Endogenous Non-Tradeable Goods (Iceberg Trade Costs). As in the case of exogenous non-tradeable goods, consider an economy with two countries ($J = 2$) and a continuum of goods ($Z = [0,1]$). The production functions are $Q_z^j = L_z^j / a_{L,z}^j$, where $a_{L,z}^j > 0$ is the unit labor requirement in industry z in country j. Let $A_z = a_{L,z}^2 / a_{L,z}^1$ and assume that country 1 has a comparative advantage in lower-indexed goods. Specifically, for $z \in [0,1]$ A_z is a continuously differentiable strictly decreasing function. In contrast with the previous section, all goods are assumed to be tradeable, but there are transportation costs. A fraction $g < 1$ of each good shipped from one country to the other is lost.

Under autarky, the analysis is the same as in the previous section. Under free trade, in a trading equilibrium, country 1 produces low-indexed goods $z \in [0, \bar{z}_L]$, country 2 produces high-indexed goods $z \in [\bar{z}_H, 1]$ and both countries produce goods $z \in [\bar{z}_L, \bar{z}_H]$. Goods in the ranges $[0, \bar{z}_L]$ and $[\bar{z}_H, 1]$ are tradeable, while goods in the range $[\bar{z}_L, \bar{z}_H]$ are non-tradeable. The marginal industries $0 < \bar{z}_L < \bar{z}_H < 1$ are given by

$gA_{\bar{z}_L} = w^1/w^2 = A_{\bar{z}_H}/g$. The balanced trade condition implies $w^1/w^2 = [\alpha(\bar{z}_L)/(1-\alpha(\bar{z}_H))] \left(L^2/L^1\right)$, where $\alpha(z) = \int_0^z \alpha_z dz$. There is a unique tuple $\left(\bar{z}_L, \bar{z}_H, w^1/w^2\right)$ with $0 < \bar{z}_L < \bar{z}_H < 1$ and $w^1/w^2 > 0$ that simultaneously satisfies the two marginal industry conditions and the balanced trade condition. Then, the indirect utility of a worker who owns one unit of labor is given by:

$$v^1 = C + T^1 + \int_{\bar{z}_H}^1 \alpha_z \ln\left(\frac{A_{\bar{z}_H}}{A_z}\right) dz$$
$$v^2 = C + T^2 + \int_0^{\bar{z}_L} \alpha_z \ln\left(\frac{A_z}{A_{\bar{z}_L}}\right) dz$$

where $gA_{\bar{z}_L} = [\alpha(\bar{z}_L)/1-\alpha(\bar{z}_H)] \left(L^2/L^1\right) = A_{\bar{z}_H}/g$ and $T^j = -\int_0^1 \alpha_z \ln\left(a_{L,z}^j\right) dz$. If labor mobility is not allowed, then $L^j = \bar{L}^j$. If labor mobility is allowed, mobile workers will go to or stay in the country with higher v^j. If $v^1 > v^2$, then mobile workers will move from country 2 to 1, v^1 will decrease and v^2 will increase. Analogously, if $v^2 > v^1$, then mobile workers will move from country 1 to 2, v^2 will decrease and v^1 will increase. Therefore, and, provided that there are enough mobile workers, they will relocate until $v^1 = v^2$, which implies: $\ln\left(\frac{w^1}{w^2}\right) = \frac{1}{\alpha(\hat{z}_L)}\left[-\int_{\hat{z}_L}^{\hat{z}_H} \alpha_z \ln(A_z)\, dz - [1-\alpha(\hat{z}_H)] \ln(A_{\hat{z}_H})\right] + \ln g$, where $gA_{\hat{z}_L} = w^1/w^2 = A_{\hat{z}_H}/g$. Once we have determined $\left(\hat{z}_L, \hat{z}_H, w^1/w^2\right)$, the balanced trade condition determines the country allocation of mobile workers, which is given by $L^2/L^1 = \left(w^1/w^2\right)[1-\alpha(\hat{z}_H)/\alpha(\hat{z}_L)]$. Then, indirect utilities are given by:

$$v^1 = v^2 = C + T^1 + \int_{\hat{z}_H}^1 \alpha_z \ln\left(\frac{A_{\hat{z}_H}}{A_z}\right) dz$$

Finally, we must verify that the distribution of mobile workers between countries does not violate $L^j \in \left[(1-m)\bar{L}^j, \bar{L}^j + m\bar{L}^{-j}\right]$. In order to avoid such a situation, we impose the following assumption.

Assumption 1 (Continuum of Goods and Iceberg Trade Costs) *Labor mobility induces full convergence. Formally:*

$$\frac{\bar{L}^2 + m\bar{L}^1}{(1-m)\bar{L}^1} > gA_{\hat{z}_L}\left[\frac{1-\alpha(\hat{z}_H)}{\alpha(\hat{z}_L)}\right] > \frac{(1-m)\bar{L}^2}{\bar{L}^1 + m\bar{L}^2}$$

Lemma 1 characterizes the effects of trade and labor mobility on relative wages.

Lemma 1 (Continuum of Goods and Iceberg Trade Costs). *Let $T^j = -\int_0^1 \alpha_z \ln\left(a_{L,z}^j\right) dz$ be the average productivity of country j and assume $T^1 > T^2$. Define $\Delta_{\bar{z}_L,\bar{z}_H} = \alpha(\bar{z}_L)\ln(A_{\bar{z}_L}) + [1-\alpha(\bar{z}_H)]\ln(A_{\bar{z}_H}) + T_N^1 - T_N^2$, where $gA_{\bar{z}_L} = [\alpha(\bar{z}_L)/1-\alpha(\bar{z}_H)]\left(\bar{L}^2/\bar{L}^1\right) = A_{\bar{z}_H}/g$ and $T_N^j = \int_{\bar{z}_L}^{\bar{z}_H} \alpha_z \ln\left(a_{L,z}^j\right) dz$ is the average productivity of country j in the production of non-tradeable goods. Suppose that Assumption 3 holds. Then:*

1. *If $\Delta_{\bar{z}_L,\bar{z}_H} > \left(T^1 - T^2\right)$, then $v^1(1,0) - v^2(1,0) > v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0$.*
2. *If $0 < \Delta_{\bar{z}_L,\bar{z}_H} < \left(T^1 - T^2\right)$, then $v^1(0,0) - v^2(0,0) > v^1(1,0) - v^2(1,0) > v^1(1,1) - v^2(1,1) = 0$.*

3. *If* $\Delta_{\bar{z}_L,\bar{z}_H} < 0$*, then* $v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0 > v^1(1,0) - v^2(1,0)$

Proof: Under autarky, regardless of mobile workers' location decisions, we have $v^{j,im}(0,\mu) = C + A^j$. Thus, $v^{1,im}(0,0) - v^{2,im}(0,0) = A^1 - A^2$, which is positive by assumption. Under free trade, if there is no factor mobility, $v^{1,im}(1,0) = C + A^1 + \int_{\bar{z}_H}^{1} \alpha_z \ln\left(\frac{A_{\bar{z}_H}}{A_z}\right) dz$ and $v^{2,im}(1,0) = C + A^2 + \int_0^{\bar{z}_L} \alpha_z \ln\left(\frac{A_z}{A_{\bar{z}_L}}\right) dz$. Hence, $v^{1,im}(1,0) - v^{2,im}(1,0) = \int_{\bar{z}_L}^{\bar{z}_H} \alpha_z \ln(A_z) + \ln\left[(A_{\bar{z}_L})^{\alpha(\bar{z}_L)} (A_{\bar{z}_H})^{1-\alpha(\bar{z}_H)}\right]$. If there is free factor mobility, $v^1 = C + A^1 + \int_{\hat{z}_H}^{1} \alpha_z \ln\left(\frac{A_{\hat{z}_H}}{A_z}\right) dz$ and $v^2 = C + A^2 + \int_0^{\hat{z}_L} \alpha_z \ln\left(\frac{A_z}{A_{\hat{z}_L}}\right) dz$. Hence, $v^{1,im}(1,1) - v^{2,im}(1,1) = \int_{\hat{z}_L}^{\hat{z}_H} \alpha_z \ln(A_z) + \ln\left[(A_{\hat{z}_L})^{\alpha(\hat{z}_L)} (A_{\hat{z}_H})^{1-\alpha(\hat{z}_H)}\right]$. Provided that assumption 1 holds, in equilibrium it must be that $\ln\left[(A_{\hat{z}_L})^{\alpha(\hat{z}_L)} (A_{\hat{z}_H})^{1-\alpha(\hat{z}_H)}\right] = -\int_{\hat{z}_L}^{\hat{z}_H} \alpha_z \ln(A_z)$. Therefore, $v^{1,im}(1,1) - v^{2,im}(1,1) = 0$. Simple comparisons complete the proof of lemma 3. ■

Free trade and free labor mobility lead to full convergence in real wages, and trade has an ambiguous effect on relative wages. Trade can produce, divergence, partial convergence, or even a reversal of fortune, depending on the values of $\Delta_{\bar{z}_L,\bar{z}_H}$ and $(T^1 - T^2)$. Once again, we can interpret $\Delta_{\bar{z}_L,\bar{z}_H}$ as a measure of the productivity differential between the countries under free trade. There are, however, two novelties. First, since there are two marginal industries, we must average these productivity differentials. Second, the average productivity of country j in the production of non-tradeable goods is now endogenous.

Proposition 1 characterizes the political equilibrium.

Proposition 1 (Continuum of Goods and Iceberg Trade Costs). *Suppose that Assumption 3 holds,* $T^1 > T^2$ *and* $\Delta_{\bar{z}_L,\bar{z}_H} \neq 0$*. Then, the trade and labor mobility game has three Nash equilibria: (i)* $(\lambda_T, \lambda_M) = (0,0)$*; (ii)* $(\lambda_T, \lambda_M) = (0,1)$*; and (iii)* $(\lambda_T, \lambda_M) = (1,0)$*. Moreover:*

1. $W_G^1(1,0) > W_G^1(0,1) = W_G^1(0,0)$*;*
2. $\{W_G^2(1,0), W_G^2(0,1)\} > W_G^2(0,0)$*, while* $W_G^2(1,0) > W_G^2(0,1)$ *if and only if* $\int_0^{\bar{z}_L} \alpha_z \ln(A_z/A_{\bar{z}_L}) dz > m(T^1 - T^2)$*.*

Proof*:* Government 1 payoffs are given by $W_G^1(0,0) = W_G^1(0,1) = C + A^1$, $W_G^1(1,0) = C + A^1 + \int_{\bar{z}_H}^{1} \alpha_z \ln(A_{\bar{z}_H}/A_z) dz$, and $W_G^1(1,1) = C + A^1 + \int_{\hat{z}_H}^{1} \alpha_z \ln(A_{\hat{z}_H}/A_z) dz$. Government 2 payoffs are given $W_G^2(0,0) = C + A^2$, $W_G^2(0,1) = C + mA^1 + (1-m)A^2$, $W_G^2(1,0) = C + A^2 + \int_0^{\bar{z}_L} \alpha_z \ln\left(\frac{A_z}{A_{\bar{z}_L}}\right) dz$ and $W_G^2(1,1) = C + A^2 + \int_0^{\hat{z}_L} \alpha_z \ln\left(\frac{A_z}{A_{\hat{z}_L}}\right) dz$. (These calculations are implicitly based on Assumption 2).

$(\lambda_T, \lambda_M) = (0,0)$ is always a Nash equilibrium.

$(\lambda_T, \lambda_M) = (0,1)$ is a Nash equilibrium when $W_G^1(0,1) \geq W_G^1(0,0)$ and $W_G^2(0,1) \geq W_G^2(0,0)$. $W_G^1(0,1) = W_G^1(0,0) = C + T^1$, while $W_G^2(0,1) - W_G^2(0,0) = m(T^1 - T^2) > 0$, which is positive by assumption.

$(\lambda_T, \lambda_M) = (1,0)$ is a Nash equilibrium when $W_G^1(1,0) \geq W_G^1(0,0)$ and $W_G^2(1,0) \geq W_G^2(0,0)$. $A_z > A_{\bar{z}_L}$ for $z \in [0, \bar{z}_L)$ while $A_z < A_{\bar{z}_H}$ for $z \in (\bar{z}_H, 1]$. Then $W_G^1(1,0) - W_G^1(0,0) = \int_{\bar{z}_H}^{1} \alpha_z \ln(A_{\bar{z}_H}/A_z) dz > 0$ and $W_G^2(1,0) - W_G^2(0,0) = \int_0^{\bar{z}_L} \alpha_z \ln(A_z/A_{\bar{z}_L}) dz > 0$.

$(\lambda_T, \lambda_M) = (1,1)$ is not a Nash equilibrium. In order to prove this, note that $W_G^1(1,1) - W_G^1(1,0) = \int_{\hat{z}_H}^{1} \alpha_z \ln(A_{\hat{z}_H}/A_z) dz - \int_{\bar{z}_H}^{1} \alpha_z \ln(A_{\bar{z}_H}/A_z) dz$ and $W_G^2(1,1) - W_G^2(1,0) = \int_0^{\hat{z}_L} \alpha_z \ln(A_z/A_{\hat{z}_L}) dz -$

$\int_0^{\bar{z}_L} \alpha_z \ln\left(A_z/A_{\bar{z}_L}\right) dz$. Since, in equilibrium, $A_{\bar{z}_H} = g^2 A_{\bar{z}_L}$, either $\hat{z}_L > \bar{z}_L$ and $\hat{z}_H > \bar{z}_H$ or $\hat{z}_L < \bar{z}_L$ and $\hat{z}_H < \bar{z}_H$, or $\hat{z}_L = \bar{z}_L$ and $\hat{z}_H = \bar{z}_H$. If $\hat{z}_L > \bar{z}_L$ and $\hat{z}_H > \bar{z}_H$, then $A_{\hat{z}_H} < A_{\bar{z}_H}$. Thus, $W_G^1(1,1) - W_G^1(1,0) < 0$. If $\hat{z}_L < \bar{z}_L$ and $\hat{z}_H < \bar{z}_H$, then $A_{\hat{z}_L} > A_{\bar{z}_L}$. Thus, $W_G^2(1,1) - W_G^2(1,0) < 0$. Finally, note that $\hat{z}_L = \bar{z}_L$ and $\hat{z}_H = \bar{z}_H$ only if $\Delta_{\bar{z}_L,\bar{z}_H} = \ln\left[\left(A_{\bar{z}_L}\right)^{\alpha(\bar{z}_L)}\left(A_{\bar{z}_H}\right)^{1-\alpha(\bar{z}_H)}\right] + \int_{\bar{z}_L}^{\bar{z}_H} \alpha_z \ln\left(A_z\right) dz = 0$, which we rule out by assumption.

We have already proved that $W_G^1(1,0) > W_G^1(0,1) = W_G^1(0,0)$ and $\left\{W_G^2(1,0), W_G^2(0,1)\right\} > W_G^2(0,0)$. Finally, note that $W_G^2(1,0) - W_G^2(0,1) = \int_0^{\bar{z}_L} \alpha_z \ln\left(A_z/A_{\bar{z}_L}\right) dz - m\left(T^1 - T^2\right) > 0$ if and only if $\int_0^{\bar{z}_L} \alpha_z \ln\left(A_z/A_{\bar{z}_L}\right) dz > m\left(T^1 - T^2\right)$, which completes the proof of the proposition. ■

Proposition 1 shows that iceberg transportation costs do not affect the political economy of trade and labor mobility. Free trade and free labor mobility are not a Nash equilibrium. All the other outcomes are Nash equilibria, but free trade and no labor mobility always dominate other equilibria for the rich country under autarky (country 1), while the same is true for the poor country under autarky (country 2) when $\int_0^{\bar{z}_L} \alpha_z \ln\left(A_z/A_{\bar{z}_L}\right) dz > m\left(T^1 - T^2\right)$ holds, i.e., when aggregate productivity differentials between the countries are lower than the gains from trade for country 2.

A.3 Non-Homothetic Preferences

Lemma 2 (Non-Homothetic Preferences). *Suppose that Assumption 2 holds and $\tilde{v}^1 > \tilde{v}^2$, where $\int_0^{\tilde{v}^j} a_{L,z}^j dz = 1$. Then:*

1. *If $A_{\bar{z}} > 1$ and $\int_{\tilde{v}^1}^{\bar{v}^1} b_z dz > \int_{\tilde{v}^2}^{\bar{v}^2} b_z dz$, then $v^1(1,0) - v^2(1,0) > v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0$.*

2. *If $A_{\bar{z}} > 1$ and $\int_{\tilde{v}^1}^{\bar{v}^1} b_z dz < \int_{\tilde{v}^2}^{\bar{v}^2} b_z dz$ then, $v^1(0,0) - v^2(0,0) > v^1(1,0) - v^2(1,0) > v^1(1,1) - v^2(1,1) = 0$.*

3. *If $A_{\bar{z}} < 1$, then $v^1(0,0) - v^2(0,0) > v^1(1,1) - v^2(1,1) = 0 > v^1(1,0) - v^2(1,0)$.*

Proof: Under autarky, the indirect utility of a worker in country j is given by $v^j(0,0) = \int_0^{\tilde{v}^j} b_z dz$, where $\int_0^{\tilde{v}^j} a_{L,z}^j dz = 1$. Since $\tilde{v}^1 > \tilde{v}^2$ and $b_z > 0$ for all $z \in Z$, it must be the case that $v^1(0,0) - v^2(0,0) = \int_{\tilde{v}^2}^{\tilde{v}^1} b_z dz > 0$. Under free trade and no labor mobility, the indirect utility of a worker in country j is given by $v^j(1,0) = \int_0^{\bar{v}^j} b_z dz$, where $\int_{\bar{z}}^{\bar{v}^1} a_{L,z}^1 dz = 1 - \left[\bar{L}^2/A_{\bar{z}}\left(\bar{L}^1 + \bar{L}^2\right)\right]$, $\int_{\bar{z}}^{\bar{v}^2} a_{L,z}^1 dz = \bar{L}^1/A_{\bar{z}}\left(\bar{L}^1 + \bar{L}^2\right)$ and $\int_0^{\bar{z}} a_{L,z}^2 dz = \bar{L}^2/\left(\bar{L}^1 + \bar{L}^2\right)$. Since $b_z > 0$ for all $z \in Z$, $v^1(1,0) - v^2(1,0) = \int_{\bar{v}^2}^{\bar{v}^1} b_z dz > 0$ if and only if $\bar{v}^1 > \bar{v}^2$. Since $\int_{\bar{v}^2}^{\bar{v}^1} a_{L,z}^1 dz = 1 - 1/A_{\bar{z}}$ and $a_{L,z}^1 > 0$ for all $z \in Z$, $\bar{v}^1 > \bar{v}^2$ if and only if $A_{\bar{z}} > 1$. We have already seen that, under free trade and free labor mobility, the indirect utility of a worker is the same in both countries, i.e., $v^1(1,1) - v^2(1,1) = 0$. Finally, $v^1(1,0) - v^2(1,0) > v^1(0,0) - v^2(0,0)$ if and only if $\int_{\bar{v}^2}^{\bar{v}^1} b_z dz > \int_{\tilde{v}^2}^{\tilde{v}^1} b_z dz$ or, which amounts to the same thing, $\int_{\tilde{v}^1}^{\bar{v}^1} b_z dz > \int_{\tilde{v}^2}^{\bar{v}^2} b_z dz$. ■

Proposition 2 (Non-Homothetic Preferences). *Suppose that Assumption 2 holds and $\tilde{v}^1 > \tilde{v}^2$, where $\int_0^{\tilde{v}^j} a_{L,z}^j dz = 1$. Then, the trade and labor mobility game has three Nash equilibria: (i) $(\lambda_T, \lambda_M) = (0,0)$; (ii) $(\lambda_T, \lambda_M) = (0,1)$; and (iii) $(\lambda_T, \lambda_M) = (1,0)$. Moreover:*

1. $W_G^1(1,0) > W_G^1(0,1) = W_G^1(0,0)$;

2. $\{W_G^2(1,0), W_G^2(0,1)\} > W_G^2(0,0)$, *while* $W_G^2(1,0) > W_G^2(0,1)$ *if and only if* $\int_{\tilde{v}^2}^{\bar{v}^2} b_z dz > m\int_{\tilde{v}^2}^{\tilde{v}^1} b_z dz$.

Proof: Since $\tilde{v}^1 > \tilde{v}^2$ implies $v^1 = \int_0^{\tilde{v}^1} b_z dz > \int_0^{\tilde{v}^2} b_z dz = v^2$, under autarky and free labor mobility, all mobile workers go to or stay in country 1. Due to assumption 2, under free trade and free labor mobility, mobile workers relocate until $v^1 = v^2 = \int_0^{\hat{v}} b_z dz$. The payoffs of government 1 are given by: $W_G^1(0,0) = W_G^1(0,1) = \int_0^{\tilde{v}^1} b_z dz$, where $\tilde{v}^1$ is given by $\int_0^{\tilde{v}^1} a_{L,z}^1 dz = 1$; $W_G^1(1,0) = \int_0^{\bar{v}^1} b_z dz$, where $\bar{v}^1$ is given by $\frac{1}{A_{\bar{z}}}\int_0^{\bar{z}} a_{L,z}^2 dz + \int_{\bar{z}}^{\bar{v}^1} a_{L,z}^1 dz = 1$; and $W_G^1(1,1) = \int_0^{\hat{v}} b_z dz$, where $\hat{v}$ is given by $\int_{\hat{z}}^{\hat{v}} a_{L,z}^1 dz = 1 - \int_0^{\hat{z}} a_{L,z}^2 dz$. The payoffs of government 2 are given by: $W_G^2(0,0) = \int_0^{\tilde{v}^2} b_z dz$, where $\tilde{v}^2$ is given by $\int_0^{\tilde{v}^2} a_{L,z}^2 dz = 1$; $W_G^2(0,1) = m\int_0^{\tilde{v}^1} b_z dz + (1-m)\int_0^{\tilde{v}^2} b_z dz$; $W_G^2(1,0) = \int_0^{\bar{v}^2} b_z dz$, where $\bar{v}^2$ is given by $\int_0^{\bar{z}} a_{L,z}^2 dz + A_{\bar{z}}\int_{\bar{z}}^{\bar{v}^2} a_{L,z}^1 dz = 1$; and $W_G^1(1,1) = \int_0^{\hat{v}} b_z dz$.

$(\lambda_T, \lambda_M) = (0,0)$ is a always a Nash equilibrium.

$(\lambda_T, \lambda_M) = (0,1)$ is a Nash equilibrium when $W_G^j(0,1) \geq W_G^j(0,0)$ for $j = 1,2$. $W_G^1(0,1) = W_G^1(0,0)$, while $W_G^2(0,1) - W_G^2(0,0) = m\int_{\tilde{v}^2}^{\tilde{v}^1} b_z dz > 0$ because $b_z > 0$ for all z and $\tilde{v}^1 > \tilde{v}^2$.

$(\lambda_T, \lambda_M) = (1,0)$ is a Nash equilibrium when $W_G^j(1,0) \geq W_G^j(0,0)$ for $j = 1,2$. The indirect utility of a worker in country 1 under autarky is $v^1(0,0) = \int_0^{\tilde{v}^1} b_z dz$, where $\tilde{v}^1$ is given by $\int_0^{\tilde{v}^1} a_{L,z}^1 dz = 1$. The indirect utility of a worker in country 1 under free trade and no labor mobility is $v^1(1,0) = \int_0^{\bar{v}^1} b_z dz$, where $\bar{v}^1$ is given by $\frac{1}{A_{\bar{z}}}\int_0^{\bar{z}} a_{L,z}^2 dz + \int_{\bar{z}}^{\bar{v}^1} a_{L,z}^1 dz = 1$. Therefore, $\frac{1}{A_{\bar{z}}}\int_0^{\bar{z}} a_{L,z}^2 dz + \int_{\bar{z}}^{\bar{v}^1} a_{L,z}^1 dz = \int_0^{\tilde{v}^1} a_{L,z}^1 dz$. This implies $\int_0^{\bar{z}} a_{L,z}^1 \frac{A_z}{A_{\bar{z}}} dz + \int_{\bar{z}}^{\bar{v}^1} a_{L,z}^1 dz = \int_0^{\tilde{v}^1} a_{L,z}^1 dz$, which, after some simple algebra, implies $\int_{\tilde{v}^1}^{\bar{v}^1} a_{L,z}^1 dz = \int_0^{\bar{z}} a_{L,z}^1 \left(1 - \frac{A_z}{A_{\bar{z}}}\right) dz$. Since $A_z < A_{\bar{z}}$ for $z \in [0, \bar{z})$ and $a_{L,z}^1 > 0$ for all z, it must be the case that $\int_0^{\bar{z}} a_{L,z}^1 \left(1 - \frac{A_z}{A_{\bar{z}}}\right) dz > 0$. Since $a_{L,z}^1 > 0$ for all z, $\int_{\tilde{v}^1}^{\bar{v}^1} a_{L,z}^1 dz > 0$ implies $\bar{v}^1 > \tilde{v}^1$. Finally, since $b_z > 0$ for all z, $\bar{v}^1 > \tilde{v}^1$ implies $W_G^1(1,0) - W_G^1(0,0) = \int_{\tilde{v}^1}^{\bar{v}^1} b_z dz > 0$. The indirect utility of a worker in country 2 under autarky is $v^2(0,0) = \int_0^{\tilde{v}^2} b_z dz$, where $\tilde{v}^2$ is given by $\int_0^{\tilde{v}^2} a_{L,z}^2 dz = 1$. The indirect utility of a worker in country 2 under free trade and no labor mobility is $v^2(1,0) = \int_0^{\bar{v}^2} b_z dz$, where $\bar{v}^2$ is given by $\int_0^{\bar{z}} a_{L,z}^2 dz + A_{\bar{z}}\int_{\bar{z}}^{\bar{v}^2} a_{L,z}^1 dz = 1$. Therefore, $\int_0^{\bar{z}} a_{L,z}^2 dz + A_{\bar{z}}\int_{\bar{z}}^{\bar{v}^2} a_{L,z}^1 dz = \int_0^{\tilde{v}^2} a_{L,z}^2 dz$. This implies $\int_0^{\bar{z}} a_{L,z}^2 dz + \int_{\bar{z}}^{\bar{v}^2} \frac{A_{\bar{z}}}{A_z} a_{L,z}^2 dz = \int_0^{\tilde{v}^2} a_{L,z}^2 dz$, which, after some simple algebra, implies $\int_{\bar{z}}^{\bar{v}^2} \frac{A_{\bar{z}}}{A_z} a_{L,z}^2 dz = \int_{\bar{z}}^{\tilde{v}^2} a_{L,z}^2 dz$. Since $A_z > A_{\bar{z}} > 0$ for $z > \bar{z}$ and $a_{L,z}^2 > 0$ for all z, it must be the case that $\bar{v}^2 > \tilde{v}^2$. Finally, since $b_z > 0$ for all z, $\bar{v}^2 > \tilde{v}^2$ implies $W_G^2(1,0) - W_G^2(0,0) = \int_{\tilde{v}^2}^{\bar{v}^2} b_z dz > 0$.

$(\lambda_T, \lambda_M) = (1,1)$ is not a Nash equilibrium. Given L^1 and L^2, the equilibrium $(\bar{v}^1, \bar{v}^2, \bar{z})$ is determined by $\int_{\bar{z}}^{\bar{v}^1} a_{L,z}^1 dz = 1 - L^2/A_{\bar{z}}(L^1 + L^2)$, $\int_{\bar{z}}^{\bar{v}^2} a_{L,z}^1 dz = L^1/A_{\bar{z}}(L^1 + L^2)$, and $\int_0^{\bar{z}} a_{L,z}^2 dz = L^2/(L^1 + L^2)$. Differentiating these expressions with respect to $L^1/(L^1 + L^2)$, we obtain

$$\frac{\partial \bar{v}^1}{\partial [L^1/(L^1+L^2)]} = \frac{-A_{\bar{z}}' L^2}{(A_{\bar{z}})^2 (L^1 + L^2)\, a_{L,\bar{v}^1}^1 a_{L,\bar{z}}^2} < 0$$

$$\frac{\partial \bar{v}^2}{\partial [L^1/(L^1+L^2)]} = \frac{A_{\bar{z}}' L^1}{(A_{\bar{z}})^2 (L^1 + L^2)\, a_{L,\bar{v}^2}^1 a_{L,\bar{z}}^2} > 0$$

Thus, as the proportion of the labor force that decides to relocate to country 1 increases (decreases), $\bar{v}^1$ decreases (increases) and $\bar{v}^2$ increases (decreases). We have already shown that $\bar{v}^1 > \bar{v}^2$ if and only if $A_{\bar{z}} > 1$. Therefore, when $A_{\bar{z}} > 1$, if there is free labor mobility, $L^1 > \bar{L}^1$ and $L^2 < \bar{L}^2$. Then, $\bar{v}^1 < \hat{v} < \bar{v}^2$, which implies $W_G^1(1,0) - W_G^1(1,1) = \int_{\hat{v}}^{\bar{v}^1} b_z dz > 0$ and $W_G^2(1,1) - W_G^2(1,0) = \int_{\bar{v}^2}^{\hat{v}} b_z dz > 0$. Conversely, when $A_{\bar{z}} < 1$, if there is free labor mobility, $L^1 < \bar{L}^1$ and $L^2 > \bar{L}^2$. Then, $\bar{v}^2 < \hat{v} < \bar{v}^1$, which implies $W_G^1(1,1) - W_G^1(1,0) = \int_{\bar{v}^1}^{\hat{v}} b_z dz > 0$ and $W_G^2(1,0) - W_G^2(1,1) = \int_{\hat{v}}^{\bar{v}^2} b_z dz > 0$. Thus, provided that $A_{\bar{z}} \neq 1$, free trade and free labor mobility will never be a Nash equilibrium.

We have already shown that $W_G^1(1,0) > W_G^1(0,0) = W_G^1(0,1)$ and $W_G^2(1,0) > W_G^1(0,0)$ and $W_G^2(0,1) > W_G^2(0,0)$. The last step is to compare $W_G^2(1,0) = \int_0^{\bar{v}^2} b_z dz$ and $W_G^2(0,1) = m\int_0^{\tilde{v}^1} b_z dz + (1-m)\int_0^{\tilde{v}^2} b_z dz$. $W_G^2(1,0) > W_G^2(0,0)$ if and only if $\int_{\tilde{v}^2}^{\bar{v}^2} b_z dz > m\int_{\tilde{v}^2}^{\tilde{v}^1} b_z dz$. This completes the proof of the proposition. ■

A.4 Multiple Countries

Lemma 3 (Multiple Countries). *Suppose that Assumption 3 holds and $T^j > T^k$. Then:*

1. *If* $\ln\left(\frac{\bar{L}^j}{\bar{L}^k}\right) < \left(1-\theta-\theta^2\right)\ln\left(\frac{T^j}{T^k}\right)$, $v^j(1,0) - v^k(1,0) > v^j(0,0) - v^k(0,0) > v^j(1,1) - v^k(1,1) = 0$.
2. *If* $\left(1-\theta-\theta^2\right)\ln\left(\frac{A^j}{A^k}\right) < \ln\left(\frac{\bar{L}^j}{\bar{L}^k}\right) < \ln\left(\frac{T^j}{T^k}\right)$, *then,* $v^j(0,0) - v^k(0,0) > v^j(1,0) - v^k(1,0) > v^j(1,1) - v^k(1,1) = 0$.
3. *If* $\ln\left(\frac{\bar{L}^j}{\bar{L}^k}\right) > \ln\left(\frac{T^j}{T^k}\right)$, $v^j(0,0) - v^k(0,0) > v^j(1,1) - v^k(1,1) = 0 > v^j(1,0) - v^k(1,0)$.

Proof: Under autarky, regardless of mobile workers' location decisions, we have $v^j(0,\mu) = -\ln(\gamma) + (1/\theta)\ln T^j$. Thus, $v^j(0,0) - v^k(0,0) = \theta\ln\left(T^j/T^k\right)$, which is positive by assumption. Under free trade, if there is no labor mobility, $v^j(1,0) = -\ln(\gamma) + (1+\theta)^{-1}\ln\left(T^j/\bar{L}^j\right) + (1/\theta)\ln\left[\sum_{i\in J}\left(T^i\right)^{\frac{1}{1+\theta}}\left(\bar{L}^i\right)^{\frac{\theta}{1+\theta}}\right]$. Hence, $v^j(1,0) - v^k(1,0) = (1+\theta)^{-1}\left[\ln\left(T^j/L^j\right) - \ln\left(T^k/L^k\right)\right]$. If there is free labor mobility and Assumption 3 holds, $v^j(1,1) = -\ln(\gamma) + (1/\theta)\ln\left(\sum_{i\in J} T^i\right)$. Hence, $v^j(1,1) - v^k(1,1) = 0$. Simple comparisons complete the proof of the lemma. ■

Proposition 3 (Multiple Countries). *Suppose that assumption 3 holds and assume that $T^j \neq T^k$ and $T^j/\bar{L}^j \neq T^k/\bar{L}^k$ for all $j,k \in J$ and $j \neq k$. Then:*

1. *No trade and any pattern of labor mobility policy is a Nash equilibrium. Moreover, among those equilibria, no trade and complete free labor mobility prevail over the other equilibria for all countries.*
2. *No labor mobility and any pattern of trade policy is a Nash equilibrium. Moreover, among those equilibria, no labor mobility and complete free trade prevail over the other equilibria for all countries.*
3. $W_G^j(1,0) > W_G^j(0,1)$ *if and only if:*

$$\ln\left[\frac{\sum_{i\in J}\left(T^i\right)^{\frac{1}{1+\theta}}\left(\bar{L}^i\right)^{\frac{\theta}{1+\theta}}}{\left(T^j\right)^{\frac{1}{1+\theta}}\left(\bar{L}^j\right)^{\frac{\theta}{1+\theta}}}\right] > m\ln\left(\frac{\max_{i\in J}\left\{T^i\right\}}{T^j}\right)$$

In other words, if the above condition holds, for country complete free trade and no labor mobility are better than complete free factor mobility and no trade.

4. *Any pattern of trade policy other than complete autarky and any pattern of labor mobility policy within the countries that trade with each other other than no labor mobility are not a Nash equilibrium. In particular, complete free trade and any pattern of labor mobility policy other than no mobility are not a Nash equilibrium.*

Proof: No trade and any pattern of labor mobility policy is a Nash equilibrium. Suppose that no country allows free trade and consider any partition $\mathbf{J}_M$ of the set of countries J. Each element of $\mathbf{J}_M$ is a set of countries that allow factor mobility among them, but do not allow it with the rest of world. Arbitrarily select $j \in J_M \in \mathbf{J}_M$. Since all countries are blocking trade, there is no unilateral move by j that can induce trade. Since countries in $J - J_M$ do not accept labor mobility with countries in J_M, there is no unilateral move by j that can induce labor mobility outside J_M. Therefore, the only relevant decision for j is about labor mobility with countries in J_M. In fact, given that mobile workers can move from one country to another at no cost, j must decide between accepting free labor mobility with all countries in J_M or with none of them. Regardless of j's decision, immobile workers in country j get $v^j = -\ln\gamma + (1/\theta)\ln T^j$. If j does not allow labor mobility, then mobile workers in j also get $v^j = -\ln\gamma + (1/\theta)\ln T^j$. Conversely, if j allows labor mobility, mobile workers in j will relocate in the richest country in J_M. Thus, they will get $v^j = -\ln\gamma + (1/\theta)\max_{i\in J_M}\left\{\ln T^i\right\}$. Since $W_G^j = mv^{j,m} + (1-m)\, v^{j,im}$, it follows that W_G^j when j allows labor mobility will be higher than or equal to W_G^j when j blocks labor mobility. Finally, since $j \in J_M \in \mathbf{J}_M$ were also selected arbitrarily, the same analysis applies to any $j \in J_M \in \mathbf{J}_M$, which completes the proof that no trade and any pattern of labor mobility are a Nash equilibrium. Finally, note that $W_G^j = -\ln\gamma + (m/\theta)\max_{i\in J_M}\left\{\ln T^i\right\} + \left[(1-m)/\theta\right]\ln T^j$ is nondecreasing in J_M. Indeed, W_G^j is strictly increasing in J_M for all countries except the one with the highest T^j, for which $\max_{i\in J_M}\left\{\ln T^i\right\}$ does not change with J_M. Thus, under complete autarky, the pattern of labor mobility that maximizes W_G^j for all $j \in J$ is $J_M = J$. This completes the proof of part 1.

No labor mobility and any pattern of trade policies is a Nash equilibrium. Suppose that no country allows migration and consider any partition $\mathbf{J}_T$ of the set of countries J. Each element of $\mathbf{J}_T$ is a set of countries that allows free trade within that group, but does not allow it with the rest of the world. Arbitrarily select $j \in J_T \in \mathbf{J}_T$. Since no country is offering free labor mobility, there is nothing that country j can do to bring about labor mobility. Suppose that country j decides to trade only with a subset $\tilde{J}_T \subset J_T$. Then, $W_G^j = v^j = -\ln(\gamma) + (1+\theta)^{-1}\ln\left(T^j/\bar{L}^j\right) + (1/\theta)\ln\left[\sum_{i\in\tilde{J}_T}\left(T^i\right)^{\frac{1}{1+\theta}}\left(\bar{L}^i\right)^{\frac{\theta}{1+\theta}}\right]$. Since W_G^j increases with the number of countries in J_T, the best response for country j is to set $\tilde{J}_T = J_T$. Since we have picked an arbitrary country, the same analysis applies to all $j \in J_T \in \mathbf{J}_T$. Therefore, complete free trade and any pattern of labor mobility policy are a Nash equilibrium. Finally, note that $W_G^j = -\ln\gamma + (1+\theta)^{-1}\ln\left(T^j/\bar{L}^j\right) + (1/\theta)\ln\left[\sum_{i\in J_T}\left(T^i\right)^{\frac{1}{1+\theta}}\left(\bar{L}^i\right)^{\frac{\theta}{1+\theta}}\right]$ is increasing in J_T. Thus, when there is no labor mobility, the pattern of trade that maximizes W_G^j for all $j \in J$ is $J_T = J$. This completes the proof of part 2.

The payoff of the government of country j under autarky and free factor mobility is given by $W_G^j(0,1) = -\ln\gamma + (m/\theta)\max_{i\in J}\left\{\ln T^i\right\} + \left[(1-m)/\theta\right]\ln T^j$, while, under complete free trade and no labor mobility, it is $W_G^j(1,0) = -\ln\gamma + (1+\theta)^{-1}\ln\left(T^j/\bar{L}^j\right) + \frac{1}{\theta}\ln\left[\sum_{i\in J_T}\left(T^i\right)^{\frac{1}{1+\theta}}\left(\bar{L}^i\right)^{\frac{\theta}{1+\theta}}\right]$. Therefore, $W_G^j(1,0) > W_G^j(0,1)$ if and only if $\ln\left[\frac{\sum_{i\in J}\left(A^i\right)^{\frac{1}{1+\theta}}\left(\bar{L}^i\right)^{\frac{\theta}{1+\theta}}}{\left(A^j\right)^{\frac{1}{1+\theta}}\left(\bar{L}^j\right)^{\frac{\theta}{1+\theta}}}\right] > m\ln\left(\frac{\max_{i\in J}\left\{A^i\right\}}{A^j}\right)$. This completes the proof of part 3.

Free trade and any pattern of labor mobility other than no mobility is not a Nash equilibrium. Assume that all countries are allowing free trade and consider any arbitrary labor mobility partition $\mathbf{J}_M$ for which at least one set J_M has more than one country. Among the countries in J_M, let j be the one with the highest $T^j/\bar{L}^j$ ratio. Next, we show that, if country j blocks labor mobility with countries in J_M, then W_G^j increases. The utility of a worker in country $j \in J_M \in \mathbf{J}_M$ is given by:

$$v^j = -\ln(\gamma) + \frac{1}{1+\theta}\ln\left(\frac{T^j}{L^j}\right) + \frac{1}{\theta}\ln\left[\sum_{i\in J_M}\left(T^i\right)^{\frac{1}{1+\theta}}\left(L^i\right)^{\frac{\theta}{1+\theta}} + \sum_{i\in J-J_M}\left(T^i\right)^{\frac{1}{1+\theta}}\left(L^i\right)^{\frac{\theta}{1+\theta}}\right],$$

where L^i is the labor force of country i. Let us reorder the countries in J_M in such a way that $T^1/\bar{L}^1 > T^2/\bar{L}^2 > ... > T^{n_M}/\bar{L}^{n_M}$, where $n_M = \#J_M \geq 2$ is the number of countries in J_M. Mobile worker will go to or stay in the country with the highest T^j/L^j. Thus, mobile workers in J_M will first relocate to country 1 until $T^1/L^1 = T^2/(1-m)\bar{L}^2$. Then, they will relocate to countries 1 and 2 until $T^1/L^1 = T^2/L^2 = T^3/(1-m)\bar{L}^3$. The relocation of mobile workers will end when (a) $T^1/L^1 = ... = T^l/L^l > T^{l+1}/(1-m)\bar{L}^2 > ... > T^{n_M}/(1-m)\bar{L}^{n_M}$ and $\sum_{i=1}^{l}L^i = \sum_{i=1}^{l}\bar{L}^i + m\sum_{i=l+1}^{n_M}\bar{L}^i$; (b) $T^1/L^1 = T^2/L^2 = ... = T^{n_M}/L^{n_M}$ and $\sum_{i=1}^{n_M}L^i = \sum_{i=1}^{n_M}\bar{L}^i$. In case (a), we obtain $L^j = \left(T^j/\sum_{i=1}^{l}T^i\right)\left(\sum_{i=1}^{l}\bar{L}^i + m\sum_{i=l+1}^{n_M}\bar{L}^i\right)$ for $j = 1,...,l$ and $L^j = (1-m)\bar{L}^j$ for $j = l+1,...,n_M$. In order for this to be the equilibrium allocation of mobile workers we must verify that $L^j \geq (1-m)\bar{L}^j$ for $j = 1,...,n_M$ and $T^1/L^1 = ... = T^l/L^l > T^{l+1}/(1-m)\bar{L}^{l+1}$, which holds if and only if $T^l/(1-m)\bar{L}^l \geq \sum_{i=1}^{l}T^i/\left(\sum_{i=1}^{l}\bar{L}^i + m\sum_{i=l+1}^{n_M}\bar{L}^i\right) > T^{l+1}/(1-m)\bar{L}^{l+1}$. We must also check that there is not another $l' < l$ for which the above condition holds. In case (b), we obtain $L^j = \left(T^j/\sum_{i=1}^{n_M}T^i\right)\left(\sum_{i=1}^{n_M}\bar{L}^i\right)$ for $j = 1,...,n_M$. In order for this to be the equilibrium allocation of mobile workers we must verify that $L^j \geq (1-m)\bar{L}^j$ for $j = 1,...,n_M$, which holds if and only if $T^{n_M}/(1-m)\bar{L}^{n_M} \geq \sum_{i=1}^{n_M}T^i/\sum_{i=1}^{n_M}\bar{L}^i$. Summing up, the equilibrium allocation of mobile workers is $L^j = \left(T^j/\sum_{i=1}^{l}T^i\right)\left(\sum_{i=1}^{l}\bar{L}^i + m\sum_{i=l+1}^{n_M}\bar{L}^i\right)$ for $j = 1,...,l(J_M)$ and $L^j = (1-m)\bar{L}^j$ for $j = l(J_M)+1,...,n_M$, where $l(J_M)$ is given by the first time that $T^l/(1-m)\bar{L}^l \geq \sum_{i=1}^{l}T^i/\left(\sum_{i=1}^{l}\bar{L}^i + m\sum_{i=l+1}^{n_M}\bar{L}^i\right) > T^{l+1}/(1-m)\bar{L}^{l+1}$ holds .

Result 1: $l(J_M - \{1\}) \geq l(J_M)$. Proof: It suffices to show that $\sum_{i=1}^{l} T^i / \left(\sum_{i=1}^{l} \bar{L}^i + m \sum_{i=l+1}^{n_M} \bar{L}^i\right) > \sum_{i=2}^{l} T^i / \left(\sum_{i=2}^{l} \bar{L}^i + m \sum_{i=l+2}^{n_M} \bar{L}^i\right)$ for each l.

$$\begin{aligned}
\frac{T^1}{\bar{L}^1} > \frac{\sum_{i=2}^{l} T^i}{\sum_{i=2}^{l} \bar{L}^i} \Rightarrow \frac{T^1}{\bar{L}^1} &> \frac{\sum_{i=2}^{l} T^i}{\sum_{i=2}^{l} \bar{L}^i + m \sum_{i=l+2}^{n_M} \bar{L}^i} \\
&\Leftrightarrow \frac{T^1 + \sum_{i=2}^{l} T^i}{\bar{L}^1 + \sum_{i=2}^{l} \bar{L}^i + m \sum_{i=l+2}^{n_M} \bar{L}^i} > \frac{\sum_{i=2}^{l} T^i}{\sum_{i=2}^{l} \bar{L}^i + m \sum_{i=l+2}^{n_M} \bar{L}^i} \\
&\Leftrightarrow \frac{\sum_{i=1}^{l} T^i}{\sum_{i=1}^{l} \bar{L}^i + m \sum_{i=l+1}^{n_M} \bar{L}^i} > \frac{\sum_{i=2}^{l} T^i}{\sum_{i=2}^{l} \bar{L}^i + m \sum_{i=l+1}^{n_M} \bar{L}^i}
\end{aligned}$$

The first line relies on the fact that we have reordered countries in such a way that $T^1/\bar{L}^1 > T^2/\bar{L}^2 > ... > T^{n_M}/\bar{L}^{n_M}$. The other lines are simple algebra.

Result 2: $\bar{L}^1 < L^1(J_M)$ and $L^j(J_M - \{1\}) \geq L^j(J_M)$ for $j = 2, ..., n_M$. Proof:

$$\begin{aligned}
\frac{T^1}{\bar{L}^1} > \frac{\sum_{i=1}^{l} T^i}{\sum_{i=1}^{l} \bar{L}^i} \Rightarrow \frac{T^1}{\bar{L}^1} &> \frac{\sum_{i=1}^{l} T^i}{\sum_{i=1}^{l} \bar{L}^i + m \sum_{i=l+1}^{n_M} \bar{L}^i} \\
&\Rightarrow \left(\frac{T^1}{\sum_{i=1}^{l} T^i}\right) \left(\sum_{i=1}^{l} \bar{L}^i + m \sum_{i=l+1}^{n_M} \bar{L}^i\right) > \bar{L}^1 \\
&\Rightarrow L^1(J_M) > \bar{L}^1
\end{aligned}$$

The first line relies on the fact that we have reordered countries in such a way that $T^1/\bar{L}^1 > \frac{A^2}{\bar{L}^2} > ... > \frac{A^{n_M}}{\bar{L}^{n_M}}$. The last line introduces the equilibrium value of $L^1(J_M)$.

$$\begin{aligned}
\frac{T^1}{\bar{L}^1} > \frac{\sum_{i=2}^{l} T^i}{\sum_{i=2}^{l} \bar{L}^i} \Rightarrow \frac{T^1}{\bar{L}^1} &> \frac{\sum_{i=2}^{l} T^i}{\sum_{i=2}^{l} \bar{L}^i + m \sum_{i=l+1}^{n_M} \bar{L}^i} \\
&\Rightarrow \left(\frac{T^j}{\sum_{i=2}^{l} T^i}\right) \left(\sum_{i=2}^{l} \bar{L}^i + m \sum_{i=l+1}^{n_M} \bar{L}^i\right) > \left(\frac{T^j}{\sum_{i=1}^{l} T^i}\right) \left(\sum_{i=1}^{l} \bar{L}^i + m \sum_{i=l+1}^{n_M} \bar{L}^i\right) \\
&\Rightarrow L^j(J_M - \{1\}) \geq L^j(J_M) \text{ for } j \leq l(J_M - \{j\})
\end{aligned}$$

The first line relies on the fact that we have reordered countries in such a way that $T^1/\bar{L}^1 > T^2/\bar{L}^2 > ... > T^{n_M}/\bar{L}^{n_M}$. The last line introduces the equilibrium values of $L^j(J_M - \{1\})$ and $L^j(J_M)$ for $j \leq l(J_M - \{j\})$. Finally, for $l > l(J_M - \{j\})$, we have $L^j(J_M) = (1-m)\bar{L}^j$. Thus, it must be the case that $L^j(J_M - \{1\}) \geq (1-m)\bar{L}^j$ for $l > l(J_M - \{j\})$.

Result 3: v^j is decreasing in L^j and increasing in L^i. Proof: v^j is given by:

$$v^j = -\ln(\gamma) + \frac{1}{1+\theta} \ln\left(\frac{T^j}{L^j}\right) + \frac{1}{\theta} \ln\left[\sum_{i \in J_M} \left(T^i\right)^{\frac{1}{1+\theta}} \left(L^i\right)^{\frac{\theta}{1+\theta}} + \sum_{i \in J - J_M} \left(T^i\right)^{\frac{1}{1+\theta}} \left(L^i\right)^{\frac{\theta}{1+\theta}}\right]$$

Taking the derivative of v^j with respect to L^j and L^i, we obtain:

$$\frac{\partial v^j}{\partial L^j} = \frac{1}{(1+\theta)\, L^j}\left[-1+\frac{\left(T^j\right)^{\frac{1}{1+\theta}}\left(L^j\right)^{\frac{\theta}{1+\theta}}}{\sum_{i\in J_M}\left(T^i\right)^{\frac{1}{1+\theta}}\left(L^i\right)^{\frac{\theta}{1+\theta}}}\right] < 0$$

$$\frac{\partial v^j}{\partial L^i} = \frac{1}{(1+\theta)\, L^i}\frac{\left(T^i\right)^{\frac{1}{1+\theta}}\left(L^i\right)^{\frac{\theta}{1+\theta}}}{\sum_{i\in J_M}\left(T^i\right)^{\frac{1}{1+\theta}}\left(L^i\right)^{\frac{\theta}{1+\theta}}} > 0 \;\; i \neq j, i \in J_M$$

Thus, v^j is decreasing in L^j and increasing in L^i.

Results 1-3 imply that v^1 prefers to block labor mobility. Thus, under complete free trade, the richest country in a set of countries that are allowing free labor mobility within that set prefers to deviate and block labor mobility. This completes the proof that complete free trade and any pattern of labor mobility policy other than no mobility is not a Nash equilibrium. This result can also be used to prove that any pattern of trade policy except complete autarky and any pattern of labor mobility policy within the trading-partner countries other than no labor mobility is not a Nash equilibrium. Take any partition $\mathbf{J}_T$ and consider any arbitrary set $J_T \in \mathbf{J}_T$. Then, any pattern of labor mobility within J_T other than no mobility is not part of a Nash equilibrium. The proof arises immediately from the previous results because each J_T can be treated as a world economy with J_T countries among which there is complete free trade. This completes the proof of part 4. ■

A.5 Increasing Returns to Scale

Proposition 4 (Increasing Returns to Scale). *Suppose that Assumptions 1, 4 and 5 hold. Then:*

1. *No trade and no labor mobility is a Nash equilibrium.*

2. *No trade and partial labor mobility is a Nash equilibrium if and only if:*

$$\bar{\lambda}_M\left\{T^1 - T^2 + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\bar{L}^1+\bar{\lambda}_M m\bar{L}^2}{\left(1-\bar{\lambda}_M m\right)\bar{L}^2}\right]\right\} \geq -\frac{\alpha_1}{\sigma-1}\ln\left(1-\bar{\lambda}_M m\right)^{\frac{1}{m}}$$

Moreover, if no trade and partial labor mobility is an equilibrium, then $W_G^j\left(0,\bar{\lambda}_M\right) \geq W_G^j\left(0,0\right)$ *for* $j=1,2$.

3. *No trade and free labor mobility is a Nash equilibrium if and only if:*

$$\bar{\lambda}_M\left\{T^1 - T^2 + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\bar{L}^1+\bar{\lambda}_M m\bar{L}^2}{\left(1-\bar{\lambda}_M m\right)\bar{L}^2}\right]\right\} \leq \left(T^1-T^2\right) + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\left(\bar{L}^1+m\bar{L}^2\right)(1-m)^{\frac{1}{m}}}{(1-m)\,\bar{L}^2\left(1-\bar{\lambda}_M m\right)^{\frac{1}{m}}}\right]$$

Moreover, if no trade and free labor mobility is an equilibrium, then $W_G^j(0,1) \geq \max\left\{W_G^j(0,0), W_G^j\left(0,\bar{\lambda}_M\right)\right\}$ *for* $j=1,2$.

4. *Free trade and no labor mobility is a Nash equilibrium if and only if:*

$$\left(\frac{1-\alpha_3}{\alpha_2}\right)^{\frac{1}{\sigma}}(A_1)^{\frac{\sigma-1}{\sigma}} > \frac{\alpha_1 \bar{L}^2}{\alpha_2 \bar{L}^1}$$

5. *Suppose that the following condition holds:*

$$\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)^{\frac{\alpha_1-\alpha_2(\sigma-1)}{\sigma-1}}\left[\left(1-\bar{\lambda}_M m\right)\bar{L}^2\right]^{\alpha_2} > \max\left\{\left(\bar{L}^1\right)^{\frac{\alpha_1-\alpha_2(\sigma-1)}{\sigma-1}}\left(\bar{L}^2\right)^{\alpha_2}, \left(L^1\right)^{\frac{\alpha_1-\alpha_2(\sigma-1)}{\sigma-1}}\left(L^2\right)^{\alpha_2}\right\},$$

where $L^2/L^1 = (\alpha_2/\alpha_1)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$. *Then, free trade and partial labor mobility is a Nash equilibrium, but free trade and free labor mobility is not a Nash equilibrium.*

Proof:

$(\lambda_T, \lambda_M) = (0,0)$ is a always a Nash equilibrium.

$(\lambda_T, \lambda_M) = \left(0, \bar{\lambda}_M\right)$ is a Nash equilibrium if and only if $W_G^j\left(0, \bar{\lambda}_M\right) \geq W_G^j(0,0)$ for $j = 1,2$. If $\lambda_T = 0$ and $\lambda_M = \bar{\lambda}_M$, then Assumption 4 implies that a proportion $\bar{\lambda}_M m$ of mobile workers in country 2 will relocate to country 1. Then $W_G^1\left(0, \bar{\lambda}_M\right) = v^1\left(0, \bar{\lambda}_M\right)$ and $W_G^2\left(0, \bar{\lambda}_M\right) = \bar{\lambda}_M m v^1\left(0, \bar{\lambda}_M\right) + \left(1-\bar{\lambda}_M m\right) v^2\left(0, \bar{\lambda}_M\right)$, where $v^1\left(0, \bar{\lambda}_M\right) = C + T^1 + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\alpha_1\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}{f}\right]$ and $v^2\left(0, \bar{\lambda}_M\right) = C + T^2 + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\alpha_1\left(1-\bar{\lambda}_M m\right)\bar{L}^2}{f}\right]$. If $\lambda_T = 0$ and $\lambda_M = 0$, then $W_G^j(0,0) = v^j(0,0) = C + T^j + \frac{\alpha_1}{\sigma-1}\ln\left(\frac{\alpha_1 \bar{L}^j}{f}\right)$. Note that $W_G^1\left(0, \bar{\lambda}_M\right) - W_G^1(0,0) = \frac{\alpha_1}{\sigma-1}\ln\left(\frac{\bar{L}^1+\bar{\lambda}_M m\bar{L}^2}{\bar{L}^1}\right) > 0$, while $W_G^2\left(0, \bar{\lambda}_M\right) - W_G^2(0,0) \geq 0$ if and only if $\bar{\lambda}_M\left\{T^1 - T^2 + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}{\left(1-\bar{\lambda}_M m\right)\bar{L}^2}\right]\right\} \geq -\frac{\alpha_1}{\sigma-1}\ln\left(1-\bar{\lambda}_M m\right)^{\frac{1}{m}}$. Thus, $\left(0, \bar{\lambda}_M\right)$ is a Nash equilibrium if and only if $\bar{\lambda}_M\left\{T^1 - T^2 + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}{\left(1-\bar{\lambda}_M m\right)\bar{L}^2}\right]\right\} \geq -\frac{\alpha_1}{\sigma-1}\ln\left(1-\bar{\lambda}_M m\right)^{\frac{1}{m}}$.

$(\lambda_T, \lambda_M) = (0,1)$ is a Nash equilibrium if and only if $W_G^j(0,1) \geq \max\left\{W_G^j\left(0, \bar{\lambda}_M\right), W_G^j(0,0)\right\}$ for $j = 1,2$. If $\lambda_T = 0$ and $\lambda_M = 1$, then Assumption 4 implies that all mobile workers will relocate to country 1. Then, $W_G^1(0,1) = v^1(0,1)$ and $W_G^2(0,1) = mv^1(0,1) + (1-m)v^2(0,1)$, where $v^1(0,1) = C + T^1 + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\alpha_1\left(\bar{L}^1+m\bar{L}^2\right)}{f}\right]$ and $v^2(0,1) = C + T^2 + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\alpha_1(1-m)\bar{L}^2}{f}\right]$. Note that $W_G^1(0,1) - W_G^1(0,0) = \frac{\alpha_1}{\sigma-1}\ln\left(\frac{\bar{L}^1+m\bar{L}^2}{\bar{L}^1}\right) > W_G^1\left(0, \bar{\lambda}_M\right) - W_G^1(0,0) = \frac{\alpha_1}{\sigma-1}\ln\left(\frac{\bar{L}^1+\bar{\lambda}_M m\bar{L}^2}{\bar{L}^1}\right) > 0$. Also note that $W_G^2(0,1) - W_G^2\left(0, \bar{\lambda}_M\right) \geq 0$ if and only if $\left(T^1 - T^2\right) + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\left(\bar{L}^1+m\bar{L}^2\right)}{(1-m)\bar{L}^2}\frac{(1-m)^{\frac{1}{m}}}{\left(1-\bar{\lambda}_M m\right)^{\frac{1}{m}}}\right] \geq \bar{\lambda}_M\left\{A^1 - A^2 + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}{\left(1-\bar{\lambda}_M m\right)\bar{L}^2}\right]\right\}$ and $W_G^2(0,1) - W_G^2(0,0) \geq 0$ if and only if $\left(T^1 - T^2\right) + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\left(\bar{L}^1+m\bar{L}^2\right)}{(1-m)\bar{L}^2}\frac{(1-m)^{\frac{1}{m}}}{\left(1-\bar{\lambda}_M m\right)^{\frac{1}{m}}}\right] \geq 0$. But Assumption 4 implies that $T^1 - T^2 + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}{\left(1-\bar{\lambda}_M m\right)\bar{L}^2}\right] > 0$ because $\left(T^1 - T^2\right) > \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\bar{L}^2+m\bar{L}^1}{(1-m)\bar{L}^1}\right]$. Thus, $(0,1)$ is a Nash equilibrium if and only if $\left(T^1 - T^2\right) + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\left(\bar{L}^1+m\bar{L}^2\right)}{(1-m)\bar{L}^2}\frac{(1-m)^{\frac{1}{m}}}{\left(1-\bar{\lambda}_M m\right)^{\frac{1}{m}}}\right] \geq \bar{\lambda}_M\left\{T^1 - T^2 + \frac{\alpha_1}{\sigma-1}\ln\left[\frac{\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}{\left(1-\bar{\lambda}_M m\right)\bar{L}^2}\right]\right\}$.

$(\lambda_T,\lambda_M)=(1,0)$ is a Nash equilibrium if and only if $W_G^j(1,0)\geq W_G^j(0,0)$ for $j=1,2$. If $\lambda_T=1$ and $\lambda_M=0$, Assumption 1 implies that $v^1(1,0)=C+T^1+\alpha_2\ln\left[\frac{a_{L,2}^1\alpha_1\bar{L}^2}{a_{L,2}^2\alpha_2\bar{L}^1}\right]+\frac{\alpha_1}{\sigma-1}\ln\left[\frac{(1-\alpha_3)\bar{L}^1}{f}\right]$ and $v^2(1,0)=C+T^2+\alpha_1\ln\left(\frac{a_{L,1}^2\alpha_2\bar{L}^1}{a_{L,1}^1\alpha_1\bar{L}^2}\right)+\frac{\alpha_1}{\sigma-1}\ln\left[\frac{(1-\alpha_3)\bar{L}^1}{f}\right]$. Since there is no labor mobility, $W_G^j(1,0)=v^j(1,0)$. Note that $W_G^1(1,0)-W_G^1(0,0)=\alpha_2\ln\left[\frac{a_{L,2}^1\alpha_1\bar{L}^2}{a_{L,2}^2\alpha_2\bar{L}^1}\right]+\frac{\alpha_1}{\sigma-1}\ln\left[\frac{(1-\alpha_3)}{\alpha_1}\right]>0$, because Assumption 1 implies that $a_{L,2}^1\alpha_1\bar{L}^2/a_{L,2}^2\alpha_2\bar{L}^1>1$. Also note that $W_G^2(1,0)-W_G^2(0,0)=\alpha_1\ln\left(\frac{a_{L,1}^2\alpha_2\bar{L}^1}{a_{L,1}^1\alpha_1\bar{L}^2}\right)+\frac{\alpha_1}{\sigma-1}\ln\left[\frac{(1-\alpha_3)\bar{L}^1}{\alpha_1\bar{L}^2}\right]>0$ if and only if $\frac{\alpha_1\bar{L}^2}{\alpha_2\bar{L}^1}<\left[\frac{a_{L,1}^2(1-\alpha_3)^{\sigma-1}}{a_{L,1}^1(\alpha_2)^{\sigma-1}}\right]^{\frac{1}{\sigma}}$, which also holds due to Assumption 1. Thus, $(1,0)$ is a Nash equilibrium.

$(\lambda_T,\lambda_M)=(1,\bar{\lambda}_M)$ is a Nash equilibrium if and only if $W_G^j(1,\bar{\lambda}_M)\geq\max\left\{W_G^j(1,0),W_G^j(0,\bar{\lambda}_M),W_G^j(0,0)\right\}$ for $j=1,2$. If $\lambda_T=1$ and $\lambda_M=\bar{\lambda}_M$, then Assumption 4 implies that a proportion $\bar{\lambda}_M m$ of mobile workers in country 2 will relocate to country 1. Thus, $W_G^1(1,\bar{\lambda}_M)=v^1(1,\bar{\lambda}_M)$ and $W_G^2(1,\bar{\lambda}_M)=\bar{\lambda}_M m v^1(1,\bar{\lambda}_M)+\left(1-\bar{\lambda}_M m\right)v^2(1,\bar{\lambda}_M)$, where $v^1(1,\bar{\lambda}_M)=C+T^1+\alpha_2\ln\left[\frac{a_{L,2}^1\alpha_1\bar{L}^2\left(1-\bar{\lambda}_M m\right)}{a_{L,2}^2\alpha_2\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}\right]+\frac{\alpha_1}{\sigma-1}\ln\left[\frac{(1-\alpha_3)\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}{f}\right]$ and $v^2(1,\bar{\lambda}_M)=C+T^2+\alpha_1\ln\left(\frac{a_{L,1}^2\alpha_2\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}{a_{L,1}^1\alpha_1\bar{L}^2\left(1-\bar{\lambda}_M m\right)}\right)+\frac{\alpha_1}{\sigma-1}\ln\left[\frac{(1-\alpha_3)\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}{f}\right]$. Note that $W_G^1(1,\bar{\lambda}_M)-W_G^1(1,0)=\alpha_2\ln\left[\frac{\bar{L}^2\left(1-\bar{\lambda}_M m\right)}{\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)\bar{L}^2}\right]+\frac{\alpha_1}{\sigma-1}\ln\left[\frac{\bar{L}^1+\bar{\lambda}_M m\bar{L}^2}{\bar{L}^1}\right]\geq 0$ if and only if $\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)^{\frac{\alpha_1-\alpha_2(\sigma-1)}{\sigma-1}}\left[\left(1-\bar{\lambda}_M m\right)\bar{L}^2\right]^{\alpha_2}\geq\left(\bar{L}^1\right)^{\frac{\alpha_1-\alpha_2(\sigma-1)}{\sigma-1}}\left(\bar{L}^2\right)^{\alpha_2}$. Also note that $W_G^1(1,\bar{\lambda}_M)-W_G^1(0,\bar{\lambda}_M)=\alpha_2\ln\left[\frac{a_{L,2}^1\alpha_1\bar{L}^2\left(1-\bar{\lambda}_M m\right)}{a_{L,2}^2\alpha_2\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}\right]+\frac{\alpha_1}{\sigma-1}\ln\left[\frac{(1-\alpha_3)}{\alpha_1}\right]>0$ because Assumption 1 implies that $\frac{a_{L,2}^1\alpha_1\bar{L}^2\left(1-\bar{\lambda}_M m\right)}{a_{L,2}^2\alpha_2\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}>1$. Since we have already proved that $W_G^1(0,\bar{\lambda}_M)>W_G^1(0,0)$ and $W_G^1(1,0)>W_G^1(0,0)$, then $W_G^1(1,\bar{\lambda}_M)\geq\max\left\{W_G^1(1,0),W_G^1(0,\bar{\lambda}_M),W_G^1(0,0)\right\}$ if and only if $\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)^{\frac{\alpha_1-\alpha_2(\sigma-1)}{\sigma-1}}\left[\left(1-\bar{\lambda}_M m\right)\bar{L}^2\right]^{\alpha_2}\geq\left(\bar{L}^1\right)^{\frac{\alpha_1-\alpha_2(\sigma-1)}{\sigma-1}}\left(\bar{L}^2\right)^{\alpha_2}$. $W_G^2(1,\bar{\lambda}_M)-W_G^2(1,0)\geq 0$ if and only if $\bar{\lambda}_M m\left\{T_N^1-T_N^2+\ln\left[\frac{\alpha_1\left(1-\bar{\lambda}_M m\right)\bar{L}^2}{\alpha_2\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}\right]^{(\alpha_1+\alpha_2)}\right\}+\alpha_1\ln\left[\frac{\bar{L}^1+\bar{\lambda}_M m\bar{L}^2}{\bar{L}^1\left(1-\bar{\lambda}_M m\right)}\right]+\frac{\alpha_1}{\sigma-1}\ln\left[\frac{\bar{L}^1+\bar{\lambda}_M m\bar{L}^2}{\bar{L}^1}\right]>0$, which holds because Assumption 4 implies that $T_N^1-T_N^2+\ln\left[\frac{\alpha_1\left(1-\bar{\lambda}_M m\right)\bar{L}^2}{\alpha_2\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}\right]^{\alpha_1+\alpha_2}>0$. $W_G^2(1,\bar{\lambda}_M)-W_G^2(0,\bar{\lambda}_M)=\bar{\lambda}_M m\left(v^1(1,\bar{\lambda}_M)-v^1(0,\bar{\lambda}_M)\right)+\left(1-\bar{\lambda}_M m\right)\left(v^2(1,\bar{\lambda}_M)-v^2(0,\bar{\lambda}_M)\right)$, where $v^1(1,\bar{\lambda}_M)-v^1(0,\bar{\lambda}_M)=\alpha_2\ln\left[\frac{a_{L,2}^1\alpha_1\bar{L}^2(1-\bar{\mu}m)}{a_{L,2}^2\alpha_2\left(\bar{L}^1+\bar{\mu}m\bar{L}^2\right)}\right]+\frac{\alpha_1}{\sigma-1}\ln\left[\frac{(1-\alpha_3)}{\alpha_1}\right]>0$ because Assumption 1 implies that $\frac{a_{L,2}^1\alpha_1\bar{L}^2(1-\bar{\mu}m)}{a_{L,2}^2\alpha_2\left(\bar{L}^1+\bar{\mu}m\bar{L}^2\right)}>1$ and $v^2(1,\bar{\lambda}_M)-v^2(0,\bar{\lambda}_M)=\alpha_1\ln\left(\frac{a_{L,1}^2\alpha_2\left(\bar{L}^1+\bar{\mu}m\bar{L}^2\right)}{a_{L,1}^1\alpha_1\bar{L}^2(1-\bar{\mu}m)}\right)+\frac{\alpha_1}{\sigma-1}\ln\left[\frac{(1-\alpha_3)\left(\bar{L}^1+\bar{\mu}m\bar{L}^2\right)}{\alpha_1(1-\bar{\mu}m)\bar{L}^2}\right]>0$ due to Assumption 5. $W_G^2(1,\bar{\lambda}_M)-W_G^2(0,0)=\bar{\lambda}_M m\left(v^1(1,\bar{\lambda}_M)-v^2(1,\bar{\lambda}_M)\right)+\left(v^2(1,\bar{\lambda}_M)-v^2(0,0)\right)$, where $v^1(1,\bar{\lambda}_M)-v^2(1,\bar{\lambda}_M)=T_N^1-T_N^2+\ln\left[\frac{\alpha_1\left(1-\bar{\lambda}_M m\right)\bar{L}^2}{\alpha_2\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}\right]^{(\alpha_1+\alpha_2)}>0$ due to Assumption 4 and $v^2\left(1,\bar{\lambda}_M\right)-v^2\left(0,0\right)=\alpha_1\ln\left[\frac{a_{L,1}^2\alpha_2\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)}{a_{L,1}^1\alpha_1\left(1-\bar{\lambda}_M m\right)\bar{L}^2}\right]+\frac{\alpha_1}{\sigma-1}\ln\left[\frac{(1-\alpha_3)\left(\bar{L}^1+\bar{\mu}m\bar{L}^2\right)}{\alpha_1\bar{L}^2}\right]>0$ due to Assumption 5.

Finally, $(\lambda_T,\lambda_M)=(1,1)$ is not a Nash equilibrium when $\left(\bar{L}^1+\bar{\lambda}_M m\bar{L}^2\right)^{\frac{\alpha_1-\alpha_2(\sigma-1)}{\sigma-1}}\left[\left(1-\bar{\lambda}_M m\right)\bar{L}^2\right]^{\alpha_2} > \left(L^1\right)^{\frac{\alpha_1-\alpha_2(\sigma-1)}{\sigma-1}}\left(L^2\right)^{\alpha_2}$ if and only if $W_G^1\left(1,\bar{\lambda}_M\right) > W_G^1\left(1,1\right)$.

A.6 Extractive Elite

Proposition 5 (Extractive Elite). *Suppose that Assumptions 6 and 7 hold and $\beta^1<\beta^2$. Assume $\bar{L}^2/\bar{L}^1\neq\left(\alpha_2\Gamma^2/\alpha_1\Gamma^1\right)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$. Then*

1. *No trade and no labor mobility is always a Nash equilibrium.*
2. *Free trade and no labor mobility is always a Nash equilibrium. Moreover, $W_G^j\left(1,0\right)\geq W_G^j\left(0,0\right)$ for $j=1,2$.*
3. *No trade and free labor mobility is a Nash equilibrium if and only if $1+\varphi^2\leq\frac{m\bar{L}^2\ln\left(\frac{1-\beta^1}{1-\beta^2}\right)}{-E^2\ln(1-m)}$.*
4. *If $\bar{L}^2/\bar{L}^1>\left(\alpha_2\Gamma^2/\alpha_1\Gamma^1\right)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$, free trade and free labor mobility is a Nash equilibrium if and only if:*
   (a) $\left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2}>\left(\bar{L}^1\right)^{(1-\alpha_2)}\left(\bar{L}^2\right)^{\alpha_2}$ *and*
   $$1+\varphi^1>\bar{\varphi}^1=\frac{\bar{L}^1\alpha_2\ln\left(\frac{L^1\bar{L}^2}{\bar{L}^1L^2}\right)}{E^1\ln\left[\frac{\left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2}}{\left(\bar{L}^1\right)^{(1-\alpha_2)}\left(\bar{L}^2\right)^{\alpha_2}}\right]}$$
   (b) $\left(L^1\right)^{\alpha_1}\left(L^2\right)^{1-\alpha_1}>\left(\bar{L}^1\right)^{\alpha_1}\left(\bar{L}^2\right)^{1-\alpha_1}$ *or* $\left(L^1\right)^{\alpha_1}\left(L^2\right)^{1-\alpha_1}<\left(\bar{L}^1\right)^{\alpha_1}\left(\bar{L}^2\right)^{1-\alpha_1}$ *and*
   $$1+\varphi^2<\bar{\varphi}^2=\frac{-\bar{L}^2\alpha_1\ln\left(\frac{L^1\bar{L}^2}{\bar{L}^1L^2}\right)}{E^2\ln\left[\frac{\left(L^1\right)^{\alpha_1}\left(L^2\right)^{1-\alpha_1}}{\left(\bar{L}^1\right)^{\alpha_1}\left(\bar{L}^2\right)^{1-\alpha_1}}\right]}$$
5. *If $\bar{L}^2/\bar{L}^1<\left(\alpha_2\Gamma^2/\alpha_1\Gamma^1\right)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$, free trade and free labor mobility is a Nash equilibrium if and only if:*
   (a) $\left(L^1\right)^{\alpha_1}\left(L^2\right)^{1-\alpha_1}>\left(\bar{L}^1\right)^{\alpha_1}\left(\bar{L}^2\right)^{1-\alpha_1}$ *and* $1+\varphi^2>\bar{\varphi}^2$;
   (b) $\left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2}>\left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2}$ *or* $\left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2}<\left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2}$ *and* $1+\varphi^1<\bar{\varphi}^1$.

Proof: Note that:

$$W_G^j(0,\lambda_M) = C + T + \frac{\bar{L}^j \ln\left(1-\beta^j\right) + E^j\left(1+\varphi^j\right)\left[\ln\left(\delta\beta^j\right) + \ln\left(L^j/E^j\right)\right]}{\bar{L}^j + E^j\left(1+\varphi^j\right)}$$

$$W_G^1(1,\lambda_M) = C + T + \alpha_2 \ln\left(\frac{\alpha_1\left[1-\beta^2(1-\delta)\right]L^2}{A_2\alpha_2\left[1-\beta^1(1-\delta)\right]L^1}\right) + \\ + \frac{\bar{L}^1\ln\left(1-\beta^1\right) + E^1\left(1+\varphi^1\right)\ln\left(\delta\beta^1 L^1/E^1\right)}{\bar{L}^1 + E^1\left(1+\varphi^1\right)}$$

$$W_G^2(1,\lambda_M) = C + T + \alpha_1 \ln\left(\frac{A_1\alpha_2\left[1-\beta^1(1-\delta)\right]L^1}{\alpha_1\left[1-\beta^2(1-\delta)\right]L^2}\right) + \\ + \frac{\bar{L}^2\ln\left(1-\beta^2\right) + E^2\left(1+\varphi^2\right)\ln\left(\delta\beta^2 L^2/E^2\right)}{\bar{L}^2 + E^2\left(1+\varphi^2\right)}$$

$(\lambda_T,\lambda_M) = (0,0)$ is a always a Nash equilibrium.

$(\lambda_T,\lambda_M) = (0,1)$ is a Nash equilibrium if and only if $W_G^j(1,0) \geq W_G^j(0,0)$, which holds because: $W_G^1(1,0) - W_G^1(0,0) = \alpha_2\ln\left(\frac{\alpha_1\left[1-\beta^2(1-\delta)\right]\bar{L}^2}{A_2\alpha_2\left[1-\beta^1(1-\delta)\right]\bar{L}^1}\right) > 0$ and $W_G^1(1,0) - W_G^1(0,0) = \alpha_1\ln\left(\frac{A_1\alpha_2\left[1-\beta^1(1-\delta)\right]L^1}{\alpha_1\left[1-\beta^2(1-\delta)\right]L^2}\right) > 0$ due to Assumption 6.

$(\lambda_T,\lambda_M) = (0,1)$ is a Nash equilibrium if and only if $W_G^j(0,1) \geq W_G^j(0,0)$. $W_G^1(0,1) - W_G^1(0,0) = \frac{E^1\left(1+\varphi^1\right)\ln\left(\frac{\bar{L}^1+m\bar{L}^2}{\bar{L}^1}\right)}{\bar{L}^1+E^1(1+\varphi^1)} > 0$ and $W_G^2(0,1) - W_G^2(0,0) = \frac{\bar{L}^2 m\ln\left(\frac{1-\beta^1}{1-\beta^2}\right) + E^2\left(1+\varphi^2\right)\ln(1-m)}{\bar{L}^2+E^2(1+\varphi^2)}$ if and only if $1+\varphi^2 \leq \frac{m\bar{L}^2\ln\left(\frac{1-\beta^1}{1-\beta^2}\right)}{-E^2\ln(1-m)}$.

$(\lambda_T,\lambda_M) = (1,1)$ is a Nash equilibrium if and only if $W_G^j(1,1) \geq \max\left\{W_G^j(1,0), W_G^j(0,1)\right\}$. $W_G^1(1,1) - W_G^1(0,1) = \alpha_2\ln\left(\frac{\alpha_1\left[1-\beta^2(1-\delta)\right]L^2}{A_2\alpha_2\left[1-\beta^1(1-\delta)\right]L^1}\right) + \frac{E^1\left(1+\varphi^1\right)\ln\left(L^1/\left(\bar{L}^1+m\bar{L}^2\right)\right)}{\bar{L}^1+E^1(1+\varphi^1)} > 0$ due to Assumption 7. $W_G^2(1,1) - W_G^2(0,1) = \alpha_1\ln\left(\frac{A_1\alpha_2\left[1-\beta^1(1-\delta)\right]L^1}{\alpha_1\left[1-\beta^2(1-\delta)\right]L^2}\right) + \frac{-\bar{L}^2 m\ln\left(\frac{1-\beta^1}{1-\beta^2}\right) + E^2\left(1+\varphi^2\right)\ln\left(L^2/\bar{L}^2(1-m)\right)}{\bar{L}^2+E^2(1+\varphi^2)} > 0$ due to Assumption 7. Note that $W_G^1(1,1) - W_G^1(1,0) = \alpha_2\ln\left(\frac{\bar{L}^1 L^2}{L^1\bar{L}^2}\right) + \frac{E^1\left(1+\varphi^1\right)\ln\left(L^1/\bar{L}^1\right)}{\bar{L}^1+E^1(1+\varphi^1)}$, while $W_G^2(1,1) - W_G^2(1,0) = \alpha_1\ln\left(\frac{\bar{L}^2 L^1}{L^2\bar{L}^1}\right) + \frac{E^2\left(1+\varphi^2\right)\ln\left(L^2/\bar{L}^2\right)}{\bar{L}^2+E^2(1+\varphi^2)}$. We must consider several possible cases.

(i) Suppose $\bar{L}^2/\bar{L}^1 > \left(\alpha_2\Gamma^2/\alpha_1\Gamma^1\right)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$. Then $L^1 > \bar{L}^1$ and $L^2 < \bar{L}^2$. $W_G^1(1,1) - W_G^1(1,0) > 0$ and $W_G^2(1,1) - W_G^2(1,0) > 0$ if and only if $E^1\left(1+\varphi^1\right)\ln\left[\frac{\left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2}}{\left(\bar{L}^1\right)^{(1-\alpha_2)}\left(\bar{L}^2\right)^{\alpha_2}}\right] > \alpha_2\bar{L}^1\ln\left(\frac{L^1\bar{L}^2}{\bar{L}^1 L^2}\right)$ and $\alpha_1\bar{L}^2\ln\left(\frac{\bar{L}^2 L^1}{L^2\bar{L}^1}\right) > E^2\left(1+\varphi^2\right)\ln\left[\frac{\left(\bar{L}^1\right)^{\alpha_1}\left(\bar{L}^2\right)^{1-\alpha_1}}{\left(L^1\right)^{\alpha_1}\left(L^2\right)^{1-\alpha_1}}\right]$. Conditions (a) and (b) in part 4 are equivalent to these two inequalities.

(ii) Suppose $\bar{L}^2/\bar{L}^1 < \left(\alpha_2\Gamma^2/\alpha_1\Gamma^1\right)(A_3)^{\frac{-\alpha_3}{\alpha_1+\alpha_2}}$. Then $L^1 < \bar{L}^1$ and $L^2 > \bar{L}^2$. $W_G^1(1,1) - W_G^1(1,0) > 0$ and $W_G^2(1,1) - W_G^2(1,0) > 0$ if and only if $\alpha_2\bar{L}^1 \ln\left(\frac{\bar{L}^1 L^2}{L^1 \bar{L}^2}\right) > E^1\left(1+\varphi^1\right)\ln\left[\frac{\left(\bar{L}^1\right)^{(1-\alpha_2)}\left(\bar{L}^2\right)^{\alpha_2}}{\left(L^1\right)^{(1-\alpha_2)}\left(L^2\right)^{\alpha_2}}\right]$ and $E^2\left(1+\varphi^2\right)\ln\left[\frac{\left(L^1\right)^{\alpha_1}\left(L^2\right)^{1-\alpha_1}}{\left(\bar{L}^1\right)^{\alpha_1}\left(\bar{L}^2\right)^{1-\alpha_1}}\right] > \alpha_1\bar{L}^2\ln\left(\frac{L^2\bar{L}^1}{\bar{L}^2 L^1}\right)$. Conditions (a) and (b) in part 5 are equivalent to these inequalities. This completes the proof of the proposition. ■

A.7 Beyond the Ricardian World

Lemma 4 (Mutiple Factors and Non-Tradeable Goods under Autarky). *Assume there is no trade in goods, i.e., $\lambda^1 = \lambda^2 = 0$.*

1. *Suppose there is no labor mobility, i.e., $\mu^1 = \mu^2 = 0$. Then, in equilibrium, utilities in country j are given by:*

$$v_L^j(0,0) = \left[\frac{(b)^{b\alpha_M}\left(\alpha_N + b\alpha_M\right)^{\alpha_F+(1-b)\alpha_M}}{\left(\alpha_F\right)^{b\alpha_F}\left(\alpha_F+\alpha_M\right)^{(1-b)(\alpha_F+\alpha_M)}}\right] T^j \left(\frac{\bar{F}^j}{\bar{L}^j}\right)^{b\alpha_F}\left(\frac{\bar{K}^j}{\bar{L}^j}\right)^{(1-b)(\alpha_F+\alpha_M)},$$

$$v_K^j(0,0) = \left[\frac{(b)^{b\alpha_M}(1-b)\left(\alpha_F+\alpha_M\right)^{1-(1-b)(\alpha_F+\alpha_M)}}{\left(\alpha_F\right)^{b\alpha_F}\left(\alpha_N+b\alpha_M\right)^{b(1-\alpha_F)}}\right] T^j \left(\frac{\bar{F}^j}{\bar{K}^j}\right)^{b\alpha_F}\left(\frac{\bar{L}^j}{\bar{K}^j}\right)^{\alpha_N+b\alpha_M},$$

$$v_F^j(0,0) = \left[\frac{\left(\alpha_F\right)^{1-b\alpha_F}(b)^{1+b\alpha_M}}{\left(\alpha_F+\alpha_M\right)^{(1-b)(\alpha_F+\alpha_M)}\left(\alpha_N+b\alpha_M\right)^{\alpha_N+b\alpha_M}}\right] T^j \left(\frac{\bar{K}^j}{\bar{F}^j}\right)^{(1-b)(\alpha_F+\alpha_M)}\left(\frac{\bar{L}^j}{\bar{F}^j}\right)^{\alpha_N+b\alpha_M}.$$

   where $T^j = \left(A_F^j\right)^{\alpha_F}\left(A_M^j\right)^{\alpha_M}\left(A_N^j\right)^{\alpha_N}$.

2. *Suppose there is free labor mobility, i.e., $\mu^1 = \mu^2 = 1$. Then, in equilibrium, the labor force in country j is*

$$L^j = \left[\left(T^j\right)\left(\bar{F}^j\right)^{b\alpha_F}\left(\bar{K}^j\right)^{(1-b)(\alpha_F+\alpha_M)}\right]^{\frac{1}{\alpha_F+(1-b)\alpha_M}}\left(\bar{T}\right)^{-1}\bar{L},$$

   where $\bar{T} = \sum_{k=1,2}\left[\left(T^k\right)\left(\bar{F}^k\right)^{b\alpha_F}\left(\bar{K}^k\right)^{(1-b)(\alpha_F+\alpha_M)}\right]^{\frac{1}{\alpha_F+(1-b)\alpha_M}}$. *Moreover, utilities in country $j = 1,2$ are given by:*

$$v_L^1(0,1) = v_L^2(0,1) = \left[\frac{(b)^{b\alpha_M}\left(\alpha_N+b\alpha_M\right)^{\alpha_F+(1-b)\alpha_M}}{\left(\alpha_F\right)^{b\alpha_F}\left(\alpha_F+\alpha_M\right)^{(1-b)(\alpha_F+\alpha_M)}}\right]\left(\frac{\bar{T}}{\bar{L}}\right)^{b\alpha_F+(1-b)(\alpha_F+\alpha_M)},$$

$$v_K^j(0,1) = \left[\frac{(b)^{b\alpha_M}(1-b)\left(\alpha_F+\alpha_M\right)^{1-(1-b)(\alpha_F+\alpha_M)}}{\left(\alpha_F\right)^{b\alpha_F}\left(\alpha_N+b\alpha_M\right)^{b(1-\alpha_F)}}\right]\left(T^j\right)^{\frac{1}{\alpha_F+(1-b)\alpha_M}}\left(\frac{\bar{F}^j}{\bar{K}^j}\right)^{\frac{b\alpha_F}{\alpha_F+(1-b)\alpha_M}}\left(\frac{\bar{L}}{\bar{T}}\right)^{\alpha_N+b\alpha_M},$$

$$v_F^j(0,1) = \left[\frac{\left(\alpha_F\right)^{1-b\alpha_F}(b)^{1+b\alpha_M}}{\left(\alpha_F+\alpha_M\right)^{(1-b)(\alpha_F+\alpha_M)}\left(\alpha_N+b\alpha_M\right)^{\alpha_N+b\alpha_M}}\right]\left(T^j\right)^{\frac{1}{\alpha_F+(1-b)\alpha_M}}\left(\frac{\bar{K}^j}{\bar{F}^j}\right)^{\frac{(1-b)(\alpha_F+\alpha_M)}{\alpha_F+(1-b)\alpha_M}}\left(\frac{\bar{L}}{\bar{T}}\right)^{\alpha_N+b\alpha_M}.$$

Proof. Under autarky the equilibrium conditions in country j are:

$$r_F^j = p_F^j A_F^j b \left(K_F^j/\bar{F}^j\right)^{1-b},$$
$$r_K^j = p_F^j A_F^j (1-b) \left(\bar{F}^j/K_F^j\right)^b = p_M^j A_M^j (1-b) \left(L_M^j/K_M^j\right)^b,$$
$$w^j = p_N^j A_N^j = p_M^j A_M^j b \left(K_M^j/L_M^j\right)^{1-b},$$
$$K_F^j + K_M^j = \bar{K}^j,\ L_M^j + L_N^j = L^j,$$
$$(1-\alpha_N)\, p_N^j Q_N^j = \alpha_N \left(p_F^j Q_F^j + p_M^j Q_M^j\right),\ \alpha_M p_F^j Q_F^j = \alpha_F p_M^j Q_M^j,$$
$$L^j = \bar{L}^j \text{ (when there is no labor mobility)},$$
$$v_L^1 = v_L^2,\ L^1 + L^2 = \bar{L} = \bar{L}^1 + \bar{L}^2 \text{ (when there is free labor mobility)}.$$

- *Equilibrium quantities*: $K_M^j = \frac{\alpha_M}{\alpha_F+\alpha_M}\bar{K}^j$, $K_F^j = \frac{\alpha_F}{\alpha_F+\alpha_M}\bar{K}^j$, $L_M^j = \frac{b\alpha_M}{\alpha_N+b\alpha_M}L^j$, $L_N^j = \frac{\alpha_N}{\alpha_N+b\alpha_M}L^j$, $Q_F^j = \left(\frac{\alpha_F}{\alpha_F+\alpha_M}\right)^{1-b} A_F^j \left(\bar{F}^j\right)^b \left(\bar{K}^j\right)^{1-b}$, $Q_M^j = \left[\frac{(b)^b\alpha_M}{\alpha_N+b\alpha_M}\right] A_M^j \left(L^j\right)^b \left(\bar{K}^j\right)^{1-b}$ and $Q_N^j = \left(\frac{\alpha_N}{\alpha_N+b\alpha_M}\right) A_N^j L^j$.

- *Equilibrium prices*: $\frac{p_F^j}{p_M^j} = \left(\frac{b\alpha_F}{\alpha_N+b\alpha_M}\right)^b \frac{A_M^j}{A_F^j}\left(\frac{L^j}{\bar{F}^j}\right)^b$ and $\frac{p_N^j}{p_M^j} = (b)^b \left(\frac{\alpha_N+b\alpha_M}{\alpha_F+\alpha_M}\right)^{1-b}\left(\frac{A_M^j}{A_N^j}\right)\left(\frac{\bar{K}^j}{L^j}\right)^{1-b}$.

- *Equilibrium factor prices*:
  - *Factor L*: $\frac{w^j}{p_F^j} = \frac{\alpha_N+b\alpha_M}{(\alpha_F)^b(\alpha_F+\alpha_M)^{1-b}} A_F^j \left(\frac{\bar{F}^j}{L^j}\right)^b \left(\frac{\bar{K}^j}{L^j}\right)^{1-b}$, $\frac{w^j}{p_M^j} = (b)^b \left(\frac{\alpha_N+b\alpha_M}{\alpha_F+\alpha_M}\right)^{1-b} A_M^j \left(\frac{\bar{K}^j}{L^j}\right)^{1-b}$, and $\frac{w^j}{p_N^j} = A_N^j$.
  - *Factor K*: $\frac{r_K^j}{p_F^j} = (1-b)\left(\frac{\alpha_F+\alpha_M}{\alpha_F}\right)^b A_F^j \left(\frac{\bar{F}^j}{\bar{K}^j}\right)^b$, $\frac{r_K^j}{p_M^j} = (1-b)\left[\frac{b(\alpha_F+\alpha_M)}{\alpha_N+b\alpha_M}\right]^b A_M^j \left(\frac{L^j}{\bar{K}^j}\right)^b$, and $\frac{r_K^j}{p_N^j} = (1-b)\left[\frac{\alpha_F+\alpha_M}{\alpha_N+b\alpha_M}\right] A_N^j \left(\frac{L^j}{\bar{K}^j}\right)$.
  - *Factor F*: $\frac{r_F^j}{p_F^j} = b\left(\frac{\alpha_F}{\alpha_F+\alpha_M}\right)^{1-b} A_F^j \left(\frac{\bar{K}^j}{\bar{F}^j}\right)^{1-b}$, $\frac{r_F^j}{p_M^j} = \frac{\alpha_F b(b)^b}{(\alpha_F+\alpha_M)^{1-b}(\alpha_N+b\alpha_M)^b} A_M^j \left(\frac{L^j}{\bar{F}^j}\right)^b \left(\frac{\bar{K}^j}{\bar{F}^j}\right)^{1-b}$ and $\frac{r_F^j}{p_N^j} = \frac{\alpha_F b}{\alpha_N+b\alpha_M} A_N^j \left(\frac{L^j}{\bar{F}^j}\right)$.

- *Utilities*: Utilities are given by $v_L^j(0,\mu) = \left(\frac{w^j}{p_F}\right)^{\alpha_F}\left(\frac{w^j}{p_M}\right)^{\alpha_M}\left(\frac{w^j}{p_N^j}\right)^{\alpha_N}$, $v_K^j(0,\mu) =$

$\left(\frac{r_K^j}{p_F}\right)^{\alpha_F}\left(\frac{r_K^j}{p_M}\right)^{\alpha_M}\left(\frac{r_K^j}{p_N^j}\right)^{\alpha_N}$ and $v_F^j(0,\mu)=\left(\frac{r_F^j}{p_F}\right)^{\alpha_F}\left(\frac{r_F^j}{p_M}\right)^{\alpha_M}\left(\frac{r_F^j}{p_N^j}\right)^{\alpha_N}$. Then:

$$v_L^j(0,\mu)=B\left(\alpha_N+b\alpha_M\right)^{\alpha_F+(1-b)\alpha_M}T^j\left(\frac{\bar{F}^j}{L^j}\right)^{b\alpha_F}\left(\frac{\bar{K}^j}{L^j}\right)^{(1-b)(\alpha_F+\alpha_M)},$$

$$v_K^j(0,\mu)=\frac{B(1-b)\left(\alpha_F+\alpha_M\right)}{\left(\alpha_N+b\alpha_M\right)^{b(1-\alpha_F)}}T^j\left(\frac{\bar{F}^j}{\bar{K}^j}\right)^{b\alpha_F}\left(\frac{L^j}{\bar{K}^j}\right)^{\alpha_N+b\alpha_M},$$

$$v_F^j(0,\mu)=\frac{Bb\alpha_F}{\left(\alpha_N+b\alpha_M\right)^{\alpha_N+b\alpha_M}}T^j\left(\frac{\bar{K}^j}{\bar{F}^j}\right)^{(1-b)(\alpha_F+\alpha_M)}\left(\frac{L^j}{\bar{F}^j}\right)^{\alpha_N+b\alpha_M}.$$

where $B=\left[\frac{(b)^{b\alpha_M}}{(\alpha_F)^{b\alpha_F}(\alpha_F+\alpha_M)^{(1-b)(\alpha_F+\alpha_M)}}\right]$ and $T^j=\left(A_F^j\right)^{\alpha_F}\left(A_M^j\right)^{\alpha_M}\left(A_N^j\right)^{\alpha_N}$.

When there is no labor mobility $L^j=\bar{L}^j$. When there is free labor mobility, $v_L^1=v_L^2$, which implies

$$L^j=\left[\left(T^j\right)\left(\bar{F}^j\right)^{b\alpha_F}\left(\bar{K}^j\right)^{(1-b)(\alpha_F+\alpha_M)}\right]^{\frac{1}{\alpha_F+(1-b)\alpha_M}}\left(\bar{T}\right)^{-1}\bar{L},$$

where $\bar{T}=\sum_{k=1,2}\left[\left(T^k\right)\left(\bar{F}^k\right)^{b\alpha_F}\left(\bar{K}^k\right)^{(1-b)(\alpha_F+\alpha_M)}\right]^{\frac{1}{\alpha_F+(1-b)\alpha_M}}$. Thus, under autarky, there are migrations to country 1 if and only if

$$\left(\frac{T^1}{T^2}\right)>\left(\frac{\bar{F}^2}{\bar{F}^1}\right)^{b\alpha_F}\left(\frac{\bar{K}^2}{\bar{K}^1}\right)^{(1-b)(\alpha_F+\alpha_M)}\left(\frac{\bar{L}^1}{\bar{L}^2}\right)^{\alpha_F+(1-b)\alpha_M}.$$

Finally, utilities under autarky and free labor mobility are:

$$v_L^1(0,1)=v_L^2(0,1)=B\left(\alpha_N+b\alpha_M\right)^{\alpha_F+(1-b)\alpha_M}\left(\frac{\bar{T}}{\bar{L}}\right)^{b\alpha_F+(1-b)(\alpha_F+\alpha_M)},$$

$$v_K^j(0,1)=\frac{B(1-b)\left(\alpha_F+\alpha_M\right)}{\left(\alpha_N+b\alpha_M\right)^{b(1-\alpha_F)}}\left(T^j\right)^{\frac{1}{\alpha_F+(1-b)\alpha_M}}\left(\frac{\bar{F}^j}{\bar{K}^j}\right)^{\frac{b\alpha_F}{\alpha_F+(1-b)\alpha_M}}\left(\frac{\bar{L}}{\bar{T}}\right)^{\alpha_N+b\alpha_M},$$

$$v_F^j(0,1)=\frac{Bb\alpha_F}{\left(\alpha_N+b\alpha_M\right)^{\alpha_N+b\alpha_M}}\left(T^j\right)^{\frac{1}{\alpha_F+(1-b)\alpha_M}}\left(\frac{\bar{K}^j}{\bar{F}^j}\right)^{\frac{(1-b)(\alpha_F+\alpha_M)}{\alpha_F+(1-b)\alpha_M}}\left(\frac{\bar{L}}{\bar{T}}\right)^{\alpha_N+b\alpha_M}.$$

This completes the proof of the lemma. ■

Lemma 5 (Mutiple Factors and Non-Tradeable Goods under Free Trade). *Assume there is free trade of goods, i.e.,* $\lambda^1=\lambda^2=1$, *and the following conditions hold: .*

$$\alpha_N\alpha_F\left(\frac{\bar{L}^1}{\bar{L}^2}\right)>\left(1-\alpha_N\right)\left(\alpha_N+b\alpha_M\right)\left(\frac{A_F^1A_M^2}{A_M^1A_F^2}\right)^{\frac{1}{b}}\left(\frac{\bar{F}^1}{\bar{F}^2}\right),$$

$$\left(\frac{\bar{K}^1}{\bar{K}^2}\right)^{1-b}>\frac{\alpha_M\left[\left(1-\alpha_N\right)b+\alpha_N\right]^b\left[\alpha_N+\left(1-\alpha_N\right)b\left(\frac{A_F^1A_M^2}{A_M^1A_F^2}\right)^{\frac{1}{b}}\left(\frac{\bar{L}^2\bar{F}^1}{\bar{L}^1\bar{F}^2}\right)\right]^{1-b}}{\left[\alpha_N\alpha_F-\left(1-\alpha_N\right)\left(\alpha_Mb+\alpha_N\right)\left(\frac{A_F^1A_M^2}{A_M^1A_F^2}\right)^{\frac{1}{b}}\left(\frac{\bar{L}^2\bar{F}^1}{\bar{L}^1\bar{F}^2}\right)\right]}\left(\frac{A_M^2}{A_M^1}\right)\left(\frac{\bar{L}^2}{\bar{L}^1}\right)^b.$$

1. *Suppose there is no labor mobility , i.e., $\mu^1 = \mu^2 = 0$. Then, in equilibrium, country 1 is diversified, country 2 specializes in good F and $(p_F/p_M) = \check{p}$ is the unique solution to $BT\left(\check{p}, \bar{L}^1\right) = 0$.*

2. *Suppose there is free labor mobility i.e., $\mu^1 = \mu^2 = 1$. Assume the following condition holds.*

$$\left(\frac{A_N^1}{A_N^2}\right)^{\frac{\alpha_N}{\alpha_M+\alpha_F}} > \frac{\alpha_N \alpha_F \left(\frac{\bar{L}^1}{\bar{L}^2}\right) - \left(\alpha_N + \alpha_M b\right)\left(1-\alpha_N\right)\left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}}\left(\frac{\bar{F}^1}{\bar{F}^2}\right)}{\alpha_M\left[\left(1-\alpha_N\right)b + \alpha_N\right]}$$

Then, in equilibrium, country 1 is diversified, country 2 specializes in good F, $p_F/p_M = \hat{p}$, and L_1 are given by the solution to $BT\left(\hat{p}, L^1\right) = 0$ and $FM\left(p, L_1\right)$. Moreover, $\hat{p} > \check{p}$ and $L_1 > \bar{L}_1$.

3. *Utilities are given by:*

$$v_L^1(1,\mu) = \left[\frac{(b)^b\left[\left(1-\alpha_N\right)b+\alpha_N\right]^{(1-b)}}{\left(1-\alpha_N\right)^{(1-b)}}\right]^{(\alpha_M+\alpha_F)} \frac{T^1\left(\bar{K}^1\right)^{(1-b)(\alpha_M+\alpha_F)}}{\left[L^1 + \left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}}\bar{F}^1\right]^{(1-b)(\alpha_M+\alpha_F)}}\left(\frac{A_M^1}{A_F^1}\frac{p_M}{p_F}\right)^{\alpha_F}$$

$$v_K^1(1,\mu) = \frac{T^1(1-b)}{\left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\alpha_F}}\left\{\frac{\left[\left(1-\alpha_N\right)b\right]\left[L^1 + \left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}}\bar{F}^1\right]}{\left[\left(1-\alpha_N\right)b+\alpha_N\right]\bar{K}^1}\right\}^{\alpha_N + b(\alpha_F+\alpha_M)}$$

$$v_F^1(1,\mu) = T^1(b)^{b(\alpha_M+\alpha_F)}\left(\frac{A_F^1}{A_M^1}\right)^{\frac{\alpha_N}{b}}\left(\frac{p_F}{p_M}\right)^{\frac{\alpha_N+b\alpha_M}{b}}\left\{\frac{\left[\left(1-\alpha_N\right)b+\alpha_N\right]\bar{K}^1\left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}}}{\left(1-\alpha_N\right)\left[L^1+\left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}}\bar{F}^1\right]}\right\}^{(\alpha_M+\alpha_F)(1-b)}$$

$$v_L^2(1,\mu) = \left(\frac{\alpha_N}{1-\alpha_N}\right)^{\alpha_F+\alpha_M}\left(\frac{\bar{F}^2}{L^2}\right)^{b(\alpha_M+\alpha_F)}\left(\frac{\bar{K}^2}{L^2}\right)^{(1-b)(\alpha_M+\alpha_F)}\left(\frac{A_F^2}{A_M^2}\right)^{\alpha_M} T^2\left(\frac{p_F}{p_M}\right)^{\alpha_M}$$

$$v_K^2(1,\mu) = (1-b)\left(1-\alpha_N\right)^{\alpha_N}\left(A_N^2\right)^{\alpha_N}\left(A_F^2\right)^{\alpha_F+\alpha_M}\left(\frac{p_F}{p_M}\right)^{\alpha_M}\left(\frac{\bar{F}^2}{\bar{K}^2}\right)^{b(\alpha_F+\alpha_M)}\left(\frac{L^2}{\bar{K}^2}\right)^{\alpha_N}$$

$$v_F^2(1,\mu) = b\left(\frac{1-\alpha_N}{\alpha_N}\right)^{\alpha_N}\left(A_N^2\right)^{\alpha_N}\left(A_F^2\right)^{\alpha_F+\alpha_M}\left(\frac{\bar{K}^2}{\bar{F}^2}\right)^{(1-b)(\alpha_F+\alpha_M)}\left(\frac{L^2}{\bar{F}^2}\right)^{\alpha_N}\left(\frac{p_F}{p_M}\right)^{\alpha_M}$$

where if $\mu^1 = \mu^2 = 0$, $L_1 = \bar{L}^1$ and p_F/p_M is the unique solution to $BT\left(p, \bar{L}^1\right) = 0$, while if $\mu^1 = \mu^2 = 1$, p_F/p_M, and L_1 are given by the solution to $BT\left(p, L^1\right) = 0$ and $FM\left(p, L_1\right)$.

Proof. Under free trade equilibrium conditions are:

$$r_F^j = p_F A_F^j b \left(K_F^j / \bar{F}^j\right)^{1-b}$$

$$r_K^j = p_M A_M^j (1-b) \left(L_M^j / K_M^j\right)^b = p_F A_F^j (1-b) \left(\bar{F}^j / K_F^j\right)^b \text{ for } L_M^j > 0,$$

$$r_K^j = p_F A_F^j (1-b) \left(\bar{F}^j / K_F^j\right)^b \text{ and } \left(A_M^j\right)^{-1} \left(w^j\right)^b \left(r_K^j\right)^{1-b} > \left(A_M^{-j}\right)^{-1} \left(w^{-j}\right)^b \left(r_K^{-j}\right)^{1-b} \text{ for } L_M^j = 0,$$

$$w^j = p_N^j A_N^j = p_M A_M^j b \left(K_M^j / L_M^j\right)^{1-b} \text{ for } L_M^j > 0,$$

$$w^j = p_N^j A_N^j \text{ and } \left(A_M^j\right)^{-1} \left(w^j\right)^b \left(r_K^j\right)^{1-b} > \left(A_M^{-j}\right)^{-1} \left(w^{-j}\right)^b \left(r_K^{-j}\right)^{1-b} \text{ for } L_M^j = 0,$$

$$K_F^j + K_M^j = \bar{K}^j,\ L_M^j + L_N^j = L^j,$$

$$(1-\alpha_N) p_N^j Q_N^j = \alpha_N \left(p_F^j Q_F^j + p_M^j Q_M^j\right),$$

$$\alpha_M p_F \left(Q_F^1 + Q_F^2\right) = \alpha_F p_M \left(Q_M^1 + Q_M^2\right),$$

$$L^j = \bar{L}^j \text{ (when there is no labor mobility)},$$

$$v_L^1 = v_L^2,\ L^1 + L^2 = \bar{L} = \bar{L}^1 + \bar{L}^2 \text{ (when there is free labor mobility)},$$

There are two possible cases to consider: either both countries are diversified or one country is diversified and othe other specializes in good F. We focus on the second case and, without lose of generality, we assume that country 1 is diversified and country 2 specialized in good F.

- *Equilibrium quantities*: $K_F^1 = \left[\frac{(1-\alpha_N)b+\alpha_N}{(1-\alpha_N)b}\right]\left[\frac{\left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}}\bar{F}^1}{L^1+\left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}}\bar{F}^1}\right]\bar{K}^1$, $K_M^1 = \frac{1}{(1-\alpha_N)b}\left[\frac{(1-\alpha_N)bL^1-\left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}}\alpha_N\bar{F}^1}{L^1+\left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}}\bar{F}^1}\right]\bar{K}^1$, $L_M^1 = \frac{(1-\alpha_N)bL^1-\alpha_N\left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}}\bar{F}^1}{(1-\alpha_N)b+\alpha_N}$, $L_N^1 = \frac{\alpha_N L^1+\alpha_N\left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}}\bar{F}^1}{(1-\alpha_N)b+\alpha_N}$, $Q_M^1 = \frac{\left[(1-\alpha_N)bL^1-\alpha_N\left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}}\bar{F}^1\right]A_M^1\left(\bar{K}^1\right)^{1-b}}{[(1-\alpha_N)b+\alpha_N]^b(1-\alpha_N)^{1-b}(b)^{1-b}\left[L^1+\left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}}\bar{F}^1\right]^{1-b}}$, $K_F^2 = \bar{K}^2$, $K_M^2 = 0$, $L_N^2 = L^2$, $L_M^2 = 0$, $Q_F^2 = A_F^2\left(\bar{F}^2\right)^b\left(\bar{K}^2\right)^{1-b}$, $Q_M^2 = 0$, and $Q_N^2 = A_N^2\bar{L}^2$. For this to be an equilibrium we must verify that country 1 exports M or, which is equivalent, that the equilibrium relative price of F is lower under free than under autarky in country 1. Formally, $(p_F/p_M) < \left(p_F^1/p_M^1\right)^A = \left(\frac{b\alpha_F}{\alpha_N+b\alpha_M}\right)^b\left(\frac{A_M^1}{A_F^1}\right)\left(\frac{L^1}{\bar{F}^1}\right)^b$. We must also verify that country 2 specializes in good F. Formally, $\left(A_M^2\right)^{-1}\left(w^2\right)^b\left(r_K^2\right)^{1-b} > \left(A_M^1\right)^{-1}\left(w^1\right)^b\left(r_K^1\right)^{1-b}$ or, which is equivalent, $(p_F/p_M) > \left(p_F^2/p_M^2\right)^S = [(1-\alpha_N)b/\alpha_N]^b\left(A_M^2/A_F^2\right)\left(L^2/\bar{F}^2\right)^b$. Thus, we need the following condition

$$\left[\frac{(1-\alpha_N)b}{\alpha_N}\right]^b\left(\frac{A_M^2}{A_F^2}\right)\left(\frac{L^2}{\bar{F}^2}\right)^b = \left(\frac{p_F^2}{p_M^2}\right)^S < \frac{p_F}{p_M} < \left(\frac{p_F^1}{p_M^1}\right)^A = \left(\frac{b\alpha_F}{\alpha_N+b\alpha_M}\right)^b\left(\frac{A_M^1}{A_F^1}\right)\left(\frac{L^1}{\bar{F}^1}\right)^b$$

Note that $(p_F/p_M) < \left(p_F^1/p_M^1\right)^A$ immediately implies $L_M^1 > 0$ and $K_M^1 > 0$. Also note that $\left(p_F^2/p_M^2\right)^S < \left(p_F^1/p_M^1\right)^A$ if and only if

$$\alpha_N \alpha_F \left(\frac{L^1}{L^2}\right) > (1-\alpha_N)(\alpha_N + b\alpha_M)\left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}} \left(\frac{\bar{F}^1}{\bar{F}^2}\right).$$

- *Equilibrium good prices*: $\frac{p_N^1}{p_M} = (b)^b \left(\frac{(1-\alpha_N)b+\alpha_N}{1-\alpha_N}\right)^{1-b} \left[\frac{\left(p_M A_M^1\right)^{\frac{1}{b}}}{\left(p_M A_M^1\right)^{\frac{1}{b}} L^1 + \left(p_F A_F^1\right)^{\frac{1}{b}} \bar{F}^1}\right]^{1-b} \frac{A_M^1}{A_N^1} \left(\bar{K}^1\right)^{1-b}$ and $\frac{p_N^2}{p_F} = \left(\frac{\alpha_N}{1-\alpha_N}\right) \frac{A_F^2}{A_N^2} \left(\frac{\bar{F}^2}{L^2}\right)^b \left(\frac{\bar{K}^2}{L^2}\right)^{1-b}$. $(p_F/p_M) = \check{p}$ is implicitly given by the solution to $BT(\check{p}, L_1) = 0$, where

$$BT(p, L_1) = \frac{(1-\alpha_N)^b A_M^1 \left(\bar{K}^1\right)^{1-b} \left[\alpha_F b L^1 - (\alpha_M b + \alpha_N)\left(\frac{A_F^1}{A_M^1}\right)^{\frac{1}{b}} (p)^{\frac{1}{b}} \bar{F}^1\right]}{\alpha_M (b)^{1-b} \left[(1-\alpha_N) b + \alpha_N\right]^b A_F^2 \left(\bar{F}^2\right)^b \left(\bar{K}^2\right)^{1-b} \left[L^1 + \left(\frac{A_F^1}{A_M^1}\right)^{\frac{1}{b}} (p)^{\frac{1}{b}} \bar{F}^1\right]^{1-b}} - p.$$

(We obtain $BT(p, L_1) = 0$ introducing Q_M^1, Q_F^1, Q_F^2 into the balanced trade equation $\alpha_M p_F \left(Q_F^1 + Q_F^2\right) = \alpha_F p_M \left(Q_M^1 + Q_M^2\right)$). Note that $BT(p, L_1)$ is strictly decreasing in p for $p \in \left[\left(p_F^2/p_M^2\right)^S, \left(p_F^1/p_M^1\right)^A\right]$, $BT\left(\left(p_F^1/p_M^1\right)^A, L_1\right) < 0$ and $BT\left(\left(p_F^2/p_M^2\right)^S, L_1\right) > 0$ if and only if

$$\left(\bar{K}^1/\bar{K}^2\right)^{1-b} > \frac{\alpha_M \left[(1-\alpha_N) b + \alpha_N\right]^b (D)^b \left[\alpha_N + D(1-\alpha_N) b \left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}} \left(\frac{L^2 \bar{F}^1}{L^1 \bar{F}^2}\right)\right]^{1-b}}{\left[\alpha_N \alpha_F - D(1-\alpha_N)(\alpha_M b + \alpha_N)\left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}} \left(\frac{L^2 \bar{F}^1}{L^1 \bar{F}^2}\right)\right]} \left(\frac{A_M^2}{A_M^1}\right) \left(\frac{L^2}{L^1}\right)^b$$

Thus, when this condition holds $BT(p, L_1) = 0$ has a unique solution $\check{p} \in \left[\left(p_F^2/p_M^2\right)^S, \left(p_F^1/p_M^1\right)^A\right]$.

- *Equilibrium factor prices*:

  – Factor L: $\frac{w^1}{p_F} = A_M^1 \frac{(b)^b}{(1-\alpha_N)^{1-b}} \left[\frac{(1-\alpha_N)b+\alpha_N}{L^1 + \left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}} \bar{F}^1}\right]^{1-b} \left(\bar{K}^1\right)^{1-b} \left(\frac{p_M}{p_F}\right)$, $\frac{w^1}{p_M} = A_M^1 \frac{(b)^b}{(1-\alpha_N)^{1-b}} \left[\frac{(1-\alpha_N)b+\alpha_N}{L^1 + \left(\frac{p_F A_F^1}{p_M A_M^1}\right)^{\frac{1}{b}} \bar{F}^1}\right]^{1-b} \left(\bar{K}^1\right)^{1-b}$, $\frac{w^1}{p_N^1} = A_N^1$, $\frac{w^2}{p_F} = \left(\frac{\alpha_N}{1-\alpha_N}\right) A_F^2 \left(\frac{\bar{F}^2}{L^2}\right)^b \left(\frac{\bar{K}^2}{L^2}\right)^{1-b}$, $\frac{w^2}{p_M} = \left(\frac{\alpha_N}{1-\alpha_N}\right) A_F^2 \left(\frac{\bar{F}^2}{L^2}\right)^b \left(\frac{\bar{K}^2}{L^2}\right)^{1-b} \left(\frac{p_F}{p_M}\right)$, $\frac{w^2}{p_N^2} = A_N^2$.

– Factor K: $\frac{r_K^1}{p_F} = A_F^1 (1-b) \left\{ \frac{(1-\alpha_N) b \left[L^1 + \left(\frac{p_F A_F^1}{p_M A_M^1} \right)^{\frac{1}{b}} \bar{F}^1 \right]}{[(1-\alpha_N) b + \alpha_N] \left(\frac{p_F A_F^1}{p_M A_M^1} \right)^{\frac{1}{b}} \bar{K}^1} \right\}^b$, $\frac{r_K^1}{p_M} = A_M^1 (1-b) \left\{ \frac{(1-\alpha_N) b \left[L^1 + \left(\frac{p_F A_F^1}{p_M A_M^1} \right)^{\frac{1}{b}} \bar{F}^1 \right]}{[(1-\alpha_N) b + \alpha_N] \bar{K}^1} \right\}^b$, $\frac{r_K^1}{p_N^1} = \frac{(1-\alpha_N) A_N^1 (1-b) \left[L^1 + \left(\frac{p_F A_F^1}{p_M A_M^1} \right)^{\frac{1}{b}} \bar{F}^1 \right]}{[(1-\alpha_N) b + \alpha_N] \bar{K}^1}$, $\frac{r_K^2}{p_F} = (1-b) A_F^2 \left(\frac{\bar{F}^2}{\bar{K}^2} \right)^b$, $\frac{r_K^2}{p_M} = \left(\frac{p_F}{p_M} \right) (1-b) A_F^2 \left(\frac{\bar{F}^2}{\bar{K}^2} \right)^b$, $\frac{r_K^2}{p_N^2} = \frac{(1-\alpha_N)(1-b) A_N^2 L^2}{\bar{K}^2}$.

– Facor F: $\frac{r_F^1}{p_F} = A_F^1 b \left[\frac{(1-\alpha_N) b + \alpha_N}{(1-\alpha_N) b} \right]^{1-b} \left[\frac{\left(\frac{p_F A_F^1}{p_M A_M^1} \right)^{\frac{1}{b}} \bar{K}^1}{L^1 + \left(\frac{p_F A_F^1}{p_M A_M^1} \right)^{\frac{1}{b}} \bar{F}^1} \right]^{1-b}$, $\frac{r_F^1}{p_M} = \left(\frac{p_F}{p_M} \right) A_F^1 b \left[\frac{(1-\alpha_N) b + \alpha_N}{(1-\alpha_N) b} \right]^{1-b} \left[\frac{\left(\frac{p_F A_F^1}{p_M A_M^1} \right)^{\frac{1}{b}} \bar{K}^1}{L^1 + \left(\frac{p_F A_F^1}{p_M A_M^1} \right)^{\frac{1}{b}} \bar{F}^1} \right]^{1-b}$, $\frac{r_F^1}{p_N^1} = A_N^1 \left(\frac{p_F}{p_M} \right)^{\frac{1}{b}} \left(\frac{A_F^1}{A_M^1} \right)^{\frac{1}{b}}$, $\frac{r_F^2}{p_F} = b A_F^2 \left(\frac{\bar{K}^2}{\bar{F}^2} \right)^{1-b}$, $\frac{r_F^2}{p_M} = \left(\frac{p_F}{p_M} \right) b A_F^2 \left(\frac{\bar{K}^2}{\bar{F}^2} \right)^{1-b}$, $\frac{r_F^2}{p_N^2} = \frac{(1-\alpha_N) b A_N^2 L^2}{\alpha_N \bar{F}^2}$.

- Utilities: Utilities are given by $v_K^j(1,\mu) = \left(\frac{r_K^j}{p_F} \right)^{\alpha_F} \left(\frac{r_K^j}{p_M} \right)^{\alpha_M} \left(\frac{r_K^j}{p_N^j} \right)^{\alpha_N}$, $v_F^j(1,\mu) =$

$\left(\frac{r_F^j}{p_F}\right)^{\alpha_F}\left(\frac{r_F^j}{p_M}\right)^{\alpha_M}\left(\frac{r_F^j}{p_N^j}\right)^{\alpha_N}$, $v_L^1(1,\mu)=\left(\frac{w^j}{p_F}\right)^{\alpha_F}\left(\frac{w^j}{p_M}\right)^{\alpha_M}\left(\frac{w^j}{p_N^j}\right)^{\alpha_N}$. Then:

$$v_L^1(1,\mu)=\left[\frac{(b)^b\left[(1-\alpha_N)b+\alpha_N\right]^{(1-b)}}{(1-\alpha_N)^{(1-b)}}\right]^{(\alpha_M+\alpha_F)}\frac{T^1\left(\bar{K}^1\right)^{(1-b)(\alpha_M+\alpha_F)}}{\left[L^1+\left(\frac{p_FA_F^1}{p_MA_M^1}\right)^{\frac{1}{b}}\bar{F}^1\right]^{(1-b)(\alpha_M+\alpha_F)}}\left(\frac{A_M^1}{A_F^1}\frac{p_M}{p_F}\right)^{\alpha_F}$$

$$v_K^1(1,\mu)=\frac{T^1(1-b)}{\left(\frac{p_FA_F^1}{p_MA_M^1}\right)^{\alpha_F}}\left\{\frac{\left[(1-\alpha_N)b\right]\left[L^1+\left(\frac{p_FA_F^1}{p_MA_M^1}\right)^{\frac{1}{b}}\bar{F}^1\right]}{\left[(1-\alpha_N)b+\alpha_N\right]\bar{K}^1}\right\}^{\alpha_N+b(\alpha_F+\alpha_M)}$$

$$v_F^1(1,\mu)=T^1(b)^{b(\alpha_M+\alpha_F)}\left(\frac{A_F^1}{A_M^1}\right)^{\frac{\alpha_N}{b}}\left(\frac{p_F}{p_M}\right)^{\frac{\alpha_N+b\alpha_M}{b}}\left\{\frac{\left[(1-\alpha_N)b+\alpha_N\right]\bar{K}^1\left(\frac{p_FA_F^1}{p_MA_M^1}\right)^{\frac{1}{b}}}{(1-\alpha_N)\left[L^1+\left(\frac{p_FA_F^1}{p_MA_M^1}\right)^{\frac{1}{b}}\bar{F}^1\right]}\right\}^{(\alpha_M+\alpha_F)(1-b)}$$

$$v_L^2(1,\mu)=\left(\frac{\alpha_N}{1-\alpha_N}\right)^{\alpha_F+\alpha_M}\left(\frac{\bar{F}^2}{L^2}\right)^{b(\alpha_M+\alpha_F)}\left(\frac{\bar{K}^2}{L^2}\right)^{(1-b)(\alpha_M+\alpha_F)}\left(\frac{A_F^2}{A_M^2}\right)^{\alpha_M}T^2\left(\frac{p_F}{p_M}\right)^{\alpha_M}$$

$$v_K^2(1,\mu)=(1-b)(1-\alpha_N)^{\alpha_N}\left(A_N^2\right)^{\alpha_N}\left(A_F^2\right)^{\alpha_F+\alpha_M}\left(\frac{p_F}{p_M}\right)^{\alpha_M}\left(\frac{\bar{F}^2}{\bar{K}^2}\right)^{b(\alpha_F+\alpha_M)}\left(\frac{L^2}{\bar{K}^2}\right)^{\alpha_N}$$

$$v_F^2(1,\mu)=b\left(\frac{1-\alpha_N}{\alpha_N}\right)^{\alpha_N}\left(A_N^2\right)^{\alpha_N}\left(A_F^2\right)^{\alpha_F+\alpha_M}\left(\frac{\bar{K}^2}{\bar{F}^2}\right)^{(1-b)(\alpha_F+\alpha_M)}\left(\frac{L^2}{\bar{F}^2}\right)^{\alpha_N}\left(\frac{p_F}{p_M}\right)^{\alpha_M}$$

When there is no labor mobility $L^j=\bar{L}^j$. The required conditions for the existence of a unique equilibrium $\check{p}\in\left[\left(p_F^2/p_M^2\right)^S,\left(p_F^1/p_M^1\right)^A\right]$ become

$$\alpha_N\alpha_F\left(\frac{\bar{L}^1}{\bar{L}^2}\right)>(1-\alpha_N)(\alpha_N+b\alpha_M)\left(\frac{A_F^1A_M^2}{A_M^1A_F^2}\right)^{\frac{1}{b}}\left(\frac{\bar{F}^1}{\bar{F}^2}\right)$$

$$\left(\frac{\bar{K}^1}{\bar{K}^2}\right)^{1-b}>\frac{\alpha_M\left[(1-\alpha_N)b+\alpha_N\right]^b\left[\alpha_N+(1-\alpha_N)b\left(\frac{A_F^1A_M^2}{A_M^1A_F^2}\right)^{\frac{1}{b}}\left(\frac{\bar{L}^2\bar{F}^1}{\bar{L}^1\bar{F}^2}\right)\right]^{1-b}}{\left[\alpha_N\alpha_F-(1-\alpha_N)(\alpha_Mb+\alpha_N)\left(\frac{A_F^1A_M^2}{A_M^1A_F^2}\right)^{\frac{1}{b}}\left(\frac{\bar{L}^2\bar{F}^1}{\bar{L}^1\bar{F}^2}\right)\right]}\left(\frac{A_M^2}{A_M^1}\right)\left(\frac{\bar{L}^2}{\bar{L}^1}\right)^b.$$

Furthermore, $v_L^1(1,0)>v_L^2(1,0)$ if and only if $(\alpha_Mb+\alpha_N)\left(\frac{A_F^1}{A_M^1}\right)^{\frac{1}{b}}(p)^{\frac{1}{b}}\bar{F}^1+\frac{\alpha_Mb[(1-\alpha_N)b+\alpha_N]}{\alpha_N}\left(\frac{A_N^1}{A_N^2}\right)^{\frac{\alpha_N}{(\alpha_M+\alpha_F)}}\bar{L}^2>\alpha_Fb\bar{L}^1$, which holds for all $p\in\left[\left(p_F^2/p_M^2\right)^S,\left(p_F^1/p_M^1\right)^A\right]$ when

$$\left(\frac{A_N^1}{A_N^2}\right)^{\frac{\alpha_N}{(\alpha_M+\alpha_F)}}>\frac{\alpha_N\alpha_F\left(\frac{\bar{L}^1}{\bar{L}^2}\right)-(\alpha_Mb+\alpha_N)(1-\alpha_N)\left(\frac{A_F^1A_M^2}{A_M^1A_F^2}\right)^{\frac{1}{b}}\left(\frac{\bar{F}^1}{\bar{F}^2}\right)}{\alpha_M\left[(1-\alpha_N)b+\alpha_N\right]}.$$

When the above condition holds, if allowed, workers will have an incentive to migrate from country 2 to country 1. This will increase L_1 and decrease L_2 and, hence, the conditions for the existence of a unique equilibrium $\check{p} \in \left[\left(p_F^2/p_M^2\right)^S, \left(p_F^1/p_M^1\right)^A\right]$ will continue to hold. Moreover, as L_1 increases, the equilibrium $\check{p}$ also increases. In order to prove this, we use the implicit function theorem to $BT(p, L_1) = 0$ to obtain $\frac{d\check{p}}{dL_1} = \frac{-\frac{\partial BT(p,L_1)}{\partial L_1}}{\frac{\partial BT(p,L_1)}{\partial p}}$. We have already shown that $BT(p, L_1)$ is decreasing in p. Thus, $\frac{\partial BT(p,L_1)}{\partial p} > 0$. Diferentiating $BT(p, L_1)$ with respect to L_1 we obtain

$$\frac{\partial BT(p, L_1)}{\partial L^1} = \frac{(1-\alpha_N)^b A_M^1 \left(\bar{K}^1\right)^{1-b} \left[\alpha_F b^2 L^1 + \left[\alpha_F b + (\alpha_N + \alpha_M b)(1-b)\right] \left(\frac{A_F^1}{A_M^1}\right)^{\frac{1}{b}} (p)^{\frac{1}{b}} \bar{F}^1\right]}{\alpha_M (b)^{1-b} \left[(1-\alpha_N) b + \alpha_N\right]^b A_F^2 \left(\bar{F}^2\right)^b \left(\bar{K}^2\right)^{1-b} \left[L^1 + \left(\frac{A_F^1}{A_M^1}\right)^{\frac{1}{b}} (p)^{\frac{1}{b}} \bar{F}^1\right]^{2-b}} > 0$$

Since $v_L^1(1, \mu)$ is decreasing in L_1 and p_F/p_M, as workers move from country 2 to country 1, $v_L^1(1, \mu)$ decreases. Since $v_L^2(1, \mu)$ is decreasing in L_2 and increasing in p_F/p_M, as workers move from country 2 to country 1, $v_L^2(1, \mu)$ increases. Under labor mobility, workers will move until $v_L^1(1, 1) = v_L^2(1, 1)$, which implies $FM(p, L_1) = 0$, where

$$FM(p, L_1) = \frac{\alpha_M \left[(1-\alpha_N) b + \alpha_N\right] \left(\frac{A_N^1}{A_N^2}\right)^{\frac{\alpha_N}{(\alpha_M + \alpha_F)}} \bar{L} + \alpha_N (\alpha_M b + \alpha_N) \left(\frac{A_F^1}{A_M^1}\right)^{\frac{1}{b}} (p)^{\frac{1}{b}} \bar{F}^1}{\alpha_N \alpha_F b + \alpha_M \left[(1-\alpha_N) b + \alpha_N\right] \left(\frac{A_N^1}{A_N^2}\right)^{\frac{\alpha_N}{\alpha_M + \alpha_F}}} - L_1.$$

Thus, the equilibrium under free labor mobility is the solution to $BT(p, L_1) = 0$ and $FM(p, L_1) = 0$. This completes the proof of lemma 5. ■

Proposition 6 (Mutiple Factors and Non-Tradeable Goods). *Suppose that governments maximizes the welfare of domestic workers. Assume that the following conditions hold*

$$\alpha_N \alpha_F \left(\frac{\bar{L}^1}{\bar{L}^2}\right) > (1-\alpha_N)(\alpha_N + b\alpha_M) \left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}} \left(\frac{\bar{F}^1}{\bar{F}^2}\right),$$

$$\left(\frac{\bar{K}^1}{\bar{K}^2}\right)^{1-b} > \frac{\alpha_M \left[(1-\alpha_N) b + \alpha_N\right]^b (D)^b \left[\alpha_N + D(1-\alpha_N) b \left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}} \left(\frac{\bar{L}^2 \bar{F}^1}{\bar{L}^1 \bar{F}^2}\right)\right]^{1-b} \left(\frac{A_M^2}{A_M^1}\right) \left(\frac{\bar{L}^2}{\bar{L}^1}\right)^b}{\left[\alpha_N \alpha_F - D(1-\alpha_N)(\alpha_M b + \alpha_N) \left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}} \left(\frac{\bar{L}^2 \bar{F}^1}{\bar{L}^1 \bar{F}^2}\right)\right]},$$

$$\left(\frac{A_N^1}{A_N^2}\right)^{\frac{\alpha_N}{\alpha_M + \alpha_F}} > \frac{\alpha_N \alpha_F \left(\frac{\bar{L}^1}{\bar{L}^2}\right) - (\alpha_M b + \alpha_N)(1-\alpha_N) \left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}} \left(\frac{\bar{F}^1}{\bar{F}^2}\right)}{\alpha_M \left[(1-\alpha_N) b + \alpha_N\right]}.$$

where $D = \left(\frac{\alpha_F + \alpha_M}{\alpha_F}\right)^{\frac{\alpha_F}{\alpha_M}} \left(\frac{\alpha_N + b\alpha_M}{\alpha_N}\right)^{\frac{\alpha_F + (1-b)\alpha_M}{\alpha_M b}}$. *Then, the trade and labor mobility game has only two Nash equilibria: no trade and no labor mobility and free trade and no labor mobility. Moreover,* $v_L^j(1, 0) > v_L^j(0, 0)$ *for* $j = 1, 2$.

Proof:

No trade and no labor mobility is always a Nash equilibrium.

Free trade and no labor mobility is a Nash equilibrium if and only if $v_L^j(1,0) > v_L^j(0,0)$ for $j = 1,2$. $v_L^1(1,0) > v_L^1(0,0)$ if and only if

$$\frac{(\alpha_F b)^{\frac{b\alpha_F}{\alpha_M+\alpha_F}} \left[(1-\alpha_N) b + \alpha_N\right]^{(1-b)}}{(\alpha_N + b\alpha_M)^{\frac{\alpha_F+(1-b)\alpha_M}{\alpha_M+\alpha_F}}} \left(\frac{A_M^1}{A_F^1}\right)^{\frac{\alpha_F}{\alpha_M+\alpha_F}} \frac{\left(\bar{L}^1\right)^{\frac{\alpha_F+(1-b)\alpha_M}{(\alpha_M+\alpha_F)}}}{\left(\bar{F}^1\right)^{\frac{b\alpha_F}{\alpha_M+\alpha_F}}} > \left(\frac{p_F}{p_M}\right)^{\frac{\alpha_F}{\alpha_M+\alpha_F}} \left[\bar{L}^1 + \left(\frac{A_F^1}{A_M^1}\right)^{\frac{1}{b}} \left(\frac{p_F}{p_M}\right)^{\frac{1}{b}} \bar{F}^1\right]^{1-b}$$

The left hand side is increasing in (p_F/p_M). Under the conditions in the proposition, $(p_F/p_M) < \left(p_F^1/p_M^1\right)^A = \left(\frac{b\alpha_F}{\alpha_N+b\alpha_M}\right)^b \left(\frac{A_M^1}{A_F^1}\right) \left(\frac{\bar{L}^1}{\bar{F}^1}\right)^b$. Finally, when we evaluate the right hand side at $\left(p_F^1/p_M^1\right)^A$, the inequality becomes an equality. $v_L^2(1,0) > v_L^2(0,0)$ if and only if

$$\frac{p_F}{p_M} > \check{p} = \frac{(b)^b (1-\alpha_N)^{b\left(\frac{\alpha_F+\alpha_M}{\alpha_M}\right)} (\alpha_N + b\alpha_M)^{\frac{\alpha_F+(1-b)\alpha_M}{\alpha_M}}}{(\alpha_F)^{\frac{b\alpha_F}{\alpha_M}} (\alpha_N)^{\frac{\alpha_F+\alpha_M}{\alpha_M}}} \left(\frac{A_M^2}{A_F^2}\right) \left(\frac{\bar{L}^2}{\bar{F}^2}\right)^b$$

$(p_F/p_M) > \check{p}$ if and only if $B\left(\check{p}, \bar{L}_1\right) > 0$ or, which is equivalent,

$$\left(\frac{\bar{K}^1}{\bar{K}^2}\right)^{1-b} > \frac{\alpha_M \left[(1-\alpha_N) b + \alpha_N\right]^b (D)^b \left[\alpha_N + D(1-\alpha_N) b \left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}} \left(\frac{\bar{L}^2 \bar{F}^1}{\bar{L}^1 \bar{F}^2}\right)\right]^{1-b} \left(\frac{A_M^2}{A_M^1}\right) \left(\frac{\bar{L}^2}{\bar{L}^1}\right)^b}{\left[\alpha_N \alpha_F - D(1-\alpha_N)(\alpha_M b + \alpha_N) \left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}} \left(\frac{\bar{L}^2 \bar{F}^1}{\bar{L}^1 \bar{F}^2}\right)\right]},$$

where $D = \left(\frac{\alpha_F+\alpha_M}{\alpha_F}\right)^{\frac{\alpha_F}{\alpha_M}} \left(\frac{\alpha_N+b\alpha_M}{\alpha_N}\right)^{\frac{\alpha_F+(1-b)\alpha_M}{\alpha_M b}} > 1$.

Free trade and free labor mobility is not a Nash equilibrium. We have already proved that when $\left(\frac{A_N^1}{A_N^2}\right)^{\frac{\alpha_N}{(\alpha_M+\alpha_F)}} > \frac{\alpha_N \alpha_F \left(\frac{\bar{L}^1}{\bar{L}^2}\right) - (\alpha_M b + \alpha_N)(1-\alpha_N) \left(\frac{A_F^1 A_M^2}{A_M^1 A_F^2}\right)^{\frac{1}{b}} \left(\frac{\bar{F}^1}{\bar{F}^2}\right)}{\alpha_M \left[(1-\alpha_N) b + \alpha_N\right]}$, $v_L^1(1,0) > v_L^2(1,0)$ and as workers move from country 2 to country 1, $v_L^1(1,\mu)$ decreases. Therefore, it must be the case that $v_L^1(1,0) > v_L^1(1,1)$.

No trade and free labor mobility is not a Nash equilibrium. Suppose that $L^1 = \left[\left(T^1\right)\left(\bar{F}^1\right)^{b\alpha_F}\left(\bar{K}^1\right)^{(1-b)(\alpha_F+\alpha_M)}\right]^{\frac{1}{\alpha_F+(1-b)\alpha_M}} \left(\bar{T}\right)^{-1} \bar{L} > \bar{L}^1$. Then, under no trade and free labor mobility, workers will migrate from country 2 to country 1. Moreover $v_L^1(0,0) > v_L^1(0,1)$.if and only if $\left[\left(T^1\right)\left(\bar{F}^1\right)^{b\alpha_F}\left(\bar{K}^1\right)^{(1-b)(\alpha_F+\alpha_M)}\right]^{\frac{1}{\alpha_F+(1-b)\alpha_M}} \bar{L} > \bar{T}\bar{L}^1$. Suppose that $L^1 = \left[\left(T^1\right)\left(\bar{F}^1\right)^{b\alpha_F}\left(\bar{K}^1\right)^{(1-b)(\alpha_F+\alpha_M)}\right]^{\frac{1}{\alpha_F+(1-b)\alpha_M}} \left(\bar{T}\right)^{-1} \bar{L} < \bar{L}^1$, then under no trade and free labor mobility, workers will migrate from country 1 to country 2. Moreover, $v_L^2(0,0) > v_L^2(0,1)$.if and only if $\left[\left(T^1\right)\left(\bar{F}^2\right)^{b\alpha_F}\left(\bar{K}^1\right)^{(1-b)(\alpha_F+\alpha_M)}\right]^{\frac{1}{\alpha_F+(1-b)\alpha_M}} \bar{L} > \bar{T}\bar{L}^1$. This completes the proof of the proposition. ■