This is to certify that the
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IMMIGRATION AND ECONOMIC INTEGRATION

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ILKAY YILMAZ

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John D. Wilson
Major Professor's Signature

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IMMIGRATION AND ECONOMIC INTEGRATION

By

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ABSTRACT

IMMIGRATION AND ECONOMIC INTEGRATION

By

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This dissertation contains four chapters, three of which are theoretical and the other is empirical.

In the first chapter, by using a probabilistic static model, a possible relationship between the desirability of economic integration and (illegal) immigration is studied. Using the framework developed in Levy (1997), it is shown that migration from a labor abundant country to a capital abundant country leads to economic integration between the two countries. By reducing the median voter's utility in the capital abundant country, migration induces voters to support economic integration. In the second chapter the same relationship is studied within the framework of a dynamic model. As in the first chapter, it is shown that migration might lead to economic integration in the future.

The positive relationship between migration and economic integration suggests a complementary relationship between factor movements and goods trade. Showing such a relationship within a Heckscher-Ohlin setting indicates that supplementing the classical Heckscher-Ohlin model with illegal immigration and political economy might render invalid the earlier conclusions (starting with Mundell's classical 1957 paper) that within

the standard Heckscher-Ohlin model factor movements and goods trade are undoubtedly substitutes.

Both chapters also show that the possibility of economic integration is increasing (decreasing) in income inequality in the relatively labor (capital) abundant country. This result is compatible with Mayer's (1984) prediction that an increase in inequality, holding constant the economy's overall relative endowments, raises trade barriers in capital-abundant economies and lowers them in capital-scarce economies.

The third chapter incorporates smuggling to the two-good variant of the dynamic model developed in the second chapter. It shows that the effect of smuggling on the time of economic integration is ambiguous. It suggests that a higher (lower) detection rate of smuggled goods tend to make the time of economic integration, i.e. free trade, later (sooner).

In the last chapter I empirically test the prediction that the possibility of economic integration is increasing (decreasing) in income inequality in the relatively labor (capital) abundant country. I have found that only in democratic countries a positive (negative) relationship exists between the income inequality level in the relatively labor-abundant (capital-abundant) country and the possibility of the FTA.

to my parents and sister

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INTRODUCTION

The two major economic blocks, NAFTA and EU, seem to be centers of attraction for immigration. It is not far-fetched to assume that in the absence of immigration costs and restrictions, these economic blocks would have to absorb huge sizes of poor immigrants who would change the economic and ethnic compositions of these blocks radically. It is no wonder that the average citizen in these blocks is against immigration. It is also reasonable to expect that illegal immigration from developing countries to the high-income countries will intensify in the future. In the case of economic blocks (especially the EU), some of the source countries of these illegal immigration might be possible candidates to these economic blocks. Then a natural question arises: "Does illegal immigration from a candidate country to an economic block increase or decrease the chance of being accepted to that block?" This thesis is an attempt to give an answer to this question.

Europe has a long history of human migration, reasons of which were various such as persecution of minorities, wars, dispossession of land, industrialization etc. In the 19th and 20th centuries emigration to the New World was the dominant movement. Between 1820 and 1940, an estimated 55-60 million Europeans left for the New World. 38 million of these ended up in the United States. Just before the First World War, at the peak of the transatlantic migration) over 1 million people were migrating to the United States from Europe annually.

Migrations within Europe were also important before 1940. Both economic and political factors contributed to this phenomenon. Industrial countries like Britain, France and Germany attracted workers from neighboring countries.

Two world wars caused tens of millions of people to move across borders and resettle in countries where they were not born in. According to Kosinski (1970), the First World War caused 7.7 million people to cross borders in Europe and the Second World War - 25 million. On this episode of European history especially the movements of German speaking people were dominant. At the end of 1940's there were 7.8 million refugees in West Germany and 3.5 million in East Germany. Furthermore between 1950 and 1961, 3 million East Germans fled to the West (King 1995).

Even when political factors were the main cause of migration, i.e. when political events forced people to move or created opportunities to move, people considered economic perspectives and chose to move to places where they can materially live better, as in the case of East German refugees to the West.

The migration of so called guest workers, on the other hand, was purely economic. It started in the 1950s, continued throughout 1960s and diminished in 1970's. This mass movement of workers helped rich North European countries to satisfy manpower needs. At the beginning the idea was that foreign workers would migrate temporarily and they would return to their countries after they gained experience in modern industries and when their host country no longer needed them. In the 1950s Italy was the source of

migrant workers. Germany, the biggest economy in Europe, made a treaty with Italy in 1955 to recruit temporary guest workers. Similar treaties with Spain, Turkey, Morocco, Portugal, Greece, Tunisia, Yugoslavia and South Korea were concluded in 1960s. Besides Germany, economies of emerging European Common Market, France, Belgium, Holland and Luxemburg were the other main recruiting countries.

The general recession following the oil shocks in early 1970's ended the demand for foreign workers abruptly in 1974. As White (1986) and King (1995) pointed out many migration flows continues until 1975. After that migration did not come to a holt, rather the character of the flows changed. The migration of single (mainly male) workers was replaced by the migration of family members. Also, since Western European economies no longer sought foreign workers, for those who want to emigrate to Western Europe illegal immigration and political asylum options become more important.

As it can be seen in table A.1, stocks of foreign populations in Western European countries did not shrink through 1980s, on the contrary they increased.

Following the collapse of the Communist block in Eastern Europe, a new wave of migration from East to West emerged. Legal migration of ethnic minorities, like German speaking people from former USSR, and illegal immigration from the former Communist block countries caused by economic collapse took place. The humanitarian catastrophe caused by civil wars in former Yugoslavia led to huge increases in the number of asylum seekers into Western European countries especially in the early 1990s.

Tables A.2, A.3 and A.4 present a statistical overview of immigration into European countries, the number of asylum seekers and the stocks of foreign born populations throughout the 1990s. From these figures its easy to see the importance of migration wave (mainly to Germany) in the early 1990s caused by the collapse of the USSR and the civil war in former Yugoslavia. The mere fact that the influx of foreign populations into Europe has never been less than 1 million annually throughout the 1990s indicates the importance of immigration for Europe.

As mentioned above, in the 19th century and in the first decades of the 20th century millions of Europeans moved to the United States in search of a new and better life. Also 10 to 20 million Africans were transported to the USA and other parts of the Americas as slaves between 1700 and 1850 (when slavery was officially ended in the USA). These people were mainly used in cotton and other plantations even after the Civil War.

During the long history of US immigration there were periods dominated by anti-immigration sentiments, such as the campaigns against Chinese and other Asian immigrants in 1880s. The anti-immigrant feelings of 1920s and 1930s contributed to the increasing number of restrictions and controls which were consolidated by the 1924 National Origins Act. As a result of this act and other anti-immigrant policies between 1931 and 1940 only about 500,000 new immigrants came to the United States. As it can be seen in Table A.5 this is the lowest such number in the recent history of United States immigration.

Later in 1965 amendments to the Immigration and Nationality Act led to a system of worldwide immigration by replacing earlier national origins quota arrangements. From then on the ratio of non-Europeans to Europeans in the immigrant population significantly increased.

The enactment of the Immigration Reform and Control Act of 1986, tried to improve control over irregular immigration. By giving preference to family reunifications it multiplied flows from particular source countries. One of the major components of this act was an illegal immigrant amnesty program. As it can be seen from table A.6, the number of illegal immigrants decreased about 2.4 million mainly due to the legalization component of this act.

According to the Immigration and Naturalization Service (INS) in January 2000, there were 7 million illegal aliens living in the United States. It is estimated that this number is increasing by half a million a year. Therefore the illegal alien population in the beginning of 2004 must be around 9 million. INS also reports a close link between legal and illegal immigration, which is reflected by the fact that 1.5 million green cards were given to illegal aliens in 1990s.

The largest share of illegal immigrants comes from Mexico. As shown in table A.7, in 1998, 54% of all illegal immigrants in the US were from Mexico. Given this fact it is not surprising that one of the aims of NAFTA was to reduce migration from Mexico to the

United States by stimulated economic growth. Although general agreements on migration were explicitly not part of the NAFTA, leaders of both Mexico and the United States supported NAFTA under the expectation that in the long run trade would substitute migration.

The NAFTA debate emphasizes the question of whether free trade could stop unwanted migration from less developed countries to developed ones. The standard comparative statics analysis gives the answer that migration of labor without the existence of trade tends to decrease and end because of the adjustment of wages. Migration decreases wages in the receiving country and it increases wages in the sending country. The Heckscher-Ohlin trade model concludes that trade and migration are substitutes. Trade, by equalizing factor prices, eliminates the reason why people migrate.

An interesting question here is that if migration helps to lead to the creation of FTAs, then should we regard migration and trade complements rather than substitutes? If the Mexican immigration had not occurred over the years and if there were no threat of further (illegal) immigration, would NAFTA get enough support in the United States? Or in the European Union context, could the possibility of possible further unwanted migration from Eastern Europe and Turkey be one of the reasons why these regions are in the European enlargement perspectives?

The main idea of my thesis is that although unwanted migration hurts the median voter in the receiving country, free trade with the sending country that will stop migration

might be preferable to further migration without free trade. The thesis constructs Heckscher-Ohlin-Samuelson type models in which illegal migration from a labor abundant country to a capital abundant country leads to economic integration (free trade) between the two countries. The models suggest an ambivalent answer to the question of whether goods trade and factor mobility are substitutes or complements. On the one hand, the motivation for migration (factor mobility) is the absence of goods trade (if there were goods trade, then we would have factor price equalization and no labor movement). Furthermore, when countries switch from autarky to free trade, labor migration no longer occurs. Thus, factor mobility and goods trade seem to be substitutes. On the other hand, the reason for free trade is the labor migration, which suggests that factor movements and goods trade are complements.

By conducting comparative statics analysis on the models, it is shown that the probability of economic integration is increasing (decreasing) in income inequality in the relatively labor (capital) abundant country. The econometric part of the thesis provides evidence for this prognosis.

Table A.1: Stocks of foreign populations in selected European countries by nationality, 1978 and 1989 (thousands)

Receiving Country	Germany		Netherlands		Sweden		Switzerland		Belgium		France	
	1978	1989	1978	1989	1978	1989	1978	1989	1977	1989	1976	1985
Sending Country												
Austria	159	171	-	-	4	3	35	29	-	-	-	-
Finland	9	10	-	-	188	123	-	-	-	-	-	-
Greece	306	294	4	5	18	7	9	8	24	21	-	-
Italy	572	520	21	17	6	4	443	379	287	241	466	277
Portugal	110	75	9	8	2	2	8	69	10	15	823	751
Spain	189	127	25	17	4	3	96	115	65	52	507	268
Turkey	1165	1613	107	192	15	24	30	59	59	82	58	146
Yugoslavia	610	611	14	13	40	40	38	117	5	6	-	-
Algeria	-	-	-	-	-	-	-	-	10	11	790	821
Morocco	29	62	64	148	-	-	-	-	81	138	300	516
Tunisia	19	24	2	2	-	-	-	-	5	6	147	203
Other	813	1342	185	241	149	250	241	265	305	309	607	770
Total	3981	4846	435	642	424	456	898	1040	851	881	3700	3752

Source: King 1995

Notes: For Germany, Netherlands, Sweden and Belgium (1989) the figures are based on "foreigners files" kept at local registry offices. For Belgium (1977) the figures are from the sample census of that year and are not strictly comparable with the 1989 Belgium figures. For Switzerland the figures are for annual and "establishment" permit-holders, not seasonal or frontier migrants. For France the 1976 figure is based on an estimate of an International Working Party; the 185 figure is based on the census and estimates by the Institut National d'Etudes Démographiques; these two figures are therefore not strictly comparable. In all cases, figures may not tally owing to rounding.

Table A.2: Inflows of foreign population into selected European countries 1990-2000 (thousands)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Austria	-	-	-	-	-	-	-	-	59.2	72.4	66.0
Belgium	50.5	54.1	55.1	53.0	56.0	53.1	51.9	49.2	50.7	68.7	68.6
Czech Republic	-	-	-	-	-	5.9	7.4	9.9	7.9	6.8	4.2
Denmark	15.1	17.5	16.9	15.4	15.6	33.0	24.7	20.4	21.3	20.3	-
Finland	6.5	12.4	10.4	10.9	7.6	7.3	7.5	8.1	8.3	7.9	9.1
France	102.4	109.9	116.6	99.2	91.5	77.0	75.5	102.4	139.5	108.1	119.3
Germany	824.4	920.5	1207.6	986.9	774.0	788.3	708.0	615.3	605.5	673.9	648.8
Greece	-	-	-	-	-	-	-	-	38.2	-	-
Hungary	37.2	23.0	15.1	16.4	12.8	13.2	12.8	12.2	12.3	15.0	-
Ireland	-	-	-	-	13.3	13.6	21.5	23.5	20.8	21.6	24.1
Italy	-	-	-	-	-	-	-	-	111.0	268.0	271.5
Luxemburg	9.3	10.0	9.8	9.2	9.2	9.6	9.2	9.4	10.6	11.8	10.8
Netherlands	81.3	84.3	83.0	87.6	68.4	67.0	77.2	76.7	81.7	78.4	91.4
Norway	15.7	16.1	17.2	22.3	17.9	16.5	17.2	22.0	26.7	32.2	27.8
Portugal	-	-	13.7	9.9	5.7	5.0	3.6	3.3	6.5	10.5	15.9
Sweden	53.2	43.9	39.5	54.8	74.7	36.1	29.3	33.4	35.7	34.6	33.8
Switzerland	101.4	109.8	112.1	104.0	91.7	87.9	74.3	72.8	74.9	85.8	87.4
United Kingdom	-	-	203.9	190.3	193.6	206.3	216.4	236.9	258.0	276.0	288.8
EU (*)	-	-	1756.5	1517.1	1309.5	1296.4	1224.9	1178.7	1238.7	1312.5	1310.6

(*): Above countries only (excluding Austria, Greece and Italy)

Sources: Geddes (2003), OECD (2003)

Table A.3: Inflows of asylum seekers into selected European countries 1991-2001 (thousands)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Austria	27.3	16.2	4.7	5.1	5.9	7.0	6.7	13.8	20.1	18.3	30.1
Belgium	15.4	17.6	26.5	14.7	11.7	12.4	11.8	22.1	35.8	42.7	24.5
Bulgaria	-	0.2	-	-	0.5	0.3	0.4	0.8	1.3	1.8	2.4
Czech Republic	2.0	0.9	2.2	1.2	1.4	2.2	2.1	4.1	7.2	8.8	18.0
Denmark	4.6	13.9	14.3	6.7	5.1	5.9	5.1	5.7	6.5	10.3	12.4
Finland	2.1	3.6	2.0	0.8	0.8	0.7	1.0	1.3	3.1	3.2	1.7
France	47.2	28.9	27.6	26.0	20.4	17.4	21.4	22.4	30.9	38.7	47.3
Germany	256.1	438.2	322.6	127.2	127.9	116.4	104.4	98.6	95.1	78.6	88.4
Greece	2.7	2.0	0.8	1.3	1.4	1.6	4.4	2.6	1.5	3.1	5.5
Hungary	-	0.9	0.7	0.4	0.6	0.7	1.1	7.4	11.5	7.8	9.6
Ireland	-	-	0.1	0.4	0.4	1.2	3.9	4.6	7.7	10.9	10.3
Italy	31.7	2.6	1.3	1.8	1.7	0.7	1.9	11.1	33.4	24.5	9.8
Luxemburg	0.2	0.1	0.2	0.2	0.2	0.3	0.4	1.6	2.9	0.6	0.7
Netherlands	21.6	20.3	35.4	52.6	29.3	22.9	34.4	45.2	42.7	43.9	32.6
Norway	4.6	5.2	12.9	3.4	1.5	1.8	2.3	8.5	10.2	10.8	14.8
Poland	-	0.6	0.8	0.6	0.8	3.2	3.5	3.4	3.0	4.4	4.5
Portugal	0.2	0.5	1.7	0.6	0.3	0.2	0.3	0.3	0.3	0.2	0.2
Romania	-	0.8	-	-	-	0.6	1.4	1.2	1.7	1.4	2.4
Slovak Republic	-	0.1	0.1	0.1	0.4	0.4	0.7	0.5	0.9	1.5	8.2
Spain	8.1	11.7	12.6	12.0	5.7	4.7	5.0	6.8	8.4	7.9	9.2
Sweden	27.4	84.0	37.6	18.6	9.0	5.8	9.6	12.5	11.2	16.3	23.5
Switzerland	41.6	18.0	24.7	16.1	17.0	18.0	24.0	41.3	46.1	17.6	20.8
United Kingdom	74.3	32.3	28.0	42.2	55.0	37.0	41.5	58.0	91.2	98.9	92.0
EU	-	672.0	515.4	310.0	274.9	234.1	251.8	306.7	390.9	398.1	388.1

Sources: Geddes (2003), OECD (2003)

Table A.4: Stocks of foreign population in selected European countries, 1990-2000 (thousands and percentages)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Austria	456.1	532.7	623.0	689.6	713.5	723.5	728.2	732.3	737.3	748.2	757.9
% of total population	5.9	6.8	7.9	8.6	8.9	9.0	9.0	9.1	9.1	9.2	9.3
Belgium	904.5	922.5	909.3	920.6	922.3	909.8	911.9	903.2	892.0	897.1	861.7
% of total population	9.1	9.2	9.0	9.1	9.1	9.0	9.0	8.9	8.7	8.8	8.4
Czech Republic	-	-	41.2	77.7	103.7	158.6	198.6	209.8	219.8	228.9	201.0
% of total population	-	-	0.4	0.8	1.0	1.5	1.9	2.0	2.1	2.2	2.0
Denmark	160.6	169.5	180.1	189.0	196.7	222.7	237.7	249.6	256.3	259.4	258.6
% of total population	3.1	3.3	3.5	3.6	3.8	4.2	4.7	4.7	4.8	4.9	4.8
Finland	26.3	37.6	46.3	55.6	62.0	68.6	73.8	80.6	85.1	87.7	91.1
% of total population	0.5	0.8	0.9	1.1	1.2	1.3	1.4	1.6	1.6	1.7	1.8
France	2596.6	-	-	-	-	-	-	-	-	3263.2	-
% of total population	6.0	-	-	-	-	-	-	-	-	5.6	-
Germany	5342.5	5882.3	6495.8	6878.1	6990.5	7173.9	7314.0	7365.8	7319.5	7343.6	7296.8
% of total population	8.4	7.3	8.0	8.5	8.6	8.8	8.9	9.0	8.9	8.9	8.9
Hungary	-	-	-	-	137.9	139.9	142.2	243.8	-	127.0	-
% of total population	-	-	-	-	1.3	1.4	1.4	1.4	-	1.3	-
Ireland	80.0	87.7	94.9	89.9	91.1	96.1	118.0	114.4	111.0	117.8	126.5
% of total population	2.3	2.5	2.7	2.7	2.7	2.7	3.2	3.1	3.0	3.2	3.3
Italy	781.1	863.0	925.2	987.4	922.7	991.4	1095.6	1240.7	1250.2	1252.0	1388.2
% of total population	1.4	1.5	1.6	1.7	1.6	1.7	2.0	2.1	2.1	2.2	2.4

Luxemburg	113.1	117.8	122.7	127.6	132.5	138.1	142.8	147.7	152.9	159.4	164.7
% of total population	29.4	30.2	31.0	31.8	32.6	33.4	34.1	34.9	35.6	36.0	37.3
Netherlands	692.4	732.9	757.4	779.8	757.1	725.4	679.9	678.1	662.4	651.5	667.8
% of total population	4.6	4.8	5.0	5.1	5.0	4.7	4.4	4.3	4.2	4.1	4.2
Norway	143.3	147.8	154.0	162.3	164.0	160.8	157.5	158.0	165.0	178.7	184.3
% of total population	3.4	3.5	3.6	3.8	3.8	3.7	3.6	3.6	3.7	4.0	4.1
Poland	-	-	-	-	-	-	-	-	-	42.8	-
% of total population	-	-	-	-	-	-	-	-	-	0.1	-
Portugal	107.8	114.0	123.6	131.6	157.1	168.3	172.9	175.3	177.8	190.9	208.2
% of total population	1.1	1.2	1.3	1.3	1.6	1.7	1.7	1.8	1.8	1.9	21.0
Slovak Republic	-	-	-	11.0	16.9	21.9	24.1	24.8	27.4	29.5	28.3
% of total population	-	-	-	0.2	0.3	0.4	0.5	0.5	0.5	0.5	0.5
Spain	278.7	360.7	393.1	430.4	461.4	499.8	539.0	609.8	719.6	801.3	895.7
% of total population	0.7	0.9	1.0	1.1	1.2	1.3	1.4	1.6	1.8	2.0	2.2
Sweden	483.7	493.8	499.1	507.5	537.4	531.8	526.6	522.6	499.9	487.2	477.3
% of total population	5.6	5.7	5.7	5.8	6.1	5.2	6.0	6.0	5.6	5.5	5.4
Switzerland	1100.3	1163.2	1213.5	1260.3	1300.1	1330.6	1337.6	1340.8	1347.9	1368.7	1384.4
% of total population	16.3	17.1	17.6	18.1	18.6	18.9	18.9	19.0	19.0	19.2	19.3
United Kingdom	1723.0	1750.0	1985.0	2001.0	2032.0	1948.0	1934.0	2066.0	2207.0	2208.0	2342.0
% of total population	3.2	3.1	3.5	3.5	3.6	3.4	3.4	3.6	3.8	3.8	4.0

Sources: OECD (2000), OECD (2003)

Table A.5: Shares of US decennial population growth attributable to immigration, 1820-1990 (population in thousands)

Year	Total US population	Population increase in the decade	Immigrants to the USA	Immigrants as % share of the increase
1820	9638			
1830	12866	3228	143	4
1840	17069	4203	599	14
1850	23192	6123	1713	28
1860	31443	8251	2598	31
1870	38558	7115	2315	33
1880	50189	11631	2812	24
1890	62721	12532	5247	42
1900	76747	14026	3688	26
1910	92198	15451	8795	57
1920	106005	13807	5736	42
1930	123197	17192	4107	24
1940	132184	8987	528	6
1950	151291	19107	1035	5
1960	179420	28129	2515	9
1970	203302	23882	3322	14
1980	226546	23244	4493	19
1990	248710	22164	7338	33

Source: Ghosh (1997)

A.6 Estimates of the illegal immigrant population in the US, 1980-1998

Year	Number of undocumented immigrants
1980	2100000
1986	3200000
1987	4800000
1988	2200000
1990	2600000
1992	3400000
1994	3750000
1998	4700000

Source: Rivera-Batiz (2001)

Table A.7: Undocumented immigrants in the US, by country of origin, 1998

Country of origin	Total number of undocumented immigrants	Percentage of total undocumented population
Total	4,700,000	100.0
Mexico	2,538,000	54.0
El Salvador	315,000	6.7
Guatemala	155,000	3.3
Canada	113,000	2.4
Haiti	99,000	2.1
Philippines	89,000	1.9
Honduras	85,000	1.8
The Bahamas	66,000	1.4
Nicaragua	66,000	1.4
Poland	66,000	1.4
Colombia	61,000	1.3
Other	1,047,000	22.3

Source: Rivera-Batiz (2001)

The thesis is organized as follows:

In the following section, I discuss the related literature of illegal immigration, substitutability and complementarity of factor movements and goods trade, and political economy of economic integration.

The first chapter introduces a 2-factor, 2-country static probabilistic model of migration and economic integration. Both countries have identical constant returns to scale technologies; they differ in capital-labor ratios, i.e. wages are higher in the relatively rich (capital abundant) country. I work with a one-good model, but the model is later extended to include two goods, following the Heckscher-Ohlin set up. Decisions are made by majority rule, which means that the chosen policy is the one most preferred by the median voter. At the beginning (in the first stage) the median voter in the poor country prefers economic union, whereas the median voter in the rich country does not. In the first stage an illegal migration wave from the poor country to the rich country occurs; in the second stage, people (excluding illegal immigrants) in the rich country vote in order to determine whether to form an integrated economy including the two countries, i.e. free movement of capital and labor in the case of one-good model and free trade in the case of two-good model. In one-good model, it is assumed that in the case of economic integration, a sufficient level of capital movement from the rich country to the poor country occurs instantaneously, which equalizes factor prices in both countries (factor-price equalization requires free movement of only one factor not both). In two-good model, free trade in the two goods leads to factor price equalization. In these

models migration of labor from the poor country to the rich country in the first stage makes the median voter in the rich country indifferent between economic integration and non-integration in the second stage. Then the probability of integration is determined by the cost of migration and wage difference between the two countries.

In the second chapter, I set up two-country dynamic models to analyze the relationship between immigration and economic integration decisions. I mainly show that the movement of the poor from a relatively poor country to a relatively rich country gradually increases the public support for the economic union between these two countries in the rich country. The novelty of these models is their dynamic structure. There is a continuous flow of immigrants from the poor country to the rich country. The flow of immigrants decreases over time because of the decrease in the wage rate difference caused by the past immigration. The more immigrants there are in the rich country the further the capital-labor ratio falls down, while the capital-labor ratio in the poor country goes up. The decrease in the capital-labor ratio decreases the utility of the median voter in the rich country, provided that the median voter's capital-labor endowment ratio is less than the country's. In some cases this decrease in utility might be big enough to compel him to prefer an economic union with the poor country, which will give him a utility level no less than what he enjoys in his secluded country. In the second part of this chapter, I switch from one-good model to two-good model and economic integration means free trade in this case. As in the one-good model we will observe a decrease in the real wage difference as a result of migration. Also the rich country's

median voter's utility level once again will decrease exactly to the level which he would enjoy under free trade and he will eventually vote for free trade.

The third chapter presents an extension to the 2-good dynamic model developed in the second chapter. Smuggling is introduced to the model and it is shown that smuggling has two opposing effects on the time of free trade. On the one hand it brings relative prices closer in the two countries, which tends to slow down migration and tends to make the time of free trade later. On the other hand it decreases the utility level of the median voter in the capital abundant country, which decreases the necessary migration level for free trade and tends to make the time of free trade earlier. The net effect of these two opposing forces determines whether the model with smuggling makes free trade earlier or later compared to the earlier model without smuggling.

In the fourth chapter combining a subset of the data used in Baier and Bergstrand (2003) with GINI coefficients data from UN Development program and POLITY data from POLITY IV project, I tested the relationship between income inequality and the possibility of FTAs. I found evidence of a positive (negative) relationship between the inequality level in the relatively poor (rich) country and the possibility of the FTA in democratic countries, but I fail to find any relationship between the inequality level and the possibility of the FTA in undemocratic countries.

The fourth chapter is followed by a small section in which the main conclusions of the thesis and suggestions for further research are given.

LITERATURE REVIEW

There are three main dimensions of my dissertation, namely illegal immigration, substitutability and complementarity of goods trade and factor movements, and finally political economy within the context of economic integration.

To my knowledge, there is no earlier work about the linkage between economic integration and illegal immigration.

Among the earlier works on the illegal immigration it is worth to mention Ethier (1986), Bond and Chen (1987), Bucci and Tenorio (1996) and Yoshida (2000), all of which include static models.

In Ethier (1986) the effects of border and internal enforcement policies in a one-country, two-factor (skilled and unskilled labor), one good model are analyzed. He defines the subject of illegal immigration by partially successful attempts to prevent that migration. He models these attempts as border enforcement and internal enforcement. He assumes that of those who illegally attempt to immigrate, a certain number are caught and denied entry. The authorities' success in preventing illegal entry depends upon the resources devoted to border enforcement, which are financed by taxes. Internal enforcement, on the other hand, is described as random inspections of firms. Again, the number of illegal immigrants caught in the work place depends on the resources devoted to internal enforcement which, again, are financed by taxes. The government policy

instrument in the model is the exogenous level of resources devoted to border and internal enforcement efforts and it is used to control the internal distribution of income between skilled and unskilled workers and also the level of illegal immigrants. But these two policy targets are linked to each other technologically and cannot be unbundled. In the model, illegal migration is motivated by the higher wage rate for unskilled workers in the host country. Implicitly it is assumed that the ratio of unskilled labor to skilled labor is higher at the outside world. The main conclusions of the paper are as follows: Border enforcement policy will probably reduce national income even if the country has monopoly power in the world market for unskilled workers. Nevertheless border enforcement is an effective way of controlling the unskilled labor employment rate (if there is a rigid wage rate in the unskilled labor market) or the wage of unskilled labor (if wages are flexible). However if illegal immigrants are also taxed, the effects of border enforcement on these are not predictable. Given an interdiction policy, varying the number of legal immigrants will have no effect on the total number of immigrants (legal and illegal together). In other words there is a perfect trade-off between the number of legal immigrants and the number of illegal immigrants. If firms can distinguish illegal immigrants, domestic enforcement policies will make illegal immigrants disadvantaged relative to legal workers, otherwise such policies will harm all unskilled workers (native, legal and illegal immigrants) relative to skilled workers. It is possible to reduce the cost of immigration policy by mixing border and domestic enforcement methods instead of using just one of them. Strangely, if illegal immigrants can pose as legal immigrants both border and domestic enforcement seem to be more successful than they are.

By extending Ethier model, Bond and Chen (1987) constructed a standard, two-country, one-good, two factor model and analyzed the effect of an internal enforcement policy by the host country government on the host country's welfare. In their work, they hold the level of border enforcement constant and concentrate on internal enforcement against firms that hire illegal workers. Firms produce one type of good by using capital and labor. The optimal level of enforcement is examined and the effects of allowing capital mobility are considered. They derive a formula for the optimal level of enforcement against firms that hire illegal workers. They show that if terms of trade effects are large enough and marginal cost of enforcement is sufficiently low, a non-zero enforcement level that maximizes the national welfare may exist. On the other hand if home country firms cannot distinguish illegal workers from legal workers, the optimum level of enforcement is more likely to be zero. They also show that the enforcement policy is less efficient than a wage tax because of enforcement costs. When capital mobility is allowed, an increase in enforcement in home country benefits foreign workers since it causes capital outflow. Finally it is shown that the optimal policy for home country may be both penalizing illegal immigrants and allowing capital export.

Bucci and Tenorio (1996) on the other hand examined the effects of financing internal enforcement on the host country's welfare by introducing a government budget constraint similar to Ethier's into a small-country model. Yoshida by using Bond and Chen (1987) and Bucci and Tenorio (1996) models reassessed the welfare effects of the enforcement policy in terms of the welfare of the host country, the foreign country and the world.

In my models I use the term illegal immigration by two reasons. First, median voter in the rich country does not want migration, i.e. majority of the rich country does not want these immigrants in their country. Second, immigrants from the poor country do not posses voting rights in the rich country. They are not legal citizens of the rich country and they are not allowed to participate in voting for a possible free trade agreement between the country in which they live and the country from which they came.

Since my major aim is to capture the relationship between migration and economic integration, rather than welfare effects of various enforcement policies as in most of the illegal immigration literature, I do not follow the aforementioned papers to model illegal immigration. In my models the illegal aspect of migration is represented by the high cost of migration before the economic integration.

Before switching to the literature about the substitutability and complementarity between goods trade and factor movements, I want to present the following four meanings of these concepts given by Wong (1986 and 1995):

> *1. Quantitative-Relationship Sense: Goods trade and factor movements are said to be substitutes (or complements) in the quantitative-relationship sense if an increase in the volume of trade will diminish (or augment) the level of factor movements and/or if an increase in the level of factor movements will diminish (or augment) the volume of trade.*

2. Price-Equalization Sense: Goods trade and factor movements are substitutes if free trade in goods implies factor price equalization and/or free trade in factors implies commodity price equalization.

3. World-efficiency Sense: 'Substitutes here refers to the case where either (trade or factor mobility) is sufficient to establish efficiency in world production, and hence maximize potential world welfare' (Purvis 1972), and they are complements if both of them are required to establish world productive efficiency.

4. National-welfare Sense: Trade and factor mobility are substitutes if either of them is sufficient to bring maximum welfare to the domestic economy, and complements if both of them are required.

The question of whether goods trade and factor mobility are substitutes or complements has been discussed since Mundel's classical paper (1957), in which Mundel showed that tariff-generated factor movements have the effect of reducing trade in the Heckscher-Ohlin-Samuelson model. Markussen (1983) examined a number of situations, such as differences in production technology and external economies of scale, and showed that goods trade and factor mobility may be complements if the cause of trade is not factor endowment differences. Generalizing Heckscher-Ohlin theorem, Svensson (1984) compared the goods trade patterns with and without factor trade. He concluded that factor trade and goods trade tend to be substitutes (complements) if traded and non-traded factors are "cooperative" ("non-cooperative"). The definition of the terms "cooperative" and "non-cooperative" are purely technical and they are given without a clear intuition. In their joint paper, Markusen and Svensson (1985) developed a general

model of trade caused by international differences in production technology and examine factor mobility within the context of this model. They showed that factor mobility leads to an increase in the correlation between goods and factor trade, indicating a reinforcement of the pattern of goods trade relative to the no-factor trade situation. Thus, they concluded that factor trade and commodity trade are complements. Wong (1986) on the other hand developed a 2x2x2 general equilibrium framework of the world which allowed differences in tastes and technologies between the trading countries. He derived the necessary and sufficient condition for substitutability and complementarity. Lately Neary (1995) developed a two country model of trade and factor mobility in which capital was sector-specific but internationally mobile. His model, unlike Heckscher-Ohlin-Samuelson model, avoided the indeterminacy of the level of trade and factor flows and the propensity to specialize in production and trade.

My political economy analyses on the first two chapters were mainly motivated by Levy (1997). In this paper Levy compares the desirability of a bilateral trade agreement with multilateral trade liberalization. He models countries' decisions on trade relations as binary choices. Countries first choose whether to join a free trade agreement with another country or a group of countries, and then they choose whether to participate in a broader multilateral agreement. Individuals in each country have different holdings of capital and labor and for this reason they have different reactions to any given proposal. The decisions of countries are characterized by the decisions of their median voters (the individual with the median capital-labor ratio). Levy uses two models, Heckscher-Ohlin and Differentiated Product, in his paper. In the former setting, he shows that there can be

no politically feasible bilateral trade agreements that would prevent a politically feasible multilateral trade agreement. However in the latter, a bilateral free trade agreement can weaken the support for a multilateral trade agreement by offering the median voter a huge product variety gain with relatively small adverse price loss that will raise the utility of the median voter above the one offered by the multilateral agreement. In my models, I use the Heckscher-Ohlin framework of the first part of Levy's paper. As in Levy's paper I allow individuals to have different holdings of capital so that their reactions to a free trade agreement are different. I also retain the majority rule, i.e. the median voter's preference is the chosen policy.

Benhabib's (1996) paper uses a similar setting to the models used here. He studies how immigration policies that impose capital and skill requirements would be determined under majority voting when native agents differ in their wealth holdings and vote to maximize their income. He shows that the population will be polarized between those who would want an immigration policy that will maximize capital-labor ratio and those who would want an immigration policy that will minimize it. I used Benhabib's notation to describe population sizes and capital stocks in the two countries in my models. Another similarity is the majority rule. In Benhabib's paper, as in my models, natives with high capital endowment in the capital abundant country benefit from labor immigration whereas natives with low capital endowment suffer from it.

In a relatively new paper, Hansen and Kessler (2001) try to explain the stylized fact that geographically small (big) countries tend to have low (high) tax rates. They argue

that immigration and democratically elected tax rates, together and interdependently, lead to the mentioned stylized fact. They start with the reasonable assumption that high income individuals, in general, prefer to live in countries with low taxation, and low income individuals, on the other hand, prefer to live in countries with high taxation, i.e. generous public spending. This causes the segregation of income classes across countries. If this segregation is supported by national vote on tax level, then equilibrium at which high income individuals live in low tax countries and low income individuals live in high tax countries emerges. Here the geographical size of countries play a very important role by providing the mechanism that prevents middle-class individuals from immigration into countries with low tax rates. Scarcity of land in small countries causes such high property prices that only rich people can immigrate to such countries. Unlike my model, this paper does not use any factors of production. Individuals have constant exogenous income rather than factors of production. Two other differences are that migration is costless and not "illegal" in the sense I use this term, i.e. migrants become natives and they have voting rights.

Surprisingly there is nothing much in the literature on what is behind the decision of a group of countries to bilaterally liberalize factor flows. Giovanni Facchini's (2002) paper titled "Why does a country join an FTA?" represents a first attempt at answering this question. It develops a theory of the endogenous formation of a common market in a three country, n-factor model. Import restrictions/subsidies are determined by direct democracy, i.e. by the decision of the median voter. The decision to join a common market is modeled as a simultaneous move game between the two prospective members.

It is showed that differences in subsidies before the vote do not affect the decision of the median voter. For a common market to be established the ex-post factor flows must be balanced. In other words, if most of the factor flows are in one direction, then the median voter in the country which receives most of the factor flows will be negatively affected. Finally the possibility that a common market will be established increases in the number of factors enjoying ex post enhanced protection, which indicates the potential tension between social desirability and political feasibility of the common market.

This thesis tries to model the linkage between (illegal) migration and economic integration. As we have seen above, almost all illegal immigration literature concerns with welfare(s) of the host country and/or source country. Also no political economy paper seems to have dealt with migration and free trade areas jointly. Although Facchini's (2002) model states the importance of ex-post factor flows in FTA decision, it assumes no factor flow before the establishment of the common market. So far, to my knowledge, there has been no attempt to model the linkage between (ex-ante) migration and economic integration, which is surprising given the fact that one of the well known reasons of NAFTA was to stop illegal migration from Mexico to the US by increasing trade and economic growth in Mexico. By showing how the median voter's decision to join an FTA is affected by unwanted migration from a relatively poor country, I provide a model which links the decision to join an FTA directly to migration.

CHAPTER ONE

TWO STATIC PROBABILISTIC MODELS OF MIGRATION AND ECONOMIC INTEGRATION

1.1 Introduction

This chapter presents two (one-good and two-good) two-country two-factor static probabilistic models of migration and economic integration. These models aim to expose a possible relationship between migration and economic integration. It is shown that by changing the median voter's utility level in the migrant-receiving capital abundant country, migration of workers from a labor abundant country makes economic integration possible between the two countries. To my knowledge there is no earlier work which models migration as a determinant of free trade areas, although some authors, like Martin (2001), acknowledge that stopping illegal immigration in the long run was one of the goals of NAFTA. Explaining migration as a determinant of a free trade area has important implications for the discussion about the substitutability and complementarity between goods trade and factor movements. Migration causing free trade suggests that factor mobility and goods trade are in a sense complements, rather than substitutes. Although I use a Heckscher-Ohlin type model, the implication about the substitutability and complementarity between goods trade and factor movements are different from the

usual interpretation of the Heckscher-Ohlin model, which clearly sees them as substitutes.

It is also shown that a more egalitarian income distribution in the capital abundant country increases the probability of economic integration whereas a more egalitarian income distribution in the labor abundant country might prevent economic integration by decreasing the number of possible migrants. These are compatible with Mayer's (1984) prediction that an increase in inequality, holding constant the economy's overall relative endowments, raises trade barriers in capital abundant economies and lowers them in capital scarce economies.

It should be noted here that the probabilistic model that I use in this chapter of the dissertation is different than the probabilistic voting model associated with Hinich (1977), Coughlin and Nitzan (1981), and Ledyard (1981, 1984). In probabilistic voting models basically voters do not vote with certainty for one particular policy or candidate, even if that particular policy/candidate gives them higher utility than the alternative(s). For example, when choosing between two political parties, say A and B, voters compare utilities they would get under the two alternatives, A and B. Then the probability of voting for the political party A is a smooth and continuous function of the two utility levels, increasing in the utility the voter would get under the policy A and decreasing in the utility the voter would get under the policy B. The probabilistic model which I use, on the other hand, does not allow such a behavior. In the model used here, voters with absolute certainty vote for the policy which gives them higher utility than the alternative,

and hence the policy preferred by the median voter is accepted with absolute certainty. Only when median voter is indifferent between two alternatives, the outcome of voting becomes probabilistic.

1.2 One-Good Static Model

This first part of the chapter presents a two-country static probabilistic model of migration and economic integration. The two countries differ from each other in their capital-labor ratios. The country with low capital-labor ratio and the wage rate is named as the poor country, the other as the rich country. The poor country applies for an economic integration (i.e. full movement of capital and labor) with the rich one; but the majority of the rich country, characterized by the decision of its median voter, does not prefer the integration. An important portion of the poor country's labor stock consists of workers without capital. These workers are potential migrants who may migrate to the rich country if their expected wage differences cover the cost of migration. The migration of workers without capital from the poor country to the rich country makes the median voter in the rich country indifferent between economic union and non-union. The possibility of economic union is determined by the cost of migration and the wage difference between the two countries.

This part of the chapter is organized as follows. First the setting of the model is introduced. Then, within a framework of a sub-model with exogenous immigration, possible beginning equilibriums are presented. It is also shown here that the immigration

of the poor to the rich country increases the percentage of voters which are in favor of integration in the rich country. Finally the probabilistic model is presented in detail. The main results, i.e. the positive (negative) relationship between a better income distribution in the rich (poor) country and the possibility of integration, are given at the end.

1.2.1 The Setting

There are two countries: relatively labor abundant poor country (P) and relatively capital abundant rich country (R). R could be interpreted as an attractive economic block and P as a candidate to this block. P and R produce one good by using the same technology with capital and labor. Since here I use one-product model, naturally there is no trade between countries. Wages are higher in R and interest rates are higher in P. In this context, economic integration means free movement of factors (labor and capital). Initially the only linkage between the two economies is illegal migration from P to R. I assume that country P already applied for economic integration with R. Therefore integration decision was made solely in R. I neglect the affect of illegal migration on the decision of country P.

Each individual has one unit of labor and individuals are indexed by the units of capital that they own, k. As in Benhabib (1996), the number of individuals is given by the density function $N_j(k)$, defined on $[0,\bar{k}_j]$. We have two countries (poor and rich), so j=P,R. The density function $N_j(k)$ is continuous in $(0,\bar{k}_j]$, but for the poor country at 0 we allow a positive mass of individuals that have no capital (this assumption is necessary

to capture the potential immigrant stock in P). Call this number of individuals who do not posses capital Z.

The initial capital stocks, K_j for j=P,R, are given by

$$K_j = \int_0^{\bar{k}_j} N_j(k)\, k\, dk \ . \tag{1.1}$$

The initial population sizes, $L_{P,0}$ and $L_{R,0}$, are

$$L_{P,0} = Z + \int_0^{\bar{k}_P} N_P(k)\, dk \tag{1.2}$$

$$L_{R,0} = \int_0^{\bar{k}_R} N_R(k)\, dk \tag{1.3}$$

The country R is relatively capital abundant such that

$$\frac{\int_0^{\bar{k}_R} N_R(k)\, k\, dk}{\int_0^{\bar{k}_R} N_R(k)\, dk} > \frac{\int_0^{\bar{k}_P} N_P(k)\, k\, dk}{Z + \int_0^{\bar{k}_P} N_P(k)\, dk}. \tag{1.4}$$

At time t capital-labor ratios are $k_{P,t} = \frac{K_P}{L_{P,t}}$ and $k_{R,t} = \frac{K_R}{L_{R,t}}$, where $k_{j,t}$ is the capital-labor ratio in country j at time t and $L_{j,t}$ is the labor stock of country j at time t. Since P is relatively labor abundant, at the beginning (when t=0) we have $k_{P,0} = \frac{K_P}{L_{P,0}} < k_{R,0} = \frac{K_R}{L_{R,0}}$.

We do not have time subscripts on K_P and K_R, since it is assumed that capital endowments of the two countries are constant. The overall capital-labor ratio in P and R

together is k_U, $k_U = (K_P + K_R)/(L_{P,0} + L_{R,0})$, which is between $k_{P,0}$ and $k_{R,0}$. Again we do not need time subscript for k_U, since total number of individuals in both countries at any time $(L_{P,t} + L_{R,t})$ is equal to the total number of individuals in both countries at the beginning $(L_{P,0} + L_{R,0})$.

I assume the same constant-returns neoclassical production function $F(K,L) = L\,f(k)$, $f'(k) > 0$ and $f''(k) < 0$ for both countries. So wage rate is $w(k) = f(k) - f'(k)\,k$ and interest rate is $r(k) = f'(k)$.

An individual's income (W^i) is the sum of his wage and his earnings from his capital:

$$W^i = w(k) + r(k)\,k^i \tag{1.5}$$

where k is the capital-labor ratio of the economy in which individual i with capital endowment k^i lives. Since every individual has only one unit of labor, individuals' capital-labor ratios and their capital endowments are identical. The derivative of W^i is

$$\frac{dW^i}{dk} = r'(k)\,(k^i - k) \tag{1.6}$$

By the property of diminishing marginal productivity, r declines with k. In symbols, $r'(k) = f''(k) < 0$. As illustrated in Figure 1, the relation between an individual's utility and the economy's capital-labor ratio is U-shaped. In particular,

$$\frac{dW^i}{dk} < 0 \qquad for\ k < k^i \tag{1.7a}$$

$$\frac{dW^i}{dk} > 0 \qquad for\ k > k^i \tag{1.7b}$$

$$\frac{dW^i}{dk} = 0 \qquad for\ k = k^i \tag{1.7c}$$

This equation characterizes the preference of the individual i in R with respect to the capital-labor ratio of the economic entity in which he would like to live. So the welfare of individual i roughly could be graphed as Figure 1.1.

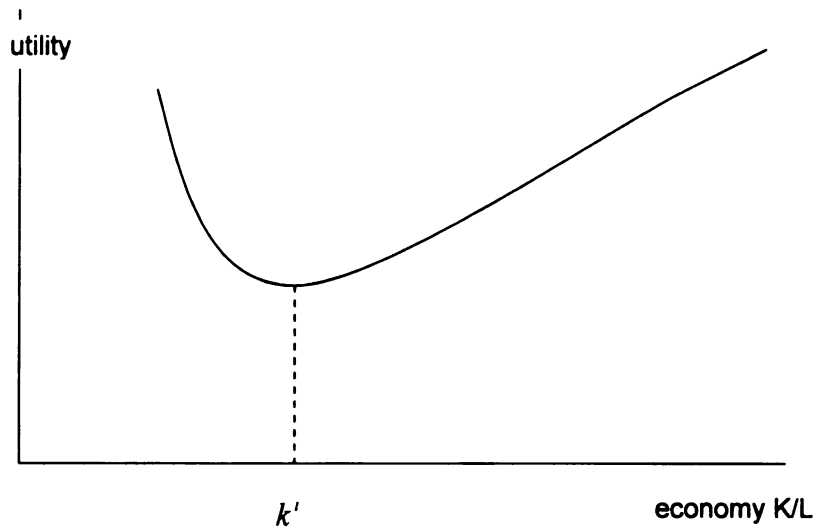

Figure 1.1: Utility level of individual i with capital endowment k^i.

Horizontal axis in Figure 1.1 represents the capital-labor ratio of the economy in which individual i lives. On the vertical axis his utility level is shown. He gets the minimum utility when his capital-labor ratio is equal to the economy's capital labor-ratio.

1.2.2 A Simple Model with Exogenous Immigration

Before introducing static model with endogenized immigration, let us examine a simple median voter model with exogenous illegal immigration in a two-stage setting. At

the beginning, in the first stage (t=0), P applies for an economic union with R. People in R go to the polls to determine in a referendum whether to establish an economic union with P. The decision is made by majority vote, and the alternative most preferred by the individual with the median capital-labor ratio is the winning alternative. We refer to this individual as the "median voter" If this voter is indifferent between the two alternatives, then there is a tie vote, in which case the chosen alternative is treated as random, with a probability distribution endogenously determined below.

If the result of the referendum is positive, then the two countries economically unite and capital move freely between the two countries causing the equalization of wages and capital rents. If the result of the referendum is negative, then the only economic linkage between the two countries is illegal immigration from P to R. The result of this illegal immigration is an increase in the capital-labor ratio in P and its decrease in R, which might change the preferences of voters in R to such a degree that the result of another majority voting in R at the second stage (t=1) might be positive.

Here, it is important to remember that I use "illegal immigration" instead of "immigration" mainly by two reasons: First, the median voter in R would prefer to eliminate immigration. Second, the immigrants do not have voting rights in R, since they are not legal citizens of R.

To describe the possible equilibria at the beginning (t=0), we first define k_R^{median} as the median voter's capital-labor ratio:

$$\frac{\int_0^{k_R^{median}} N_R(k)\,dk}{L_{R,0}} = 0.5\,. \tag{1.8}$$

Assuming unequal society in which the relative capital endowment of the median individual is less than the mean, we have $k_R^{median} < k_R$. The median voter's preference between two alternative economy capital-labor ratios is preferred by at least half of the population in R. To see this, suppose that an integration agreement under consideration would lead to a capital-labor ratio in the resulting integrated economy that was lower than the alternative current capital-labor ratio. If this increases the utility of the median voter, as illustrated in Figure 1.4, we can deduce from (1.7) that all voters with higher capital-labor ratios than the median voter would also gain. The same reasoning applies if an integration agreement would reduce the median voter's utility. The symbol $\tilde{k}_R$ represents the level of capital-labor ratio of R that is greater than k_R^{median} and makes the median voter indifferent between integration and non-integration, as illustrated in Figures 1.3, 1.4 and 1.7. So, it satisfies the following three conditions:

$$\tilde{k}_R \neq k_U\,, \tag{1.9a}$$

$$\tilde{k}_R > k_R^{median}\,, \tag{1.9b}$$

$$w(k_U) + r(k_U)\,k_R^{median} = w(\tilde{k}_R) + r(\tilde{k}_R)\,k_R^{median}\,. \tag{1.9c}$$

Now we can describe the possible beginning conditions:

a) $k_R^{median} < k_U < k_{R,0}$

b) $k_U < k_R^{median} < \tilde{k}_R < k_{R,0}$

c) $k_U < k_R^{median} < k_{R,0} < \tilde{k}_R$

In cases a and b, given by Figures 1.2 and 1.3, median voter enjoys a higher level of utility in his home country than in the integrated economy. Therefore he opposes the economic integration with P. On the other hand when we have case c, as in Figure 1.4, median voter prefers the integrated economy with P to his own secluded R economy.

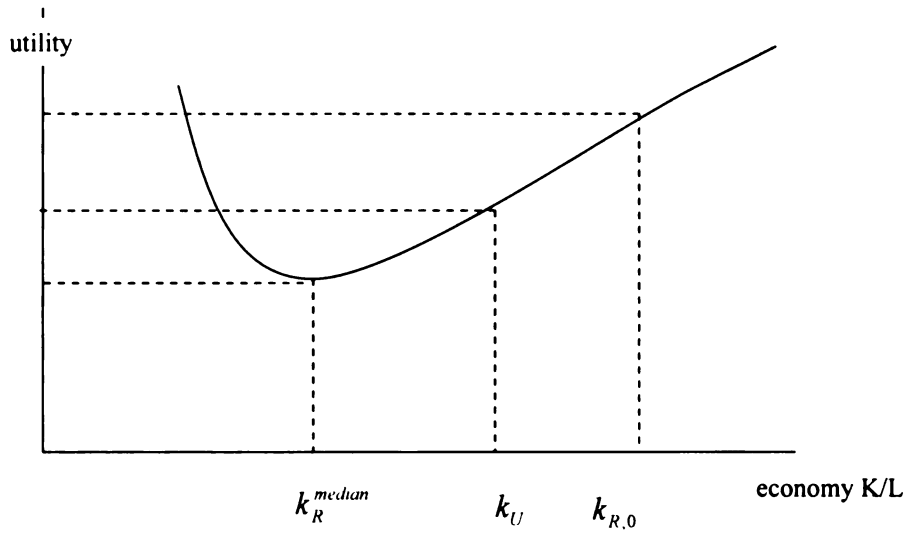

Figure 1.2: Utility of the median voter when $k_R^{median} < k_U < k_{R,0}$.

Figure 1.2 illustrates the first case when $k_R^{median} < k_U < k_{R,0}$. Median voter's utility in his country is greater than the utility he would get living under the integrated economy. Median voter opposes integration.

In Figure 1.3, as in Figure 1.2, median voter's utility in his country is greater than the utility he would get living under the integrated economy. Median voter opposes

integration. Unlike Figure 1.2, here we are able to define $\widetilde{k}_R$, since k_U is less than k_R^{median}.

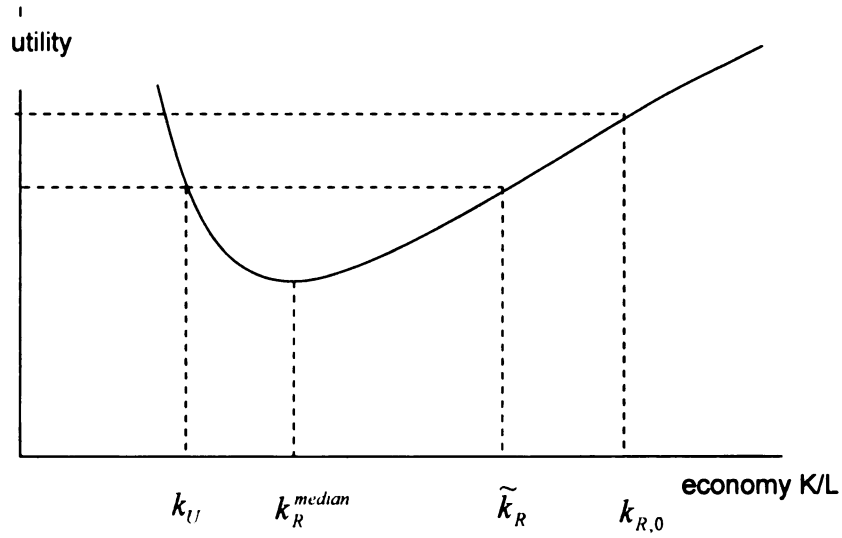

Figure 1.3: Utility of the median voter when $k_U < k_R^{median} < \widetilde{k}_R < k_{R,0}$.

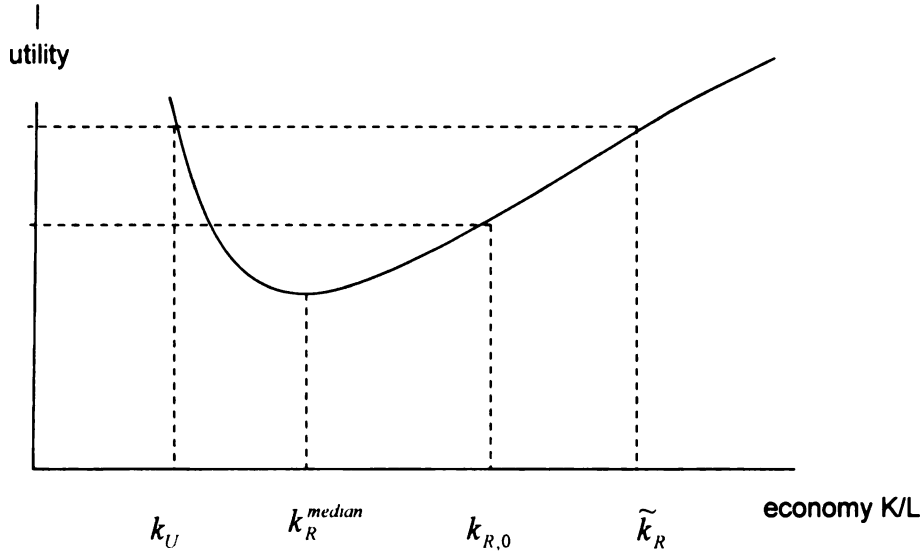

Figure 1.4: Utility of the median voter when $k_U < k_R^{median} < k_{R,0} < \widetilde{k}_R$.

In Figure 1.4, the median voter's utility in his country is less than the utility he would get living under the integrated economy. Median voter supports integration.

Since median voter's decision determines the result of the referendum, in the last case (when $k_U < k_R^{median} < k_{R.0} < \tilde{k}_R$) the two countries establish an economic union in the first stage, equalizing wages and rents by enough capital flow from R to P.

Now let us discuss the effect of an exogenous immigration wave to R from P in the first two cases. The motivation for immigration is simply the wage difference between the two countries. Since the result of the referendum in the first stage is negative, we are dealing with two countries with different capital-labor ratios (R has a higher capital-labor ratio, wages are higher in R than in P).

For analytical simplicity I assume that only those who do not have any capital in P are potential immigrants, i.e. all immigrants are wage earners; they do not have any capital earnings.

Assume that immigration level (number of illegal immigrants) is exogenous, say T. To exclude unrealistic extreme situations, assume also that T is not big enough to make k_R less than k_U in the second stage (such a "huge" level of immigration would cause welfare decrease of the immigrants). In the first stage (t=0) for this case, T workers illegally immigrate from P to R, and in the second stage (t=1) they work and earn wages

in R. Since they are not legal citizens of R they do not have voting rights in R in the second stage.

The main effect of this immigration of T people on the voting shows itself through the change in capital-labor ratio. In the second stage capital-labor ratio in R becomes $k_{R,1} = K_R /(L_{R,0} + T)$. Obviously this ratio is less than $k_{R,0} = K_R / L_{R,0}$ in the first stage.

In the second stage, when they decide how to vote, citizens of R compare their current earnings (from both capital and labor) in R to the would-be earnings under U, i.e. $w(k_R) + r(k_R)\, k^i$ vs. $w(k_U) + r(k_U) k^i$. If their would-be earnings under U are greater than their current earnings in R, then they vote in favor of an economic integration with P; otherwise they vote against it.

RESULT#1: Immigration of T number of people in the first stage increases the percentage of votes which are in favor of integration with P.

To see this result define $\breve{k}$ as the capital endowment of the voter who is indifferent between economic union and non-economic union as in Figure 1.5. $\breve{k}$ satisfies the following equation:

$$w(k_U) + r(k_U)\breve{k} = w(k_R) + r(k_R)\breve{k} . \qquad (1.10)$$

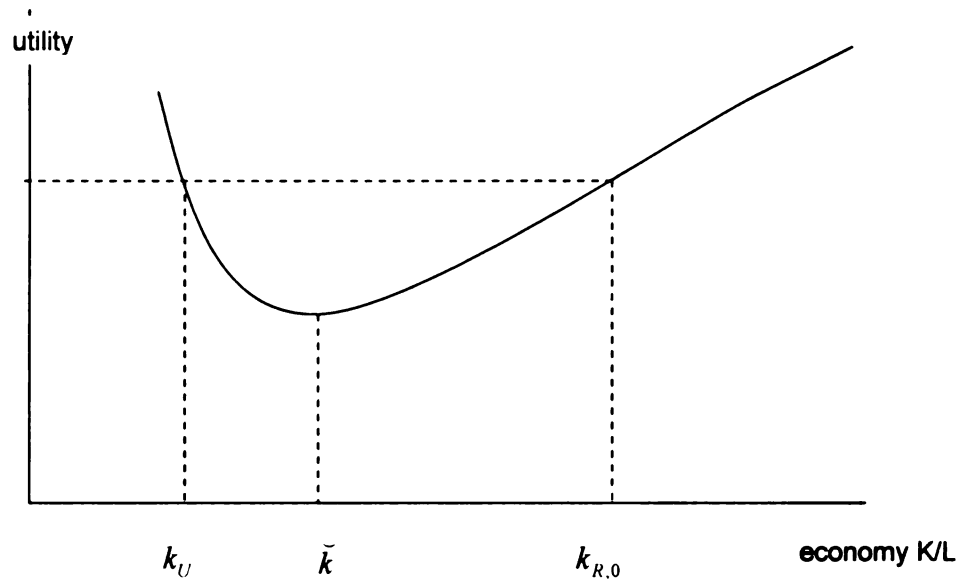

Figure 1.5: The voter with capital endowment $\breve{k}$ is indifferent between economic union and non-economic union.

Clearly $\breve{k}$ is between k_U and k_R. Those citizens who have more capital than $\breve{k}$ will vote for economic integration with P and the others, those with less capital than $\breve{k}$, will vote against it. Illegal immigration decreases k_R which leads to a decrease in $\breve{k}$. Since those with capital endowment greater than $\breve{k}$ all vote for economic integration, the vote share of economic integration necessarily increases. Formally this result could be obtained by differentiating the both sides of the equation (1.10):

$$\frac{d\breve{k}}{dk_R} = \frac{r'(k_R)(\breve{k} - k_R)}{r(k_U) - r(k_R)} > 0 \qquad (1.11)$$

Since $d\breve{k}/dk_R$ is positive, any decrease in k_R makes $\breve{k}$ smaller, which indicates an increase in the percentage of votes in favor of integration with P.

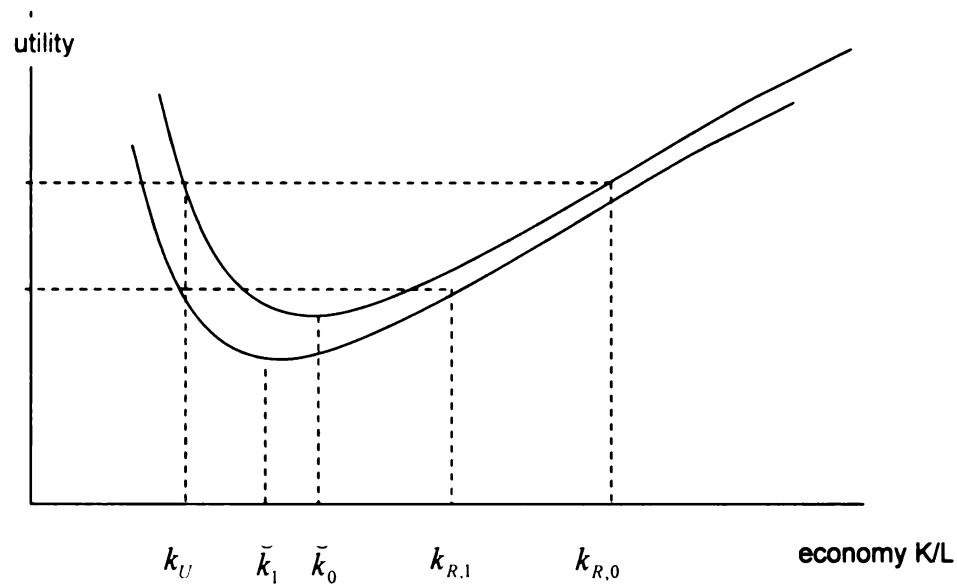

Figure 1.6: Immigration takes the capital-labor ratio in R from $k_{R,0}$ to $k_{R,1}$.

In Figure 1.6, immigration takes the capital-labor ratio in R from $k_{R,0}$ to $k_{R,1}$. The higher curve shows the utility of the person who is indifferent between integration and non-integration, before the immigration. His capital endowment is $\breve{k}_0$. All individuals who have capital endowments greater than $\breve{k}_0$ support economic integration, since they get higher utility under economic integration than under autarky. Others, with capital endowments less than $\breve{k}_0$, are against it. After the immigration, another individual with capital endowment $\breve{k}_1$ becomes indifferent between economic integration and non-integration. The lower curve shows the utility of this individual. Now, all those with capital endowment higher than $\breve{k}_1$ are in favor of economic integration, while those with less capital endowment than $\breve{k}_1$ are against it. Immigration increases the public support for economic integration.

In the second stage, we have voting for an integration agreement. If the median voter prefers his own country's capital-labor ratio to the integrated economy's capital-labor ratio, then the integration agreement is infeasible, i.e. it does not pass in the referendum. If, on the other hand, the median voter prefers the integrated economy's capital-labor ratio to his own country's capital-labor ratio, then he certainly votes for integration, i.e. the integration agreement is feasible.

RESULT#2: a) Assuming $k_R^{median} < k_U < k_{R,0}$, *integration is infeasible. b) Assuming* $k_U < k_R^{median} < \widetilde{k}_R < k_{R,0}$, *there is a level of immigration* $\widetilde{T}$ *such that if* $T > \widetilde{T}$ *in the first stage, economic integration becomes feasible in the second stage.*

The first case (Result 2a) is obvious. Since we defined the level of exogenous immigration, T, as something, not big enough to make k_R less than k_U in the second stage, we will still have the same order of capital-labor ratios in the second stage, namely $k_R^{median} < k_U < k_{R,1}$.

In Figure 1.7 we see the median voter's utility level when we have $k_R^{median} < k_U < k_{R,0}$. Before the immigration the median voter compares his current utility level at capital-labor ratio $k_{R,0}$ to the utility level at capital-labor ratio k_U. He prefers non-integration. The immigration pulls the capital labor-ratio in R to $k_{R,1}$ at which the median voter still

gets higher utility than what he would get under integration. Therefore he still prefers non-integration, i.e. the integration is infeasible.

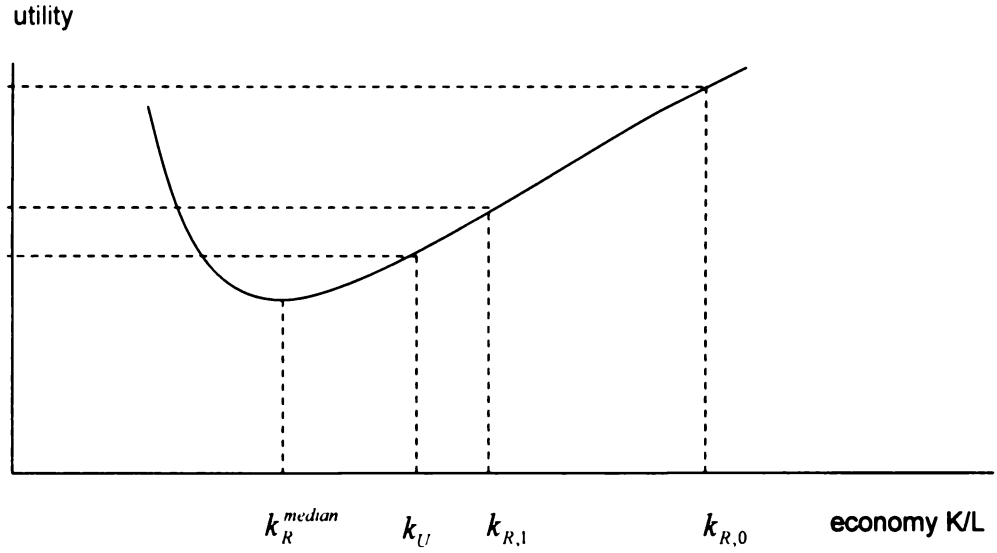

Figure 1.7: Utility of the median voter when $k_R^{median} < k_U < k_{R,1} < k_{R,0}$

When we have $k_U < k_R^{median} < \tilde{k} < k_{R,0}$ as in the second case (Result 2b), we will have the following inequality:

$$w(k_U) + r(k_U)k_R^{median} < w(k_{R,0}) + r(k_{R,0})k_R^{median}. \tag{1.12}$$

Now define $\Delta W_{R,t}^{median}$ as follows:

$$\Delta W_{R,t}^{median} = [w(k_{R,t}) + r(k_{R,t})k_R^{median}] - [w(k_U) + r(k_U)k_R^{median}] \tag{1.13}$$

When we switch from the first stage to the second stage, the only changing variable in $\Delta W_{R,t}^{median}$ is $k_{R,t}$. Therefore $\Delta W_{R,t}^{median}$ could be interpreted as a function of $k_{R,t}$; $\Delta W_{R,t}^{median} = \psi(k_{R,t})$. Now remember that $\tilde{k}_R$ is the level of capital-labor ratio of R which

makes the median voter indifferent between integration and non-integration. Formally $\psi(\tilde{k}) = 0$, i.e. $\tilde{k}_R = \psi^{-1}(0)$. $\tilde{T}$ is then the level of immigration which will pull down $\tilde{k}_R$ from $K_R / L_{R,0}$ (in the first stage) to $\tilde{k}_R$ (in the second stage). Since $\tilde{k}_R = K_R /(L_{R,0} + \tilde{T})$,

$$\tilde{T} = (K_R - \tilde{k}_R L_{R,0}) / \tilde{k}_R . \tag{1.14}$$

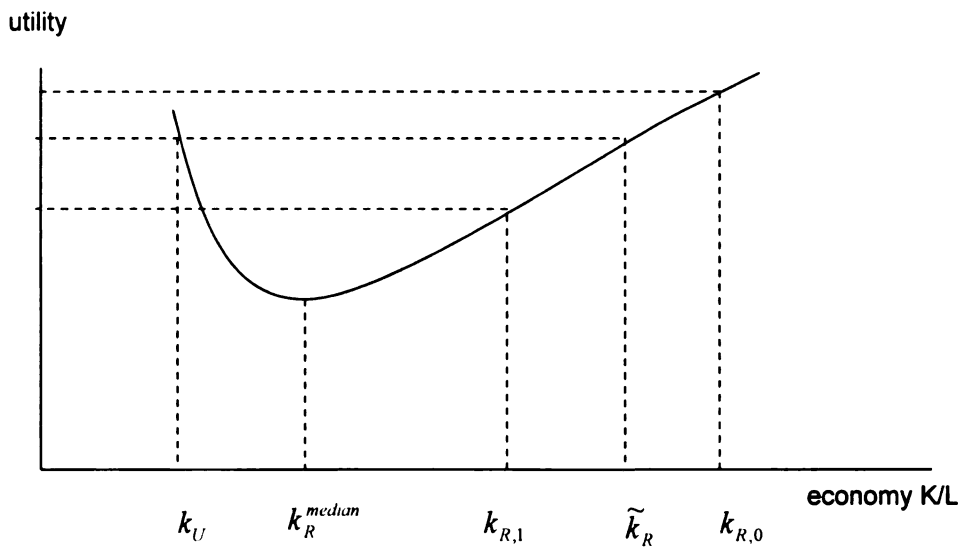

Figure 1.8: Utility of the median voter when $k_U < k_R^{median} < k_{R,1} < \tilde{k}_R < k_{R,0}$

As in Figure 1.8, when we have $k_U < k_R^{median} < \tilde{k}_R < k_{R,0}$, there is a level of immigration $\tilde{T}$ which pulls the capital-labor ratio in R from $k_{R,0}$ to $\tilde{k}_R$. At this capital-labor ratio, $\tilde{k}_R$, the median voter is indifferent between integration and non-integration. If we have an immigration level greater than $\tilde{T}$, then the capital labor ratio in R becomes less than $\tilde{k}_R$, such as $k_{R,1}$ on the graph and the median voter prefers integration to non-integration.

1.2.3 Static-Probabilistic Model

In this part we have the same setting and again two stages as in the simple exogenous migration model, but now the number of migrants is endogenous, i.e. the number of migrants in the first stage is determined within the model. Also, to exclude uninteresting beginning situations, I assume that the median voter does not prefer economic integration in the first stage, but immigration might change his preference, so $k_U < k_R^{median} < \widetilde{k}_R < k_{R.0}$ as in Figures 1.3 and 1.8.

The only equilibrium number of immigrants is the number which will make the median voter in the rich country indifferent between economic integration and non-integration, i.e. $\widetilde{T}$. In other words, after the migration wave in the first stage, in the second stage capital-labor ratio will be $\widetilde{k}_R$. The reason is simple: Any number of migrants greater than $\widetilde{T}$ will make the probability of economic integration equal to 1, since median voter will chose economic integration in this case. But if the possibility of economic integration is one, no one would want to immigrate and incur migration costs in the first place, since they can get all the benefits of economic integration by staying at home and not incurring costs of migration. Similarly any number of migrants less than $\widetilde{T}$ will make the probability of economic integration equal to 0. But if the probability of economic integration is 0, then all workers (more than $\widetilde{T}$) would migrate to enjoy the higher wages of R the second stage. This could not be an equilibrium, because if all workers immigrate, the immigrant stock in R becomes bigger than $\widetilde{T}$, which indicates that the probability of economic integration is 1, not 0.

Then what is the possibility of economic integration when only $\widetilde{T}$ number of people immigrates to R? We can find this by equating the cost of migration to the expected gains from migrating. To keep the analysis simple, I use the "psychic" cost concept of Sjaastad (1962). Migration involves a psychic cost, because people are often genuinely reluctant to leave familiar surroundings, family, and friends. We might argue that in the case of illegal immigration psychic cost becomes more relevant, since immigrants' very presence is not welcomed by the majority of the host country citizens. In our model median voter is against immigration, since his real utility is decreasing because of immigration. Median voter with at least half of the population in R is against immigration. Living in a foreign country in which majority dislikes immigrants must not be very appealing to the potential migrants. As Sjasstad explained, psychic costs do not represent real resource costs:

> "*...Rather they are of the nature of lost consumer (or producer) surplus on the part of the migrant. Given the earnings levels at all other places, there is some minimum earning level at location i which will cause a given individual to be indifferent between migration and remaining at i. For any higher earnings at i, he collects a surplus in the sense that part of his earnings could be taxed away and that taxation would not cause him to migrate. The maximum amount that could be taken away without inducing migration represents the value of the surplus. By perfect discrimination, it would be possible to take away the full amount of the surplus, but in doing so leave resource allocation unaffected (other than through*

distributive effects). Hence, the psychic cost of migration involve no resources for the economy and should not be included as part of the investment in migration."

Assuming that every immigrant incurs a constant psychic cost, C, we can find the equilibrium level of migration and the probability of integration. Equilibrium level of migration should make workers indifferent between staying in P without incurring the cost C and migrating to R with incurring the cost C:

$$(1-\beta)w(\tilde{k}_P)+\beta w(k_U)=(1-\beta)[w(\tilde{k}_R)-C]+\beta[w(k_U)-C], \tag{1.15a}$$

$$C=(1-\beta)[w(\tilde{k}_R)-w(\tilde{k}_P)], \tag{1.15b}$$

$$\beta=1-\frac{C}{w(\tilde{k}_R)-w(\tilde{k}_P)} \tag{1.15c}$$

where endogenous variable β is the probability of a vote in favor of economic integration and $\tilde{k}_P$ is the capital-labor ratio in P which corresponds to the capital labor ratio $\tilde{k}_R$ in R. In other words, when $\tilde{T}$ number of people immigrates to R, the capital-labor ratio in P becomes $\tilde{k}_P$:

$$\tilde{k}_P=K_P/(L_{P,0}-\tilde{T}) \tag{1.16}$$

Now we can restate the equilibrium conditions for the equilibrium number of immigrants, $\tilde{T}$, and the equilibrium probability of economic integration, β:

i) The equilibrium number of immigrants, $\tilde{T}$, satisfies equation (1.14)

$$\tilde{T}=(K_R-\tilde{k}_R L_{R,0})/\tilde{k}_R. \tag{1.14}$$

where $\tilde{k}_R$ is determined by conditions (1.9a), (1.9b) and (1.9c).

$$\tilde{k}_R \neq k_U, \tag{1.9a}$$

$$\tilde{k}_R > k_R^{median}, \tag{1.9b}$$

$$w(k_U) + r(k_U)k_R^{median} = w(\tilde{k}_R) + r(\tilde{k}_R)k_R^{median}. \tag{1.9c}$$

ii) The equilibrium probability of economic integration, β, is given by equation (1.15c)

$$\beta = 1 - \frac{C}{w(\tilde{k}_R) - w(\tilde{k}_P)} \tag{1.15c}$$

where $\tilde{k}_P$ is determined by equation (1.16).

$$\tilde{k}_P = K_P / (L_{P,0} - \tilde{T}) \tag{1.16}$$

1.2.3.1 Results

Here I will present the implications of the model about the effects of income distribution and cost of migration on the probability of economic integration.

1) A more (less) equal income distribution in R, characterized by an increase (decrease) in k_R^{median}, leads to an increase (decrease) in the possibility of economic union.

To see this result, we need to take the derivative of $\tilde{k}_R$ with respect to k_R^{median}. Differentiating the both sides of the equation (1.7) will give us

$$\frac{d\tilde{k}_R}{dk_R^{median}} = \frac{r(k_U) - r(\tilde{k}_R)}{r'(\tilde{k}_R)(k_R^{median} - \tilde{k}_R)} > 0. \tag{1.17}$$

The positive sign of this derivative means that an increase in k_R^{median} will lead to an increase in $\tilde{k}_R$ (as in Figure 1.9), which indicates decreases in $\tilde{T}$ and $\tilde{k}_P$. A higher $\tilde{k}_R$ requires less migration from P than a lower $\tilde{k}_R$, which means $\tilde{T}$ decreases. Decrease in migration, $\tilde{T}$, on the other hand, means a decrease in $\tilde{k}_P$. Since wage rate is increasing in the economy capital-labor ratio, $w(\tilde{k}_R) - w(\tilde{k}_P)$ will increase. Then it is easy from equation (1.15c) that β increases.A similar analysis shows that a decrease in k_R^{median} will cause a decrease in β.

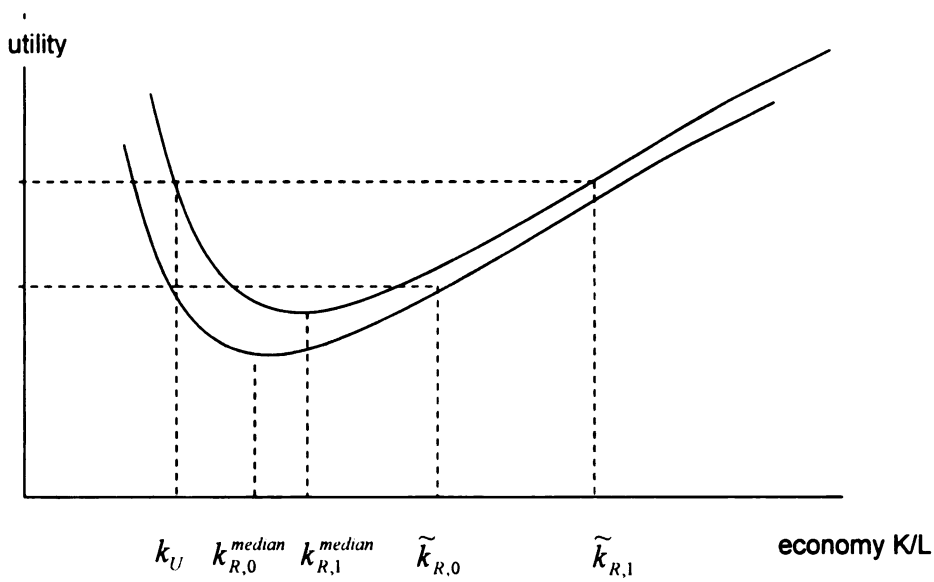

Figure 1.9: Utility of the median voter when his capital-labor ratio increases from $k_{R,0}^{median}$ to $k_{R,1}^{median}$.

Figure 1.9 shows that an increase in median voter's capital-labor ratio from $k_{R,0}^{median}$ to $k_{R,1}^{median}$ will lead to an increase in the capital-labor ratio at which the median voter is indifferent between integration and non-integration (from $\widetilde{k}_{R,0}$ to $\widetilde{k}_{R,1}$).

2) A more (less) equal income distribution in P, characterized by a decrease (increase) in the number of workers without capital, may render infeasible an otherwise possible economic integration.

Improvement of income distribution case:

Remember that Z the total number of workers without capital in P. These are the only potential migrants by assumption. If we start with a situation of $Z > \widetilde{T}$, there is a possibility of economic integration since total number of immigrants required for economic integration is $\widetilde{T}$. Any income distributional change which decreases Z below $\widetilde{T}$ makes economic union politically infeasible, since when all workers without capital immigrate to R, R's capital-labor ratio will still be greater than $\widetilde{k}_R$ and the median voter in R will prefer non-integration with absolute certainty.

Worsening of income distribution case:

If we start with a situation of $Z < \widetilde{T}$, there is no prospect for economic union. Since even when all the potential workers immigrate, the capital-labor ratio in R will still be higher than $\widetilde{k}_R$ and median voter will strictly prefer non-integration. In such a situation

any income distributional change which makes Z greater than $\tilde{T}$ makes the total number of immigrants equal to $\tilde{T}$ and the possibility of economic integration arises.

3) Increase in the cost of migration will lead to a lower possibility of economic integration. From equation (1.15c), it is very easy to see this.

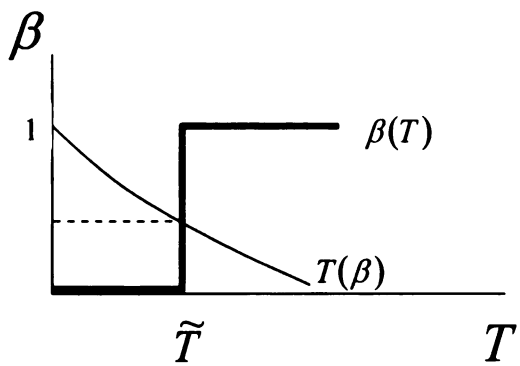

Figure 1.10: Equilibrium number of immigrants and the probability of economic integration.

As illustrated in Figure 1.10, the number of immigrants depends on the probability of integration, but the probability of integration depends on the number of immigrants. From the $\beta(T)$ curve we see that as long as the total number of immigrants is less than $\tilde{T}$, the probability of integration will be 0, since median voter will prefer non-integration. An immigration level above $\tilde{T}$ will make median voter prefer integration, i.e. the possibility of migration will be 1. On the other hand, if it is certain that in the second stage the two economies will integrate, no one immigrates in the first stage (why should anyone pay for the cost of migration if in the second stage wages are equal in both countries?). The lower the probability of integration is, the higher the immigration will be. We can see this as we

go along the $T(\beta)$ curve. Therefore the only possible number of immigrants is $\widetilde{T}$, which is determined by the intersection of the two curves.

1.3 Two-Good Static Model

As in Levy (1997), this section will consider economic integration in a standard two good, two-factor Heckscher-Ohlin trade model. By adding migration and probabilistic features of the preceding section to the framework developed in Levy, I will show that the results of the one-good model also hold true in the two-good model.

We keep all the assumptions of the previous one-good model except the number of goods. Now, capital and labor are used in the constant returns to scale production of goods Q_K and Q_L. The identical technologies in both countries are assumed to be such that capital is used relatively intensively in Q_K (and labor in Q_L) with no factor-intensity reversals. Perfect competition makes sure that profits are zero.

Individuals are assumed to have identical and homothetic preferences. People spend their full income on goods Q_K and Q_L. Labor intensive good, Q_L, is the numeraire good; p_P is the price of Q_K in terms of Q_L in the poor country and p_R is the price of Q_K in terms of Q_L in the rich country.

In this two-good model integration is defined as a free trade agreement that will equalize factor prices across the two economies. With free trade, the integrated economy

that would result from factor mobility will be achieved instead through trade flows. To make things simple it is assumed that tariffs are either zero or prohibitive, so without free trade both countries are in autarky. If two countries establish a free-trade area, the resulting relative price will be between the autarky prices in the two countries and the capital-abundant rich country will export Q_K and import Q_L.

Levy (1997) showed that in a standard two-good, two-factor Heckscher-Ohlin trade model the utility of an agent i with a capital endowment k', can be depicted as a function of k, the capital-labor ratio of the economy in which he lives. This function is strictly quasi-convex in k and has a unique minimum when the agent's capital-labor ratio is equal to that of the economy.

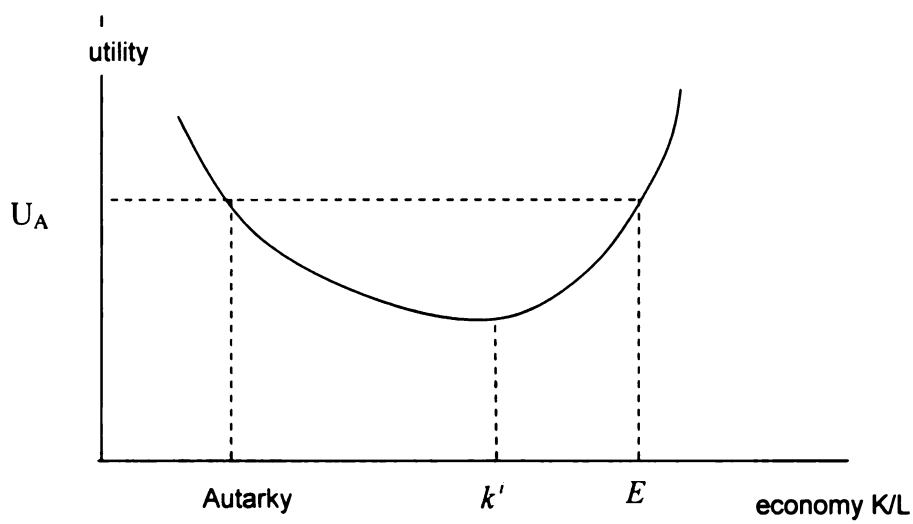

Figure 1.11: The strictly quasi-convex utility of an agent with a given capital-labor ratio as a function of the economy's capital-labor ratio.

Figure 1.11 shows the strictly quasi-convex utility of an agent with a given capital-labor ratio as a function of the economy's capital-labor ratio. Levy uses this figure to illustrate his proposition. If this represented the median voter in a country, he would

reject trade agreements which resulted in economy capital-labor ratios in the range (Autarky, E). Outside of that range, utility increases as the distance from Autarky increases.

We can see the argument behind the U-shaped relationship between an individual's utility and the economy's capital-labor ratio, by using indirect utility function and zero profit condition of the economy. Differentiating indirect utility function of individual i, $V^i = V^i(w + rk^i, p)$, gives

$$dV^i = \lambda(dw + dr\,k^i) + \frac{\partial V^i}{\partial p}dp \qquad (1.18)$$

where dV^i is the change in indirect utility, λ is the marginal utility of income, dw is the change in the wage rate, dr is the change in the interest rate, k^i is the individual's capital endowment, $\frac{\partial V^i}{\partial p}$ is the marginal utility of a change in the price of the capital intensive good and dp is the change in the price of the capital intensive good. Since the labor intensive good's price is numeraire, the change in its price is zero. Dividing both sides of (1.18) by λ, and using Roy's identity, i.e. $\frac{\frac{\partial V^i}{\partial p}}{\lambda} = -C_K^i$, where C_K^i is the individual's consumption of the capital intensive good, we will have

$$\frac{dV^i}{\lambda} = dw + dr\,k^i - C_K^i dp\,. \qquad (1.19)$$

Dividing both sides of the equation (1.19) by the individual's income, $w + r\,k^i$, allow us to write

$$\frac{dV^i}{\lambda(w+rk^i)} = \frac{dw}{w}\frac{w}{(w+rk^i)} + \frac{dr}{r}\frac{rk^i}{(w+rk^i)} - \frac{dp}{p}\frac{pC_K^i}{(w+rk^i)} \tag{1.20a}$$

or

$$\frac{dV^i}{\lambda(w+rk^i)} = \hat{w}\Theta_L^i + \hat{r}\Theta_K^i - \hat{p}\Gamma_K \tag{1.20b}$$

where $\hat{w} = dw/w$, $\hat{r} = dr/r$, $\hat{p} = dp/p$, $\Theta_L^i = w/(w+rk^i)$, $\Theta_K^i = rk^i/(w+rk^i)$ and $\Gamma_K = pC_K^i/(w+rk^i)$. In this notation, $\hat{w}$ is the proportional change in the wage rate, $\hat{r}$ is the proportional change in the interest rate, $\hat{p}$ is the proportional change in the price of the capital intensive good, Θ_L^i is the share of labor in the income of individual i, Θ_K^i is the share of capital in the income of individual i, and finally Γ_K is the share of spending on capital intensive good in individual i's total spending. We do not have superscript i in Γ_K, simply because of the fact that with homothetic and identical preferences all individuals have the same Γ_K. Since the marginal utility of income, λ, and the income of individual i, $w+rk^i$, are positive, we can conclude that if an increase in the economy's capital-labor ratio leads to an increase in $\frac{dV^i}{\lambda(w+rk^i)}$, then dV/dk is positive. Similarly if an increase in the economy's capital-labor ratio leads to a decrease in $\frac{dV^i}{\lambda(w+rk^i)}$, dV/dk is negative.

To determine the sign of $\frac{dV^i}{\lambda(w+rk^i)}$ we can use the zero profit condition for the economy:

$$wL + rK - C_L - pC_K = 0 \tag{1.21}$$

In this equation L is the country's labor stock, K is the country's capital stock, C_L is the total consumption of labor intensive good in the economy and C_K is the total consumption of capital intensive good in the economy. Dividing everything by L, gives us

$$w - r\,k^{mean} - C_L^{mean} - pC_K^{mean} = 0\,. \tag{1.22}$$

where k^{mean} is the mean capital-labor ratio in the economy, C_L^{mean} is the mean consumption of labor intensive good in the economy and C_K^{mean} is the mean consumption of capital intensive good in the economy. Differentiating equation (1.22) results in

$$dw - dr\,k^{mean} - dpC_K^{mean} = 0\,. \tag{1.23}$$

Dividing everything in (1.23) by the average income, $w + r\,k^{mean}$, allows us to write

$$\frac{dw}{w}\frac{w}{(w+r\,k^{mean})} - \frac{dr}{r}\frac{r\,k^{mean}}{(w+r\,k^{mean})} - \frac{dp}{p}\frac{p\,C_K^{mean}}{(w+r\,k^{mean})} = 0 \tag{1.24a}$$

or

$$\hat{w}\Theta_L^{mean} + \hat{r}\,\Theta_K^{mean} - \hat{p}\Gamma_K = 0 \tag{1.24b}$$

where $\hat{w} = dw/w$, $\hat{r} = dr/r$, $\hat{p} = dp/p$, $\Theta_L^{mean} = w/(w+r\,k^{mean})$, $\Theta_K^{mean} = r\,k^{mean}/(w+r\,k^{mean})$ and $\Gamma_K = p\,C_K^{mean}/(w+r\,k^{mean})$. Once again, we do not have superscript mean in Γ_K, simply because of the fact that with homothetic and identical preferences all individuals have the same Γ_K. Equation (1.24b) indicates

$$\hat{p}\Gamma_K = \hat{w}\Theta_L^{mean} + \hat{r}\,\Theta_K^{mean}\,. \tag{1.25}$$

Using equation (1.25) in (1.20b) gives us

$$\frac{dV^i}{\lambda(w+rk^i)} = \hat{w}(\Theta_L^i - \Theta_L^{mean}) + \hat{r}(\Theta_K^i - \Theta_K^{mean}). \tag{1.26}$$

Since $\Theta_L^i + \Theta_K^i = 1$ and $\Theta_L^{mean} + \Theta_K^{mean} = 1$, $(\Theta_K^i - \Theta_K^{mean})$ is equal to the negative of $(\Theta_L^i - \Theta_L^{mean})$. This would allow us to rewrite (1.25) as

$$\frac{dV^i}{\lambda(w+rk^i)} = (\hat{w} - \hat{r})(\Theta_L^i - \Theta_L^{mean}). \tag{1.27}$$

From equation (1.27) we can easily see that the derivative of an individual's utility with respect to the economy's capital-labor ratio is negative if the individual's capital endowment is greater than the economy's capital-labor ratio. It is zero if the individual's capital endowment is equal to the economy's capital-labor ratio and it is positive if the individual's capital endowment is lower than the economy's capital-labor ratio.

Consider first, the situation where the individual i's capital endowment is greater than the economy's. Then the individual i has a higher income than the individual with the mean capital endowment which is equal to the economy's capital-labor ratio. Since both individuals have the same wage, the labor share of the income of the individual i must be less than the labor share of the income of an individual with the mean capital endowment. In other words $(\Theta_L^i - \Theta_L^{mean})$ is negative. An increase in the capital-labor ratio of the economy will increase the real return on labor and decrease the real return on capital, which indicates that $\hat{w} - \hat{r}$ is positive. Therefore we conclude that when an individual's capital-labor ratio is greater than the economy's, derivative of the individual's utility with respect to economy's capital-labor ratio is negative:

$$\frac{dV^i}{dk} < 0 \qquad for\, k^i > k \tag{1.28a}$$

where k is the capital-labor ratio of the economy and k^i is the individual's capital endowment.

If the individual's capital endowment is equal to the economy's, then we will have $\Theta_L^i = \Theta_L^{mean}$, which indicates

$$\frac{dV^i}{dk} = 0 \qquad for\, k^i = k\,. \tag{1.28b}$$

If the individual i's capital endowment, on the other hand, is less than the economy's, then the individual i has a lower income than the individual with the mean capital endowment which is equal to the economy's capital-labor ratio. Since both individuals have the same wage, the labor share of the income of the individual i must be greater than the labor share of the income of an individual with the mean capital endowment. In other words $(\Theta_L^i - \Theta_L^{mean})$ is positive. Therefore we conclude that when an individual's capital-labor ratio is less than the economy's, derivative of the individual's utility with respect to economy's capital-labor ratio is positive:

$$\frac{dV^i}{dk} > 0 \qquad for\, k^i < k \tag{1.28c}$$

Derivatives (1.28a), (1.28b) and (1.28c) together mean that the relationship between an individual's utility and the economy's capital-labor ratio is U-shaped in the two-good model just as it is in the one good model.

After having showed that the utilities of individuals are U shaped with minimums at the individual's capital-labor ratio, just like in the previous one-good model, now we turn to the relationship between migration and economic integration, i.e. free trade. As in the previous section, we have two stages and again the number of migrants in the first stage is endogenous. Again we start with a situation where the median voter has lower capital-labor ratio than his own country's (inequality assumption) and he does not prefer economic integration. So, we have $k_U < k_R^{median} < \widetilde{k}_R < k_{R,0}$ as in Figure 1.3. For analytical purposes, we can use Figure 1.3 without any problem here, since it is U shaped with a minimum at the median voter's capital-labor ratio. Once again k_U is the capital-labor ratio of the integrated economy, k_R^{median} is the capital-labor ratio of the median voter in R, $\widetilde{k}_R$ is the capital-labor ratio at which the median voter is indifferent between economic integration (now free trade) and non-integration (autarky) and finally $k_{R,0}$ is the capital-labor ratio in R in the first stage.

The argument developed in the one-good model that the only equilibrium number of immigrants is the number which will make the median voter in R indifferent between economic integration and non-integration, $\widetilde{T}$, is also valid here, since median voter's decision determines the outcome of the referendum.

Again defining C as constant psychic costs of living in R (now C is in terms of the indirect utility), we can find the equilibrium level of migration and the probability of

economic integration. Equilibrium level of migration should make workers indifferent between staying in P without incurring the cost C and migrating to R with incurring the cost C:

$$\begin{aligned}&(1-\beta)V(w(\tilde{k}_P),p(\tilde{k}_P))+\beta V(w(k_U),p(k_U))\\&=(1-\beta)[V(w(\tilde{k}_R),p(\tilde{k}_R))-C]+\beta[V(w(k_U),p(k_U))-C]\end{aligned} \tag{1.29a}$$

$$C=(1-\beta)[V(w(\tilde{k}_R),p(\tilde{k}_R))-V(w(\tilde{k}_P),p(\tilde{k}_P))] \tag{1.29b}$$

$$\beta=1-\frac{C}{V(w(\tilde{k}_R),p(\tilde{k}_R))-V(w(\tilde{k}_P),p(\tilde{k}_P))} \tag{1.29c}$$

where V(.) represents the indirect utility function.. At equilibrium we have the equality (1.29c). Figure 1.10 once again depicts the equilibrium number of immigrants and the probability of integration.

Results of the previous section are also valid here. An increase in $\tilde{k}_R$, caused by an increase in k_R^{median} (as in Figure 1.8), will require lower migration level, since a decrease in the equilibrium number of migrants will lead to a higher capital-labor ratio in R in the second stage. Less migration will lead to an increase in the capital-labor ratio in P at the equilibrium, $\tilde{k}_P$. Since the indirect utility of a wage earner is increasing in the capital-labor ratio of the economy in which he lives, $V(w(\tilde{k}_R),p(\tilde{k}_R))$ increases and $V(w(\tilde{k}_P),p(\tilde{k}_P))$ decreases. Therefore the probability of free trade increases. So once again we have seen that *a more (less) equal income distribution in R, characterized by an increase (decrease) in* k_R^{median}*, leads to an increase (decrease) in the possibility of economic union.*

The second result of the previous section, that is *a more (less) equal income distribution in P, characterized by a decrease (increase) in the number of workers without capital, may render infeasible an otherwise possible economic integration*, is also valid here and the reasoning behind it is the same.

Finally the third result, that is *an increase in the cost of migration will lead to a lower possibility of economic integration*, can easily be seen from equation (1.29c).

1.3.1 A Numerical Example for Two-Good Model

In this section, I will present a numerical example for the two-good model developed above. In this example, the initial capital and labor endowments in the two countries and in the integrated economy are as follows:

Economy:	Poor	Rich	Integrated Economy
Capital:	$K_P = 30$	$\dot{K}_R = 90$	$K_U = 120$
Labor:	$L_{P,0} = 30$	$L_{R,0} = 10$	$L_U = 40$
Capital-labor ratio:	$k_{P,0} = 1$	$k_{R,0} = 9$	$k_U = 3$

We have the following identical Cobb-Douglas production functions in both countries:

$$Q_1 = K_1^{.6} L_1^{.4} \tag{1.30}$$

$$Q_2 = K_2^{.4} L_2^{.6} \tag{1.31}$$

Therefore, good-1 is capital intensive and the good-2 is labor intensive.

Consumer utility is also in the Cobb-Douglas form and identical in both countries:

$$U = Q_1^{.5} Q_2^{.5}. \tag{1.32}$$

Defining $\overline{K}$ and $\overline{L}$ as total endowments of capital and labor in the economy allows us to write, $K_2 = \overline{K} - K_1$ and $L_2 = \overline{L} - L_1$. Plugging these into equation (1.31) gives

$$Q_2 = (\overline{K} - K_1)^{.4} (\overline{L} - L_1)^{.6}. \tag{1.33}$$

Plugging equations (1.30) and (1.33) into equation (1.32) gives

$$U = K_1^{.3} L_1^{.2} (\overline{K} - K_1)^{.2} (\overline{L} - L_2)^{.3} \tag{1.34}$$

Maximizing equation (1.34) indicates the following distribution of capital and labor endowments across the production of labor intensive good-1 and the production of capital intensive good-2.

$$K_1 = .6\overline{K}$$
$$K_2 = .4\overline{K}$$
$$L_1 = .4\overline{L}$$
$$L_2 = .6\overline{L}$$

Now we can write the revenue function by using these proportions of capital and labor:

$$R = (.6^{.6})(.4^{.4})(p\overline{K}^{.6}\overline{L}^{.4} + \overline{K}^{.4}\overline{L}^{.6}) \tag{1.35}$$

where p is the price of the capital intensive good in terms of the numeraire labor intensive

good. Derivative of the revenue function with respect to the labor endowment gives the wage rate:

$$w = \frac{\partial R}{\partial \bar{L}} = (.6^{.6})(.4^{.4})(.4pk^{.6} + .6k^{.4}) \tag{1.36}$$

where k is the capital-labor ratio, $\bar{K} / \bar{L}$, Similarly, derivative of the revenue function with respect to the capital endowment gives the interest rate:

$$r = \frac{\partial R}{\partial \bar{K}} = (.6^{.6})(.4^{.4})(.6pk^{-.4} + .4k^{-.6}). \tag{1.37}$$

Zero profit conditions gives:

$$(.6^{.6})(.4^{.4})pk^{.6} = .6rk + .4w \tag{1.38}$$

$$(.6^{.6})(.4^{.4})k^{.4} = .4rk + .6w. \tag{1.39}$$

Plugging equations (1.36) and (1.37) either into equation (1.38) or into (1.39) results in

$$p = k^{-.2}. \tag{1.40}$$

Plugging equation (1.40) into equations (1.36) and (1.37) gives

$$w = (.6^{.6})(.4^{.4})k^{.4} \tag{1.41}$$

$$r = (.6^{.6})(.4^{.4})k^{-.6} \tag{1.42}$$

With these wage rate and interest rate we can calculate median voter's income once we know his capital endowment. Also individual utility maximization gives us quantities of good-1 and good-2 in terms of individual income and the prices of goods:

$$Q_1 = \frac{income}{2p} \tag{1.43}$$

$$Q_2 = \frac{income}{2} \tag{1.44}$$

Plugging equations (1.43) and (1.44) into consumer utility function (1.32) and using (1.40) gives us the indirect utility function:

$$V^i = \frac{income^i}{2p^{.5}} = k^{.1}\frac{w + rk^i}{2} \tag{1.45}$$

Using equations (1.41) and (1.42), we can write the indirect utility of the median voter as

$$V_R^{median} = \frac{(.6^{.6})(.4^{.4})}{2}(k_R^{.5} + k_R^{-.5}k_R^{median}). \tag{1.46}$$

Assume capital endowment of the median voter in R is 5. Then we can calculate his utility under free trade and autarky at the beginning (t=0).

$$V_U^{median}(k_U = 3; k_R^{median} = 5) = \frac{(.6^{.6})(.4^{.4})}{2}(3^{.5} + 3^{-.5}5) \cong 1.178187$$

$$V_R^{median}(k_R = 9; k_R^{median} = 5) = \frac{(.6^{.6})(.4^{.4})}{2}(9^{.5} + 9^{-.5}5) \cong 1.190396$$

Since the utility of the median voter under autarky in R is greater than his utility under free trade with P, he prefers autarky to free trade.

Median Voter is indifferent between economy capital-labor ratios 3 and 75/9, since

$$V_R^{median}(k_R = \frac{75}{9}; k_R^{median} = 5) = \frac{(.6^{.6})(.4^{.4})}{2}\left[\left(\frac{75}{9}\right)^{.5} + \left(\frac{75}{9}\right)^{-.5}5\right] \cong 1.178187.$$

The necessary migration for economic integration is .8, because $\tilde{k}_R = \frac{75}{9} = \frac{90}{10 + \tilde{T}}$ means $\tilde{T}$ =.8. At this critical level of migration, capital-labor ratio in P is

$$\tilde{k}_P = \frac{30}{30-.8} \cong 1.027397$$

Let the cost of migration to be .2, i.e. C=.2. To calculate the probability of free trade agreement, we need to calculate the utilities of a worker without capital at this level of critical migration under autarky in R and under autarky in P.

$$\beta = 1 - \frac{C}{V(w(\tilde{k}_R), p(\tilde{k}_R)) - V(w(\tilde{k}_P), p(\tilde{k}_P))} \tag{1.29c}$$

$$V(w(\tilde{k}_R), p(\tilde{k}_R)) = \frac{(.6^{.6})(.4^{.4})(8.333333^{.5})}{2} \cong .736367$$

$$V(w(\tilde{k}_P), p(\tilde{k}_P)) = \frac{(.6^{.6})(.4^{.4})(1.027397^{.5})}{2} \cong .258556$$

$$\beta = 1 - \frac{.2}{.736367 - .258556} \cong .581424 \approx 58.1\%$$

Now let us see that an increase in the cost of migration C, decreases the probability of economic union. Let now C to be .25.

C=.25

$$\beta = 1 - \frac{.25}{.736367 - .258556} \cong .476781 \approx 47.7\%$$

The decrease in the probability of free trade from 58.1% to 47.7% is due to the increase in the cost of migration from .2 to .25.

To see that an increase in k_R^{median} increases the probability of economic union, let us increase k_R^{median} from 5 to 5.1.

$$k_R^{median} = 5.1$$

$$V_U^{median}(k_U = 3; k_R^{median} = 5.1) = \frac{(.6^{.6})(.4^{.4})}{2}(3^{.5} + 3^{-.5}\,5.1) \cong 1.192914$$

$$V_R^{median}(k_R = 9; k_R^{median} = 5.1) = \frac{(.6^{.6})(.4^{.4})}{2}(9^{.5} + 9^{-.5}\,5.1) \cong 1.198899$$

Again at the beginning (t=0) median voter prefers non-integration.

Median Voter is indifferent between economy capital-labor ratios 3 and 8.67, since

$$V_R^{median}(k_R = 8.67; k_R^{median} = 5.1) = \frac{(.6^{.6})(.4^{.4})}{2}(8.67^{.5} + 8.67^{-.5}\,5.1) \cong 1.192914$$

The necessary migration for economic integration is 0.380623, because $\tilde{k}_R = 8.67 = \frac{90}{10 + \tilde{T}}$ indicates $\tilde{T}$ =.380623. At this critical migration level, capital-labor ratio in P is

$$\tilde{k}_P = \frac{30}{30 - .380623} = 1.012850.$$

Again the cost of migration is .2, i.e. C=.2.

$$\beta = 1 - \frac{C}{V(w(\tilde{k}_R), p(\tilde{k}_R)) - V(w(\tilde{k}_P), p(\tilde{k}_P))} \qquad (1.29c)$$

$$V(w(\tilde{k}_R), p(\tilde{k}_R)) = \frac{(.6^{.6})(.4^{.4})(8.67^{.5})}{2} \cong .751094$$

$$V(w(\tilde{k}_P), p(\tilde{k}_P)) = \frac{(.6^{.6})(.4^{.4})(1.012850^{.5})}{2} \cong .256719$$

$$\beta = 1 - \frac{.2}{.751094 - .256719} \cong .595449 \approx 59.5\%$$

This increase in the probability of free trade from 58.1% to 59.5% is due to the increase in the capital-labor ratio of the median voter from 5 to 5.1.

1.4 Conclusion

By presenting two (one-good and two-good) static probabilistic models of migration and economic integration, this chapter provided an analytical basis for studying the relationship between migration and economic integration. As it is stated earlier, to my knowledge, there is no previous work in the literature which models migration as a cause of free trade agreements. Therefore the models presented in this chapter seem to be the first attempts in this direction.

It is shown that immigration might change the political economy equilibrium trade policy from autarky to free trade, which implies a complimentary relationship between factor movements and goods trade. This is an interesting result, because it conflicts with Mundel's (1957) classic conclusion that factor mobility in response to international factor price differences leads to the elimination of trade via the elimination of the factor proportions basis for trade, i.e. factor movements and goods trade are substitutes. This important difference is because of the political economy and illegal immigration aspects of my models. Illegal immigration changes the political economy equilibrium trade policy by changing the median voter's utility level and thus his preference about the trade policy.

Results about the income distribution and the probability of free trade are given. These results are in full compliance with Mayer's (1984) prediction about the political economy equilibrium trade policies in an unequal society (one in which the relative capital endowment of the median individual is less than the mean). These policies will be biased against capital owners. Mayer's framework indicates that an increase in inequality (the difference between the mean and the median capital-labor ratio), holding constant the economy's overall relative endowments, raises trade barriers in capital-abundant economies and lowers them in capital-scarce economies. On this chapter, we have found results that are analogous to Mayer's in the context of free trade areas: An increase in inequality in a capital rich country decreases the probability of free trade and an increase in inequality in a labor rich country can make a free trade agreement feasible.

CHAPTER TWO

TWO DYNAMIC MODELS OF MIGRATION AND ECONOMIC INTEGRATION

2.1 Introduction

This chapter presents two (one-good and two-good) two-country two-factor dynamic models of migration and economic integration. As in the previous chapter, I aim to expose a possible relationship between migration and economic integration. Once again it will be shown that by changing the median voter's utility level in the migrant-receiving capital abundant country, migration of workers from a labor abundant country makes economic integration possible between the two countries. The main difference in this chapter from the previous one is the time dimension. Adding time dimension to the framework developed in the previous chapter allows us to study the equilibrium time of economic integration and the equilibrium time path of immigration instead of equilibrium probability of economic integration of the first chapter. Also this new dynamic feature makes it possible for us to asses the impact of the changes in income inequality on the time of economic integration.

As in the previous chapter, implications for the discussion about the substitutability and complementarity between goods trade and factor movements is that migration causing free trade suggests that factor mobility and goods trade are in a sense

complements, rather than substitutes. Using a dynamic model rather than a static and probabilistic one does not change this new complementarity feature of factor movements and goods trade within a Heckscher-Ohlin type model.

It is also shown that a more egalitarian income distribution in the capital abundant country makes the time of economic integration sooner whereas a less egalitarian income distribution makes the time of economic integration later. This prediction is compatible with the similar one in the previous chapter and with Mayer's (1984) prediction that an increase in inequality, holding constant the economy's overall relative endowments, raises trade barriers in capital abundant economies and lowers them in capital scarce economies. Now the change in income inequality shows its effect on the time of economic integration rather than the possibility of economic integration.

In the following section (2.2), I present the one-good model. A one-good model is more suitable for pedagogical purposes, and the equalities and expressions are easier to follow. In both models, we have two countries and two factors. The two countries differ from each other in their relative factor endowments. The two factors are capital and labor. The country with low capital-labor ratio and the wage rate is named as the poor country (P), the other as the rich country (R). The poor country applies for an economic integration with the rich one, i.e. free movement of both factors (for the factor price equalization free movement of one factor is enough), but the majority of the rich country, characterized by the decision of its median voter, does not prefer the integration. An important portion of the poor country's labor stock consists of workers without capital.

These workers are potential migrants who migrate to the rich country as long as the present value of their future wage difference (the difference between the wage they get in the rich country and the wage they would get in the poor country, if they had not migrated) is non-negative (specifically 0). Naturally, the migration of workers without capital from the poor country to the rich country increases the capital-labor ratio and the wage rate in the former and decreases them in the latter. As capital-labor ratios get closer and closer to each other, so do the wage ratios, i.e. the wage difference between the two countries shrink. This shrinkage of wage difference coincides with a decreasing migration rate. Migration continues until the median voter in the rich country becomes indifferent between the economic integration of the two countries and the non-integration.

In the section (2.3) I switch to the two-good model. Since these two countries do not trade at the time of autarky, we do not have exchange rates that would let us compare wage rates in these countries. To see the motivation for migration, i.e. higher real wages in R compared to P, we can use indirect utility functions of individuals. Assuming that migrants do not have capital (as done in the previous section) and choosing the price of the labor-intensive good as numeraire lets us define indirect utility only as a function of wage and the price of the capital good. Then an increase in capital-labor ratio in P caused by migration will increase wages and decrease the price of capital good, which undoubtedly increase the utility of a wage earner. Similarly the decrease of capital-labor ratio in R will decrease the real wage there. Therefore as in the one-good model we will observe a decrease in the real wage difference as a result of migration. This result can also be seen by using Rybczynski and Stolper-Samuelson theorems. By Rybczynski

theorem, holding product prices fixed, the decrease in P's endowment of labor will expand the capital-intensive industry and contract the labor-intensive industry, which indicates an increase in Q_K / Q_L ratio (capital-intensive good production/labor-intensive good production) in P. This will make the capital intensive good cheaper in terms of the labor intensive good, which is numeraire. Now by using Stolper-Samuelson theorem we can safely argue that the real wage in P will increase. A similar analysis for R shows that the real wage will decrease in R as a result of migration, i.e. increase of labor endowment in R.

In the last section (2.4) I present the conclusions.

2.2 One-Good Dynamic Model

The setting of this dynamic model is similar to the one on the previous model. The main difference is the definition of migration costs. Now it is assumed that migrants need some time to find "good jobs" at which they can exert their full labor and get the same wage as native workers in the rich country. Until they find such jobs, they spend a time period at bad jobs, C(M(t)), where M(t) is the total number of migrants at the time of migration t. In these bad jobs they have low productivity (their individual labor is lowered from 1 to a fraction, b) and therefore they got b fraction of the wage rate in the rich country. We assume that b is low enough so that in this initial time period (t,t+C(M(t))) migrants' wage is less than what they would get in their home country. Therefore the time period spent in bad jobs (t,t+C(M(t))) represents the cost of migration.

It is natural to assume that C(.) is increasing in M(t), since more migrants means more competition among migrants for the same kind of jobs. After t+C(M(t)), migrants who migrated at time t get used to the environment in the host country R and switch to good jobs with full wages. The time spent in these good jobs until economic integration at time τ represents the benefits of migration. After economic integration, τ, wages will be equalized across countries, i.e. there will be no benefits or costs after this time. The main result is again the positive relationship between a more equal income distribution in R and the closeness of integration.

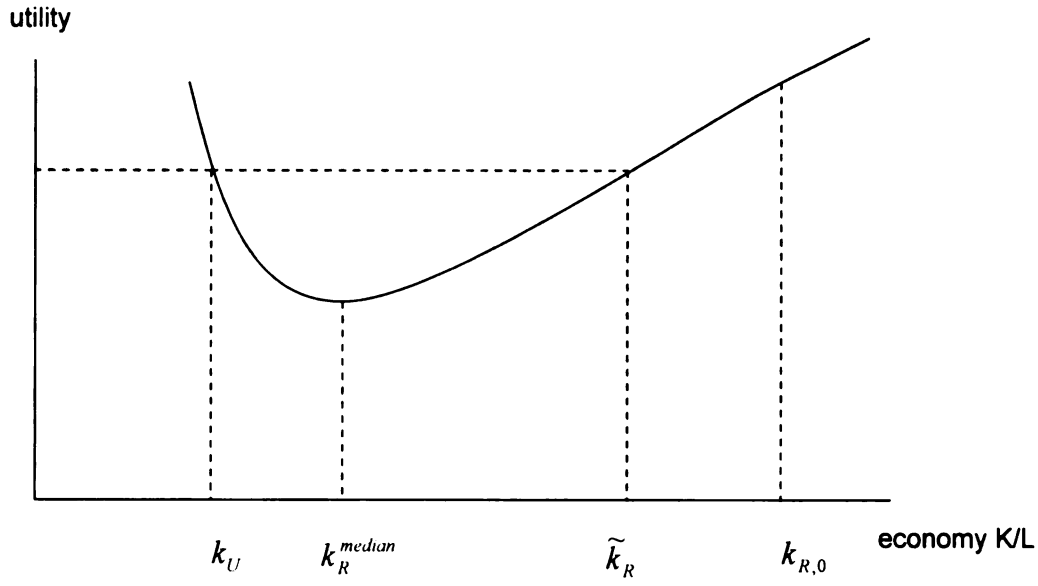

Figure 2.1: Utility of the median voter in the rich country when $k_U < k_R^{median} < \widetilde{k}_R < k_{R,0}$.

Now define k_R^{median} as the capital-labor ratio of the median voter, and assume that $k_U < k_R^{median} < \widetilde{k}_R < k_{R,0}$, that is median voter's capital-labor ratio is between the capital-labor ratio of the integrated economy, k_U, and the capital-labor ratio, $\widetilde{k}_R$, at which the

median voter is indifferent between economic integration and non-integration. Also at the beginning the capital-labor ratio in R, $k_{R,0}$, is greater than $\tilde{k}_R$. Figure 2.1 shows an illustration of this condition. As explained in the previous chapter, this is the case where migration might cause economic integration. We need a reduction of the capital-labor ratio of R from $k_{R,0}$ to $\tilde{k}_R$ to make the median voter indifferent between economic integration and non-integration.

In this dynamic model we no longer have two stages. Instead we have continuous time, i.e. t is in $[0,\infty)$. At the beginning (t=0), the median voter in R prefers no integration. Therefore we have two economies linked to each other only by illegal immigration. Immigration occurs continuously. Workers without capital in P immigrate to R as long as the present value of their expected benefits from immigration covers the cost. In R, on the other hand, voting for economic union occurs every instant of time, i.e. whenever majority of the population in R prefers union, they vote for it and economic union is established instantaneously. Again the median voter's preference will determine the result of any referendum.

Since wages are higher in R, there is a continuous flow of immigrants from P to R. The labor stocks in the poor and rich countries are:

$$L_{P,t} = L_{P,0} - \int_0^t M(s)\,ds \tag{2.1}$$

$$L_{R,t} = L_{R,0} + \int_0^t b\,M(s)\,ds + \int_0^t (1-b)\,M(s)\,I(s)\,ds \tag{2.2}$$

where I(s) = 0 (1) if s+C(M(s)) >(<) t. The capital-labor ratios in the poor and rich countries are:

$$k_{P,t} = \frac{K_P}{L_{P,t}} = \frac{K_P}{L_{P,0} - \int_0^t M(s)\,ds} \tag{2.3}$$

$$k_{R,t} = \frac{K_R}{L_{R,t}} = \frac{K_R}{L_{R,0} + \int_0^t b\,M(s)\,ds + \int_0^t (1-b)\,M(s)\,I(s)\,ds} \tag{2.4}$$

$K_p, K_R, L_{P,0}$ and $L_{R,0}$ are constants. Naturally immigration decreases $L_{P,t}$ and $k_{R,t}$, increases $L_{R,t}$ and $k_{P,t}$ over time.

To decide whether to immigrate, workers look at the present value of their future effective wage differences between the two countries. At any positive level of migration, workers are indifferent about immigrating, as described by the following condition:

$$\int_t^{t+C(M(t))} e^{-\rho(s-t)}\,[b\,w(k_{R,s}) - w(k_{P,s})]\,ds + \int_{t+C(M(t))}^{\tau} e^{-\rho(s-t)}\,[w(k_{R,s}) - w(k_{P,s})]\,ds = 0 \tag{2.5}$$

where $C(M(t))$ is the period spent at bad jobs (this function's value and its first derivative are positive) and ρ is the discount rate. The Greek symbol τ represents the time when R decides to form an economic union with P. In the absence of such a union, τ could be interpreted as infinity. I assume that as soon as R decides to form an economic union with P, capital movements become possible instantaneously and that alone equalizes factor prices in the two countries. Hence there is no wage difference between the two countries after time τ.

Since both countries use the same constant returns neoclassical production function, wage rate in country j is $w(k_j) = f(k_j) - f'(k_j)\,k_j$. It is assumed that b is low enough so that in the initial time period (t,t+C(M(t))) migrants' wage is less than what they would get in their home country. The following condition satisfies this assumption:

$$b < \frac{w(k_{P,0})}{w(k_{R,0})} \tag{2.6}$$

The left hand side of the equation (2.5) represents the present value of their future effective wage differences. The first integral gives the cost of migration in the form of negative wage differences incurred in the initial work period at bad jobs, whereas the second integral gives the return of migration in the form of positive wage differences after the workers switch jobs from bad ones to good ones. The summation of these two integrals must be equal to 0 at the equilibrium. It is easy to see the reasoning behind this equality. If the summation was negative, no one would immigrate to R. On the other hand, if the summation was positive, more than M(t) number of workers would immigrate to R, which would increase the cost of migration and decrease the benefits of it until the summation would be equalized to 0.

Since the wage rate is increasing in the country's capital-labor ratio, the wage rate in R is always higher than in P, but the difference between them is decreasing as the immigration flow from P to R continues. The reason is simple; as in the previous simple model, the main effect of immigration is again to decrease the capital-labor ratio and the wage rate in R and to increase them in P. Naturally as workers with no capital immigrate from P to R, the wage difference between the two countries will decrease and eventually

the stock of immigrants in R will reach to a level where capital-labor ratio in R will be such that median voter will be indifferent between integration and non-integration.

2.2.1 Equilibrium Migration and Time of Integration

First note that all migration occurs before the time of economic integration since there is no point in migrating from P to R after wages are equalized. Also, if the lowest cost of immigration C(0) is greater than 0, there must be a period of no migration before economic integration occurs. When economic integration is in the very near future, there will not be enough time with a positive wage difference to cover the cost of migrating. Therefore we typically have the following time line:

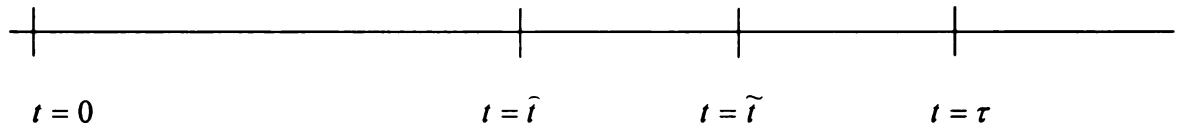

Figure 2.2: Time line

As shown in Figures 2.2 and 2.3, we start at time 0. At time t=0, migration rate has its maximum value. Migration continues by declining. The closer we are to the integration time ($t = \tau$), the lower the wage rate in R will be. Late workers will not have as much time at good jobs to get high wages before the integration as the early ones. Therefore their cost also must be lower. Since C(M(t)) declines only if M(t) falls, fewer and fewer workers should migrate as time passes. Migration ends at $t = \hat{t}$. So when $0 \leq t < \hat{t}$, we

have positive migration rate, i.e. $M(t) > 0$, and we observe the equation (2.5). At time $t = \hat{t}$, $M(t) = 0$. After $t = \hat{t}$, we don't observe equation (2.5), instead we have,

$$\int_{t}^{t+C(0)} e^{-\rho(s-t)} [b\, w(k_{R,s}) - w(k_{P,s})] ds + \int_{t+C(0)}^{\tau} e^{-\rho(s-t)} [w(\tilde{k}_R) - w(\tilde{k}_P)] ds < 0 . \qquad (2.7)$$

This inequality (2.7) show that after $t = \hat{t}$, if a worker migrated, he would not have enough time at good jobs to cover the cost of migration period, C(0). Therefore he doesn't migrate. After $t = \hat{t}$, we need C(0) time period, for the last migrant to find a good job. So at $t = \tilde{t} = \hat{t} + C(0)$, all the migrants find good jobs, i.e. when capital-labor ratio in R reaches the critical level, $\tilde{k}_R$ at which the median voter in R is indifferent between economic integration and non-integration. Finally at $t = \tau$, the median voter in R votes for economic integration.

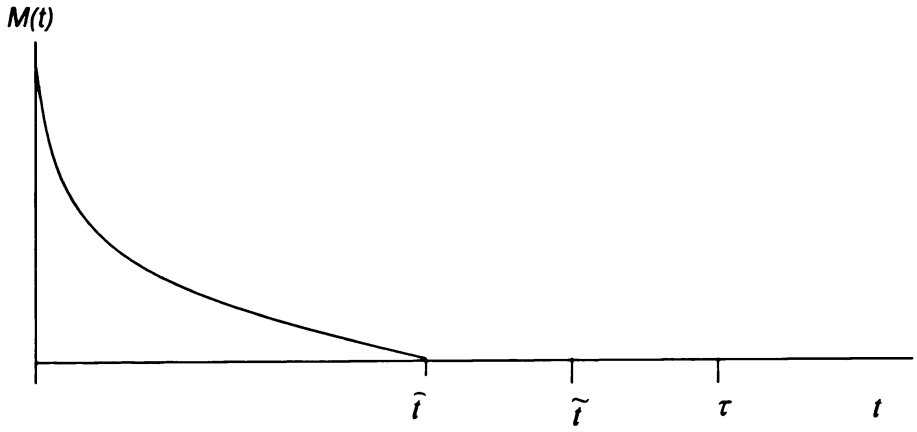

Figure 2.3: Migration rate as a function of time

Here we should note that for economic integration to occur eventually, C(0) must be low enough to allow the necessary number of migrants to pull the capital-labor ratio of R from $k_{R,0}$ to $\tilde{k}_R$. The following expression satisfies this condition:

$$0 \le C(0) < -\frac{\ln\left(\dfrac{-[b\,w(\tilde{k}_R) - w(\tilde{k}_P)]}{(1-b)w(\tilde{k}_R)}\right)}{\rho} \tag{2.8}$$

To derive (2.8), one can look at condition necessary for the last immigrant to migrate to R from P:

$$-\int_0^{C(0)} e^{-\rho t}[b\,w(\tilde{k}_R) - w(\tilde{k}_P)]dt < \int_{C(0)}^{\infty} e^{-\rho t}[w(\tilde{k}_R) - w(\tilde{k}_P)]dt \tag{2.9}$$

If (2.9) is not satisfied, for the last immigrant, the lowest cost possible with the equilibrium level of $\tilde{k}_R$ (left hand side of 2.9) is not less than the highest possible benefit with the equilibrium level of $\tilde{k}_R$ (right hand side of 2.9). Therefore the last migrant that would make capital-labor ratio of R equal to $\tilde{k}_R$ will never migrate from P to R and therefore economic integration will never occur. On section 2.2.3, I discuss the situations where (2.8) is not satisfied.

In equation (2.5), wage differences, both $[b\,w(k_{R,s}) - w(k_{P,s})]$ and $[w(k_{R,s}) - w(k_{P,s})]$, depend on the total level of capital-labor ratios in the two countries, which are uniquely determined by migration flow up to the time s, $\int_0^s M(t)dt$. Then, given τ, both the current cost and the expected gains depend solely on the behavior of the immigration rate through time. This fact implies why immigration is a function of time given τ. Soon we will see the equilibrium time of economic integration is endogenously determined, but for the time being I will use the notation $M(t;\tau)$ for immigration rate to emphasize that at this stage τ is a given number.

At the time of economic integration equilibrium, we will have a certain capital-labor ratio, $\tilde{k}_R$, which is defined as the level of capital-labor ratio of R that is greater than k_R^{median} and makes the median voter indifferent between integration and non-integration. So, $\tilde{k}_R$ satisfies the following three conditions:

$\tilde{k}_R \neq k_U$,

$\tilde{k}_R > k_R^{median}$,

$$w(k_U) + r(k_U)k_R^{median} = w(\tilde{k}_R) + r(\tilde{k}_R)k_R^{median} . \tag{2.10}$$

If we call the number of migrants at the equilibrium $\tilde{T}$, then it is clear that with $\tilde{T}$ number of immigrants the capital-labor ratio in R becomes $\tilde{k}_R$. We can express $\tilde{T}$ in terms of initial capital and labor endowments of R and $\tilde{k}_R$:

$$\tilde{k}_R = \frac{K_R}{L_{R,0} + \tilde{T}} . \tag{2.11}$$

$$\tilde{T} = \frac{K_R}{\tilde{k}_R} - L_{R,0} \tag{2.12}$$

Since the total number of immigrants equal to this constant $\tilde{T}$ at the equilibrium, we can write,

$$\int_0^{\tilde{t}} M(t;\tau)\,dt = \tilde{T} . \tag{2.13}$$

Now we can restate the equilibrium conditions for M(t) and τ. At the equilibrium, $M(t) = M(t,\tau)$ and τ, together satisfy

(i) equality (2.5) for t such that $M(t) > 0$.

$$\int_{t}^{t+C(M(t))} e^{-\rho(s-t)}[b\,w(k_{R,s}) - w(k_{P,s})]ds + \int_{t+C(M(t))}^{\tau} e^{-\rho(s-t)}[w(k_{R,s}) - w(k_{P,s})]ds = 0 \qquad (2.5)$$

(ii) equality (2.13), where $\hat{t}$ is simply the lowest positive t such that $M(t) = 0$.

$$\int_{0}^{\hat{t}} M(t;\tau)\,dt = \tilde{T} \qquad (2.13)$$

Conditions (i) and (ii) together imply that at the equilibrium, we also observe (2.7) for $t > \hat{t}$.

$$\int_{t}^{t+C(0)} e^{-\rho(s-t)}[b\,w(k_{R,s}) - w(k_{P,s})]ds + \int_{t+C(0)}^{\tau} e^{-\rho(s-t)}[w(\tilde{k}_{R}) - w(\tilde{k}_{P})]ds < 0. \qquad (2.7)$$

To find the equilibrium value of τ and migration function one can follow the following steps:

1. For a given τ use (2.5) to determine $M(t,\tau)$ for $0 \le t < \tau$.

2. Defining $\hat{t}$ as the lowest positive t such that $M(t,\tau) = 0$, calculate $\int_{0}^{\hat{t}} M(t;\tau)\,dt$.

3. If $\int_{0}^{\hat{t}} M(t;\tau)\,dt > \tilde{T}$, decrease τ and go back to step 1.

4. If $\int_{0}^{\hat{t}} M(t;\tau)\,dt < \tilde{T}$, increase τ and go back to step 1.

5. If $\int_0^{\tilde{t}} M(t;\tau)\,dt = \tilde{T}$, current τ is the equilibrium time of economic integration and the current $M(t,\tau)$ is the equilibrium path of the migration level.

2.2.2 Results

Here I will present the implications of the dynamic model about the effects of income distribution and cost of migration on the time of economic integration.

1) Improvement (worsening) of income distribution in R, characterized by a increase (decrease) in k_R^{median}, causes economic integration to occur at an earlier (later) time.

An increase in the capital endowment of the median voter, k_R^{median}, i.e. a more equal income distribution, increases $\tilde{k}_R$ (as in Figure 1.8) and decreases $\tilde{k}_P$. An increase in $\tilde{k}_R$ and a decrease in $\tilde{k}_P$ means that less migration is needed for pulling the capital-labor ratio in R from the initial $k_{R,0}$ to $\tilde{k}_R$ at which the median voter in R is indifferent between integration and non-integration. Therefore, the critical immigration stock necessary for integration, $\tilde{T}$, decreases.

To see this result, first differentiate the equation (2.13):

$$M(\tilde{t};\tau)\,d\tilde{t} + \left(\int_0^{\tilde{t}} \frac{\partial M(\tilde{t};\tau)}{\partial \tau}\,dt\right) d\tau = d\tilde{T}\,. \tag{2.14}$$

Then consider the last migrant's costs and benefits of migration:

$$\int_{\hat{t}}^{\hat{t}+C(0)} e^{-\rho(s-\hat{t})}[b\,w(k_{R,s}) - w(k_{P,s})]ds + \int_{\hat{t}+C(0)}^{\tau} e^{-\rho(s-\hat{t})}[w(\tilde{k}_R) - w(\tilde{k}_P)]ds = 0 \tag{2.15}$$

Differentiating (2.15) gives

$$\begin{aligned}&\left\{b[e^{-\rho C(0)}\,w(\tilde{k}_R) - w(k_{R,\hat{t}})] + [w(k_{P,\hat{t}}) - e^{-\rho C(0)}w(\tilde{k}_R)]\right\}d\hat{t} \\ &+ e^{-\rho(\tau-\hat{t})}[w(\tilde{k}_R) - w(\tilde{k}_P)]d\tau = 0.\end{aligned} \tag{2.16}$$

The coefficient of $d\tau$ is obviously positive. We can determine the sign of the coefficient of $d\hat{t}$ by using the knowledge that the time derivate of the migration rate, $dM(t)/dt = \dot{M}(t) < 0$, is negative. Remember that the closer we are to the integration time ($t = \tau$), the lower the wage rate in R will be. Late workers will not have as much time at good jobs to get high wages before the integration as the early ones. Therefore their cost also must be lower. Since C(M(t)) declines only if M(t) falls, fewer and fewer workers should migrate as time passes. By differentiating equation (2.5), we can get the expression for $\dot{M}(t)$:

$$\dot{M}(t) = \frac{[b\,w(k_{R,t}) - w(k_{P,t})] + (1-b)e^{-\rho C(M(t))}w(k_{R,t+C(M(t))})}{C'(M(t))(b-1)e^{-\rho C(M(t))}w(k_{R,t+C(M(t))})} \tag{2.17}$$

Since the first derivative of the cost function is positive, the denominator in this fraction is negative. Therefore the numerator has to be positive. This lets us to observe the following inequality as long as the migration continues:

$$b > \frac{w(k_{P,t}) - e^{-\rho C(M(t))}w(k_{R,t+C(M(t))})}{w(k_{R,t}) - e^{-\rho C(M(t))}w(k_{R,t+C(M(t))})} \text{ for } t\,in\,(0,\tau). \tag{2.18}$$

Inequality (2.18) implies that the coefficient of $d\hat{t}$ in the equation (2.16) is negative.

When we rewrite the differentiated equations (2.14) and (2.16) in matrix form, we have the following signs:

$$\begin{bmatrix} 0 & + \\ - & + \end{bmatrix} \begin{bmatrix} d\hat{t} \\ d\tau \end{bmatrix} = \begin{bmatrix} - \\ 0 \end{bmatrix} \tag{2.19}$$

Then both $d\hat{t}$ and $d\tau$ are obviously negative.

Some intuition behind this result is that a better income distribution makes the median voter wealthier and less oppose to the economic integration. To make the median voter indifferent between integration and non-integration less migration is needed. Therefore, the time of economic integration is closer.

2) Improvement (worsening) of income distribution in P, characterized by a decrease (increase) in the number of workers without capital, may render infeasible an otherwise feasible economic integration.

The reasoning behind this result is the same as in the first chapter. An improvement in income distribution in P might make economic integration infeasible by decreasing the number of workers without capital below the critical migration stock, $\tilde{T}$. Similarly a worsening of income distribution might increase the number of workers without capital from a level below $\tilde{T}$ to a level above $\tilde{T}$. Thus, it might make it possible.

3) An increase (decrease) in the cost of migration causes economic integration to occur at a later (earlier) time.

To see the effect of a change in the cost function, redefine the cost function as $\ddot{C}(M(t)) = aC(M(t))$, where a is a positive constant. The analysis up to this point may be seen as a special case where a=1.

An increase in constant a will make equation (2.5) invalid, unless τ, the time of economic integration, increases. To see this consider the left hand side of equation (2.5) with the new cost function:

$$\int_{t}^{t+aC(M(t))} e^{-\rho(s-t)}[b\,w(k_{R,s}) - w(k_{P,s})]ds + \int_{t+aC(M(t))}^{\tau} e^{-\rho(s-t)}[w(k_{R,s}) - w(k_{P,s})]ds \qquad (2.5a)$$

For any a>1 with the old path of M(t) (the equilibrium path of M(t) at the usual case a=1) the value of this summation will be negative for every instant of time from $t = 0$ to $t = \hat{t}$, because a>1 indicates some increase in the cost of migration (first integral in summation 2.5a) and some decrease in the benefit of migration (second integral in summation 2.5a). Since the total migration stock compatible with economic integration equilibrium is constant as equation (2.13), i.e. $\int_0^{\hat{t}} M(t;\tau)\,dt = \tilde{T}$, shows, without increasing τ, one cannot adjust the path of M(t) to make (2.5a) equal to zero for $0 < t < \hat{t}$. Therefore economic integration occurs at a later time. A similar analysis shows that a decrease in constant a will cause economic integration to occur at an earlier time.

2.2.3 Non-Integration Cases with High C(0)

It is already stated that for the economic integration equilibrium, we need the condition (2.8) derived from (2.9). Obviously if the cost of migration is too high migration might stop before total immigrant stock reaches the critical level $\tilde{T}$ or migration might not occur at all. Now let us see different possibilities if the condition (2.8) is not satisfied:

$$\text{Case \#1: } C(0) > -\frac{\ln\left(\frac{-[b\,w(k_{R,0}) - w(k_{P,0})]}{(1-b)w(k_{R,0})}\right)}{\rho} \tag{2.20}$$

No immigration occurs. The cost is simply too high for any person to immigrate from P to R. This condition is another way of stating the following inequality:

$$-\int_0^{C(0)} e^{-\rho t}\,[b\,w(k_{R,0}) - w(k_{P,0})]\,dt > \int_{C(0)}^{\infty} e^{-\rho t}\,[w(k_{R,0}) - w(k_{P,0})]\,dt \tag{2.21}$$

Left hand side of (2.21) shows the present value of the cost of migration whereas the right hand side represents the present value of the benefits. This inequality implies that C(0) is so high that even one single worker will not migrate from P to R.

$$\text{Case \#2: } -\frac{\ln\left(\frac{-[b\,w(\tilde{k}_R) - w(\tilde{k}_P)]}{(1-b)w(\tilde{k}_R)}\right)}{\rho} \le C(0) \le -\frac{\ln\left(\frac{-[b\,w(k_{R,0}) - w(k_{P,0})]}{(1-b)w(k_{R,0})}\right)}{\rho} \tag{2.22}$$

In this case, the cost of migration is not as high as in the first case. So, some migration occurs. But the total number of immigrants never reaches $\widetilde{T}$. Since the capital-labor ratio in R will always be above $\widetilde{k}_R$, R never decides to form an economic union with P. The left part of this condition is derived from the following inequality:

$$-\int_0^{C(0)} e^{-\rho t}\,[b\,w(\widetilde{k}_R) - w(\widetilde{k}_P)]\,dt \geq \int_{C(0)}^{\infty} e^{-\rho t}\,[w(\widetilde{k}_R) - w(\widetilde{k}_P)]\,dt \qquad (2.23)$$

This is just the opposite of inequality (2.9). It implies that the last immigrant necessary for total immigrant stock in R to reach the critical level $\widetilde{T}$, will never migrate to R.

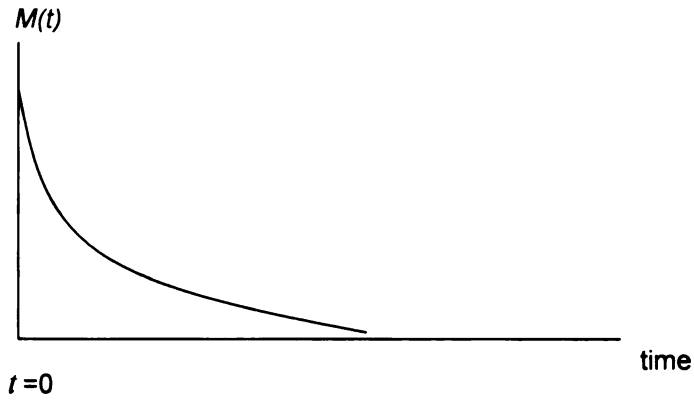

Figure 2.4: Migration rate for the case #2

In Figure 2.4 we see the migration rate for the case #2. C(0) is not too high to prevent some migration, but it is also not low enough to allow the immigrant stock in R to reach the critical level $\widetilde{T}$. Therefore free trade never occurs. In particular, if we have strict inequality instead of (2.23), then the total immigrant stock in R will never even approach to $\widetilde{T}$. On the other hand if we have equality, then the total immigrant stock in R will asymptotically approach to $\widetilde{T}$ as time goes to infinity, but it will always be below $\widetilde{T}$ to allow free trade in real time:

$$T = \int_0^{\infty} M(t)\,dt < \tilde{T}, \qquad \text{if } C(0) > -\frac{\ln\left(\frac{-[b\,w(\tilde{k}_R) - w(\tilde{k}_P)]}{(1-b)w(\tilde{k}_R)}\right)}{\rho} \tag{2.24}$$

$$T = \int_0^{\infty} M(t)\,dt = \tilde{T}, \qquad \text{if } C(0) = -\frac{\ln\left(\frac{-[b\,w(\tilde{k}_R) - w(\tilde{k}_P)]}{(1-b)w(\tilde{k}_R)}\right)}{\rho} \tag{2.25}$$

2.3 Two-Good Dynamic Model

In this section we switch from one-good model to two-good model. Now instead of a one common good, we have two different goods, Q_K and Q_L. There are identical technologies in the two countries. Capital is used relatively intensively in Q_K (and labor in Q_L) with no factor-intensity reversals. Perfect competition makes sure that profits are zero. As shown in the previous chapter, the U-shaped relationship between an individual's utility and economy's capital-labor ratio is still valid in the two-good model. The utility of an agent i with a capital endowment k^i is a function of k, economy's capital-labor ratio. This function is strictly quasi-convex in k and has a unique minimum when the agent's capital-labor ratio is equal to that of the economy.

Although most of the features of the one-good model and the two-good model are the same, there is one important feature of the two-good model that is particularly important for us. To see the complementarity/substitutability relationships between the factor movements and the goods trade we need to define economic integration as free trade rather than free and full factor mobility of the previous one-good section. That is the main

reason why we are interested in the two-good model. Now non-integration is defined as no-trade (autarky) and integration as free trade. For simplicity I assume that when free trade is accepted good prices and factor prices are equalized across countries instantaneously.

We have the basic Heckscher-Ohlin assumptions for the production of two goods in the two countries, rich and poor as described in the previous sections; also consumers in both countries have identical homothetic demands.

At the time t=0, I assume that $k_{U} < k_{R}^{median} < \widetilde{k} < k_{R,0}$ as in Figure 2.1. Therefore we start with a situation at which the median voter in R does not prefer free trade at the beginning. Since P is the labor abundant country the relative wage rate is lower and the price of the capital intensive good is higher in P compared to R, which makes it certain that the real wage is higher in R. Therefore workers in P have an incentive to migrate to R.

As in the previous section the cost of migration, $C(M(t))$, is the time spend at bad jobs with labor supply b<1.

2.3.1 Equilibrium Migration and the time of Free Trade

When a worker decides to migrate to R from P, he looks at the present value of his future real earnings. These are equal to 0 at equilibrium:

$$\int_{t}^{t+C(M(t))} e^{-\rho(s-t)}[V(bw_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds$$
$$+ \int_{t+C(M(t))}^{\tau} e^{-\rho(s-t)}[V(w_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds = 0. \quad (2.26)$$

Here V(.) is the indirect utility function. It gives us the maximum utility achievable at given prices and income. Since our immigrants do not have capital, their only income is wage; $w_{J,s}$ is the wage rate in country J at time s. Everything is defined in terms of the numeraire labor intensive good. Hence, $p_{J,s}$ is the price of the capital intensive good in country J at time s. We assume that b is low enough so that with the reduced wage a migrant's indirect utility in the rich country during the initial period is less than what it would be in his home country. The necessary condition for this is $V(bw_{R,0}, p_{R,0}) < V(w_{P,0}, p_{P,0})$. If we have this initial inequality at the beginning, then we can be sure that the inequality $V(bw_{R,t}, p_{R,t}) < V(w_{P,t}, p_{P,t})$ will be satisfied throughout the migration period, since migration will decrease (increase) the wage and increase (decrease) the price of the capital intensive good in the rich (poor) country. This necessary condition also guarantees that the reduced wage in terms of the numeraire good in the rich country, $bw_{R,t}$, during the initial "cost" period is less than the wage in terms of the numeraire good in the poor country, $w_{P,t}$; in other words, $b < w_{P,0} / w_{R,0}$.

Equation (2.26) is analogous to the equation (2.5) of the one-good model. In (2.26) the first integral, $\int_{t}^{t+C(M(t))} e^{-\rho(s-t)}[V(bw_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds$, gives the cost of migration in the form of negative indirect utility differences incurred in the initial work period at

bad jobs. The second integral, $\int_{t+C(M(t))}^{\tau} e^{-\rho(s-t)}[V(w_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds$, on the other hand, gives the return of migration in the form of positive wage differences after the workers switch jobs from bad ones to good ones. The argument behind the equality to 0 is the same as in the previous section. If the summation was negative, people would not migrate and if the summation was positive, all potential migrants would want to migrate.

Remember that we have infinite number of equations in the form of equation (2.26) for t in $(0,\hat{t})$, where $\hat{t}$ is the end of migration wave as in the previous section. For a given τ, these equations imply that immigration rate is a function of time. So the notation for immigration rate at this moment is $M(t;\tau)$.

As in the previous section, after $\hat{t}$ migration no longer covers its costs, so for $t > \hat{t}$, we have the following inequality:

$$\int_{t}^{t+C(M(t))} e^{-\rho(s-t)}[V(bw_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds + \int_{t+C(M(t))}^{\tau} e^{-\rho(s-t)}[V(w_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds < 0. \tag{2.27}$$

Defining $\tilde{T}$ as the size of immigration stock in R necessary for making the capital-labor ratio of R equal to the critical level $\tilde{k}_R$ at which the median voter in R is indifferent between autarky and free trade, we have once again equalities (2.12) and (2.13):

$$\tilde{T} = \frac{K_R}{\tilde{k}_R} - L_{R,0} \tag{2.12}$$

$$\int_0^{\hat{t}} M(t;\tau)\,dt = \tilde{T} \tag{2.13}$$

Also at the end of the migration period, $\hat{t}$, we have the following equation:

$$\begin{aligned}&\int_{\hat{t}}^{\hat{t}+C(M(0))} e^{-\rho(s-t)}[V(bw_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds \\ &+ \int_{\hat{t}+C(M(0))}^{\tau} e^{-\rho(s-t)}[V(\tilde{w}_R, \tilde{p}_{R,s}) - V(\tilde{w}_{P,s}, \tilde{p}_{P,s})]ds = 0.\end{aligned} \tag{2.28}$$

Equation (2.28) is analogous to equation (2.15) of the one-good section. Here, $\tilde{w}_J$ is the wage rate and $\tilde{p}_J$ is the price of the capital intensive good in country J when the capital-labor ratio of R reaches the critical level $\tilde{k}_R$.

As in the previous section, we need an upper bound for the minimum cost of migration, C(0). We assume that

$$0 \le C(0) < -\frac{\ln\left(\dfrac{-[V(b\tilde{w}_R, \tilde{p}_R) - V(\tilde{w}_P, \tilde{p}_P)]}{V(\tilde{w}_R, \tilde{p}_R) - V(b\tilde{w}_R, \tilde{p}_R)}\right)}{\rho}. \tag{2.29}$$

This condition is analogous to the condition (2.8) of the one-good model. It is derived from the condition necessary for the last immigrant to migrate to R from P in the two-good model:

$$-\int_0^{C(0)} e^{-\rho s}[V(b\tilde{w}_R, \tilde{p}_R) - V(\tilde{w}_P, \tilde{p}_P)]ds < \int_{C(0)}^{\infty} e^{-\rho s}[V(\tilde{w}_R, \tilde{p}_R) - V(\tilde{w}_P, \tilde{p}_P)]ds \tag{2.30}$$

The left hand side of the inequality (2.30) is the lowest possible equilibrium cost possible with the critical capital-labor ratio $\tilde{k}_R$ and the right hand side is the highest possible

benefit with this capital-labor ratio of R. If inequality (2.30) is not satisfied, then the last immigrant that would make the capital-labor ratio of R equal to $\widetilde{k}_R$ will never migrate from P to R and free trade will never occur. In section 2.3.3, the situations where the inequality (2.30) is not hold, will be discussed.

Now we can restate the equilibrium conditions for M(t) and τ for the two-good model. At the equilibrium, $M(t) = M(t,\tau)$ and τ, together satisfy

(i) equality (2.26) for t such that $M(t) > 0$,

$$\int_{t}^{t+C(M(t))} e^{-\rho(s-t)}[V(bw_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds + \int_{t+C(M(t))}^{\tau} e^{-\rho(s-t)}[V(w_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds = 0. \tag{2.26}$$

(ii) equality (2.13), where $\hat{t}$ is simply the lowest positive t such that $M(t) = 0$.

$$\int_{0}^{\hat{t}} M(t;\tau)\,dt = \widetilde{T}. \tag{2.13}$$

Conditions (i) and (ii) together imply that at the equilibrium, we also observe (2.27) for $t > \hat{t}$.

$$\int_{t}^{t+C(M(t))} e^{-\rho(s-t)}[V(bw_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds + \int_{t+C(M(t))}^{\tau} e^{-\rho(s-t)}[V(w_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds < 0. \tag{2.27}$$

To find the equilibrium value of τ and migration function one can follow the following steps:

1. For a given τ use (2.26) to determine $M(t,\tau)$ for $0 \le t < \tau$.

2. Defining $\hat{t}$ as the lowest positive t such that $M(t,\tau) = 0$, calculate $\int_0^{\hat{t}} M(t;\tau)\,dt$.

3. If $\int_0^{\hat{t}} M(t;\tau)\,dt > \widetilde{T}$, decrease τ and go back to step 1.

4. If $\int_0^{\hat{t}} M(t;\tau)\,dt < \widetilde{T}$, increase τ and go back to step 1.

5. If $\int_0^{\hat{t}} M(t;\tau)\,dt = \widetilde{T}$, current τ is the equilibrium time of economic integration and the current $M(t,\tau)$ is the equilibrium path of the migration level.

2.3.2 Results

Since practically no difference between the one-good model and the two-good model we have analogous results:

1) Improvement (worsening) of income distribution in R, characterized by a increase (decrease) in k_R^{median}, causes economic integration to occur at an earlier (later) time.

An increase in the capital endowment of the median voter, k_R^{median}, i.e. a more equal income distribution, increases $\widetilde{k}_R$ (as in Figure 1.8) and decreases $\widetilde{k}_P$. Increase in $\widetilde{k}_R$ and decrease in $\widetilde{k}_P$ means that less migration is needed for pulling the capital-labor ratio in R from the initial $k_{R,0}$ to $\widetilde{k}_R$ at which the median voter in R is indifferent between autarky

and free trade. Therefore, critical immigration stock necessary for free trade, $\tilde{T}$, decreases.

To see this result, first differentiate the equation (2.13):

$$M(\hat{t};\tau)\,d\hat{t} + \left(\int_0^{\hat{t}} \frac{\partial M(\hat{t};\tau)}{\partial \tau}\,dt\right) d\tau = d\tilde{T}\,. \tag{2.14}$$

Then consider the last migrant's costs and benefits of migration:

$$\begin{aligned} &\int_{\hat{t}}^{\hat{t}+C(0)} e^{-\rho(s-\hat{t})}[V(bw_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds \\ &+ \int_{\hat{t}+C(0)}^{\tau} e^{-\rho(s-\hat{t})}[V(\tilde{w}_R, \tilde{p}_{R,s}) - V(\tilde{w}_{P,s}, \tilde{p}_{P,s})]ds = 0. \end{aligned} \tag{2.28}$$

Differentiating (2.28) gives

$$\begin{aligned} &\left\{e^{-\rho C(0)}[V(b\tilde{w}_R, \tilde{p}_R) - V(\tilde{w}_R, \tilde{p}_R)] - [V(bw_{R,\hat{t}}, p_{\hat{t}}) - V(w_{P,\hat{t}}, p_{p,\hat{t}})]\right\} d\hat{t} \\ &+ e^{-\rho(\tau-\hat{t})}[V(\tilde{w}_R, \tilde{p}_R) - V(\tilde{w}_P, \tilde{p}_P)]d\tau = 0 \end{aligned} \tag{2.31}$$

The coefficient of $d\tau$ is obviously positive. We can determine the sign of the coefficient of $d\hat{t}$ by using the knowledge that the time derivate of the migration rate, $dM(t)/dt = \dot{M}(t) < 0$, is negative. By differentiating equation (2.26), we can get the expression for $\dot{M}(t)$. That gives us,

$$\dot{M}(t) = \frac{\phi}{\theta}$$

where

$$\begin{aligned}\phi &= V(bw_{R,t}, p_{R,t}) - V(w_{P,t}, p_{P,t}) \\ &- e^{-\rho(s-t)}[V(bw_{R,t+C(M(t))}, p_{R,t+C(M(t))}) - V(w_{R,t+C(M(t))}, p_{R,t+C(M(t))})]\end{aligned} \tag{2.32}$$

and

$$\theta = C'(M(t))e^{\rho C(M(t))}[V(bw_{R,t+C(M(t))}, p_{R,t+C(M(t))}) - V(w_{R,t+C(M(t))}, p_{R,t+C(M(t))})].$$

Since $\dot{M}(t)$ itself and the denominator, θ, in the fraction is negative, the numerator, φ, has to be positive:

$$\begin{aligned}\phi &= V(bw_{R,t}, p_{R,t}) - V(w_{P,t}, p_{P,t}) \\ &- e^{-\rho(s-t)}[V(bw_{R,t+C(M(t))}, p_{R,t+C(M(t))}) - V(w_{R,t+C(M(t))}, p_{R,t+C(M(t))})] > 0\end{aligned} \tag{2.33}$$

Inequality (2.33) implies that the coefficient of $d\hat{t}$ in the equation (2.31) is negative.

When we rewrite the differentiated equations (2.14) and (2.31) in matrix form, we have the following signs:

$$\begin{bmatrix} 0 & + \\ - & + \end{bmatrix}\begin{bmatrix} d\hat{t} \\ d\tau \end{bmatrix} = \begin{bmatrix} - \\ 0 \end{bmatrix} \tag{2.34}$$

Then both $d\hat{t}$ and $d\tau$ are obviously negative.

Intuition behind this result is that a better income distribution makes the median voter wealthier and less oppose to the free trade. To make the median voter indifferent between autarky and free trade less migration is needed. Therefore, the time of free trade is closer.

2) Improvement (worsening) of income distribution in P, characterized by a decrease (increase) in the number of workers without capital, may render infeasible an otherwise feasible economic integration.

The reasoning behind this result is the same as in the first chapter.

3) An increase (decrease) in the cost of migration causes free trade to occur at a later (earlier) time.

To see the effect of a change in the cost function, redefine the cost function as $\ddot{C}(M(t)) = aC(M(t))$, where a is a positive constant. The analysis up to this point may be seen as a special case where a=1.

An increase in constant a will make equation (2.26) invalid, unless τ, the time of free trade, increases. To see this consider the left hand side of equation (2.26) with the new cost function:

$$\int_{t}^{t+aC(M(t))} e^{-\rho(s-t)}[V(bw_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds + \int_{t+aC(M(t))}^{\tau} e^{-\rho(s-t)}[V(w_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds = 0. \tag{2.26a}$$

For any a>1 with the old path of M(t) (the equilibrium path of M(t) at the usual case a=1) the value of this summation will be negative for every instant of time from $t = 0$ to $t = \hat{t}$, because a>1 indicates some increase in the cost of migration (first integral in summation 2.26a) and some decrease in the benefit of migration (second integral in

summation 2.26a). Since the total migration stock compatible with free trade equilibrium is constant as equation (2.13), i.e. $\int_0^{\tilde{t}} M(t;\tau)dt = \tilde{T}$, shows, without increasing τ, one cannot adjust the path of M(t) to make (2.26a) equal to zero for $0 < t < \hat{t}$. Therefore free trade occurs at a later time. A similar analysis shows that a decrease in constant a will cause free trade to occur at an earlier time.

2.3.3 Non-integration (Autarky) Cases with High C(0)

I have already stated that for free trade to occur at the end of the migration process, we need the condition (2.29) derived from (2.30). We will not have free trade equilibrium, if these conditions are not met. A high cost rate might not allow the total stock of immigrants in R to reach the critical number of immigrants, $\tilde{T}$, or if the cost of immigration is too high there may not even be any migration at all. As we have done in the previous one-good section, now let us see two possibilities if the condition (2.29) is not satisfied.

$$\text{Case\#1: } C(0) > -\frac{\ln\left(\dfrac{-[V(bw_{R,0},p_{R,0})-V(w_{P,0},p_{P,0})]}{V(w_{R,0},p_{R,0})-V(bw_{R,0},p_{R,0})}\right)}{\rho} \tag{2.35}$$

No immigration occurs. The cost is simply too high for any person to immigrate from P to R. This condition is another way of stating the following inequality:

$$-\int_0^{C(0)} e^{-\rho s}[V(bw_{R,0}, p_{R,0}) - V(w_{P,0}, p_{P,0})]ds > \int_{C(0)}^{\infty} e^{-\rho s}[V(w_{R,0}, p_{R,0}) - V(w_{P,0}, p_{P,0})]ds \tag{2.36}$$

The left hand side of (2.36) is greater than the right hand side, which indicates loss for even one single migrant. That is why we do not observe any migration in this case.

Case#2:

$$-\frac{\ln\left(\frac{-[V(b\tilde{w}_R, \tilde{p}_R) - V(\tilde{w}_P, \tilde{p}_P)]}{V(\tilde{w}_R, \tilde{p}_R) - V(b\tilde{w}_R, \tilde{p}_R)}\right)}{\rho} \le C(0) \le -\frac{\ln\left(\frac{-[V(bw_{R,0}, p_{R,0}) - V(w_{P,0}, p_{P,0})]}{V(w_{R,0}, p_{R,0}) - V(bw_{R,0}, p_{R,0})}\right)}{\rho} \tag{2.37}$$

Although C(0) is not high enough to prevent any migration, it is too high to allow enough immigration to cause the necessary drop in capital-labor ratio of R to $\tilde{k}_R$. Therefore total number of immigrants in R never reaches the necessary critical level $\tilde{T}$ to lead to free trade. The left part of this inequality comes from the opposite of the condition (2.30):

$$-\int_0^{C(0)} e^{-\rho s}[V(b\tilde{w}_R, \tilde{p}_R) - V(\tilde{w}_P, \tilde{p}_P)]ds \ge \int_{C(0)}^{\infty} e^{-\rho s}[V(\tilde{w}_R, \tilde{p}_R) - V(\tilde{w}_P, \tilde{p}_P)]ds \tag{2.38}$$

This condition indicates that the C(0) is too high to allow the migration of the last immigrant that would make the total immigrant stock in R equal to $\tilde{T}$. Therefore free trade never occurs. In particular, if we have strict inequality instead of (2.38), then the total immigrant stock in R will never even approach to $\tilde{T}$. On the other hand if we have

equality, then the total immigrant stock in R will asymptotically approach to $\widetilde{T}$ as time goes to infinity, but it will always be below $\widetilde{T}$ to allow free trade in real time.

$$T = \int_0^{\infty} M(t)\,dt < \widetilde{T}, \qquad \text{if } C(0) > -\frac{\ln\left(\dfrac{-[V(b\widetilde{w}_R, \widetilde{p}_R) - V(\widetilde{w}_P, \widetilde{p}_P)]}{V(\widetilde{w}_R, \widetilde{p}_R) - V(b\widetilde{w}_R, \widetilde{p}_R)}\right)}{\rho} \tag{2.39}$$

$$T = \int_0^{\infty} M(t)\,dt = \widetilde{T} \qquad \text{if } C(0) = -\frac{\ln\left(\dfrac{-[V(b\widetilde{w}_R, \widetilde{p}_R) - V(\widetilde{w}_P, \widetilde{p}_P)]}{V(\widetilde{w}_R, \widetilde{p}_R) - V(b\widetilde{w}_R, \widetilde{p}_R)}\right)}{\rho} \tag{2.40}$$

2.4 Conclusion

In this chapter dynamic models of migration and economic integration are developed. The results of this chapter support the previous chapter's results. Once again migration causes economic integration by lowering the median voter's utility level. In the previous chapter, the existence of economic integration was not certain, since I used probabilistic model. In this chapter migration leads to economic integration with certainty in a specific time in the future, provided that the cost of migration is not very high. Therefore this chapter provides a more convincing argument of the complementarity of factor movements and goods trade. It is interesting to note that we have a basic Heckscher-Ohlin model enriched with illegal migration and political economy, and yet we have the opposite of Mundell's classical conclusion that factor movements and goods trade are substitutes rather than complements in the Heckscher-Ohlin model.

Results about the income distribution and the probability of free trade are also very much analogous to the ones in the previous chapter. One again, these results are in full compliance with Mayer's (1984) prediction about the political economy equilibrium trade policies in an unequal society (one in which the relative capital endowment of the median individual is less than the mean). These policies will be biased against capital owners. Mayer's framework indicates that an increase in inequality (the difference between the mean and the median capital-labor ratio), holding constant the economy's overall relative endowments, raises trade barriers in capital-abundant economies and lowers them in capital-scarce economies. The results of this chapter supports this prediction: An increase (decrease) in inequality in a capital rich country makes the time of free trade later (sooner) and an increase (decrease) in inequality in a labor rich country can make a free trade agreement feasible (infeasible).

CHAPTER THREE

EXTENSION WITH SMUGGLING

3.1 Introduction

On this chapter, I incorporate smuggling into the model with two goods from chapter three. To prevent unnecessary complexities, I use a very basic framework. Smuggling is assumed to consist of transporting labor intensive goods from the poor country in exchange for capital-intensive goods from the rich country. I assume that smuggling industry is competitive and smugglers maximize profits, therefore the residence of the smuggler clearly does not matter, since the smuggling profits under competition is zero. Compared to the case without smuggling, introducing smuggling to the model have two opposing effects on the time of economic integration. On the one hand, we have price effect. Smuggling makes the real wage difference between the two countries smaller by bringing the relative prices in the two countries closer. This in return decreases the rate at which people migrate from the poor country to the rich one and tend to postpone the time of economic integration. On the other hand, the median voter gets a lower utility because of smuggling and therefore less migration is needed to switch his vote in favor of economic integration, which tends to bring the time of economic integration closer. The net effect of these two opposing effects determines whether the case with smuggling, compared to the case without smuggling, brings the economic integration closer in time or not.

3.2 Literature Review

In the area of smuggling Bhagwati and Hansen (1973) is regarded as the seminal paper, since it represents the first general equilibrium analysis of smuggling. By using a version of Heckscher-Ohlin-Samuelson model, they implicitly assume that smuggling, unlike legal trade with zero transport costs, has special real resource costs. These costs are incurred in the form of the two tradables which enter the utility functions. The analyses are done by using smuggling transformation (or offer) curve. They state that this curve must be less favorable than the terms of trade, which imply smuggling costs. Thus the country faces two terms of trade one in legal trade and the other in smuggling. Furthermore they also implicitly assume that smuggling is riskless. By examining the welfare effects of smuggling under perfect competition and monopoly in a two-good model they find that smuggling would necessarily reduce welfare in a small open economy only when smuggling coexisted with legal trade. The reason for this result is that when both smuggling and legal trade exist, the domestic price is tariff inclusive world price, which indicates loss of tariff revenue, but no improvement in terms of trade. Also Bhagwati and Hansen assume that, in the monopolistic smuggling case, the smuggler is a nonresident so that profits which he earns are not part of the country's welfare. In the case of competitive smuggling the identities of the smugglers do not matter, since then profits are zero.

On the other hand, Kemp (1976) shows that if smuggling and legal trade have equal transport costs, then for the welfare of the country, whether smuggling occurs or not is not important, because fines and confiscations completely replace any reduction in the tariff revenue.

In his alternative model to Bhagwati and Hansen model, Sheikh (1974) assumes that smuggling requires real resources, in the form of a transportation commodity, T, which is assumed to be produced with a constant returns to scale technology. Thus he has a three-good (exportable, importable and T) and two-factor (capital and labor) model. To smuggle one unit of the importable good, one unit of T is needed. Legal trade, on the other hand, has no transportation costs. All goods are produced under perfect competition and constant returns to scale. In this model, smugglers can smuggle any quantity at constant unit risk costs. Risk costs are confiscation of smuggled goods and fines in the case of detection. Thus, smuggling requires costs in two forms T and confiscations and fines. However, smuggling is also an increasing cost industry because of diseconomies, i.e. a smuggler's risk costs increase if other smugglers increase their smuggling level. Sheikh, himself, acknowledges that such an increasing cost assumption is necessary for solution of the model. Sheikh's model, unlike Bhagwati-Hansen model, implies that the presence of smuggling, in requiring the use of a non tradable good using labor and capital, affects the domestic transformation curve among the two tradable goods entering the utility function. Therefore smuggling can affect the domestic production of the two tradable goods even if the tariff-inclusive domestic price of the importable good is unaffected by smuggling. Also, smuggling and legal trade can co-exist in Sheikh's model

and improve welfare, while Bhagwati-Hansen model indicates welfare loss when smuggling coexists with legal trade.

Pitt (1981) provides a model in which legal trade, smuggling and price disparity (the difference between the actual domestic price and the tariff inclusive world price of and import good) exist simultaneously. In his model, illegal trade is carried on by the same firms that engage in legal trade trough legal entry points rather than illegal entry points as in Bhagwati and Hansen. Pitt's smuggling function, which is strictly concave and twice differentiable, continuous linear homogeneous function, g (l,s), relates a typical firm's smuggling to the level of its legal trade (l) and to the quantity (s) of input in terms of the good being traded. Given this smuggling function firms are able to smuggle goods without making tariff payments and to sell them in the domestic market at a price below the tariff inclusive world price. Smuggling costs could be interpreted either as real transportation costs or as fines and confiscations. The welfare effect of smuggling is ambiguous in the former case and positive in the latter.

Martin and Panagariya (1984) explicitly model smuggling as an illegal act for which the consequences are unknown ex ante by the trader. Firms engaging in smuggling take the risk of being caught and punished. Therefore their behavior depends on the vigor with which the authorities enforce the law. The probability of detection is increasing in the ratio of smuggled to legal imports. They also specify real resource costs attached to smuggling like special packing costs or payments to foreign firms for under-invoicing. They analyze the real costs of smuggling as a choice variable of the firm. Transport costs

are, on the other hand, zero. They show that, as in Pitt, smuggling , legal trade and price disparity may coexist. Actually at equilibrium there are no profits or rents and all firms have the same ratio of smuggled to legal imports. Increased enforcement of laws against smuggling raises real per unit costs of smuggling and the domestic price of importables but lowers both the absolute quantity and the share of illegal imports in total imports. They find that the net effect of smuggling on welfare is ambiguous.

Norton (1988) develops a model to explain smuggling of Common Agricultural Policy (CAP) goods between neighboring EEC (now EU) countries. He particularly thinks about the area between the Republic of Ireland and Northern Ireland (UK). Norton considers a trader located within the EEC but outside the national border at a certain distance from Home. Home is the country into which goods are smuggled. Trader has to decide whether to keep his initial stock of goods to himself or to export them. If he decides to export, then he must decide whether to sell his goods legally, to smuggle or both. Norton assumes that smuggling requires domestic resources, which would otherwise be used for production. In his model he assumes that "smuggling of agricultural goods is an increasing cost industry – not because of external diseconomies which cause upward shifts in the cost structures of firms as the industry expands, as in some earlier models, but owing to increasing transport costs as the distance-margin for smuggling, i.e. the distance between the original place of the smuggled good and the border, is extended". Therefore smuggled goods originate within a certain distance from the border between the countries. The greater distance the smuggled goods are carried, the higher per unit smuggling costs. Also, a fraction of smuggled goods is detected and

confiscated at the border. Confiscations and fines represent the risk cost of smuggling. The possibility of detection is decreasing in the quantity of goods legally exported by the trader and it is increasing in the quantity of goods allocated to smuggling by the trader. The model predicts that an increase in the tariff rate, reflecting price differentials between contiguous countries, will induce increased contraband from existing smugglers. Also it will enlarge the area in which smuggled goods originate. Norton's model allows smugglers, generally those close to the frontier, to earn large economic rents. This is due to the assumptions that the locations of smugglers (traders) are exogenous and there is no price disparity within the home country because of intervention agency transactions.

Thursby, Jensen and Thursby (1991) examine how market structure and enforcement affect smuggling and welfare in a model where smuggling is camouflaged by legal sales. They model an import sector composed of firms in a Cournot industry. In this industry both legal traders and firms that smuggle through camouflaging can survive if firms differ in their excess cost of smuggling and have some market power. The probability of successful smuggling of a firm depends on two things: the level of enforcement mechanism and the fraction of smuggled goods to the total amount the firm imports. There is also an additional cost of smuggling that firms incur regardless of whether the smuggling is successful or not. This cost could be a real cost like packaging and or a bribe to customs officials. Increasing the number of firms in the industry increases the total volume of imports and it pulls the price down to the level which would prevail under pure competition. The conclusions of the paper are (i) that the price disparity that occurs in models where smuggled trade is camouflaged is directly related to the degree of

competition in the importing industry; (ii) the welfare effect of smuggling is also directly related to the degree of competition in the importing industry, since this price disparity is welfare improving; and (iii) an increase in enforcement may reduce welfare even when enforcement is costless, since the quantity imported by a camouflager exceeds that of a legal trader.

Lovely and Nelson (1995), unlike previous authors who used some versions of Heckscher-Ohlin-Samuelson model, use a Ricardo-Viner type economy to analyze smuggling. They consider a small open economy in which two goods (an exportable and an importable) are produced from intersectorally mobile labor and sector-specific capital. In their model the possibility of detection of a firms' smuggling activity by the government depends positively on the ratio of smuggled goods to legal imports and negatively on the quantity of smuggling services purchased by the importing firm per smuggled unit. Their conclude that smuggling need not reduce domestic welfare of a tariff-ridden economy, even when smuggling uses domestic resources that would otherwise be used for production. Smuggling decreases welfare if the value of productive activity displaced by smuggling exceeds the benefit of the lower domestic price resulting from smuggling.

Larue and Lapan (2002) extend Bhagwati's (1965, 1969) analysis about the nonequivalence between tariffs and quotas when domestic production is monopolized and the terms of trade are exogenous, by allowing smuggling. The average cost in the smuggling industry is increasing in the total level of smuggling, but the average cost at

the individual smuggler's level is constant, which implies that as total illegal imports increase, individual smugglers must incur additional costs to avoid detection by the government. The free entry and zero-profit conditions determine the total level of smuggling. Laure and Lapan show that the dominance of tariff over quota is not robust: When the price differential between domestic and world products falls below a certain level, smuggling is irrelevant and the tariff remains a better instrument that the quota. However, at lower levels of legal imports (higher tariffs), the quota is better than the tariff. Also smuggling is welfare-improving (decreasing) when legal imports are constrained by a quota (tariff).

As it is seen above, most of the smuggling literature try to explain welfare effects of smuggling to the country into which goods are smuggled. From the earlier literature, there is no clear answer to the effect of smuggling on welfare. In most papers the effect on welfare is ambiguous.

Incorporating smuggling into the model which was developed in the previous chapter will allow us to see its effect on migration and economic integration. The effect of smuggling on migration and economic integration, to my knowledge, has never been analyzed.

As it will be seen in the next section, in my model, I assume an increasing detection rate, i.e. the higher the volume of smuggling is, the higher the proportion of the detected smuggled goods is. In the literature this increasing rate of detection is explained by two

approaches. One approach follows Bhagwati and Hansen (1973), which is lately extended by Laure and Lapan (2002), where smuggling is conducted through illegal entry points: There are real resource costs of smuggling and there are a large number of smugglers. The average cost at the industry level is increasing but the average cost at the individual smuggler's level is constant. This congestion effect implies that, as total illegal imports increase, individual smugglers must incur additional costs to avoid detection by the enforcement authorities. Although this approach does not model detection explicitly, it implicitly assumes that given a constant resource allocation of smuggling firms for avoiding detection of smuggling activity, detection rate increases in the total level of smuggling.

The other approach is by Martin and Panagariya (1983): They assume that firms engage in both legal and illegal trade. So, smuggling is conducted through legal entry points. The detection rate depends on two things, the ratio of legal to smuggled imports and real costs of smuggling. Real costs of smuggling may be in the form of payments to foreign firms for under-invoicing or of special packing costs necessary for concealing the smuggled goods or of bribes paid to customs officials. The firms chooses a parameter β and for each unit of smuggled good it purchases $1/\beta$ more of the same good, i.e. $(1-\beta)/\beta$ units "melt away" for each unit of smuggled good. With this interpretation, detection rate increases in β. Other than this β, the detection rate also depends on the ratio of smuggled to legal imports. The interpretation of this assumption is simple. If the firm imports 100 tons of a good and declares 99 tons, it will probably succeed smuggling the 1 ton of illegal imports. But if the firm declares 1 ton and tries to smuggle 99 tons, then it will

probably be detected. It is also implicitly assumed that the number of firms in the industry is constant and all firms are identical, which implies that as the ratio of total illegal imports to legal imports increase so does the detection rate. In the paper it is explained how this model can be modified to handle Bhagwati-Hansen type of illegal trade through illegal entry points. When smuggling is carried on through illegal entry points, then the detection rate will depend on the absolute quantity of illegal imports and legal imports will be equalized to zero.

Incorporating smuggling into the model with an increasing detection rate, gives an ambiguous result. Depending on the parameters of the model, smuggling might increase or slow the speed to free trade. If we interpret an earlier free trade agreement welfare improving, then the result of this chapter supports the earlier findings in the literature: the effect of smuggling on welfare is ambiguous.

3.3 Two-Good Model with Smuggling

I assume that there are no transportation costs, i.e. any amount of goods can be transported between P and R free of charge. The poor country does not do anything to prevent illegal movement of goods (it is already assumed in previous sections that the poor country already wants economic union, i.e. free trade, so it is unwilling to stop any kind of trade). The rich country government can detect a portion of smuggled goods. It is assumed, as in the most papers in the smuggling literature, this portion, q, is strictly increasing in the amount of smuggled goods.

I try to model smuggling as simple as possible. I follow Bhagwati and Hansen's implicit assumption that the detection rate is increasing in the volume of total illegal imports; also there are no legal imports. As in the previous chapters, following Levy (1997), we are trying to compare autarky (here with smuggling) and free trade.

$q = q(S_L)$; where S_L is the amount of smuggled labor intensive good.

This function is an increasing (its first derivative is positive), non-negative function (it takes values in (0,1) for positive S_L). For simplicity, as in Norton (1988), I assume that all detected smuggled goods are confiscated and subsequently destroyed. In the literature there are also papers which assume the distribution of confiscated goods to the public in the same manner as tariff revenue. If such an assumption is adopted instead of the destruction of confiscated goods, then the analysis virtually no different from legal trade replacing tariff revenue with confiscated goods. The assumption of the disappearance (destruction) of confiscated goods is also suitable for the alternative "melting away" interpretation as in Martin and Panagariya (1983).

There are a large number of competitive smugglers. Entry to the smuggling industry is free. A typical smuggling activity occurs as follows: 1 unit of labor intensive good bought in the poor country is smuggled into the rich country and exchanged for $\frac{1}{p_R}$ unit of the capital intensive good. This capital intensive good is then taken home and sold at

the unit price p_P. With the detection rate $q(S_L)$, the revenue is $\left(\frac{p_P}{p_R}\right)[1-q(S_L)]$. By the zero profit condition, this is equal to cost of one:

$$\left(\frac{p_P}{p_R}\right)[1-q(S_L)]=1 \tag{3.1a}$$

$$\left(\frac{p_P}{p_R}\right)=\frac{1}{1-q(S_L)} \tag{3.1b}$$

This equality determines the total level of smuggling between the two countries. Smuggling makes the capital intensive good more expensive in the poor country and cheaper in the rich country. Therefore the more smuggling occurs, the lower the LHS becomes and the higher the RHS becomes. This indicates that there is an equilibrium level of smuggling which satisfies equation (3.1b).

Now we can look at the derivatives of prices in both countries and the total equilibrium level of smuggling with respect to capital-labor ratios in both countries:

$$p_P = p_P(k_P,k_R); \frac{dp_P}{dk_P}<0, \frac{dp_P}{dk_R}>0$$

$$p_R = p_R(k_P,k_R); \frac{dp_R}{dk_P}>0, \frac{dp_R}{dk_R}<0$$

$$S_L = S_L(k_P, k_R); \frac{dS_L}{dk_P} < 0, \frac{dS_L}{dk_R} > 0$$

The reasoning behind these derivatives is simple. As capital-labor ratios come closer to each other (as k_P increases and k_R decreases) the prices of the capital intensive good in these two countries come closer to each other and this, naturally, makes smuggling less profitable.

To see the effect of migration within the framework of the dynamic model developed in the previous section, we need to figure out how smuggling affects median voter's utility level in the rich country and the migration process between the two countries. Remember that the median voter in the rich country has a lower capital-labor ratio than the rich country's overall capital-labor ratio and that he prefers autarky to free trade, i.e. his utility from autarky at the country's capital-labor ratio is higher than the utility he would get under free trade. Smuggling reduces the welfare of the median voter in the rich country by increasing the relative price of the capital intensive good.

Figure 3.1 illustrates how smuggling reduces the utility level of the median voter. Note that smuggling reduces the median voter's utility level when capital-labor ratio of the country is far greater than the median voter's. At these capital-labor ratios median voter gains from being in a relatively capital abundant country. Smuggling reduces the median voter's utility by making the relative prices more like what they would be in a less capital-abundant country. By providing smuggled labor intensive goods to the rich country, smuggling decreases the relative demand for labor and it increases the relative

demand for capital in the rich country. This, naturally, increases the relative price of

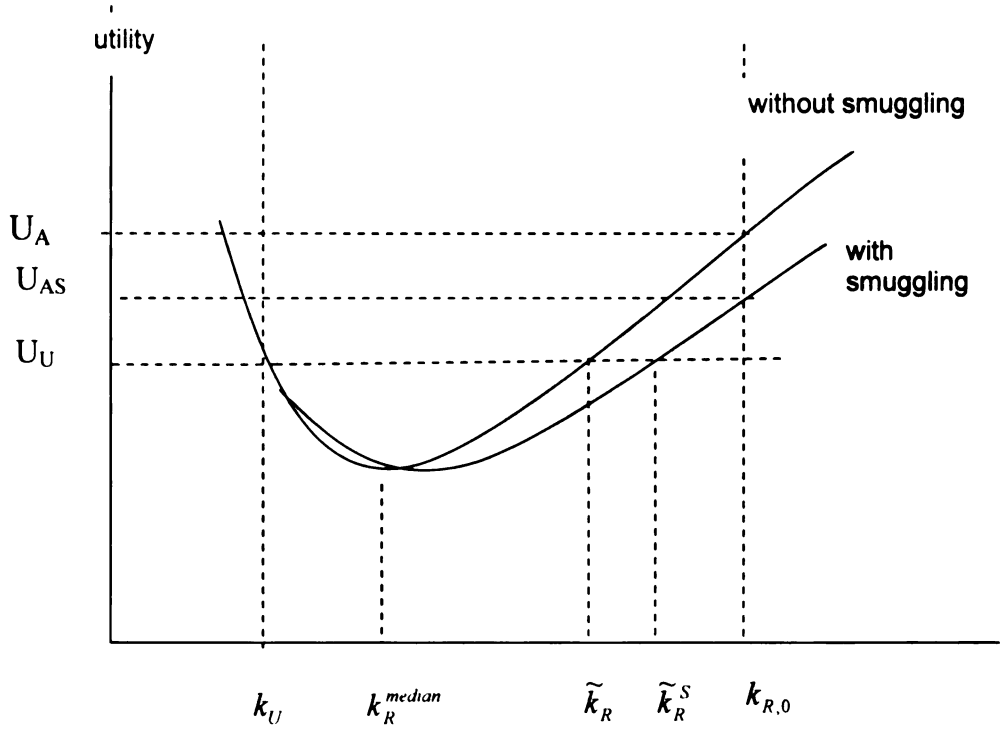

Figure 3.1: Smuggling reduces the utility level of the median voter

capital and decreases the relative price of labor. On the other hand smuggling increases median voter's utility level when he lives in an economy in which the capital-labor ratio is less than his own. That's why his utility level increases because of smuggling when the capital labor ratio of the economy in which he lives is between k_U and k_R^{median}. It is also important to note that in the graph as we move from k_U to further right along the horizontal line, the level of smuggling is increasing, since price differences are becoming more attractive for smugglers. At k_U we have no smuggling and that's why both utility graphs overlap at this level. At the beginning, when the capital-labor ratio in R is $k_{R,0}$,

median voter's utility is U_A without smuggling. Smuggling reduces the median voter's utility by lowering the relative price of the labor intensive good. With smuggling median voter gets the utility U_{AS}. The case without smuggling requires the reduction of capital-labor ratio from $k_{R,0}$ to $\widetilde{k}_R$ for free trade. With smuggling a smaller reduction from $k_{R,0}$ to $\widetilde{k}_R^S$ is needed.

As it could be seen from Figure 3.1, two opposing effects of the smuggling process play role here. On the one hand less migration is needed for economic integration to occur. The case without smuggling requires a migration level which will take the capital-labor ratio from $k_{R,0}$ to $\widetilde{k}_R$, which indicates $\frac{K_R}{\widetilde{k}_R} - L_{R,0}$ amount of migration; but smuggling requires a migration level which will take the capital-labor ratio only from $k_{R,0}$ to $\widetilde{k}_R^S$, which indicates $\frac{K_R}{\widetilde{k}_R^S} - L_{R,0}$ amount of migration. On the other hand because of Stolper-Samuelson effect, a lower relative price of the labor intensive good will lead to a decrease in real wages in R, which will make migration from P to R less attractive. The former effect tends to make the time of economic integration sooner, the latter effect – later.

The negative effect through the change in prices can be seen from the following equality. As it is explained in the previous section, when a worker decides to migrate to R from P, at the equilibrium he is indifferent between staying in P and moving to R, i.e. the present value of his expected future wage differences (between what he would get in P and R) is zero.

$$\int_{t}^{t+C(M(t))} e^{-\rho(s-t)}[V(bw_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds + \int_{t+C(M(t))}^{\tau} e^{-\rho(s-t)}[V(w_{R,s}, p_{R,s}) - V(w_{P,s}, p_{P,s})]ds = 0. \tag{2.26}$$

The effect of smuggling on these variables is as follows: for a given capital-labor ratio, now we have lower w_R and p_P, and higher w_P and p_R. If the same amount of migration, $\frac{K_R}{\tilde{k}_R} - L_{R,0}$, were required for free trade, then we would certainly have free trade at a later time than the case without smuggling. But we now require less migration, $\frac{K_R}{\tilde{k}_R^S} - L_{R,0}$, for free trade:

$$\int_0^{\hat{t}} M(t;\tau)\,dt = \tilde{T} = \frac{K_R}{\tilde{k}_R^S} - L_{R,0} \tag{3.2}$$

Although the effect of smuggling on the time of free trade is ambiguous in general, we can identify two extreme situations: One with immediate free trade, and one with a time of free trade later than the case without smuggling.

Let us now see the first extreme case with immediate free trade. We have just seen that smuggling reduces the welfare of the median voter at the beginning (t=0). It is easy to see from equation 3.1 that the lower the $q(S_L)$ is, the higher the equilibrium level of S_L is. For a sufficiently low $q(S_L)$, we can get an S_L sufficiently high so that the median voter's utility falls below what he would get under free trade, as illustrated in Figure 3.2.

In such a situation median voter chooses free trade right away. Hence, smuggling alone might cause free trade without any involvement of migration.

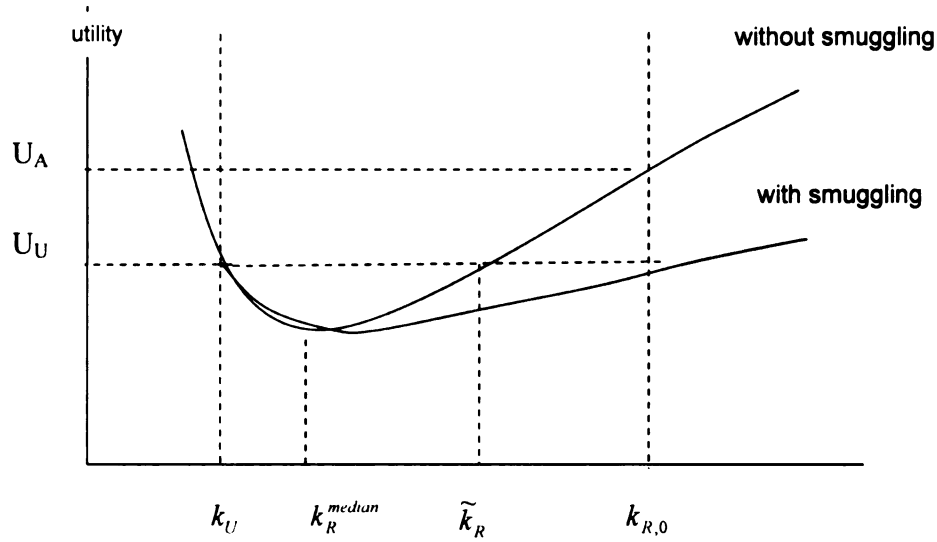

Figure 3.2: Utility of the median voter when smuggling immediately causes economic integration

Figure 3.2 shows the situation where smuggling immediately causes economic integration. Without smuggling median voter's utility is U_A at the beginning (t=0). With smuggling he gets utility below U_U. Therefore he chooses free trade immediately at the beginning.

Formally we can easily find how low the detection rate must be in order to allow free trade to occur immediately. Let $\ddot{S}_L$ be the level of smuggling which would make the median voter indifferent between free trade and autarky with smuggling at the beginning (t=0) when the capital-labor ratio is $k_{R,0}$. If $q(\ddot{S}_L)$ is such that

$$\frac{p_{P,0}}{p_{R,0}} = \frac{1}{1-q(\ddot{S}_L)}, \tag{3.3}$$

where $p_{P,0}$ and $p_{R,0}$ are the prices of the capital intensive good in terms of the labor intensive good in P and R respectively, then the median voter in R is indifferent between autarky with smuggling and free trade. Therefore any detection rate function such that

$$q(\ddot{S}_L) \leq 1 - \frac{p_{R,0}}{p_{P,0}} \tag{3.4}$$

leads to free trade immediately without any requirement for migration.

The second extreme example occurs when the detection rate is high enough so that smuggling stops before median voter becomes indifferent between autarky and free trade, as illustrated in Figure 3.3. Therefore in such a situation, to pull the capital-labor ratio from $k_{R,0}$ to $\tilde{k}_R$, we need exactly the same number of immigrants as in the case without smuggling. Since smuggling makes relative prices for migration less appealing for possible immigrants, compared to the case without smuggling, we will certainly need more time for free trade.

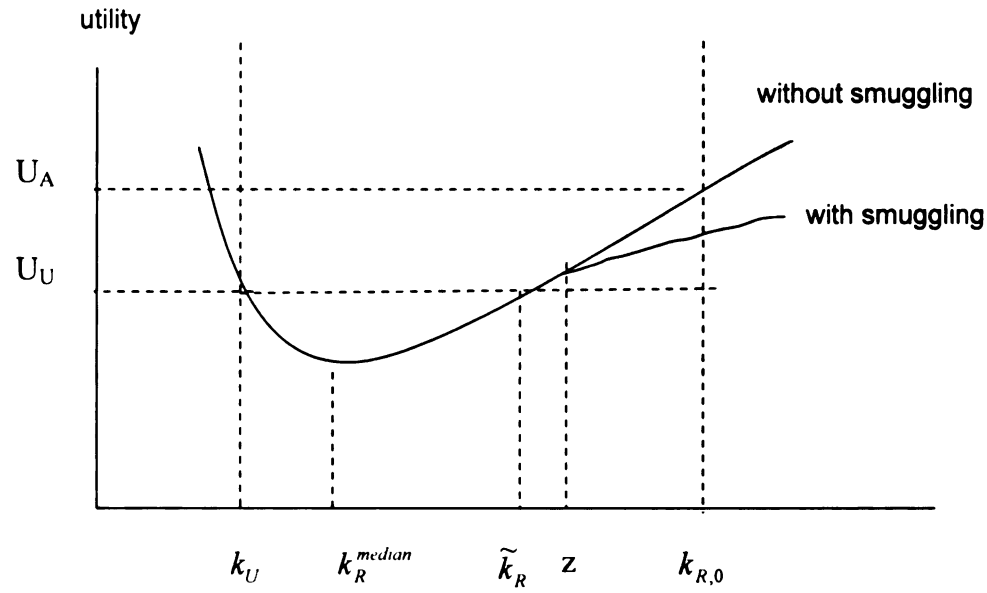

Figure 3.3: Utility of the median voter when it takes longer to have free trade with smuggling than without smuggling

On the Figure 3.3, we see the median voter's utility for the extreme case when it takes longer to have free trade with smuggling than without smuggling. When the capital-labor ratio is less than z, smuggling is not profitable. For capital-labor ratios greater than z, price differences between the two countries are sufficient to allow smuggling. Both with and without smuggling we need to reduce capital-labor ratio from $k_{R,0}$ to $\tilde{k}_R$ for free trade. Since the case with smuggling has less attractive relative prices for migration, it requires more time for free trade.

Formally, for the second extreme case we need detection rate to be high enough for even "zero" number of smuggled goods such that

$$1-\frac{\tilde{p}_R}{\tilde{p}_P} \le q(0) < 1-\frac{p_{R,0}}{p_{P,0}}, \tag{3.5}$$

where $\tilde{p}_R$ and $\tilde{p}_P$ are the prices of the capital intensive good in R and P respectively,

when the capital-labor ratio in R is $\widetilde{k}_R$. For any detection rate function $q(S_L)$ which satisfies inequality (3.5) we will have a longer waiting time for free trade compared to the case without smuggling. If, on the other hand, q(0) is extremely high so that

$$q(0) \geq 1 - \frac{p_{R,0}}{p_{P,0}} \tag{3.6}$$

then we would have no smuggling at all even at the beginning (t=0).

3.4 Conclusion

In this chapter, we have incorporated smuggling into the two-good, two-factor, dynamic model of migration and economic integration developed in the previous chapter. We have seen that introducing smuggling into the model has an ambiguous effect on the time of economic integration depending on the parameters of the model, especially the rate of detection. With high detection rates the model tends to lengthen the waiting time between the beginning and free trade. With low detection rates the model tends to shorten it. If we interpret a longer (shorter) waiting time as a loss (gain) of welfare, then we can say that smuggling's effect on welfare of both countries is ambiguous. In the literature review we have seen that most of the papers in the smuggling literature imply that the effect of smuggling on welfare is ambiguous. Here we have the same conclusion.

CHAPTER FOUR

THE EFFECT OF INCOME INEQUALITY IN THE DETERMINATION OF FREE TRADE AGREEMENTS

4.1 Introduction

The goal of this chapter is to empirically investigate whether income inequalities in country pairs could be one of the key economic factors influencing the possibility of an FTA between the two countries.

The median-voter approach to trade policy determination as in Mayer (1984) in the Heckscher-Ohlin framework indicates that an increase in inequality in a capital-abundant (labor-abundant) economy raises (decreases) trade barriers. Dutt and Mitra (2002) find support for this prediction using cross-country data on inequality, capital-abundance and diverse measures of protection. For developing countries with lower capital-labor ratios, greater inequality leads to lower tariffs. Conversely, for industrialized countries with higher capital-labor ratios, greater inequality leads to higher tariffs. This provides support for the median voter framework in the context of the Heckscher-Ohlin model. In addition, Dutt and Mitra find that this relationship holds better in democracies than in dictatorships.

In the models developed in the previous chapters we have also seen a similar prediction that when migration is possible between country pairs, an increase in inequality in the relatively poor (rich) country will tend to decrease (increases) the possibility of economic integration between the two countries.

Although there is a large literature explaining empirically tariff and non-tariff barriers between countries, the first econometric work that tries to explain empirically the determinants of FTAs is a very recent one: Baier and Bergstrand (2004). My work on this chapter basically follows their work. I added inequality variables (GINI coefficients in the country pairs) to their explanatory variables to see whether they make a difference. Their econometric model is based upon a general equilibrium theoretical model of world trade with two factors of production, two monopolistically competitive product markets, and explicit intercontinental and intracontinental transportation costs among multiple countries on multiple continents. They find that trade –creating and trade-diverting economic characteristics play an important role in explaining the probability of an FTA between two governments. According to their results, two economies tend to form FT: (i) the closer are two countries in distance; (ii) the more remote a pair of continental trading partners is from the rest of the world; (iii) the larger in economic size are two trading partners; (iv) the more similar in economic size are two partners; (v) the greater the difference of capital-labor ratios between two partners (vi) the smaller the difference of the members' capital-labor ratios with respect to the rest of the world's capital-labor ratio; and (vii) the higher are the rest of the world's tariffs. In their empirical model these

characteristics correctly predict 85 percent of the 286 FTAs existing in 1996 among 1431 pairs of countries and 97 percent of the remaining 1145 pairs with no FTAs.

The contribution of this chapter is to include income inequality in the analysis of the economic determinants of the likelihood of FTAs between country pairs. Although Dutt and Mitra (2002) find support for the prediction that an increase in inequality in a capital-abundant (labor-abundant) economy raises (decreases) trade barriers, their work does not say anything about FTAs. On the other hand Baier and Bergstrand (2004) did not consider income inequality levels in their attempt to explain economic determinants of FTAs.

My main finding is that in democratic countries a negative (positive) relationship exists between the income inequality level in the relatively capital-abundant (labor-abundant) country and the possibility of the FTA. I failed to find a similar relationship in non-democratic countries.

4.2 Econometric Model and Estimation Method

As I mentioned above, my model is based on Baier and Bergstrand (2004)'s best probit result. Therefore it includes their explanatory variables as well as inequality variables (gini coefficients) of the two countries in the pair and also interaction terms

between these inequality variables and dummy variables which indicate whether the countries can be regarded as democratic:

$$P(FTA = 1) = P(y^* > 0)$$
$$= G(\beta_0 + \mathbf{x\beta} + \delta_1 GINIP + \delta_2 GINIR + \delta_3 GINIP.DEMP + \delta_4 GINIR.DEMR) \quad (4.1)$$

where y* denotes the (unobservable) difference in utility levels from the action of forming of an FTA and

$$y^* = \beta_0 + \mathbf{x\beta} + \delta_1 GINIP + \delta_2 GINIR + \delta_3 GINIP.DEMP + \delta_4 GINIR.DEMR + e.$$

It is assumed that e is independent of **x** (the vector of explanatory variables from Baier and Bergstrand), GINIP, GINIR, GINIP.DEMP and GINIR.DEMR and it has a standard normal distribution. Since both countries' consumers need to benefit from an FTA for their representative countries to form one, formally $y^* = \min(\Delta U_i, \Delta U_j)$.

The dependent variable FTA gets the value 1 if there exists an FTA between the two countries in 1996, which indicates $y^* > 0$, and 0 otherwise, which indicates $y^* \leq 0$. Here the standard normal cumulative distribution function G(.) ensures that P(FTA=1) is in (0,1).

Parameters $\boldsymbol{\beta} = [\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6]'$ are the ones corresponding to the explanatory variables from Baier and Bergstrand. The first one of these explanatory variables $NATURAL_{ij}$ measures the geographical closeness of i and j. It is the natural logarithm of the inverse of the distance between the economic centers i and j. The second one $REMOTE_{ij}$, on the other hand measures the remoteness of a pair of continental trading partners from the rest of the world. It takes the value 0 if the two countries are on

different continents. However if they are in the same continent then $REMOTE_{ij}$ measures the simple average of the natural logarithms of the mean distance of country i from all of its trading partners except j and the mean distance of country j from all of its trading partners except i. While the third explanatory variable $RGDP_{ij}$ simply measures the sum of the logs of real GDPs of countries i and j in 1960, the fourth explanatory variable $DRGDP_{ij}$ measures the absolute value of the difference between the logs of real GDPs of countries i and j in 1960. The fifth explanatory variable DKL_{ij} measures the absolute value of the difference between the logs of the capital-labor ratios of countries i and j in 1960. The sixth explanatory variable $DROWKL_{ij}$ measures the difference between the capital-labor ratios of i and j and the rest of the world's capital-labor ratio. It is the simple average of two differences, which are between the natural logarithm of the combined capital-labor ratio of i(j)'s all trading partners and the natural logarithm of the capital-labor ratio of i(j).

The explanatory variable GINIP measures the income inequality in the relatively labor abundant country in the pair. Similarly GINIR measures the income inequality in the relatively capital abundant country in the pair. These are the averages of gini coefficients from the years 1960-69. The dummy variable DEMP takes the value 1 if the relatively labor abundant country in the pair is democratic in the years 1960-69, it takes the value 0 otherwise. Similarly DEMR takes the value 1 if the relatively capital-abundant country in the pair is democratic in the years 1960-69 and it takes the value 0 otherwise.

Since it is not possible to find reliable gini coefficients and democracy data from 1960s for all the countries in B&B, the number of observations available for my model shrank to 406 from 1431 observations used in B&B. To see whether this shrinkage in data size causes any substantial change in the B&B model I also recalculated their model, i.e.

$$P(FTA = 1) = P(y^* > 0) = G(\beta_0 + \mathbf{x}\boldsymbol{\beta}) \tag{4.2}$$

by using only the 406 observations available for my model.

As in Baier and Bergstrand (2004), I use the maximum likelihood estimation (MLE) method to estimate the parameters of the model. As stated in Wooldridge (2000), the general theory of (conditional) MLE for random samples implies that, under very general conditions, the MLE is consistent, asymptotically normal, and asymptotically efficient.

5.3 The Data

The data for B&B (Baier and Bergstrand [2004]) variables (FTA_{ij}, $NATURAL_{ij}$, $REMOTE_{ij}$, $RGDP_{ij}$, $DRGDP_{ij}$, DKL_{ij}, $DROWKL_{ij}$) were taken from Dr. Baier. For further information about their sources, one can look at B&B. Here it should be emphasized once more that although FTA_{ij} shows whether the pair has an FTA in 1996, explanatory variables $RGDP_{ij}$, $DRGDP_{ij}$, DKL_{ij} and $DROWKL_{ij}$ are measurements related to 1960. This time difference between the dependent variable and these

explanatory variables are due to potential endogeneity. B&B explains this choice by the following lines:

> *"... Since an FTA formed several years prior to 1996 likely influenced subsequent trade – which then influenced economic growth – incomes and capital stocks in 1996 (variables in x) may well be endogenous to the dependent variable, FTA. To account for this, we used the earliest data on incomes, capital stocks, and populations available in Baier, Dwyer, and Tamura (2000) for a wide sample, namely, 1960 data."*

The data for GINI coefficients are obtained from the UNU/WIDER – UNDP World Income Inequality Database (WIID) which can be downloaded from the UNU/WIDER web pages at

http://www.wider.unu.edu/wiid/wiid.htm

or from the UNDP/SEPED web pages at

http://www.undp.org/povery/initiatives/wider/wiid.htm.

To obtain a fairly reliable data subset of gini coefficients from this source, only those data points with OKIN ("*Reliable income or expenditure data referring to the entire [national] population, not affected by apparent inconsistencies*") quality rating were chosen. Since very few countries had gini coefficient data for the year 1960 for this rating, averages of gini coefficients over the years from 1960 to 1969 are used. By this way, gini variables are obtained for 30 countries out of 54 in B&B.

The data for dummy variables DEMP and DEMR are constructed by using data from the Polity IV Project dataset. This dataset is easily available at the web at:

www.cidcm.umd.edu/inscr/polity.

The indicator "POLITY" in the dataset ranges from -10 (full autocracy) to +10 (full democracy). For each country average of POLITY scores from the years 1960-69 are used. Those countries with positive average POLITY scores are regarded as democratic and others with negative average POLITY scores are regarded as undemocratic. This method allowed me to construct democracy dummy variables for the 29 countries out of the 30 countries with gini variables. Table 5.1 gives GINI and POLITY averages of the 29 countries used in this chapter.

Subsequently GINIP, GINIR, DEMP and DEMR variables are constructed for 406 pairs out of 1431 pairs in B&B. To determine the "poor" and the "rich" in each pair, capital-labor ratios for the year 1960 are compared and the country with a higher capital-labor ratio is labeled as "rich" and the other as "poor". If the average POLITY score for the relatively labor abundant country in the pair is positive (negative), then the variable DEMP is unity (zero). Similarly, if the average POLITY score for the relatively capital abundant country in the pair is positive (negative), the variable DEMR is unity (zero).

Table 5.1: GINI and POLITY averages for 1960s

		GINI average (1960s), %	POLITY average (1960s)
1	Argentina	42.0	-4.2
2	Australia	32.5	10.0
3	Bolivia	53.0	-3.6
4	Brazil	53.5	-2.9
5	Canada	31.8	10.0
6	Chile	37.7	5.6
7	Columbia	62.0	7.0
8	Costa Rica	50.0	10.0
9	Denmark	37.0	10.0
10	Ecuator	38.0	0.5
11	El Salvador	53.0	-1.2
12	France	48.3	5.3
13	Germany	45.0	10.0
14	Honduras	61.9	-1.0
15	Japan	35.7	10.0
16	Mexico	54.2	-6.0
17	Netherlands	42.0	10.0
18	Norway	35.0	10.0
19	Panama	48.0	1.8
20	Peru	61.0	2.3
21	Philippines	50.4	4.7
22	South Korea	32.2	1.5
23	Spain	32.0	-7.0
24	Sweden	37.9	10.0
25	Thailand	42.3	-6.0
26	Turkey	56.0	8.4
27	United Kingdom	32.8	10.0
28	United States	34.7	10.0
29	Venezuela	42.0	6.4

Table 5.2: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
FTA	0.1749	0.3803	0	1
NATURAL	-8.5186	0.8000	-9.6086	-5.0752
REMOTE	1.8652	3.5769	0	9.1274
RGDP	34.9953	2.3018	28.8239	41.0509
DRGDP	1.9203	1.4122	0.0071	6.9436
DKL	1.0145	0.7158	0.0076	2.8312
DROWDKL	0.8545	0.2780	0.1491	1.6893
GINIP	46.8700	9.5700	31.8	62
GINIR	41.5507	8.7985	31.8	62
DEMP	0.6650	0.4726	0	1
DEMR	0.8350	0.3717	0	1
GINIP.DEMP	30.3402	22.9238	0	62
GINIR.DEMR	33.7943	16.8427	0	62

Number of observations: 406

On table 5.2 it is no surprise that minimum and maximum values of GINIP and GINIR variables are the same. This is due to the fact that 27 out of 29 countries used in the formation of 406 country pairs are labeled "poor" in some country pairs and "rich" in others. Since we are considering relative country pairs, a given country is labeled "poor" in a pair if the other country in the pair has higher 1960 capital-labor ratio and it is labeled "rich" if the other country has lower 1960 capital-labor ratio. The two countries that do not change their status of being "poor" or "rich" in all pairs are Thailand and Australia. Thailand has the lowest 1960 capital-labor ratio whereas the Australia has the highest among the 29 countries.

5.4 Results

Probit results indicate that the smaller data set of my model does not cause an important distortion in the calculations of B&B coefficients. In Table 5.2, the first column gives the results from B&B. The coefficient estimates of the same model calculated with the smaller data set are given in the second column (2a). For each explanatory variable coefficient estimates from both columns have the same sign and all the coefficient estimates except the one for DROWKL in the second column are statistically significant at 5% level. The coefficient estimates of the same model without DROWKL are presented in the column 2b, where all variables are statistically significant at 1% level.

The estimated coefficients of the model with gini coefficients and democracy dummies from the third column show that the variables GINIP and GINIR are statistically insignificant although interaction terms GINIP.DEMP and GINIR.DEMR are statistically significant at 5% level with expected signs. This indicates that income inequality has an effect on the formation of FTAs only in democratic countries. Also once again we see that the variable DROWKL is insignificant at 5% level, although all other B&B variables are statistically significant at 1% level. Therefore in column 3b the version without DROWKL is presented. Taking DROWKL out of the regression does not have any effect on the signs of the coefficient estimates. It only makes the variable DKL statistically significant at 5% level instead of at 1% level. The variables GINIP and GINIR stay statistically insignificant at 5% level.

Therefore another probit specification which includes only B&B variables and the interaction terms GINIP.DEMP and GINIR.DEMR is estimated with the 406 pairs and presented in column 4a of Table 5.3. The coefficient estimates of the both interaction terms have expected signs and they are statistically significant. The coefficient estimate of the interaction term GINIP.DEMP is positive and it is statistically significant at 1% level. The coefficient estimate of the other interaction term GINIR.DEMR is negative and it is statistically significant at 5% level. Also, in column 4b the version without DROWKL is presented. Taking DROWKL out of the regression does not have any effect on the signs of coefficient estimates or on their statistical significances.

Table 5.3: Probit Results for the Probability of an FTA

Variable	1 (B&B)	2a	2b	3a	3b	4a	4b
CONSTANT	7.90	6.66	4.46	3.62	2.36	6.52	5.32
	(4.92)*	(2.68)*	(2.15)**	(1.07)	(0.75)	(2.43)**	(2.21)**
	[5.40]*	[3.43]*	[3.04]*	[1.48]	[1.01]	[3.00]*	[2.85]*
NATURAL	1.76	1.53	1.52	1.79	1.82	1.74	1.76
	(13.43)*	(6.41)*	(6.57)*	(6.22)*	(6.39)*	(6.38)*	(6.54)*
	[12.05]*	[6.63]*	[7.02]*	[7.34]*	[7.51]*	[6.92]*	[7.12]*
REMOTE	0.18	0.18	0.18	0.21	0.21	0.20	0.20
	(10.03)*	(5.77)*	(5.80)*	(5.78)*	(5.80)*	(5.74)*	(5.76)*
	[10.04]*	[5.60]*	[5.53]*	[5.50]*	[5.75]*	[5.50]*	[5.67]*
RGDP	0.17	0.15	0.19	0.25	0.28	0.20	0.22
	(3.67)*	(2.20)**	(3.06)*	(2.89)*	(3.42)*	(2.66)*	(3.23)*
	[4.53]*	[2.58]*	[3.68]*	[3.76]*	[4.44]*	[3.11]*	[3.88]*
DRGDP	-0.34	-0.45	-0.43	-0.59	-0.59	-0.57	-0.56
	(-5.45)*	(-4.15)*	(-4.19)*	(-4.47)*	(-4.54)*	(-4.46)*	(-4.52)*
	[-5.46]*	[-3.70]*	[-3.79]*	[-4.55]*	[-4.48]*	[-4.67]*	[-4.92]*

DKL	0.85	0.59	0.44	0.70	0.64	0.65	0.59
	(7.37)*	(2.73)*	(2.35)*	(2.69)*	(2.58)**	(2.84)*	(2.70)*
	[6.74]*	[2.61]*	[2.20]**	[3.11]*	[3.03]*	[2.96]*	[2.82]*
DROWKL	-1.29	-1.00		-0.68		-0.66	
	(-5.53)*	(-1.83)		(-1.16)		(-1.14)	
	[-4.91]*	[-2.22]**		[-1.24]		[-1.23]	
GINIP				0.02	0.02		
				(1.00)	(0.93)		
				[1.10]	[1.02]		
GINIR				0.02	0.02		
				(1.07)	(1.12)		
				[1.07]	[1.13]		
GINIP.DEMP				0.02	0.02	0.02	0.02
				(2.42)**	(2.50)**	(2.70)*	(2.80)*
				[2.61]*	[2.66]*	[3.02]*	[3.08]*
GINIR.DEMR				-0.02	-0.02	-0.02	-0.02
				(-2.12)**	(-2.42)**	(-2.09)**	(-2.38)**
				[-2.11]**	[-2.41]**	(-2.05)**	[-2.34]**
Pseudo Rsq	0.728	0.665	0.655	0.707	0.703	0.700	0.697
Log likelihood	-194.4	-63.12	-64.86	-55.21	-55.89	-56.39	-57.04
# of observations	1431	406	406	406	406	406	406

Notes: The quantities in paranthesis below the estimates are z-statistics. The quantities in brakets are robust z-statistics. *(**) denotes statistically significant z-statistic at 1 percent (5 percent) level in two-tailed test.

The fact that the estimated coefficients of GINIP.DEMP and GINIR.DEMR are both statistically significant with the expected signs also shows its effect on the goodness-of-fit measure percent correctly predicted. The probit estimate of the model with B&B variables and the interaction terms GINIP.DEMP and GINIR.DEMR (column 4a in Table 5.3) correctly predicts 81.69 percent of the 71 FTAs, and 97.01 percent of the remaining 335 pairs with no FTAs while the probit estimate of the model only with B&B variables

(column 2a in Table 5.3) correctly predicts 77.46 percent of the 71 FTAs and 96.72 percent of the remaining 335 pairs with no FTAs. Comparisons of the goodness-of-fit measure percent correctly predicted of the models without DROWKL also shows a similar picture. The probit estimate of the model with B&B variables without DROWKL, and with the interaction terms GINIP.DEMP and GINIR.DEMR (column 4b in Table 5.3) correctly predicts 83.10 percent of the 71 FTAs, and 97.01 percent of the remaining 335 pairs with no FTAs while the probit estimate of the model only with B&B variables without DROWKL (column 2b in Table 5.3) correctly predicts 74.65 percent of the 71 FTAs and 97.61 percent of the remaining 335 pairs with no FTAs.

5.5 Conclusion

The purpose of this study was to find evidence of the effect of income inequalities on the formation of FTAs. It provides this evidence for democratic countries. The main conclusion of the study is that in democratic countries the potential welfare gains and likelihood of an FTA between a pair of countries is higher, the more (less) egalitarian the income distribution in the relatively capital (labor) abundant country of the pair is. This result is in full compliance with the predictions of the previous theoretical chapters of this dissertation. The results of these chapters indicate that an increase in income inequality in the relatively capital (labor) abundant country in a two-country pair decreases (increases) the possibility of a free trade agreement between these two countries. One of the main assumptions of these models was that decisions for joining an FTA were made by voting

in both countries. Therefore finding empirical evidence for this prediction only in democratic countries and not in non-democratic countries is also compatible with these models.

CONCLUSION

AND

SUGGESTIONS FOR FURTHER RESEARCH

This dissertation has shown that incorporating migration and median voter approaches to the Heckscher-Ohlin setting leads to a complementary relationship between factor movements and goods trade. Considering two non-trading countries which differ from each other by their economy capital-labor ratios and assuming unequal distribution of capital endowment within societies (those in which the relative capital endowment of the median individual is less than the mean), we know that the median voter in the labor abundant country would want his country to have a free trade agreement with the capital abundant one, whereas the median voter in the capital abundant country would oppose such an agreement. Migration of labor from the labor abundant country to the capital abundant country changes the median voter's decision in the capital abundant country by lowering his utility level. When his utility level in the autarky situation is lowered to the level he would get under free trade, the median voter will be ready to prefer free trade to autarky. The absence of trade would mean further migration and further decrease in the utility level of the median voter.

Thus, migration (factor mobility) causes free trade (goods trade). It is interesting to note that migration occurs because of wage differences between the countries as a result of the absence of trade. This indicates usual substitutability relationship of the Heckscher-Ohlin model between the factor mobility and goods trade. However, since

migration eventually causes free trade through political economy, we observe the complementary relationship in the big picture.

The models in this dissertation employ the median voter approach to trade policy determination, as in Mayer (1986). In the static model, an increase in inequality in capital abundant countries, holding constant the economy's overall relative endowments of factors, decreases the probability of free trade. In the dynamic model, this rise in inequality postpones the time of free trade to a later date. An increase in inequality in labor abundant countries, on the other hand, may render feasible an otherwise infeasible free trade agreement.

One extension of the previous models would be to consider more than two countries. For example, if we start with three different countries the pattern of immigration and its result might be quite different than the two-country case. When modeling three-country case, the cost of immigration function $C(M(t))$ could be different across the country pairs. Such an enrichment of the models might allow us to understand more about the directions of labor movements across countries by answering questions like, What are the directions of migration between countries, i.e. which country or countries receive immigrants and which country or countries are the source(s) of migration? Such a model also might help us predict which country pairs would be more likely to establish free trade agreements. Also we might be able to see whether a bilateral free trade agreement could undermine political support for further multilateral trade liberalization.

Including illegal capital investment might also be an interesting extension. Citizens of the capital abundant country might be allowed to invest in the labor abundant country with a probability of detection and confiscation of their investment. It would be interesting to see whether such a change would increase or decrease the probability of free trade in the static model and whether it would make the time of free trade sooner or later in the dynamic model.

Another possible extension is to include remittance payments to the model. One way of doing this would be to assume that every migrant worker in the capital abundant country sends a constant amount of remittance to the labor abundant country and total amount of remittances are equally distributed among workers in the labor abundant country. It should be noted that since there are impediments to trade, remittance payments will also be subject to these impediments. Therefore these remittance payments should include "melting away" type of cost. In this case migration rate, $M(t)$, might decrease since the future wage differences of migrant workers has to cover both the cost of migration and the remittance payments. Naturally this might in the end lead to further delay of free trade.

Delay in factor price equalization after the free trade agreement might also be an extension. If we assume that after free trade agreement it would take some time to equalize wages and rents, then we might witness a higher migration rate at the beginning and migration might continue after the free trade agreement because of the prevailing wage differences. We might also witness a closer date of the free trade agreement,

although the full equalization of wages might be later than the normal case. A sharp decrease in the cost of migration after the free trade agreement might result in an increase in the migration rate after the free trade agreement, which would be in accordance with the real life experience as in the case of NAFTA. Martin (2001) draws attention to this possibility of an increase in migration after the free trade agreement and reminds that "the US Commission for the Study of International Migration and Cooperative Economic Development, which embraced free trade as the best long term solution for unwanted economically motivated migration, -'expanded trade between the sending countries and the United States is the single most important remedy'- nonetheless concluded that 'the economic development process itself tends in the short to medium term to stimulate migration'. In other words, the same policies that reduce migration in the long run can increase migration in the short run, creating 'a very real short-term versus long-term dilemma' for a country such as the United States considering a free trade agreement as a means to curb unauthorized immigration from Mexico." Martin also mentions that loosening the assumption that the adjustment to changes in international markets is instantaneous can produce a migration hump, meaning that, when migration flows are charted over time, migration first increases with closer economic integration and then decreases.

The models of this dissertation ignore population growth. However, one can have the same results by adding a constant population growth rate in both countries. This might not give the exact same date of free trade unless $C(M(t))$ function is adjusted to allow a proportional increase in the migration rate as the growth rate of population. However, the complementary relationship and the effect of changes in income inequality results should

be the same even without any corresponding change in $C(M(t))$. Extending the model by allowing populations of the labor abundant country, the capital abundant country and migrants to grow at different rates might make it too complicated, but it might also lead to interesting results. For example, if the illegal immigrants grow faster than the native population in the capital abundant country, this increases the rate at which the capital-labor ratio in the capital abundant country decreases and consequently makes the economic integration sooner. On the other hand, if immigrants are given voting rights, they will vote against economic integration in order to further enjoy high wages in the capital abundant country. This might cause economic integration to occur at a later time or even prevent it altogether. However if we assume that the migrants and their descendents vote nationalistically (i.e. for economic integration with their original country), rather than economically (i.e. against economic integration with their original country), then the time of economic integration would be sooner.

Incorporating both the static and the dynamic models in one model might be more realistic. One might remodel the dynamic model in such a way that starting with the time when the median voter becomes indifferent between autarky and free trade for every instant of time we have a constant probability of economic integration between 0 and 1 rather than either 0 or 1. A constant probability of free trade indicates a constant expected waiting time for free trade, thus a poisson distribution. Then we can conjecture that if people are risk neural, the equilibrium expected time of free trade is the same as the time of free trade in the perfect foresight models of this dissertation. If, on the other hand,

people are risk takers (averse) the equilibrium expected time of free trade is sooner (later).

As these various suggestions for further research indicate, this dissertation which incorporates political economy and migration to the Heckscher-Ohlin model seems to have laid a foundation for a fruitful research area.

REFERENCES

Baier, S. L. and J. H. Bergstrand (2004), Economic Determinants of Free Trade Agreements, *Journal of International Economics*, forthcoming.

Baier, S. L., G. Dwyer and R. Tamura (2000), *The Growth and Development of Nations*, manuscript.

Benhabib, J. (1996), On the political economy of immigration, *European Economic Review* 40, 1737-1743.

Bhagwati, J.N. (1965), On the Equivalence of Tariffs and Quotas, in R. E. Baldwin et al. (eds), *Trade Growth and the Balance of Payments: Essays in Honor of Gottfried Haberler*, Chicago: Rand-McNally, 53-67.

_____, (1969), On the Equivalence of Tariffs ad Quotas," in J. N. Bhagwati (ed), *Trade, Tariffs, and Growth*, Cambridge, MA: MIT Press, 248-65.

Bhagwati, J. and B. Hansen (1973), A theoretical analysis of smuggling, *Quarterly Journal of Economics 87*, 172-187.

Bond, E. and Tain-Jy Chen (1987), The welfare effects of illegal immigration, *Journal of International Economics* 23, 315-328.

Bucci, G. A. and R. Tenorio (1996), On financing the internal enforcement of illegal immigration policies, *Journal of Population Economics* 9, 65-81.

Coughlin, P. and S. Nitzan (1981), Electoral outcomes with probabilistic voting and Nash social welfare maxima, *Journal of Public Economics* 15, 113-21

Dutt, P. and D. Mitra (2002), "Endogenous Trade Policy Through Majority Voting," *Journal of International Economics* 58, 107-134.

Ethier, W. J. (1986), Illegal immigration: The host-country problem, *American Economic Review* 76, 56-71.

Facchini, G. (2002), Why join a common market?, Unpublished.

Geddes, A. (2003), *The Politics of Migration and Immigration in Europe*, London: Sage Publications

Gosh, B. (1997), Magnitude, trends, and dynamics of immigration into North America. The need for a global perspective: the contextual framework, in E. M. Ucarer and

D. J. Puchala (ed), Immigration Into Western European Societies, London: Pinter, 147-174.

Hansen, A. H. and A. S. Kessler (2001), The Geography of Tax H(e)avens and Tax Hells, *American Economic Review* 91, 1103-1115.

Hinich, M. J. (1977), Equilibrium in spatial voting: The median voter result is an artifact, Journal of Economic Theory 16, 208-129

Kemp, M. C. (1976), Smuggling and Optimal Commercial Policy, *Journal of Public Economics* 5, 381-384.

King, R. (1995), European international migration 1945-90: a statistical and geographical overview, in R. King (ed), *Mass Migration to Europe: The Legacy and the Future*, John Wiley & Sons, 19-39.

Kosinski, L. (1970), *The Population of Europe*, Longman, London.

Larue, B. and H. E. Lapan (2002), Smuggling and Bhagwati's Nonequivalence Between Tariffs and Quotas, *Review of International Economics* 10(4), 729-748.

Ledyard, J. O. (1981), The paradox of voting and candidate competition: A general equilibrium analysis, in A. L. Roth and J. Kagel, (eds.), *The Handbook of Experimental Economics*, Princeton, N.J.: Princeton University, 777-94.

Ledyard, J. O. (1984), The pure theory of large two-candidate elections, *Public Choice 44*, 7-41

Levy, P. I. (1997), A Political-Economic Analysis of Free Trade Agreements, *American Economic Review* 87, 506-519.

Lovely, M. E. and D. Nelson (1995), Smuggling and welfare in a Ricardo-Viner economy, *Journal of Economic Studies* 22, 26-45.

Markusen, J. R. (1983), Factor movements and commodity trade as complements, *Journal of International Economics* 99, 483-99.

Markusen, J. R. and L. E. O. Svensson (1985), Trade in goods and factors with international differences in technology, *International Economic Review* 26, 175-192.

Martin, P. L. (2001), Trade and Migration: the Mexico-US case, in S. Djajic (ed), *International Migration: Trends, policies and economic impact*, New York: Routledge, 89-109

Martin, L. and A. Panagariya (1984), Smuggling, Trade and Price Disparity: A Crime-Theoretic Approach, *Journal of International Economics* 17, 201-217.

Mayer, Wolfgang, (1984), "Endogenous Tariff Formation," *American Economic Review,* 74, 970-985.

Mundell, R. A. (1957), International trade and factor mobility, *American Economic Review* 47, 321-335.

Neary, J. P. (1995), Factor mobility and international trade, *The Canadian Journal of Economics* 28, S4-S23.

Norton, D. A. G. (1988), On the Economic Theory of Smuggling, *Economica*, New Series, Vol. 55, No. 217, 107-118.

Organization for Economic Co-operation and Development (OECD) (2003), *Trends in International Migration: The 2003 SOPEMI Report*, Paris: OECD

Organization for Economic Co-operation and Development (OECD) (2000), *Trends in International Migration: The 2000 SOPEMI Report*, Paris: OECD

Pitt, M. M. (1981), Smuggling and Price Disparity, *Journal of International Economics* 11, 447-58.

Purvis, D. D. (1972) Technology, trade and factor mobility, *Economic Journal* 82, 991-999

F. L. Rivera-Batiz (2001), Illegal immigrants in the US economy: a comparative analysis of Mexican and non-Mexican undocumented workers, in S. Djajic (ed), International Migration: Trends, policies and economic impact, London and New York: Routledge, 180-203

Sheikh, M. A. (1974), Smuggling, Production and Welfare, *Journal of International Economics* 4, 355-64.

Sjaastad, L. A. (1962), The Costs and Returns of Human Migration, *Journal of Political Economy* 70, 80-93

Svensson, L. E. O. (1984), Factor trade and goods trade, *Journal of International Economics* 16, 365-378.

Thursby, M., R. Jensen, J. Thursby (1991), Smuggling Camouflaging, and Market Structure, *The Quarterly Journal of Economics*, Vol. 106, No. 3, 789-814.

White, P. E. (1986), International migration in the 1970s: evolution or revolution? in Findlay, A.M. and White, P.E. (eds), *West European population change*, Croom Helm, London, 50-80.

Wooldridge, J. M. (2000), *Introductory Econometrics*, Cincinnati: South-Western Publishing.

Wong, K. Y. (1986), Are international trade and factor mobility substitutes?, *Journal of International Economics* 21, 25-44.

Wong, K. Y. (1995), *International Trade in Goods and Factor Mobility*, The MIT Press.

Yoshida, C., 2000, *Illegal Immigration and Economic Welfare*, Heidelberg: Physica-Verlag.