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The Effect of High-Skilled Emigration, Foreign Direct Investment, and Policy on the Growth Rate of Source Countries: A Panel Analysis

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We study the effect of the high-skilled emigration rate on the growth rate of the source countries. We incorporate the foreign direct investment and the policy variables into the panel model and also their interactions with the high-skilled emigration rate, as they are related to the network externality that may be created by the high-skilled emigrants working abroad. We apply the static fixed-effects model and compare it with the results obtained in the dynamic panel model with system generalized methods of moments estimators. We find the negative effect of the high-skilled emigration rate by itself and in its interaction with the foreign direct investment only in the dynamic model. However, we find positive coefficient for the interaction of the high-skilled emigration rate and the civil liberties index, which holds across the static and dynamic specifications. This implies that the effect of the high-skilled emigration rate on the growth rate of the source countries can be positive, and the extent is larger for countries with 'poor' civil liberties. The developing countries with low levels of foreign direct investment inflows and 'poor' civil liberties can best benefit from the high levels of skilled emigration outward. Through finding significant interactions with other variables, we confirm that the high-skilled emigration should be considered along with other related variables in measuring its impact on growth. The implications offer suggestions for the international trade and aid policies.

Keywords: High-skilled Emigration, Brain Drain, FDI, Democracy, Growth Rate
JEL classification: O15, O43, O50

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I. INTRODUCTION

International migration has become a central issue in global society as it can cause other problems as well as serve as a solution for shortage in workforce. An example of a recent problem is that of the Syrian refugees, about a total of 2 million, who have spread out to all over Europe. The problem of illegal immigrants from Latin American countries, such as Mexico, is not new to the U.S. On the other hand, East Asian countries like Japan and South Korea are facing the problem of aging population and World Bank report (2016) suggests the adoption of young immigrants to maintain the supply of labor force. The rate of immigrant population is very low in both countries, at 1.1% for South Korea and 1.7% for Japan in 2015.

There is a reason why the two countries have restricted the inflow of immigrant population. Accepting immigrants has many implications for the destination societies and economies, such as the openness of culture and the risk of terrorist attacks. Most importantly, the incoming immigrants under the work visas play a role in the economies of the destination countries. They imply an increase in the supply of the labor force, which ultimately changes the equilibrium in the labor market. Hence, the policies governing the international migration have to be carefully implemented, and it would also be helpful and necessary for various international organizations to keep evaluating the implication for the health of the global society as well as that of each country.

International institutions such as International Monetary Fund and World Bank as well as many scholars and researchers have studied the economic perspective of the migration problem. On the receiving side of the problem, it is a well-established belief from a simple economics theory that the supply of immigrant labor increases competition in the job market and increases the unemployment rate. While such an unfortunate event may occur in countries such as New Zealand (Koh, 2015), the influx of immigrant labor may be a requirement for higher production outputs in other societies that are experiencing fast growth. Even so, this is still not a complete picture of the international migration. There are many other considerations on both sides of the migration, the destination and the source economies. Highly developed nations are in the position to benefit from sourcing highly intellectual individuals from out of the country. They can promote innovation and growth using the infrastructure and technology that they already have in place. Capable workers from poorer countries who seek employment in these posts would be helping the

firms in the country that they work for, and at the same time the higher wages they earn would certainly bring income to their home countries. In the case of very poor countries, the remittances sent from citizens working abroad may in some instances be enough to end poverty and bring sustainable economic development.

Currently, many professionals including scientists, engineers and physicians from developing countries work and earn income in the United States, Canada and West Europe (Carrington and Detragiache, 1999). The phenomenon of skilled labor moving to the highly developed countries in order to seek better career opportunities is called *brain drain*. Often defined as the international transfer of resources in the form of human capital, brain drain mainly applies to the migration of relatively highly educated individuals, and this movement is typically from lower-income countries to higher-income countries (Beine et al., 2008). There have been many studies on the economic factors that affect the skilled workers' decision to move to the developed countries to work there (Lee, 2006; Narayan and Smyth, 2006; O'rourke and Sinnott, 2006; Gibson and McKenzie, 2011; Lee, 2013). Other works by economists have focused on the economic impacts on the destination countries in various contexts (Beine et al., 2001; Feridun, 2004; Borjas, 2005; Card, 2005; Beine et al., 2008).

The effect on the destination countries has received much attention because it has border control policy implications. However, the other side of the problem has not been investigated as in depth in literature, perhaps because the problem of its citizens emigrating out to other countries is not under the control of the government in most democratic/civilized nations. Nonetheless, the problem of losing educated human resources can have a serious implication for sustained growth and innovation of the country. In order to answer the questions on the perspective of the source country and possible implications, this study attempts to address the variances in literature about the effect on the source countries that the high-skilled workers leave behind.

Other factors have been identified in literature as being related to the high-skilled emigration, and they include foreign direct investment (FDI) and policy variables. While some prior studies provide a facet of the problem surrounding the high-skilled emigration, often considering one channel of the effect or narrowly defined regional or local effects, the literature providing a fuller picture of the supply-side problem is lacking. Our work wishes to address this gap in the literature by extending the scope of the analysis to the entire database of all existent countries and to prior

years from 1975, which is as far as the data are available. An anecdotal speculation that a certain medium-income country would stop growing because of many of its high-skilled workers leaving the country for better opportunities abroad has called for our attention in recent years. The result of this research provides answers for whether the speculation is correct, and the actual impact on the growth rates can be examined for different groups of countries in varying socioeconomic statuses.

The remainder of the paper is organized as follows. Section 2 provides the literature review on the underlying theories of high-skilled emigration. Section 3 explains the variables and the data used in the study. Section 4 introduces the panel model and Section 5 covers the results of the analysis. The paper provides discussion, including the implications and limitations, and concludes in Section 6.

II. LITERATURE REVIEW

1. Economic Impact in Source Countries

According to Docquier and Marfouk (2006), there were 20 million highly skilled emigrants living in the OECD countries, a 63.7% increase in the last ten years compared to only a 14.4% increase for unskilled emigrants. While the economic impact of the high- skilled migration on the US labor market has been thoroughly studied (Borjas, 2005; Card, 2005; Borjas et al., 2012), there are contrasting literatures on the impact of the high- skilled emigration on the various source countries. Although a number of papers have been written on the subject in the past decades, some papers claim that the effect is negative while others find positive results. This is at the center of the intellectual quest we set out to answer in this paper. We first examine the related literature in detail.

A traditional research of brain drain on source countries is done by Bhagwati and Hamada (1974), and their argument is that it is possible that the average product of labor and per capita income might fall due to the emigration of educated labors. Moreover, a more recent OECD report in 2001 supports Bhagwati and Hamada's idea by claiming that the absence of R&D-related human capital, due to the brain drain phenomenon, may slow down the source country's innovative performance and disrupt the research base (OECD, 2001). As a result, the number of students who are willing to acquire college and graduate education might possibly decrease when faced with the lack of opportunities at home countries. Groizard and Llull

(2006) state that when the high-skilled labor emigrates to developed countries, there will be a harmful influence in forming human capital in the source country.

In contrast to the negative claims made in the aforementioned papers, some researchers have shown that there are positive impacts of brain drain on the source countries, and thus renamed it to 'brain gain' or 'brain bank'. Beine et al. (2001) and Stark et al. (1997) commonly explain that there are several positive and feedback effects in the presence of emigrated high-skilled labors. Emigration eventually increases the accumulation of human capital when the benefit of investing in education is broadened especially in the developing countries. When the expected income is higher because of the opportunities to work at higher-income countries abroad and achieve a higher standard of living, the incentive to invest more heavily in higher education rises and the average education level of the population also follows. This improves the human capital in the source countries that is essential in promoting economic growth.

Feedback effects also exist through several mechanisms. Many high-skilled emigrants working abroad send remittances to their home countries (Cinar and Docquier, 2004). Transfer of funds should promote economic growth in developing nations. Remittances help alleviate poverty and improve the standard of living for families left behind at home countries, and may also enable the family members to get more education. When the high-skilled workers return home after years of studying and/or working at other countries, they bring with them the skills and the knowledge they acquired through the experience abroad, and they serve as the advanced human resources critical for innovation and growth of the source countries (Stark et al., 1997; Beine et al., 2001). However, Beine et al. (2001) acknowledge that this effect is lost when the high-skilled workers decide to remain in the destination countries.

Another feedback effect may occur through the creation of business networks. Rauch and Trindade (2002) and Stark et al. (1997) state that through the influences of the returned high-skilled workers and the diasporas pervasive throughout the highly-developed countries, often new technology and resources for innovation are transferred from those highly-developed countries to the source countries. This creates a network of high-skilled workers linked by their origin and further makes it possible for FDI and business/trade contracts to occur between the destination and source countries.

While many papers have investigated the effect of high-skilled emigration on the source countries, our conclusion from this literature is that there are contrasting claims

in them and that the phenomenon is complex with many mixed and feedback effects. Hence, we aim to address this question by collecting all available historic emigration data for all countries (which have become available only in recent years), and by constructing an empirical estimation model that attempts to embody a fuller picture of the phenomenon. Other factors that are included in our estimation model that may be related to the high-skilled emigration's impact on the source countries are explained in the next subsections, and incorporating them into the model enables us to empirically examine whether the hypothesized network effects are indeed present.

2. Emigration and Foreign Direct Investment

In between 1990 and 2000, an increase in international trade and global FDI flows has been twice and six times that of the world output, respectively (Kugler and Rapoport, 2004). These statistical figures highlight the importance and the fast growth of trade between countries, and its implication for developing countries is supposedly much more significant. FDI can act as a source of private external finance for developing countries but perhaps, the most important aspect of FDI may be that it implies the transfer of production technology, skills, innovative capacity, organizational and managerial knowledge as well as an access to the international marketing networks. When the highly skilled emigrants play the role of transferring the skills and the technology to their home country, this is known as 'diaspora externality' as explained by Docquier and Lodigiani (2010). According to Docquier and Lodigiani, diaspora externality is an important channel through which brain drain can positively affect the source countries. Their empirical study has shown that an increase in the emigration rate of the high-skilled labor leads to an increase in the FDI inflow (Doquier and Lodigiani, 2010). An insight from their empirical analysis is that the size of the diaspora is an important factor and that larger countries will likely benefit more from the business externalities.

This theory is in contrast to the traditional theory that Samuelson (1948) explains in his work: the relationship between migration and trade (FDI) is a relationship of substitutability, because trade contributes to factor price equalization and therefore, it lowers the incentives for factor mobility. At the same time, factor mobility reduces price difference and the scope of the trade. A more recent study by Aroca

and Maloney (2005) is in agreement with Samuelson that migration and FDI are negatively related since FDI and trade variables are substitutes for labor inflows.

Other recent studies about migration and FDI focus on the complementary relationship. Gould (1994) argues that trade and migration appear to be complements rather than substitutes. Gould explains that the participation of emigrants in trade network reduces the transaction cost between host and home countries and furthermore, this link encourages future FDI inflow to home countries, which will then foster development and growth in the source countries. Rauch and Casella (2003) also support the complementary relationship of migration and FDI. Rauch and Casella state that diasporas play as conduits for trade, investment, and technology transfer from developed countries to developing countries in several ways. First, diaspora creates trust in a weak international legal environment. Co-ethnic networks provide business community with trusting relationships and prevent potential violation of contracts. Second, diaspora provides market information and referral services. Third, diaspora reduces communication barriers; migrants know the language, the culture, the values, the law, and the practices of their home country. Gao (2003) supports Rauch and Casella's claim by investigating Chinese diaspora externalities. Gao studies the role of ethnic Chinese networks in attracting FDI, and his empirical analysis result shows that 1% point increase in the ethnic Chinese population share in the investing country leads to a 3.7% or higher increase in cumulative FDI inflows to China.

There is a mixed idea about migration and FDI in Kugler and Rapoport (2004) paper. They conclude that skilled migration and FDI inflows are negatively correlated contemporaneously but past skilled migration is associated with an increase in current FDI inflows. The idea is that skilled migration and FDI are substitutes immediately in the match between the firms and the workers, but over a long run the network of high-skilled emigrants is created, which facilitates FDI eventually. Together with the literature on the complementary relationship between emigration and FDI, we hypothesize that high-skilled emigration and FDI are interrelated in the process of both factors affecting the growth of the source countries.

3. Emigration and Policy/Institution

In this section, the underlying theories on the relationship between the high-skilled emigration and the source country's institution quality are reviewed. There are

several papers that study the topic of the home country's policy, but the most prominent and related work is Docquier et al. (2015), which investigates whether emigration and good policy are positively associated and lead to economic growth in source countries.

Docquier et al. (2015) outline that migration affects institutions because it implies an 'exit option' for people. In order to explain what is meant by an exit option, Hirschman's exit and voice theory needs to be reviewed. According to Hirschman (1970), there are two dichotomous options with which people can response to a declining state: either they exit or they voice. To exit means to simply leave the country and to voice means to make noises by complaining, protesting, or organizing internal opposition. Another possible action would be a reverse of exit; people who have exited previously can return home and make up for the loss that they created for their home countries during their absences. Hirschman calls this a 'reversal phenomenon', and Docquier et al. (2015) introduce a successful story of Croatia where Croatian diaspora has made a dramatic institutional change. Many Croatians who had exited the country before returned home and supported their home country economically and politically. They actively participated in raising funds, organizing demonstration, petition, and media campaign, and lobbying activities that they took 12 seats out of 120 seats at the national assembly during the first post-communist election in 1990 and this was ultimately called the Croatian Diaspora Effect.

Although it is well established in literature that good institution plays an important role for economic growth and prosperity (Acemoglu et al., 2005), there are some contrasting claims in literature on the relationship between institution and emigration. According to Li and McHale, emigration can have an indirect effect on institution by influencing the action of people who are educated or willing to be educated (Li and McHale, 2006). As Li and McHale states, highly educated people contribute more to institutional change and they tend to resolve problems through negotiation and voting, rather than through other violent actions. Thus, educated human capital contributes to form less violent and more peaceful politics and this can ultimately lead to political stability (Lipset, 1960). Importance of human capital in relation to institution and growth is studied by several literatures, and one prominent work is Glaeser et al. (2004). Glaeser et al. argue that human capital is a more basic source of growth for a country than the institutions. Their empirical analysis result shows that if there is a greater human capital in a community, then more positive institutional opportunities follow. Their conclusion is that institutions have a second-order effect

on the economic performance (i.e. growth) while the first-order effect comes from the human capital, which shapes the institutional capacities of a society.

While highly educated people can contribute their knowledge and talents to establishing sound policies, the opposite may result when the educated human capital is lost through emigration. Docquier et al. (2015) point out that brain drain can hurt domestic institutional quality since people who emigrate to higher-income countries are typically the upper-middle class and/or highly educated people, and thus a reduced number of human capital ends up participating in politics in the home country. This phenomenon is referred to as a selective process of migration. Addressing the underlying theoretical framework, Docquier et al. (2015) examine the relationship between emigration, institutional quality, and human capital. Their regression results show that the countries with the openness to migration have a positive impact on institutional quality and also human capital has a positive and significant effect on institutional quality. These findings imply that arguments of both Acemoglu et al. (2005) and Gleaser et al. (2004) are supported. However, the skilled emigration shows an ambiguous result on institutional quality. The empirical analysis shows a positive but statistically insignificant effect of the skilled emigration. Hence, the authors run numerical simulation to find out if the positive effect is significant for a certain group of countries yet is being diluted by the other countries with insignificant effects. The marginal effect of the skilled emigration on the institutional quality is shown to be positive and significant in short run for twenty-four countries and they also find that in the long run, even more countries have showed positive and significant effect of the high-skilled emigration on institutional quality. Through the empirical result and the result of the numerical simulation in this paper, the authors offer implications that since emigration prospects provide additional incentives to invest in human capital, the effect of the high-skilled emigration on institutional quality can possibly become positive in certain countries. This effect appears to be pronounced for the countries with moderate levels of institutional quality that have high potential for policy improvement.

Acknowledging that there is a strikingly opposite view on the emigration as a ‘safety valve’, which releases intensity in political system and reduces demand for political improvement in home countries (Hirschman, 1970), it is difficult to ignore the evidences presented in other literatures about the reinforcing effect of emigration on the source countries’ policy environments. Following the arguments in Docquier et al. (2015), we hypothesize that the high-skilled emigration rates and the source

countries' policies are interrelated and together they affect the economic development and growth of the source countries. Local authorities and educated people in home countries can benefit from the high-skilled emigrants' enriching experiences abroad and those emigrants can act as pioneers for institutionalizing democratic and good politics for growth.

III. DATA

1. High-Skilled Emigration Rates

In this research, we are specifically interested in tertiary-educated workforce that is working abroad. Tertiary-educated[1] workforce is defined as the human capital that is at least college-educated. University graduates as well as the workforce with graduate degrees belong to this group. Any college- or graduate-educated individual who is working in another country other than one's home country or the country s/he is a resident of, is of interest in this study.

There are a few sources that provide such high-skilled emigration rates by sending countries. First of all, OECD has published the "Database on Immigrants in OECD Countries" (OECD, DIOC) for 2000 and 2005/2006. The data for 2010/2011 seem to have been gathered, but the high-educated emigration rates have not been calculated or published by OECD yet. This database only represents those immigrants that are working in any one of the OECD countries; while most high-skilled labor seeks jobs at highly developed OECD countries, and hence this emigration rate would account for most of the immigrants globally, this certainly does not capture 100% of emigration taking place. Some countries (such as Hong

[1] The International Standard Classification of Education (ISCED) provides the guideline on the two types of tertiary education: 5A and 5B. Tertiary Education ISCED 5A refers to largely theory-based programs designed to provide sufficient qualifications for entry to advanced research programs and professions with high skill requirements. Duration takes at least three years full-time, though usually four or more years. These programs are not exclusively offered at universities; and not all programs nationally recognized as university programs fulfill the criteria to be classified as tertiary-type A. Tertiary type A programs include second-degree programs, such as the American master's degree. Tertiary education ISCED 5B refers to the programs that are typically shorter than those of tertiary type A and focus on practical, technical or occupational skills for direct entry into the labor markets, although some theoretical foundations may be covered. Minimum duration of the program is two years of full-time study (UNESCO Institute for Statistics, 2011).

Kong and Singapore) are popular destinations for many immigrants yet they do not belong to the OECD classification, and therefore immigrants in those countries are not accounted for.

Another source of emigration rates is by Docquier and Marfouk (2006). In their first version of database release, they have gathered the data on high-educated emigrants to OECD countries, by source countries in year 1990 and 2000. They provide the emigration stock data first, and then provide the emigration rates which are based on the stock and the relevant high-educated population in each country. The data were gathered from Census in each country. The authors claim that there exist some discrepancies in data-collecting practices among the countries and some of them cannot be controlled for. They give detailed information about the definition of each variable as well as the limitations of the data. The extent of the limitations and the implications are given in their paper, and it appears that similar difficulties would also be present in other data sources related to emigration rates. Because Docquier and Marfouk provide the data on emigration stocks in 1990 and 2000, the advantage of this database is the ability to calculate the flow of highly educated immigrants between 1990 and 2000.

Lastly, there is yet another database kept by World Bank, called the "Panel Data on International Migration 1975-2000" (World Bank, 2011). The latest update has been made in 2013. This appears to be a fairly recent update on the effort to collect emigration data by the World Bank. What is unique about this dataset is that it covers the years from 1975 to 2000 by 5 year increments. The emigration rates in such earlier years had not been available in any other databases. The data set provides the emigration stock of the tertiary-educated workers (college-educated or higher) by source country, and uses the same methodology that is employed by the Docquier-Marfouk data set. This project is part of a larger effort to collect previous years' emigration rates by collaborating with the census department in each of the six receiving countries (Australia, Canada, France, Germany, the UK and the US). The information on the emigrants and their education levels are collected from these six representative countries and sorted according to their home countries, so discrepancies are expected to be minimal when compared with the data coming from over 100 countries in the world. We understand that some errors may be present for the earlier years such as in 1970's and 1980's when the record keeping practice was not as rigorous or digitized as is nowadays. The data set is estimated to represent about 77 percent of the world migration during this period. This World

Band data set allows panel analysis by the source country over many years, which can better capture the variability across country and time dimensions. In order to investigate the effect of high-skilled emigration rates on growth rates, for an exhaustive list of countries and for all available years, we use the emigration rates in the panel data published by the World Bank in this research. Use of the panel model would not be possible on any other dataset on emigration rates, due to the lack of the number of years that the emigration rates are published for. The unit of measurement for high-skilled emigration rates in this dataset is also the percentage of the high-skilled labor in a country that has emigrated to countries other than one's own home/birth countries.

2. World Development Indicators

Another popular database maintained by the World Bank is World Development Indicators (World Bank, WDI). WDI provides numerous developmental metrics for a comprehensive list of countries. Many of the variables used in this study have been extracted from the WDI database.

The dependent variable in this study is the growth rate of each country, represented by the annual percentage growth rate of gross domestic product (GDP). The dependent variable is taken for the subsequent year to capture the effect of the explanatory variable in the previous year. Hence, the emigration rate, other explanatory and control variables are for years 1975, 1980, 1985, 1990, 1995, and 2000, while the corresponding growth rate is for years 1976, 1981, 1986, 1991, 1996, and 2001. We try two different measures for the growth rate: 1) annual percentage growth rate of GDP per capita and 2) annual percentage growth rate of GDP. All GDPs are based on constant local currencies, but since the growth rates are percentage changes from the previous year, variations in currencies among the countries do not matter. GDP per capita is calculated by dividing the GDP by midyear population. Using the growth rate in GDP per capita as the dependent variable controls for the possible changes in population within a year. Also, per capita GDP is one of the control variables, so the growth rate in per capita GDP seems to be the corresponding dependent variable in this case. On the other hand, many of the explanatory and control variables are expressed as percentages of GDP of the whole country, and thus the growth rate of GDP as an entire country appears to be more consistent in this case. We investigate both measurements of the dependent variable and find that results do not vary

much, likely because the population change is gradual in most nations and such change within a year is marginal.

One of our explanatory variables, the foreign direct investment (FDI), is also extracted from the WDI. The FDI is the net inflows from foreign investors, and our measure is represented as percentage of GDP. Other control variables also taken from the WDI database are: per capita GDP, secondary school enrollment, urbanization, and trade. GDP per capita is GDP divided by midyear population, and is in units of constant 2005 US Dollars. Secondary school enrollment is the gross percentage of total enrollment, regardless of age, out of the population of the age group that officially corresponds to the secondary education. Secondary school is the 9th-12th year of education after primary (elementary) education but before entering tertiary (college or graduate school) education, and in most countries corresponds to high school education. Urbanization is the percentage of population living in urban areas, and represents the degree of urbanization in each country. Trade is the sum of imports and exports of goods and services and is measured as the percentage of GDP. This variable represents the openness of each country in its trade activities with other nations.

3. Freedom in the World Indexes

Freedom House is a non-partisan and non-governmental organization that advocates and conducts research on democracy, political freedom, and human rights. The organization publishes a number of reports and "Freedom in the World" is its flagship publication that has been reported annually since 1973 (Freedom House, 2015b). The report includes comparative assessment of political rights and civil liberties in 195 countries worldwide. The political rights index and the civil liberties index are each assessed on a 1 to 7 scale, with 1 being the most free and 7 being the least free. The indexes are based on survey results that consider the following items for each index: meaningful process by which chief authority and legislature are elected, fairness in election laws and campaigning opportunity, reflection of voter preference in distribution of power, absence of military or foreign control, etc. for the political rights index, and freedom of open public discussion, assembly and demonstration, freedom of political censorship in media and literature, nondiscriminatory rule of law, protection of personal property rights, freedom of trade unions and businesses, freedom from unjustified terror or imprisonment, etc. for the civil

liberties index. The rating process of index is composed of a total of 12 political rights questions and 15 civil liberties questions. For political rights questions, 0-12 points are assigned for electoral process, 0-12 points for political pluralism and participation, 0-12 points for functioning of government, and two discretionary questions each ranging from 0 to 4 and -4 to 0 points. For civil liberties questions, 0-16 points are assigned for freedom of expression and belief, 0-12 points for associational and organizational rights, 0-16 points for rule of law, and 0-16 points for personal autonomy and individual rights. Readers are referred to the Freedom House website documentation on the survey methodology for more information on the actual questions used for each category of surveys (Freedom House, 2015a). The highest score that can be awarded to the political rights survey is 40, and the highest score that can be awarded to the civil liberties survey is 60. The total scores and the corresponding PR and CL ratings are shown in Table 1. Both indexes for all available countries for years 1975, 1980, 1985, 1990, 1995, and 2000 are used in this study.

Table 1. Total Survey Scores and PR and CL Rating Indexes

Political Rights (PR)		Civil Liberties (CL)	
Total Scores	PR Rating	Total Scores	CL Rating
36-40	1	53-60	1
30-35	2	44-52	2
24-29	3	35-43	3
18-23	4	26-34	4
12-17	5	17-25	5
6-11	6	8-16	6
0-5	7	0-7	7

Summary of all variables used in this study, including the definitions and the descriptive statistics, are shown in Table 2.

Table 2. Summary of Variables

Variable		Obs	Mean	Std. Dev.	Min	Max	Source
PGDPGR	Annual Growth Rate in Per Capita GDP (%)	951	1.758	7.048	-64.997	92.361	World Bank WDI
GDPGR	Annual Growth Rate in GDP (%)	951	3.629	7.154	-64.047	88.958	World Bank WDI
EMI	High-skilled Emigration Rate (% of Tertiary-educated Population That Have Emigrated To Other Countries)	1079	19.089	22.583	0	100	World Bank Panel Data

Table 2. Continued

Variable		Obs	Mean	Std. Dev.	Min	Max	Source
FDI	Foreign Direct Investment, Net Inflows (% of GDP)	817	2.362	5.582	-25.782	89.476	World Bank WDI
PR	Political Rights Index (1=Most Free, 7=Least Free)	991	3.923	2.248	1	7	Freedom House
CL	Civil Liberties Index (1=Most Free, 7=Least Free)	991	3.925	1.937	1	7	Freedom House
PGDP	Per Capita GDP (Constant 2005 US Dollars)	933	8952.496	15159.080	68.567	122438.500	World Bank WDI
SSE	Secondary School Enrollment (Gross % of Enrollment in Secondary School, Based on the Age Group for Secondary -education)	745	57.589	33.487	0.643	160.619	World Bank WDI
URBAN	Urbanization(% of Population Residing in Urban Area)	1140	48.675	24.568	3.525	100	World Bank WDI
TRADE	Trade (Imports + Exports, as % of Total GDP)	898	79.177	51.579	1.085	411.035	World Bank WDI

4. Included Countries and All Available Data

This study is targeted for all existent and listed countries in the world for which data are available. The countries considered in the analysis are listed in Table 3, categorized by income levels. The classification is based on gross national income (GNI) per capita and follows the World Bank Atlas method (World Bank, Country Classification). Holy City (Vatican City), Nauru, and occupied Palestinian territory are omitted because they are not listed as independent economies in some databases. Serbia and Montenegro are also omitted from this analysis, because they underwent separation during the years studied here and hence some variables such as the emigration rates are not consistent throughout.

Some countries are completely omitted from the final dataset because the data for all variables used in this study were not available for any of the six years. These countries are denoted within Table 3. Many of the countries have only a few years, out of all six, included in the final dataset, while some high-income countries as well as other countries supposedly with good record-keeping practices have all six years of data included. The average number of years included for each country is

3.6. The number of countries in the final dataset is 154, and the number of all observations is 562.

Data seem to be more frequently available for recent years such as 1995 and 2000 for high-income countries, but this trend is also found in upper-middle and lower-middle-income countries. There seems to be no apparent selection bias caused by the availability of data. The exhaustive list of all countries and for which years the data were available to be used in this study can be found in Appendix.

Table 3. List of Countries by Income Groups

(World Bank categorization based on Gross National Income per capita).

Low-Income Economies ($1,045 or less)			
Afghanistan†	Congo, Dem. Rep.	Liberia	Rwanda
Benin	Eritrea†	Madagascar	Sierra Leone
Burkina Faso	Ethiopia	Malawi	Somalia†
Burundi	Gambia, The	Mali	Tanzania
Cambodia	Guinea	Mozambique	Togo
Central African Rep.	Guinea-Bisau	Nepal	Uganda
Chad	Haiti†	Niger	Zimbabwe
Comoros†			
Lower-Middle-Income Economies ($1,046 to $4,125)			
Armenia	Guatemala	Moldova	Sri Lanka
Bangladesh	Guyana	Morocco	Sudan†
Bhutan†	Honduras	Myanmar (Burma)†	Swaziland
Bolivia	India	Nicaragua	Syrian Arab Rep.
Cabo Verde	Indonesia	Nigeria	Tajikistan
Cameroon	Kenya	Pakistan	Timor-Leste (East Timor)†
Congo, Rep.	Kiribati	Papua New Guinea	Ukraine
Côte d'Ivoire	Kyrgyz Rep. (Kyrgyzstan)	Philippines	Uzbekistan
Djibouti	Laos	Samoa	Vanuatu
Egypt, Arab Rep.	Lesotho	São Tomé and Principe†	Vietnam
El Salvador	Mauritania	Senegal	Yemen, Rep.†
Georgia	Micronesia, Fed. Sts.†	Solomon Islands	Zambia
Ghana			

Table 3. Continued

Upper-Middle-Income Economies ($4,126 to $12,735)			
Albania	Cuba†	Libya†	Peru
Algeria	Dominica	Macedonia, FYR	Romania
Angola	Dominican Rep.	Malaysia	South Africa
Azerbaijan	Ecuador	Maldives†	St. Lucia
Belarus	Fiji	Marshall Islands†	St. Vincent and the Grenadines
Belize	Gabon	Mauritius	Suriname
Bosnia and Herzegovina†	Grenada	Mexico	Thailand
Botswana	Iran, Islamic Rep.	Mongolia	Tonga
Brazil†	Iraq†	Namibia	Tunisia
Bulgaria	Jamaica†	Palau	Turkey
China	Jordan	Panama	Turkmenistan†
Colombia	Kazakhstan	Paraguay	Tuvalu†
Costa Rica	Lebanon†		
High-Income Economies ($12,736 or more)			
Andorra†	Estonia	Liechtenstein†	Seychelles
Antigua and Barbuda	Equatorial Guinea	Lithuania†	Singapore†
Argentina	Finland	Luxembourg†	Slovak Rep.
Australia	France	Macao SAR, China†	Slovenia
Austria	Germany	Malta	Spain
Bahamas, The	Greece	Monaco†	St. Kitts and Nevis
Bahrain	Hong Kong SAR, China†	Netherlands	Sweden
Barbados	Hungary	New Zealand	Switzerland
Belgium†	Iceland	Norway	Taiwan, China†
Brunei Darussalam (Brunei)†	Ireland	Oman	Trinidad and Tobago
Canada	Israel	Poland	United Arab Emirates†
Chile	Italy	Portugal	United Kingdom
Croatia	Japan	Qatar	United States
Cyprus	Korea, Rep.	Russian Federation	Uruguay
Czech Republic	Kuwait	San Marino†	Venezuela
Denmark	Latvia	Saudi Arabia†	

†: Countries that were excluded due to missing data.

IV. METHODOLOGY

1. Fixed-Effects Panel Analysis

We use the panel model to test the effect of high-skilled emigration in relation with FDI and policy variables. The panel model allows us to capture each country's individual characteristics, and hence is more suitable than the cross-sectional analysis. The sufficient number of observations gathered over the 25-year period makes it possible to utilize the panel structure. In this first part of the analysis, we focus on the static panel analysis and we do not model the time effect, because 1) the panel is unbalanced and in fact many countries have only one or two years of data available, and for the countries that have three to five years of data, those are not necessarily consecutive series; 2) the data are available for every five year increments (limited by the availability of the emigration rates data), and thus autocorrelation in the time series should not be strong.

We capture the inter-relation between the high-skilled emigration rate and the FDI through an interaction term. Likewise, we allow the emigration rate to interact with each of the two possible policy variables, the political rights and the civil liberties indexes. Hence, the explanatory variables that go into the model include: the high-skilled emigration rate, FDI, policy, the interaction of high-skilled emigration rate and FDI, and the interaction of high-skilled emigration rate and policy. The dependent variable is the growth rate in the following year. Other control variables that may affect the growth rate include: per capita GDP, secondary school enrollment, urbanization, and trade. Another variable that is found in literature as affecting the growth of a country is the investment into research and development. However, R&D is omitted from our model because the data are not available for many countries, especially for older years. Understandably, many of these omissions would represent zero investment into R&D for low-income countries. Even for more established nations, the value for R&D investment appears to be more frequently available for only recent years. Considering that R&D activities mainly affect long-term growth, the effect of R&D in the subsequent year's growth rate is expected to be limited, and hence we also expect any omitted variable problem caused by excluding the R&D from the model to be minimal.

The rationale behind using a fixed-effects model is that each country has an inherent unobserved characteristic that is time-persistent and may affect other variables in the model. This individual characteristic should be unique to each country and should not be correlated with other countries' characteristics. The fixed-effects model appears to be appropriate because we are interested in understanding how changes in the predictors affect the outcome variable within each country, and the scope of our analysis is the exhaustive list of all countries (as far as data availability permits) and not just a sample of countries. On the other hand, the random-effects model assumes the variations across countries to be random, and the individual effects to be uncorrelated with other regressors; this sounds unlikely for our data. In order to test which model is appropriate, we run the Hausman test on all versions of our model. The null hypothesis is strongly rejected in all cases, and we confirm that the fixed-effects model is suitable for our analysis.

The first version of the model is shown below.

Model (1):

$$PGDPGR_{i,t+1} = \beta_1 EMI_{it} + \beta_2 FDI_{it} + \beta_3 PR_{it} + \beta_5 (EMI_{it} \times FDI_{it}) + \beta_6 (EMI_{it} \times PR_{it}) + \beta_8 PGDP_{it} + \beta_9 SSE_{it} + \beta_{10} URBAN_{it} + \beta_{11} TRADE_{it} + \alpha_i + \varepsilon_{it},$$
$$\text{for } t = 1975, 1980, 1985, 1990, 1995, 2000 \text{ and } i = 1, \dots, 154$$

where *PGDPGR* is the growth rate in per capita GDP, *EMI* is the high-skilled emigration rate, *FDI* is the foreign direct investment, *PR* represents the political rights index, *PGDP* is per capita GDP, *SSE* is secondary school enrollment, *URBAN* is urbanization, and *TRADE* is the sum of imports and exports. All variables are yearly values for each country *i*, and are available for years *t* = 1975, 1980, 1985, 1990, 1995, and 2000, except that the corresponding growth rates are for years *t* + 1 = 1976, 1981, 1986, 1991, 1996, and 2001.

In an alternative formulation, we substitute the civil liberties index instead of the political rights index.

Model (2):

$$PGDPGR_{i,t+1} = \beta_1 EMI_{it} + \beta_2 FDI_{it} + \beta_4 CL_{it} + \beta_5(EMI_{it} \times FDI_{it}) + \beta_7(EMI_{it} \times CL_{it}) + \beta_8 PGDP_{it} + \beta_9 SSE_{it} + \beta_{10} URBAN_{it} + \beta_{11} TRADE_{it} + \alpha_i + \varepsilon_{it},$$
$$\text{for } t = 1975, 1980, 1985, 1990, 1995, 2000 \text{ and } i = 1, \dots, 154$$

where CL stands for the civil liberties index.

Model (3) and (4) are the parallel versions of model (1) and (2), except that the dependent variable is the annual growth rate in GDP instead of per capita GDP. The formulations follow.

Model (3):

$$GDPGR_{i,t+1} = \beta_1 EMI_{it} + \beta_2 FDI_{it} + \beta_3 PR_{it} + \beta_5(EMI_{it} \times FDI_{it}) + \beta_6(EMI_{it} \times PR_{it}) + \beta_8 PGDP_{it} + \beta_9 SSE_{it} + \beta_{10} URBAN_{it} + \beta_{11} TRADE_{it} + \alpha_i + \varepsilon_{it},$$
$$for\ t = 1975, 1980, 1985, 1990, 1995, 2000\ \ and\ \ i = 1, \dots, 154$$

and Model (4):

$$GDPGR_{i,t+1} = \beta_1 EMI_{it} + \beta_2 FDI_{i\square} + \beta_4 CL_{it} + \beta_5(EMI_{it} \times FDI_{it}) + \beta_7(EMI_{it} \times CL_{it}) + \beta_8 PGDP_{it} + \beta_9 SSE_{it} + \beta_{10} URBAN_{it} + \beta_{11} TRADE_{it} + \alpha_i + \varepsilon_{it},$$
$$\text{for t} = 1975, 1980, 1985, 1990, 1995, 2000 \text{ and } i = 1, \dots, 154$$

where *GDPGR* is the growth rate in GDP. Hence, Model (3) and (4) also include possible changes in population within its dependent variable, but represent more macroscopic country-wide changes in the growth rates. Since the estimation equations include independent variables that are both per capita basis (per capita GDP) as well as country-wide basis (trade as a percentage of total GDP), the choice of either version of the growth rate is arbitrary.

2. Dynamic Panel Analysis

The shortcoming in using a simple fixed-effects panel model is that the variables in this study may cause endogeneity problem. For example, civil liberty may cause growth, which then may enhance civil liberty in return. All three variables that are

used as proxies for the channels through which emigration rates may affect growth (foreign direct investment, political right, and civil liberty) may indeed be correlated with error realizations in previous and/or current years. In order to address these possibly endogeneous variables, we run dynamic panel analysis in the same data set. Previous growth rate is added as an explanatory variable, which gives the model a dynamic structure. We add the year dummies and divide the independent variables into a set of endogenous and exogenous variables. The dynamic panel specification takes the following form in general:

$$y_{it} = \beta_1 y_{i,t-1} + \beta_2 X_{it} + \beta_3 Z_{it} + u_{it}$$

where X_{it} represents a set of endogeneous variables, Z_{it} represents a set of exogenous variables, and u_{it} includes unobserved country-specific effects and the errors. In our study, the unit of time in the dynamic structure is 5 years, i.e., all variables are set to evolve with a 5-year period. Although some variables have annual data available, the high-skilled emigration rates are only available for every 5 years during 1975-2000, which limits the data set for use in the dynamic model as well. The endogenous variables for our study include foreign direct investment, political rights index, and the civil liberties index. The exogenous variables are the high-skilled emigration rates, per capita GDP, secondary school enrollment, urbanization, trade, and the year dummies. Emigration rate is taken as an exogenous variable because it is determined by factors outside of the system under study. There is a clear pattern in what influences the high-skilled workers' decision to work abroad (salaries, career prospects, work environment conditions, proximity to home country, similarity in languages, etc.) as discussed in previous literature but those factors are considered external to the model in this study.

The estimators for the dynamic panel model have been developed by Arellano and Bond (1991) and the extension to the system context has been developed by Arellano and Bover (1995) and Blundell and Bond (1998). System generalized method of moments (GMM) includes lagged levels as well as lagged differences as instruments and increases efficiency compared to the difference GMM. We use the system GMM in which all instrumental variables are internal, the coefficients for the autocorrelated dependent variable and the endogenous variables are estimated GMM style and those for the exogenous variables are estimated IV style. We use the improved estimation methods developed by Roodman (2009).

In addition to examining the effect of the explanatory variables on the growth rates in the following year, we also examine the effect on the lagged dependent variable, that are the growth rates 5 years later and 10 years later. Lagged dependent variables are motivated by the possibility that the influence of high-skilled emigration on growth through human capital and knowledge and technology transfer may occur in the long-term. The exact specification used in this analysis for a short-term and two longer-term effect models are shown below.

Dynamic Panel Data (DPD) Model (1): short-term, +1 year

$$y_{i,t+1} = \beta_1 y_{i,t-4} + \beta_2 X_{it} + \beta_3 Z_{it} + u_{it}$$

$$\text{for } t = 1975, 1980, 1985, 1990, 1995, 2000 \text{ and all available } i's$$

DPD Model (2): +5 year

$$y_{i,t+5} = \beta_1 y_{i,t} + \beta_2 X_{it} + \beta_3 Z_{it} + u_{it}$$

$$\text{for } t = 1975, 1980, 1985, 1990, 1995, 2000 \text{ and all available } i's$$

DPD Model (3): +10 year

$$y_{i,t+10} = \beta_1 y_{i,t+5} + \beta_2 X_{it} + \beta_3 Z_{it} + u_{it}$$

$$\text{for } t = 1975, 1980, 1985, 1990, 1995, 2000 \text{ and all available } i's$$

V. RESULTS

1. Multicollinearity

Before we get to the main results, we check for possible multicollinearity problems. The correlations of all variables used in the panel model are shown in Table 4. Some correlations are expected to be high; the growth rate in per capita GDP and the

growth rate in GDP are obviously highly correlated, so are the political rights index and the civil liberties index. These are not problematic since the variables are substitutes of each other for alternative models. The correlation between the interaction term and its constituent is often expected to be somewhat high, which is true for some cases in our data. We also find that some of the control variables are highly correlated, but this is understandable. While each control variable stands for a unique factor, a well-established nation typically has a high per capita GDP, a high level of public education, and a high rate of urbanization, while a low-income and less developed country likely has low levels of all three variables. We confirm that per capita GDP, secondary school enrollment, and urbanization are positively correlated. Trade seems to be independent of the three.

We check the variation inflation factor (VIF) to see if these somewhat high levels of correlations should concern us about the multicollinearity problem that may invalidate our results. Some sources say that VIFs over 10 should be addressed (O'Brien, 2007), while other sources claim that VIFs up to 30 is acceptable (Stata Manual 13). SSE and URBAN consistently have VIFs around 12. These two variables are the pair of control variables with the highest correlation. All other variables, including the interactions, have VIFs well under 10. We can apply mean- centering to SSE and URBAN, which would effectively bring down VIFs to around 3 (Table 5). However, since these variables are stand-alone variables that are not multiplicative (neither interaction nor power terms), mean-centering does not affect the coefficients or the significances. We leave the variables as is for easier interpretations on the coefficients.

Table 4. Correlations of Variables

	PGDPGR	GDPGR	EMI	FDI	PR	CL	EMIxFDI	EMIxPR	EMIxCL	PGDP	SSE	URBAN	TRADE
PGDPGR	1												
GDPGR	0.964	1											
EMI	-0.009	-0.021	1										
FDI	0.145	0.115	0.136	1									
PR	-0.027	0.097	-0.125	-0.150	1								
CL	-0.019	0.111	-0.173	-0.150	0.919	1							
EMIxFDI	0.052	0.030	0.522	0.618	-0.181	-0.198	1						
EMIxPR	-0.040	0.004	0.693	-0.042	0.383	0.296	0.173	1					
EMIxCL	-0.037	0.009	0.753	-0.017	0.294	0.295	0.231	0.940	1				
PGDP	-0.029	-0.133	-0.135	0.092	-0.558	-0.606	-0.009	-0.322	-0.326	1			
SSE	0.020	-0.147	-0.030	0.148	-0.610	-0.633	0.068	-0.323	-0.321	0.695	1		
URBAN	-0.009	-0.112	-0.203	0.013	-0.498	-0.506	-0.059	-0.384	-0.380	0.638	0.740	1	
TRADE	0.172	0.174	0.303	0.339	-0.058	-0.087	0.300	0.061	0.090	0.013	0.123	0.053	1

Table 5. Variation Inflation Factors (VIFs) Before and After Mean-Centering

Pre-Centering				Post-Centering			
Model (1)		Model (2)		Model (1)		Model (2)	
Variable	VIF	Variable	VIF	Variable	VIF	Variable	VIF
SSE	11.93	URBAN	12.25	EMI	7.36	EMI	8.73
URBAN	11.80	SSE	12.11	EMIxPR	5.80	EMIxCL	7.26
EMI	7.80	EMI	9.43	TRADE	5.41	TRADE	5.55
EMIxPR	6.13	EMIxCL	7.78	PR	4.72	CL	4.93
TRADE	5.80	TRADE	5.78	SSE (centered)	3.13	SSE (centered)	3.18
PR	4.84	CL	5.63	EMIxFDI	2.77	EMIxFDI	2.76
PGDP	3.40	PGDP	3.55	URBAN (centered)	2.59	URBAN (centered)	2.58
EMIxFDI	2.81	EMIxFDI	2.79	FDI	2.57	FDI	2.57
FDI	2.57	FDI	2.57	PGDP	2.54	PGDP	2.55
Mean VIF	6.34	Mean VIF	6.87	Mean VIF	4.10	Mean VIF	4.46

2. Fixed-Effects Panel Results

The fixed-effects panel regression results are shown in Table 6. Our main results are as follows. 1) The high-skilled emigration rate does not independently affect the growth rate of the country in the model. The coefficient is consistently negative but is never significant, meaning that it is not significantly different from zero. 2) The FDI positively affects the growth rates, and this is consistently true for all variations in specification. However, the FDI does not seem to interact with the high-skilled emigration rate in affecting the growth rate. 3) The policy variable plays an important role, but the effects of the two indexes are distinct. The political rights index by itself is negatively associated with the growth rate; this means that improving the fairness in political systems (thus lowering the PR index) would promote growth. However, the political structure of a country is not related to the high-skilled emigration rate in its role in influencing the growth rate. On the contrary, the civil liberties index is significant by itself as well as in the interaction with the high-skilled emigration rate. The coefficient for the civil liberties index is negative, while that for the interaction term is positive.

Table 6. Fixed-Effects Panel Regression Results

	DV = Growth Rate in Per Capita GDP		DV = Growth Rate in GDP	
	Model (1)	Model (2)	Model (3)	Model (4)
EMI	-0.0242	-0.0503	-0.0189	-0.0533
	(0.0567)	(0.0560)	(0.0571)	(0.0563)
FDI	0.2125	0.2090	0.1904	0.1869
	(0.0833)**	(0.0828)**	(0.0838)**	(0.0833)**
PR	-0.4381		-0.5119	
	(0.2557)*		(0.2572)**	
CL		-0.8631		-0.9377
		(0.3239)***		(0.3258)***
EMI x FDI	-0.0045	-0.0043	-0.0035	-0.0033
	(0.0029)	(0.0029)	(0.0030)	(0.0030)
EMI x PR	0.0117		0.0108	
	(0.0095)		(0.0096)	
EMI x CL		0.0201		0.0212
		(0.0110)*		(0.0111)*
PGDP	-0.000275	-0.000276	-0.000230	-0.000233
	(0.000085)***	(0.000084)***	(0.000086)***	(0.000085)***
SSE	0.0012	0.0016	-0.0155	-0.0142
	(0.0244)	(0.0241)	(0.0245)	(0.0242)
URBAN	-0.0903	-0.1028	-0.1199	-0.1319
	(0.0571)	(0.0571)*	(0.0574)**	(0.0574)**
TRADE	0.0449	0.0448	0.0431	0.0435
	(0.0127)***	(0.0127)***	(0.0128)***	(0.0128)***
Constant†	6.2730	8.4132	10.4946	12.5794
	(2.8232)**	(2.9749)***	(2.8405)***	(2.9928)***
N	562	562	562	562
N_i	154	154	154	154
R^2	0.5230	0.5280	0.5363	0.5412
Adjusted-R^2	0.3294	0.3363	0.3481	0.3549

*, **, and *** indicate significance at 0.10, 0.05, and 0.01 level, respectively.
† : Constant represents the average value of fixed effects.

Figures 1 and 2 show the interplay between the high-skilled emigration rate and the civil liberties index in affecting the growth rate. The marginal changes in the growth rate are plotted against the high-skilled emigration rate and the civil liberties index, as predicted by our model. Several insights can be drawn from these interactions. As evident from the positive coefficient of the interaction term, the effect of the high-skilled emigration on the growth rate is positive, and this is the only meaningful impact of the skilled emigration under this model, which occurs through the interaction with civil liberties. In other words, increasing the percentage of tertiary-educated people who emigrate to other countries increases the growth rate.

Figure 1. Marginal Effect of High-Skilled Emigration on Growth Rate

The predicted marginal changes in the growth rate of per capita GDP or GDP over the range of high-skilled emigration rate are shown for each civil liberties index, from Model (2).

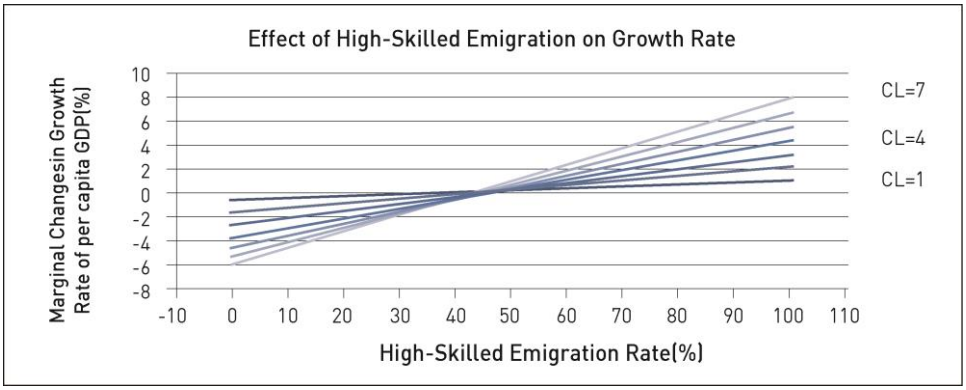
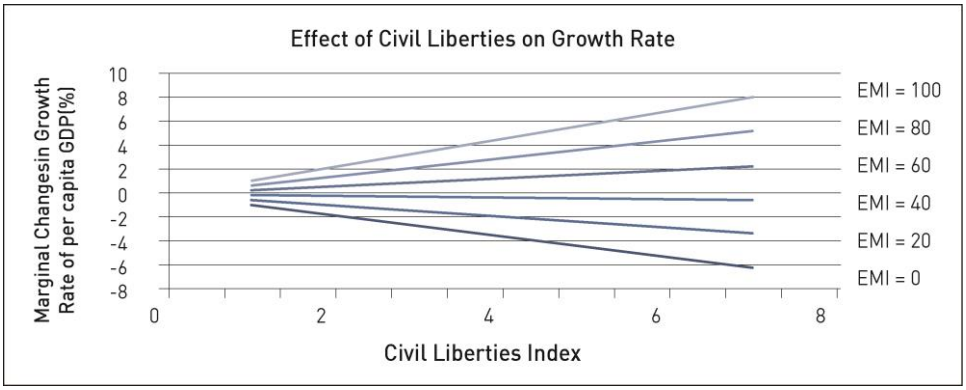


Figure 2. Marginal Effect of Civil Liberty on Growth Rate

The predicted marginal changes in the growth rate of per capita GDP or GDP over the range of civil liberties index are shown for varying levels of high-skilled emigration rate, from Model (2).



However, the extent of this impact depends on the state of the civil liberties in that source country. For countries that have ‘good’ civil liberties (e.g. CL=1 or 2), educated citizens leaving for other countries to learn skills and obtain work experiences benefit the growth of the (already developed) home country mildly. On the other hand, for countries that have ‘poor’ civil liberties (e.g. CL=7 or 6), the effect of the

high-skilled emigration is more positive, indicating that those countries would benefit a lot by sending their top intellects to more developed countries.

The impact of the civil liberties on the growth rate also depends on the level of the high-skilled emigration rates, and the sign of the effect of the civil liberties index changes from (-) to (+) as the high-skilled emigration rate increases. When the brain drain is low, the countries with 'poor' civil liberty structures would have a serious problem with economic growth. However, when the high-skilled emigration rate is at high levels, the countries with 'poor' civil liberty structures benefit from this trade in human capital and would experience faster growth rates.

The overall interpretations give support to the network theory that the high-skilled labors create externalities that are beneficial for the source countries. For already well-developed countries, the benefit of this network effect is smaller, but the impact of the high-skilled emigration is still positive on growth. In other words, it never hurts to send highly educated people abroad. For developing countries, the implication of the high-skilled emigration is larger, and they would leap the most benefit from the externalities created by the emigrated high-skilled workers.

We also find that per capita GDP and urbanization are negatively associated with the growth rates, meaning that, controlling for other factors, an increase in the per capita GDP and the percentage of urban population is associated with a decrease in the growth rate. This likely non-causal relationship may stem from the fact that a lot of the less-developed nations bear a huge potential in achieving high growth while such a possibility would be lower for the already-developed countries. Trade is consistently positively associated with the growth rate, implying that an increase in imports and exports is associated with an increase in the growth rates. This result is in line with the theme of the main result that promoting a network with other nations is helpful for the growth of a country.

3. Dynamic Panel Results

The system GMM results for the short-term effects are shown in Table 7. When the estimation accounts for some of the endogeneous variables, we find slightly different dynamics in the results. It is interesting to compare the results with that found in static panel analysis, and to note what effects persist vs. what are different. We note the following findings. 1) The effect of the high-skilled emigration is more

pronounced. The EMI is by itself significant when the interaction terms are excluded from the model, and has a negative association with growth rates, implying signs of brain drain. When the interaction terms are included, the interaction term of EMI and FDI is significant, which was not found in the static panel model, and the interaction of EMI and CL remains significant with a positive coefficient. The interpretation on the interplay between EMI and CL also remains the same, except that the coefficient is about three times bigger. 2) The sign of the coefficient for EMI x FDI is negative, which was also the case for static panel results, but what was not significant is now strongly significant at 1% level. This implies that for countries with high levels of FDI inflows, the negative effect of high-skilled emigration on the growth rate is higher. For countries that are not receiving much FDIs, the negative impact of brain drain is attenuated. 3) The FDI fosters growth, which conforms to the earlier results we found. Although the coefficient for the interaction with EMI is negative, the coefficient for FDI alone is much higher, so except for the countries with abnormally high levels of emigration rates, the effect of FDI is likely to stay positive. However, an increasing level of the high-skilled emigration diminishes the positive effect of FDI on growth, and can possibly offset the growth-enhancing effect of FDI. 4) The two policy variables have the opposite effects. To be precise, the effect of the civil liberties index, and the effect of its interaction with the high-skilled emigration rate, remains the same in the same direction and increased magnitude, but the effect of the political rights index is reversed. The interaction term with EMI, although insignificant, also had the opposite sign coefficients under the fixed-effects model. Positive coefficients for PR imply that the countries with limited political freedom (non-democratic institutions) have experienced higher growth rates. This relationship likely stems from observational association that some countries with low levels of political freedom (high PR index) have experienced significant economic growth during the periods of 1975-2000.

Longer-term results are displayed in Table 8, in which we do not find interesting associations that we expected. Although the signs of the coefficients are the same for most variables, all of the effects of the explanatory variables and the interaction effects that we observed for short-term have been greatly weakened. We do find significant and positive effect of secondary school enrollment, which was missing in the short-term results. We can infer that the positive effect of human capital investment occurs on a long-term rather than a short-term. The results are similar

for when the lag length of 3 to 4 or 3 to 5 is used in the IV estimation. The coefficients, the significant variables, and the significance levels do not change a lot whether standard or robust errors are used, hence the results for which the specification tests pass with high p-values are shown in Table 8.

Table 7. Dynamic Panel Data System GMM Results

	(1) DV = Growth Rate in Per Capita GDP, +1 year			
	Lag: min 3 / max 4		Lag: min 3 / max 5	
	Std. Err.	Std. Err.	Std. Err.	Std. Err.
L1.PGDPGR	-0.1567	-0.0701	-0.1081	-0.0875
	(0.1212)	(0.1058)	(0.1134)	(0.0976)
EMI	-0.0308**	-0.0698	-0.0336**	-0.0644
	(0.0138)	(0.0507)	(0.0136)	(0.0493)
FDI	0.4574**	0.5187***	0.3781**	0.4942***
	(0.1949)	(0.1935)	(0.1825)	(0.1796)
PR	1.7687**	2.0885**	1.8423**	2.0113**
	(0.8019)	(0.9304)	(0.7884)	(0.8853)
CL	-2.2113**	-2.8389**	-2.4103***	-2.7157**
	(0.9496)	(1.1195)	(0.9256)	(1.0590)
EMI x FDI		-0.0103***		-0.0103***
		(0.0036)		(0.0035)
EMI x PR		-0.0460		-0.0428
		(0.0283)		(0.0274)
EMI x CL		0.0689**		0.0643*
		(0.0350)		(0.0340)
PGDP	-0.000063*	-0.000078**	-0.000068**	-0.000072**
	(0.000034)	(0.000035)	(0.000033)	(0.000034)
SSE	-0.0108	0.0006	-0.0111	-0.0001
	(0.0123)	(0.0125)	(0.0122)	(0.0123)
URBAN	0.0055	-0.0031	0.0022	-0.0033
	(0.0149)	(0.0147)	(0.0146)	(0.0143)
TRADE	0.0201***	0.0248***	0.0212***	0.0257***
	(0.0078)	(0.0078)	(0.0076)	(0.0074)
YR1980	2.5941	2.4737	3.1474	2.3344
	(2.3235)	(2.2411)	(2.2618)	(2.1593)
YR1985	2.9554	2.8173	3.6727	2.6237
	(2.4164)	(2.3418)	(2.3290)	(2.2405)
YR1990	2.0672	2.4507	2.7120	2.2799
	(2.2738)	(2.2242)	(2.1968)	(2.1371)
YR1995	3.6111	3.9146*	4.4351*	3.7127
	(2.4706)	(2.3749)	(2.3649)	(2.2635)
YR2000	2.2830	2.6412	3.1118	2.5522
	(2.5424)	(2.3709)	(2.4377)	(2.2604)

Table 7. Continued

	(1) DV = Growth Rate in Per Capita GDP, +1 year			
	Lag: min 3 / max 4		Lag: min 3 / max 5	
	Std. Err.	Std. Err.	Std. Err.	Std. Err.
N	485	485	485	485
N_i	152	152	152	152
$N_{instruments}$	42	66	46	73
Sargan/Hansen test	0.237	0.189	0.314	0.224
Diff Sargan/Hansen test	0.525	0.134	0.526	0.078
AR(1) test	0.031	0.003	0.015	0.003
AR(2) test	0.296	0.451	0.386	0.411

*, **, and *** indicate significance at 0.10, 0.05, and 0.01 level, respectively.

Table 8. Dynamic Panel Data System GMM Results for Long-term Effects

	(2) DV = GR in PGDP, +5 years		(3) DV = GR in PGDP, +10 years	
	Lag: min 3 / max 4		Lag: min 3 / max 4	
	Robust Std. Err.	Robust Std. Err.	Robust Std. Err.	Std. Err.
L1.PGDPGR	-0.1444	-0.1903	-0.3566 **	-0.1633
	(0.1730)	(0.1292)	(0.1803)	(0.1210)
EMI	0.0014	-0.0331	-0.0221	-0.0419
	(0.0164)	(0.0520)	(0.0200)	(0.0435)
FDI	0.0220	0.3493	-0.1994	-0.0957
	(0.2247)	(0.2323)	(0.1869)	(0.1755)
PR	0.6738	0.5598	0.2461	-0.2164
	(0.8919)	(1.0489)	(0.9221)	(0.8494)
CL	-0.7434	-0.6538	-1.0777	-0.4482
	(0.9733)	(1.2823)	(1.0316)	(1.0444)
EMI x FDI		-0.0044		-0.0036
		(0.0037)		(0.0032)
EMI x PR		-0.0070		0.0117
		(0.0311)		(0.0247)
EMI x CL		0.0243		0.0020
		(0.0373)		(0.0312)
PGDP	-0.000042	-0.000057*	-0.000102 ***	-0.000082***
	(0.000029)	(0.000034)	(0.000035)	(0.000031)
SSE	0.0377***	0.0462***	0.0267 *	0.0273**
	(0.0144)	(0.0154)	(0.0146)	(0.0124)
URBAN	-0.0218	-0.0174	-0.0326 *	-0.0259*
	(0.0159)	(0.0173)	(0.0197)	(0.0136)
TRADE	-0.0040	-0.0062	0.0035	0.0080
	(0.0080)	(0.0086)	(0.0095)	(0.0064)

Table 8. Continued

	(2) DV = GR in PGDP, +5 years		(3) DV = GR in PGDP, +10 years	
	Lag: min 3 / max 4		Lag: min 3 / max 4	
	Robust Std. Err.	Robust Std. Err.	Robust Std. Err.	Std. Err.
YR1980	1.7220	0.7708	6.1085 ***	3.9693*
	(2.2610)	(2.8459)	(2.2935)	(2.1053)
YR1985	1.7371	0.6991	7.4947 ***	5.1772**
	(2.3648)	(2.8905)	(2.3024)	(2.1827)
YR1990	2.5779	1.8008	7.5309 ***	5.2531**
	(2.3251)	(2.9574)	(2.2888)	(2.0956)
YR1995	2.6724	1.3631	8.7054 ***	6.1502***
	(2.4987)	(3.0020)	(2.3771)	(2.2128)
YR2000	3.4427	1.8143	8.3936 ***	5.6176**
	(2.4898)	(2.9640)	(2.5004)	(2.2500)
N	491	491	504	504
N_i	153	153	154	154
$N_{instruments}$	42	66	42	66
Sargan/Hansen test	0.177	0.233	0.166	0.253
Diff Sargan/Hansen test	0.118	0.129	0.544	0.316
AR(1) test	0.011	0.001	0.305	0.000
AR(2) test	0.812	0.568	0.042	0.238

*, **, and *** indicate significance at 0.10, 0.05, and 0.01 level, respectively.

4. Post-Estimation Considerations

In order to confirm that the results are not solely driven by the high-income countries, we considered the groups of countries by income levels. In general, developed countries correspond to the high-income economies as classified by World Bank (Table 3). The rest are considered to be developing countries at GNI per capita of $12,735 or below, and this includes the majority of the countries that are low-income, lower-middle-income, and upper-middle-income economies. When we repeated the analyses excluding the high-income countries, we obtained similar results as what was found for the entire sample. Because the number of the developing countries far exceeds that of the developed countries, the results are driven by those lower-income countries and the interpretations should also apply to those economies.

With the mixed results we find, we offer the following interpretations. The setup of the study does not track the exact flow of the newly emigrated high- skilled workers, but instead measures the effect of the gross percentage of high- skilled workers abroad at each time point. Hence, we should not consider those newly emigrated human capital as the ‘agents’ that will affect the growth of the source

countries in a long-term. Although the theory supports such long-term effects, our study measures whether the changes in the gross stock levels of the emigrated high-skilled workers have associations with the growth rates, and thus such effects seem to be best captured in subsequent years. The stock of the high-skilled workers abroad are considered to be positioned to already take part in the externality creation process, which is why this study aimed to analyze the immediate effects of such changes.

We also point out that growth rates and per capita GDP are very different. It is often considered that highly developed nations would have the advantage in achieving growth, as those nations already have the social and economical infrastructure suitable for faster growth. However, it turns out that the nations with high per capita GDP have low and stable growth rates. These countries have already achieved economical success, and hence there would be a less likely chance to achieve drastic growth any further. On the other hand, for the nations with low per capita GDP, their economic prospects can go very well or very badly. Some countries achieve highly positive growth rates while others experience negative growth, and this variance gets larger for poorer countries. Civil liberties index also shows a surprising association. While it is true that nations with high per capita GDP tend to have good civil liberties index, there are many poor countries at all levels of civil liberty. Growth rate is also quite steady across all levels of civil liberty, except that there are a few outliers with low levels of civil liberty that have experienced notably high or low growth rates.

When we look at the high-skilled emigration rate data across countries in our data set, some countries with very low per capita GDP have experienced extremely high rates of high-skilled emigration in the past. It is also true that some poor countries are still at a low level of high-skilled emigration (e.g. largely due to the economic or political barrier of moving abroad), but all high-skilled emigration rates above 50% occurs for nations with under $30,000 per capita GDP (in constant 2005 US Dollars). The trend is clear; high-skilled human capital in relatively poorer countries is making the international migration, likely to wealthier countries with better opportunities: higher income, better career prospects, higher quality of life, etc. We also find that high levels of emigration rates are observed for all levels of civil liberty, but there is a concentration of relatively good civil liberty nations (CL = 2 and 3) making a high level of outward emigration among the tertiary-educated citizens. We noted above that there are quite a lot of poor nations with good civil liberties. Hence, we can infer that it is the group of poor countries

with relatively good levels of civil liberty that is making the high rates of high-skilled emigration to other countries.

There are a few countries that have experienced exceptionally high or low growth rates, but these outliers are not the countries that have particularly high emigration rates. The relationship between the growth rate and the emigration rate appears to be driven not by these outliers but by the majority of cases with growth rates from -20% to +20%. There are a group of countries with CL = 1~3 and with exceptionally high emigration rates over 50%, that appear to have achieved slightly higher growth rates than the other countries with the same CL index but with lower high-skilled emigration rates. This group may be driving the positive coefficient for the interaction between EMI and CL. The fact that we do not observe that many countries with CL = 4~7 with high rates of high-skilled emigration informs us that the predicted positive effect of the high-skilled emigration in our model hints at the potential for these countries to achieve growth.

We find different results for the effect of civil liberties and the political rights index. Although the two indexes are positively correlated in general, the cases where the values of the two indexes differ by 1 or 2 are quite common, and the difference by 3 is also observed. Furthermore, there is a trend in how these differences between the two indexes occur. For countries with a high level of political freedom (low PR index), the civil liberty tends to be slightly less free. On the other end of the spectrum with the countries with less political freedom, the civil liberty tends to be freer [(PR, CL) = (2, 3) is more common than (PR, CL) = (3, 2), and (PR, CL) = (6, 5) is more common than (PR, CL) = (5, 6)]. This somewhat systematic difference between the two indexes explains that the two variables represent different entities and may have differing effects on the dependent variable.

VI. DISCUSSION AND CONCLUSION

We examine the impact of the high-skilled emigration rate, the foreign direct investment, and the policy variables on the growth rate, and especially pay attention to the interplay of the emigration rate with the FDI and the policy variables. Interesting insights are discovered in its interplay with the civil liberties index. We find that the effect of the high-skilled emigration is positive through this interaction, and the degree of the impact depends on the civil liberty structures of

the source country; the countries that have 'poor' civil liberty would experience faster growth when the high-skilled emigration increases. The direction of the effect of the civil liberty on the growth rate depends also on the level of the high-skilled emigration; in a restricted environment where people do not emigrate to developed nations, the 'poor' civil structure damages the growth rate, while in an open environment where educated people emigrate freely to higher-income nations, the countries with 'poor' civil liberties are positioned to actually achieve the highest growth rates.

The high-skilled emigration rate is found to interact with the FDI when the endogeneity of the variables are accounted for in the dynamic panel model. The effect of the high-skilled emigration in this context is negative, and this decrease in growth rate caused by the educated workers leaving the home country is mitigated for countries that have yet to receive much foreign direct investments. Put the other way, the growth-enhancing positive effect of the FDI is reduced for countries that have high levels of tertiary-educated workers leaving for better opportunities abroad. Possible interpretation can be that the high levels of the high-skilled emigration imply a void in the human capital that can achieve faster growth through receiving capital investments and knowledge/technology transfer. This result is in agreement with Kugler and Rapoport (2004), in that the high-skilled emigration and the FDI are negatively related contemporaneously and work as substitutes. Although it may be true that the externalities created by the emigrated workers generate FDI inflows to the source countries on a long run (Kugler and Rapoport, 2004; Docquier and Lodigiani, 2010), such investments do not seem to generate proportionate levels of growth, as evidenced by the subsequent years' growth rates.

In summary, we find that FDI and good civil liberty supports growth, while high-skilled workers emigrating out of the country harms growth rates. However, by examining the interplay between emigration rates and other variables, we find that high levels of high-skilled emigration rates can be beneficial to countries with low levels of civil liberty, and the harmful effect of brain drain is mitigated for countries for which the FDI inflow is low. Overall, openness, as represented by the trade of goods and services (imports and exports), human capital (high-skilled emigration) in some instances, and funds (foreign direct investment), appears to foster growth.

Our analysis pulls data from multiple sources, and incorporates all available data for all existent countries. We first use the fixed effects panel model that captures the time-invariant country-specific effects, which is appropriate and fits the data well. The panel specification is more suitable than using the cross-sectional model on pooled data for this problem. Our econometric specifications address the network and feedback effect of the high-skilled emigration, together in the model for predicting the growth rates. Many of our variables are macro-economic variables, yet we found significant associations between some explanatory variables. Next we apply the dynamic panel model structure that addresses the possible endogeneity problem. We find some new insights from this result, namely the brain drain effect of the high-skilled emigration and its negative interaction with the FDI, but the positive and significant coefficient for the interaction term of EMI and CL is confirmed to hold true for both static and dynamic estimation models. The positive interaction of EMI and CL hints that supporting the highly skilled people of the developing countries to be able to study and work abroad, for example by hiring those workers, may benefit the developing nations and help them achieve faster growth rates. This has implications for another form of foreign aid that may be effective in promoting growth in developing nations, and merits further empirical research in this area as more refined emigration data become available.

Our work is not without limitations. There are some countries that are omitted from the analysis because they had missing data. Although there appears to be no bias in the omitted countries, it would be better to incorporate all countries into the analysis, perhaps by filling in estimated values for the missing variables if possible. In the history of the years studied, some economies experienced abrupt changes in political regimes and underwent changes in emigration laws. Our method does not control for such events for each of those nations. Remittance is another channel through which the high-skilled workers abroad can affect their home countries' economic growth. This variable is not included in the study because many missing data especially for older years reduce the sample size greatly. Although the dynamic panel model accounts for the endogeneity among the variables, short-term effects are not free from outside forces, namely the economic fluctuations and the world-wide prosperity that was observed during the study period. It is important to note that the empirical results only provide support for the association of the variables, and any causal relationships must be drawn from theoretic developments in the literature.

We find an insightful and meaningful relationship between the high-skilled emigration rate and the civil liberties index, but not with the political rights index. So what distinguishes the civil liberties index from the political rights index? Although the two indexes are obviously positively correlated, there are some distinct differences in the categories of the constructs they measure. Examining the actual questions used by Freedom House in evaluating the two indexes for all countries may give us some answers. While the questions for the political rights index measure the fairness and the oppressiveness of the political system in a country, the questions for the civil liberties index are more closely related with the implications for engaging in economic activities in a given nation. We speculate that this is the critical difference because the network externalities created by the high-skilled workers and its impact on the growth rate are of an economic matter.

Appendix. Countries and Years Included in the Final Data Set of the Fixed-Effects Panel Study

Data available for:	1975	1980	1985	1990	1995	2000
Low-Income Economies ($1,045 or less)						
Afghanistan						
Benin	O	O	O			O
Burkina Faso	O	O	O	O		O
Burundi			O	O		
Cambodia						O
Central African Rep.		O	O	O		
Chad			O	O	O	O
Comoros						
Congo, Dem. Rep.	O	O	O		O	
Eritrea						
Ethiopia					O	O
Gambia, The		O	O	O	O	
Guinea				O		
Guinea-Bisau			O			O
Haiti						
Liberia	O	O				O
Madagascar		O		O		
Malawi	O	O	O	O	O	O
Mali	O	O	O	O	O	O
Mozambique		O	O	O	O	O
Nepal		O	O	O		O
Niger	O	O		O		O
Rwanda		O	O	O		O
Sierra Leone	O	O	O	O		
Somalia						
Tanzania					O	
Togo	O	O	O	O	O	O
Uganda			O	O	O	O
Zimbabwe	O	O	O	O	O	O

Appendix. Continued

Data available for:	1975	1980	1985	1990	1995	2000
Lower-Middle-Income Economies ($1,046 to $4,125)						
Armenia						O
Bangladesh		O	O	O		O
Bhutan						
Bolivia	O					O
Cabo Verde				O		O
Cameroon		O	O	O	O	O
Congo, Rep.		O	O	O		
Côte d'Ivoire	O	O	O			
Djibouti					O	O
Egypt, Arab Rep.		O	O	O	O	O
El Salvador		O				O
Georgia						O
Ghana	O	O	O	O	O	O
Guatemala		O	O		O	O
Guyana			O			
Honduras	O	O	O			
India	O	O			O	O
Indonesia				O	O	O
Kenya	O	O	O			O
Kiribati			O	O	O	O
Kyrgyz Rep. (Kyrgyzstan)					O	O
Laos			O	O	O	O
Lesotho		O	O	O	O	O
Mauritania				O	O	O
Micronesia, Fed. Sts.						
Moldova					O	O
Morocco	O	O	O	O	O	O
Myanmar (Burma)						
Nicaragua	O	O	O	O	O	O
Nigeria		O	O	O		O
Pakistan	O	O	O	O		
Papua New Guinea	O			O	O	
Philippines	O	O	O	O	O	

Appendix. Continued

Data available for:	1975	1980	1985	1990	1995	2000
Lower-Middle-Income Economies ($1,046 to $4,125) Continued						
Samoa					O	O
São Tomé and Principe						
Senegal		O	O	O		O
Solomon Islands				O		O
Sri Lanka		O	O	O	O	
Sudan						
Swaziland	O	O	O		O	O
Syrian Arab Rep.	O	O	O	O	O	O
Tajikistan					O	O
Timor-Leste (East Timor)						
Ukraine						O
Uzbekistan					O	O
Vanuatu		O				O
Vietnam				O		
Yemen, Rep.						
Zambia	O	O	O	O		

Appendix. Continued

Data available for:	1975	1980	1985	1990	1995	2000
Upper-Middle-Income Economies ($4,126 to $12,735)						
Albania					O	O
Algeria	O	O	O	O		O
Angola			O	O		O
Azerbaijan					O	
Belarus					O	
Belize					O	O
Bosnia and Herzegovina						
Botswana	O	O	O	O	O	O
Brazil						
Bulgaria				O	O	O
China			O	O	O	O
Colombia	O	O	O		O	O
Costa Rica		O	O	O	O	O
Cuba						
Dominica				O		O
Dominican Rep.	O	O			O	O
Ecuador		O	O	O		O
Fiji		O	O			O
Gabon		O	O		O	
Grenada			O	O		
Iran, Islamic Rep.	O		O	O	O	O
Iraq						
Jamaica						
Jordan		O	O	O		O
Kazakhstan						O
Lebanon						
Libya						
Macedonia, FYR					O	O
Malaysia	O	O	O	O	O	O
Maldives						
Marshall Islands						
Mauritius		O	O	O		O
Mexico	O	O	O	O	O	O

Appendix. Continued

Data available for:	1975	1980	1985	1990	1995	2000
Upper-Middle-Income Economies ($4,126 to $12,735) Continued						
Mongolia					O	O
Namibia				O	O	O
Palau						O
Panama		O	O	O	O	O
Paraguay					O	O
Peru	O	O	O	O	O	O
Romania				O	O	O
South Africa				O		O
St. Lucia		O	O	O		O
St. Vincent and the Grenadines			O			O
Suriname	O	O	O	O		
Thailand	O	O	O	O	O	
Tonga			O	O		O
Tunisia		O	O	O	O	O
Turkey		O		O	O	O
Turkmenistan						
Tuvalu						

Appendix. Continued

Data available for:	1975	1980	1985	1990	1995	2000
High-Income Economies ($12,736 or more)						
Andorra						
Antigua and Barbuda						O
Argentina	O	O	O	O		O
Australia					O	O
Austria			O	O	O	O
Bahamas, The		O	O	O	O	
Bahrain		O	O	O	O	O
Barbados	O	O	O	O		O
Belgium						
Brunei Darussalam (Brunei)						
Canada	O	O	O	O	O	O
Chile	O	O	O	O		O
Croatia					O	O
Cyprus	O	O	O	O	O	O
Czech Republic					O	O
Denmark		O	O	O	O	O
Estonia					O	O
Equatorial Guinea						O
Finland	O	O	O	O	O	O
France	O	O	O	O	O	O
Germany					O	O
Greece	O	O	O	O	O	O
Hong Kong SAR, China						
Hungary					O	O
Iceland		O	O	O	O	O
Ireland	O	O	O	O	O	O
Israel	O	O	O	O	O	O
Italy	O	O	O	O	O	O
Japan		O	O	O	O	O
Korea, Rep.		O	O	O	O	O
Kuwait					O	O
Latvia					O	O
Liechtenstein						

Appendix. Continued

Data available for:	1975	1980	1985	1990	1995	2000
High-Income Economies ($12,736 or more) Continued						
Lithuania						
Luxembourg						
Macao SAR, China						
Malta	O	O	O	O	O	O
Monaco						
Netherlands	O	O	O	O	O	O
New Zealand		O	O	O	O	O
Norway	O	O	O	O	O	O
Oman	O	O	O	O	O	O
Poland				O	O	O
Portugal	O	O		O	O	O
Qatar						O
Russian Federation					O	
San Marino						
Saudi Arabia						
Seychelles		O	O		O	O
Singapore						
Slovak Rep.					O	O
Slovenia					O	O
Spain	O	O	O	O	O	O
St. Kitts and Nevis			O			O
Sweden	O	O	O	O	O	O
Switzerland			O	O	O	O
Taiwan, China						
Trinidad and Tobago			O	O		
United Arab Emirates						
United Kingdom	O	O	O	O	O	O
United States	O	O	O	O	O	O
Uruguay	O		O	O	O	O
Venezuela	O	O	O	O		O

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