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Middle-Income Traps

A Conceptual and Empirical Survey

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Abstract

In recent years, the term "middle-income trap" has entered common parlance in the development policy community. The term itself often has not been precisely defined in the incipient literature. This paper discusses in more detail definitional issues on the so-called middle-income trap. The paper presents evidence in terms of both absolute and relative thresholds. To get a better understanding of whether the performance of the middle-income trap has been different from other income categories, the paper examines historical transition phases in the inter-country distribution of income based on previous work in the literature. Transition matrix analysis provides little support for the idea of a middle-income trap. Analysis of cross-country patterns of growth provides additional support for the conclusions in the paper, which closes with a general discussion of potential policy implications.

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Middle-Income Traps: A Conceptual and Empirical Survey

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I. Introduction

In recent years, the term middle income or "MIC" trap has entered common parlance in the development policy community – particularly, in East Asia where concerns about slower growth following the 1997 regional financial crisis prompted concerns of a protracted period of subpar performance. The term itself often has not been precisely defined in the incipient literature. In some cases, the phenomenon is described in terms of relative "catch-up" with the United States or some other rich country reference (Woo, 2011; Lin and Rosenblatt, 2012). In others, it is based on stagnation or painfully slow growth in absolute income levels. For example, Felipe et al (2012) establish a definition based on the number of years a country takes to move from one income category to another, based on absolute thresholds for low, lower middle, upper middle and high income countries.

The concept of a low-equilibrium growth "trap" has been explored in theory and empirically, but with a focus on low-income country "poverty traps" (Azariadis and Drazen, 1990; Azariadis and Stachurski, 2005; Kraay and Raddatz, 2007). A variety of models have been developed that focus on aid volatility (Agenor and Aizenman, 2010), natural resource exploitation (Antoci et al, 2011), or institutions (Capra et al, 2009; Gradstein, 2008). Recently, Agenor and Canuto (2012) developed a model with a knowledge externality in the "design" sector that produces multiple equilibria, including the possibility of a low productivity growth MIC trap.

In terms of development strategy or the microeconomic determinants of growth, a number of authors have focused on the peculiar position of MICs within the global supply chains. The basic idea is that incomes (and wages) in MICs have increased enough to require graduation from low-skilled labor intensive activities, but MICs have not yet developed national innovation systems -- or perhaps not even accumulated enough physical and human capital – to compete with high-income countries in more sophisticated products (Gill and Kharas, 2007; Jankowska et al, 2012; Yusuf and Nabeshima, 2009; and Woo, 2009). This line of inquiry leads directly to policy discussions of what needs to be done (Kharas and Kohli, 2011; Shijin et al, 2012; Xiaohe, 2012; Flaeen et al, 2013) to transition successfully from middle income status to high income status. Aiyar et al (2013) define the middle income trap as a special case of growth slowdowns and explore some of the determinants behind these slowdowns.

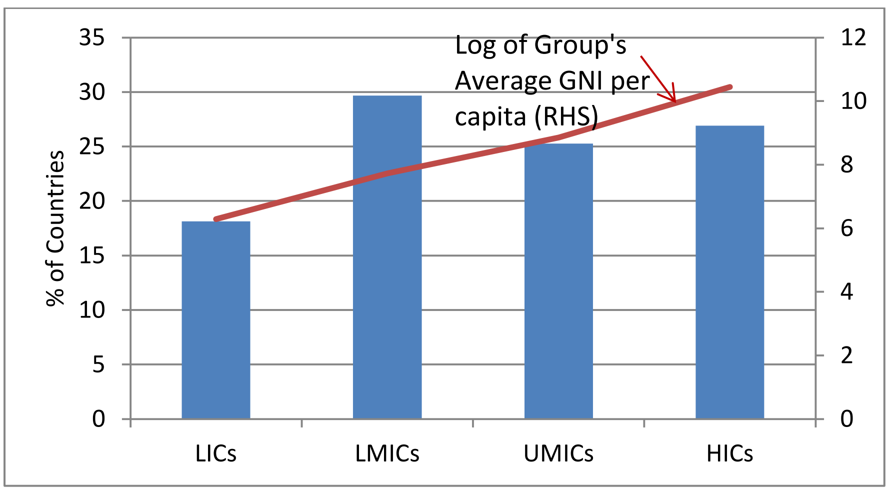
What characterizes a middle income country (MIC)? Quite literally, MICs are defined as the middle of the distribution of countries ranked by per capita income. One could also imagine using some other metric, or metrics, of economic development to define the "middle class." Scanning a variety of dimensions, a "typical" MIC would have income per capita of about $4,000, an adult literacy rate of about 70 to 93 percent, infant mortality of about 19 to 50 per 1,000 live births, and life expectancy is around 65-72 years.[2] In terms of economic structure, the typical MIC possesses a wide variety of productive sectors–ranging from still large primary sectors to industries that may be highly developed—or even at the technological frontier globally. A typical MIC still has substantial shares of its population toiling at relatively low

[2] These data are from World Development Indicators (WDI). Median income per capita ("Atlas" measure of market exchange rates) was approximately $4,300 in 2010, as reported in the WDI.

productivity occupations, with limited access to capital, and with earnings that are relatively low on a global scale. On the other hand, one could argue that there is also a great dispersion across many of these socioeconomic characteristics among MICs. In brief, MICs are countries that made substantial progress in social and economic outcomes, but still lag significantly behind the rich countries in most social and economic indicators.

Most of the social indicators mentioned above are positively correlated with countries' income per capita. The simplest way to establish thresholds for MICs would be on that basis. The World Bank classifies a country as a MIC if its income per capita (Gross National Income, in accounting terms) is greater than $1,005 and less than $12,275.[3] This group of countries represented about 55 percent of all the economies for which the WDI has data for the year 2010. Broadly speaking, it does represent the middle class and the distribution of countries across these income categories looks evenly distributed (Figure 1)—at least for the categories above low-income status. In this figure, the MIC class is disaggregated into "lower middle-income" (LMIC—up to $3,975) and "upper middle-income" (UMIC). The average incomes vary exponentially; however, the log levels follow a fairly straight line across income categories (line in Figure 1).[4]

Figure 1: Distribution of countries by income per capita, 2010



Source: World Development Indicators.

Does this alleged inability of countries to progress from MIC to high-income status (HIC) imply that there is a "trap"? There have only been about 200 years of modern economic history: what has been the evolution of MICs and what would be a reasonable timeframe for progress to high-income status? This paper surveys the empirical evidence for various definitions of a MIC trap. The closest paper in the literature that we have found is Felipe et al (2012); however, we take a different approach to look at the empirics of whether the MIC to HIC transition is different

[3] This is based in "Atlas" dollars, where the "Atlas" measurement smoothes out short-term changes in countries' exchange rates. In years, where the currency has been fairly stable, the "Atlas dollar" GNI per capita is very close to a GNI per capita based on market exchange rates. More information is available at http://data.worldbank.org/about/country-classifications.

[4] Felipe et al, 2012, use a methodology to extrapolate these thresholds to Geary-Khamis PPP dollar thresholds, so as to be able to track the evolution of countries across categories using the longer term Maddison data set.

from other transitions in economic progress. First, we will discuss in more detail the definitional issues already alluded to in this introduction. Then we examine historical transition phases in the inter-country distribution of income as well as cross-country patterns of growth to get a better understanding of whether MIC performance is different from other income categories. Finally, we close with a general discussion of potential policy implications.

II. How Do We Define a Middle-Income Trap?

A number of recent papers (Cai, 2012; Felipe et al, 2012; and Kharas and Kholi, 2011; Lin and Treichel, 2012; and Woo, 2009) as well as seminar presentations (for example, Woo, 2011) discuss the potential existence of a middle-income trap—particularly in the context of a specific country or region. Two definitional issues arise in this incipient literature: how one defines the thresholds for middle-income status; and secondly, how one defines a "trap."

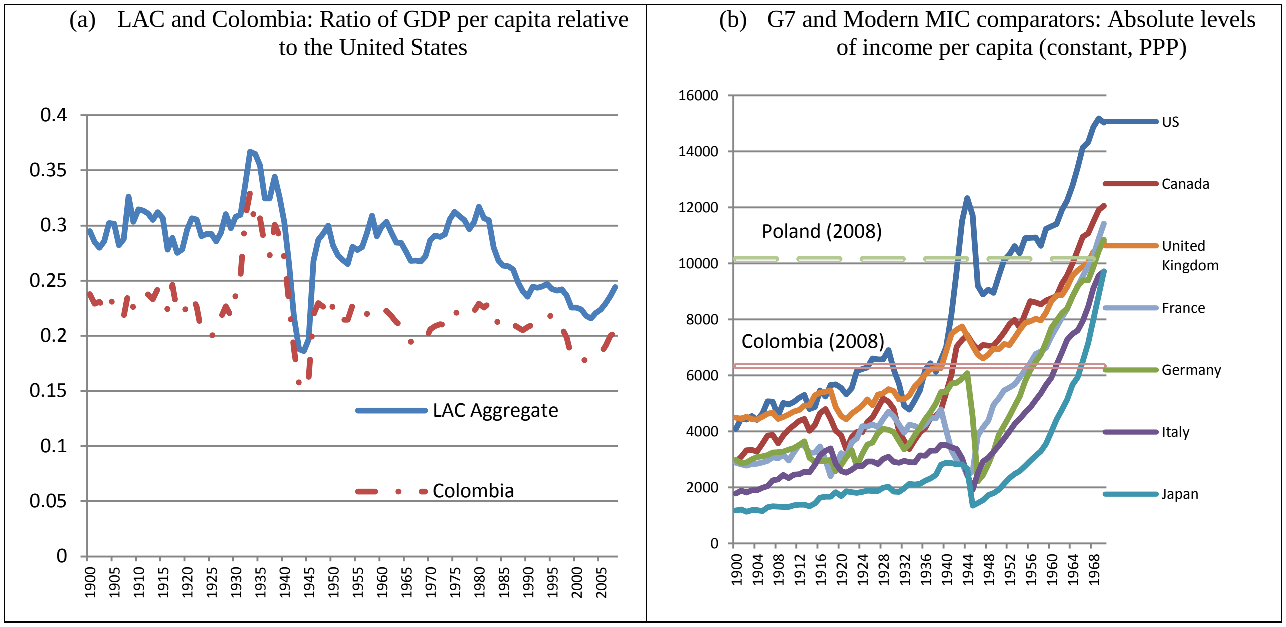
In both cases, there are obvious parallels to the literature on poverty measurement. Poverty can be measured in absolute or relative terms—a fixed household income per capita threshold (in PPP dollars or national currency) is established for the former, while a fixed proportion of mean or median household income per capita is used for the latter. Secondly, there is an extensive literature on poverty "traps", where a trap implies some form of self-reinforcing mechanism driven by market failures or lack of institutional development that inhibits progress towards either an absolute or relative threshold.

Whether one takes a relative or absolute approach to thresholds has very strong implications for descriptive statistics. For example, from a relative perspective, the Latin America and the Caribbean (LAC) region is often cited as the classic case of a MIC trap phenomenon: a review of either the regional aggregate or individual countries shows that income per capita relative to the United States did not progress during the 20th century. Figure 2(a) uses Maddison data to track the progress of the LAC aggregate's ratio as well as Colombia – the latter simply as an example.

On the other hand, if one uses an absolute definition, then one might reach the conclusion that today's high-income countries themselves were stuck in a "MIC trap" for much of the twentieth century. Figure 2(b) uses 2008 income per capita (in constant PPP adjusted dollars) for Colombia (still somewhat below the world average) and Poland (a recent "graduate" from MIC status, by World Bank standards) and compares the G7 economies to Colombia and Poland over the last century. One sees that it was only in the late 1950s that the G7 economies surpassed the recent income per capita of Colombia, and it was only in the 1970s that they all surpassed Poland.

This figure raises the question then: Were Colombia and most of Latin America stuck in a MIC "trap" for the entire twentieth century? Or was Europe stuck in a MIC "trap" for most of the twentieth century? Or are both statements relevant? Again, this reminds one of the literature on poverty measurement, where there is a clear welfare economics criterion for defining poverty based on an absolute threshold (Ravallion, 2008); however, there are other social cohesion views for taking a relativist approach.[5] It may well be that the average Colombian or Pole has a higher economic standard of living than the average Western European or American in 1930; however, they still aspire be as well off as the average Western European or American today.

Figure 2 (a) and (b): Two Views on a "Trap"—Relative and Absolute MIC Thresholds



Source: Authors' elaboration based on data from Maddison (2010).

The relative or absolute approach also has an impact on the type of analysis that one might undertake to understand the dynamics of a presumed MIC trap. The relative approach immediately takes one down the path of two relevant threads of the economics literature: (a) absolute convergence (or the lack thereof); and (b) inter-country distribution of income. On the former, there is a vast theoretical literature on neo-classical growth models,[6] and a vast empirical literature on testing convergence or lack thereof (Pritchett, 1997). On the second thread, the literature on the world distribution of income has noted that, in recent decades, widening global gaps between rich and poor individuals have been driven more by increases in the difference between countries' incomes per capita than by differences in income across households within countries (Bourguignon and Morrison, 2002; Milanovic, 2005).

The absolute definition might lead one to focus more on why some countries enter actual stagnation rather than failed "catching up." Here issues of macroeconomic stability may have played a leading role—as noted, in particular, in the literature on the Latin American experience with periodic debt crises of the last quarter century (Calvo, 1998; Calvo and Reinhart, 2002; Reinhart et al, 2003). The stagnation in per capita GDP levels also relates to the literature on

[5] For a new "weakly relative" measure that makes an explicit accounting for social cohesion, see Ravallion and Chen (2011). For the implications for global poverty measurement, see Chen and Ravallion (2012).
[6] Parente and Prescott (2005), and Banerjee and Duflo (2005) present surveys from different perspectives.

low-growth "poverty traps" that generally focuses on low income countries,[7] as mentioned above.

III. Relative "Trap": Some Unpleasant MIC History

The preceding section (and Figure 1a) already alluded to the obvious failures of countries or entire regions to ever successfully catch up with the rich countries' income per capita—even when adjusted by purchasing power parity. There have also been some successes, but these have been painfully rare, as documented extensively elsewhere (Felipe et al, 2012; World Bank and Development Research Center (PRC), 2012; Gill and Kharas, 2007; Lin and Rosenblatt, 2012). Only a limited number of countries have made substantial progress in relative terms, and those countries are concentrated in a handful of East Asian economies, the European periphery, and special cases of substantial (per capita) natural resource discoveries.[8] Systematic growth slowdowns among MICs are another way to view the inability to converge (Eichengreen et al (2011) and Aiyar et al (2013)).

By definition, if a country grows faster (in per capita terms) than the rich countries, it will eventually catch up with the high-income countries' GDP per capita. A relevant benchmark is the long-run per capita growth of high-income countries over the last century, which is on the order of 1.5-2.0 percent per annum. Over the last 50 years, it was 2 percent – using WDI data. If one looks at the average per capita growth rates for 141 developing countries[9] over the last 50 years (1961-2011), 80 grew by at least 1.5 percent – of which, 64 grew by at least 2 percent (WDI data). While these countries are, in fact, converging, this is painfully slow convergence. Thirty-one countries grew by 3 percent or more (in per capita terms), while only 9 reached 5 percent.

More generally, the time it will take a developing country to reach the GDP per capita of a high income reference is given by the following equation:

$$T = \ln(R) / \ln\left(\frac{1 + g_M}{1 + g_H}\right)$$

where R is the initial ratio of the high GDP per capita reference to the MIC's GDP per capita, g_M is the MIC's compound rate of growth of GDP per capita, and g_H is the high income country's compound rate of growth of GDP per capita.

A MIC on the border between LMIC and UMIC has a GDP per capita that is on the order of 1/10 the United States' level or about 1/8 of the high income OECD average (in PPP dollars). The relevant "R" ratio is on the order of 8 to 10 then. One can read from Table 1 below that if this MIC grows by only 3 to 4 percent in per capita terms, it will take a century or two to catch up with the rich countries – assuming that the rich countries grow at 1.8 percent in per capita

[7] There is also a parallel microeconomic literature on poverty traps at the household level. See, for example, Antman and McKenzie, 2007.
[8] The classic example of the latter is Equatorial Guinea.
[9] This is using current year classification of developing economies. This excludes the "graduates" from MIC status then.

terms. The MIC will eventually win the race, but it will be a very long race. One should note that the official World Bank threshold for "high-income country" is substantially lower than US or OECD averages. If one were to compare a prototypical MIC to that threshold, then the relevant *R* ratio would be much lower: around 3. And the ratio would be 12 or less, even for the poorest LMICs. On the other hand, recent MIC graduates tend to grow faster than high income countries with a longer tenure at that status, so the relevant g_H might be higher for constructing a table for catch-up to borderline HICs.

Table 1: Number of Years for Convergence to Rich Countries GDP per capita, as a function of MIC Growth rate and Initial per capita GDP Ratio (HIC threshold/country's level)

(g_H = 1.8%)

R \ g_M	2%	3%	4%	5%	6%	7%	8%	9%	10%
25	1640	275	151	104	80	65	54	47	42
20	1526	256	140	97	74	60	51	44	39
15	1380	231	127	87	67	54	46	40	35
10	1173	196	108	74	57	46	39	34	30
5	820	137	75	52	40	32	27	24	21
4	706	118	65	45	34	28	23	20	18
3	560	94	51	35	27	22	19	16	14
2	353	59	32	22	17	14	12	10	9
1.5	207	35	19	13	10	8	7	6	5

Source: Authors' calculations based on Equation (1).
Notes: Assuming 1.8 percent growth in real GDP per capita in the rich country reference. *R* is the ratio of rich country GDP per capita to MIC GDP per capita. The g_M is the rate of growth of GDP per capita in the MIC.
Dividing line is to show minimum growth rates to converge to future rich country reference level in under 50 years.

One can look at country examples to get a better feeling for what would be involved in catching up over the next 50 years.[10] The table below presents calculations of the required growth rate for catch-up for a collection of current middle-income countries, along with the actual growth rate in the last column.[11] Both the United States and an aggregate for high-income OECD countries are used as a reference point. Note that the GDP per capita of these high income references are assumed to grow at 1.8 percent, resulting in GDP per capita of about $103,000 and $82,000 for the US and OECD respectively 50 years from now (measured in constant 2005 PPP dollars). Comparing the middle columns with the last column, we see that most countries have been substantially off-track in recent decades in terms of catching up to either a US standard or a high-income OECD standard.

[10] The Commission on Growth and Development (2008) did a similar exercise (page 113 in the statistical annex), but with different assumptions on growth trajectories.
[11] Actual is based on 1980 and 2011 levels in constant PPP adjusted dollars. The PPP adjusted series only goes back to 1980 in the World Development Indicators database.

Table 2: Required (per capita) Growth Rate for "Catch-up" in 50 Years

	2011 GDP Per Capita (PPP adjusted 2005 dollars)	Required Growth Rate To US	Required Growth Rate To OECD (HIC)	Actual Growth Rate (1980 to 2011)
Argentina	15,501	3.9	3.4	1.4
Brazil	10,278	4.7	4.2	1.0
Chile	15,272	3.9	3.4	3.3
China	*7,404*	*5.4*	*4.9*	*8.9*
India	3,203	7.2	6.7	4.3
Indonesia	4,094	6.7	6.2	3.7
Malaysia	13,672	4.1	3.7	3.4
Mexico	12,776	4.3	3.8	0.7
Nigeria	2,221	8.0	7.5	1.0
Russian Federation	14,808	4.0	3.5	N.A.
South Africa	9,678	4.9	4.4	0.3
Thailand	7,633	5.4	4.9	4.1
Turkey	13,466	4.2	3.7	2.7
Memo Items: US	42,486	OECD	33,726	

Source: Authors' calculations based on data from the World Development Indicators. A growth rate of 1.8 percent (per capita) is assumed for the high-income country reference points.

IV. Absolute Thresholds: Some (Relatively) Pleasant MIC Arithmetic

Obviously, if one establishes an absolute threshold – as is done by the World Bank—then any positive growth rate of income per capita will *eventually* result in successful passage to HIC status. Two problems have arisen. First, some developing countries and regions have actually experienced declines in income per capita for periods spanning a few decades (e.g., Latin America during the debt crisis or Sub-Saharan Africa during the first decades following independence). Secondly, per capita growth of only 1 or 2 percent would condemn some lower middle income countries to "developing" status for centuries.

That said, for many upper MICs, sustained growth of 2 to 4 percent per capita would result in high-income status in a generation or two. Following on the calculations in the previous section, the simple arithmetic is even simpler, if one takes the HIC standard at a fixed level of GDP per capita (in constant dollars). The g_H is then zero, and the time to achieve HIC status is much faster, as shown in Table 3. In addition, if one uses the World Bank definition of HIC, then the initial R is in a much tighter range with a maximum of about 12 (for poorest LMICs), and a maximum of 3 for all the upper middle-income countries, as noted earlier.

Table 3: Years towards reaching *absolute* high-income status, as a function of initial GDP per capita and MIC growth rate (per capita)

R \ g_M	1%	2%	3%	4%	5%	6%	7%	8%	9%
25	323	163	109	82	66	55	48	42	37
20	301	151	101	76	61	51	44	39	35
15	272	137	92	69	56	46	40	35	31
10	231	116	78	59	47	40	34	30	27
5	162	81	54	41	33	28	24	21	19
4	139	70	47	35	28	24	20	18	16
3	110	55	37	28	23	19	16	14	13
2	70	35	23	18	14	12	10	9	8
1.5	41	20	14	10	8	7	6	5	5

Source: Authors' calculations. Bold italics are added to note that Upper MICs have a ratio R that is about 3 or less – if using World Bank definitions for these thresholds.
Note: The dividing line shows minimum growth rates to reach current HIC threshold in under 50 years.

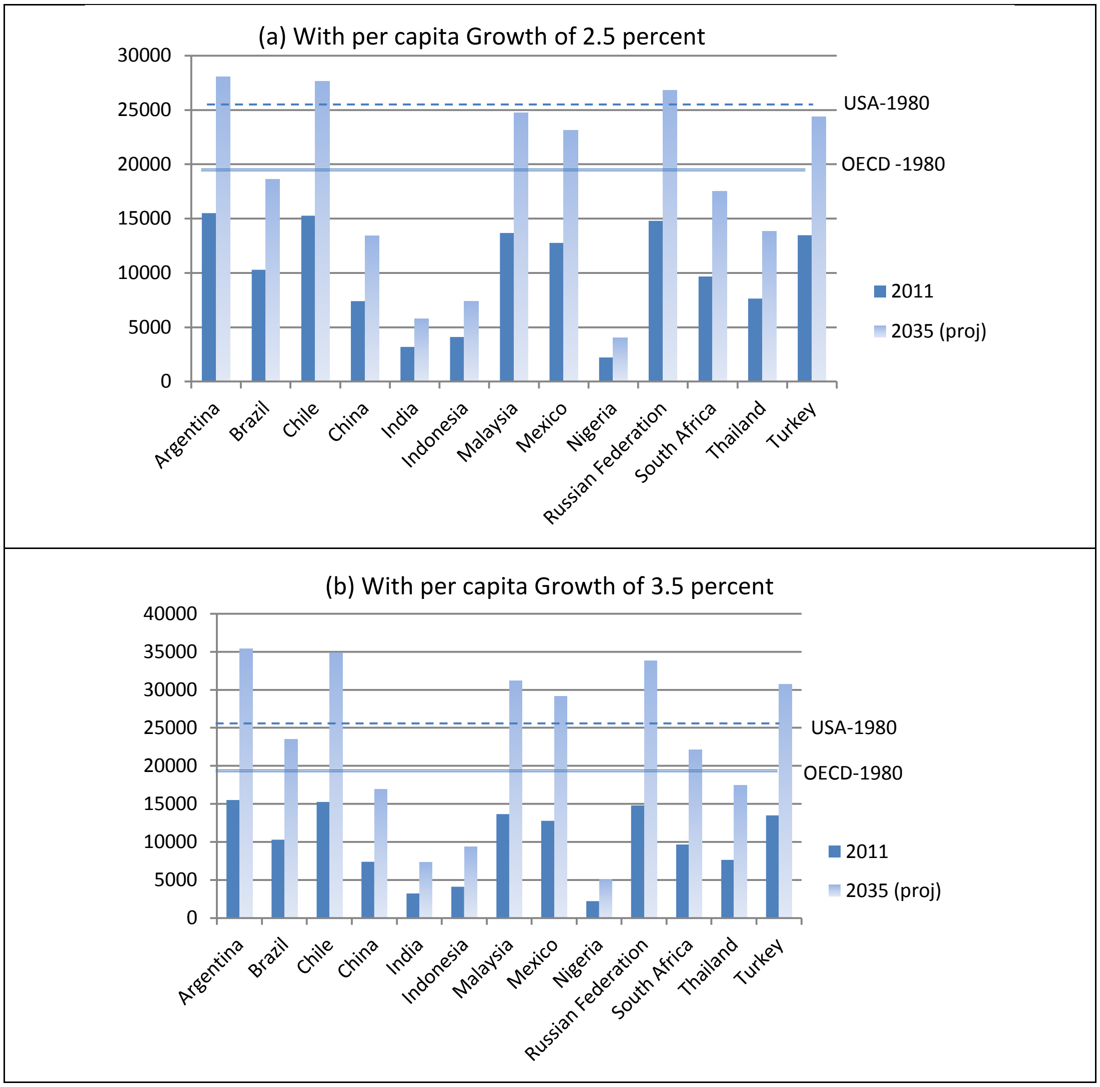
Another issue is the precise definition of the HIC threshold. There is no precise "science" to all this; however, the most thorough review of country classification that we know of is Nielsen (2011). Nielsen (2011) compares IMF, OECD and World Bank classifications and then proposes an alternative taxonomy that would first determine the number of categories based on the distribution of development outcomes and then set thresholds at the average of distribution.[12] For example, in the 3 tier system, the break between developing countries and rich countries would be the average outcome, and the sub-category between lower and medium developing countries would be at the average of that group. The World Bank's classification has operational implications in that the LIC-MIC threshold determines access to concessional IDA financing. The World Bank also uses a "graduation" threshold for initiating a dialogue to "graduate" the country from access to all World Bank financing, even the non-concessional IBRD. This threshold is roughly half the HIC threshold. Heckelman et al (2011) find that this threshold has worked reasonably well in terms of its objective: countries have graduated when they have reached the level of institutional development and creditworthiness to have adequate access to private financial markets for the country's development needs.

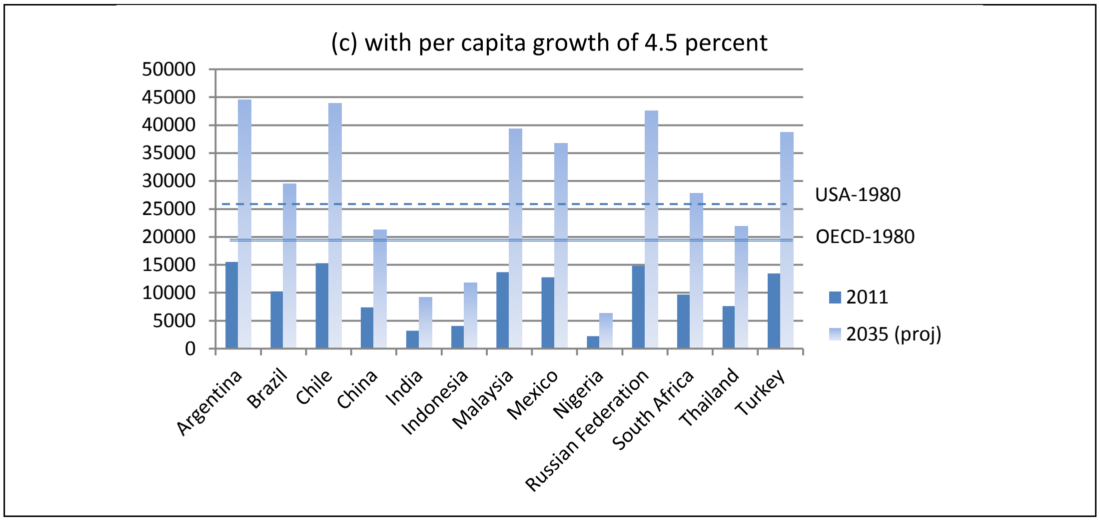
Given that there is not a consensus on threshold definition, we will focus on general rules of thumb. One more ambitious threshold – relative to the World Bank definition—would be today's GDP per capita of the OECD average or the United States or the richest country in the

[12] It should be noted that some non-income dimensions have improved dramatically. In addition, many are inherently different from the level of income per capita, given upper or lower bounds. For example, net secondary enrollment and literacy rates are bounded by 100 percent, and child mortality rates by zero below. In addition, there are access-to-service issues that exist today that were non-existent when some of today's HICs were MICs (for example, internet access). There is some discussion and data on these issues provided in Appendix 1.

world. Another ambitious threshold would be the OECD or US level of (real) income per capita in 1980 – assuming that even by today's standards, these countries were already "rich" in 1980. In terms of table 2, these higher thresholds imply moving up to higher rows in the table. In terms of specific country examples, the following figures display that a number of MICs could still reach the HIC status in 2035 – roughly one generation from now—if they can sustain per capita economic growth rates on the order of 2.5 to 4.5 percent. The horizontal lines used for comparison are the 1980 GDP per capita of the United States and (high-income) OECD aggregate (constant 2005 PPP dollars). The values (from World Development Indicators) are 25,510 and 19,386 for the US and OECD respectively. The countries were chosen for illustrative purposes only; however, they do represent a wide range of MICs. Note that in the Figure 3c, with 4.5 percent growth, a number of the more advanced MICs would also breach the 2011 levels of US and OECD GDP per capita ($42,436 and $32,726, respectively, in constant 2005 PPP dollars).

Figures 3(a)-(c): HICs in a generation with sustained moderate growth?





Source: Authors' calculations; 2011 data are from World Development Indicators. All measured in constant 2005 PPP dollars.

V. Are MICs Really Different? Some Old Approaches Applied to a "New" Concept

The above section provided some definitions and places some parameter values on MICs' growth rates to achieve success in some reasonable (but admittedly loosely defined) timeframe.[13] The MIC trap concept inevitably invokes a literature from the 1990s and early 2000s on the patterns of economic growth (for example, Pritchett 1997 and 2000) as well as the patterns of transition across the inter-country distribution of income (Quah, 1993, 1996 and 1997, and Kremer et al., 2001).

One approach, inspired by the literature on the inter-country distribution of income, is to look at transitions across income categories (in either relative or absolute terms). Are MIC-to-HIC transitions more infrequent than other transitions?[14] Or is the inter-country distribution of income per capita similarly stable for all income categories? Another simple empirical approach to exploring the relevance of the "trap" term is to just look at MICs' growth patterns. In simple terms, do MICs seem to perform differently from other income classes of countries?

a. Transition Matrices and the MIC Trap: Are MICs Less Upwardly Mobile?

We follow the transition matrix approach previously laid out in Quah (1993) and Kremer et al. (2001) to describe the dynamics of income per capita distribution across countries. We classify countries into groups by relative income per capita taking the United States as a benchmark.[15] Rather than estimating one-year transition probabilities as in Quah or five-year

[13] Felipe et al (2012) define a trap threshold based on the median number of years it takes countries to cross lower MIC and upper MIC absolute thresholds.
[14] The authors would like to thank Aart Kraay for suggesting this approach.
[15] Our results remain the same even if we take the top 5 richest countries rather than just the United States. This is apparent if we simply look at the growth differential between the initial high income countries and the United States.

transition probabilities as in Kremer et al., we focus on ten-year intervals.[16] The longer time span seems more appropriate to analyze the so-called MIC trap since transitions (or lack of them) from middle income to high income status do not occur overnight. Moreover, our focus is mainly on the transitions from middle-income to other status and less on the long-run distribution of world income. Nevertheless, we do compute the ergodic distribution and the half-life implied by the respective matrices of transition probabilities.

We exclude from our analysis oil-exporting as well as resource rich countries since these countries are outliers as resource discoveries are a very special form of "catch-up."[17] We include many East European and Central Asian countries in the analysis, although for many of them GDP per capita series were only available since 1990 in our sample.[18] We use PPP income per capita from Maddison (2010) to compute the transition matrices for 125 countries from 1950 to 2008.

Suppose that a country's relative income per capita follows a first-order Markov chain with time-invariant transition probabilities denoted by $\{p_{ij}\}$, with i = 1,..., N and j = 1,..., N. Each p_{ij} describes the likelihood that state i will be followed by state j. We denote the set of states as $S = \{s_1, s_2, \dots, s_N\}$. The probability that s_t equals some particular value j depends only on the most recent value s_{t-1} and not on other past realizations of s_t:

$$\Pr(s_t = j | s_{t-1} = i, s_{t-2} = k, \dots) = \Pr(s_t = j | s_{t-1} = i) = p_{ij}$$

In other words, a country's relative income today depends solely on yesterday's relative income and not on any other past realizations. We can represent the transition probabilities in matrix form as:

$$P = \begin{pmatrix} p_{11} & p_{12} & \cdots & p_{1N} \\ p_{21} & \ddots & \vdots & p_{2N} \\ \vdots & \cdots & \ddots & \vdots \\ p_{N1} & \cdots & \cdots & p_{NN} \end{pmatrix}$$

[16] This also reduces the effect of business cycle fluctuations on countries that are near the relative income thresholds. We recalculate the transition matrices detrending the GDP per capita series using the Hodrick-Prescott filter. Our main results change very little.

[17] The following countries are included in the analysis: Afghanistan, Albania, Argentina, Armenia, Australia, Austria, Bangladesh, Belarus, Belgium, Benin, Bolivia, Bosnia, Brazil, Bulgaria, Burkina Faso, Burma, Burundi, Cambodia, Canada, Cape Verde, Central African Republic, Chile, China, Comoro Islands, Costa Rica, Côte d'Ivoire, Croatia, Cuba, Czech Republic, Denmark, Djibouti, Dominican Republic, Egypt, El Salvador, Eritrea and Ethiopia, Estonia, Finland, France, Gambia, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Guinea Bissau, Haïti, Honduras, Hong Kong SAR, China, Hungary, India, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Kyrgyzstan, Laos, Latvia, Lebanon, Lesotho, Liberia, Lithuania, Macedonia, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mauritius, Moldova, Mongolia, Morocco, Mozambique, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, North Korea, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Puerto Rico, Romania, Rwanda, Sao Tomé & Principe, Senegal, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia, Somalia, South Africa, South Korea, Spain, Sri Lanka, Swaziland, Sweden, Switzerland, Taiwan, China, Tajikistan, Tanzania, Thailand, Togo, Tunisia, Turkey, Uganda, United Kingdom, Ukraine, Uruguay, United States, Uzbekistan, West Bank and Gaza, Zaire (Congo-Kinshasa), Zambia, and Zimbabwe.

[18] Our main messages do not change even if we exclude these countries (see Appendix 3).

P is an N x N matrix of transition probabilities or just transition matrix. Note that $\sum_j p_{ij} = 1$. In matrix notation, we have that P x **1** = **1**, where **1** is an N x 1 vector of ones. Diagonal elements indicate the probability of countries of remaining in the same relative income per capita group after a ten-year period. Off-diagonal elements indicate the probability of a given country to jump into another relative income per capita category after one period or step.

If P is ergodic, we can compute the ergodic or stationary distribution of the Markov chain, which can be interpreted as the unconditional probability of each of $S = \{s_1, s_2, \ldots, s_N\}$. We may also be interested in the speed of convergence towards the steady state. For that, we utilize the concept of half-life of convergence, which refers to the number of periods required to cut the difference between the current distribution and the stationary distribution in half: $h = -\frac{\log 2}{log|\lambda_2|}$. λ_2 is the second largest eigenvalue of the transition matrix.[19]

Two additional concepts may be useful for the analysis: the mean first passage time and the mean first recurrence time. The former -denoted as mp_{ij}- indicates the expected number of periods to reach state *j* for the first time starting at state *i*. The latter indicates the expected time it takes to return to a given state i for the first time. We denote this mr_{ii}. The mean first passage time can be computed using the elements of the transition matrix and solving for a system of linear equations:

$$mp_{ij} = 1 + \sum_{k \neq j} p_{ik} mp_{jk}$$

Then, using the off-diagonal values of the mean first passage time, we can substitute into the following formula to calculate the mean first recurrence time as follows:

$$mr_{ii} = p_{ij} + \sum_{k} p_{ik}(mp_{ki} + 1)$$

We compute two different transition matrices using two alternative relative income groups. In both cases, we divide countries into five relative income groups (states 1 to 5). The selection of the relative income intervals, along with the choice of the period intervals, plays a fundamental role in determining the elements of the transition probability matrix. By adopting two different relative income classifications, we try to reduce some of the arbitrariness associated with the choice of the income groups. We assume that the process is time-invariant, as it is often done in the literature. In one set of transition matrices, countries are classified as follows: those with incomes less than 0.15 of the US income; those between 0.15 and 0.30 of the US income; those between 0.30 and 0.45 of US income; those between 0.45 and 0.60 of US income; and those with income higher than 0.60 of US income. In the second relative income classification, we adopt a similar country grouping as in Kremer et al. (2001).[20] Countries are sorted into five

[19] See, for example, Hamilton (1994) for a general reference on Markov chains. Kremer et al. (2001) also utilizes the half life to analyze the transition path towards the stationary distribution.

[20] Quah (1993) divides countries into five categories: countries with less than 1/4 of the world average per capita income, those between 1/4 and 1/2, those between 1/2 world average and world average income, those between 1 and 2, and those with income greater than 2 times the world average income. As pointed out by Kremer et al. (2001),

groups: those with incomes less than 1/16 of US income; those between 1/16 and 1/8 of US income; those between 1/8 and 1/4 of US income; those between 1/4 and 1/2 of US income; and those with income higher than 1/2 of US income.

Each cell of Panel I of Table 4 and Table 5 indicates the number of transitions from one relative income group to another one. Similarly, each cell of Panel II shows the probability of making such transition. The sum of each row of Panel I amounts to the number of states observed between 1950 and 2008.[21] The sum of each row of Panel II should equal unity. Hence, a cell a_{ij} in Panel I illustrates the total number of transitions from group *i* to group *j* over ten-year intervals for the period in consideration. p_{ij}, on the other hand, in Panel II, denotes the probability of transition between relative income groups *i* and *j*. These transition matrices can be used to describe the evolution of world income over time. For instance, after *n* periods, the relative distribution of income at time $t + n$ will be given by $d_{t+n} = P^n d_t$, where d_t is a N x 1 vector describing the relative income distribution at time *t*.

Table 4: Ten-year transition matrix 1950-2008

Panel I: Total number of transitions

	[0-0.15)	[0.15-0.3)	[0.3-0.45)	[0.45-0.6)	≥0.6
[0-0.15)	356	20	0	0	0
[0.15-0.3)	25	88	23	2	0
[0.3-0.45)	1	11	19	14	3
[0.45-0.6)	0	0	4	17	11
≥0.6	0	0	0	1	87

Panel II: Transition matrix

p(i,j)	[0-0.15)	[0.15-0.3)	[0.3-0.45)	[0.45-0.6)	≥0.6
[0-0.15)	0.95	0.05	0.00	0.00	0.00
[0.15-0.3)	0.18	0.64	0.17	0.01	0.00
[0.3-0.45)	0.02	0.23	0.40	0.29	0.06
[0.45-0.6)	0.00	0.00	0.13	0.53	0.34
≥0.6	0.00	0.00	0.00	0.01	0.99

Panel III: Mean first passage time

	[0-0.15)	[0.15-0.3)	[0.3-0.45)	[0.45-0.6)	≥0.6
[0-0.15)	20.9	146.0	63.1	75.0	69.6
[0.15-0.3)	374.5	52.3	44.3	56.2	50.8
[0.3-0.45)	723.4	127.2	106.5	34.7	28.0
[0.45-0.6)	973.4	250.0	250.0	35.6	9.6
≥0.6	1061.4	338.0	338.0	88.0	1.1

Ergodic distribution for transition matrix					
	0.05	0.01	0.01	0.03	0.90
Eigenvalues for transition matrix					
	0.20	0.56	0.76	0.98	1.00
Half-life for transition matrix					
	40.0				

The total number of states observed is as follows: 376, 138, 48, 32 and 88. Not surprisingly, Table 4 shows that transitions between adjacent cells are not uncommon in a ten-year span. On the other hand, transitions between non-adjacent groups are less frequent. Moreover, results in Table 4 suggest that countries are more likely to stay in their relative income group over a ten-year period: the probability of being in group *i* and remaining in group *i* is greater than the probability of being in group *i* and moving to group *j* after a decade –i.e. $p_{ii} > p_{ij}$ for $i \neq j$ for each single row. In other words, diagonal elements are larger than non-diagonal elements.

Table 4 indicates that low income countries relative to the US are much more likely to remain in that group (p_{11} equals 0.95). This may suggest the low income countries may be subject to a poverty trap. On the other hand, the probability of being a high income country and remaining as such is also high (p_{55} equals 0.99), indicating that once you join the high income

this can lead to a distribution in which most countries have more than twice the world average income. Countries can be classified relative to a leading country or a group of leading countries to avoid this problem.

[21] We also include in the tables the transition for the final years of our sample, i.e. the transitions from 2000 to 2008.

country club, you are very likely to remain part of this selective group. Only one demotion episode has been recorded for 1950-2008.

How can we evaluate the so-called MIC trap? We can either look at the probability of starting as a middle income country and staying as such, or we can also look at the probability of moving out of that relative income bracket. Alternatively, we can compare the expected mean first passage times, i.e. the expected time to move from one income category to another one (Panel III).[22] From our relative income classification, we could define a lower middle income country as those countries with relative incomes between 0.15 and 0.30, "middle-middle" as 0.30 to 0.45, and upper-middle income country as having an income per capita greater than 0.45 but less than 0.6 of the income per capita of the US.[23]

Now that we have a working definition for a middle income country, what does Table 4 tell us about the existence of the MIC trap? First, the probability of being a middle income country and staying as such is lower than the probability of being a low or high income country and remaining in those relative income bracket groups (p_{22}, p_{33} and p_{44} equal 0.64, 0.40 and 0.53, respectively). Moreover, in fourteen out of forty-eight occasions, "middle-middle" income countries were able to move up to the upper middle income bracket and three transitions from "middle-middle" income to high income were recorded over the period under study. "Middle-middle" income countries have also been subject to negative shocks and slowdowns in growth, resulting in "downgrades" in their relative income status. However, these backwards transitions were less frequent than the upwards transitions. The lower-middle income group is more problematic – with more persistence – and has only an equally likely chance of moving up or down the ladder.

Table 5: Ten-year transition matrix 1950-2008

Panel I: Total number of transitions

	[0-1/16)	[1/16-1/8)	[1/8-1/4)	[1/4-1/2)	≥1/2
[0-1/16)	178	14	0	0	0
[1/16-1/8)	31	86	23	0	0
[1/8-1/4)	1	24	94	26	0
[1/4-1/2)	0	3	14	67	15
≥1/2	0	0	0	1	105

Panel II: Transition matrix

p(i,j)	[0-1/16)	[1/16-1/8)	[1/8-1/4)	[1/4-1/2)	≥1/2
[0-1/16)	0.93	0.07	0.00	0.00	0.00
[1/16-1/8)	0.22	0.61	0.16	0.00	0.00
[1/8-1/4)	0.01	0.17	0.65	0.18	0.00
[1/4-1/2)	0.00	0.03	0.14	0.68	0.15
≥1/2	0.00	0.00	0.00	0.01	0.99

Panel III: Mean first passage time

	[0-1/16)	[1/16-1/8)	[1/8-1/4)	[1/4-1/2)	≥1/2
[0-1/16)	6.2	37.5	38.3	68.0	113.2
[1/16-1/8)	71.1	13.2	24.6	54.3	99.5
[1/8-1/4)	160.9	23.8	23.9	29.7	74.9
[1/4-1/2)	244.4	103.5	103.7	22.9	45.2
≥1/2	350.4	209.5	209.7	106.0	1.4

Ergodic distribution for transition matrix					
	0.16	0.05	0.04	0.04	0.70
Eigenvalues for transition matrix					
	0.41	0.61	0.85	0.99	1.00
Half-life for transition matrix					
	50.6				

[22] By definition, the mean first passage time of a diagonal element is zero. For illustrative purposes, the diagonal elements of the matrix in Panel III are comprised of the mean first recurrence time, or in other words, the expected time it takes to move away from a diagonal element and then return to that state for the first time.

[23] For example, in 2008 (Maddison data), Dominican Republic (0.14), Peru (0.17), Romania (0.16) and Sri Lanka (0.16) are near the 0.15 threshold. Uruguay (0.32) and Malaysia (0.33) are just above the 0.30 threshold. Chile (0.42) and Latvia (0.48) are near the 0.45 threshold. Estonia (0.64) and South Korea (0.63) are just over the 0.60 threshold.

Table 5 tells a very similar story. With this relative income grouping, the distribution of states across brackets seems more balanced: 192, 140, 145, 99, and 106 for income groups 1, 2, 3, 4, and 5 respectively. As with the previous income classification, jumping between non-adjacent cells is a rare occurrence. It is much more likely for a country to stay in their relative income group over a ten-year period. Countries in the low income bracket find it difficult to move out from there (p_{11} equals 0.93). Similarly, countries that reached high income status tend to stay in that relative income bracket (p_{55} equals 0.99). This second classification opens up two tiers that are both roughly within the "less-than 0.15" (1/8 =0.125) category of Table 4. One worrisome statistic is that this second lowest category appears to be more downwardly mobile than upwardly mobile over the period. Finally, Panel II of Table 5 shows that there is upwards and downwards mobility for middle income countries. For group 4, out of a total of 99 cases, in seventeen occasions countries have moved to a lower income bracket, whereas in fifteen occasions middle income countries have become high income countries.

One common theme across both income classifications is that the convergence process towards the stationary distribution is painfully slow. The asymptotic half-life is estimated at 35.4-40.0 for the ten-year period matrices using the relative income per capita classification in Table 4, and 50.6-53.4 using the relative income classification in Table 5. Since each step or period is measured at ten years, for Tables 4 and 5 this implies that it will roughly take 400 years and 506 years to cut the distance between the current and the ergodic distribution in half. Since in the ergodic distribution, most countries are "HICs," these half-life calculations are broadly consistent with the simple, intuitive calculations presented in Table1.

Now we examine the mean first passage time matrices depicted in Tables 4 and 5. On the off-diagonal cells, element mp_{45} is the smallest, and the sum of mp_{45} and mp_{35} is smaller than the sum of mp_{24} and mp_{34}: it takes less time to move from upper-middle or middle-middle to HIC status than from lower-middle or middle-middle to upper-middle. This corresponds to the higher combined probability of this occurrence.

Using the other relative income classification (Table 5), we observe that in this case element mp_{45} is larger than mp_{34}, and the sum of mp_{45} and mp_{35} is larger than the sum of mp_{24} and mp_{34}: it takes more time to move from upper-middle or middle-middle to high income than from lower-middle or middle-middle to upper-middle income status. This corresponds to the sum of p_{24} and p_{34} being greater than the sum of p_{45} and p_{35}. However, it should be noted that this is not much larger. The intuition behind the differences between the matrices in Tables 4 and 5 is that the income brackets become wider for upper middle income countries, and that this may result in longer transition times to move from one income category to the other.

Overall, the analysis of the transition probability and the mean first passage time matrices suggests very little or no evidence of the existence of a "middle income trap": the upper middle to high income transitions appear to be as likely as lower middle income to upper middle income transitions. In terms of the expected time it takes to move from upper middle income to high income status, we find very little evidence supporting the claim that it takes longer to make this transition than the transition from lower middle income to middle income.

b. Robustness Checks

We perform several robustness checks. The results for our first relative income grouping remain unchanged, whereas, as we will see, they are less supportive of a MIC trap for the second relative income classification. First, we examine whether transitions (or lack of) from one relative income category to the other are the result of business cycle fluctuations, especially for those cases where the relative level of income is near one of the relative income thresholds. While we previously argued that this is not an important concern given the ten-year period considered for the transition matrices, in Appendix Table A3.1 we apply the Hodrick-Prescott filter to correct for high frequency fluctuations in income per capita.[24] Then, we recalculate the transition matrices relying on the detrended series. The transition matrices computed with the filtered series looked very similar to the previous ones, suggesting little change from our previous findings. The analysis of the mean first passage time matrices also yields similar conclusions.

Second, we exclude from our sample all countries that have a shorter time series of income per capita –those countries for which the series start in 1990 in our sample. Elements of the mean first passage time matrix for the second relative income grouping mp_{45} and mp_{34} are of similar magnitude, and the sum of mp_{45} and mp_{35} is about the same as the sum of mp_{24} and mp_{34}: it takes more or less the same time to move from upper-middle or middle-middle to high income than lower-middle or middle-middle to upper-middle. This logically corresponds to the fact that the sum of p_{24} and p_{34} is about the same as the sum of p_{45} and p_{35}.

Finally, we take a longer transition period. The rationale behind doing this is twofold. First, the shorter the time period, the lower the probability to jump from one income class to another. Second, all the periods are of equal length.[25] Not surprisingly, for the 14-year period transition matrices, the half-life is shortened to 29.8 and 43.8 periods for the different income categorizations. This may imply less periods or steps, but each period spans a longer time. The mean first passage time matrix (Table A3.3) suggests that it takes more or less the same time to move from upper-middle or middle-middle to high income than lower-middle or middle-middle to upper-middle, and the sum of the corresponding elements (p_{24} and p_{34}, on the one hand, and p_{45} and p_{35}, on the other) also points in this direction.

Overall, this section reinforces the idea that the transition probabilities and the expected transition time from upper middle income to high income do not differ radically from the transition from lower middle income to upper middle income, rendering little support to the existence of a middle income trap.

c. Patterns of Growth: Do MICs Look Different?

Relevant to the MIC trap discussion is the literature on sudden shifts in growth patterns – whether they are accelerations (Hausmann et al, 2004) or slowdowns (Eichengreen et al, 2011). In terms of empirical evidence of a "trap," Eichengreen et al find an empirical regularity in a

[24] We apply a smoothing parameter of 6.25, the standard for annual data.
[25] One of the reasons behind taking 2000-2008 as the last period for the ten-year period transition analysis was to use all the years available in our time-series.

panel of countries: that at about $17,000 (2005 PPP adjusted dollars) fast growing economies' growth rates tend to slow down by two percentage points. It is not clear that this is evidence of a MIC trap. First of all, the slowdown threshold is at a level that would probably correspond to a high-income country by World Bank standards, depending upon the PPP adjustment factor involved. Secondly, a slowdown by two percentage points in per capita growth – for example, from 9 to 7 percent or 8 to 6 percent certainly maintains a country on a rapid pace towards convergence, as discussed in sections III and IV above. Finally, if we were to define the MIC trap relative to a leading country (or group of leading countries), a more relevant metric would be the country's growth vis-à-vis the leader's. Aiyar et al (2013) find that TFP slowdowns in MICs are more frequent than in HICs and LICs. They explore structural, institutional, economic, and policy determinants of these slowdowns.

A more general approach to patterns of growth is laid out in Pritchett (2000), motivated by the fact that a single time trend may not represent an adequate characterization of the evolution of GDP per capita for most countries. Here we reproduce his results with another decade or so of data. The additional decade was one in which developing countries, in general, and middle-income countries, in particular, experienced more favorable growth. Various macroeconomic crisis episodes – the multiple Latin American episodes, the Russian crisis, the Asian crisis—were left behind, and faster and more stable growth was restored across a wide variety of developing countries.

Table 6: Patterns of Growth Since 1950, by number of countries by income classification

End-year WB classification* below:	Steep Hills	Hills	Plateaus	Mountains	Plains	(Mild) Accelerators
LICs (39)	0	1	6	8	10	14
L-MICs (31)	2	6	6	6	4	7
U-MICs (23)	1	6	6	0	1	9
HICs (11)	0	8	2	0	0	1
*o/w HIC (21) "Escapees"***	7	10	1 (Germany!)	0	0	3

Source: Authors' calculations based on data from Maddison, World Bank.

*In 1950, WB classification did not exist, so we use the end-year. (Admittedly, this opens up a tautology.)

**Relative standard for non-HIC status in 1950 was used, given differences in Maddison and World Bank data. Less than 50 percent of US in 1950 (or initial data year for that country) was used as threshold.

In this section we report several of Pritchett's (2000) statistics and we also include the average growth differential of a given country relative to the United States, which may prove to be useful in explaining the evolution of a country's relative income status. Pritchett's (2000) characterization of growth patterns into steep hills, hills, plateaus, mountains, plains and (mild) accelerators is very informative. The distribution of these patterns of growth is described in Table 6 below. The methodology involves identifying break points in OLS growth rates across countries and then categorizing the pattern of growth based on the pre-break growth rate and post-break growth rate. For example, plateaus would be a pattern whereby countries grew by greater than 1.5 percent pre-break, but then leveled off into a slower, but still positive growth rate.[26] The complete results of the full calculations by country are presented in Appendix 2. The summary of how countries fit into patterns is presented in Table 6.

Since the World Bank Classifications did not exist in 1950, Table 6 presents a bit of a tautology: end-period HICs would tend to have performed better than non-HICs during the preceding decades, and end-period LICs would have tended to perform worse. That is how they ended up in these categories. On the other hand, in relative terms, our earlier analysis of transition matrices revealed that there is a lot of persistence across relative categories. Table 6 then shows that the actual patterns of growth across MICs vary substantially. There are a few "super-fast" examples, some fast examples, and many (mild) accelerators that offer some hope for the future for MICs. Unfortunately, there are also many "plateaus", "mountains" (growth collapses) and "plains" observed. Similarly, there are different paths to success when examining the last row of Table 6. While most are "hills" or even "steep hills" (the super-stars), there are also several examples of more gradual paths to success.

Take, for instance, the set of countries that were successful in making the transition to high income countries according to the two income groupings that we have adopted in the previous section. We then compare selected indicators for those countries that still remain MICs ("still" MICs) and fell within one standard deviation interval of the initial relative income levels of those countries that successfully became HICs. For Table 4, we have that the median and mean relative income for those countries that transitioned into HIC status were 0.36 and 0.32. The standard deviation was about 0.15, giving us a lower bound of 0.17 and an upper bound of 0.47.[27] For Table 5, the median and mean initial relative income for the "new HICs" was 0.26 and 0.28, with a standard deviation of 0.12, giving us a lower and upper bound of 0.16 and 0.39.[28]

A very revealing picture emerges from Tables 7 and 8. The initial HICs have more or less grown at a similar pace as the United States –the average growth differential is negligible. In general, they are characterized by relatively low volatility –provided that we believe a single trend growth describes well the growth pattern of a given country—, and with a few exceptions, most of them are characterized by what Pritchett denominates "hills". The average of the ratio of the final GDP per capita and the minimum GDP per capita for the initial HICs is about 3.5.

[26] According to Pritchett's classification, we have: i) steep hills: pre- and post-break OLS growth are higher than 3%, ii) hills: pre- and post-break OLS growth are higher than 1.5%, iii) plateaus: pre-break OLS growth is higher than 1.5%, post-break OLS growth is positive but less than 1.5%, iv) mountains: pre-break OLS growth is higher than 1.5%, post-break OLS growth is negative, v) plains: pre- and post-break OLS growth are less than 1.5%, vi) (mild) accelerators: pre-break OLS growth less than 1.5%, post-break OLS growth is higher than 1.5%.

[27] The maximum value for the relative income in 1950 was 0.57 and the minimum was 0.09 for the set of "new HICs".

[28] The maximum value for the relative income in 1950 was 0.44 and the minimum was 0.09 for the set of "new HICs" using the relative income thresholds depicted in Table 5.

Table 7: Patterns of Growth Since 1950: Old HICs, new HICs, and "still MICs"

Country	OLS growth	Volatility	Avg. GDP growth differential	Final to minimum GDP	Initial GDP to US GDP	Final GDP to US GDP	Growth pattern LP
			Initial HICs				
Australia	0.022	0.033	0.001	3.414	0.775	0.812	Hills
Canada	0.022	0.060	0.001	3.465	0.763	0.810	Hills
Denmark	0.023	0.064	0.001	3.549	0.726	0.790	Hills
Netherlands	0.024	0.068	0.004	4.118	0.627	0.792	Hills
Sweden	0.021	0.082	0.002	3.606	0.708	0.783	Hills
Switzerland	0.015	0.082	-0.003	2.770	0.948	0.805	Plateaus
United Kingdom	0.021	0.024	0.001	3.421	0.726	0.762	Hills
Mean: Initial HICs	***0.021***	***0.059***	***0.001***	***3.478***	***0.753***	***0.793***	
			New HICs				
Austria	0.030	0.110	0.012	6.511	0.388	0.774	Hills
Belgium	0.026	0.075	0.005	4.331	0.571	0.759	Hills
Estonia	0.050	0.129	0.020	2.477	0.466	0.640	Accelerators
Finland	0.029	0.088	0.010	5.723	0.445	0.781	Hills
France	0.025	0.100	0.005	4.285	0.542	0.713	Hills
Germany	0.025	0.131	0.009	5.360	0.406	0.667	Plateaus
Hong Kong	0.049	0.097	0.027	14.293	0.232	1.017	Steep hills
Ireland	0.037	0.103	0.016	8.080	0.361	0.895	Steep hills
Italy	0.029	0.128	0.010	5.685	0.366	0.639	Hills
Japan	0.042	0.239	0.023	11.879	0.201	0.732	Hills
Singapore	0.051	0.141	0.025	12.856	0.232	0.902	Steep hills
South Korea	0.059	0.105	0.036	24.922	0.089	0.629	Steep hills
Spain	0.037	0.122	0.018	9.003	0.229	0.632	Steep hills
Taiwan	0.059	0.095	0.035	22.851	0.096	0.671	Steep hills
Mean: New HICs	***0.039***	***0.119***	***0.018***	***9.875***	***0.330***	***0.746***	
			"Still" MICs				
Bolivia	0.008	0.103	-0.013	1.878	0.201	0.095	Plateaus
Bulgaria	0.020	0.227	0.010	5.382	0.173	0.285	Plateaus
Brazil	0.023	0.135	0.003	3.846	0.175	0.206	Plateaus
Chile	0.020	0.145	0.003	3.593	0.384	0.423	Accelerators
Costa Rica	0.021	0.094	0.004	4.117	0.205	0.258	Hills
Cuba	0.006	0.147	-0.008	2.037	0.214	0.121	Accelerators
Greece	0.034	0.169	0.017	8.544	0.200	0.525	Hills
Guatemala	0.013	0.104	-0.007	2.243	0.218	0.143	Plateaus
Hungary	0.018	0.134	0.003	3.831	0.259	0.305	Hills
Israel	0.031	0.152	0.012	6.367	0.295	0.575	Hills
Jordan	0.018	0.161	0.003	3.509	0.174	0.183	Plateaus
Lebanon	0.007	0.159	-0.007	2.300	0.254	0.143	Accelerators
Mauritius	0.032	0.122	0.011	5.836	0.260	0.466	Hills
Namibia	0.009	0.110	-0.007	2.116	0.226	0.147	Plateaus
Nicaragua	-0.009	0.236	-0.017	1.308	0.169	0.054	Mountains
Panama	0.021	0.130	0.002	3.605	0.200	0.214	Hills
Paraguay	0.016	0.133	-0.008	2.204	0.166	0.106	Plains
Peru	0.007	0.141	-0.005	2.335	0.241	0.173	Hills
Poland	0.020	0.129	0.005	4.152	0.256	0.326	Hills
Portugal	0.036	0.124	0.014	6.919	0.218	0.463	Hills
Puerto Rico	0.034	0.119	0.014	7.031	0.224	0.483	Hills
Seychelles	0.024	0.100	0.001	3.195	0.200	0.196	Mountains
South Africa	0.007	0.110	-0.010	1.891	0.265	0.154	Plateaus
Turkey	0.026	0.060	0.008	4.970	0.170	0.259	Hills
Mean: "Still" MICs	***0.018***	***0.135***	***0.001***	***3.884***	***0.223***	***0.263***	

Memorandum items: USA

	OLS growth	Volatility	Avg. GDP growth differential
United States	0.021	0.032	0.000
All countries	0.017	0.138	-0.001

Note: GDP per capita series for Estonia starts in 1990.

Table 8: Patterns of Growth Since 1950: Old HICs, new HICs, and "still MICs"

Country	OLS growth	Volatility	Avg. GDP growth differential	Final to minimum GDP	Initial GDP to US GDP	Final GDP to US GDP	Growth pattern LP
			Initial HICs				
Australia	0.022	0.033	0.001	3.414	0.775	0.812	Hills
Belgium	0.026	0.075	0.005	4.331	0.571	0.759	Hills
Canada	0.022	0.060	0.001	3.465	0.763	0.810	Hills
Denmark	0.023	0.064	0.001	3.549	0.726	0.790	Hills
France	0.025	0.100	0.005	4.285	0.542	0.713	Hills
Netherlands	0.024	0.068	0.004	4.118	0.627	0.792	Hills
New Zealand	0.014	0.046	-0.007	2.437	0.884	0.598	Plateaus
Sweden	0.021	0.082	0.002	3.606	0.708	0.783	Hills
Switzerland	0.015	0.082	-0.003	2.770	0.948	0.805	Plateaus
United Kingdom	0.021	0.024	0.001	3.421	0.726	0.762	Hills
Mean: Initial HICs	***0.021***	***0.063***	***0.001***	***3.540***	***0.727***	***0.762***	
			New HICs				
Austria	0.030	0.110	0.012	6.511	0.388	0.774	Hills
Estonia	0.050	0.129	0.020	2.477	0.466	0.640	Accelerators
Finland	0.029	0.088	0.010	5.723	0.445	0.781	Hills
Germany	0.025	0.131	0.009	5.360	0.406	0.667	Plateaus
Greece	0.034	0.169	0.017	8.544	0.200	0.525	Hills
Hong Kong	0.049	0.097	0.027	14.293	0.232	1.017	Steep hills
Ireland	0.037	0.103	0.016	8.080	0.361	0.895	Steep hills
Israel	0.031	0.152	0.012	6.367	0.295	0.575	Hills
Italy	0.029	0.128	0.010	5.685	0.366	0.639	Hills
Japan	0.042	0.239	0.023	11.879	0.201	0.732	Hills
Singapore	0.051	0.141	0.025	12.856	0.232	0.902	Steep hills
Slovenia	0.036	0.054	0.013	1.951	0.468	0.583	Steep hills
South Korea	0.059	0.105	0.036	24.922	0.089	0.629	Steep hills
Spain	0.037	0.122	0.018	9.003	0.229	0.632	Steep hills
Taiwan	0.059	0.095	0.035	22.851	0.096	0.671	Steep hills
Mean: New HICs	***0.040***	***0.124***	***0.019***	***9.767***	***0.298***	***0.711***	
			"Still" MICs				
Bolivia	0.008	0.103	-0.013	1.878	0.201	0.095	Plateaus
Bulgaria	0.020	0.227	0.010	5.382	0.173	0.285	Plateaus
Brazil	0.023	0.135	0.003	3.846	0.175	0.206	Plateaus
Chile	0.020	0.145	0.003	3.593	0.384	0.423	Accelerators
Costa Rica	0.021	0.094	0.004	4.117	0.205	0.258	Hills
Cuba	0.006	0.147	-0.008	2.037	0.214	0.121	Accelerators
Djibuti	-0.008	0.148	-0.023	1.149	0.157	0.040	Plains
Guatemala	0.013	0.104	-0.007	2.243	0.218	0.143	Plateaus
Hungary	0.018	0.134	0.003	3.831	0.259	0.305	Hills
Jordan	0.018	0.161	0.003	3.509	0.174	0.183	Plateaus
Lebanon	0.007	0.159	-0.007	2.300	0.254	0.143	Accelerators
Malaysia	0.039	0.101	0.013	7.284	0.163	0.330	Steep hills
Mauritius	0.032	0.122	0.011	5.836	0.260	0.466	Hills
Namibia	0.009	0.110	-0.007	2.116	0.226	0.147	Plateaus
Nicaragua	-0.009	0.236	-0.017	1.308	0.169	0.054	Mountains
Panama	0.021	0.130	0.002	3.605	0.200	0.214	Hills
Paraguay	0.016	0.133	-0.008	2.204	0.166	0.106	Plains
Peru	0.007	0.141	-0.005	2.335	0.241	0.173	Hills
Poland	0.020	0.129	0.005	4.152	0.256	0.326	Hills
Portugal	0.036	0.124	0.014	6.919	0.218	0.463	Hills
Puerto Rico	0.034	0.119	0.014	7.031	0.224	0.483	Hills
Seychelles	0.024	0.100	0.001	3.195	0.200	0.196	Mountains
Singapore	0.051	0.141	0.025	12.856	0.232	0.902	Steep hills
South Africa	0.007	0.110	-0.010	1.891	0.265	0.154	Plateaus
Turkey	0.026	0.060	0.008	4.970	0.170	0.259	Hills
Mean: "Still" MICs	***0.018***	***0.132***	***0.001***	***3.983***	***0.216***	***0.259***	

Memorandum items: USA

	OLS growth	Volatility	Avg. GDP growth differential
USA	0.021	0.032	0.000
All countries	0.017	0.138	-0.001

Note: GDP per capita series for Estonia and Slovenia start in 1990.

The group of new HICs is comprised of hills, steep hills, accelerators, and one plateau (Germany, which is not surprising given that the break year is 1990). While volatility is higher, these countries have grown much faster than the United States: the growth differential average is 1.8-1.9%. The average of the ratio of the final GDP per capita and the minimum GDP per capita for the new HICs is about 9.8-9.9, almost three times larger than for the initial HICs. Thus, it is not surprising why these countries have joined the HIC group.

Finally, we take a look at those countries that remain middle income, or "still" MICs. Volatility is the highest among the three groups depicted here. Their average growth differs very little from the leading country or the initial HICs. The average ratio of final to minimum GDP is between 3.9 and 4, not much different from the ratio of the initial HICs. Finally, we see a wide range of growth patterns, including hills, plateaus, plains, accelerators, and mountains. We do not observe, however, steep hills, a very common categorization among new HICs or "escapees".

Table 9: Time required to cross the lower and upper threshold of upper-middle countries

Country	Year for lower bondary of UMIC	GDP to US GDP - Lower threshold	Year for upper boundary of UMIC	GDP to US GDP - Upper threshold	Number of years	Average growth differential for 1950-2008	Average growth differential for the transition period from MIC to HIC status	Average growth differential until reaching the upper UMIC threshold
Countries that have crossed both lower and upper thresholds of the UMIC: 0.45 and 0.60 of US GDP per capita between 1950 and 2008								
Austria	1955	0.46	1969	0.60	14	0.012	0.022	0.024
Finland	1951	0.45	1970	0.64	19	0.010	0.019	0.019
Germany	1953	0.46	1958	0.63	5	0.009	0.062	0.058
Hong Kong	1976	0.47	1982	0.62	6	0.027	0.055	0.032
Italy	1957	0.47	1968	0.61	11	0.010	0.028	0.030
Ireland	1980	0.46	1996	0.61	16	0.016	0.020	0.012
Japan	1966	0.46	1970	0.65	4	0.023	0.080	0.061
Singapore	1980	0.49	1990	0.61	10	0.025	0.030	0.026
South Korea	1994	0.45	2007	0.61	13	0.036	0.026	0.036
Spain	1973	0.46	2006	0.61	33	0.018	0.009	0.018
Taiwan	1991	0.46	2004	0.61	13	0.035	0.027	0.036
Mean					*13.1*	*0.020*	*0.034*	*0.032*
Countries that have crossed both lower and upper thresholds of the UMIC: 0.25 and 0.50 of US GDP per capita between 1950 and 2008								
Greece	1957	0.26	2007	0.51	50	0.017	0.015	0.017
Hong Kong	1956	0.25	1978	0.50	22	0.027	0.034	0.029
Japan	1955	0.25	1968	0.54	13	0.023	0.058	0.057
Singapore	1969	0.26	1981	0.50	12	0.025	0.060	0.026
South Korea	1983	0.26	1997	0.50	14	0.036	0.049	0.039
Spain	1954	0.26	1975	0.51	21	0.018	0.036	0.034
Taiwan	1978	0.26	1993	0.51	15	0.035	0.048	0.040
Mean					*21.0*	*0.026*	*0.043*	*0.035*

In Table 9, we list the countries that have crossed both the lower and upper thresholds of what we classify as upper middle income countries between 1950 and 2008.[29] On average, it took about 13.1 years (or 21 years, depending on the arbitrary relative income threshold we choose) to make the transition. A first look at the last three columns suggests that all these countries grew much faster than the United States. While this is not a rigorous test, Table 9 shows that the average growth differential until reaching the upper UMIC threshold is slightly

[29] Estonia, for example, was left out because only a few years were available and the transition period from upper MIC to HIC spans most of the years available in the sample (1990-2006), thus, making the comparison of growth differentials across periods less meaningful.

lower than the average growth differential for the transition period, providing little support to this idea of a growth slowdown once a country reaches upper middle income status, at least for this set of countries.

We now proceed to compare whether some of these countries have slowed down once they have become upper middle income countries. As we pointed out earlier, several authors have suggested that middle income countries may be in a crossroad between low-skilled labor intensive activities linked to low income countries and more sophisticated products that are associated with high income countries which, in turn, may translate in the need to move from a development model based on low skills-low wages towards a productive structure based on innovation and high skills. This transition process may be neither smooth nor straightforward. On the other hand, these countries are also relatively closer to their respective steady-states, which may also suggest a moderation in growth.

We therefore examine this growth slowdown hypothesis by looking at upper middle income countries that failed to graduate (the cases of Greece, Israel, Portugal, and Puerto Rico) and countries that succeeded in becoming high income countries (Ireland, Korea, Singapore, Spain and Taiwan, China) based on the 0.45-0.60 UMIC classification.[30] For the former group, a simple one-tailed means test for each country suggests that there has been a slowdown in growth -measure as growth differential relative to the United States- after crossing the upper middle income threshold. For the latter, however, only for Spain we find that there has been a statistically significant moderation in growth.

We perform a similar exercise but using the 0.25-0.50 relative income definition. We look at the cases of new HICs: Korea, Singapore, and Taiwan, China. A means test for each of these countries suggests that only for the case of Singapore we observe a difference in growth that is statistically significant -in this case an acceleration rather than a slowdown. Among countries that have crossed the 0.25 relative income threshold but failed to become HICs (Brazil, Costa Rica, Jamaica, Panama, Thailand, Malaysia, Jordan, Namibia and Seychelles)[31], we observe a statistically significant slowdown only in Brazil and Jamaica. In both cases, once these countries crossed the 0.25 threshold, average growth differential has become negative.

Finally, we take a quick look at the cases of Thailand and Malaysia, the latter cited as an example of the so-called "middle-income trap". Both countries crossed the 0.25 relative income threshold in the early 1990s. However, the Asian crisis of 1997 adversely impacted the progression towards HIC status. In 2008, GDP per capita relative to the US stood at 0.33 and

[30] The choice of countries follows two criteria: at least ten yearly observations before crossing the 0.45 threshold and ten yearly observations after crossing the 0.45 threshold for UMICs or ten yearly observations in the UMIC income bracket for countries that jumped into the HIC group (above 0.60). This leaves Japan and Hong Kong SAR, China, out, for example.

[31] The choice of countries corresponds to the following criteria: at least ten yearly observations before crossing the 0.25 threshold and ten yearly observations after crossing the 0.25 threshold for UMICs or ten yearly observations in the UMIC income bracket for countries that jumped into the HIC group (above 0.50).

0.28 for Malaysia and Thailand, respectively, whereas average growth differential after crossing the UMIC lower threshold was 2% and 1.2% respectively. If we assume that these countries were to keep this pace, it will take about 20 years for Malaysia and about 50 years for Thailand to cross the 0.5 relative income threshold. It should be noted that the average relative growth rates for each of these countries has been dampened by the output contraction during the 1997 Asian crisis. From 2000 onwards, the growth differential with respect to the United States was 2% for Malaysia and 2.7% for Thailand and about 2.5% for both in the last five years of the sample. At the latter pace, it would take about 17 and 24 years respectively to cross the 0.5 relative income per capita threshold. Take, for instance, the relative income per capita of Malaysia and Thailand in 1996 (0.31 and 0.27). Had the Asian Crisis not taken place, Malaysia would have become a high income country by 2016 and Thailand by 2021.

VI. Policy Discussion

The simplest version of the neoclassical growth model suggests that, if technologies are the same across countries, then higher returns to capital in low capital per worker countries would ensure convergence towards a common level of income per capita and a common growth rate—in other words, unconditional convergence. This has not been the reality – whether one considers all the countries of the world or subsets like MICs. In recent decades, numerous theories have focused on a variety of factors, "endogenous" growth models that explain differences in the rate of technological change removing the assumption of constant returns to scale, and policy, institutional and historical explanations that may result in multiple equilibriums or simply differences across countries (Banerjee and Duflo, 2005; Azariadis and Stachurski, 2005; Parente and Prescott, 2005).

The empirical literature has focused on conditional convergence and which factors, or controls, are the most appropriate for explaining the lack of unconditional convergence, ranging from the rate of capital accumulation and population growth/human capital (Mankiw et al, 1992), the role of public infrastructure (Calderón and Servén, 2004) to policies, including the investment climate, and institutions (Dollar and Kraay, 2003; Loayza and Servén, 2009). Jones and Romer (2010) have developed what they call the "New Kaldor Facts" that emerge from the empirical literature. Without entering into all six, two of them are: (a) there is a large degree of variation in modern growth rates and that variation in growth increases with the distance from the technology frontier; and (b) there are large differences in total factor productivity across countries--differences in measured inputs explain less than half of the differences in GDP per capita.

This discussion raises doubts about the relevance of using a relative measure of MIC success or failure or "trap." It may be reasonable to imagine a future in which all countries are "rich" from some absolute perspective; however, given differences in preferences, endowments, geography, initial conditions, historical antecedents and even random shocks, it is hard to imagine a world in which all countries have a nearly identical income per capita. Even if all policies were "perfect," it is not clear that one would expect rapid or complete convergence. In addition, the results above indicate that transition states have taken a long time to converge. In the 200 years of modern economic history, one might have hoped that more countries could have caught up to the world leaders, but this is a relatively short time span for convergence to occur. It may be a misnomer to consider growth "slowdowns" to be a "trap," and in some cases, they have represented just a slower convergence path.

Our results also show that MICs do not really look that different in terms of transitions across the inter-country distribution of income. Their growth patterns also do not conform to one clear pattern that can be easily characterized as a "trap."

On the other hand, the "MIC Trap" concept is useful for guiding policy discussions. First, it recognizes the particular challenges faced by countries at that stage of development. Secondly, it calls attention to the limited number of MICs that have been fully successful in attaining a truly developed country status – even if absolute incomes have risen and even if non-income dimensions have improved substantially in many countries. At the same time, a certain amount of realism might be added to the discussion. The identification of the small group of fast MIC "escapees" can lead to a form of "outlier worship." The attempt to grow at 7 or 10 percent could lead to unsustainable policies that eventually create the "trap"-like pattern of dismal growth that MICs are trying to avoid in the first place. Gradualism may be more sustainable and less risky – especially for upper middle income countries.

If conditional convergence is the reality, then policies might focus on overcoming the "initial conditions" that inhibit growth – institutions and other factors.[32] Aiyer et al (2013) provide some evidence of potential determinants of MIC slowdowns that are relevant to the debate. In addition, some of the non-income factors that are often used to measure development progress may themselves be the control factors limiting a country's convergence. Policies that affect the distribution and increase the inclusiveness of growth (for example, investing in the human capital of the poor) may actually accelerate catch-up, as has been noted in the vast theoretical and empirical literature on economic growth.

[32] Felipe et al (2012) conduct an empirical evaluation of these factors in determining exit from their definition of a MIC trap.

Appendix 1: Other dimensions of MIC status in historical perspective

As noted in the introduction, many other socio economic indicators are highly correlated with income per capita; however, relative performance is often on a different scale. For example, access to safe drinking water is either 100 percent or less. In other words, for some access to service measures of development or human capital attainment, one does not have the case of infinitely "moving goalposts," as discussed above in term of relative MIC status, as measured by income per capita. In addition, technological change implies that there are services today that many MIC residents enjoy that did not even exist in the late 19th or early 20th century, when today's HICs were, in fact, MICs by some absolute standard.

Table A1.1 below presents some basic data on the status of middle income countries in a number of non-income dimensions. We see that Upper MICs are reaching over 90 percent access to improved water source and electricity. Life expectancy in Upper MICs is above the US level in 1920 or 1960 and is almost 93 percent the level of the US life expectancy. Even Lower MICs have a life expectancy that is 83 percent of the US level. The infant mortality rate in both Upper and Lower MICs is far lower than it was in the US in 1920, but they still lag pretty badly behind the current US level – especially in Lower MICs which suffer from infant mortality that is over 8 times as high as in the US today. Education variables are lagging as well. In general terms, however, while the history of "catch-up" in per capita incomes is not very favorable, the history on a number of non-income social dimensions is substantially better – at least from the perspective of this brief sketch of some relevant social outcomes.

Table A1.1: Non-income Dimensions of MICs and Comparison to the United States

	Upper MIC (2009)	Lower MIC (2009)	US in 1920	US in 1960	US in 2010
Access to electricity (% of population)	97.3	67.7			
Life expectancy at birth, total (years)	72.4	65.2	54.1	67.4	78.2
Mortality rate, infant (per 1,000 live births)	19.3	50.7	85.8	26	6.5
School enrollment, secondary (% gross)	84.4	59.0	64.3**	84.4**	96.0
School enrollment, secondary (% net)	75.9	52.4*			89.5
Physicians (per 1,000 people)	1.7	0.8	1.37	1.48	2.4
Improved water source (% of population with access)	91.9	86.5			
Literacy Rate (percent)	93.5	70.9	94	97.8***	

Sources: World Development Indicators and Bureau of the Census (1975)

Notes: *Data for 2008 instead of 2009

**Slightly different definition: primary and secondary, % of population 5 to 20 years of age

***1959 instead of 1960.

US data for 2010 is from WDI. US data for 1920 and 1960 is from Bureau of the Census (1975).

Appendix 2: Statistical Annex on Growth Patterns and Country Classifications

Table A2.1: List of countries

List of countries		
Afghanistan	Guinea Bissau	Nepal
Albania	Greece	New Zealand
Argentina	Guatemala	Pakistan
Armenia	Hong Kong	Panama
Australia	Honduras	Peru
Austria	Croatia	Philippines
Burundi	Haïti	Poland
Belgium	Hungary	Puerto Rico
Benin	India	North Korea
Burkina Faso	Ireland	Portugal
Bangladesh	Israel	Paraguay
Bulgaria	Italy	Romania
Bosnia	Jamaica	Rwanda
Belarus	Jordan	Senegal
Bolivia	Japan	Singapore
Brazil	Kenya	Sierra Leone
Central African Republic	Kyrgyzstan	El Salvador
Canada	Cambodia	Somalia
Switzerland	South Korea	Sao Tomé and Principe
Chile	Laos	Slovakia
China	Lebanon	Slovenia
Côte d'Ivoire	Liberia	Sweden
Comoro Islands	Sri Lanka	Swaziland
Cape Verde	Lesotho	Seychelles
Costa Rica	Lithuania	Togo
Cuba	Latvia	Thailand
Czech Rep.	Morocco	Tajikistan
Germany	Moldova	Tunisia
Djibouti	Madagascar	Turkey
Denmark	Macedonia	Taiwan
Dominican Republic	Mali	Tanzania
Egypt	Burma	Uganda
Eritrea and Ethiopia	Mongolia	Ukraine
Spain	Mozambique	Uruguay
Estonia	Mauritania	United States
Finland	Mauritius	Uzbekistan
France	Malawi	West Bank and Gaza
United Kingdom	Malaysia	South Africa
Georgia	Namibia	Zaire (Congo-Kinshasa)
Ghana	Niger	Zambia
Guinea	Nicaragua	Zimbabwe
Gambia	Netherlands	

Table A2.2: Growth Patterns and Country Classifications

Steep hills: Pre-break OLS growth > 3 percent, Post-break OLS growth 3 > percent - 10 countries

Country	Income classification	Initial year	GDP to US GDP - Initial year	Final year	GDP to US GDP - Final year	Year of break	GDP to US GDP - Break year	Pre-break OLS growth	Post-break OLS growth	Pre-break avg. growth differential with US	Post-break avg. growth differential with US
Hong Kong	High income: nonOECD	1950	0.232	2008	1.017	1986	0.657	0.053	0.031	0.029	0.023
Ireland	High income: OECD	1950	0.361	2008	0.895	1982	0.481	0.032	0.053	0.008	0.026
Malaysia	Upper middle income	1950	0.163	2008	0.330	1990	0.221	0.035	0.034	0.007	0.026
Singapore	High income: nonOECD	1950	0.232	2008	0.902	1987	0.539	0.053	0.038	0.023	0.027
Slovenia	High income: nonOECD	1990	0.468	2008	0.583	2004	0.498	0.030	0.053	0.004	0.036
South Korea	High income: OECD	1950	0.089	2008	0.629	1968	0.122	0.035	0.060	0.017	0.044
Spain	High income: OECD	1950	0.229	2008	0.632	1961	0.301	0.034	0.032	0.018	0.018
Taiwan	High income: nonOECD	1950	0.096	2008	0.671	1986	0.352	0.060	0.044	0.037	0.033
Thailand	Lower middle income	1950	0.085	2008	0.281	1988	0.170	0.040	0.034	0.017	0.030
Tunisia	Lower middle income	1950	0.117	2008	0.196	1986	0.143	0.033	0.032	0.009	0.011

Hills: Pre-break OLS growth > 1.5 percent, Post-break OLS growth > 1.5 percent - 31 countries

Country	Income classification	Initial year	GDP to US GDP - Initial year	Final year	GDP to US GDP - Final year	Year of break	GDP to US GDP - Break year	Pre-break OLS growth	Post-break OLS growth	Pre-break avg. growth differential with US	Post-break avg. growth differential with US
Albania	Lower middle income	1950	0.105	2008	0.133	1991	0.078	0.024	0.054	0.001	0.017
Australia	High income: OECD	1950	0.775	2008	0.812	1980	0.776	0.025	0.022	-0.001	0.002
Austria	High income: OECD	1950	0.388	2008	0.774	1972	0.676	0.047	0.021	0.027	0.004
Belgium	High income: OECD	1950	0.571	2008	0.759	1969	0.660	0.030	0.020	0.006	0.005
Burma	Low income	1950	0.041	2008	0.100	1987	0.040	0.021	0.071	0.002	0.041
Canada	High income: OECD	1950	0.763	2008	0.810	1990	0.813	0.026	0.021	0.002	-0.001
China	Lower middle income	1950	0.047	2008	0.216	1976	0.050	0.020	0.064	0.007	0.045
Costa Rica	Upper middle income	1950	0.205	2008	0.258	1981	0.248	0.032	0.023	0.009	0.000
Denmark	High income: OECD	1950	0.726	2008	0.790	1964	0.827	0.029	0.019	0.007	0.000
Egypt	Lower middle income	1950	0.095	2008	0.119	1975	0.087	0.019	0.020	-0.008	0.013
Finland	High income: OECD	1950	0.445	2008	0.781	1969	0.585	0.037	0.023	0.012	0.009
France	High income: OECD	1950	0.542	2008	0.713	1969	0.717	0.038	0.017	0.014	0.001
Greece	High income: OECD	1950	0.200	2008	0.525	1963	0.314	0.051	0.025	0.033	0.013
Hungary	High income: OECD	1950	0.259	2008	0.305	1990	0.278	0.027	0.033	0.004	0.002
Israel	High income: nonOECD	1950	0.295	2008	0.575	1971	0.569	0.052	0.018	0.032	0.002
Italy	High income: OECD	1950	0.366	2008	0.639	1961	0.559	0.051	0.023	0.036	0.004
Japan	High income: OECD	1950	0.201	2008	0.732	1966	0.460	0.074	0.026	0.055	0.012
Lesotho	Lower middle income	1950	0.037	2008	0.063	1976	0.048	0.030	0.024	0.009	0.012
Mauritius	Upper middle income	1950	0.260	2008	0.466	1968	0.196	0.020	0.041	-0.008	0.019
Morocco	Lower middle income	1950	0.152	2008	0.111	1992	0.109	0.018	0.020	-0.006	-0.003
Netherlands	High income: OECD	1950	0.627	2008	0.792	1964	0.739	0.031	0.020	0.011	0.002
Pakistan	Lower middle income	1950	0.067	2008	0.072	1997	0.068	0.026	0.024	0.002	0.000
Panama	Upper middle income	1950	0.200	2008	0.214	1988	0.198	0.032	0.017	0.006	-0.006
Peru	Upper middle income	1950	0.241	2008	0.173	1988	0.167	0.015	0.023	-0.006	-0.003
Poland	Upper middle income	1950	0.256	2008	0.326	1989	0.246	0.026	0.039	0.000	0.013
Portugal	High income: OECD	1950	0.218	2008	0.463	1970	0.364	0.047	0.026	0.022	0.009
Puerto Rico	High income: nonOECD	1950	0.224	2008	0.483	1969	0.385	0.054	0.025	0.028	0.007
Slovakia	High income: OECD	1990	0.335	2008	0.418	2004	0.324	0.026	0.078	-0.003	0.059
Sweden	High income: OECD	1950	0.708	2008	0.783	1967	0.811	0.033	0.016	0.007	0.000
Turkey	Upper middle income	1950	0.170	2008	0.259	1966	0.193	0.023	0.024	0.007	0.008
United Kingdom	High income: OECD	1950	0.726	2008	0.762	1980	0.696	0.022	0.023	-0.001	0.003

Table A2.2: Growth Patterns and Country Classifications (cont.)

Plateaus: Pre-break OLS growth > 1.5 percent, 0 < Post-break OLS growth < 1.5 percent - 21 countries

Country	Income classification	Initial year	GDP to US GDP - Initial year	Final year	GDP to US GDP - Final year	Year of break	GDP to US GDP - Break year	Pre-break OLS growth	Post-break OLS growth	Pre-break avg. growth differential with US	Post-break avg. growth differential with US
Argentina	Upper middle income	1950	0.522	2008	0.353	1981	0.403	0.021	0.012	-0.005	-0.007
Burkina Faso	Low income	1950	0.050	2008	0.034	1973	0.044	0.023	0.012	0.000	-0.010
Bulgaria	Upper middle income	1950	0.173	2008	0.285	1964	0.286	0.052	0.008	0.040	0.001
Bolivia	Lower middle income	1950	0.201	2008	0.095	1982	0.131	0.015	0.011	-0.013	-0.013
Brazil	Upper middle income	1950	0.175	2008	0.206	1972	0.222	0.029	0.011	0.010	-0.001
El Salvador	Lower middle income	1950	0.156	2008	0.094	1979	0.139	0.021	0.012	-0.002	-0.015
Gambia	Low income	1950	0.064	2008	0.033	1983	0.049	0.021	0.006	0.000	-0.021
Germany	High income: OECD	1950	0.406	2008	0.667	1990	0.687	0.034	0.014	0.015	-0.004
Guinea	Low income	1950	0.032	2008	0.020	1981	0.029	0.020	0.007	-0.002	-0.014
Guatemala	Lower middle income	1950	0.218	2008	0.143	1982	0.202	0.025	0.011	-0.002	-0.014
Jamaica	Upper middle income	1950	0.139	2008	0.118	1974	0.237	0.045	0.004	0.027	-0.021
Jordan	Lower middle income	1950	0.174	2008	0.183	1976	0.182	0.019	0.006	-0.001	0.006
Kenya	Low income	1950	0.068	2008	0.035	1977	0.056	0.016	0.000	-0.007	-0.014
Mauritania	Low income	1950	0.049	2008	0.042	1964	0.065	0.031	0.005	0.007	-0.004
Mozambique	Low income	1950	0.119	2008	0.069	1974	0.102	0.020	0.012	-0.002	-0.012
Namibia	Upper middle income	1950	0.226	2008	0.147	1962	0.241	0.017	0.004	0.000	-0.009
New Zealand	High income: OECD	1950	0.884	2008	0.598	1977	0.682	0.019	0.014	-0.006	-0.007
Philippines	Lower middle income	1950	0.112	2008	0.094	1984	0.108	0.023	0.014	0.004	-0.012
South Africa	Upper middle income	1950	0.265	2008	0.154	1962	0.267	0.018	0.002	0.002	-0.012
Swaziland	Lower middle income	1950	0.075	2008	0.101	1970	0.135	0.052	0.006	0.020	0.000
Switzerland	High income: OECD	1950	0.948	2008	0.805	1969	1.056	0.030	0.009	0.005	-0.006

Mountains: Pre-break OLS growth > 1.5 percent, Post-break OLS growth < 0 percent - 14 countries

Country	Income classification	Initial year	GDP to US GDP - Initial year	Final year	GDP to US GDP - Final year	Year of break	GDP to US GDP - Break year	Pre-break OLS growth	Post-break OLS growth	Pre-break avg. growth differential with US	Post-break avg. growth differential with US
Burundi	Low income	1950	0.038	2008	0.015	1985	0.032	0.017	-0.022	-0.005	-0.028
Comoro Islands	Low income	1950	0.059	2008	0.018	1975	0.049	0.030	-0.007	0.006	-0.036
Côte d'Ivoire	Lower middle income	1950	0.109	2008	0.035	1968	0.116	0.029	-0.016	0.001	-0.027
Guinea Bissau	Low income	1950	0.030	2008	0.020	1964	0.050	0.054	-0.006	0.037	-0.017
Mongolia	Lower middle income	1950	0.046	2008	0.032	1990	0.057	0.031	-0.006	0.007	-0.033
Nicaragua	Lower middle income	1950	0.169	2008	0.054	1979	0.114	0.024	-0.010	0.000	-0.033
Niger	Low income	1950	0.065	2008	0.017	1960	0.067	0.019	-0.015	0.000	-0.027
North Korea	Low income	1950	0.089	2008	0.036	1971	0.165	0.039	-0.032	0.022	-0.031
Romania	Lower middle income	1950	0.124	2008	0.157	1971	0.210	0.045	-0.001	0.022	-0.004
Seychelles	Lower middle income	1950	0.200	2008	0.196	1996	0.242	0.026	-0.012	0.004	-0.010
Togo	Low income	1950	0.060	2008	0.019	1964	0.066	0.021	-0.016	0.002	-0.024
West Bank & Gaza	Lower middle income	1950	0.100	2008	0.070	1997	0.185	0.031	-0.096	0.013	-0.073
Zaire (Congo-Kinshasa)	Low income	1950	0.060	2008	0.008	1962	0.064	0.016	-0.034	-0.002	-0.040
Zambia	Low income	1950	0.069	2008	0.027	1959	0.081	0.023	-0.010	0.008	-0.019

Table A2.2: Growth Patterns and Country Classifications (cont.)

Plains: Pre-break OLS growth < 1.5 percent, Post-break OLS growth < 1.5 percent - 15 countries

Country	Income classification	Initial year	GDP to US GDP - Initial year	Final year	GDP to US GDP - Final year	Year of break	GDP to US GDP - Break year	Pre-break OLS growth	Post-break OLS growth	Pre-break avg. growth differential with US	Post-break avg. growth differential with US
Benin	Low income	1950	0.113	2008	0.045	1979	0.057	0.000	0.006	-0.026	-0.007
Central African Republic	Low income	1950	0.081	2008	0.017	1979	0.041	-0.001	-0.013	-0.021	-0.032
Djibouti	Lower middle income	1950	0.157	2008	0.040	1970	0.138	0.008	-0.020	-0.017	-0.026
Ghana	Low income	1950	0.117	2008	0.053	1975	0.077	0.010	0.009	-0.011	-0.014
Haïti	Low income	1950	0.110	2008	0.022	1976	0.065	-0.005	-0.021	-0.021	-0.032
Honduras	Lower middle income	1950	0.137	2008	0.075	1974	0.106	0.009	0.003	-0.016	-0.007
Liberia	Low income	1950	0.110	2008	0.026	1990	0.046	-0.003	-0.033	-0.026	-0.018
Madagascar	Low income	1950	0.099	2008	0.023	1981	0.050	0.003	-0.011	-0.019	-0.031
Malawi	Low income	1950	0.034	2008	0.024	1971	0.033	0.015	0.004	-0.006	-0.005
Paraguay	Lower middle income	1950	0.166	2008	0.106	1977	0.143	0.014	0.001	-0.008	-0.007
Sao Tomé & Principe	Lower middle income	1950	0.086	2008	0.048	1961	0.082	0.002	0.001	-0.010	-0.008
Somalia	Low income	1950	0.111	2008	0.031	1991	0.044	-0.003	-0.001	-0.018	-0.022
Tanzania	Low income	1950	0.044	2008	0.024	1962	0.039	0.001	0.002	-0.012	-0.010
Uruguay	Upper middle income	1950	0.487	2008	0.317	1967	0.329	-0.002	0.014	-0.020	-0.001
Zimbabwe	Low income	1950	0.073	2008	0.025	1997	0.054	0.014	-0.053	-0.005	-0.064

Accelerators: Pre-break OLS growth < 1.5 percent, Post-break OLS growth > 1.5 percent - 34 countries

Country	Income classification	Initial year	GDP to US GDP - Initial year	Final year	GDP to US GDP - Final year	Year of break	GDP to US GDP - Break year	Pre-break OLS growth	Post-break OLS growth	Pre-break avg. growth differential with US	Post-break avg. growth differential with US
Afghanistan	Low income	1950	0.067	2008	0.028	1992	0.024	0.001	0.037	-0.022	0.008
Armenia	Lower middle income	1990	0.261	2008	0.373	1999	0.155	-0.032	0.118	-0.048	0.094
Bangladesh	Low income	1950	0.056	2008	0.037	1971	0.038	0.008	0.020	-0.015	-0.003
Belarus	Upper middle income	1990	0.310	2008	0.404	1994	0.215	-0.070	0.069	-0.070	0.036
Bosnia	Upper middle income	1990	0.161	2008	0.233	1996	0.134	-0.132	0.046	-0.106	0.090
Cambodia	Low income	1950	0.050	2008	0.080	1998	0.037	0.014	0.100	-0.003	0.073
Cape Verde	Lower middle income	1950	0.047	2008	0.088	1980	0.045	0.009	0.038	-0.012	0.036
Chile	Upper middle income	1950	0.384	2008	0.423	1982	0.275	0.012	0.042	-0.005	0.012
Croatia	High income: nonOECD	1990	0.317	2008	0.286	1999	0.226	-0.002	0.041	-0.032	0.020
Cuba	Upper middle income	1950	0.214	2008	0.121	1991	0.113	0.011	0.034	-0.012	0.000
Czech Republic	High income: OECD	1990	0.383	2008	0.413	2002	0.335	0.013	0.053	-0.013	0.033
Dominican Republic	Upper middle income	1950	0.107	2008	0.143	1970	0.104	0.014	0.022	-0.005	0.011
Eritrea & Ethiopia	Low income	1950	0.041	2008	0.028	1990	0.025	0.013	0.023	-0.012	0.005
Estonia	High income: nonOECD	1990	0.466	2008	0.640	1993	0.341	-0.116	0.067	-0.111	0.037
Georgia	Lower middle income	1990	0.328	2008	0.192	2003	0.139	-0.032	0.085	-0.060	0.073
India	Lower middle income	1950	0.065	2008	0.095	1979	0.048	0.014	0.039	-0.007	0.021
Kyrgyzstan	Low income	1990	0.155	2008	0.091	1994	0.078	-0.143	0.030	-0.137	-0.004
Laos	Low income	1950	0.064	2008	0.054	1997	0.042	0.012	0.038	-0.009	0.019
Latvia	Upper middle income	1990	0.427	2008	0.475	1993	0.229	-0.252	0.075	-0.219	0.042
Lebanon	Upper middle income	1950	0.254	2008	0.143	1987	0.100	0.012	0.036	-0.014	0.005
Lithuania	Upper middle income	1990	0.373	2008	0.364	1993	0.229	-0.150	0.057	-0.138	0.020
Macedonia	Upper middle income	1990	0.171	2008	0.130	1993	0.132	-0.074	0.018	-0.073	-0.007
Mali	Low income	1950	0.048	2008	0.037	1993	0.031	0.012	0.032	-0.008	0.007
Moldova	Lower middle income	1990	0.266	2008	0.114	1994	0.101	-0.202	0.031	-0.168	-0.013
Nepal	Low income	1950	0.052	2008	0.036	1985	0.035	0.008	0.018	-0.011	0.001
Rwanda	Low income	1950	0.057	2008	0.033	1993	0.032	0.015	0.032	-0.009	0.008
Senegal	Low income	1950	0.132	2008	0.047	1991	0.053	-0.002	0.015	-0.022	-0.008
Sierra Leone	Low income	1950	0.069	2008	0.022	1995	0.031	0.008	0.020	-0.015	-0.027
Sri Lanka	Lower middle income	1950	0.131	2008	0.157	1971	0.095	0.005	0.033	-0.014	0.012
Tajikistan	Low income	1990	0.130	2008	0.049	1996	0.033	-0.235	0.058	-0.206	0.018
Uganda	Low income	1950	0.072	2008	0.032	1978	0.038	0.010	0.017	-0.019	-0.008
Ukraine	Lower middle income	1990	0.260	2008	0.160	1994	0.135	-0.117	0.046	-0.117	-0.003
United States	High income: OECD	1950	1.000	2008	1.000	1964	1.000	0.015	0.020	0.000	0.000
Uzbekistan	Low income	1990	0.184	2008	0.169	2002	0.128	-0.015	0.063	-0.034	0.045

Appendix 3: Transition Matrices

Table A3.1: Transition matrices including East European countries (Hodrick-Prescott filtered time-series)

Panel I: Total number of transitions

	[0-0.15)	[0.15-0.3)	[0.3-0.45)	[0.45-0.6)	≥0.6
[0-0.15)	357	21	0	0	0
[0.15-0.3)	25	89	23	2	0
[0.3-0.45)	0	10	19	15	3
[0.45-0.6)	0	0	3	16	11
≥0.6	0	0	0	1	87

Panel II: Transition matrix

p(i,j)	[0-0.15)	[0.15-0.3)	[0.3-0.45)	[0.45-0.6)	≥0.6
[0-0.15)	0.94	0.06	0.00	0.00	0.00
[0.15-0.3)	0.18	0.64	0.17	0.01	0.00
[0.3-0.45)	0.00	0.21	0.40	0.32	0.06
[0.45-0.6)	0.00	0.00	0.10	0.53	0.37
≥0.6	0.00	0.00	0.00	0.01	0.99

Panel III: Mean first passage time

	[0-0.15)	[0.15-0.3)	[0.3-0.45)	[0.45-0.6)	≥0.6
[0-0.15)	37.8	188.2	68.2	68.3	61.0
[0.15-0.3)	662.1	67.8	50.2	50.3	43.0
[0.3-0.45)	1292.0	170.2	144.7	29.1	20.5
[0.45-0.6)	1624.6	332.7	332.7	36.2	6.5
≥0.6	1712.6	420.7	420.7	88.0	1.1

Ergodic distribution for transition matrix					
	0.03	0.01	0.01	0.03	0.93
Eigenvalues for transition matrix					
	0.22	0.56	0.75	0.98	1.00
Half-life for transition matrix					
	35.4				

Panel I: Total number of transitions

	[0-1/16)	[1/16-1/8)	[1/8-1/4)	[1/4-1/2)	≥1/2
[0-1/16)	178	12	0	0	0
[1/16-1/8)	30	89	23	0	0
[1/8-1/4)	1	24	96	26	0
[1/4-1/2)	0	3	11	69	15
≥1/2	0	0	0	1	104

Panel II: Transition matrix

p(i,j)	[0-1/16)	[1/16-1/8)	[1/8-1/4)	[1/4-1/2)	≥1/2
[0-1/16)	0.94	0.06	0.00	0.00	0.00
[1/16-1/8)	0.21	0.63	0.16	0.00	0.00
[1/8-1/4)	0.01	0.16	0.65	0.18	0.00
[1/4-1/2)	0.00	0.03	0.11	0.70	0.15
≥1/2	0.00	0.00	0.00	0.01	0.99

Panel III: Mean first passage time

	[0-1/16)	[1/16-1/8)	[1/8-1/4)	[1/4-1/2)	≥1/2
[0-1/16)	6.3	43.9	42.7	74.7	116.5
[1/16-1/8)	84.2	14.8	26.8	58.9	100.7
[1/8-1/4)	187.9	28.1	27.8	32.1	73.9
[1/4-1/2)	285.2	125.5	125.2	22.5	41.8
≥1/2	390.2	230.5	230.2	105.0	1.4

Ergodic distribution for transition matrix					
	0.16	0.05	0.04	0.04	0.72
Eigenvalues for transition matrix					
	0.44	0.63	0.86	0.99	1.00
Half-life for transition matrix					
	53.4				

Table A3.2: Transition matrices excluding East European countries

Panel I: Total number of transitions

	[0-0.15)	[0.15-0.3)	[0.3-0.45)	[0.45-0.6)	≥0.6
[0-0.15)	351	17	0	0	0
[0.15-0.3)	20	84	19	1	0
[0.3-0.45)	0	6	17	14	2
[0.45-0.6)	0	0	3	15	11
≥0.6	0	0	0	1	87

Panel II: Transition matrix

p(i,j)	[0-0.15)	[0.15-0.3)	[0.3-0.45)	[0.45-0.6)	≥0.6
[0-0.15)	0.95	0.05	0.00	0.00	0.00
[0.15-0.3)	0.16	0.68	0.15	0.01	0.00
[0.3-0.45)	0.00	0.15	0.44	0.36	0.05
[0.45-0.6)	0.00	0.00	0.10	0.52	0.38
≥0.6	0.00	0.00	0.00	0.01	0.99

Panel III: Mean first passage time

	[0-0.15)	[0.15-0.3)	[0.3-0.45)	[0.45-0.6)	≥0.6
[0-0.15)	44.6	189.3	66.1	71.8	66.7
[0.15-0.3)	944.9	59.9	44.5	50.1	45.1
[0.3-0.45)	1866.9	167.6	148.7	23.4	17.8
[0.45-0.6)	2199.3	332.3	332.3	36.8	5.9
≥0.6	2287.3	420.3	420.3	88.0	1.1

Ergodic distribution for transition matrix

0.02	0.01	0.01	0.03	0.94

Eigenvalues for transition matrix

0.24	0.58	0.76	0.98	1.00

Half-life for transition matrix

39.3

Panel I: Total number of transitions

	[0-1/16)	[1/16-1/8)	[1/8-1/4)	[1/4-1/2)	≥1/2
[0-1/16)	177	14	0	0	0
[1/16-1/8)	31	84	19	0	0
[1/8-1/4)	0	21	92	22	0
[1/4-1/2)	0	0	10	59	13
≥1/2	0	0	0	1	105

Panel II: Transition matrix

p(i,j)	[0-1/16)	[1/16-1/8)	[1/8-1/4)	[1/4-1/2)	≥1/2
[0-1/16)	0.93	0.07	0.00	0.00	0.00
[1/16-1/8)	0.23	0.63	0.14	0.00	0.00
[1/8-1/4)	0.00	0.16	0.68	0.16	0.00
[1/4-1/2)	0.00	0.00	0.12	0.72	0.16
≥1/2	0.00	0.00	0.00	0.01	0.99

Panel III: Mean first passage time

	[0-1/16)	[1/16-1/8)	[1/8-1/4)	[1/4-1/2)	≥1/2
[0-1/16)	8.5	43.0	43.0	77.1	109.6
[1/16-1/8)	102.0	15.1	29.3	63.4	96.0
[1/8-1/4)	261.4	29.4	29.4	34.1	66.7
[1/4-1/2)	407.4	146.0	146.0	22.0	32.6
≥1/2	513.4	252.0	252.0	106.0	1.3

Ergodic distribution for transition matrix

0.12	0.04	0.03	0.05	0.77

Eigenvalues for transition matrix

0.45	0.65	0.86	0.99	1.00

Half-life for transition matrix

53.4

Table A3.3: Transition matrices including East European countries (14-year transitions)

Panel I: Total number of transitions

	[0-0.15)	[0.15-0.3)	[0.3-0.45)	[0.45-0.6)	≥0.6
[0-0.15)	234	12	1	0	0
[0.15-0.3)	20	55	18	2	0
[0.3-0.45)	0	5	12	12	4
[0.45-0.6)	0	0	3	8	9
≥0.6	0	0	0	1	53

Panel II: Transition matrix

p(i,j)	[0-0.15)	[0.15-0.3)	[0.3-0.45)	[0.45-0.6)	≥0.6
[0-0.15)	0.95	0.05	0.00	0.00	0.00
[0.15-0.3)	0.21	0.58	0.19	0.02	0.00
[0.3-0.45)	0.00	0.15	0.36	0.36	0.12
[0.45-0.6)	0.00	0.00	0.15	0.40	0.45
≥0.6	0.00	0.00	0.00	0.02	0.98

Panel III: Mean first passage time

	[0-0.15)	[0.15-0.3)	[0.3-0.45)	[0.45-0.6)	≥0.6
[0-0.15)	35.6	116.2	53.8	59.3	51.0
[0.15-0.3)	611.1	49.0	37.7	41.8	33.6
[0.3-0.45)	1200.7	105.3	95.0	21.8	12.3
[0.45-0.6)	1369.3	168.7	168.7	28.6	4.7
≥0.6	1423.3	222.7	222.7	54.0	1.1

Ergodic distribution for transition matrix					
	0.03	0.01	0.01	0.04	0.92
Eigenvalues for transition matrix					
	0.11	0.48	0.70	0.98	1.00
Half-life for transition matrix					
	29.8				

Panel I: Total number of transitions

	[0-1/16)	[1/16-1/8)	[1/8-1/4)	[1/4-1/2)	≥1/2
[0-1/16)	113	10	0	0	0
[1/16-1/8)	28	50	17	0	0
[1/8-1/4)	1	20	58	22	0
[1/4-1/2)	0	0	9	41	14
≥1/2	0	0	0	1	65

Panel II: Transition matrix

p(i,j)	[0-1/16)	[1/16-1/8)	[1/8-1/4)	[1/4-1/2)	≥1/2
[0-1/16)	0.92	0.08	0.00	0.00	0.00
[1/16-1/8)	0.29	0.53	0.18	0.00	0.00
[1/8-1/4)	0.01	0.20	0.57	0.22	0.00
[1/4-1/2)	0.00	0.00	0.14	0.64	0.22
≥1/2	0.00	0.00	0.00	0.02	0.98

Panel III: Mean first passage time

	[0-1/16)	[1/16-1/8)	[1/8-1/4)	[1/4-1/2)	≥1/2
[0-1/16)	7.0	43.9	38.1	68.0	91.7
[1/16-1/8)	74.0	19.6	25.8	55.7	79.4
[1/8-1/4)	190.3	31.6	30.4	29.8	53.6
[1/4-1/2)	300.1	109.8	109.8	19.6	23.7
≥1/2	366.1	175.8	175.8	66.0	1.4

Ergodic distribution for transition matrix					
	0.14	0.04	0.03	0.05	0.74
Eigenvalues for transition matrix					
	0.30	0.55	0.81	0.98	1.00
Half-life for transition matrix					
	43.8				

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