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THE MIDDLE-INCOME TRAP FROM AN INTERNATIONAL OVERVIEW: A LOGIT PANEL DATA ANALYSIS

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Abstract

This paper analyzes the probabilities of economies to lie into the middle-income trap by using a Logit Panel Data model. We define the trap with more encompassing criteria: average GDPs per capita relative to the US one and GDP per capita growth rates for ten-year averages in both cases. To determine those probabilities, we include two different sets of covariates. Firstly, a set of covariates that might be influenced by policymakers, e.g., inflation, exports, and education. Secondly, another set of covariates that are independent of policymakers' influence; a trend, a dummy for the international financial crisis, growth rates of world leader economies (US and China), growth rates of continental leader economies, and dummies by continents. We find that domestic variables are essentialto determine the probability of lying into the middle-income trap. Also, the independent covariates are significant. The trend shows that the trap is a stable equilibrium where economies tend to stay for a long time. A global economic crisis can push the countries out of the trap, but the impulse makes them back to lower-income stages. Our model also finds that regional linkages with surrounding economies are essential for middle-income economies.

Keywords: Middle-Income Trap, International Economics, Logit Models, Panel Data

JEL Classifications: O1, F63, F43, C23

1. Introduction

Countries in the last decade have been exhibiting a long period of progress and development in many areas, better access to health-care programs and education, a more stable macroeconomic context, and, definitely, an increasing trade dynamic between economies. In this context, it results naturally to imagine that countries' economies are in a better social and economic situation than 50 years ago. Nevertheless, the speed of development is heterogeneous across countries. Moreover, they face different and specific difficulties.

One of the development objectives for every country is to be classified as a developed or high-income economy. Every country tries to get into the club, but not everyone can reach it. Since 1970, around 11 countries have left the status of middle-income to achieve the status of a high-income economy. Nonetheless, another group of more than 20 countries entered into the middle-income category. It indicates that the number of new middle-income economies grow faster than countries that leave the middle-income stage.

Additionally, around 40 countries have been staying into this group for more than two decades, i.e., a growing number of stacked countries are into the middle-income stage. The literature called this phenomenon Middle-Income Trap. In this respect, the literature faces the problem of how to define and identify the phenomenonaccurately in order to find the main factors that explain the trap and establish policies to reduce any possible risk.

To face the definition problem, we adopt a more comprehensive and enveloping definition. We consider that an economy is trapped if it is classified as a middle-income economy (i.e., its GDP per capita is within the range of 10-50% of the US GDP per capita) and its growth rate is less than 2% (the US GDP per capita long run term growth rate). These definitions are based on the 10-year average to avoid outlier movements on the economy.

Nevertheless, regardless of the definition of the middle-income trap (MIT, hereinafter), the factors that might affect the chance to lie into the trap must be considered carefully. In this concern, we identify two kinds of covariates, the first group of variables that potentially are affected by policymakers' decisions; and the second group of variables that are independent of policymaker's influence, especially for small and open economies, as it is the case of middle-income economies. Respect to the first group, we include the influence of agriculture and industry sector, exports, imports, inflation, education, and the volatility of the GDP per capita growth rate. On the other hand, for the second group of variables, we have a trend, world leader GDP growth rates (US and China), continental leader economies average growth rate, the influence of global economic crisis, and the invariant continental characteristics capture by dummies.

The results imply that domestic variables are fundamental to explain the probability of lying into the MIT. However, the variables that are independent of policymakers are also crucial. The estimation results show that the MIT is a stable stage where economies tend to stay for along time. Additionally, we determine that global economic crisis provokes a negative shock over middle-income economies that push them out the MIT, and they end off in lower-income stages. Finally, we find that global leader economies might influence the chance to be trapped. However, the linkages created with neighbor economies are essential and stable covariate that can reduce the chance to lie into the MIT.

The remainder of the paper is structured as follows. Section 2 reviews the primary literature of the middle-income trap analysis from different perspectives. Section 3 presents the methodology we use in this research. Section 4 describes the detail of dataset for the empirical analysis and its empirical facts. Section 5 proposes the results of the empirical analysis. The final section gives concluding remarks.

2. Literature review

Economists turned to be interested in the development struggles after the East Asian financial crisis (1997) when some economies failed to catch up with their "rich" neighbors. A significant number of authors named the phenomenon in different ways like "Catch up" process, low-equilibrium growth "trap" and "poverty trap." Finally, in the decade of the 2000s, the concept changed to "Middle-Income Trap." Regardless of the name change, the central concept did not change drastically, the idea remains, countries have problems of moving their economies to higher-income stages.

The World Bank classifies the countries based on their Gross National Income per capita: low-income (US$ 1,005 or less), lower-middle-income (between US$ 1,006 - US$ 3,975), upper-middle-income (US$ 3,976 - US$ 12,275) and high-income countries (US$ 12,276 or above). Some authors adopted similar classifications for their analysis of the MIT as Aiyar (2013), Eichengreen (2011, 2013). Nevertheless, these classifications result to be inconvenient since the thresholds are static and ignore the economic evolution of countries. In that sense, Aiyar (2013) proposes a different approach by using growth slowdowns as a permanent deviation from the predicted growth path. Gill and Kharas (2007), otherwise, define MIT when middle-income economies grow less rapidly than either high or low-income countries, similar to

Eichengreen (2011, 2013). Felipe (2012) and Felipe *et al.* (2012), from a different perspective, define MIT as the number of years that transition takes from middle to high-income stage.

Other issues linked with the problem of defining accurately the MIT are the methodologies to detect it and determine its main factors. Wu (2013) investigates the role of productivity in the economic growth path by a cross-section model for the Chinese regional data. The results show that high-income regions tend to follow a stable growth path by receiving the benefits from technological progress. These technological benefits are not clear for middle and low-income regions. Wu (2013) sustains that these results can be transferred to countries. Islam (2013) also analyzes China and its chance to lie into the MIT. They highlight that persistent income inequality might increase the probability of staying into the MIT.

The analysis of the MIT also requires the addition of international factors. In this sense, Fortunato and Razo (2014) take an international trade viewpoint of the MIT by creating an Index of Sophistication of exports based on i) first, establishing a relationship between the GDP per capita and exports, ii) second, linking the income and exports basket, and, iii) third, creating the Index of Sophistication. Fortunato and Razo (2014) find that diversification, innovation, and education are crucial variables to achieve high-income stages. Kumagai (2015), also with a Panel Data model and international viewpoint, highlights the dependency of some countries' respect to their commodities exports and narrow export base, then the MIT can be considered as a sort of Dutch disease for middle-income economies due to their economic structure.

Ito (2017) analyzes the process of growth convergence related to the MIT for the Asian countries toward their US GDP level and argues that MIT occurs when a country fails to jump and converge to a higher income steady stage and it requires reforms to avoid the trap. Arias and Wen (2016), by using a first-order Markov chain, calculate the probabilities of a country to move from one to another range of income, where each range classifies a country as low, middle or high-income economy. They show that relative low-income countries fail more than middle-income countries to upgrade their status to higher income levels. Additionally, a significant number of trapped countries into the MIT are found in Latin America, while in Africa, countries lie into a low-income trap with more frequency.

Yulek (2017) focuses his theoretical analysis in the industrialization process as a tool to escape from the MIT and identifies that policies must consider the generation of added value, linkages to related sectors, technological progress, and potential learning for future new sectors to develop adaptabilities into economies. Bulman *et al.* (2016) suggest that middle-income countries might shift their growth strategies to have a smooth transition to higher stages.

To sum up, the primary literature examines the role of internal variables such as productivity, innovation, inequality, education, and industry policies. Moreover, their methods and definitions consider only partially the whole concept of MIT, for example, panel data models with growth rates or cross-section models with relative incomes. On the contrary, this paper covers this gap in the literature by using a more encompassing definition and analyzing not only domestic variables but external variables such as the effect of world economic crisis, world leader economies, and continental economic situation (i.e., continental dummies and average GDP growth rates of foremost continental leaders).

3. Methodology

By using a Panel Data model to estimate the MIT under binary endogenous variable, we have:

$$P[z_{it}=1] = \alpha_i + X_{it}^{'}\beta + \epsilon_{it}, \quad (1)$$
$$\epsilon_i \sim iid(0,\sigma^2), \ \ i = 1, \dots, n$$

where$z_{\{it\}}$ is the endogenous variable for MIT defined as:

$$z_{it} = \begin{cases} 1, & if\ 0.1 < y_{it}/y_{US,t} < 0.5,\ \ and\ \ g_{y_{it}} < 0.02 \\ 0, & otherwise \end{cases}$$

where y_{it} is the average GDP per capita for each economy over the lastten years, $y_{US,t}$ is the average US GDP per capita for over the last ten years, and $g_{y_{it}}$ is the average growth rate of the GDP per capita for each economy over the last ten years at the time t.

Under this definition, a country "i" lies into the MIT if two conditions hold:

- Its average GDP per capita constant dollar of 2010 over the last ten years is between 10-50% of the US one for each period.
- Its average GDP per capita constant dollar of 2010 over the last ten years grows less than 2% (US GDP per capita long-rungrowth rate).

The above definition of the MIT is more complex and encompassing. Furthermore, the definitions based on 10-year averages help to avoid temporal outliers. On the other hand, the matrix X_{it} represents the exogenous variables, and they are divided into two sets, controllable and uncontrollable variables, which are based on their senses to be affected by policymakers. Additionally, α_i that captures the specific characteristics for each country, and $\epsilon_{\{it\}}$ is a zero-mean residual uncorrelated with all the terms on the right-hand side of the equation.

3.1. Panel logit model - Fixed effects

For logit models, the cumulative distribution function is defined as $\mathrm{F}(\mathrm{X}'\beta)=\frac{\mathrm{e}^{\{\mathrm{X}'\beta\}}}{\left[1+\mathrm{e}^{\{\mathrm{X}'\beta\}}\right]}$ which goes from zero to one for all values of $\mathrm{X}'\beta$ and estimated by Maximum Likelihood (ML).

By assuming, the probability of observing $\mathrm{z_i}=1$ is $\mathrm{F}(\mathrm{X}'\beta)$ while the probability of observing the complement $\mathrm{z_i}=0$ is $1-\mathrm{F}(\mathrm{X}'\beta)$. The log-likelihood for the logit panel data model for fixed effects is:

$$\mathrm{lnL}(\mathrm{z}|\mathrm{X},\beta,\alpha_\mathrm{i})=\sum_{\{\mathrm{i}=1\}}^{\mathrm{N}}\left[\mathrm{z_i}\ln\left(\frac{\mathrm{e}^{\{\mathrm{X}'\beta+\alpha_\mathrm{i}\}}}{1+\mathrm{e}^{\{\mathrm{X}'\beta+\alpha_\mathrm{i}\}}}\right)+(1-\mathrm{z_i})\ln\left(\frac{1}{1+\mathrm{e}^{\{\mathrm{X}'\beta+\alpha_\mathrm{i}\}}}\right)\right]. \quad (2)$$

For logit models, Chamberlain (1980) finds that conditioning the log-likelihood on $\sum_{\{\mathrm{i}=1\}}^{\mathrm{N}}\mathrm{z_i}$, the function does not contain α_i.

To clarify how it works, we consider the case of T=2, then $\sum_{\{\mathrm{i}=1\}}^{\mathrm{N}}\mathrm{z_i}$ can take the values of 0, 1, or 2 due to:

- $\sum_{\{\mathrm{i}=1\}}^{\mathrm{N}}\mathrm{z_{it}}=0$ then $\mathrm{z_{i1}}=0$, $\mathrm{z_{i2}}=0$ and $P\left(0,0\middle|\sum_{\{\mathrm{i}=1\}}^{\mathrm{N}}\mathrm{z_i}=0\right)=1$
- $\sum_{\{\mathrm{i}=1\}}^{\mathrm{N}}\mathrm{z_{it}}=2$ then $\mathrm{z_{i1}}=1$, $\mathrm{z_{i2}}=1$ and $P\left(1,1\middle|\sum_{\{\mathrm{i}=1\}}^{\mathrm{N}}\mathrm{z_i}=2\right)=1$
- $\sum_{\{\mathrm{i}=1\}}^{\mathrm{N}}\mathrm{z_{it}}=1$ then $\mathrm{z_{i1}}=0$, $\mathrm{z_{i2}}=1$ or $\mathrm{z_{i1}}=1$, $\mathrm{z_{i2}}=0$ and $P\left(1,0\middle|\sum_{\{\mathrm{i}=1\}}^{\mathrm{N}}\mathrm{z_i}=1\right)=1$ or $P\left(0,1\middle|\sum_{\{\mathrm{i}=1\}}^{\mathrm{N}}\mathrm{z_i}=1\right)=1$.

The last case is the only that contributes to the log-likelihood. Then, the definition of the probability for any conditional event is:

$$\Pr\left(\sum_t \mathrm{z}_{it}=1\right)=\Pr(\mathrm{z}_{i1}=1,\mathrm{z}_{i2}=0)+\Pr(\mathrm{z}_{i1}=0,\mathrm{z}_{i2}=1)$$
$$=\mathrm{P}_{i1}(1-\mathrm{P}_{i2})+(1-\mathrm{P}_{i1})\mathrm{P}_{i2}$$
$$=\left(\frac{\mathrm{e}^{\{\mathrm{X}_{i1}'\beta+\alpha_\mathrm{i}\}}}{1+\mathrm{e}^{\{\mathrm{X}_{i1}'\beta+\alpha_\mathrm{i}\}}}\right)\left(\frac{1}{1+\mathrm{e}^{\{\mathrm{X}_{i2}'\beta+\alpha_\mathrm{i}\}}}\right)+\left(\frac{1}{1+\mathrm{e}^{\{\mathrm{X}_{i1}'\beta+\alpha_\mathrm{i}\}}}\right)\left(\frac{\mathrm{e}^{\{\mathrm{X}_{i2}'\beta+\alpha_\mathrm{i}\}}}{1+\mathrm{e}^{\{\mathrm{X}_{i2}'\beta+\alpha_\mathrm{i}\}}}\right)$$

$$= \left(\frac{e^{\{X_{i1}{}'\beta+\alpha_i\}} + e^{\{X_{i2}{}'\beta+\alpha_i\}}}{\left[1+e^{\{X_{i1}{}'\beta+\alpha_i\}}\right]\left[1+e^{\{X_{i2}{}'\beta+\alpha_i\}}\right]} \right). \quad (3)$$

For the case of the conditional probability of observing 1 then 0 (Chamberlain, 1980):

$$\Pr(z_{i1} = 1, z_{i2} = 0 | z_{i1} + z_{i2} = 1) = \frac{\Pr(z_{i1} = 1, z_{i2} = 0)}{\Pr(z_{i1} + z_{i2} = 1)}$$
$$= \frac{e^{\{X_{i1}{}'\beta+\alpha_i\}}}{e^{\{X_{i1}{}'\beta+\alpha_i\}} + e^{\{X_{i2}{}'\beta+\alpha_i\}}}$$
$$= \frac{e^{\{X_{i1}{}'\beta\}}}{e^{\{X_{i1}{}'\beta\}} + e^{\{X_{i2}{}'\beta\}}}$$
$$= \frac{e^{\{[X_{i1}-X_{i2}]'\beta\}}}{1+e^{\{[X_{i1}-X_{i2}]'\beta\}}} \quad (4)$$

then α_i is eliminated by conditioning on $\sum_t z_{\{it\}}$. Additionally, the log-likelihood function is:

$$L(\beta) = \sum_{\sum y=1} d_i (X_{i1} - X_{i2})'\beta - \ln(1 + \exp[(X_{i1} - X_{i2})'\beta]), \quad (5)$$

where $d_i = 1$if $z_{i1} = 1,\ z_{i2} = 0$ and 0 if $z_{i1} = 0, z_{i2} = 1$. If X_{it} contains invariant covariates, their effects disappear due to $(X_{i1} - X_{i2})$. Moreover, the fixed effects logit only uses data from individuals who experience change on the endogenous variable. Then, comparison models between Fixed and Random Effects by Hausman test is possible under the assumption of independence between α_i respect to the set of covariates.

3.2. Panel logit model - Random effects

For a RE model, we assume $\epsilon_{it} = c_i + \mu_{it}$ where there is independence between c_i and X_{it}, and normal distribution for the error components: $c_i \sim N(0, \sigma_c^2)$,and $\mu_{it} \sim N(0, \sigma_\mu^2)$. Since $E(\epsilon_{it}\epsilon_{is}) = \sigma_c^2$ for $t \neq s$, the joint likelihood of $(z_{i1}, .., z_{iT})$ cannot be written as the product of the marginal likelihood of z_{iT}. This fact complicates the derivation of the max likelihood that involves T-dimensional integrals as follows:

$$L(z|X, \beta, \alpha_i) = \Pr(z_{i1}, .., z_{iT}|X) = \int ... \int f(\epsilon_{i1}, .., \epsilon_{iT}) d\epsilon_{i1} ... d\epsilon_{iT}. \quad (6)$$

By the assumption of independence between ϵ_{it} and c_i:

$$f(\epsilon_{i1}, .., \epsilon_{iT}) = \int \prod_{t=1}^{T} f(\epsilon_{it}|c_i)\, dc_i. \quad (7)$$

Moreover, by substituting equation (6) into (7), we obtain the likelihood function to be estimated:

$$L(z|X, \beta, \alpha_i) = \int_{-\infty}^{+\infty} [\prod_{t=1}^{T} \Pr(z_{i1}, .., z_{iT}|X_{it}{}'\beta + \alpha_i)] f(c_i)\, dc_i. \quad (8)$$

4. Data

Respect to the data, it was collected from the World Development Indicators (World Bank) for the covariates and the endogenous variable from 1960 to 2016. For a descriptive purpose, some data was extracted from the International Monetary Fund, which contains GDP forecast until 2021. The original number of countries was 197, and it was reduced to maximize the information available for the Panel Data regressions.

We divide the exogenous variables into two sets. Controllable variables:

- agriculture: value-added as a percentage of the GDP. Each value corresponds to International Standard Industrial Classification (ISIC) divisions 1-5 and includes forestry, hunting, fishing, cultivation of crops and livestock production.
- industry: value-added as a percentage of the GDP. ISIC divisions 10-45, and it includes manufacturing, mining, construction, electricity, water, and gas.
- exports: defined as exports of goods and services as a percentage of the GDP. They include merchandise, freight, insurance, transport, travel, royalties, license fees, and other services.
- imports: defined as imports of goods and services as a percentage of the GDP. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services.
- inflation: measured by the annual growth rate of the GDP implicit deflator, which is the ratio of GDP in current local currency to GDP in constant local currency.
- SD(GDP), corresponds to the yearly standard deviation of the GDP per capita growth rate over the last ten years.
- education: defined as the gross enrollment ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level shown in tertiary education.

Differently, uncontrollable variables are defined as:

- trend: the natural trend defined as $trend = 1(t - t_0)$, where t_0 is the initial time.
- d_crisis: dummy of crisis that captures any structural break in the probability of lying into the MIT. It is defined as 1 for $t > 2006$ and 0 otherwise. This variable captures the effect of the financial crisis in the last 2000s.
- usa: defined as $usa = \ln(y_{US,t}) - \ln(y_{US,t-1})$, where $y_{US,t}$ is the US GDP constant dollar of 2010 at the time t, and "ln" is the natural logarithm. These growth rates capture the effect that the world leader economy on the probability to lie into the MIT;
- china: defined as $china = \ln(y_{china,t}) - \ln(y_{china,t-1})$, where $y_{china,t}$ is the Chinese GDP constant dollar of 2010 at the time t, and "ln" is the natural logarithm.These growth rates capture the effect that the second world leader economy on the probability to lie into the MIT;
- leader: defined as $leader = \ln(y_{leader,t}) - \ln(y_{leader,t-1})$, where $y_{leader,t}$ is the average GDP constant dollar of 2010 at the time t for the leading three economies in each continent, and "ln" is the natural logarithm. These growth rates capture the effect of regional leaders;
- *d_i:* a continental dummy with 1 if the country belongs to the continent i=Europe, America, Asia, Africa or Oceania, 0 otherwise; in total five dummies.

The sample countries were divided into three categories according to their income level. Low-income countries (LIC) if their GDP per capita represents 10% or less of the US GDP per capita, middle-income countries (MIC) if the level is between 10% to 50% and high-income countries (HIC) for values larger than 50%.

Table 1 shows the basic statistics of each set of countries divided by their income category previously defined. It displays that MICs have a significantly lower level of agriculture as a percentage of the GDP respect to LICs but higher than HICs, as the *agriculture* variable shows. Similarly, the variable of *exports* shows higher values for MICs respect to LICs but lower than HICs. The *inflation* variable, based on the deflator of the GDP, has similar values for low and middle-income countries but significantly lower values for HICs. The *inflation* variable also shows that for low and middle-income countries, they have a large standard deviation due to the presence of countries with high inflation levels.

Moreover, Table 1, based on the values of the mean column for the dummy variables, displays that 47% of the countries classified as LICs are located in Africa and 26% in Asia. Likewise, 44% of the MICs are located in America (due to the significant influence of Latin-

American countries), and 21% are in Europe. Finally, HICs are mainly placed in Europe and Asia, with 53% and 22%, respectively.

Table 1. Descriptive statistics

Low-Income Countries					
Variables	Obs	Mean	Std. Dev.	Min	Max
agriculture	3631	24.02157	12.7513	1.95363	79.04237
industry	3589	25.30656	11.84133	2.073173	85.65871
exports	3510	29.88356	17.59637	0.005377	125.7485
imports	3510	41.45158	22.08233	0	236.391
inflation	3868	46.03983	573.0675	-36.5156	26765.86
SD(GDP)	3833	4.691995	4.185091	0.157204	40.87904
education	2287	11.8807	14.76989	0	118.3337
d_america	3917	0.138116	0.345066	0	1
d_europe	3917	0.043911	0.204924	0	1
d_asia	3917	0.254787	0.435797	0	1
d_africa	3917	0.47179	0.499267	0	1
d_oceania	3917	0.091397	0.288209	0	1
Middle-Income Countries					
Variables	Obs	Mean	Std. Dev.	Min	Max
agriculture	1901	7.488666	6.288566	0.264811	52.34584
industry	1898	30.48321	13.03376	5.49755	87.79689
exports	1977	42.97724	26.11665	3.218027	202.0546
imports	1978	46.23501	26.70058	4.631322	208.9807
inflation	2081	42.67691	407.8365	-27.6327	15444.38
SD(GDP)	2053	4.550263	4.268384	0.093926	55.22868
education	1312	31.78451	23.65311	0.0134	104.2135
d_america	2119	0.44219	0.496764	0	1
d_europe	2119	0.207173	0.405376	0	1
d_asia	2119	0.192544	0.394391	0	1
d_africa	2119	0.126003	0.331931	0	1
d_oceania	2119	0.032091	0.176282	0	1
High-Income Countries					
Variables	Obs	Mean	Std. Dev.	Min	Max
agriculture	1070	2.518432	2.649666	0.029934	18.65574
industry	1072	28.5514	14.99624	3.720151	90.51295
exports	1449	49.82396	42.64378	5.391815	433.2235
imports	1449	45.23637	37.86995	5.182715	427.5765
inflation	1697	5.662299	15.04393	-31.9048	384.7703
SD(GDP)	1679	3.074283	2.466354	0.577993	28.29109
education	1108	41.34407	23.90558	1.01348	126.3826
d_america	1719	0.183246	0.386981	0	1
d_europe	1719	0.528214	0.499349	0	1
d_asia	1719	0.223967	0.417022	0	1
d_africa	1719	0	0	0	0
d_oceania	1719	0.064572	0.245841	0	1

Note: The statistics consider all the information available across countries and among the time; however, since the panel is unbalanced, some statistics are based on a different number of observations.

Source: Author's calculation based on World Bank (2017)

Table 2, on the first column, shows the countries that were able to upgrade their status toward higher income levels at least once during the period of analysis, i.e., countries might move from low to middle or from middle to high-income level. Contrarily, the second column shows the countries that failed and reduce their status toward lower income levels at least once during the period of analysis, i.e., countries might move from high to middle or middle to low-income level. Some countries appear twice listed, as succeeded and failed, i.e., we can classify a country as LIC, and during some years, it upgrades its status toward MIC level and finally backs to be LIC, e.g., Cuba, Dominica, Georgia, and Peru.

The third, fourth, and fifth columns in Table 2 list the countries that were into the MIT. Column 3 refers to countries that were into the MIT in the initial period, 1970. From all countries with data available (102), only four were classified to be into the MIT. The fourth column shows the countries that were into the MIT in the last period, 2016. The 35 of 197 countries were classified as trapped. Finally, the last column presents the list of countries that were into the MIT most of the periods with data available, 50% or more, for each country. For example, Venezuela was classified as a trapped country for most of the 50% of its year available with data.

Table 2. Country classification

MIC	MIC	Trapped Countries		
Succeed	Failed	1970 (N=102)	2016 (N=197)	50% or more
Azerbaijan	Algeria	Algeria	American Samoa	American Samoa
Belarus	Angola	Ecuador	Antigua-Barbuda	Argentina
Botswana	Aruba	El Salvador	Argentina	Barbados
Bulgaria	Bahrain	Uruguay	Aruba	Brazil
China	Bulgaria		Bahrain	Czech Republic
Cuba	Cuba		Barbados	Gabon
Cyprus	Dominica		Brazil	Hungary
Dominica	Ecuador		Croatia	Iran
Dominican R.	El Salvador		Czech Republic	Jamaica
Eq. Guinea	Fiji		Dominica	Lebanon
Fiji	Georgia		Eq. Guinea	Libya
Georgia	Jamaica		Estonia	Mexico
Greece	Kiribati		Gabon	Nor. Mariana Islands
Hong Kong	Macedonia		Grenada	Palau
Korea	Namibia		Hungary	Russia
	Nor. Mariana			
Malaysia	Islands		Iran	South Africa
Mauritius	Paraguay		Latvia	Uruguay
Namibia	Peru		Lebanon	Venezuela
Nauru	Saudi Arabia		Libya	
Paraguay	Ukraine		Mexico	
Peru	Venezuela		Northern Mariana Islands	
Puerto Rico			Oman	
Serbia			Palau	
Singapore			Portugal	
St. Vincent				
Grenadines			Russia	
Thailand			Saudi Arabia	
Turkmenistan			Serbia	
			Slovenia	
			South Africa	
			St. Kitts & Nevis	
			St. Lucia	
			St. Vincent & Grenadines	
			Suriname	
			Trinidad & Tobago	
			Venezuela	

Note: Column 3 refers to countries that were into the MIT in the initial period, 1970. For that year, the data is available for 102 countries; four of them are classified as trapped countries. In Column 4, similarly, for 2016, we have data for 197 countries, and 35 are cataloged as trapped economies. Finally, column 5 shows the classification for the whole period (1970-2016). A country is trapped if more of its periods with data available, 50% or more, is classified as a trapped country. For example, country A with ten years of data available is classified as trapped in six years; then, country A is included on the list.

Source: Author's calculation based on World Bank (2017)

Respect to the evolution of the GDP per capita PPP relative to the US for MICs, Figure 1 shows that most of the MICs have struggled to reach higher income levels. Egypt, Peru, and Brazil are into the middle-income status for more than 30 years, with few chances to avoid the trap. Mexico and South Africa, on the contrary, started the period as high-income countries and fell into the middle-income stage a few years later. Some Asian countries have a different story, Thailand, China, and India are possible countries that can reach a high-income status in the future and avoid the MIT.

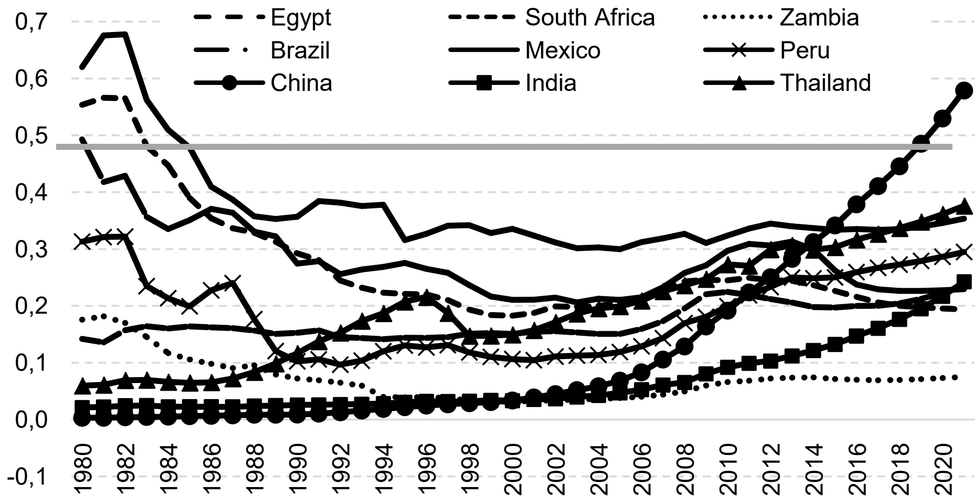

Figure 1. Middle-income status
Source: International Monetary Fund (2016)

Figure 2 gives us more hints to identify the MIT and the countries that fell into it. We present the long-run evolution of the GDP per capita, PPP relative, to the US for 120 countries for 1980 and 2015. On the horizontal ax, we tabulate the relative GDP per capita for each country for 1980, while on the vertical ax, we present the values for 2015. The MIT is located in the central area, countries that were middle-income economies in 1980, and they could not upgrade their status for 2015 and staying there trapped.

One clear evidence is the positive relationship between the GDP per capita on both years that suggest a persistence on the status-quo of countries, i.e., rich economies remain rich in 2015. Secondly, a few countries moved from low or middle-income status to high-income status. Specifically, during this period, ten countries were able to upgrade their income status toward a high-income level. At the same time, more than ten countries entered into the category of middle-income countries from low or high-income status. In other words, regardless some economies are upgrading their status and getting out of the middle-income level status, a higher number of countries are entering into it, like an attractive equilibrium or a trap. Thirdly, the evidence suggests that most of the success cases are in Asia or Europe, countries that were middle-income economies, but they showed a high dynamic on their economies that let them move out from the trap.

Finally, both figures show evidence of the MIT and its persistence through time. Additionally, they suggest that the MIT is a complex concept that must include a dynamic and relative definition. To determine if a country is trapped, we need to consider its position relative to a reference country; moreover, it requires considering the country's evolution for the whole period of analysis. This paper takes these ideas and defines the MIT more comprehensively.

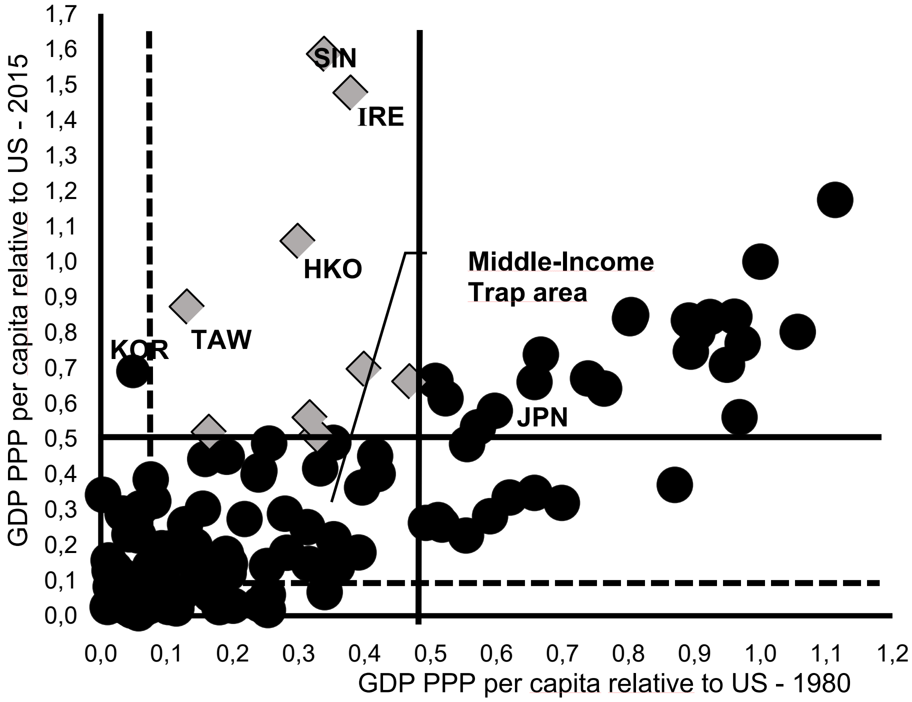

Figure 2. Relative Income Dynamics: 1980-2015
Source: International Monetary Fund (2017)

5. Results

Table 3 shows the estimation results for five different models. The first column refers to a Logit Pooled model which does not control by heterogeneity across countries. The second column for Fixed Effects Logit Panel Data that control the heterogeneity across countries. On the third column, the Random Effects model, where individual effects randomly distributed across individuals. The fourth column displays the Random Effects model of column 3 plus a trend variable. Finally, the fifth column shows an extension of the Random Effects model that control by time effect variables of trend and dummy of crisis. Their estimated coefficients are shown with their corresponding p-value in parenthesis below each coefficient.

For column 1, all the estimated coefficients of the variables are statistically significant at 1% except the corresponding coefficient of the intercept that is significant at 10%. The estimated coefficients for the variables of *agriculture, industry, imports*, and *education* are negative and statistically significant, i. e., these variables reduce the probability to lie into the MIT for the 172 countries[1]. Differently, the estimated coefficients of *exports*, *inflation,* and *SD(GDP)* are positive and statistically significant, i. e., those variables increase the probability to stay into the MIT for countries considered in the sample.

Respect to the second column, by following Allison (2009), there are two conditions in the endogenous variable to estimate Fixed Effect models. (i) More than two years of observations; and, (ii) Variability across time for some substantial portion of individuals. Nevertheless, for some countries of our sample, the condition of being LIC, MIC, or HIC does not change during the whole period of analysis, 124 out of 172 countries. Those observations were drop out automatically from the estimation as Table 3. The main consequence of this observation's reduction is reflectedin the power of tests.

[1]In total 25 countries were dropped respect to the original dataset of 197 countries since there was no data available for the variable considered in our estimations.

Table 3. Estimation results for logit models

	Pooled	FE	RE	RE + trend	RE + crisis
agriculture	-0.1115***	0.0708***	0.0306*	0.1689***	0.1754***
	(0.000)	(0.000)	(0.072)	(0.000)	(0.000)
industry	-0.0145***	-0.0507***	-0.0407***	-0.0175	-0.0124
	(0.017)	(0.001)	(0.004)	(0.252)	(0.424)
exports	0.0042	0.0685***	0.0667***	0.0697***	0.0705***
	(0.463)	(0.000)	(0.000)	(0.002)	(0.000)
imports	-0.0270***	-0.0603***	-0.0624***	-0.0623***	-0.0594***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
inflation	0.0036***	0.0096***	0.0068***	0.0092***	0.0094***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SD(GDP)	0.0721***	-0.0023	-0.0065	0.0504	0.0485
	(0.000)	(0.941)	(0.834)	(0.112)	(0.129)
education	-0.0157***	-0.0007	-0.0039	-0.0705***	-0.0620***
	(0.000)	(0.904)	(0.495)	(0.000)	(0.000)
trend				0.1434***	0.1527***
				(0.000)	(0.000)
d_crisis					-0.6154**
					(0.021)
cons	0.5923*		-6.2065***	-16.7139***	-17.6669
	(0.053)		(0.000)	(0.000)	(0.000)
time control	NO	NO	NO	YES	YES
NT	3887	1229	3887	3887	3887
N		48	172	172	172
chi2	357.1	114.3	58.7	128.8	141.1
AIC	2408.4	1069.1	1608.5	1511.6	1508.4
LogLike	-1196.2	-527.5	-795.3	-745.8	-743.2
rho			0.8999	0.9705	0.9714
sigma_u			5.4395	10.3941	10.5677

Notes: The value in parenthesis corresponds to the p-values. *** p<0.01, ** p<0.05, and * p<0.1.These results are based in an unbalanced panel dataset where "N" refers to the number of countries, "T" the number of years, and NT is the total number of data (number of countries and years available for the panel). The unbalanced panel data in STATA is not transformed into a balanced panel data for estimation purposes; differently, the software uses all the information available for the set of variables considered.

Columns 3, 4, and 5 display the estimation results for the Random Effects model. Specifically, column 3 shows the estimated coefficients for the basic set of variables, while column 4 adds the trend to control any possible temporal effect over the probability to lie into the MIT. Finally, column 5 adds the dummy of the crisis variable (*d_crisis*).

Additionally, we can divide the estimated coefficients into three categories. Stable parameters if they do not change their signs and significance level across models, e.g., *imports, inflation,* and *trend*. Semi-stable parameters, if the estimated coefficients change to be no significant or they change their sign and significance level, e.g., *exports, industry*, the volatility of the GDP per capita growth rate variable -*SD(GDP)*-, and *education*. Finally, unstable parameters are those whose sign changes but remains significant across models, e.g., *agriculture*. The dummy variable of crisis is not considered onto these categories since it appears once in the estimation results in Table 3.

The estimated coefficients in a logit model are not informative themselves; nonetheless, their signs represent the direction of the relationships. In this sense, the estimated coefficient for the *inflation* variable is stable, positive, and with significance level at 1% across models. Its sign shows that the higher the inflation levels, the higher the probability of lying into the MIT. Moreover, the estimated coefficients for *industry* and *education* are semi-stable, and their signs indicate that higher access to education and higher levels of industry respect to the GDP reduce the chances of countries to be trapped. On the other hand, the signs of the estimated coefficients for *exports* (semi-stable) and *imports* (stable) are positive and negative, respectively.

These signs relationships are according to the complexity of the domestic industry; most of the MICs have exports based on commodities and light industries while they get new technology and upgrade their industries through imports. These results are in concordance to the findings of Fortunato and Razo (2014), Kumagai (2015), Bulman *et al.* (2016), and Yulek (2017). The estimated coefficient for *agriculture* is unstable, which means that once the individual effects are disclosure to be taken into account, the variable increase the probability of a country to lie into the MIT, i.e., countries with higher levels of agriculture respect to the GDP tend to be trapped. The volatility of the GDP per capita growth rate, *SD(GDP)*, changed to have no significance level for panel data models.

In columns 4 and 5, the estimated coefficient for time control variables, *trend,* and *d_crisis* are statistically significant. The *trend* has a positive sign, i.e., countries tend to be in the MIT for a longer time, like lie into a stable stage (Arias and Wen, 2016). A new result is that when a crisis occurs, it reduces the probability of staying into the MIT for middle-income countries. The reason for this negative, and counter-intuitive, relationship with the probability to lie into the MIT is due to in crisis periods, small-open economies are more sensitive to external shocks and reduce their income levels. To sustain these results, during the period of analysis there were 17 cases of countries that failed to stay in the middle-income stage, and they reduced their GDP per capita levels until be classified as low-income countries, while the number of countries that left the stage to be high-income countries was only 5.

For the selection procedure, we discard the Pooled model since it presents the highest AIC value across all models; in other words, it is the model with the highest loss of information. Between the Fixed and Random Effect model, a priori we discard the Fixed Effect model since it drops out an essential quantity of observations due to a lack of variation inside the endogenous variable. Moreover, the Hausman test (Hausman, 1978) proposes as a null hypothesis that only the Random Effects estimator is efficient and consistent while on the alternative hypothesis, the Random Effects model is inconsistent while Fixed Effects are still consistent. In this sense, the Hausman test supports the selection of the Random Effects model at 1% of significance level with a p-value of 0.223 (Chi2(7)=9.44), which does not reject the null hypothesis. On the other hand, respect to the selection criteria across the different Random Effect models, the AIC criterion supports the selection of the model in column 5, i.e., the model with *trend* and *d_crisis*.

Table 4 expands the results by including an extra set of variables to control some possible interrelation effects between countries. Column 1 shows the estimation results after it includes the variable *usa* and *china*. The variables were built by the first difference of the natural logarithm of the GDP in constant dollars of 2010; additionally, they represent the effect of the first (US) and second (China) world leader economies over the probability to lie into the MIT. The estimated coefficients are negative in the significant cases for *usa* variable and positive for all significant cases for the *china* variable. The results show that when the US economy grows, MICs increase their chances to get out the MIT; on the other hand, when the Chinese economy grows, the countries increase their risk to lie into the trap. The type of commerce that MICs have with the world leader economies sustains these results. The export basket of countries that trade with China and the US are based on commodities. However, the US case seems to be more complicated. The variables *usa* and *d_crisis* are complement variables after the effect of continental dummies are included; this supports the fact that the US effect incorporates the shock provoked by the global financial crisis. Then, when the US economy grows, MICs increase their chances to lie out the MIT by moving down to be a LIC.

Table 4. Estimation results for random effects logit panel data models

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
agriculture	0.1716***	0.1778***	0.1981***	0.1990***	0.1996***	0.1978***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
industry	-0.0098	-0.0078	-0.0037	-0.0011	-0.0024	-0.0009
	(0.524)	(0.607)	(0.808)	(0.944)	(0.876)	(0.951)
exports	0.0741***	0.0741***	0.0727***	0.0731***	0.0711***	0.0735***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
imports	-0.0604***	-0.0611***	-0.0648***	-0.0631***	-0.0621***	-0.0621***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
inflation	0.0091***	0.0089***	0.0084***	0.0084***	0.0085***	0.0084***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SD(GDP)	0.0285	0.0249	0.0455	0.0414	0.0475	0.0382
	(0.385)	(0.455)	(0.176)	(0.218)	(0.158)	(0.261)
education	-0.0567***	-0.0599***	-0.0730***	-0.0677***	-0.0706***	-0.0670***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
trend	0.1132***	0.1101***	0.1277***	0.1301***	0.1533***	0.1265***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
d_crisis	-1.0062**	-0.6475*		-0.4788*	-0.5117	-0.6228
	(0.005)	(0.090)		(0.083)	(0.178)	(0.107)
usa	-0.4589*	-0.1365	0.1543		0.0425	-0.1416
	(0.051)	(0.599)	(0.415)		(0.861)	(0.591)
china	0.2261**	0.1874*	0.1538	0.1589**		0.1786*
	(0.019)	(0.053)	(0.107)	(0.077)		(0.066)
leader		-0.3896***	-0.3896***	-0.3819***	-0.3846***	-0.3469**
		(0.004)	(0.002)	(0.003)	(0.007)	(0.016)
d_america			5.6745**	5.7043**	5.7575**	5.7064**
			(0.021)	(0.020)	(0.019)	(0.020)
d_asia			-2.6407	-2.6334	-2.6017	-2.6478
			(0.275)	(0.276)	(0.397)	(0.273)
d_africa			-6.2249**	-6.0949**	-6.1340**	-6.0489**
			(0.014)	(0.016)	(0.016)	(0.557)
d_europe			3.1754	3.1093	3.2188	3.1154
			(0.190)	(0.199)	(0.184)	(0.198)
cons	-16.8915***	-15.2222***	-14.1925***	-14.5458***	-13.9744***	-14.4073***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
NT	3887	3887	3887	3887	3887	3887
N	172	172	172	172	172	172
chi2	149.1	145.8	132.9	134.2	131.9	135.2
AIC	1505.1	1493.1	1470	1467.7	1470.8	1469.4
LogLike	-739.8	-735.3	-718	-716.8	-718.4	-716.7
rho	0.9683	0.9648	0.9457	0.9445	0.945	0.9442
sigma_u	10.0303	9.492	7.566	7.4856	7.5189	7.4579

Notes: The value in parenthesis corresponds to the p-values. *** p<0.01, ** p<0.05, and * p<0.1. These results are based in an unbalanced panel dataset where "N" refers to the number of countries, "T" the number of years, and NT is the total number of data (number of countries and years available for the panel). The unbalanced panel data in STATA is not transformed into a balanced panel data for estimation purposes; differently, the software uses all the information available for the set of variables considered.

The second column includes the variable *leader,* which controls the effects of the leader economies on corresponding regions respect to the probability to lie into the MIT for each country. The estimated coefficients are negative and stable in all cases, i.e., when the regional or continental leader economies grow, the surrounding economies reduce their probabilities to lie into the MIT. This output is a consequence of the linkages created between MICs with their continental leaders.

In column 3, we include a set of dummy variables to control the intrinsic characteristics of each continent that are time-invariant. Each dummy was built as follows: d_i=1 for the continent i=America, Africa, Asia, Europe and Oceania; and 0 otherwise. Moreover, to avoid the multicollinearity problem between the set of dummy variables created and the intercept, we discard to use the dummy of Oceania. For the corresponding estimated coefficients, only the dummies of America and Africa are stable and statistically significant, while the others are not significant. It means there are intrinsic characteristics into the American continent that increases the probability of lying into the MIT for countries in that area. On the contrary, for countries in Africa, the intrinsic dynamic between them decrease their chances to be trapped, possibly because most of the countries are classified as low-income countries, and they move effortlessly between low and middle-income stages.

Column 4 displays the estimation results leaving aside the effect of *usa* variable. Column 5, in a different way, considers the effect of *usa* but omits the *china* variable effect. Finally, column 6 considers all the variables and their estimated coefficients. From models 3, 4, 5, and 6, we notice that the effect of the leader economies variables (*usa* and *china*) interacts with the continent dummies, they reduce their significance level. Additionally, when we include the dummy of crisis and the effect of the US economy in the same model with continental dummies, their significance level is reduced due to the *usa* coefficient dynamic, and the interaction with the dummy takes part of the crisis effect into it.

Regardless of the estimated coefficients for the new set of variables, most of the variables brought from Table 3 keep their significance level. The estimated coefficient for *agriculture, exports, imports, inflation, education,* and *trend,* are stable, and their sign does not change respect to the model results in column 5 in Table 3. On the other hand, *industry* and *SD(GDP)* coefficients are unstable across models. Additionally, the dummy of crisis is found semi-stable with no significance level for column 5. Finally, the AIC criterion suggests that the model with the best goodness of fit is model 4, and it represents in the best way the relationship between the MIT binary variable and the sets of covariates used in this paper.

5. Conclusion

The paper shows evidence that the main factors that affect the probability to lie into the MIT can be divided into two sets: internal and external factors. The first set of factors are those able to be influenced by policymakers. The results suggest that middle-income countries must focus on their trade structure, exports and imports, and control key macroeconomic variables represented by inflation to avoid the MIT. The education results to be another critical variable that might help countries to avoid the trap. Additionally, the trend variable suggests that MIT is a stable stage where countries tend to stay for a long time, as the estimated coefficient suggests.

For the second set of variables, international factors cannot be controlled or influenced by policymakers in middle-income countries. The model results suggest that countries' linkages they can have with their surrounding economies are crucial to reducing the probability of lying into the MIT. When the leader economies in each continent grow, middle-income countries obtain better chances to keep their growth path toward high-income status. Additionally, economies are affected by the international crisis likely due to the vulnerability that middle-income country still has. Finally, the continental dummies propose that there are intrinsic characteristics that made some areas prompt to lie or to stay out of the middle-income trap. For American countries, the probability of being trapped is higher than in other areas, on the contrary, African countries have less probability of lying into the MIT (probably because most of the countries in that area are classified as low-income countries).

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