THE EVIDENCE AND MECHANISM OF THE MIDDLE INCOME TRAP

by

Xiangyu Zhao

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Supervisor: Mehmet Dalkir, PhD, Dept. of Economics

Examining Board: Philip Leonard, PhD, Dept. of Economics

Murshed Chowdhury, PhD, Dept. of Economics

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Abstract

In recent years, the term “middle-income trap” has increasingly been discussed in the publications on development policy. The term itself often has not been precisely defined in the literature. In this report, I will discuss the existence of middle income trap, its policy implications, and its statistical significance. The middle income trap is empirically tested by Generalized method of moments (GMM) estimation method. The results show that there are differences in economic development pace of countries in different income groups. Middle income countries need to formulate further actions to evolve to higher income groups.

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1.Introduction

In recent years, the term middle-income trap has been increasingly discussed among developing countries. This term was first introduced in 2007 report of the World Bank, *An East Asian Renaissance: Ideas for Economic Growth*. The report shows that "middle-income countries have grown less rapidly than either rich or poor countries" (Gill and Kharas, 2007).

The term middle income trap is used to refer to the phenomenon that some developing countries, particularly those previously poor ones, that grew to middle income level after a difficult period, fail to maintain their developmental driving force and slip into long-term economic stagnation.

Discussion of middle-income trap countries, it mostly focuses on Latin America, East Asia, and the Middle East. Latin America has the highest concentration of middle-income countries in the region. According to the categorization of the World Bank in 2016[1], in its 33 economies, there are 28 economies in the middle income group. As of 2011, among Latin American countries in the "middle income trap" the average time spent in the trap was 37 years, with Chile spending 40 years, Uruguay 38 years, Mexico 37 years, Brazil 36 years and Colombia 32 years. This shows that these countries caught in the middle-income trap have endured a long period of stagnation.

[1] 1. According to World Bank, as of July 1, 2016,
Low-income countries: <$1,025
Lower-middle income: $1,025<GNI<$4,036
Upper-middle income: $4,036<GNI<$12,475
High income: >$12,476

Although the middle income trap has been well-researched, the argument is still controversial. Criticism mainly concentrates on two aspects. First, there is little evidence to support the actual existence of the phenomenon, What are the characteristics for a country that falls into the middle-income trap? What percentage of the countries that enter the middle-income bracket will fall into the "middle-income trap"? There is no accurate data to support the existence of a middle income trap. Secondly, there is lack of theoretical support. To the best of my knowledge, there is no economic theory, similar to the poverty trap or the vicious circle of poverty theories, that can logically portray the phenomenon of middle income trap. If there is more empirical evidence that suggests that the middle-income trap is a relatively common phenomenon for developing countries, there should be some mechanism in support of this empirical fact.

This article will first list the theoretical foundation and empirical evidence that has been published, in order to discuss whether or not the middle income trap is a common phenomenon in middle income countries. Secondly, the article will build a model which is under the framework of economic growth research based on Derong Zhang's model(2013), seeking the difference in the driving force in different stages of economic development.

2. Literature review

2.1 Theoretical Foundations

Over the past 20 years, many economists attempted to explain whether the middle income trap exists in theoretical and empirical terms, and several studies published to identify a mechanism for the Middle-Income Trap.

Fang Cai(2012) built an economy framework, which combines several economic theories to explain the existence of the middle income trap and portray the phenomenon of the middle income trap.

Firstly, he introduced equilibrium trap history and application. In his words, "traditionally, the word 'trap' is used to describe an economic state of super-stable equilibrium that is beyond a comparative static equilibrium and cannot be changed by normal short-term outside forces." The pessimistic views of Thomas Robert Malthus on the relationship between population growth and economic development are reflected in the "Malthusian trap" or the "Malthusian equilibrium". R. R. Nelson combined the Malthusian Trap with the Harrod-Domar growth model to form the low level equilibrium trap model, which captured the characteristics of the less-developed countries (See Yujiro, Hayami & Yoshihisa Godo, 2009). High level equilibrium trap has been suggested as a explanation for China's development and a solution for the Needham Puzzle. The critical minimum effort theories and the big-push theories, and their explanatory theories and policy implications are based on the low-level equilibrium trap hypothesis. It is evident that the concept of equilibrium trap has a long history in development economics and is helpful for expounding policy implications

from theories. For instance, Schultz (1999) defines traditional agriculture in developing countries as being in a state of equilibrium, and suggested policies to break this equilibrium by introducing new factors of production, include labour, capital, land and entrepreneurialism.

Secondly, Fang Cai discussed the way to prove the existence of middle income trap logically." Aoki (2011) divides East Asia economic development into 5 phases[2]. Hansen and Prescott (2002) also noticed a transitional phase from the Malthusian model to the Solow model."(2012) All these division of development phases indicate that shifts between phases involve jumps or breaches, like middle-income shift to high-income. If some economies have long failed to achieve these jumps or breaches, then this phenomenon is common and has statistical significance, indicating important theoretical and policy implications. Therefore, the existence of the middle-income trap is logically proven.

Thirdly, Fang Cai summarized a definition of middle income trap. "Eeckhout and Jovanovic (2007) found that in the era of globalization, the long-term growth rate of various economies when ranked using per capita income is U-shaped. Garrett (2004) noted that when rich countries experience accelerated technological advancement, the poorest countries experience faster growth in manufacturing, but middle-income countries fail to make headway."(2012) These stylized facts contribute to an initial

[2] Aoki (2011) suggested the following phase analysis: (1) the Malthusian phase of the poverty trap (M-phase), (2) the government-led development phase (G-phase), (3) the Kuznets (or Lewis) process in which development is realized through structural shifts (K-phase), (4) the human capital-based development phase (H-phase), and (5) the post-demographic transition phase (PD-phase).

theoretical framework of the middle-income trap. Advanced countries gain from globalization due to their comparative advantages in capital-intensive and technology-intensive industries; poorer countries also gain from globalization given their comparative advantages in labor-intensive industries; middle-income countries gain less from globalization because they do not have comparative advantages in either aspect. Fang Cai summarize the scenario as a "comparative advantage vacuum"(2012).

Until here, from summarizing what Fang Cai found from several theories, we can get the basic theories, long development history, and wide range applications of the middle income trap. Below I will list discussions of what steps needs to be taken for middle income countries successfully transition to high income countries.

Jankowska et al (2012) explain the middle income trap occurring when the incomes (and wages) in middle income countries have increased enough to require graduation from low-skilled labor intensive activities, but middle income countries have not yet developed national innovation systems, or perhaps not even accumulated enough physical and human capital, to transfer to high-income.

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. Hausmann, et al. (2005) found that growth accelerations tend to be correlated with increases in investment and trade, real exchange rate depreciations, political regime changes and economic reforms.

As convergence hypothesis (Barro and Sala-i-Martin, 1995) suggestd, growth-favorable elements (high investment ratio, human capital accumulation, government function, infrastructure conditions) are subject to the law of diminishing returns; when all the “low-hanging fruits” have been harvested, the growth will slow down unless the economy successfully shifts from exogenous growth model to an endogenous growth model driven mainly by total factor productivity. David Bulman (2014) did some survey and found the overwhelming majority of growth comes from capital accumulation in low income countries, but for middle and high income countries, the share of TFP growth is much larger. It suggests the limits of capital accumulation (after all, investment has a decreasing marginal return) and suggests the important roles of education, research and innovation, and structural reforms.

The 2007 World Bank also report points out that new development strategies and policies must be adopted during a country’s transition from the middle-income to the high-income phase (Indermit and Kharas, 2008).

2.2 Empirical Studies

Through studying world economic history, Morgan Stanley Asia/Pacific economists find the phase in which economic growth generally slows down verifies the existence of the middle-income trap (Wang et al., 2009). They find the turning point of the process comes when purchasing power parity-based per capita GDP reaches US$7000. Over the past 100 years, there are 40 economies per capita GDP reached the turning point of

US$7000; 31 of these economies saw their growth rates decline by 2.8 percentage points on average after reaching that turning point.

Fang Cai (2012) performed some empirical work and found that there were 32 middle-income countries in 1960 and 24 in 2008[3]. There is 50% possibility of the middle-income countries staying middle-income; the possibility of moving lower is greater than that of moving higher. But the number of countries moving upward from the low-income group is double that of those moving downward from the high-income group.

Eichengreen et al. (2011) construct a sample of cases where fast-growing economies slow down. They show that rapidly growing economies slow down significantly when their per capita incomes reaches around $US17,000 in year-2005 constant international prices.

Derong Zhang (2014) sets 1960, 1965, 1970, 1975, and 1980, as the baseline years, and counts the numbers of the middle income countries starting from the baseline years through the subsequent years， found only 26% of the lower middle income countries in 1960 remain in the same level 50 years later in 2010; 44% in 1970 remain unchanged after 40 years in 2010; and 59% in 1980 stay in the same level after 30 years in 2010. Same situation happened to upper middle income countries. With thirty years being the reference frame, as time goes by from 1960, the likelihood of upper middle income

[3] Definition: CUI higher than 55 percent as high-income countries, those with a CUI between 20 and 55 percent as middle-income countries, and those with a CUI lower than 20 percent as low-income countries.

countries being locked in the same income level has increased from 26% in 1960 to 50% in 1980. From those statistical data, we can find there are a large proportion of lower middle income countries or upper middle income countries has stuck in the same income level for 30-50 years, and very likely to stay in the same income level forever.

3. Methodology and data

According to the economic growth convergence hypothesis (Barro & Sala-i-Martin, 1995), economic growth depends on multiple factors or determinants, such as investment ratio, human capital accumulation, government function, infrastructure conditions, and system and policy environments. We realize that the dynamic mechanism of economic growth at different stages of economic development is likely to be different. For instance, the driving forces to promote economic growth in the low income stage may be less effective in the middle income stage. Thus, transforming the economic growth mechanism in the middle income stage is likely crucial for a country to avoid the middle income trap. From this perspective, the following empirical study attempts to find out the difference of economic growth mechanisms in different development stages.

3.1 Model Design

In this part, firstly we would build a model which is based on the research of Derong Zhang (2014), who conducted the empirical study on the economic growth mechanisms in different stages, setting the following regression model:

$$y_{(i,t)} = \gamma y_{(i,t-1)-} + \beta' X_{(i,t)} + \eta_t + \mu_i + \varepsilon_{(i,t)} \quad (1)$$

However, in this paper, we estimated the panel models by the Arellano-Bover/Blundell-Bond Generalized method of moments (GMM) estimator, which is an extension of the Arellano-Bond model where past values and different transformations of past values of the potentially problematic independent variable are used as instruments with other instrumental variables. Moreover, possible nonlinearity of related explanatory variables has also been considered, and squared items of related explanatory variables are added into the regression equation.

In equation (1), y denotes logarithmic GDP per capita, and X is a vector, which includes factors that affect economic growth, such as the fixed capital formation rate, labor, human capital level, the extent of openness, institution, technical innovation, and so forth

3.2 Variable

We included the following dependent variable: logarithmic GDP per capita converted into the price level in 2010 (lngdp),

We included following independent variables.

INVEST, Gross fixed capital formation (% of GDP). Which includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools,

offices, hospitals, private residential dwellings, and commercial and industrial buildings. According to the 1993 SNA, net acquisitions of valuables are also considered capital formation (World Bank, 2016 Series Code: NE.GDI.FTOT.ZS).

FDI, the extent of openness measured by Foreign direct investment, net inflows (% of GDP), Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP (World Bank,2016 Series Code: BX.KLT.DINV.CD.WD).

JOURNAL, Technological progress measured by the number of scientific journal articles published per 1 million people in each country(Journal), which is refer to the number of scientific and engineering articles published in the following fields: physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences. (World Bank, 2016) We use indicator Scientific and technical journal articles(World Bank,2016 Series Code:

IP.JRN.ARTC.SC)divide population of each country(World Bank,2016 Series Code: SP.POP.TOTL) and then multiply 1 million.

LABOR, Labor force participation rate, total (% of total population ages 15-64) (modeled ILO estimate) Labor force participation rate is the proportion of the population ages 15-64 that is economically active: all people who supply labor for the production of goods and services during a specified period.

The labor force is the supply of labor available for producing goods and services in an economy. It includes people who are currently employed and people who are unemployed but seeking work as well as first-time job-seekers. Not everyone who works is included, however. Unpaid workers, family workers, and students are often omitted, and some countries do not count members of the armed forces. The labor force participation rates are the ILO estimates the International Labour Organization from the ILO's Key Indicators of the Labour Market database. The series includes both nationally reported and imputed data (World Bank, 2016 Series Code: SL.TLF.ACTI.MA.ZS).

CORRUPTION INDEX (Corruption) is adopted from ICRG to measure institution quality. The corruption index scores and ranks countries/territories based on how corrupt a country’s public sector is perceived to be. It is a composite index, a combination of surveys and assessments of corruption, collected by a variety of

reputable institutions. The corruption index is the most widely used indicator of corruption worldwide.

EDU, Use School enrollment, primary (% gross) to measure the level of human capital.

Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Primary education provides children with basic reading, writing, and mathematics skills along with an elementary understanding of such subjects as history, geography, natural science, social science, art, and music (World Bank, 2016 Series Code: E.PRM.ENRR).

The possible nonlinear relationships being considered, the squared items of Journal are added in the regression model as the explanatory variables for the factors of technological progress (Journal),

3.3 Data

This paper mainly use data from World Bank, the data of Corruption Index from ICRG. Considering data availability problem (like corruption index variable, which only collected data after 1995), this study collected data from 1995-2014.

Unlike Derong Zhang, who collected data from all the countries in the world, we followed the categorization of the World Bank of countries with per capita gross national income (GNI 2016):

GNI < US$1025 = low income group,

US$1025 < GNI < US$4036 = lower middle income group;

US$4036 < GNI < US$12475 = upper-middle income group

GNI > US$12475 = high income countries.

We listed four groups and chose 3 typical countries for each group to avoid the data availability problem, for instance the corruption index was created in 1990, but only includes 90 countries in the first 5 years; mostly low income countries are not included.

There are some lower- middle income countries and higher-middle income countries that lack 5 - 10 years data in some variables.

3.4 Tests

Considering the panel data we chose, we need performed some tests to make sure of the data availability, and to determine the model choice from fixed effects model and random effects model。

Unit Root Test

Some non-stationary economic time series tend to show a common trend. These sequences are not necessarily directly related to each other; if we regress this data, the R-square value we get may be very high, but the result makes no sense. This situation is known as spurious regression. Therefore, in order to avoid spurious regression, to ensure the validity of the estimation results, unit root test is necessary.

Hausman test

In the panel data model, the Hausman test is mainly used to differentiate between fixed effects model and random effects model. The null hypothesis of the Hausman test is that there are no systematic differences in the coefficients of random effects and fixed effects. When the null hypothesis is true, the random effects model is more effective than the fixed effect model. If the null hypothesis is not true, the random effects model is inconsistent. Therefore, if the null hypothesis is true, the estimated value of FE and RE will converge to the true value of the parameter, but if the gap of the estimated value between FE and RE is too large, it is more inclined to reject the null hypothesis. In this paper, after the Hausman test, the result shows that the null hypothesis has been rejected, and the random effect mode is inconsistent.

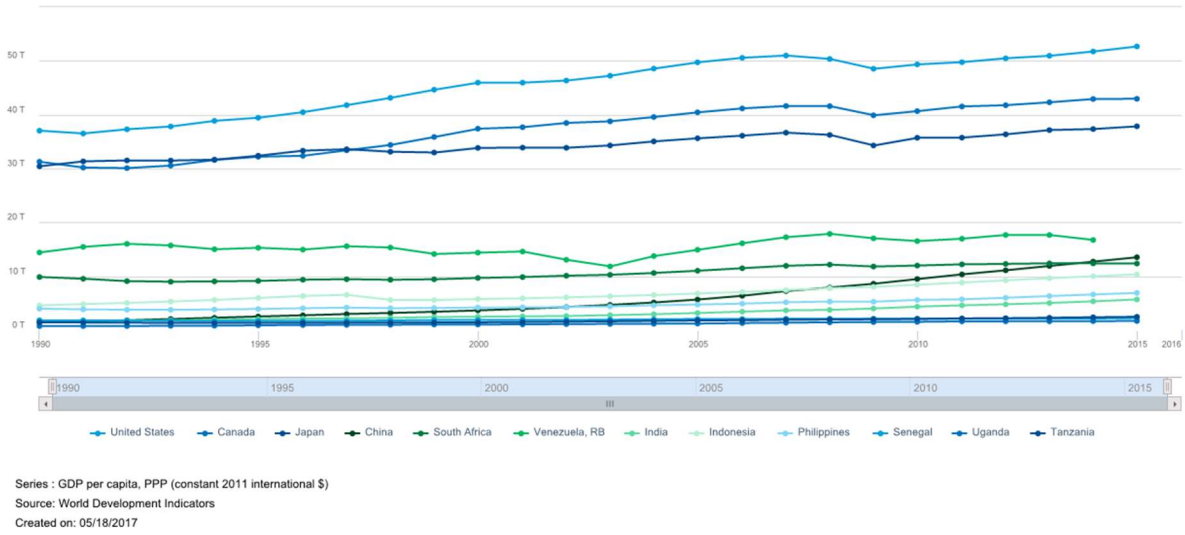
Therefore, the fixed effect model will be used in the empirical study part. The results of the Hausman test are shown in the Appendix.

I also applied vif(Variance Inflation Factors) test and White test to test the multicolinearity and heteroscedasticity of my model, both get a good results, which are shown in the Appendix.

4.Results

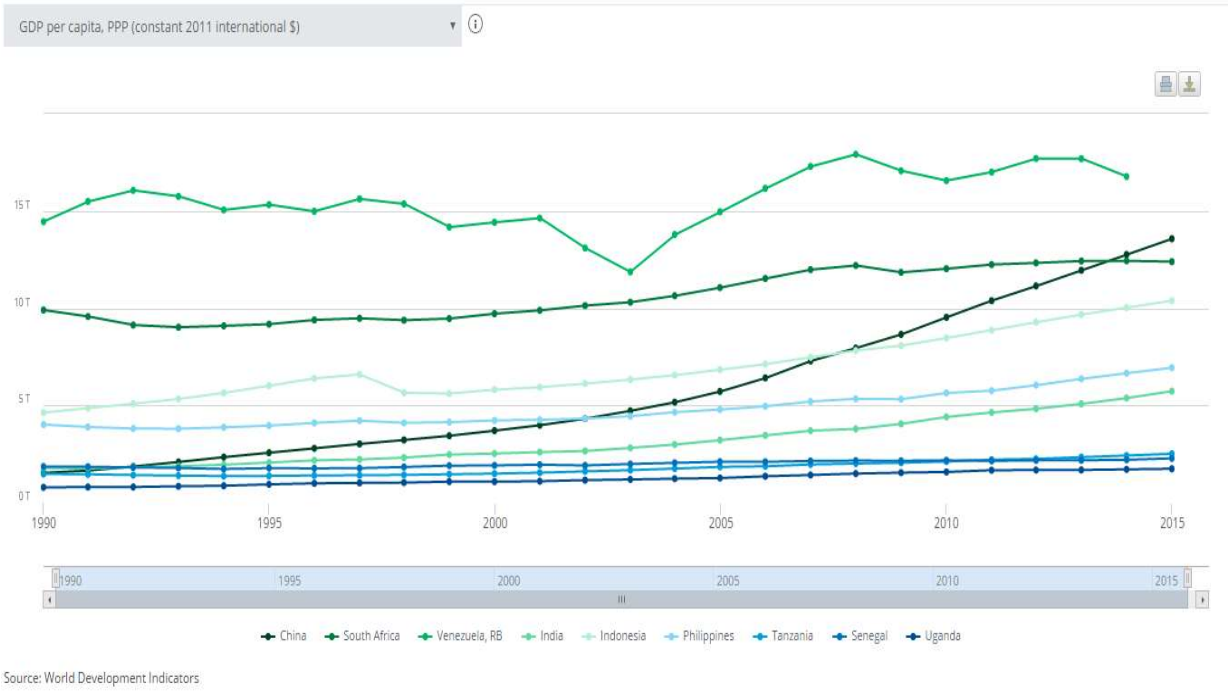
4.1 Graphical Results

Table1 GDP per capital for all countries from 1990



Series : GDP per capita, PPP (constant 2011 international $)
Source: World Development Indicators
Created on: 05/18/2017

Table4 GDP per capital for countries except for high income groups from 1990



Source: World Data Bank

As we can see from Table 1, the GDP per capital of those countries, which are grouped into high income group, both show a good growth trend from 1990. But as Table illustrate, the GDP per capital of Venezuela, RB increase from 11865.8 in 2003 to 17913 in 2008, with dramatic speed, then fluctuate in recent years. The GDP per capital of South Africa increase from 9381.7 in 1998 to 12196.6 in 2008, with a good trend, then after a slightly decreasing, keeping a almost stable status. We also grouped China into upper-middle income group; although it has maintained a good increase trend since 1991, we can find the speed of increase has decreased since 2011.The countries in upper-middle income group both enter into a down economy in varying degrees after an increase period. The same situation did not occur so obviously in low-middle income group countries and low income group countries. We would try to find why it happened to upper-middle income countries, by analyzing the results we got from the GMM model.

4.2 Empirical Results

We applied Arellano-Bond test and Levin-Lin-Chu test to identify problems of autocorrelation and unit root. Test Results of Arellano-Bond test (see appendix) shows there is autocorrelation. Levin-Lin-Chu test results (see appendix) indicate that the panel model contains unit root. In order to solve autocorrelation problem and unit root problem, we took first order difference of our model based on GMM estimation. Considering the possible nonlinear relationships, we added the square item Journal square as the explanatory variable of technological progress.

Table 3
Descriptive Statistics for High Income Countries

Variable	Obs	Mean	Std. Dev.	Min	Max
lngdp	60.00	10.5166	0.2622	9.9320	10.9041
fdi	60.00	1.6935	1.8443	-0.055016	9.2025
invest	60.00	22.0134	2.2498	17.9834	28.1423
labor	60.00	64.4117	2.7201	59.1000	67.6000
edu	53.00	101.0596	1.6781	97.0558	103.9386
corruption	60.00	7.7722	0.8111	5.8000	9.2000
Population	6.00E+01	1.51E+08	1.09E+08	2.94E+07	3.19E+08
journal	57.00	990.5240	357.9096	375.2254	1681.0880
dfdi	57.00	0.0520	1.5033	-5.3468	5.5359
dinvest	57.00	-0.0293	0.7789	-2.4672	1.4989
dlabor	57.00	-0.1123	0.3418	-0.8000	1.0000
dedu	47.00	-0.0243	0.7819	-2.4040	1.5755
djournal	54.00	34.2512	72.4772	-43.8270	310.7298
dcorruption	57.00	-0.0049	0.2577	-0.7700	0.7000

djournal2	54.00	6328.8070	18718.4400	4.5328	96553.0100
dcorruption 2	57.00	0.0653	0.1137	0.0000	0.5929

Table 4

Estimation results for High Income Countries

dgdp	Coefficients	Std. Err.	z	p-values	[95% Conf.	Interval]
dgdp						
Lag1.	0.1448	0.0800	1.8100	0.0700	-0.0120	0.3015
dfdi.	0.0099	0.0034	2.8600	0.0040	0.0031	0.0166
Lag1.	0.0164	0.0061	2.6900	0.0070	0.0045	0.0284
dinvest.	0.0426	0.0060	7.0800	0.0000	0.0308	0.0544
Lag1.	-0.0356	0.0141	-2.5300	0.0110	-0.0632	-0.0080
dlabor.	-0.0663	0.0449	-1.4800	0.1400	-0.1543	0.0217
Lag1.	0.0216	0.0339	0.6400	0.5240	-0.0448	0.0880
dedu.	0.0053	0.0070	0.7500	0.4510	-0.0084	0.0190
Lag1.	0.0218	0.0043	5.1100	0.0000	0.0134	0.0302
djournal	0.0001	0.0000	4.0800	0.0000	0.0000	0.0001
dcorruption	-0.0089	0.0135	-0.6600	0.5110	-0.0354	0.0176
djournal2	0.0000	0.0000	3.9300	0.0000	0.0000	0.0000
_cons	0.0126	0.0121	1.0400	0.2990	-0.0112	0.0364

Number of instruments = 103
Wald chi2(2) = 3.55
Prob > chi2 = 0.1696

Table 5 and Table 6 presents the summary statistic results and regression results of high income group, which indicate that, in high income stage, Variable FDI is significant at 1% significance level and the coefficient is 0.0098. Lagged Variable FDI is significant at 1% significance level and the coefficient is 0.0164. If an increase of 1 percentage point foreign direct investment rate occurred in this period, the GDP per capital would increase 0.01% in this period and increased 0.02% in the next period. The FDI indicates the net inflow of direct investment to a country, so it may take negative values. Variable Invest is significant at 1% significance level; the coefficient of Invest is 0.0425. Lagged

variable INVEST is significant at 5% significance level; the coefficient of Invest is -0.0355.This indicates that if fixed capital formation rate increase 1 percentage point, GDP per capital would increase 0.04% in this period and decrease 0.03% in next period, but in total there is still a positive effect between Invest and fixed capital formation rate. Variable EDU is insignificant, lagged variable EDU is significant at 1% significance level and the coefficient is 0.0218. This indicates that if primary school enrollment ratio increase 1 percentage point and GDP per capital would increase 0.02% in next year; therefore it makes sense that education has long-term effect on GDP per capital.

Variable Corruption is insignificant. The sample mean and stand deviation of Corruption is 0.77 and 0.81. Which indicates the quality of institution has reached a high level, it is very difficult for the quality of institution to maintain increase in such a high level, and there would not be significant effect on economic growth. so the common driving force of high income stage are foreign direct investment rate and fixed capital formation rate, human capital, and technological progress

Table 5
Descriptive Statistics for Upper Middle Income Countries

Variable	Obs	Mean	Std. Dev.	Min	Max
lngdp	60	7.7756	0.8091	6.1396	8.9973
fdi	60	2.1745	1.7545	-2.7574	5.9830
invest	60	27.8178	9.5847	15.1503	45.7597
labor	56	64.7143	9.8401	42.6000	79.4000
edu	55	106.8807	5.2651	96.2538	117.3399
corruption	60	3.4675	1.0996	1.9000	5.6800
Population	60	4.56E+08	5.99E+08	2.22E+07	1.36E+09
journal	57	81.4731	75.3856	5.7711	295.7422
dfdi	57	-0.0115	1.4161	-4.7016	5.2726

dinvest	57	0.3082	1.6289	-5.2907	4.8949
dlabor	50	0.1340	2.1172	-2.2000	11.4000
dedu	49	-0.4244	2.0688	-7.5677	4.6118
djournal	54	9.2770	10.4401	-4.6998	37.6702
dcorruption	57	-0.0095	0.2501	-0.7300	0.6200
djournal2	54	193.0404	315.1843	0.0094	1419.0430
dcorruption2	57	0.0615	0.0986	0.0000	0.5329

Table 6

Estimation results for Upper Middle Income Countries

dgdp	Coefficients	Std. Err.	z	p-values	[95% Conf.	Interval]
dgdp						
Lag1.	0.0263	0.1281	0.2100	0.8370	-0.2248	0.2774
dedu.	0.0059	0.0092	0.6400	0.5220	-0.0121	0.0239
Lag1.	0.0182	0.0091	2.0000	0.0460	0.0003	0.0361
dinvest	0.0008	0.0146	0.0500	0.9590	-0.0279	0.0295
dlabor	0.0017	0.0015	1.0900	0.2740	-0.0013	0.0046
dfdi	0.0238	0.0127	1.8800	0.0600	-0.0010	0.0486
djournal	0.0027	0.0015	1.8500	0.0640	-0.0002	0.0056
dcorruption	0.2259	0.0875	2.5800	0.0100	0.0544	0.3974
djournal2	0.0000	0.0000	1.5500	0.1210	0.0000	0.0000
_cons	0.0590	0.0288	2.0500	0.0400	0.0026	0.1154

Number of instruments = 103
Wald chi2(9) = 14.69
Prob > chi2 = 0.0997

Table 7 and Table 8 presents the summary statistic results and regression results of upper-middle income group, which indicates that in upper-middle income stage, lagged variable edu is insignificant at 5% significance level, and the coefficient is 0.0182. Which indicates that if primary school enrollment rate increase 1 percentage point and GDP per capital would increase 0.2% in next period. Variable fdi is insignificant at 10% significance level, and the coefficient is 0.0237. Which indicates that if foreign direct investment rate increase 1 percentage point and GDP per capital would increase 0.02%.

Variable Journal is significant at 10% significance level and coefficient is positive, which indicate that in upper middle income countries, technological progress has a positive influence on economic growth. Variable Corruption is insignificant at 1% significance level, and the coefficient is 0.2259. Which indicates that if corruption index increase 1 and GDP per capital would increase 0.23%. As we can see from the first differenced results of GMM model in upper-middle income countries, the fixed formation rate and labor force participation rate would not have a significant effect on economic growth. The common driving forces of upper middle income stage are foreign direct investment rate, education, corruption index and technological progress. The institution quality is the most important factor for economic growth of upper-middle income countries.

Table 7

Descriptive Statistics for Lower Middle Income Countries

Variable	Obs	Mean	Std. Dev.	Min	Max
lngdp	60	7.0593	0.6125	5.9442	8.2162
fdi	60	1.3127	1.1299	-2.7574	3.5460
invest	60	25.0719	4.8556	18.7393	34.3133
labor	60	65.6783	4.1503	56.3000	70.0000
edu	52	106.2737	5.7216	92.2219	116.8189
corruption	60	2.7797	0.5303	1.7000	3.8000
population	60	4.81E+08	4.72E+08	6.98E+07	1.30E+09
journal	57	13.2571	17.9925	0.6575	72.9578
dfdi	57	0.0333	0.9115	-2.4201	2.1779
dinvest	57	0.1659	1.6104	-5.2907	4.1697
dlabor	57	-0.1035	0.7853	-1.8000	2.7000
dedu	47	0.1731	1.7266	-2.6013	7.9388
djournal	54	1.5095	2.4583	-0.5138	10.9969
dcorruption	57	0.0616	0.2608	-0.8000	0.8000
djournal2	54	8.2099	22.5755	0.0001	120.9317

dcorruption2	57	0.0706	0.1478	0.0000	0.6400

Table 8

Estimation results for Lower-Middle Income Countries

dgdp	Coefficients	Std. Err.	z	p-values	[95%Conf.	Interval]
dgdp						
Lag1.	-0.2210	0.0979	-2.2600	0.0240	-0.4129	-0.0291
dfdi.	0.0289	0.0308	0.9400	0.3480	-0.0314	0.0892
Lag1.	0.0211	0.0110	1.9200	0.0550	-0.0005	0.0428
dinvest.	0.0214	0.0007	32.1000	0.0000	0.0201	0.0227
Lag1.	-0.0108	0.0063	-1.7200	0.0850	-0.0231	0.0015
dlabor.	0.0227	0.0435	0.5200	0.6020	-0.0626	0.1080
Lag1.	0.0293	0.0296	0.9900	0.3220	-0.0287	0.0874
dedu	0.0052	0.0028	1.8800	0.0610	-0.0002	0.0106
djournal	0.0023	0.0006	3.6800	0.0000	0.0011	0.0035
dcorruption	0.1407	0.1078	1.3100	0.1920	-0.0705	0.3519
djournal2	0.0000	0.0000	-2.1400	0.0330	-0.0001	0.0000
_cons	0.0713	0.0129	5.5200	0.0000	0.0460	0.0965

Number of instruments = 103
Wald chi2(2) = 2.51
Prob > chi2 = 0.2847

Table 10 and Table 11 presents the summary statistic results and regression results of lower-middle income group, which indicates that in lower-middle income stage, Variable FDI is insignificant. Lagged Variable FDI is significant at 10% significance level and the coefficient is 0.0211. FDI has no significant effect on GDP per capital in this period, but if it increase 1 percentage point foreign direct investment rate in this period and the GDP per capital would increase 0.02% in next period. Variable Invest is significant at 1% significance level and the coefficient of Invest is 0.0215. Lagged Variable Invest is significant at 10% significance level and the coefficient is -0.0108, which indicates that if fixed capital formation rate increase 1 percentage point; and GDP per capital would increase 0.02% in this period and decrease 0.01% in next period; in

total fixed capital formation has a positive influence on GDP per capital. Variable EDU is significant at 10% significance level and the coefficient is 0.0051, which indicates that human capital would promotes economic growth. Variable Journal is significant at 5% significance level and the coefficient is 0.0022. Variable Journal square is significant at 5% significance level and the coefficient is -0.000033, which indicates that in lower- middle income countries, technological progress advances the positive effect and the GDP per capital would decrease in early stage, and increase after creating a basic technological. Variable Corruption is insignificant, which indicate that in lower-middle income stage, there is no significant effect between corruption index and GDP per capital. In lower- middle income countries, focusing on increase institution quality would not be helpful to economic growth.

Table 9

Descriptive Statistics for Low Income Countries

Variable	Obs	Mean	Std. Dev.	Min	Max
lngdp	60	6.1964	0.5011	5.1975	6.9981
fdi	60	3.1943	1.4353	0.1722	6.4798
invest	60	22.9733	4.7231	14.7211	33.6657
labor	60	82.7983	5.7752	77.0000	90.8000
edu	55	92.8121	24.4223	55.8686	138.3829
corruption	52	2.8483	0.5158	1.9000	4.3000
population	60	2.63E+07	1.27E+07	8710746	5.18E+07
journal	57	8.4379	4.8493	2.0428	21.6254
dfdi	57	0.1002	1.3211	-3.3602	3.5949
dinvest	57	0.5466	2.0531	-4.8168	4.8314
dlabor	57	-0.0667	0.2843	-1.5000	0.2000
dedu	49	1.9469	7.7347	-9.0191	47.4913
djournal	54	0.5222	1.5726	-3.7548	5.2451
dcorruption	49	0.0427	0.2917	-0.6000	0.7000

djournal2	54	2.7000	5.8452	0.0000	27.5116
dcorruption2	49	0.0851	0.1110	0.0000	0.4900

Table 11

Estimation results for Low Income Countries

dgdp	Coefficients	Std. Err.	z	p-values	[95%Conf.	Interval]
dgdp						
Lag1.	0.2162	0.0370	5.8400	0.0000	0.1437	0.2887
dfdi.	0.0106	0.0054	1.9400	0.0520	-0.0001	0.0212
Lag1.	0.0047	0.0028	1.6900	0.0920	-0.0008	0.0103
dinvest.	0.0098	0.0028	3.4400	0.0010	0.0042	0.0153
Lag1.	0.0069	0.0027	2.5400	0.0110	0.0016	0.0123
dlabor	-0.0287	0.0056	-5.1600	0.0000	-0.0397	-0.0178
dedu	-0.0021	0.0004	-5.8900	0.0000	-0.0028	-0.0014
djournal	-0.0004	0.0005	-0.8200	0.4100	-0.0014	0.0006
dcorruption	-0.0008	0.0003	-2.4400	0.0150	-0.0014	-0.0002
djournal2	0.0000	0.0000	1.0500	0.2930	0.0000	0.0000
_cons	0.0309	0.0084	3.6900	0.0000	0.0145	0.0474

Number of instruments = 103
Wald chi2(2) = 39.90
Prob > chi2 = 0.0000

Table 12 and Table 13 presents the summary statistic results and regression results of low income group, which indicates that in low income stage, Variable FDI is significant at 10% significance level and the coefficient is 0.0105. Lagged Variable FDI is significant at 10% significance level and the coefficient is 0.0047, which indicates that if increase 1 percentage point foreign direct investment rate in this period, and the GDP per capital would increase 0.01% in this period, and increase slightly in next period. Variable Invest is significant at 1% significance level and the coefficient of Invest is 0.0097. Lagged Variable Invest is significant at 5% significance level and the coefficient is 0.0069, which indicates that if fixed capital formation rate increase 1percentage point, GDP per capital would increase 0.01% in

this period and increase 0.01% next period. Variable EDU and Variable Labor both behave unnormal here; both are significant at 1% significance level, but the coefficients are negative. This indicates human capital and labor force participation rate would decrease GDP per capital, but it does not make sense. Variable Journal is insignificant here. Variable Corruption is significant at 5% significance level and the coefficient is -0.0007, which indicates that the variable Corruption has slight negative effect on economic growth. The low income countries are not supposed to focus on technological progress and institution quality. As for the original technological progress, developing countries' lagging behind in technology determines that imitation, compared with R&D, is probably a more efficient way to progress technologically.

5. Conclusion

From the theoretical studies and empirical studies, we can explain the concept of middle income trap from within the economic analysis framework. We also found the statistical significance of middle income tap and it can indicate important theoretical and policy implications.

This paper mainly analyzed the differences in the economic driving forces between different income countries, and figured out the mechanism of the middle-income trap. For this purpose, based on Derong Zhang's model, we estimated the panel models by

the Arellano-Bover/Blundell-Bond Generalized method of moments (GMM) estimator. To improve the accuracy of analyze results, our approach selected typical countries for each income group, limited the data period, and applied Arellano-Bond test, Levin-Lin-Chu test Hausman test (for data availability).

From the results, for low-income countries, the openness-to-the-outside-world and fixed capital investment are key driving forces of economic growth. Low-income countries should maintain these forces to increase economic per capital to transfer to middle income countries.

From the results for lower middle-income countries, in addition to further enhancing the openness-to-the-outside-world and fixed capital investment, human capital is also a key factor to maintaining economic growth rate. It would be better not to focus on technological progress and institution quality, which are insignificant on GDP per capital, until this country transition to upper-middle income country.

In upper-middle income stage, the marginal effect of fixed capital investment decreases gradually until it becomes insignificant to economic growth rate. The openness-to-the-outside-world and human capital are still maintaining the increase trend of the economic growth rate. For upper-middle income countries, which would develop to high income countries but always fall into the middle income trap, technological progress and institution quality play an important role in maintaining the economic growth trend.

In summary, to avoid middle income trap, lower middle income countries should enhance human capital by increase financial input to education and employment training; Adjust appropriate international trade policies, reduce tariffs, and enhance infrastructure to reduce transportation costs, to achieve the transfer to export - oriented development model; build multi-level financial market and capital market, enhance the control of capital by build a well-regulated financial system. Upper middle income countries should deepen the reform of the system and improve the government functions to achieve the adjustment of income distribution and the promotion of social security; encourage innovation to improve the local industrial products into the high value-added products.

Finally, there are still some limitations in this report. First is data period problem, it would be better for this empirical study to include more years data. But corruption index is an essential variable in our model; due to data availability problem, we only collected 20 years data, since the corruption index has only been existence for that period of time. If we could find some other variable which has a longer data period, to replace variable corruption index to describe institution quality, the results would be improved. Secondly, the limited number of observation would decrease the robustness of the model, and increase the number of observation would increase the accuracy of our research.

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Appendix

Table 13 Arellano-Bond test Results for high income group

Arellano-Bond test for zero autocorrelation in first-differenced errors

Order	z	Prob > z
1	-1.4399	0.1499
2	-1.0407	0.2980

H0: no autocorrelation

Table 14 Arellano-Bond test Results for upper-middle income group

Arellano-Bond test for zero autocorrelation in first-differenced errors

Order	z	Prob > z
1	-1.2704	0.2039
2	-1.225	0.2206

H0: no autocorrelation

Table 15 Arellano-Bond test Results for lower-middle income group

Arellano-Bond test for zero autocorrelation in first-differenced errors

Order	z	Prob > z
1	-1.3615	0.1733
2	-1.2294	0.2189

H0: no autocorrelation

Table 16 Arellano-Bond test Results for low income group

Arellano-Bond test for zero autocorrelation in first-differenced errors

Order	z	Prob > z
1	-1.5852	0.1129
2	-.57207	0.5673

H0: no autocorrelation

Table 17 Unit root test results for high income group

Levin-Lin-Chu test results for GMM estimation

	Adjusted t*	p-value
lngdp	-1.4269	0.0768
fdi	-3.8053	0.0001
Invest	-2.8509	0.0022
Labour	-1.2384	0.1078
corruption	-0.9990	0.1589
Journal	-1.2358	0.1083

Im-Pesaran-Shin unit-root test

	Adjusted t*	p-value
Edu	0.6921	0.7556

Table 18 Unit root test results for upper-middle income group

Levin-Lin-Chu test results for GMM estimation

	Adjusted t*	p-value
lngdp	0.7113	0.7616
fdi	-1.7564	0.0395
Invest	-0.7292	0.2329
corruption	-2.7406	0.0031
Journal	-4.3134	1.0000

Im-Pesaran-Shin unit-root test

	Adjusted t*	p-value
Edu	-1.0053	0.1574
Labour	0.9282	0.8233

Table 19 Unit root test results for lower-middle income group

Levin-Lin-Chu test results for GMM estimation

	Adjusted t*	p-value

lngdp	1.3921	0.9181
fdi	-1.2317	0.1090
Invest	-0.6259	0.2657
Labour	-0.7415	0.2292
corruption	1.1109	0.8667
Journal	5.8087	1.0000

Im-Pesaran-Shin unit-root test

	Adjusted t*	p-value
Edu	0.0573	0.5229

Table 20 Unit root test results for low income group

Levin-Lin-Chu test results for GMM estimation

	Adjusted t*	p-value
lngdp	0.5717	0.7162
fdi	-2.9417	0.0016
Invest	-0.1638	0.4349
Labour	0.4913	0.6884
Journal	0.4500	0.6737

Im-Pesaran-Shin unit-root test for

	Adjusted t*	p-value
Edu	-1.2942	0.0978
corruption	-0.3383	0.3676

Table 21 White test results for GMM estimation

	Adjusted t*	p-value
High income	18.0652	0.9885
Upper middle income	26.2527	0.3842
Lower middle income	43.1441	0.1352
Low income	40.58049	0.2029

Table 22 VIF multicollinarity test results for High income group

Variable	VIF	1/VIF
dlabor	1.14	0.8757
dinvest	1.14	0.8764
dfdi	1.04	0.9579
djournal	1.04	0.9585
dedu	1.01	0.9872
dcorruption	1.01	0.9906
Mean VIF	1.07	

Table 23 VIF multicollinarity test results for Upper middle income group

Variable	VIF	1/VIF
dlabor	1.49	0.6721
dinvest	1.46	0.6837
dfdi	1.10	0.9111
djournal	1.09	0.9153
dedu	1.08	0.9255
dcorruption	1.02	0.9790
Mean VIF	1.21	

Table 24 VIF multicollinarity test results for Lower middle income group

Variable	VIF	1/VIF
dlabor	1.16	0.8650
dinvest	1.13	0.8858
dfdi	1.13	0.8866
djournal	1.09	0.9167
dedu	1.02	0.9773
dcorruption	1.01	0.9876
Mean VIF	1.09	

Table 25 VIF multicollinarity test results for Low income group

Variable	VIF	1/VIF
dlabor	1.44	0.6927
dinvest	1.43	0.6987
dfdi	1.09	0.9135
djournal	1.06	0.9419
dedu	1.04	0.9661

dcorruption	1.02	0.9844

Mean VIF 1.18

Table 26 Hausman Test Results

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
foreigndir~w	.0086294	.0105726	-.0019432	.0011812
grossfixed~p	.0113831	.0045094	.0068737	.0130586
laborforce~l	-.0313838	-.0245047	-.0068791	.0233273
grossenrol~s	-.0013371	.0164575	-.0177946	.004603
corruption~x	.3821648	1.183474	-.8013088	.2108021
journal	-.0009258	-.0003512	-.0005746	.0001515
corruption~e	-.0246309	-.0881305	.0634996	.0168052
journalsqu~e	7.82e-07	4.78e-07	3.04e-07	8.45e-08
_cons	10.99955	6.310777	4.688773	1.664382

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 14.95
Prob>chi2 = 0.0006
(V_b-V_B is not positive definite)

Curriculum Vitae

Candidate's full name: Xiangyu Zhao

Universities attended: Bachelor of Economics, Shandong University of Finance and Economics, 2014