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ORIGINAL RESEARCH ARTICLE

Old trap for a new mule: A study on the role of financial systems in escaping the middle-income trap

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ABSTRACT

The middle-income trap has been in developmental discussions for the better part of the last decade since the inability of most Latin American countries to break out of it. There is renewed interest in the concept since the realisation that one of the biggest economies in the world, i.e., China could be caught in it. While there is abundant literature on the part that social infrastructure and human capital development plays, the effect of financial systems is relatively ignored. This paper seeks to fill this gap by understanding the role of financial system variables in escaping the middle-income trap. By taking a sample of thirteen countries and using two classification techniques—Naive Bayes and random forest, it is concluded that both bank-based measures and market-based measures have an impact on income levels. These results have strong implications on understanding how to break out of the trap for policymakers.

Keywords: middle-income trap; financial systems; Naive Bayes; random forest

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1. Introduction

Natural progression for any economy would be to start with lower income levels and then move to a higher income level. However, not all countries witness this smooth transition, and they are often caught in the middle-income levels. This is exemplified by the high growth and then prolonged stagnation in the income levels of Latin American countries. Policymakers' approach of market liberalisation led to unparalleled growth in the region initially. However, since the beginning of the twenty-first century many Latin American countries have been caught in what was hypothesised as the "Middle-income Trap"[1,2]. Middle-income trap is the stillness in growth after a country reaches the middle-income levels[3,4]. **Table 1** defines the GNI per capita range to categorize the middle income trap[5].

Table 1. Classification of middle-income countries by World Bank.

Category	Range of GNI per capita
Lower middle-income	$1006–$3955
Upper middle-income	$3956–$12,235

Source: Pan and Chang[5].

The Mexican economy grew 6.6% on average annually from 1950 to 1980 but the rate was reduced to 2.4% for the next thirty years. Most Latin American countries couldn't grow much as their wage rates could not compete with countries that heavily depend on labour-intensive methods. And on the other hand, they were behind advanced economies when it came to production using sophisticated technology, resulting in lower productivity[1]. There have been few countries that were able to sustain high growth after reaching middle-income levels like Hong Kong, Israel, Korea, Singapore, and Taiwan[3]. There are two key questions that need to be answered about this hypothesis of stagnation in middle-income countries. First, why are the countries caught in this trap? Secondly, how were the aforementioned countries able to escape the middle-income trap and maintain higher levels of economic growth?

Initially, when economies embark on the road of development, they follow the Lewisian model of development, and there is movement from the primary to the manufacturing sector, leading to higher levels of wages and thereby increasing the per capita income levels of the economy[6,7]. This sustained growth pushes the economy into middle-income levels. However, once the economy reaches that level, there are few impediments to sustaining higher growth rates. It is difficult for them to compete with the countries in the higher income bracket, as their economic prosperity is dependent on higher skill levels, innovation, and technological advancements. At the same time, they are unable to compete with low-income countries as they provide labour-intensive techniques at much cheaper wage rates. Other than these factors, economies like Malaysia are unable to sustain higher levels of growth due to the quality of human capital. If the human capital is not of good quality, it impacts not only productivity levels but also Further, most of the nations in this group of income levels have widespread income inequality which further curtails their chances of achieving higher levels of growth as it impacts access to social infrastructure which is a pre-condition for growth of human capital[8]. It is imperative for middle-income countries to timely re-think their growth strategies to progress to higher income levels[9]. It is not necessary that policies that have helped economies enter the middle-income levels would also help them reach higher income levels.

Additionally, lessons can be drawn from most east Asian economies, whose export-oriented growth has been remarkable. Economies like Japan, China, South Korea, and Taiwan have experienced high growth levels in their income per capita. This exemplary growth often dubbed as the 'East Asian Miracle' in colloquial terms has been a product of several factors like trade openness, higher rates of savings, commitment to the development of social infrastructure, and overall macroeconomic measures[5,10]. Even though there has been much discussion on causes, nature, and solutions of middle-income trap, mainstream literature on the subject has been relatively quiet on the part that financial systems play and its development on the success of countries reaching higher levels of income or the impact of bottlenecks in financial infrastructure on the growth levels of countries unable to escape the trap.

Many empirical studies have been conducted on the effect of a robust financial system on economic growth since Schumpeter pointed out its relevance in achieving economic growth and development. It's needless to say that finance has an important part to play in the development of an economy. Mobilisation of savings is an essential part for fostering technological innovation, entrepreneurship, facilitating transactions, etc. A developed financial system will contribute towards capital accumulation which in turn will ensure efficient employment of capital in an economy[6].

The goal of this paper is to study the role of financial systems in economic growth, with a special focus on middle-income countries. Countries that are stuck in the middle-income trap, as well as the ones that have escaped are analysed using various financial parameters and their contribution to per capita income. These parameters have been identified from the extant literature on financial development. The paper has been divided into six sections, including introduction. Other sections are review of literature, methodology, analysis, discussion, and conclusion, in that order.

2. Review of literature

2.1. Middle-income trap

There are many definitions of middle-income Trap, but the concept was introduced by Kharas and Kohli[9].

They defined the middle-income trap as a stagnation in the growth of GDP per capita after prolonged periods of growth, which promotes these countries from lower income levels to middle-income levels[3,5]. Extant literature has identified various reasons for this slowdown. Stagnation in growth is correlated with higher levels of growth in preceding periods[11]. It can also be attributed to demographic factors such as old-age dependency ratios once the country has surpassed the stage where the maximum population is in the labour force[12,13]. Other reasons include higher wages compared to low-income countries, lack of investment in human capital or social infrastructure, devalued exchange rates, income inequality, etc.[6,11,14,15]. While the middle-income trap has been associated with aforementioned factors, not much work has been done to identify the role of financial systems in stagnating the growth of the country.

2.2. Financial systems and economic growth

Much work has been done on relationships between financial development and economic development, with Schumpeter being the earliest proponent of this hypothesis. Empirical work on this was performed decades later by taking into account factors such as the size of financial intermediaries relative to the GDP, credit issued to the private sector, etc. These studies solidified Schumpetere's claim. It has also been established that stock market growth and market-related measures like turnover ratio, total value of stocks traded and stock market capitalization are also necessary to determine the development of financial systems in an economy[16–19]. A frail financial system could lead to repeated crises and inefficiencies in the mobilization of funds to productive uses leading to profitable investments is imperative. It could also lead to increased cost of procuring capital, which is an impediment to innovation, entrepreneurship, etc.[17,20]. Countries after entering the middle-income levels need to rethink their strategy of growth if they want to reach higher levels of income. This includes re-examining the role of the financial sector. Financial liberalization can be used as a tool to break out of the trap, and there is renewed discussion on it because of the possibility of the Chinese economy entering it[21,22]. Hence, financial systems and structures are an important aspect of the growth story of an economy, and it is crucial to determine its role in breaking out of the trap.

3. Methodology

For the purpose of determining the impact of financial systems on extracting a country out of the middle-income trap, we have taken a mix of countries who are still caught in the trap and a few countries that have escaped the trap. The intention is to draw a comparison between the role of financial depth of economies that have successfully escaped the trap and the ones that need to. In order to achieve the intent of our study, thirteen countries have been chosen for our analysis. These countries are Argentina, Australia, Brazil, Chile, Hong Kong, Japan, India, Iran, Israel, Malaysia, Mexico, Singapore, and South Korea. Out of these thirteen countries, Australia, Hong Kong, Japan, Israel, and Singapore have successfully broken the trap and entered the high-income group.

The variables which have been preferred for such analyzation is GDP at constant prices as the dependent variable and financial parameters are taken as explanatory variables. These parameters are domestic credit provided by the financial sector, broad money, stock traded as a percentage of GDP, market capitalization, the number of ATM's per hundred thousand adults, and commercial bank branches per hundred thousand adults. The data obtained about the time frame of 2005 to 2020 over the span of fifteen years and it has been extracted from world bank indicators of the aforementioned countries. To substitute the null values, the mean of the non-existing collected measured variable components associated with that independent variable is being used. This can be accepted as the case for small numbers of missing data elements and is not distorting the original data.

We have used descriptive statistics to determine basic information on the characteristics of the variables in the dataset. This is followed by the robust regression in order to detect the presence of the influential outliers.

Further, Random Forest and Naïve Bayes classification techniques have been used to predict the country's GDP per capita to figure out if the country is escaping the middle-income trap or not.

The study elaborates the analysis based on regression and classification. The analysis of comparing the conclusions based on regression and classification is a major challenge to depict. While regression analysis focuses on predicting the continuous value based on input variable, classification however, is based on a predictive model that considers discrete output variables, by approximating a mapping function from input variables. In this context, the study imposes two questions. First, what is the echelon of the middle-and high-income countries in light of the development of the financial sector upliftment. And secondly, will the middle-income countries escape the trap, considering the connection of the financial sector development of the high-income countries.

Regression analysis has been framed to assess the relationship between the dependent variables and single or additional criterion variables. The regressor is an exogenous variable that manipulates the prediction of the response variable while the dependent variable is an endogenous variable which is predicted by the explanatory variable through regression analysis in a multiple linear regression model with an assumption of no specification bias. Furthermore, the linear relationship between the regressors is non-existent. In order to eliminate the chances of multicollinearity between the regressor and regress and the log-log model has been adopted. Likewise, the foremost difference in the two common techniques of normal least square regression and robust regression seems to be that the latter tends to give weight to the observations based on the value's own behaviour, whilst the OLS does not seem to. Furthermore, the equivalency remains identical between the two techniques, except that the later may have been a slightly better strategy by including outliers since the analysis as well as trying to treat the OLS regression alike[23,24]. Having followed that, classification techniques were used to recognise the set of categories to which the experimental results belonged. The Naive Bayes classifier is a probabilistic classification technique which is premised on Bayes' theorem and tends to make strong independent generalisations about the independent variables. Mathematically, $P(A|B) = P(B|A) * P(A)/P(B)$. Moreover, random forest is very much an ensemble learning method for classification crafted by incorporating numerous decision tree models. The latter facilitates in acknowledging the behavioural patterns of independent variables on dependent variables. This mechanism is used both as a classification problem and a regression mechanism; besides, it is an extensively used predictive modeling and machine learning technique[25]. Both of the antecedents are used to determine the classification technique that will best fit the data specific model in predicting whether or not the financial specifications can assist to break away the middle-income trap.

To elaborate on the choice of the classification, a portion of the main training set's decision trees is randomly chosen for the tree-based algorithm's use, namely random forest classification. The final output prediction made by the random forest classification algorithm, which is more accurate than any of the individual trees, is made by combining the outputs from all the various decision trees. The Bayes Theorem offers a formula for computing the conditional probability and is used to determine the precision of values. Furthermore, it is ironic that despite being a straightforward computation, it is employed to quickly determine the conditional probability of events, where intuition frequently fails for a data driven computation. In short, it is among the most straightforward and efficient approaches to conditional probability where the assumption of independent predictors is true. The training time is reduced since just a little amount of training data is needed to predict the test data.

4. Analysis

For the purpose of simplifying our analysis we consider:

X_1: Domestic credit provided by the financial sector;

X_2: Broad money;

X_3: Stock traded as a percentage of GDP;

X_4: Market capitalization;

X_5: No. of ATM's per hundred thousand adults;

X_6: Commercial bank branches per hundred thousand adults.

4.1. Linear Regression

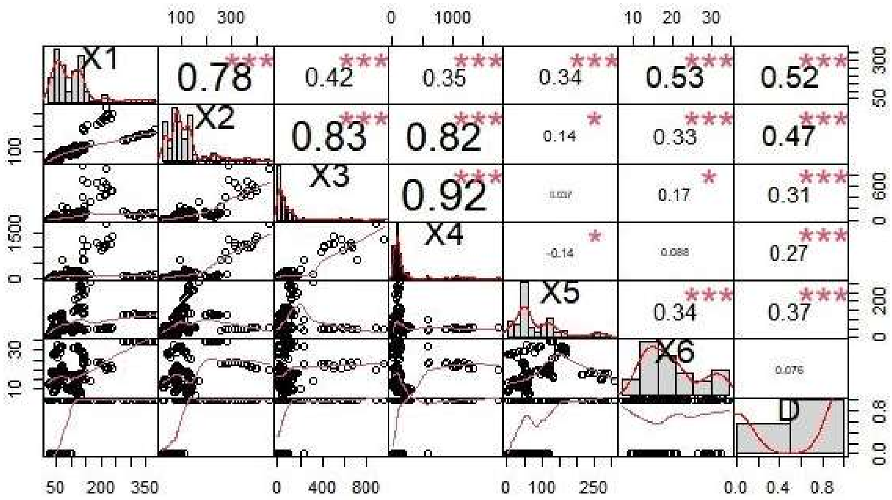


Figure 1. Correlation mapping between the explanatory variable and dependent variable.

Source: Author's calculation.

Basically from **Figure 1**, the correlation coefficient describes the direction of the relationship, i.e., if both the variables increase or decrease together or not. Here, the high numerical values of the correlation coefficient indicate the strong linear relationship between each pair of variables presented in the model, and the positive value depicts if one variable of the pair increases, the other variable also increases. In this case, the presence of high correlation is observed between the variables.

We have taken the linear regression model of GDP per capita as the dependent variable with respect to the log of the financial parameters. The logarithm is taken to avoid the problem of skewness, and consider the data to be normally distributed, and avoid the problem of multicollinearity.

$$Y = \beta_0 + \beta_1 \cdot log(X_1) + \beta_2 \cdot log(X_2) + \beta_3 \cdot log(X_3) + \beta_5 \cdot log(X_5) + \beta_6 \cdot log(X_6)$$

Linearity in the model: Ramsey Regression Equation Specification Error Test (RESET) is conducted to check whether the data is linear or not.

We define the null hypothesis as

H_o: There is linearity in the model

The p-value = 0.9663 on conducting RESET.

Since p-value > 0.05

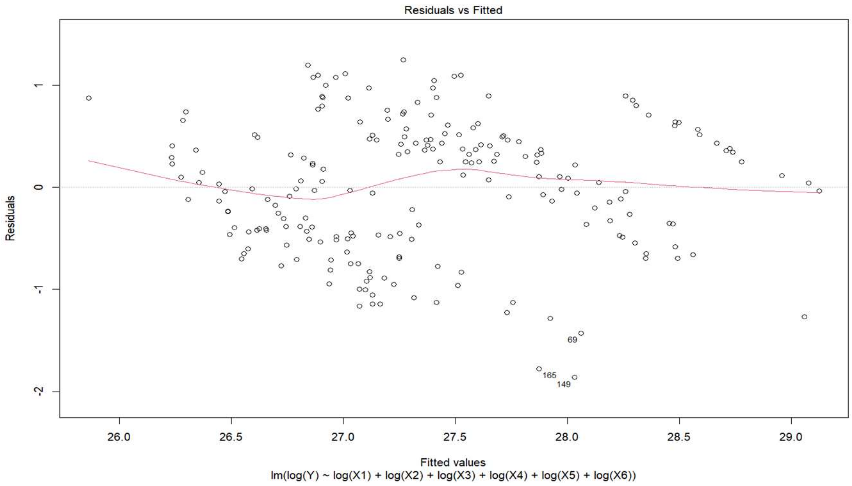
Therefore, there is linearity in the model.

4.2. A multiple linear regression model

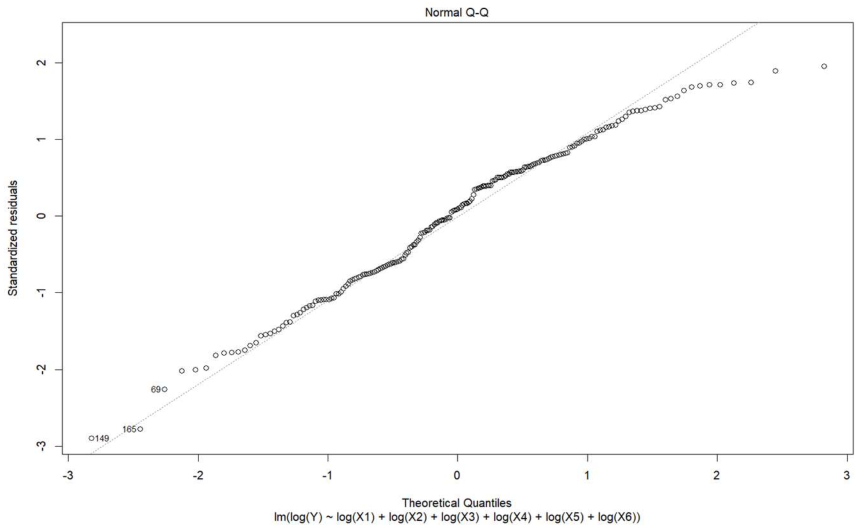
Hence the regression analysis figures out as:

$$(29.2705) + (0.5975) \cdot X_1 + (-0.0473) \cdot X_2 + (0.7036) \cdot X_3 + (-1.2813) \cdot X_4 + (-0.1679) \cdot X_5 + (-0.1629) \cdot X_6$$

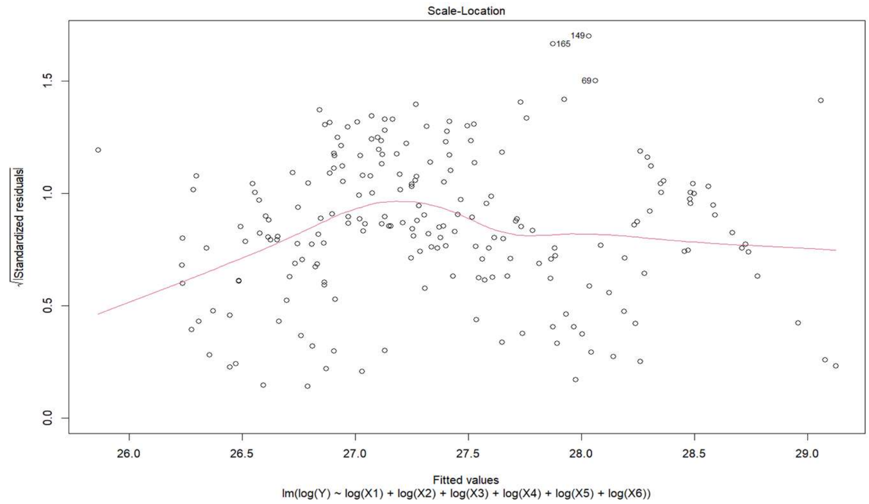
The coefficients of regression are shown in **Figure 2** as it mentions about the Residual vs Fitted plot in **2(a)**, the q-q plot in **2(b)**, the standard residual graph in **2(c)** and finally the standard residual vs the leverage graph in **2(d)**. **Table 2** shows the t-value of the coefficients of regression.



(a). Residual vs fitted graph.

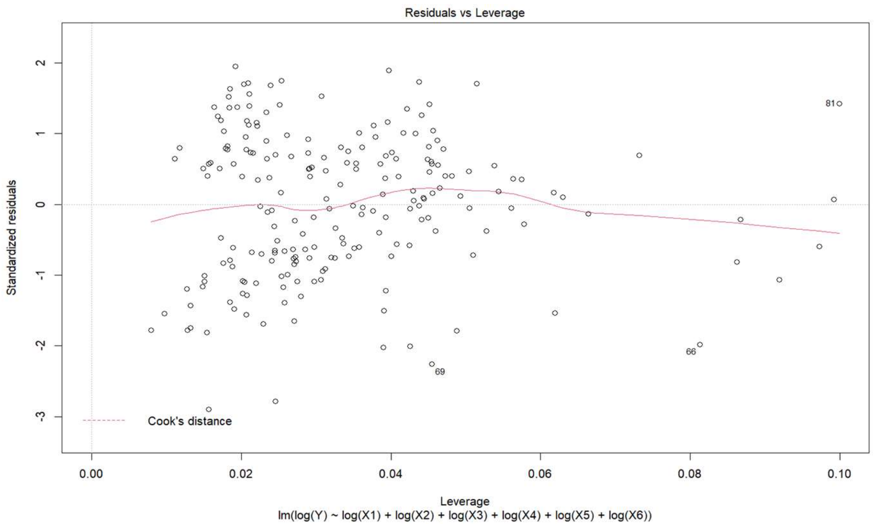


(b). The q-q plot.



(c). The standard residual graph.

Figure 2. (*Continued*).



(d). The residual vs leverage graph.

Figure 2. Least square regression line.

Source: Author's calculation.

Table 2. Result of multiple regression analysis.

Estimate	Regression coefficient	Standard error	*t*-value
Intercept	29.27053	0.52247	56.023
$log(X_1)$	0.59749	0.17319	3.450
$log(X_2)$	–0.04730	0.21640	–0.219
$log(X_3)$	0.70362	0.06852	10.269
$log(X_4)$	–1.28126	0.09730	–13.168
$log(X_5)$	–0.16786	0.06140	–2.734
$log(X_6)$	–0.16288	0.13233	–1.231

Source: Author's calculation.

4.3. Robust regression

The robust regression focuses on dampening the presence of outliers in the model.

We consider the linear model as:

$$Y = \beta_0 + \beta_1 \cdot log(X_1) + \beta_2 \cdot log(X_2) + \beta_3 \cdot log(X_3) + \beta_5 \cdot log(X_5) + \beta_6 \cdot log(X_6) + \varepsilon i$$

where $\varepsilon i = X'_i b$.

Given an estimator b for β, the fitted model is:

$$\hat{y}_i = b_0 + b_1 \cdot log(X_1) + b_2 \cdot log(X_2) + \cdots + b_6 \cdot log(X_6) + ei$$

and the residuals are given by $ei = yi - \hat{y}_i$.

With *M*-estimation, the estimates b is determined by minimizing a particular objective function over all b,

$$\sum_{i=1}^{6} \rho(ei) = \sum_{i=1}^{6} \rho \cdot (yi - Xi \cdot b)$$

$y = (29.46587) + (0.64594) \cdot X_1 + (-0.09589) \cdot X_2 + (0.74487) \cdot X_3 + (-1.34971) \cdot X_4 + (-0.20884) \cdot X_5 + (-0.10618) \cdot X_6$

where the function ρ gives the contribution of each residual to the objective function.

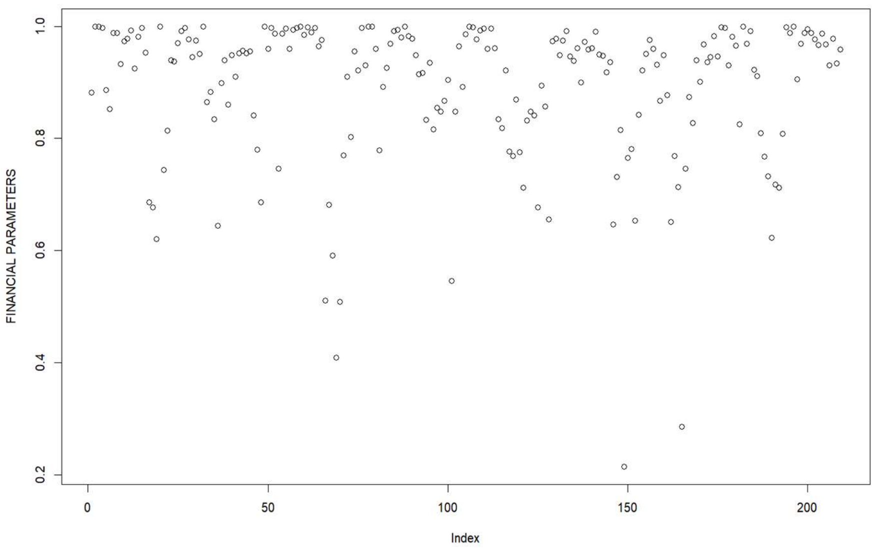


Figure 3. Weights from the robust bisquare estimator for the regression of financial parameters on GDP per capita.
Source: Author's calculation.

Comparing the results of linear regression and robust regression, it is inferred that the algorithm converges after 12 iterations. The weights from the robust bisquare estimator for the regression of financial parameters on GDP per capita is depicted in **Figure 3**. There are twelve observations where outliers are weighted as nearly 1. The remaining 197 ones are summarised as shown in **Table 3**:

Table 3. Result of observations without outliers.

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
0.2140	0.8349	0.9362	0.8848	0.9754	0.9990

Source: Author's calculation.

By down weighting outliers, the results of this regression are markedly different and there is difference in regression with respect to robust regression with significant outliers in data as represented by **Figure 4**.

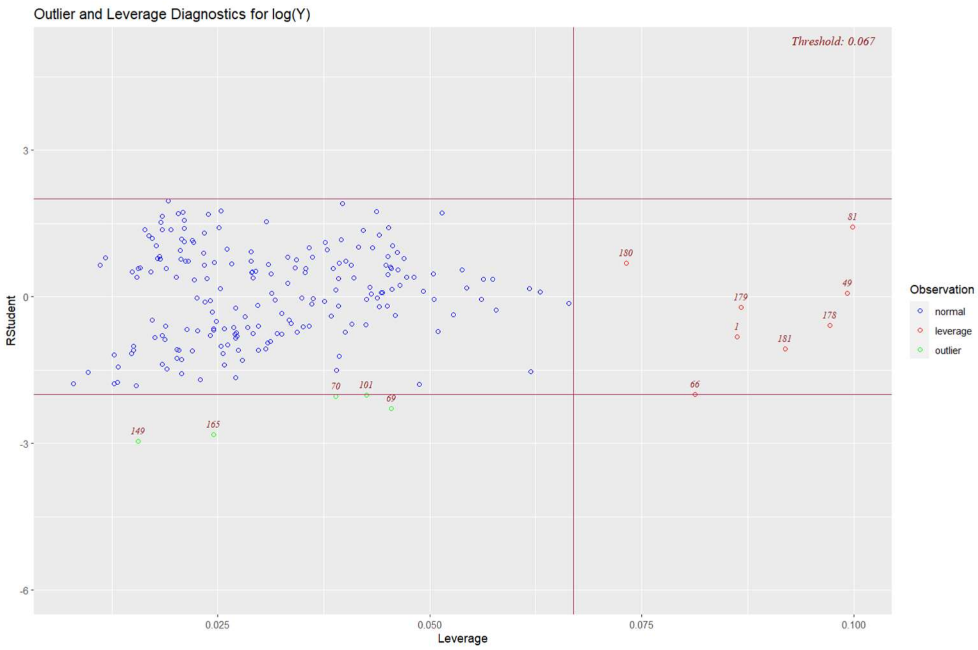


Figure 4. Outliers visualisation using robust regression.

Table 4. Result of robust regression analysis.

-	2.5%	97.5%
(Intercept)	28.2403343	30.30072629
$log(X_1)$	0.2559972	0.93897996
$log(X_2)$	–0.4739918	0.37939904
$log(X_3)$	0.5685093	0.83872611
$log(X_4)$	–1.4731209	–1.08940068
$log(X_5)$	–0.2889244	–0.04678792
$log(X_6)$	–0.4238052	0.09804630

Source: Author's calculation.

The regression analysis mentions the weighing pattern by its robustness. **Table 4** shows the effect of the financial sector on the dependent variable at the confidence interval to satisfy the interchangeable terms for most practical purposes.

4.4. Naive Bayes

A model has been devised to predict a country's GDP per capita based on the given set of attributes using Naive Bayes classifiers. Optimization of the models refers to modifying models so as to achieve the highest accuracy. A-priori probabilities of GDP per capita being considered for escaping the trap are 0.641 and 0.3585 for countries not escaping the trap. The a-priori probability is the estimated probability of a particular class before observing any of the predictors. Each conditional probability table corresponds to a predictor column (see **Tables 5** and **6**).

Table 5. Conditional probabilities based on mean.

-	X_1	X_2	X_3	X_4	X_5	X_6
0	54.21127	62.87169	27.674295	63.98405	53.23791	18.16137
1	139.73530	145.83120	127.96893	221.85572	104.11294	19.37655

Table 6. Conditional probabilities based on standard deviation.

	X_1	X_2	X_3	X_4	X_5	X_6
0	15.87206	22.50038	32.92777	72.22939	37.70713	6.785244
1	82.87647	91.07460	183.93637	335.91484	72.39985	8.209700

Source: Author's calculation.

Conditional probability based on mean is calculated by multiplying the probability of the mean values of preceding event by the probability of the succeeding or conditional event. Similarly, conditional probability based on standard deviation is the probability of the preceding values calculated on the basis of standard deviation.

While interpreting Naive Bayes classification what becomes of utmost importance is to understand the well calibrated matrix that is mentioned in **Table 7** as the confusion matrix to understand the diagonal effect. The effect of the Naïve Bayes plot of the financial inclusion is plotted against the confusion matrix diagonal effect in **Figure 5**.

Table 7. Confusion matrix using Naive Bayes classification.

-	0	1
0	20	10
1	0	35

Accuracy: 0.8462
Kappa: 0.6828
Sensitivity: 1.0000
Specificity: 0.7778
Source: Author's calculation.

The classifier using Naive Bayes gives an accuracy of 84%, the sensitivity being 100% and specificity 77.78%.

Kappa is defined as the difference of total accuracy and random accuracy by the difference of probability of random accuracy. In our analysis, Kappa is 0.6828, defining a substantial degree of agreement between the accuracy level.

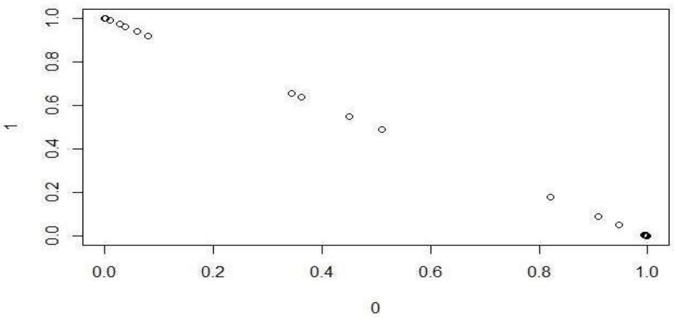


Figure 5. Naive Bayes plot of the financial variables.

Source: Author's calculation.

4.5. Random forest

The problem of collinearity will not affect the accuracy of the random forest model. The random forest method surpasses other methods in its ability to handle model overfitting and accounts for a comparable or larger amount of variance in reading measures relative to other methods[26]. The data has been classified on the basis of random forest technique which includes 70% of the observations as the training data set and 30% of the remaining observations as testing dataset. The splitting of the data is categorised as the training set and the test set. To define the terms, the training set is the subset of the sample to train a model, and the test set is a subset to test the train model.

When we implement multiple decision trees in a random forest, we ignore some of the predictor variables, since if we take all the predictor variables, our random forest model will be similar to the actual model. Hence, for having varieties in the decision tree, with better efficiency and accuracy, we need to have a smaller number of predictor variables of the total number of predictor variables.

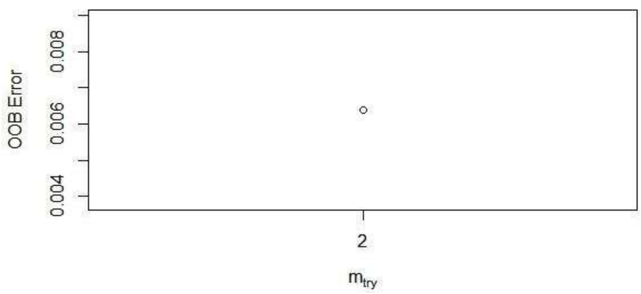


Figure 6. Out of bag score of the random forest on the financial variables.

Source: Author's calculation.

The most optimized value of the number of random variables is two, corresponding to OOB, i.e., the prediction error which is 0.69% showing the difference between the predictor variables and the actual variables. The Out of Bag (OOB) value is calculated as the correctly predicted variables out of the total sample as shown in **Figure 6**. As a result, the total aggregation effect of bagging is reduced. **Table 8** shows the importance of each variable based on author's calculation in explain the estimates to move countries from middle income trap.

Table 8. Variable importance table.

Variable	Node purity
X_1	17.147078
X_2	10.649709
X_3	5.875438
X_4	6.089147
X_5	4.661430
X_6	2.056761

Random Forest Technique: classification
Total number of trees: 500
Variables tried at each split: 2
Out of Bag estimate of error rate: 5.26%
Source: Author's calculation.

We use the random forest as classification here to check whether the countries will escape the trap or not. We have taken 500 numbers of trees at each node in the decision tree; it is split into two daughter nodes. The node purity reflects the accuracy with which the trees divide the data. The OBB estimate of the error rate is 5.26%, which is shown in the confusion matrix showing the difference between the predictor variables and the actual values. The confusion matrix is represented on **Table 9** based on author's calculation.

Table 9. Confusion matrix using random forest.

	0	1
0	20	0
1	0	45

Accuracy: 1
Kappa: 1
Sensitivity: 1.0000
Specificity: 1.0000
Source: Author's calculation.

The accuracy of the model is 100%, showing that the original model is as good as the predictive model. Both sensitivity and specificity are 100%, showing the original model is positively predicted. The Kappa value is also 1, showing the perfect fit of the model.

5. Discussion

A middle-income trap occurs when exponential growth launches an economy into middle-income level, but it stagnates after that[27]. To ascend from medium to high financial status and sustain strong economic growth, an economy must undergo structural changes since it can no longer rely on the fundamentals that propelled it to the middle-income category. A high-income economy is differentiated because of its investment in social as well as physical infrastructure, the development of human capital, and aggressive macroeconomic reforms that boost growth levels. The financial framework, on the other hand, which encourages saving, investment, innovation, and entrepreneurship, is frequently disregarded. Many decades ago, prominent economists such as Schumpeter gave finance and banking the attention it deserved in terms of economic development. However, empirical tests by King and Levin[17] were required to validate his hypothesis. They base their criteria on the function of financial depth in economic growth. These financial criteria might be set by a bank or by the market. Domestic credit to the private sector, wide money, the number of ATMs per 10,000 individuals, and the number of commercial banks per 10,000 adults are all bank-based indicators considered in this study. These indicators will help determine the importance of the banking sector in pushing an economy from middle-income to high-income levels. In order to understand the role of financial markets in the growth story of an economy, indicators chosen for the analysis are market capitalization and value of stock traded as a percentage of GDP[28]. Cumulatively, these indicators will provide an insight on the role of the financial system in the growth of an economy. They will also assist in the analysis of their contribution to the advancement of an economy to greater income levels.

A combination of thirteen economies have been identified for this study, nine of which are attempting to break further into the high-income category and four of which have effectively escaped the trap. Regression analysis and classification analysis are the methodologies applied to accomplish this purpose of the study. The use of regression analysis is objected to demonstrate the income level's dependency on the effectiveness of the financial system and market. Following that, the robust regression demonstrates that, with the exception of a few outliers, substantially every one of the aforementioned economic variables has a significant influence on the regress and GDP. The outlier chart demonstrates that the majority of variables are normal, with just a few being leveraged or outliers. Finally, classification techniques, i.e., Naive Bayes and random forest, yield an accuracy of 84% and 100%, respectively. Hence, 100% of the values are positively predicted using the random forest approach. Random forest is used as it predicts output with higher accuracy than it did in this study. It is based on a number of decision trees on various subsets of the given dataset and takes the average to improve the predictive accuracy of the dataset. Random forest uses the forecasts from each tree to predict the ultimate output based on prior predictions. The bigger the number of trees in a forest, the higher the accuracy and the less likely it is to overfit. Naive Bayes is based on conditional probability and is used to determine the probability of a hypothesis with prior knowledge. Here, the hypothesis signifies whether a country is escaping the middle-income trap or not. The data was based on income levels and corresponding financial indicators. The labelled data was based on binary variables '0' signifying not escaping the trap and '1' signifying escaping the trap. The dataset has been converted with the condition that if the GDP per capita is more than USD 2000, then it is labelled as 1 else 0. Confusion matrix is the matrix formed between the actual values and the predicted values. While it evaluates the performance of the classification models, when they make predictions on the test data and tell how good the classification model is, sensitivity shows how many values are positively predicted.

While Naive Bayes gives an accuracy of 84.62%, the random forest classification technique sidesteps the previous with a better predictive accuracy of 100%. As a result, the study based on random forest predicts that out of all the bank-based variables and market-based variables, the maximum repercussions on income levels were provided by domestic credit provided by the financial sector (node purity = 17.147078), followed by broad money (node purity = 10.649709). Out of the two market-based measures, market capitalization has the maximum impact on GDP levels (node purity = 5.875438). The effect of the financial parameters can be visualised in **Figure 7**, indicating the relative importance of the parameter on the GDP level. This further helps determine the impact of these parameters on launching a country to higher levels of income[29].

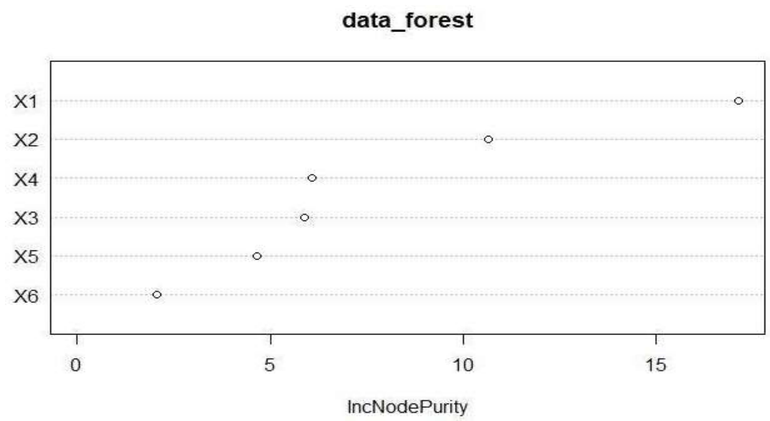


Figure 7. Effect of financial parameters on the decision.

Australia, Japan, the Republic of Korea, Israel, and Singapore are among the countries that have successfully evaded the trap in our sample. Argentina, Brazil, Chile, India, Iran, Malaysia, and Mexico, on either contrary, are all in the middle-income group classified by the World Bank. Latin America and East Asian nations are mostly criticised for being trapped in the middle-income trap since these economies increased rapidly, and their expansion was mostly export-oriented. While countries such as Korea and Taiwan maintained rapid growth and advanced to greater income levels, Malaysia's growth stalled. Taiwan started growing more than Malaysia approximately around 1963, while Korea got stuck in the trap at around 1985. Fifteen years later, in 2000, Korea reached the level of income while it took Malaysia to reach the same level in 30 years by 2014. Despite the fact, Malaysia grew from about $3420 to about $21,600 over 1970–2014, but it could not reach the high-income status. The prominence of innovation as a cause behind MIT is also aligned with the history of a small proportion of East Asian nations that have seamlessly transitioned to high-income economies in the past few decades. South Korea and Taiwan, for example, have evolved from low-wage to high-end manufacturing economies since the mid-1980s, owing to increased innovation capabilities Lee[30]. Nevertheless, it might be ascribed to financial parameters because descriptive data (see appendix) demonstrate significant financial indicators are more prominent in the Korean economy than in Malaysia. As illustrated by the deceleration of development during the Asian economic crisis of 1997–1998, one of the most significant consequences of the crisis was the requirement of a robust financial sector juxtaposed with banking and market sector[31].

Argentina, Brazil, and Chile are similarly entangled in the trap. The inference is backed by the low productivity in Latin American nations which is attributable to a scarcity of native innovation skills. One indicator of these abilities is research and development spending, which is aimed at discovering and implementing new productivity-enhancing methods and products. The question to be asked here is whether Latin American nations will seize these opportunities to adopt an innovation-driven strategy that would help them escape the middle-income trap. This is vital since Chile and Mexico have been stuck in the trap for the past 60 years. After years of exponential expansion, Brazil's per capita income has been stagnant since the 1980 Debt Crisis. This is especially concerning because the middle-income trap is defined as a span of more than 42 years[32]. To compete worldwide, particularly with high-income countries, a technological revolution is required, as is financial sector support for innovation. Because credit market growth affects the ability with which firms innovate, access to finance for firms focused on technological innovation will be high if financial markets develop[33]. As a result, middle-income countries require new sources of productivity through innovation in order to maintain high levels of growth, which requires access to capital.

6. Conclusion

This is a one-of-a-kind study that intends to link financial systems with an economy's problem of being stuck in the middle-income trap and inability to launch into higher income levels, which should have been a natural progression for it. While many research articles have given impetus to human capital and social infrastructure, very few have tried to figure out the importance of financial and monetary systems in growth from middle-income level to higher level. Financial system measures play an important role in escaping the middle-income trap, even though the effect of financial parameters have been tested on growth levels empirically decades ago.

Any economy's growth depends on the development of its financial sector. The world's developed economies have well-established banking systems and financial markets. Economic financial markets should also be a top goal for policymakers. This monetary and financial infrastructure is a base for access to credit, financial inclusion, promotion of savings, availability of funds for investment which will further be used for capital formation, financing new ventures and innovation[34]. Therefore, domestic credit provided by the financial sector and broad money which signifies the amount of money that is circulating in the economy are two of the most important measures that could help an economy reach higher levels of income. Similarly, market capitalization has a significant impact in development of financial markets. Hence, market-based measures are important for robust financial systems that could alleviate standard of living by increasing income levels. Financial markets of an economy should also be a priority for the policy makers. We recommend future research in the area using a bigger sample and taking into account more countries caught in the trap or have not reached that level also. Analysis can also be done using methods like classification regression as well.

Author contributions

Conceptualization, MS; methodology, SB; software, SB; validation, MS, SB and MK; formal analysis, SB; investigation, MS; resources, SB; data curation, SB; writing—original draft preparation, SB; writing—review and editing, SB; visualization, SB; supervision, MS; project administration, MS. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors have no conflicts of interest to declare. All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report.

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Appendix A

Table A1. Descriptive statistics.

Argentina	Variables	Q1	Median	Mean	Q3
	GDP (constant 2015 USD)	5.143e + 11	5.751e + 11	5.494e + 11	5.838e + 11
	Domestic credit provided by the financial sector	26.31	33.81	32.65	38.97
	Broad money	25.65	27.75	27.02	28.31
	Stock traded as a value of GDP	0.4607	0.6647	0.8702	0.9484
	Market capitalization	9.269	11.417	13.386	17.108
	No. of ATM's per ten thousand adults	12.891	38.932	33.550	51.038
	Commercial bank branches per ten thousand adults	13.18	13.23	13.25	13.31
Australia	**Variables**	**Q1**	**Median**	**Mean**	**Q3**
	GDP (constant 2015 USD)	1.149e + 12	1.272e + 12	1.270e + 12	1.396e + 12
	Domestic credit provided by the financial sector	121.7	125.1	128.1	137.3
	Broad money	96.96	103.38	105.17	114.55
	Stock traded as a value of GDP	57.82	72.73	78.83	91.09
	Market capitalization	87.88	106.00	107.70	127.45
	No. of ATM's per ten thousand adults	152.4	159.1	156.5	164.8
	Commercial bank branches per ten thousand adults	28.62	30.27	29.62	31.01
Brazil	**Variables**	**Q1**	**Median**	**Mean**	**Q3**
	GDP (constant 2015 USD)	1.585e + 12	1.758e + 12	1.697e + 12	1.803e + 12
	Domestic credit provided by the financial sector	47.07	59.85	55.40	63.04
	Broad money	73.29	78.84	81.56	93.22
	Stock traded as a value of GDP	28.99	32.57	37.84	41.45
	Market capitalization	42.00	48.81	54.26	65.20
	No. of ATM's per ten thousand adults	107.69	111.97	111.14	115.60
	Commercial bank branches per ten thousand adults	18.69	19.19	19.41	20.36
Chile	**Variables**	**Q1**	**Median**	**Mean**	**Q3**
	GDP (constant 2015 USD)	1.926e + 11	2.297e + 11	2.214e + 11	2.478e + 11
	Domestic credit provided by the financial sector	99.91	105.00	103.62	111.25
	Broad money	74.79	78.09	78.79	82.58
	Stock traded as a value of GDP	13.599	15.889	16.402	18.554
	Market capitalization	82.71	100.81	101.16	113.84
	No. of ATM's per ten thousand adults	49.58	54.05	54.27	58.78
	Commercial bank branches per ten thousand adults	15.24	16.71	15.94	17.18
Hong Kong	**Variables**	**Q1**	**Median**	**Mean**	**Q3**
	GDP (constant 2015 USD)	2.556e + 11	2.896e + 11	2.862e + 11	3.127e + 11
	Domestic credit provided by the financial sector	152.4	205.1	191.9	218.6
	Broad money	309.1	345.1	343.8	377.8
	Stock traded as a value of GDP	450.0	575.3	576.4	662.4
	Market capitalization	973.6	1077.6	1080.3	1203.0
	No. of ATM's per ten thousand adults	43.82	49.51	47.80	50.49
	Commercial bank branches per ten thousand adults	21.39	22.94	22.53	23.45

Table A1. (*Continued*).

	Variables	Q1	Median	Mean	Q3
India	**Variables**	**Q1**	**Median**	**Mean**	**Q3**
	GDP (constant 2015 USD)	1.390e + 12	1.759e + 12	1.843e + 12	2.316e + 12
	Domestic credit provided by the financial sector	48.63	50.25	49.38	51.87
	Broad money	74.15	77.14	76.06	78.05
	Stock traded as a value of GDP	37.94	46.70	54.47	69.09
	Market capitalization	76.09	82.84	88.63	96.69
	No. of ATM's per ten thousand adults	5.037	11.883	12.651	21.007
	Commercial bank branches per ten thousand adults	9.498	11.475	11.742	14.283
Israel	**Variables**	**Q1**	**Median**	**Mean**	**Q3**
	GDP (constant 2015 USD)	2.338e + 11	2.753e + 11	2.771e + 11	3.169e + 11
	Domestic credit provided by the financial sector	65.75	67.19	68.10	68.65
	Broad money	77.45	84.09	83.99	85.30
	Stock traded as a value of GDP	18.39	22.68	28.25	38.93
	Market capitalization	61.93	66.05	75.20	87.13
	No. of ATM's per ten thousand adults	97.80	121.15	109.15	123.05
	Commercial bank branches per ten thousand adults	18.62	19.64	19.54	21.01
Iran	**Variables**	**Q1**	**Median**	**Mean**	**Q3**
	GDP (constant 2015 USD)	3.708e + 11	3.875e + 11	3.881e + 11	4.053e + 11
	Domestic credit provided by the financial sector	47.57	52.61	54.24	62.56
	Broad money	50.25	57.71	64.87	82.28
	Stock traded as a value of GDP	2.506	3.517	19.341	6.277
	Market capitalization	14.95	20.84	66.55	32.41
	No. of ATM's per ten thousand adults	22.181	48.943	49.173	73.883
	Commercial bank branches per ten thousand adults	28.46	29.48	29.67	31.35
Japan	**Variables**	**Q1**	**Median**	**Mean**	**Q3**
	GDP (constant 2015 USD)	4.266e + 12	4.357e + 12	4.356e + 12	4.453e + 12
	Domestic credit provided by the financial sector	306.7	331.8	326.0	346.6
	Broad money	211.3	231.0	227.0	241.0
	Stock traded as a value of GDP	85.87	110.62	103.54	122.47
	Market capitalization	65.47	94.61	91.15	106.40
	No. of ATM's per ten thousand adults	124.9	127.6	126.9	128.0
	Commercial bank branches per ten thousand adults	33.90	33.92	33.98	34.03
Korean Republic	**Variables**	**Q1**	**Median**	**Mean**	**Q3**
	GDP (constant 2015 USD)	1.179e + 12	1.360e + 12	1.356e + 12	1.521e + 12
	Domestic credit provided by the financial sector	129.8	132.3	134.7	138.9
	Broad money	125.0	129.0	131.4	138.0
	Stock traded as a value of GDP	115.89	126.47	140.48	145.43
	Market capitalization	81.15	86.21	87.85	93.05
	No. of ATM's per ten thousand adults	245.8	269.3	262.6	280.9
	Commercial bank branches per ten thousand adults	16.04	17.57	17.09	18.20

Table A1. (*Continued*).

Country	Variables	Q1	Median	Mean	Q3
Malaysia	**Variables**	**Q1**	**Median**	**Mean**	**Q3**
	GDP (constant 2015 USD)	1.179e + 12	1.360e + 12	1.356e + 12	1.521e + 12
	Domestic credit provided by the financial sector	106.97	115.65	114.22	120.60
	Broad money	125.0	129.5	130.3	136.9
	Stock traded as a value of GDP	33.66	41.08	43.58	43.80
	Market capitalization	125.17	139.30	135.36	149.99
	No. of ATM's per ten thousand adults	45.91	51.08	49.02	55.76
	Commercial bank branches per ten thousand adults	10.39	10.95	10.87	11.26
Mexico	**Variables**	**Q1**	**Median**	**Mean**	**Q3**
	GDP (constant 2015 USD)	1.011e + 12	1.096e + 12	1.097e + 12	1.180e + 12
	Domestic credit provided by the financial sector	41.36	47.05	46.95	54.49
	Broad money	29.04	32.15	32.98	37.55
	Stock traded as a value of GDP	7.694	8.631	9.015	10.067
	Market capitalization	37.57	35.85	35.26	38.11
	No. of ATM's per ten thousand adults	42.54	48.73	48.33	54.85
	Commercial bank branches per ten thousand adults	13.46	13.95	13.63	14.17
Singapore	**Variables**	**Q1**	**Median**	**Mean**	**Q3**
	GDP (constant 2015 USD)	2.157e + 11	2.811e + 11	2.730e + 11	3.212e + 11
	Domestic credit provided by the financial sector	96.36	115.52	109.77	122.77
	Broad money	121.0	132.6	123.8	128.5
	Stock traded as a value of GDP	63.84	90.62	95.54	126.29
	Market capitalization	198.7	221.7	222.9	250.5
	No. of ATM's per ten thousand adults	52.32	57.77	56.11	59.14
	Commercial bank branches per ten thousand adults	8.565	9.265	9.264	9.898