STATISTICAL ANALYSIS FOR IMPACTS OF ECONOMICAL CONDITIONS ON HOUSING MARKETS: AN EXAMPLE ON FRAGILE 5 COUNTRIES

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Keywords:	ABSTRACT
Fragile five countries; Housing market; Macroeconomic indicators; Krigingmetamodelling	In the year 2013, Morgan Stanley declared the Brazilian real, the Indian rupee, the Indonesian rupiah, the South African rand and the Turkish lira as the "Fragile Five," or the troubled emerging market currencies under the most pressure against the U.S. dollar. For those countries, housing market has been a key driver of growth and has been a steady and robust performer since the year 2000. The main purpose of this study is to investigate, modeling whether there is a long-run relationship between macroeconomic indicators and housing markets in Fragile Five countries by correlation analysis, regression, krigingmetamodelling for the twelve year period from 2002 to 2013. The findings of this paper would help government and property investors for creating more effective property management strategies in these countries.
JEL Classification: E30, E44, L74, R10, R20, R30	

1. INTRODUCTION

An emerging market is a country that has some characteristics of a developed market but is not yet a developed market. This includes countries that may be developed markets in the future or were in the past. It may be a nation with social or business activity in the process of rapid growth and industrialization. The four largest emerging and developing economies by gross domestic product (GDP) are the BRIC countries (Brazil, Russia, India and China); the next four largest markets are MIKT (Mexico, Indonesia, South Korea and Turkey) and finally there is a new terminology named Fragile 5 (Brazil, India, Indonesia, Turkey and South Africa) in the emerging market.

According to the International Monetary Fund (IMF), there are 25 countries classified as emerging market economies. They exhibit varying levels of economic growth, inflation, trade and fiscal conditions. Ten years ago, Goldman Sachs declared Brazil, Russia, India and China (BRIC) as the emerging markets with the brightest economic growth prospects.

In the year 2013, Morgan Stanley declared the Brazilian real, the Indian rupee, the Indonesian rupiah, the South African rand and the Turkish lira as the "Fragile Five," or the troubled emerging market currencies under the most pressure against the U.S. dollar. According to Morgan Stanley's report these countries have important things in common—high inflation, weakening growth, large external, and high dependence on fixed income inflows leave these currencies vulnerable. The risks associated with these particular five currencies are also evident from the fact that central banks in these countries have been among the most aggressive in their bid to support their currencies.

The main purpose of this study is to investigate, modelling whether there is a long-run relationship between macroeconomic indicators and housing markets in Fragile 5 countries by impulse/ response analysis, variance decomposition, correlation analysis, regression, krigingmetamodelling for the twelve year period from 2002 to 2013.

The following section provides overview of fragile five countries and selected macroeconomic parameters. Section five and six explain the theoretical framework adopted in this study and the results. The final section is the conclusion.

2. LITERATURE REVIEW

Ghysels (2012) studied the evidence of predictability in US residential and commercial real estate markets. First, they highlight the main methodologies used in the construction of real estate indices, their underlying assumptions and their impact on the stochastic properties of the resultant series. Then survey the key empirical findings in the academic literature, including short-run persistence and long-run reversals in the log changes of real estate prices. Next, they summarize the ability of local as well as aggregate variables to forecast real estate returns. They illustrate a number of these results by relying on six aggregate indexes of the prices of unsecuritized (residential and commercial) real estate and REITs. The effect of leverage and monetary policy is also discussed.

Seth (2011) examined residential investments signals an impending decline in economic activity. Sources of demand for both residential and commercial real estate sectors are similar and this should move the markets in the same direction over the long-run. Since the residential market has already collapsed, the study of real estate investments is important. This paper utilizes real estate and macroeconomic data to forecast investment loans. Cointegration methods are used for the forecast because the data displays a tendency to move together. The results show that the forecast is inconsistent with the positive relationship between both real estate markets; the residential market will continue to decline, whereas the commercial market with see a positive growth from 2011-2012.

Guo (2012) analyzed monthly averaged prices of commercial residential building in Changsha City from Jan, 2002 to Dec, 2011, this paper construct a forecasting model to predict short-term housing price trend and affords reference to homebuyer and investors, what's more, affords technical support to government's policy making. Selected rational forecasting model is discussed, and then a price forecasting ARMA model is constructed.

Emara (2014) examined the impact of liberal policies on the economic performance of labor and capital productivity in the Middle East and North African (MENA) countries, by using nonlinear panel least squares regression with regional dummies and period fixed effects (LSDV) for a sample of 18 MENA countries over the period 1995-2009. He estimated the impact of different aspects of economic freedom on labor and capital productivity. Saljoughian et al. (2013) evaluated the performance of OECD countries and identified the most critical science and technology factors in these countries by using the indicators of science and technology progress suggested by World Bank and exploiting Data Envelopment Analysis (DEA). They measured the efficiency of these countries. They ranked the countries and performed the sensitivity analyses of the factors by Norm-2 method in order to identify the most important factors.

Öztürk, Sözdemir and Ülger (2013) examined growth rates (GDP) in developed and developing countries that is implement of inflation targeting strategy show how a change in the period before and after the crisis (2005-2011). They took into account the inflation performance of those countries for the same period. They compared growth and inflation performances of the countries by means of table and graphical form.

3. SELECTED MACROECONOMIC PARAMETERS AND FRAGILE FIVE COUNTRIES

3.1. Selected Macroeconomic Parameters

Our paper comprises dependent and independent variables: while dependent variable of analyze is residential property price index (RPPI); the independent variables are gross domestic product, current account balance, general government gross debt, general government revenue, gross national savings, inflation (average consumer prices), population, total investment, unemployment rate, real interest rate, volume of exports of goods and services, volume of imports of goods and services. The objective of the residential property price index (RPPI) is to provide an accurate measure of the contemporary rate of change in the prices of the properties. There are a lot of individuals or organizations use residential property prices indices directly or indirectly either to influence practical decision making and conduct of economic policy. Analysts, policymakers, investors and financial institutions follow trends in house prices to expand their understanding of real estate and credit market conditions as well as their impact on economic activity, and financial stability and soundness. For instance, mortgage lenders use this information to gauge default risk and central banks often rely on movements' in house price indices to track households borrowing capacity and aggregate consumption.

Gross Domestic Product represents the economic health of a country. It presents a sum of a country's production which consists of all purchases of goods and services produced by a country and services used by individuals, firms, foreigners and the governing bodies. GDP consists of consumer spending, investment expenditure, government spending and net exports hence it portrays an all-inclusive picture of an economy because of which it provides an insight to investors which highlights the trend of the economy by comparing GDP levels as an index. GDP is not only used as an indicator for most governments and economic decision-makers for planning and policy formulation; but also it helps the investors to manage their portfolios by providing them with guidance about the state of the   economy.

On the other hand, it is good measure for an economy and with improvement in research and quality of data, statisticians and governments are trying to find out measures to strengthen GDP and make it a comprehensive indicator of national income. International standards regarding the compilation of balance of payments statistics are described in the fifth edition of the Balance of Payments Manual prepared by the International Monetary Fund (IMF) in order to provide guidance to member countries. In a general sense, the balance of payments is a statistical statement that systematically records all the economic transactions between residents of a country (Central Government, monetary authority, banks, other sector) and nonresidents for a specific time period. The balance of payments statistics are classified under two major groups: "Current Account" and "Capital and Financial Account". In summary, the current account covers all transactions that involve real sources (including volume of exports and imports of goods and services,) and current transfers; the capital and financial accounts show how these transactions are financed (by means of capital transfer or investment in financial instruments). As mentioned in the European Economic series, current account deficits and surpluses are not necessarily macroeconomic imbalances in the sense of developments which are adversely affecting, or have the potential to affect the proper functioning of economies, of the monetary union, or on a wider scale. Deficits and surpluses are a natural consequence of economic interactions between countries. They show to which extent a country relies on borrowing from the rest of the world or how much of its resources it lends abroad. In this way, external borrowing and lending allows countries to trade consumption over time: a country with a current account surplus transfers consumption from today to tomorrow by investing abroad. In turn, a country with a current account deficit can increase its consumption or investment today but must transfer future income abroad to redeem its external debt. Deficits and surpluses can thus simply be the result of an appropriate allocation of savings, taking into account different investment opportunities across countries. Differences in economic prospects lead to differences in saving behavior, with brighter expectations reducing the tendency of economic agents to save and hence contributing to the accumulation of deficits. In particular, countries with a rapidly ageing population may find it opportune to save today (i.e. run surpluses) to smooth consumption over time. On the other hand, current account deficits and surpluses are part of the adjustment process in a monetary union. They absorb asymmetric shocks in the absence of independent monetary policy and nominal exchange rate adjustment. In determining the economic position of a country is through a comparison of general government gross debt, revenue, total expenditure, national savings and total investments to the gross domestic product of the country. For instance, a low government gross debt to GDP percentage is usually an indication of economic health, while a high debt to GDP percentage can indicate financial trouble for a country.

This paper also attempts to analyze the correlation that exists between RPPI and inflation plus real interest rates. Inflation refers the rate at which the general level of prices for goods and services is rising, and, subsequently, purchasing power is falling. On the other hand, the real interest rate is the rate of interest an investor expects to receive after allowing for inflation. It can be described more formally by the Fisher equation, which states that the real interest rate is approximately the nominal interest rate minus the inflation rate.

3.2. Brief Information For Fragile Five Countries

As mentioned, Morgan Stanley declared Brazil, India, Indonesia, South Africa and Turkey as the "Fragile Five" countries in the year 2013 due to their vulnerable economies. The first country among them is Brazil. Brazil is recovering gradually from the growth slowdown that started in mid-2011, but the recovery remains uneven and inflation elevated.

Output is estimated at potential with supply-side constraints, linked to tight labor market conditions and protracted weak investment since 2011, limiting near term growth. Excessive fine tuning of fiscal policy (including through public banks) has weakened the credibility of Brazil's long-standing fiscal framework, while broader policy uncertainty has weighed on investment. On the other hand, global financial conditions and commodity prices may directly affect Brazilian GDP growth rate for the following years (IMF Brazil Country Report 2013).

The tightening of global liquidity has increased external pressures and heightened the focus on India's macroeconomic imbalances (high inflation, large current account and fiscal deficits) and structural weaknesses (particularly supply bottlenecks in infrastructure, power and mining). Growth is expected to slow to 5.4% in the year 2014, reflecting global developments and domestic supply constraints. The current account deficit is narrowing, driven by a significant improvement in exports, robust remittances flows, and a rapid diminution of gold imports. High and persistent inflation is a key macroeconomic challenge facing India. If external pressures from global financial market volatility resume, Indian rupee flexibility should be the first line of defense, complimented by use of reserves, increases in short-term interest rates, actions on the fiscal front, and further easing of constraints on capital inflows (IMF, India Country Report 2013).

A slowdown in growth in major emerging market economies (EMEs) and decline in commodity prices, and more recently, a reversal in push factors tied to a prospective exit from extraordinarily easy global monetary conditions, has put pressure on Indonesia's balance of payments and heightened its vulnerability to shocks. Domestic policy accommodation and rising energy subsidies have also given rise to increased external and fiscal imbalances. Recent policy tightening, fuel price hikes, and exchange rate flexibility have been firmly aimed at reducing these pressures. Growth is projected to slow to 5.36% in 2014. Inflation will likely peak at just below 10% at end 2014, due mainly to the one-off effect of June 2013 fuel price increases and rupiah depreciation. The current account deficit is expected to exceed 3 percent of GDP in 2014 on weak commodity exports. Reserves have also come under pressure, partly due to Bank Indonesia's heavy intervention in the foreign exchange market in mid-2013. Recent market volatility and reserve losses highlight the need to deal decisively with macroeconomic imbalances and contain financial stability risks (IMF Indonesia Country Report 2013).

South Africa has made impressive strides in economic development over the past two decades. But in recent years, lower growth has exacerbated high unemployment, inequality, and vulnerabilities. Although weak trading partner growth contributed, domestic factors were an important reason why South Africa's growth has been below that of other emerging markets.

Large current account and fiscal deficits, so far easily financed by global liquidity, have raised vulnerabilities (IMF, South Africa Country Report 2013).

Finally, Turkey has a stronger domestic demand, with the current account deficit is widening again from a high level, and inflation remains well above target (7.6%). Increasing national savings and improving competitiveness are central to addressing vulnerabilities. On the other hand, economic growth lost momentum in the course of 2013, as capital market tensions pushed interest rates up. Credit and private demand decelerated. Export growth fell, notably due to rapidly declining gold sales. Political tensions have dented confidence, provoking capital outflows and forcing the central bank to raise interest rates sharply in early 2014. Growth is projected to remain subdued through mid-2015, while the current account deficit will remain very high. Sustaining domestic and international confidence is crucial. Monetary, fiscal and financial policies should remain prudent. Improving fiscal transparency with timely general government accounts and comprehensive reporting on the activities of quasi-fiscal institutions is recommended. Disinflation is essential to preserve the bulk of recent competitiveness gains and to allow Turkey to benefit more from the projected recovery in global trade. Increasing the share of foreign direct investment inflows by improving business conditions in the formal sector would help reduce external vulnerability (OECD Economic Outlook 2014).

4. METHODOLOGY

4.1. CorrelationAnalysis

Correlation is a term that refers to the strength of a relationship between two variables. A strong, or high, correlation means that two or more variables have a strong relationship with each other while a weak, or low, correlation means that the variables are hardly related. Correlation coefficients can range from -1.00 to +1.00. The value of -1.00 represents a perfect negative correlation while a value of +1.00 represents a perfect positive correlation. A value of 0.00 means that there is no relationship between the variables being tested.

The most widely used type of correlation coefficient is the Pearson r, which is also referred to as linear or product-moment correlation. This analysis assumes that the two variables being analyzed are measured on at least interval scales. The coefficient is calculated by taking the covariance of the two variables and dividing it by the product of their standard deviations (StatSoft: Electronic Statistics Textbook 2011).

4.2. Regression analysis

Regression analysis is a conceptually simple method for investigating functional relationships among variables. A real estate appraiser may wish to relate the sale price of a home from selected physical characteristics of the building and taxes (local, school, county) paid on the building. To examine whether cigarette consumption is related to various socioeconomic and demographic variables such as age, education, income, and price of cigarettes.

The relationship is expressed in the form of an equation or a model connecting the response or dependent variable and one or more explanatory or predictor variables.

In the cigarette consumption example, the response variable is cigarette consumption (measured by the number of packs of cigarette sold in a given state on a per capita basis during a given year) and the explanatory or predictor variables are the various socioeconomic and demographic variables. In the real estate appraisal example, the response variable is the price of a home and the explanatory or predictor variables are the characteristics of the building and taxes paid on the building (Chatterjee et al. 2006).

4.3. KrigingMetamodelling

Krigingmetamodelling technique that can be mathematically expressed as below:

$$\hat{y} = \hat{\mu} + r'R^{-1}(Y - 1\hat{\mu}) \tag{1}$$

In this equation, $\hat{y}$ is the predicted response value of unknown x (infill sampling point) and $\hat{\mu}$ is the mean of stochastic process. Y is the response value of a design point .The correlation matrix **R** gives the correlation between all of design points. The correlation vector **r** gives the correlation between infill sampling point and design points.

$$R = \exp\left[-\sum_{h=1}^{k}\theta_h \left|x_h^{(i)} - x^{(j)}\right|^{p_h}\right], \quad \theta_h \geq 0, \quad p_h \in [1,2]$$

$$(2)\ r_i = \exp\left[-\sum_{h=1}^{k}\theta_h \left|x_h - x_h^{(i)}\right|^2\right], \quad \theta_h \geq 0 \tag{3}$$

Maximum Likelihood Estimation is used for predicting θ parameters. Assuming Y has a normal distribution, likelihood function (L) can be written as follows

$$L = \frac{1}{(2\pi)^{\frac{n}{2}}(\sigma^2)^{\frac{n}{2}}|R|^{\frac{1}{2}}} \exp\left[\frac{(y-1\beta)'R^{-1}(y-1\beta)}{2\sigma^2}\right]$$

$$(4)$$

After obtaining θ parameters which maximize likelihood function, kriging model must be validated. For this purpose well known Cross-validation method is used for validation. In this method, a prediction is generated with one data point excluded from the data set. Then check whether that data point falls within a certain confidence interval for the prediction. If the test fails, appropriate transformations such as log or inverse may be applied to the response values (Jones, et. al, 1998; Schonlau 1997).

5. RESULTS

In this section, detailed result tables by countries are shown.

5.1. Results for Brazil

Table 1:Descriptive statistics for indicators of Brazil

Indicators	Mean
GDP Growth Rate (%)	3.44624
Total investment (% of GDP)	17.88992
Gross national savings (% of GDP)	17.08867
Inflation (%)	6.5255
Volume of imports of goods and services (% of GDP)	8.29467
Volume of exports of goods and services(% of GDP)	5.30075
Unemployment rate (%)	8.67767
Population (Mio)	188.07100
General government revenue (% of GDP)	35.50233
General government gross debt (% of GDP)	68.37592
Current account balance (% of GDP)	-.80108
Real interest rate (%)	36.97592
Residential Property Price Index (RPPI)	251.59578

There are descriptive statistics of Indicators for Brazil on Table 1. Real Interest Rate Average seems so high for time interval from 2002 to 2013. For the same time interval, average GDP growth rate seems not high. Another important average values from the table for General government gross debt. It is 0.68 of GDP for the same time interval.

Referring to Table 2, there are statistically significant, strong relationship between real interest rate, current account balance, general government revenue, population and unemployment rate with RPPI. There are negative relationship between current account balance, unemployment rate, and real interest rate with RPPI. When current account balance, unemployment rate, real interest rate increase, RPPI decreases. There are positive relationship between populations, general government revenue with RPPI. When population and general government revenue increase, RPPI increases.

Table 2: Correlation matrix for indicators of Brazil

	GDP Growth Rate (%)	Total investment (% of GDP)	Gross national savings(% of GDP)	Inflation (%; Y-o-Y)	Volume of imports of goods and services (% of GDP)	Volume of exports of goods and services (% of GDP)	Unemp. rate (%)	Populat.	General government revenue (% of GDP)	General government gross debt (% of GDP)	Current account balance (% of GDP)	Real interest rate (%)	Residential Property Price Index (RPPI)
GDP (%)	1	.463	.685(*)	-.373	.921(**)	.412	.052	-.056	.078	-.328	.182	-.041	-.181
Total investment(% of GDP)	.463	1	.371	-.485	.560	-.397	-.678(*)	.664(*)	.715(**)	-.775(**)	-.579(*)	-.610(*)	.531
Gross national savings(% of GDP)	.685(*)	.371	1	-.271	.674(*)	.204	.201	-.143	-.250	-.482	.543	.265	-.390
Inflation(%; Y-o-Y)	-.373	-.485	-.271	1	-.390	.517	.516	-.529	-.401	.665(*)	.201	.462	-.332
Volume of imports of goods and services(% of GDP)	.921(**)	.560	.674(*)	-.390	1	.324	-.190	.219	.251	-.558	.085	-.265	.079
Volume of exports of goods and services(% of GDP)	.412	-.397	.204	.517	.324	1	.589(*)	-.597(*)	-.495	.497	.538	.455	-.464
Unemployment rate (%)	.052	-.678(*)	.201	.516	-.190	.589(*)	1	-.980(**)	-.908(**)	.706(*)	.789(**)	.896(**)	-.954(**)
Population	-.056	.664(*)	-.143	-.529	.219	-.597(*)	-.980(**)	1	.851(**)	-.772(**)	-.726(**)	-.923(**)	.944(**)
General government revenue(% of GDP)	.078	.715(**)	-.250	-.401	.251	-.495	-.908(**)	.851(**)	1	-.561	-.866(**)	-.829(**)	.859(**)
General government gross debt(% of GDP)	-.328	-.775(**)	-.482	.665(*)	-.558	.497	.706(*)	-.772(**)	-.561	1	.278	.641(*)	-.537
Current account balance(% of GDP)	.182	-.579(*)	.543	.201	.085	.538	.789(**)	-.726(**)	-.866(**)	.278	1	.784(**)	-.822(**)
Real interest rate (%)	-.041	-.610(*)	.265	.462	-.265	.455	.896(**)	-.923(**)	-.829(**)	.641(*)	.784(**)	1	-.912(**)
Residential Property Price Index (RPPI)	-.181	.531	-.390	-.332	.079	-.464	-.954(**)	.944(**)	.859(**)	-.537	-.822(**)	-.912(**)	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed)

Table 3: Regression model summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.992(b)	.985	.982	.07733

a Predictors: (Constant), Population

b Predictors: (Constant), Population, Current account balance

c Dependent Variable: lnRPPI

Table 4: ANOVA Table for Regression Model

	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.518	2	1.759	294.192	.000(b)
Residual	.054	9	.006		
Total	3.572	11			

a Predictors: (Constant), Population

b Predictors: (Constant), Population, Current account balance

c Dependent Variable: lnRPPI

Table 5: Coefficients for Regression Model

	b_i	Std. Error	t	Sig.
(Constant)	-7.456	.877	-8.497	.000
Population	.068	.005	14.404	.000
Current account balance	-.056	.019	-2.975	.016

a Dependent Variable: lnRPPI

According to the Table 3, 4 and 5, there is a statistically significant stepwise regression model with 0.982 R^2_{adj}. Population and current account balance variables explain lnRPPI well.

The model can be written as follows;

lnRPPI = -7.456+0.068*Population-0.056*CurrentAccountBalance

When current account balance increases, RPPI decreases and when population increases, RPPI increases. Population variable explains RPPI variable better than current account balance variable.

When current account balance increases one percent of GDP, RPPI decreases nearly 5.5%. When population increases one million, RPPI increases nearly 7%.

For researching effects of all economic indicators, kriging model was created. When GDP, total investment, gross national savings, volume of imports of goods and services, population, general government revenue increase and inflation, current account balance, unemployment rate, Volume of exports of goods and services, General government gross debt decrease 5%; RPPI is estimated as 486.5896. RPPI decreases nearly 2.86%.

5.2. Results for Indonesia

There are descriptive statistics of Indicators for Indonesia on Table 6. General government gross debt seems so high for time interval from 2002 to 2013.

Table 6: Descriptive Statistics for Indicators of Indonesia

Indicators	Mean
GDP Growth Rate (%)	5.60385168755854
Total investment (% of GDP)	28.23858
Gross national savings (% of GDP)	29.16525
Inflation (%)	7.5452
Volume of imports of goods and services (% of GDP)	8.37933
Volume of exports of goods and services(% of GDP)	1.88142
Unemployment rate (%)	8.4500
Population (Mio)	229.6501
General government revenue (% of GDP)	18.58817
General government gross debt (% of GDP)	38.91750
Current account balance (% of GDP)	0.92650
Real interest rate (%)	4.72330613293245
Residential Property Price Index (RPPI)	128.50

Referring to Table 10, there are statistically significant, relationship between, Total Investment, Unemployment rate, population, general government gross debt, current account balance with RPPI. While there are negative relationship between current account balance, unemployment rate, general government gross debt with RPPI, there are positive relationship between, total investments, population with RPPI.

Table 7: Regression Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.984(a)	.969	.965	.02535

a Predictors: (Constant), Population
b Dependent Variable: lnRPPI

Table 8: ANOVA Table for Regression Model

	Sum of Squares	df	Mean Square	F	Sig.
Regression	.198	1	.198	307.745	.000(a)
Residual	.006	10	.001		
Total	.204	11			

a Predictors: (Constant), Population
b Dependent Variable: lnRPPI

Table 9: Coefficients for Regression Model

	b_i	Std. Error	t	Sig.
(Constant)	2.221	.150	14.812	.000
Population	.011	.001	17.543	.000

a Dependent Variable: LnRPP

Table 10:Correlation Matrix for Indicators of Indonesia

	GDP Growth Rate (%)	Total investment(% of GDP)	Gross national savings (% of GDP)	Inflation (%; Y-o-Y)	Volume of imports of goods and services (% of GDP)	Volume of exports of goods and services (% of GDP)	Unemploym. rate (%)	Populat.	General government revenue (% of GDP)	General government gross debt (% of GDP)	Current account balance (% of GDP)	Real interest rate (%)	Residential Property Price Index (RPPI)
GDP (%)	1	0.539	0.319	-0.293	0.567	0.157	-0.432	.657(*)	0.186	-.729(**)	-.645(*)	-0.537	.607(*)
Total investment (% of GDP)	0.539	1	.892(**)	-.688(*)	0.098	0.343	-.875(**)	.950(**)	-0.469	-.868(**)	-.790(**)	-0.032	.895(**)
Gross national savings (% of GDP)	0.319	.892(**)	1	-.683(*)	-0.053	0.399	-.794(**)	.763(**)	-.638(*)	-.739(**)	-0.427	0.122	.657(*)
Inflation (%; Y-o-Y)	-0.293	-.688(*)	-.683(*)	1	-0.103	0.062	.673(*)	-.583(*)	.601(*)	0.502	0.45	-0.229	-0.503
Volume of imports of goods and services (% of GDP)	0.567	0.098	-0.053	-0.103	1	0.17	-0.005	0.089	0.241	-0.136	-0.268	-0.464	0.01
Volume of exports of goods and services (% of GDP)	0.157	0.343	0.399	0.062	0.17	1	-0.057	0.295	-0.357	-0.387	-0.145	-0.234	0.237
Unemployment rate (%)	-0.432	-.875(**)	-.794(**)	.673(*)	-0.005	-0.057	1	-.855(**)	0.537	.697(*)	.672(*)	-0.224	-.809(**)
Population	.657(*)	.950(**)	.763(**)	-.583(*)	0.089	0.295	-.855(**)	1	-0.325	-.937(**)	-.864(**)	-0.179	.974(**)
General government revenue (% of GDP)	0.186	-0.469	-.638(*)	.601(*)	0.241	-0.357	0.537	-0.325	1	0.192	0.072	-.664(*)	-0.267
General government gross debt (% of GDP)	-.729(**)	-.868(**)	-.739(**)	0.502	-0.136	-0.387	.697(*)	-.937(**)	0.192	1	.734(**)	0.421	-.871(**)
Current account balance (% of GDP)	-.645(*)	-.790(**)	-0.427	0.45	-0.268	-0.145	.672(*)	-.864(**)	0.072	.734(**)	1	0.231	-.899(**)
Real interest rate (%)	-0.537	-0.032	0.122	-0.229	-0.464	-0.234	-0.224	-0.179	-.664(*)	0.421	0.231	1	-0.143
Residential Property Price Index (RPPI)	.607(*)	.895(**)	.657(*)	-0.503	0.01	0.237	-.809(**)	.974(**)	-0.267	-.871(**)	-.899(**)	-0.143	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-taile

According to the Table 7, 8 and 9, there is a statistically significant stepwise regression model with 0.965 R^2_{adj}. Population explains lnRPPI well.

The model can be written as follows;

lnRPPI = 2.221+0.011*Population

When population increases, RPPI increases. When population increases one million, RPPI increases nearly 1%.

For researching effects of all economic indicators, kriging model was created. When GDP, total investment, gross national savings, volume of imports of goods and services, population, General government revenue increase and inflation, current account balance, unemployment rate, Volume of exports of goods and services, General government gross debt decrease 5%; RPPI is estimated as 164.4999. RPPI decreases nearly 0.09%.

5.3. Results for South Africa

Table 11: Descriptive Statistics for Indicators of South Africa

Indicators	Mean
GDP Growth Rate (%)	1.984981796
Total investment (% of GDP)	19.05316667
Gross national savings (% of GDP)	15.26108333
Inflation (%)	5.907
Volume of imports of goods and services (% of GDP)	6.905666667
Volume of exports of goods and services(% of GDP)	2.426333333
Unemployment rate (%)	24.93475
Population (Mio)	49.2605
General government revenue (% of GDP)	27.5035
General government gross debt (% of GDP)	35.209
Current account balance (% of GDP)	-9.02041667
Real interest rate (%)	4.440973394
Residential Property Price Index (RPPI)	308.4777778

There are descriptive statistics of Indicators for South Africa on Table 11. General government gross debt seems so high for time interval from 2002 to 2013. For the same time interval, average GDP growth rate seems not high.

Referring to Table 12, there are statistically significant, relationship between, total Investment, population, general government revenue, unemployment rate and real interest   rate   with   RPPI.

Table 12. Correlation Matrix for Indicators of South Africa

	GDP Growth Rate (%)	Total investment (% of GDP)	Gross national savings (% of GDP)	Inflation (%; Y-o-Y)	Volume of imports of goods and services (% of GDP)	Volume of exports of goods and services (% of GDP)	Unemploy. rate (%)	Populat.	General government revenue (% of GDP)	General government gross debt (% of GDP)	Current account balance (% of GDP)	Real interest rate (%)	Residential Property Price Index (RPPI)
GDP (%)	1	0.073	-0.169	-0.271	.878(**)	.849(**)	-0.056	-0.366	0.015	-0.292	-0.35	0.256	-0.24
Total investment (% of GDP)	0.073	1	-0.3	0.37	-0.172	0.015	-.939(**)	0.525	.914(**)	-0.474	-0.467	-0.125	.715(**)
Gross national savings (% of GDP)	-0.169	-0.3	1	0.164	-0.081	-0.042	0.348	-0.212	-0.411	-0.105	0.344	-0.059	-0.244
Inflation (%; Y-o-Y)	-0.271	0.37	0.164	1	-0.516	-0.306	-0.158	0	0.31	-0.332	-0.158	0.262	0.052
Volume of imports of goods and services (% of GDP)	.878(**)	-0.172	-0.081	-0.516	1	.892(**)	0.182	-0.244	-0.169	0.094	-0.058	0.107	-0.226
Volume of exports of goods and services (% of GDP)	.849(**)	0.015	-0.042	-0.306	.892(**)	1	0.028	-0.024	0.051	0.083	-0.164	-0.022	0.02
Unemployment rate (%)	-0.056	-.939(**)	0.348	-0.158	0.182	0.028	1	-0.538	-.902(**)	0.485	0.406	0.314	-.742(**)
Population	-0.366	0.525	-0.212	0	-0.244	-0.024	-0.538	1	.687(*)	0.406	-0.02	-.634(*)	.957(**)
General government revenue (% of GDP)	0.015	.914(**)	-0.411	0.31	-0.169	0.051	-.902(**)	.687(*)	1	-0.27	-0.475	-0.349	.842(**)
General government gross debt (% of GDP)	-0.292	-0.474	-0.105	-0.332	0.094	0.083	0.485	0.406	-0.27	1	0.421	-0.309	0.14
Current account balance (% of GDP)	-0.35	-0.467	0.344	-0.158	-0.058	-0.164	0.406	-0.02	-0.475	0.421	1	-0.034	-0.186
Real interest rate (%)	0.256	-0.125	-0.059	0.262	0.107	-0.022	0.314	-.634(*)	-0.349	-0.309	-0.034	1	-.611(*)
Residential Property Price Index (RPPI)	-0.24	.715(**)	-0.244	0.052	-0.226	0.02	-.742(**)	.957(**)	.842(**)	0.14	-0.186	-.611(*)	1

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed

Table 13: Regression Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.991(a)	.981	.977	.05795

a Predictors: (Constant), Population, Unemployment rate
b Dependent Variable: lnRPPI

Table 14: ANOVA Table for Regression Model

	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.575	2	.787	234.444	.000(a)
Residual	.030	9	.003		
Total	1.605	11			

a Predictors: (Constant), Population, Unemployment rate
b Dependent Variable: lnRPPI

Table 15: Coefficients for Regression Model

	b_i	Std. Error	t	Sig.
(Constant)	2.873	.643	4.470	.002
Population	.108	.009	12.502	.000
Unemployment rate	-.100	.012	-8.183	.000

a Dependent Variable: lnRPPI

According to the Table 13, 14 and 15, there is a statistically significant stepwise regression model with 0.977 R^2_{adj}. Population and unemployment rate variables explain lnRPPI well.

The model can be written as follows;

lnRPPI = 2.873+0.108*Population-0.1*Unemployment rate

When unemployment rate increases, RPPI decreases and when population increases, RPPI increases. Population variable explains RPPI variable better than unemployment rate variable.

When unemployment rate increases one percent, RPPI decreases nearly 10.5%. When population increases one unit, RPPI increases nearly 11.4%.

For researching effects of all economic indicators, kriging model was created. When GDP, total investment, gross national savings, volume of imports of goods and services, population, general government revenue increase and inflation, current account balance, unemployment rate, Volume of exports of goods and services, General government gross debt decrease 5%; RPPI is estimated as 399.0367. RPPI decreases nearly 7.09%.

Table 16:CorrelationMatrixforIndicators of Turkey

	GDP Growth Rate (%)	Total investment (% of GDP)	Gross national savings (% of GDP)	Inflation (%; Y-o-Y)	Volume of imports of goods and services (% of GDP)	Volume of exports of goods and services (% of GDP)	Unemploy. rate (%)	Populat.	General government revenue (% of GDP)	General government gross debt (% of GDP)	Current account balance (% of GDP)	Real interest rate (%)	Residential Property Price Index (RPPI)
GDP (%)	1	0.463	0.273	0.087	.882(**)	.638(*)	-0.53	-0.25	-0.055	0.234	-0.023	-0.014	-0.221
Total investment (% of GDP)	0.463	1	0.091	-0.392	0.181	0.181	-.667(*)	0.383	0.487	-0.553	-0.157	-0.293	0.538
Gross national savings (% of GDP)	0.273	0.091	1	.609	0.377	0.464	-0.349	-.771(**)	-.742(**)	.604(*)	-0.013	0.335	-.583
Inflation (%; Y-o-Y)	0.087	-0.392	.609	1	0.374	0.206	-0.123	-.625	-.722	.810	0.075	0.003	.725
Volume of imports of goods and services (% of GDP)	.882(**)	0.181	0.377	0.374	1	.729(**)	-0.486	-0.454	-0.322	0.498	-0.226	0.152	-0.403
Volume of exports of goods and services (% of GDP)	.638(*)	0.181	0.464	0.206	.729(**)	1	-.590(*)	-0.494	-0.353	0.392	-0.241	0.423	-0.347
Unemployment rate (%)	-0.53	-.667(*)	-0.349	-0.123	-0.486	-.590(*)	1	-0.054	-0.177	0.044	0.178	0.107	-0.211
Population	-0.25	0.383	-.771(**)	-.625	-0.454	-0.494	-0.054	1	.923(**)	-.879(**)	0.089	-.647	.899(**)
General government revenue (% of GDP)	-0.055	0.487	-.742(**)	-.722	-0.322	-0.353	-0.177	.923(**)	1	-.825(**)	0.107	-0.511	.892(**)
General government gross debt (% of GDP)	0.234	-0.553	.604(*)	.810	0.498	0.392	0.044	-.879(**)	-.825(**)	1	0.136	0.463	-.926(**)
Current account balance (% of GDP)	-0.023	-0.157	-0.013	0.075	-0.226	-0.241	0.178	0.089	0.107	0.136	1	-0.264	-0.148
Real interest rate (%)	-0.014	-0.293	0.335	0.003	0.152	0.423	0.107	-.647	-0.511	0.463	-0.264	1	-0.459
Residential Property Price Index (RPPI)	-0.221	0.538	-.583(*)	-.725(**)	-0.403	-0.347	-0.211	.899(**)	.892(**)	-.926(**)	-0.148	-0.459	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed)

5.3. Results for Turkey

Table 17: Descriptive Statistics for Indicators of Turkey

Indicators	Mean
GDP Growth Rate (%)	3.69883316785921
Total investment (% of GDP)	19.92975
Gross national savings (% of GDP)	14.92167
Inflation (%)	12.81000
Volume of imports of goods and services (% of GDP)	9.53417
Volume of exports of goods and services(% of GDP)	8.45783
Unemployment rate (%)	10.64283
Population (Mio)	70.85392
General government revenue (% of GDP)	32.54708
General government gross debt (% of GDP)	48.33
Current account balance (% of GDP)	-11.26067
Real interest rate (%)	9.05431904210532
Residential Property Price Index (RPPI)	90.97893611111110

There are descriptive statistics of Indicators for Turkey on Table 17. General government revenue seems high for time interval from 2002 to 2013.

Referring to Table 16, there are statistically significant, relationship between population, general government revenue, and general government gross debt with RPPI. While there is negative relationship between general government gross debt with RPPI, there are positive relationship between population, general government revenue with RPPI.

Table 18: Regression Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.971(a)	.942	.930	.05502

a Predictors: (Constant), General government gross debt, General government revenue
b Dependent Variable: lnRPPI

Table 19: ANOVA Table for Regression Model

	Sum of Squares	df	Mean Square	F	Sig.
Regression	.446	2	.223	73.621	.000(a)
Residual	.027	9	.003		
Total	.473	11			

a Predictors: (Constant), General government gross debt, General government revenue

b Dependent Variable: lnRPPI

Table 20: Coefficients for Regression Model

		b_i	Std. Error	t	Sig.
(Constant)		3.891	.593	6.561	.000
General government gross debt		-.011	.002	-4.825	.001
General government revenue		.035	.015	2.304	.047

a Dependent Variable: lnRPPI

According to the Table 18, 19 and 20, there is a statistically significant stepwise regression model with 0.93 R^2_{adj}. General government gross debt and General government revenue variables explain lnRPPI well.

The model can be written as follows;

lnRPPI = 3.891-0.011* General government gross debt +0.035* General government revenue

When General government gross debt increases, RPPI decreases and when General government revenue increases, RPPI increases. General government revenue variable explains RPPI variable better than General government gross debt. When General government gross debt increases one percent of GDP, RPPI decreases nearly 1%. When General government revenue increases one unit, RPPI increases nearly 3.6%.

For researching effects of all economic indicators, kriging model was created. When GDP, total investment, gross national savings, volume of imports of goods and services, population, general government revenue increase and inflation, current account balance, unemployment rate, volume of exports of goods and services, general government gross debt decrease 5%; RPPI is estimated as 117.5026. RPPI decreases nearly 6.34%.

6. CONCLUSION

For Brazil, there are statistically significant, strong relationship between real interest rate, current account balance, general government revenue, population and unemployment rate with RPPI. There are negative relationship between current account balance, unemployment rate, and real interest rate with RPPI. When current account balance, unemployment rate, real interest rate increase, RPPI decreases. There are positive relationship between populations, general government revenue with RPPI. Population variable explains RPPI variable better than current account balance variable.When current account balance increases one percent of GDP, RPPI decreases nearly 5.5%. When population increases one million, RPPI increases nearly 7%. For researching effects of all economic indicators, kriging model was created.

When GDP, total investment, gross national savings, volume of imports of goods and services, population, general government revenue increase and inflation, current account balance, unemployment rate, Volume of exports of goods and services, General government gross debt decrease 5%; RPPI is estimated as 486.5896. RPPI decreases nearly 2.86%.

For Indonesia; there are statistically significant, relationship between, Total Investment, Unemployment rate, population, general government gross debt, current account balance with RPPI. While there are negative relationship between current account balance, unemployment rate, general government gross debt with RPPI, there are positive relationship between, total investments, population with RPPI. When population increases, RPPI increases. When population increases one million, RPPI increases nearly 1%. For researching effects of all economic indicators, kriging model was created. When GDP, total investment, gross national savings, volume of imports of goods and services, population, General government revenue increase and inflation, current account balance, unemployment rate, Volume of exports of goods and services, General government gross debt decrease 5%; RPPI is estimated as 164.4999. RPPI decreases nearly 0.09%.

For South Africa; there are statistically significant, relationship between, Total Investment, population, general government revenue with RPPI. While there are negative relationship between unemployment rate and real interest rate with RPPI.When unemployment rate increases, RPPI decreases and when population increases, RPPI increases. Population variable explains RPPI variable better than unemployment rate variable. When unemployment rate increases one percent, RPPI decreases nearly 10.5%. When population increases one unit, RPPI increases nearly 11.4%. For researching effects of all economic indicators, kriging model was created. When GDP, total investment, gross national savings, volume of imports of goods and services, population, general government revenue increase and inflation, current account balance, unemployment rate, Volume of exports of goods and services, General government gross debt decrease 5%; RPPI is estimated as 399.0367. RPPI decreases nearly 7.09%.

For Turkey; there are statistically significant, relationship between population, general government revenue, and general government gross debt with RPPI. While there is negative relationship between general government gross debt with RPPI, there are positive relationship between population, general government revenue with RPPI.When General government gross debt increases, RPPI decreases and when General government revenue increases, RPPI increases. General government revenue variable explains RPPI variable better than General government gross debt. When General government gross debt increases one percent of GDP, RPPI decreases nearly 1%. When General government revenue increases one unit, RPPI increases nearly 3.6%. For researching effects of all economic indicators, kriging model was created. When GDP, total investment, gross national savings, volume of imports of goods and services, population, general government revenue increase and inflation, current account balance, unemployment rate, volume of exports of goods and services, general government gross debt decrease 5%; RPPI is estimated as 117.5026. RPPI decreases nearly 6.34%.

The paper is the first academic study that investigating, modelling whether there is a long-run relationship between macroeconomic indicators and housing markets in Fragile 5 countries. The findings of this paper would help government and property investors for creating more effective property management strategies in these countries (especially in Brazil and Turkey).On the other hand due to lack of housing market data, statistical models could not be created for India.

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