The impact of financial variables and capacity utilization on driving aggregate investment in emerging economies

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Abstract

This paper investigates the impact of financial variables and capacity utilization on driving aggregate investment in emerging economies. This investigation is vital because it allows an empirical understanding of investment drivers, thus allowing policymakers to form fiscal and monetary policy that supports investment growth. Using quarterly data from public economic databases, we model a Keynesian investment function based on the existing theory, using OLS as an analysis method. We find that the profit rate is a statistically significant and strong explanator of investment in most of the countries we investigate. We also find that capacity utilization is statistically significant with a varying degree of explanatory strength in the countries we investigate. Additionally, we exhibit mixed results for financial stress and Tobin's Q across the different countries, where we find varying signs and levels of significance. Our results expose a flaw in the manner which central banks implement monetary policy as they do not consider the rate of profit when setting interest rates. Based on our findings, we recommend that it is essential for policymakers in emerging economies to form a policy framework that maximizes aggregate demand to ensure full capacity utilization and profits. This should be done by including the spread between the rate of profit and interest rates as a key variable in making policy decisions. While the results are conclusive and allow us to make recommendations, the dynamics between financial stress and investment still require further investigation. Our econometric model still leaves a significant portion of investment unexplained. Our interpretation of this result is that the "Animal Spirits" hypothesis may cause this; however, this can be expanded on in other research (Keynes, John, 1936).

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1. Background

1.1. Significance of investment

This paper investigates the impact of financial variables and capacity utilization as explanatory variables in driving aggregate investment in emerging markets. In their paper on the drivers of economic growth in Asian countries, Boamah et al. (2018) found that gross fixed capital formation was a significant explanatory variable for economic growth. This is consistent with the findings by Kononenko (2017), who concludes a positive relationship between gross fixed capital formation and GDP growth in an empirical study of 35 countries.

While the positive relationship between gross fixed capital formation and GDP growth is widely accepted in economic literature, there is a divergence in thinking regarding the drivers of aggregate investment.

In a study on the German economy, Bachmann et al. (2020) concluded that aggregate demand and technology shocks are the main drivers of gross fixed capital formation fluctuations. Demand-side shocks accounted for 65.92% to 74.81% of aggregate investment growth (Bachmann et al. 2020), with changes in technology accounting for 8.89% of the fluctuations (Bachmann et al. 2020). In a separate study, Pindyck & Solimano (1993) concluded through a panel analysis that inflation is the only economic risk indicator that is a robust explanator of investment.

This is different from the conventional Q-theories, which suggest that changes in investment are driven by the ratio of the market value of firms and the replacement cost of their capital stock (Simmons-süer, 2018). There is very little literature on the drivers of aggregate investment for emerging economies, with most of the literature targeting the developed world. The little scholarly work that has been done for emerging markets tends to be limited to a specific country – see Chetty (2006) or is limited to the impact of financial variables without incorporating real factors and the impact of financial stress in a holistic investment model – see Peltonen et al. (2011). This study, therefore, aims to add to the body of knowledge on investment by conducting a comprehensive analysis of emerging economies. Additionally, it seeks to incorporate the impact of financial stress and capacity utilization into understanding aggregate investment, an investigation that at this point hasn't been done for emerging markets.

1.2. Research Problem

Understanding the variables that drive aggregate investment is critically important to emerging economies to achieve a level of economic growth that enables full employment and improved quality of life. The study thus aims to address two problems relating to investment:

- Policymakers have the objective of promoting investment in the real economy. However, there seems to be little understanding of the factors that drive investment. Policy makers pay little attention to the structural factors (both real and financial) that inhibit or enable investment, which has significant implications for policy formation. There is therefore a need to investigate which factors drive investment and which of these factors are the most powerful drivers of investment.
- The lack of understanding by policymakers of the impact of financial stress, capacity utilization and other financial variables leads to policy formation that is ineffective in stimulating investment. This study attempts to explain the impact of all these variables, thus allowing more informed interventions in the economies of emerging markets.

1.3. Research Objectives

The questions that this paper will answer concerning the research problem in an emerging market context are hence:

a) Which variables (financial and real) explain aggregate investment?
b) Do these variables significantly explain investment, and as a result, can policymakers design interventions to create an environment that promotes investment?

Through answering these questions two objectives will be achieved; firstly, we will be able to determine which factors drive investment. Secondly, we will be able to determine whether financial factors dominate real factors in driving investment which will allow scientific policy interventions to be designed.

The rest of the paper proceeds as follows. Chapter 2 reviews the existing literature, chapter 3 explains the adopted methodology and econometric analysis. Chapter 4 analyzes and discusses the results with policy recommendations for emerging economies. Finally, chapter 5 concludes the paper.

2. Literature Review

In his book, The General Theory of Employment, Interest, and Money, Keynes postulated that investment at an aggregate level is determined partly by the rate of interest prevailing in the market and the short-term and long-term expectations of entrepreneurs (Keynes, 1936). According to Keynes (1936), investors will increase their level of investment until the expected return from the new investment is equal to the interest rates.

In his analysis of the Keynesian investment philosophy, Asimakopulos (1971) noted that investment decisions in the current period are exogenous to current economic activity. They are instead the result of decisions made at an earlier time. The critical determinants of aggregate investment are the degree of utilization of the existing capital stock, the initial level of capital stock, the state of technology, expected returns from the investments, and the recent price and wage levels (Asimakopulos, 1971). The

conclusion from an analysis of the Keynesian investment theory according to Asimakopulos (1971), is that high interest rates, generally reduce the level of investment in an economy due to the more stringent credit conditions. An observation we believe is correct.

In a panel data investigation of a Keynesian-Kaleckian model, Alexiou (2010) found that capacity utilization and the current profitability of firms are the key determinants of investment in the G7 countries. In his analysis, capacity utilization is used as an explanatory variable but as a proxy for the business cycle and not as a critical determinant itself. This is a significant shortcoming in the existing literature, as in our hypothesis capacity utilization is in itself a critical determinant and should not be relegated to a proxy for other factors.

Numerous scholars have tried to model aggregate investment using Q-theory. According to the Q investment theory, the rate at which investors wish to increase their capital stock in an economy should be related to the value of the current capital stock relative to its replacement cost (Philippon, 2009). The theory, while popular, has had poor empirical results (Gallegati & Ramsey, 2014). Gallegati & Ramsey (2014), consistent with Abel & Blanchard (1986), state that stock prices contain much more information than just the future dividends of firms as proposed by the dividend discount model. The different time horizons of investors, short-term traders, chartists, and gamblers participating in the equity market, lead to a divergence in fundamental value and observed stock prices (Gallegati & Ramsey, 2014).

The lack of empirical robustness arising from Tobin's Q as an explanatory variable for investment has led to scholars deconstructing the measurement of q in different ways to compensate for its shortcomings. Philippon (2009) constructed a measure of Q based on bond prices, using corporate bond spreads vs government-issued bonds instead of stock prices. The results from a q ratio based on bond prices used by Philippon (2009) and Gallegati & Ramsey (2014) improve the empirical performance of q theory compared to traditional q theory based on stock prices. However, they still leave a large serially correlated portion of investment unexplained. Gallegati & Ramsey (2014) conclude that stock prices over the long run are a statistically significant determinant of investment, whereas bond prices are a greater explanatory determinant in the short run.

In a separate study attempting to address the poor empirical performance of q theory, Abel & Blanchard (1986) used the present value of future cash flows instead of stock prices to compute a modified q ratio. The conclusion was that while the marginal q performs better than the average q traditionally used by scholars in explaining investment, it still does an unsatisfactory job as it leaves large serially correlated portions of investment unexplained (Abel & Blanchard, 1986).

Balakrishnan et al. (2011) define financial stress as a period when the financial system is under strain and cannot intermediate by itself. A literature review shows that minimal attempt has been made to empirically link the degree of financial stress to growth in gross fixed capital formation. Balakrishnan et al. (2011) & Cardarelli et al. (2009) define periods of financial stress as being characterized by the

four following shifts in the financial sector: significant shifts in asset prices (equities, bonds, housing), abrupt increases in risk/uncertainty, liquidity constraints and banking sector health concerns.

Cardarelli et al. (2009) highlight that financial stress is transmitted to the real economy due to asset value changes used as collateral when firms seek credit. Banking sector capital erosion also forces financial institutions to deleverage, the result of which is a drop in credit availability for firms in the real economy (Cardarelli et al. 2009). The impact of credit shocks on investment is also highlighted by Peltonen et al. (2011) who found that investment reacts negatively to shocks in the credit markets, although according to their study this shock is more dominant on the credit demand side rather than the supply side.

In their study of financial stress in emerging markets, Balakrishnan et al. (2011), building on the work by Cardarelli et al. (2009), developed an emerging market financial stress index (FSI). The index aggregates the effects of the stock markets, interest rates, the perceived level of risk in the banking sector, and an exchange market pressure index (EMPI) to quantify the overall level of financial stress in an economy.

Balakrishnan et al. (2011) found that the index accurately reflected previous crises identified in previous qualitative and quantitative literature. This work is fundamental to this work as it allows us to use an all-encompassing variable of financial stress to test the impact this has on emerging market investment rates.

A few conclusions can be drawn from reviewing the literature. Very little research has been done on the drivers of investment in emerging economies, this is partly due to the limitations of data availability. The little research that has been done is limited in that it doesn't holistically incorporate the impacts of financial stress, real factors, and financial variables into one complete model. The lack of empirical research on emerging economies therefore limits the strength of the policy instruments that emerging economies can use to stimulate investment. Secondly the existing literature does not holistically define a Keynesian investment function that incorporates all of the aforementioned variables, considering the impact of Keynesian economics on modern day emerging market macroeconomic management this is a significant gap in the literature that this study will address.

Investment models that exclude the impact of real variables or relegate them to inferior explanators to financial variables dominate the existing literature, a shortcoming that explains their poor performance, especially in the context of emerging countries, where real variables are likely to dominate financial variables due to less depth in the financial markets.

3. Methodology

3.1. Investment Function

In selecting the countries that form part of this study, we aimed for a cross-continental approach so that we can generalize our findings. However, due to the limitations in data availability only five countries form part of the final analysis. We use quarterly data from OECD and Fred databases. To supplement any missing information, the national databases[1] for each country are used. The five emerging economies with sufficient data for the study are South Africa, Mexico, Turkey, Poland, and Russia, with the data ranging from 2000 to 2021, but with differences for each country within that range.

We follow Alexiou (2010) in defining our investment equation but extend it to include the financial stress index. This leads to equation one, which is used as the base model of the investment equation, with the investment rate being the dependent variable.

$$\frac{I_t}{K_{t-1}} = \alpha_0 + \alpha_R \left(r_{t-1} - \left(i^l_{t-1} - \pi^e_{t-1}\right)\right) + \alpha_u CU_{t-1} + \alpha_Q Q_{t-1} + \alpha_f FSI_{t-1} \qquad (1)$$

In this equation I_t is the gross fixed capital formation and K_{t-1} is the opening capital stock. (r_t) is the profit rate as defined by Malikane (2017). The real interest rate is represented by i_t. CU_t represents capacity utilization, Q_t is Tobin's Q[2] and FSI_t represents financial stress as defined by Balakrishnan et al. (2011).

To use equation 1, it is necessary to compute the financial stress index. We follow Balakrishnan et al. (2011) and use equation 2 to calculate the level of financial stress.

$$FSI = \beta_{banking\,sector} + R_{stocks} + Volatility_{stocks} + SovSpreads + EMPI \qquad (2)$$

Where β, R, Volatility, SovSpreads, and EMPI represent the following, respectively: banking sector Beta as defined by the capital asset pricing model, R represents the stock market returns where a negative return is multiplied by -1 to indicate an increase in stress in the stock prices and volatility is a measure of risk modelled using a GARCH (1,1) autoregressive model with 12 lags. EMPI is the Exchange Market Pressure Index, defined by equation 3:

$$EMPI = \frac{\Delta e_i, t - \mu_{\Delta e}}{\sigma_{i,\Delta e}} - \frac{\Delta RES_{i,t} - \mu_{t,\Delta RES}}{\sigma_{i,\Delta RES}} \quad (3)$$

Where Δe_i and $\Delta RES_{i,t}$ respectively represent the change in exchange rates and foreign reserves excluding gold reserves. μ & σ represent the mean and the standard deviation of both variables.

[1] The databases used are the respective countries central banks data bases and local government statistics databases.

2 While Q investment theories have historically had poor empirical performance in studies conducted by other scholars we include Q in our model because like Abel & Blanchard (1986) and Gallegati & Ramsey (2014) we agree that the stock prices contain forward telling information about the value of a firm, which would have an impact on investment decisions

To model the investment equation, it is necessary to compute the capital stock in the economy, which requires adopting the perpetual inventory method as described by Nehru & Dhareshwar (1993). We follow Malikane (2017) in that we use the stock-flow accumulation process to calculate the initial capital stock at time zero by manipulating equation 4.

$$\frac{P_0}{K_0} = \frac{P_t I_t}{(1 + g_0^T) - (1 - \delta)(1 + \pi_0^K)} \qquad (4)$$

Where P_0, K_0, P_t, g_0^T, π_0^k and δ represent; the price of the initial capital stock, initial capital stock at time 0, price of new investments, the growth rate of investment, the inflation rate of the price index of the fixed capital stock, and the rate of depreciation of the capital stock respectively. Equation 4 is used along with the nominal and real gross fixed capital formation to calculate K_0. We then use equation 5 to calculate, the remainder of the capital stock. We assume a depreciation rate of 2.5%.

$$K_t = I_t + (1 - \delta)K_{t-1} \qquad (5)$$

The profit rate (r_t) is calculated using data from the national accounts of each respective country, as seen in equation 6. The gross operating surplus is used as a proxy for aggregate profitability.

$$r_t = \frac{GS_t}{K_{t-1}} \qquad (6)$$

Where GS_t represents the gross operating surplus derived from the income method of expressing national accounts.

3.2. Econometric Analysis

The equation is modelled in 2 stages to prevent inferences from spurious regressions. This method is recommended by Pindyck & Rubinfeld (1997) and used by Sensenbrenner (1991) as a means to correct for serial correlation and heteroscedastic data, which we observe in the 1st stage regressions for all of the countries. We extract the residuals, ε_t, we obtained through modelling equation 1. Equation 1 is then augmented with the variable ε_t which represents a lagged error term. We use this method to ensure unbiased and efficient estimators are generated (Pindyck & Rubinfeld, 1997). With this augmentation, equation 1 is extended to equation 7.

$$\frac{It}{K_{t-1}} = \alpha_0 + \alpha_{cu} CU_{t-1} + \alpha_R (r_{t-1} - (i_{t-1}^l - \pi_{t-1}^e)) + \alpha_{FSI} FSI_{t-1} + \alpha_Q Q_{t-1} + \beta \varepsilon_{t-1} \qquad (7)$$

The addition of the error terms is justified due to the statistical significance of their coefficients. In addition, equation 7 is supplemented with dummy variables to address any abnormal shocks to the investment rate, such as the global financial crisis, covid 19 pandemic and the Russian oil crisis, etc. We label these dummy variables as ψ.

The credibility of the model is confirmed by checking for heteroskedasticity, serial correlation, and identification strength. This is achieved through the following measures: an Arch test is used for the heteroskedasticity, an LM test is used for serial correlation, DW statistics are compared to their critical values to ensure regressions are not spurious, and the F-Stat is used to check for weak identification[3]. The correlation matrices for the variables are provided in the appendix for each country.

The equation is initially modelled as stipulated in equation 7, with results presented in table 1 below. Russia is excluded from the 1st regression due to the unavailability of market capitalization data to compute Tobin's Q.

[3] We use four lags in the ARCH and LM tests for heteroskedasticity and do not reject the null hypothesis of homoskedasticity and we do not reject the null hypothesis of no serial correlation present. The computed DW statistic is compared against the t-critical value for each data set. An F-stat less than 10 is assumed to signify weak identification.

Table 1: Regression results from equation 7

$$\frac{It}{K_{t-1}} = \alpha_0 + \alpha_{cu} CU_{t-1} + \alpha_R (r_{t-1} - (i^l_{t-1} - \pi^e_{t-1})) + \alpha_{FSI} FSI_{t-1} + \alpha_Q Q_{t-1} + \beta \varepsilon_{t-1}$$

	South Africa		Mexico		Poland		Turkey	
	Co-eff	**Std**	**Co-eff**	**Std**	**Co-eff**	**Std**	**Co-eff**	**Std**
$\boldsymbol{\alpha_0}$	-0.0010	(0.0106)	-0.0123*	(0.0023)	-0.0057*	(0.0026)	-0.0154*	(0.0034)
$\boldsymbol{CU_{t-1}}$	0.0566*	(0.0122)	0.0325*	(0.0044)	0.0112*	(0.0033)	0.0003*	(0.00004)
$\boldsymbol{r_{t-1}}$	0.0340*	(0.0084)	0.0912*	(0.0247)	0.2867*	(0.0213)	0.3999*	(0.0386)
$\boldsymbol{i_{t-1}}$	-0.0513*	(0.0245)	-0.0269*	(0.0055)	0.0018	(0.0167)	-0.0256*	(0.0047)
$\boldsymbol{FSI_{t-1}}$	-0.0431*	(0.0051)	0.0002	(0.0002)	-0.0001	(0.0013)	-0.00002*	(0.00000)
$\boldsymbol{Q_{t-1}}$	-0.0087*	(0.0019)	0.0030*	(0.0010)	0.0007*	(0.0001)	-0.0014	(0.0012)
$\boldsymbol{\varepsilon_{t-1}}$	0.4171*	(0.1199)	0.5593*	(0.1456)	0.5024*	(0.1195)	0.4245*	(0.1336)
$\boldsymbol{\gamma_1}$	-0.0095*	(0.0018)	0.0078*	(0.0008)	-0.0033*	(0.0007)	0.0093*	(0.0013)
$\boldsymbol{\gamma_2}$	0.0044*	(0.0019)	-0.049*	(0.0005)				
Adj. R^2	0.90		0.94		0.97		0.96	
DW	1.73		2.13		2.11		2.03	
F-Stat	89.82		97.49		274.57		190.53	
AIC	9.83		12.45		11.5		10.67	

* Significance at 5%

** Significance at 10%

The analysis of the results is done in 3 steps starting with a regression of the model using a single variable to represent the rate of profit which is a measure of the spread between the rate of profit and real interest rates (equation 7 above).

Equation 7 is then extended to separate the rate of profit from the real interest rate as two separate regressors, resulting in equation 8.

$$\frac{I_t}{K_{t-1}} = \alpha_0 + \alpha_{cu}CU_{t-1} + \alpha_r r_{t-1} + \alpha_s(i_{t-1} - \pi_{t-1}) + \alpha_{FSI}FSI_{t-1} + \alpha_Q Q_t + \beta\varepsilon_{t-1} \quad (8)$$

Lastly, a regression is computed with the rate of profit and nominal interest rates to obtain equation 9.

$$\frac{I_t}{K_{t-1}} = \alpha_0 + \alpha_{cu}CU_{t-1} + \alpha_r r_{t-1} + \alpha_i i_{t-1} + \alpha_{FSI}FSI_{t-1} + \alpha_Q Q_{t-1} + \beta\varepsilon_{t-1} \quad (9)$$

Equation 9 yielded the best identification results based on the measured adjusted coefficient of determination. Thus, equation 9 is used for the remainder of the analysis.

From table 1, positive and significant coefficients for capacity utilization are exhibited for all the countries. In addition, positive and significant coefficients for the rate of profit are also displayed for all the countries considered. Except for Poland, all countries exhibited negative and significant coefficients for the interest rate. Financial stress was found to be negative for all countries, excluding Poland. The financial stress was only statistically significant for Turkey and South Africa.

In addition to the statistical significance, we must analyze the explanatory strength of the various variables in the different countries. In the case of South Africa, capacity utilization has the greatest explanatory power, followed by interest rates and financial stress, both of which have negative signs. This result fits our hypothesis regarding the importance of capacity utilization and the rate of profit in driving investment in an emerging economy.

Interest rates and financial stress also display a negative relationship with investment. Further entrenching the hypothesis that monetary policy has an essential role in driving investment, at least in the South African case. In the South African context, Tobin's Q has the lowest explanatory power relative to the other variables, again a result that we expected in our initial hypothesis.

Mexico, Poland and Turkey exhibit different results from South Africa in terms of explanatory power. The rate of profit far exceeds the other variables in terms of explanatory strength. Capacity utilization shows strong explanatory strength in Mexico and Poland. However, the explanatory power is negligible in the case of Turkey. Interest rates exhibit weak identification power for Mexico and Turkey, while interest rates are not a strong explanatory variable for Poland.

Tobin's Q exhibited varying results across the different countries, namely, South Africa showed negative and significant coefficients, Mexico and Poland exhibited positive and significant coefficients,

while Turkey exhibited negative but insignificant results. Tobin's Q exhibits weak explanatory power for all countries, which agrees with Abel & Blanchard (1986) and Sensenbrenner (1987), who both highlight the poor empirical performance of Q theories.

A regression that includes real stock prices instead of Tobin's Q is completed in line with Adjasi & Biekpe (2009). Adjasi & Biekpe (2009) reported a positive relationship between share prices and investment growth in Africa.

A share price index was used for the five countries. The results are presented in Table 2 from equation 10.

$$\frac{I_t}{K_{t-1}} = \alpha_0 + \alpha_{cu} CU_{t-1} + \alpha_r r_{t-1} + \alpha_i i_{t-1} + \alpha_{FSI} FSI_{t-1} + \alpha_{RSP} RSP_{t-1} + \beta\varepsilon_{t-1} \quad (10)$$

Table 2: Regression results from equation 10

$$\frac{I_t}{K_{t-1}} = \alpha_0 + \alpha_{CU}CU_{t-1} + \alpha_r r_{t-1} + \alpha_i i_{t-1} + \alpha_{FSI}FSI_{t-1} + \alpha_{RSP}RSP_{t-1} + \beta\varepsilon_{t-1}$$

	South Africa		Mexico		Poland		Russia		Turkey	
	Co-eff	**Std**	**Co-eff**	**Std**	**Co-eff**	**Std**	**Co-eff**	**Std**	**Co-eff**	**Std**
α_0	-0.0063	(0.0097)	-0.0191*	(0.0043)	-0.0045	(0.0030)	0.04	(0.04)	-0.0072*	(0.0039)
CU_{t-1}	0.0710*	(0.0117)	0.0462*	(0.0092)	0.0068**	(0.0039)	-0.0424	(0.0492)	0.0003*	(0.00005)
r_{t-1}	0.0571*	(0.0067)	0.0749**	(0.0438)	0.3172*	(0.0191)	0.3607*	(0.0466)	0.3144*	(0.0484)
i_{t-1}	-0.1181*	(0.0316)	-0.0329*	(0.0102)	0.0049	(0.0182)	-0.0190	(0.0621)	-0.0306*	(0.0045)
FSI_{t-1}	-0.0308*	(0.0062)	-0.0003	(0.0003)	0.0030	(0.0018)	0.0335	(0.0333)	-0.00002*	(0.00000)
RSP_{t-1}	-0.0074*	(0.0014)	-0.0000	(0.0010)	0.0327*	(0.0100)	-0.3598	(0.6723)	-0.0391	(0.0777)
ε_{t-1}	0.5900*	(0.1158)	0.9989*	(0.2277)	0.4778*	(0.1234)	0.3305	(0.2080)	0.4598*	(0.1286)
γ_1	-0.0080*	(0.0018)	0.0095*	(0.0016)	-0.0038*	(0.0008)	-0.0059	(0.0044)	-0.0016*	(0.0004)
γ_2	-0.0070*	(0.0017)							0.0078*	(0.0012)
Adj. R^2	0.92		0.81		0.96		0.71		0.96	
DW	1.64		2.25		2.14		1.70		2.11	
F-Stat	97.30		30.75		242.55		14.02		209.25	
AIC	9.84		11.31		11.44		8.03		10.87	

* Significance at 5%

** Significance at 10%

The results showed positive and significant results for capacity utilization for all countries, excluding Russia. Similarly, the rate of profit for all countries showed positive and significant results. Russia was the only exception for the interest rates where the remaining countries exhibited negative and significant results. Whereas Russia displayed negative and insignificant results for the interest rate

South Africa and Turkey exhibit negative and significant coefficients for financial stress. Whereas Poland, Russia and Mexico exhibit insignificant results for financial stress. However, only South Africa exhibits strong explanatory power for financial stress relative to the other variables.

Share prices exhibit negative and significant results for South Africa. Poland shows positive and significant results for share prices. Finally, Mexico, Russia & Turkey exhibit insignificant results.

South Africa represents the only exception when comparing the adjusted R^2 and RMSE of the forecasts to determine the model with the greater explanatory power between a model that includes share prices or Tobin's Q. Thus, Tobin's Q is considered for the remainder of the analysis. Russia is the only country where we use the real share prices due to a lack of data.

An analysis of the results reveals four critical points at this juncture of the study:

1. The rate of profit is the most vital explanatory variable across the various countries, except for South Africa, where it follows capacity utilization closely. The relationship between profits and investment is positive.
2. Capacity utilization is an essential determinant in driving aggregate investment for most of the countries that form part of this analysis. The major difference between the countries is the explanatory strength in the different countries. Like the rate of profit, capacity utilization has a positive impact on investment
3. Interest rates have a negative relationship with investment, with varying impacts in terms of explanatory strength.
4. The relationship between the financial variables (FSI, share prices and Q) with the investment rate differs from country to country, both in explanatory strength and statistical significance; therefore, a generalized conclusion cannot be reached with these variables.

To test the robustness of the model, three regressions are computed. We compute a regression that excludes the financial variables of financial stress, interest rates, share prices/Tobin's Q as per equation 11. We present the results in table 3.

$$\frac{It}{K_{t-1}} = \alpha_0 + \alpha_{cu} CU_{t-1} + \alpha_R r_{t-1} + \beta e_{t-1} \qquad (11)$$

We substitute Q for real share prices for Russia. A regression is then computed on a model that excludes capacity utilization and only includes the financial variables as per equation 12. The results of the regression are seen in table 4.

$$\frac{It}{K_{t-1}} = \alpha_0 + \alpha_R r_{t-1} + \alpha_{FSI} FSI_{t-1} + \alpha_Q Q_{t-1} + \beta e_{t-1} \quad (12)$$

Forecasts of the three different models are computed and compared by looking at the AIC criterion, and adjusted coefficient of determination[4].

A comparison of the F-Statistics and, adjusted R^2 between the three models revealed that equation 10 above yields the best fitting model except for South Africa, where the best fitting model is obtained using equation 11 above. Additionally, to test if the models are significantly different from one another, we compute a regression of each model's squared error terms against one another using equation 10 as a base equation and its error terms as the dependent variable. In this methodology, a coefficient of 1 indicates that the y and x variables on the regression are equal and, therefore, not significantly different from one another. We provide the results of this analysis in the appendix. The results reveal that the three different models are significantly different from each other, and therefore it is reasonable to accept that the model represented by equation 10, which includes all the variables, is the best fitting model.

While the models are significantly different, it is noted that the models represented by equation 10 and equation 11 significantly outperform equation 12 in terms of the adjusted R^2. This further highlights the vital role of capacity utilization in determining the investment rate.

The results obtained have a few implications. Firstly, the high levels of serial correlation observed in the residuals, and the significance of the lagged error term suggest the model has missing explanatory drivers of investment. However, there are meaningful inferences that can be made from the results.

[4] Models with lower AIC values are better predictors than those with higher AIC values and a higher adjusted coefficient of determination is preferable.

Table 3: Regression results from equation 11

$$\frac{It}{K_{t-1}} = \alpha_0 + \alpha_{cu} CU_{t-1} + \alpha_r r_{t-1} + \alpha e_{t-1}$$

	South Africa		Mexico		Poland		Russia		Turkey	
	Co-eff	**Std**	**Co-eff**	**Std**	**Co-eff**	**Std**	**Co-eff**	**Std**	**Co-eff**	**Std**
α_0	-0.0522*	(0.0069)	-0.0090*	(0.0024)	-0.0063*	(0.0022)	0.0309	(0.0272)	-0.0184*	(0.0040)
CU_{t-1}	0.0897*	(0.0091)	0.0241*	(0.0044)	0.0128*	(0.0031)	-0.0306	(0.0443)	0.0002*	(0.00005)
r_{t-1}	0.2272*	(0.0144)	0.1603*	(0.0223)	0.3064*	(0.0087)	0.3460*	(0.0441)	0.5672*	(0.0208)
ε_{t-1}	0.8888*	(0.0678)	0.7471*	(0.1216)	0.6313*	(0.0965)	0.4322*	(0.1719)	0.6236*	(0.1210)
γ_1	-0.0060	(0.0016)	0.0072*	(0.0008)	0.0040*	(0.0008)	-0.0049	(0.0041)	0.0092*	(0.0016)
γ_2	-0.0076	(0.0015)	-0.0045*	(0.0005)						
Adj. R^2	0.93		0.92		0.97		0.72		0.93	
DW	1.70		2.28		2.23		1.56		2.26	
F-Stat	194.66		121.57		441.96		25.77		220.05	
AIC	10.10		12.27		11.52		8.16		10.33	

* Significance at 5%

** Significance at 10%

Table 4: Regression results from equation 12

$$\frac{\mathbf{It}}{\mathbf{K_{t-1}}} = \alpha_0 + \alpha_R r_{t-1} + \alpha_{FSI} FSI_{t-1} + \alpha_Q Q_{t-1} + \alpha_t e_{t-1}$$

	South Africa		Mexico		Poland		Russia		Turkey	
	Co-eff	**Std**	**Co-eff**	**Std**	**Co-eff**	**Std**	**Co-eff**	**Std**	**Co-eff**	**Std**
α_0	0.0463*	(0.0032)	0.0043*	(0.0010)	0.0017	(0.0014)	0.0142	(0.0114)	0.0029	(0.0024)
r_{t-1}	0.0276*	(0.0093)	0.1876*	(0.0256)	0.3043*	(0.0219)	0.3468*	(0.0449)	0.4400*	(0.0353)
i_{t-1}	-0.0547*	(0.0274)	-0.0106	(0.0067)	0.0110	(0.0176)	-0.0032	(0.0580)	-0.0140*	(0.0041)
FSI_{t-1}	-0.0551*	(0.0005)	0.0000	(0.0002)	-0.0020	(0.0013)	0.0366	(0.0332)	-0.00002*	(0.00000)
Q_{t-1}	-0.0101*	(0.0021)	0.0046*	(0.0013)	0.0008	(0.0001)	-0.2029	(0.6428)	0.0005	(0.0011)
ε_{t-1}	0.3995*	(0.1179)	0.6918*	(0.1359)	0.5028*	(0.1171)	0.3123	(0.2063)	0.8117*	(0.0894)
γ_1	-0.0095*	(0.0002)	0.0048*	(0.0009)	-0.0031	(0.0008)	-0.0057	(0.0042)	0.0068*	(0.0011)
γ_2	0.0038**	(0.0021)	-0.0048*	(0.0007)						
Adj. R^2	0.88		0.90		0.96		0.71		0.95	
DW	1.80		2.27		2.07		1.70		2.56	
F-Stat	80.00		63.30		280.57		16.20		247.49	
AIC	9.55		11.94		11.45		8.06		10.78	

* Significance at 5%

** Significance at 10%

4. Discussion and policy implications of the results

4.1. Rate of Profit

The high explanatory power of the rate of profit is the key finding of this research. As it exposes a fundamental flaw in the manner which central banks approach monetary policy and particularly interest rates. Prioritizing the rate of inflation in determining interest rates is counterproductive in the context of emerging economies as this approach might stifle investment. This finding is consistent with the findings by Asimakopulos (1971) and is consistent with Keynes' general theory of investment, the finding brings up an important policy implication. Central banks should include the spread between the rate of profit and the interest rates as a key input in macroeconomic management. Our study has demonstrated that they key to inducing high levels of investment in emerging economies is a healthy spread between the rate of interest and the rate of profit due to the strong explanatory strength of the rate of profit.

In 'The General Theory, Keynes (1936) highlights the inversely proportional relationship between investment and interest rates. Our results confirm that emerging economies should firstly ensure that their central banks have the monetary sovereignty to control their interest rates and that monetary policy should be structured in a manner that induces investment. The findings by Boamah et al. (2018) and Kononenko (2017) on the relationship between investment and economic growth and our results on the relationship between investment and long term interest rates lead us to the recommendation that emerging economies should include stable economic growth as a critical mandate in implementing monetary policy. This elevation of sustainable economic growth would then ensure that interest rates are kept as low as possible to ensure an enabling environment for investment exists for the private sector.

4.2. Capacity utilization

Capacity utilization is significant, with the expected positive sign in four countries. This observation, together with the significant and positive profit rate in all the countries, is in agreement with Keynes (1936) who observed that investment is influenced by the purchasing strength of the economic agents and their demand for goods as well as the prospective yield that investors can gain from purchasing additional capital stock. We thus postulate that emerging economies need to design fiscal policies that stimulate aggregate demand to ensure that firms can maximize their existing capacity. Prioritizing capacity utilization benefits increasing profitability due to the increased revenue firms gain relative to their fixed costs. Suppose we define profits at a firm level as per equation 13. Where F, V, and S represent fixed costs, variable costs, and sales, respectively, we define sales as per equation 14. CU is capacity utilization, E is production efficiency, and M is a proxy for other market factors such as competition, the business cycle, etc. It becomes evident that increasing capacity utilization directly impacts profitability due to the additional revenue achieved to cover the fixed costs.

$$P(t) = f(F, V^{-}, S^{+}) \qquad (13)$$

$$S(t) = (CU^{+}, E^{+}, M) \qquad (14)$$

Our recommendation regarding capacity utilization and the profit rate is threefold. Firstly, emerging economies need to prioritize local production over imports by imposing tariffs on strategic goods produced locally. This would ensure that local capacity is maximized and used to produce goods, increasing capacity utilization.

The emerging economies should form trade blocks that allow them to take advantage of their relative comparative advantages without competing with the developed economies. This would enable countries to maximize their spare capacity to supply the export markets.

Finally, regarding capacity utilization and profits, we recommend that emerging economies adopt a progressive fiscal policy framework to stimulate aggregate demand. Fiscal policy such as introducing tax cuts for the low and middle-income earners would directly impact capacity utilization due to their high propensity to consume compared to high-income earners (Kelton, 2020). This fiscal strategy would stimulate investment without intermediary agents that introduce corruption or inefficient spending that are customarily associated with traditional stimulus packages in emerging economies.

4.3. Financial Variables

The mixed results observed when it comes to the relationship between Tobin's Q and share prices concerning the investment rate suggest that there are structural differences in the different economies that drive that relationship. These could be the level of financial development/stock market development in the various countries, significant differences in the level of financial development between the different countries impacts the quality of the information contained in the share prices (Ojah & Kodongo, 2014). However, the size of the coefficients indicates that for emerging economies, both share prices and Tobin's Q, while statistically significant are not strong explanatory variables. Similarly, the relationship between financial stress and investment differs in different countries, and the policy implications would therefore be different for the different countries. However, governments must equip themselves with the correct policy tools for countries such as South Africa, where FSI is a relatively strong explanatory variable to react to external shocks to the financial markets.

The results obtained in this study agree with the findings from the existing literature. In his investigation, Asimakopulos (1971) found that the investment rate depends on capacity utilization, the expected return from purchasing additional capital stock, and the rate of interest. In particular, the higher the interest rate, the less likely an economy is to have investment (Asimakopulos, 1971). The poor results observed in the impact on investment of Tobin's Q adds to the growing evidence of poor empirical performance by Q theories in explaining investment as observed by (Abel & Blanchard,

1986), (Gallegati & Ramsey, 2014) & (Philippon, 2009). While Q is statistically significant, the inconsistency in its sign across the different countries and its weak explanatory power suggests it is an unreliable policy instrument to use and further investigation is required for each country for it to be useful.

Although we have extended our investment model to include additional variables, like Abel & Blanchard (1986) & Sensenbrenner (1987), we still find a significant component of serially correlated investment that isn't explained. Keynes noted in the general theory that the decision to invest is not based purely on the result of mathematical outcomes. In The General Theory he says:

> *"Human decisions affecting the future, whether personal or political or economic, cannot depend on strict mathematic expectation, since the basis for making such calculations does not exist; and that it is our innate urge to activity which makes the wheels go round, our rational selves choosing between the alternatives as best we are able, calculating where we can, but often falling back for our motive on whim or sentiment or chance" (Keynes, 1936).*

We thus postulate that what Keynes phrased as "animal spirits" forms a large part of the unexplained serially correlated portions of investment. However, further studies - perhaps qualitative and quantitative - are required to make a definite conclusion on the postulation by Keynes.

5. Conclusion

This paper investigates the impact of financial variables and capacity utilization in driving aggregate investment in emerging economies. An OLS model was adopted to investigate the drivers of investment. Generally, the findings indicate that the rate of profit, capacity utilization and interest rates are important explanatory variables for aggregate investment across the different countries. Tobin's Q and financial stress exhibit inconsistent results across the set of countries, suggesting that each country should perform an individual study of the dynamics between investment and these variables in designing the appropriate policy instruments to drive investment. The high level of serial correlation in the residuals suggests that a significant amount of the drivers of aggregate investment remain unexplained. We postulate that this could be due to the non-mathematical aspect of human decision making, which Keynes (1936) referred to as animal spirits.

The result of this study exposes a flaw in the methodology adopted by central banks in managing monetary policy. Given the importance of profit rates, central bankers need to include the spread between the rate of profit and the prevailing interest rates as a key input into their monetary policy decisions. Additionally, emerging economies need to formulate a policy framework that maximizes

capacity utilization and profits for firms. The adopted policy framework should seek to maximize aggregate demand. This can be done by implementing tax cuts for the middle class and low-income earners, as Kelton (2020) suggested, due to their high propensity to consume. Additionally, emerging economies should formulate trade agreements to allow them to utilize their relative competitive advantages without competing with developed nations. Import tariffs should accompany trade agreements on goods exported from the developed world.

The inconsistency in the performance of some of the financial variables in-between the different countries require further investigation within each country, this prevents a generalized conclusion and recommendations. This together with the “animal spirits” hypothesis we propose should be researched in further work.

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7. Appendices

Table 5: Regression of the base equation squared residuals against the residuals from equation 11

	South Africa		Mexico		Poland		Russia		Turkey	
	Co-eff	Std	Co-eff	Std	Co-eff	Std	Co-eff	Std	Co-eff	Std
α_0	0.00**	(0.00)	0.00*	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)
ε_1	0.26*	(0.06)	0.24*	(0.05)	0.53*	(0.06)	0.90	(0.03)	0.40*	(0.05)
Adj. R^2	0.22		0.32		0.58		0.95		0.45	
DW	1.27		1.75		1.21		2.13		2.07	

Table 6: Regression of the base equation squared residuals against the residuals of equation 12

	South Africa		Mexico		Poland		Russia		Turkey	
	Co-eff	Std	Co-eff	Std	Co-eff	Std	Co-eff	Std	Co-eff	Std
α_0	0.00*	(0.00)	0.00*	(0.00)	0.00	(0.00)	0.00*	(0.00)	0.00	(0.00)
ε_1	0.61*	(0.04)	0.25*	(0.05)	0.75*	(0.05)	0.95*	(0.04)	0.35*	(0.00)
Adj. R^2	0.74		0.29		0.79		0.93		0.29	
DW	1.81		1.75		1.43		1.51		2.03	

Figures representing the plots of equation, plots and forecast with standard errors included.

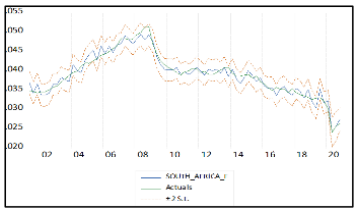

Figure 1: Forecast and actual data for South Africa modelled from equation 10. Data used in calculations obtained from (FRED ECONOMIC DATA, 2021)

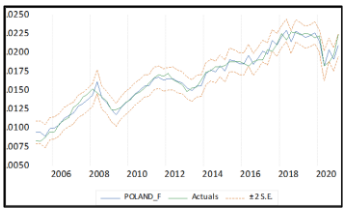

Figure 3: Forecast and actual data for Poland modelled from equation 10, data obtained from (FRED ECONOMIC DATA, 2021a)

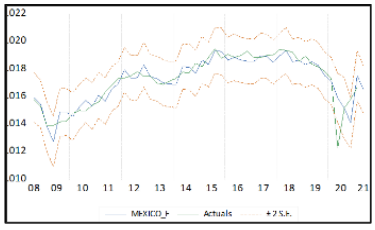

Figure 2: Forecast and actual data for Mexico modelled from equation 10. Data used in calculations obtained from (FRED ECONOMIC DATA, 2021)

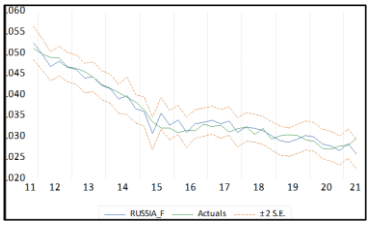

Figure 4: Forecast and actual data for Russia, modelled from equation 11, data obtained from (FRED ECONOMIC DATA, 2021b).

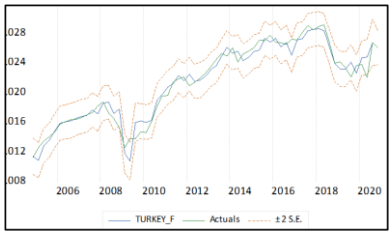

Figure 5: Turkey forecast and actuals modelled from equation 10, data obtained from (FRED ECONOMIC DATA, 2021c)

Financial Stress

We follow Balakrishnan et al. (2011) in our computation of the level of financial stress in the economy and obtain the below results. Importantly we examine the results we obtain by comparing them against the known major periods of financial stress such as the global financial crisis of 2008, the Russian financial crisis of 2014 and the Covid 19 pandemic induced recessions of 2020. This crude analysis confirms that our measure of financial stress is accurate enough to be used for the analysis.

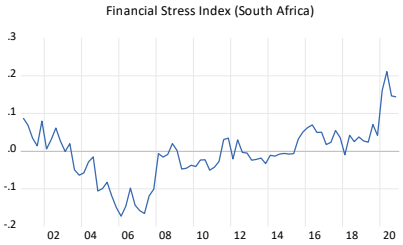

Figure 6: Financial Stress Index South Africa

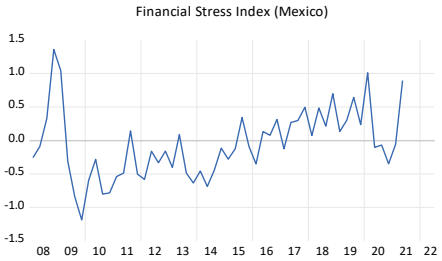

Figure 7: Financial Stress Index Mexico

Figure 8: Financial Stress Index Poland

Figure 9: Financial Stress Index Russia

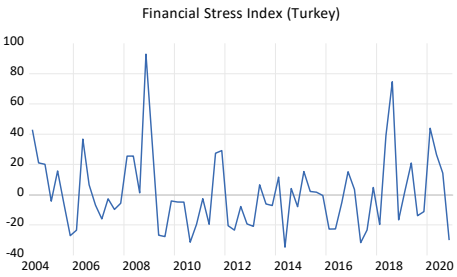

Figure 10: Financial Stress Index (Turkey)

Capacity Utilization

We use the FRED and OECD data bases to obtain the manufacturing capacity utilization numbers. Our analysis is performed in 3 stages, firstly we use the FRED numbers as provided on the data base for the different countries. Secondly we perform a peak to peak analysis of the real GDP figures to obtain our own calculation of the capacity utilization in the economy and finally we use an HP filter on the real GDP to obtain a 3rd calculation of capacity utilization. The manufacturing capacity utilization from the FRED database provides the most consistent results across the countries and is used in our final analysis.

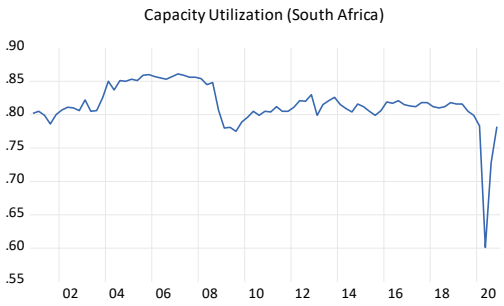

Figure 11: Capacity Utilization

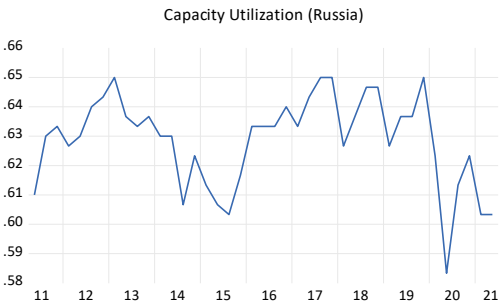

Figure 14: Capacity Utilization Russia

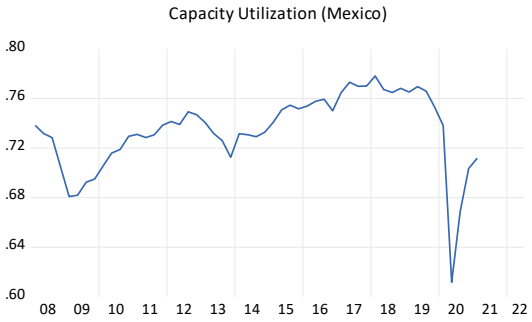

Figure 12: Capacity Utilization Mexico

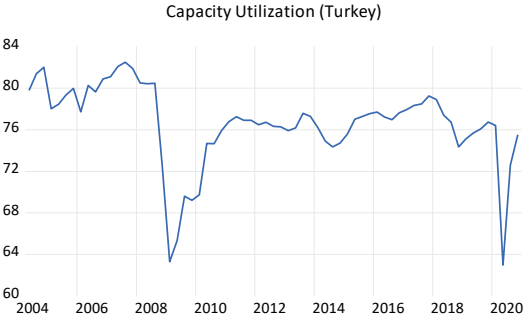

Figure 15: Capacity Utilization Turkey

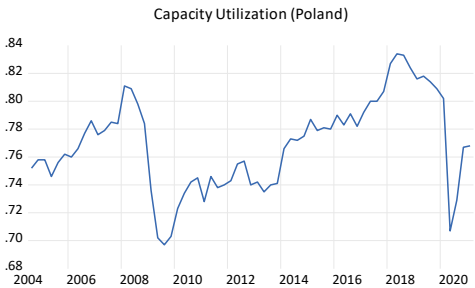

Figure 13: Capacity Utilization Poland

Correlation Matrices for each country for the independent variables

SOUTH AFRICA CORRELATION MATRIX

	CU_t	i_t	Q_t	r_t	FSI_t
$\boldsymbol{CU_t}$	1.00	-0.32	-0.41	0.56	-0.71
$\boldsymbol{i_t}$	-0.32	1.00	-0.15	0.13	0.53
$\boldsymbol{Q_t}$	-0.41	-0.15	1.00	-0.76	0.40
$\boldsymbol{r_t}$	0.56	0.13	-0.76	1.00	-0.65
$\boldsymbol{FSI_t}$	-0.71	0.53	0.40	-0.65	1.00

Table 7: Correlation matrix for South Africa

MEXICO CORRELATION MATRIX

	CU_t	FSI_t	r_t	Q_t	i_t
$\boldsymbol{CU_t}$	1.00	0.26	0.76	0.50	0.27
$\boldsymbol{FSI_t}$	0.26	1.00	0.24	0.25	0.62
$\boldsymbol{r_t}$	0.76	0.24	1.00	0.69	0.05
$\boldsymbol{Q_t}$	0.50	0.25	0.69	1.00	-0.06
$\boldsymbol{i_t}$	0.27	0.62	0.05	-0.06	1.00

Table 8: Correlation matrix for Mexico

POLAND CORRELATION MATRIX

	FSI_t	r_t	Q_t	i_t	CU_t
$\boldsymbol{FSI_t}$	1.00	-0.31	0.03	0.59	-0.44
$\boldsymbol{r_t}$	-0.31	1.00	0.51	-0.84	0.44
$\boldsymbol{Q_t}$	0.03	0.51	1.00	-0.18	0.26
$\boldsymbol{i_t}$	0.59	-0.84	-0.18	1.00	-0.40
$\boldsymbol{CU_t}$	-0.44	0.44	0.26	-0.40	1.00

Table 9: Correlation matrix for Poland

RUSSIA CORRELATION MATRIX

	FSI_t	RSP_t	CU_t	i_t	r_t
$\boldsymbol{FSI_t}$	1.00	-0.18	-0.05	0.10	-0.01
$\boldsymbol{RSP_t}$	-0.18	1.00	-0.13	-0.62	0.06
$\boldsymbol{CU_t}$	-0.05	-0.13	1.00	-0.21	0.24
$\boldsymbol{i_t}$	0.10	-0.62	-0.21	1.00	0.05
$\boldsymbol{r_t}$	-0.01	0.06	0.24	0.05	1.00

Table 10: Correlation matrix for Russia

TURKEY CORRELATION MATRIX

	CU_t	FSI_t	i_t	r_t	Q_t
$\boldsymbol{CU_t}$	1.00	-0.03	0.31	-0.14	-0.14
$\boldsymbol{FSI_t}$	-0.03	1.00	0.27	-0.11	-0.46
$\boldsymbol{i_t}$	0.31	0.27	1.00	-0.88	-0.76
$\boldsymbol{r_t}$	-0.14	-0.11	-0.88	1.00	0.67
$\boldsymbol{Q_t}$	-0.14	-0.46	-0.76	0.67	1.00

Table 11: Correlation matrix for Turkey