ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Master Thesis Financial Economics

How does FED policy change effect the investments of emerging market firms with US dollar debt?

Name student: Kadir Akbaba

Student ID number: 371555

Supervisor: Dr. Daniel Urban

Second assessor: Sebastian Pfeil

Date final version: 26-04-2020

Abstract

This research investigates the reaction of emerging market firms with US dollar debt and without US dollar debt on changes in monetary policy of the Federal Reserve. More specifically this research looks at the reaction of emerging market firm investments on monetary policy change of the Federal Reserve. This research makes use of the balanced panel data and pooled OLS methodology. It turns out that in the post period after monetary tightening emerging market firms with US dollar debt do invest significantly less. But given that emerging market companies already have US dollar debt, the extend of their US dollar debt plays less of a role regarding the reaction of the investments of emerging market firms. Smaller firms are more sensitive to monetary tightening than large firms. An explanation could be that smaller firms do face larger financial constraints and invest therefore less during period of monetary tightening. For emerging market firms without US dollar debt the variable book-to-market ratio is positive and significant and the variable market capitalisation is significant and negative. Thus indicating that growth and market valuation determine the reaction of emerging market firms without US dollar debt on change in monetary policy. The results are thus a little different for emerging market firms with US dollar debt and without US dollar debt. The reported parameters and significance tests are accurate and reliable given that all the assumptions of the regression analysis do hold.

Keywords:

Panel data, Pooled OLS, Emerging market firms, US dollar debt, Federal Reserve.

Table of Contents

List of Tables

List of Figures

1. Introduction

For non-banks the outstanding international US dollar debt has grown from $6 trillion in 2010 to $9.2 trillion in 2014, as estimated by McCauley, McGuire and Sushko (2015). Kofanova and Hatzvi (2015) state that the foreign borrowings of emerging market companies have risen from $0.8 trillion US dollar in 2004 to $3.1 trillion US dollar in 2015. This trend will continuo in the future. This means that emerging market firms will get more and more involved in US dollar debt. This will make emerging market companies more and more vulnerable to policy change of the Federal Reserve, the central bank of the United States.

How monetary policy of the Federal Reserve effects the aggregate economy is widely known and we can read many literature about it. Dueker (1993) notes that supporting the price stability by the Federal Reserve will support the long term economic growth and lower interest rates will be expansionary for the economy of the United States. Ivanova (2016) notes that the quantitative easing program of the Federal Reserve after the financial crises of 2008-2009 lead to an increase in total investments and employment in the economy. There is also already existing literature that is indicating how monetary policy of the central bank will effect the investment of firms. But usually this is measured domestically, for example how the monetary policy of the central bank of Malaysia effects the investments of Malaysian firms, see the paper of Zulkefly (2010). Another example is the paper of Foley-Fisher et al (2016) who research how the monetary extension program of the Federal Reserve effects the stock prices, hiring activities and investments of companies in the United States. But there is no research and knowledge of how the monetary policy of a central bank effects the investments of a foreign firm that has borrowed in the currency of that central bank. Given that the US dollar is a global currency for borrowing and lending activities and given the phenomena described above that US dollar debt of emerging market firms is rising rapidly it is important to research how monetary policy change of the Federal Reserve would effect the investments of companies in emerging markets that borrow in US dollars.

This is also important to research since interest costs on US dollar debt for emerging market firms can be a significant burden for them. Therefore this research aims to answer the research question below.

How does FED policy change effect the investments of emerging market firms with US dollar debt?

The hypothesis to answer this research question are:

Hypothesis 1: Emerging market firms with more US dollar debt dependence will invest less when Federal Reserve tightens monetary policy

Hypothesis 2: In the post period after monetary tightening emerging market firms with US dollar debt do significantly invest less

The first hypothesis is derived from the logic that emerging market firms with more US dollar debt dependence will face higher cost of capital when the Federal Reserve increases interest rates with monetary tightening policy. The second hypothesis is derived from the fact that in the monetary tightening period firms with US dollar debt will logically invest less given higher financial constraints and cost of capital for them. The second hypothesis does not look at the extend of US dollar debt, it looks at emerging market firms that have at least some US dollar debt.

The research results do indicate that the first hypothesis does not hold while the second hypothesis does hold. In other words emerging market firms with more US dollar debt do not invest less when the Federal Reserve tightens the monetary policy with higher interest rates. The factor US dollar debt dependence in the regression is not significant indicating zero effect on investments in the post period after monetary tightening. While the post-period factor, which indicates the period with monetary tightening leads emerging market firms that have some US dollar debt to invest significantly less.

The research question is therefore answered as that the Federal Reserve monetary policy does not effect the investments of emerging market companies based on the extend of their US dollar debt, but the monetary tightening period causes all emerging market firms that have at least some US dollar debt to invest significantly less.

This thesis is ordered as follows. Chapter 2 gives important review of relevant literature for this research. Chapter 3 describes the data and methodology that is used. Chapter 4 describes the output of the research. And chapter 5 gives a clear conclusion.

2. Literature review

Here the theoretical review of the relevant literature is given. First the phenomenon of raising US dollar debt for emerging market firms is described. Than a good description of the Federal Reserve, the central bank of US, and it's monetary policy is given. There follows an empirical review of the effect of monetary policy on the economy and the investments of firms. And finally the main paper of Foley-Fisher that is of interest for this research is described, since this research mimics their research approach for a great part.

2.1 Increasing US dollar debt of emerging market firms

The US dollar is a world currency for borrowing and lending, whether domestically or internationally. The pecking order theory is an important theory of capital structure. The pecking order theory states that internal financing is more important than external financing as mentioned by Myers (1984). When firms do prefer external financing they do prefer debt issues above equity because of lower information costs of debt issues. Gozzi, Levine and Schmukler (2010) find that debt is more important than equity issues for companies as a finance source and note that the issuance in international capital markets is twice larger for developed countries and 18 times larger for emerging market countries compared with domestic issuance. For non-banks the outstanding international US dollar debt has grown from $6 trillion in 2010 to $9.2 trillion in 2014, as estimated by McCauley, McGuire and Sushko (2015). The largest increase in international US dollar debt has been in corporate bonds of emerging market firms. Kofanova and Hatzvi (2015) state that the foreign borrowings of emerging market companies have risen from $0.8 trillion US dollar in 2004 to $3.1 trillion US dollar in 2015. It is important to know what the determinants are for firms to issue US dollar debt.

According to Allayannis, Brown and Klapper (2003) idiosyncratic and common determinants are important for each debt issue in local or foreign currency, making examining debt at disaggregate level important. They find for examples that higher difference in interest rate, given the foreign interest rate is lower, the more firms borrow in foreign currency. Also according to Bruno and Shin (2015) rising US dollar debt by emerging market firms have attributes of US dollar carry trade. This means that financing conditions are important for emerging market firms to issue US dollar debt. The meaning of a carry trade is a cross currency position in order to benefit from interest rate difference between two currencies and low volatility in the exchange rate of the relevant currencies. Borrowing cheap and lending or investing at a higher rate. The carry trade seems to be only making profits when interest rate differential advantage is not overshadowed by exchange rate movements. In other words the uncovered interest parity must hold in the long term.

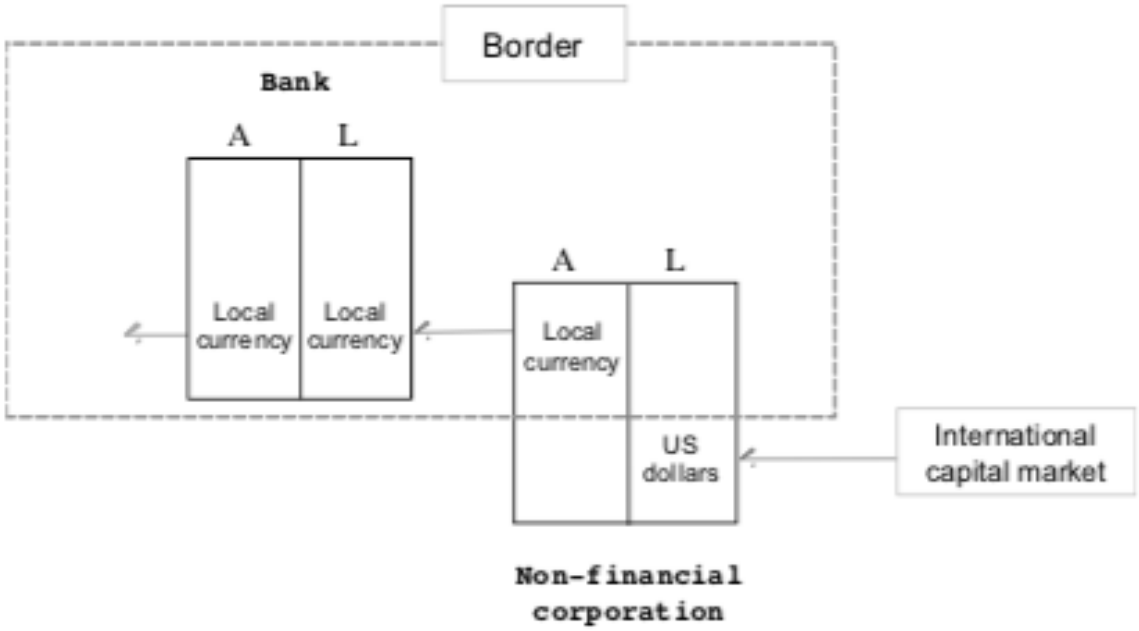


Figure 1: How does a non-financial corporation use international capital markets, Chung et al (2015).

Shin (2013) states that there is now an active bond issuance of companies.

There is a shift to the bond market from financial intermediation by banks. Companies now increase direct borrowing overseas due to more easy financing conditions as stated by Turner (2014). Most often the firm has financing vehicles abroad where overseas subsidiaries are used as financing vehicles of the firm. Almost half of US debt issued by emerging market non-financial companies are issued by finance vehicles, which are the offshore affiliates, as noted by Chui et al (2014). The funds are transferred to the headquarter in the home country when the offshore subsidiary issues bonds at global capital markets. This process might be an important factor why carry trade is important for emerging market firms when raising US dollar debt. Raise US dollar debt when dollar interest rate is lower and home country interest rate is higher, in other words when the interest rate differential this way is larger.

Another determinant for emerging market companies to borrow US dollar debt is a large cash stock as noted by Bruno and Shin (2015). According to the pecking order theory companies only switch to external financing when there are no sufficient internal cash sources as noted by Myers and Majluf (1984). This explains that borrowing US dollar is not associated with direct cash needs. This finding is contradicting the pecking order theory. Bruno and Shin (2015) also note that emerging market companies do increase US dollar debt when there is a high Sharpe ratio for the dollar carry trade. The interest rate difference is high and the volatility of the exchange rate is low. Thus the companies are not motivated by real opportunities but by financial risk taking.

There are also other factors that play a role for emerging market firms to issue US dollar denominated debt. Firm size is important, since larger companies tend to have better access to international capital markets. Macroeconomic conditions of the home country can also be important, like GDP growth and inflation. Also large export firms to US have incentive to borrow in US dollars in order to naturally hedge their foreign exchange risk exposure. Kofanova and Hatzvi (2015) mention that gross domestic product growth of developing countries and foreign currency hedging for large exporters explains much of US dollar debt increase of emerging market firms.

All in all we see that there is a dominant trend in the increase of US dollar debt of emerging market firms. And that there are several factors at play regarding this trend. It is expected that emerging market companies will even issue more US dollar debt in the future and that the US dollar debt dependence of emerging market companies will increase.

2.2 Federal Reserve

The central bank of the United States is called the Federal Reserve, or simply FED. A central bank operates to bring forth a strong economy which is in public interest. The main goals of the Federal Reserve is to establish stabilised prices and employment maximisation. It also monitors the financial system and financial institutions in the United States to guarantee a healthy financial system and minimise systematic risk. The Federal Reserve has besides this the task to foster the efficiency and safety of the settlement of the payment system. A central bank does serve the public interest. The policy decisions of the Federal Reserve are made independent from the president and the congress. The Board of Governors, The Federal Reserve Banks, and the Federal Open Market Committee do collaborate with each other to build a strong and healthy economy and financial system for the United States. The Board of Governors governs the Federal Reserve. The Federal Reserve banks are the operating subsidiaries of the Federal Reserve. A geographic area is assigned to each Federal Reserve bank. The monetary policy of the Federal Reserve is set by the Federal Open Market Committee. The fund rate, the size of Federal Reserve asset holdings and indicating to the public regarding the policy of the Federal Reserve of the future are influenced by the Federal Open Market Committee which can change the national monetary policy.

There are two channels that matter for the transmission of monetary policy to firm investments. These are the interest rate channels and the broad credit channel as noted by Chatelain et al (2006). Cost of capital changes when interest rate of Federal Reserve changes.

In the economy this will effect investments, this is the interest rate channel. The broad credit channel refers to the fact that different companies will be effected differently by changes in the Federal Reserve rates. When looking at the relative importance of both channels, the interest rate channel will dominate. Chatelain et al (2006) note that the interest rate channel is the main transmission channel of monetary policy on firm investments, but the broad credit channel can also play a role. Zulkefly (2010) notes for example that small firms are more sensitive to monetary tightening compared to large firms because they have larger financial constraints.

The Federal Reserve established monetary easing since the recent financial crises. The interest rates were lowered when facing economic contraction in the United States. The interest rates were almost reduced to 0%. Quantitative easing and supporting the real economy was the main motivation of the federal Reserve. The low interest rate is maintained by the Federal Reserve many years after the financial crises of 2008 and 2009. See below the graph of interest rates of the Federal Reserve during the relevant period for this research.

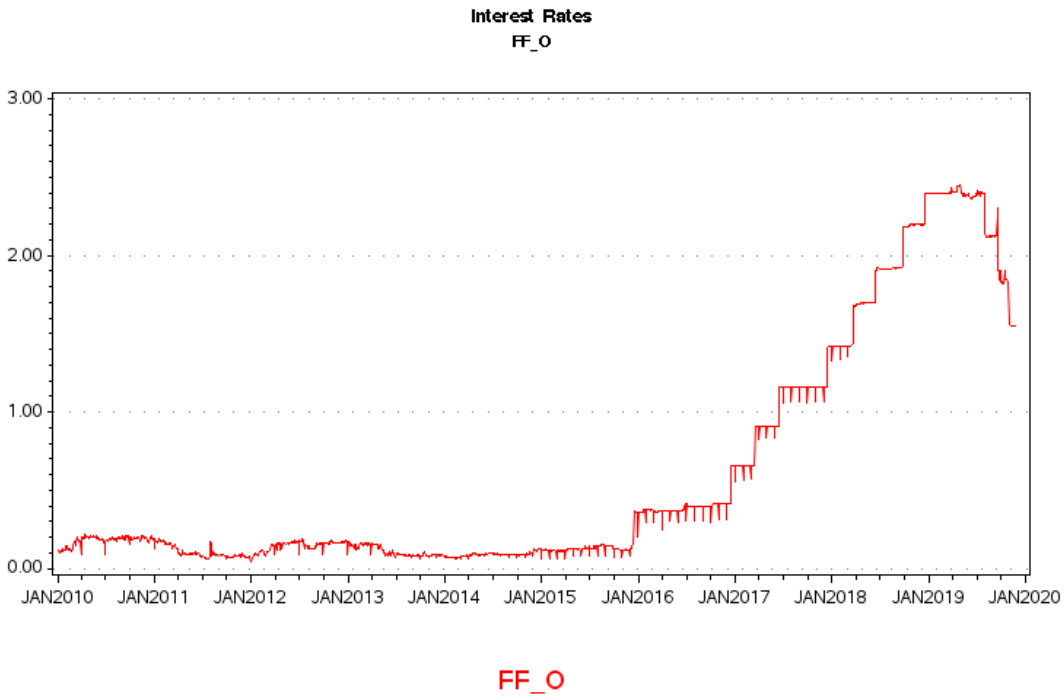


Figure 2: Federal Reserve interest rates for the period 2010 to 2020

The low interest rates that the Federal Reserve established was supportive for the economy. It is indicated that the economic performance has been improving by the information received from Federal Open Market Committee since the meeting in October 2015. Consumption and investments components of the GDP have been rising at robust rates since the last period. The housing sector performance was also good. Inflation rate is still below the target rate of 2%, but expected to increase close to 2% in the near future. The goal of the the Federal Open Market Committee is to establish maximum employment. Since the conditions at the labor market are robust the Federal Reserve announced in December 2015 that it will increase the interest rates to 0,25% to 0,50% level. The Federal Reserve expects per December 2015 more rate hikes in the future given the expected economic progress. Monetary policy will tighten more to avoid overheating of the the economy if the economy continuous this expansionary path. However the actual path of the Federal Reserve will depend on economic expectations derived from new incoming data in the future. In graph 2 above we see that the Federal Reserve did continuo with monetary tightening, indicating further economic expansion.

2.3 Effect of Monetary Policy on the Economy

Monetary policy surely has an impact on the gross domestic product of a country. The central bank changes it's monetary policy to effect the economy. The central banks of countries do have the responsibility to create and maintain a sustainable economy and financial system. An easy monetary stance with low interest rates will support the economy. While a tight monetary stance with high interest rates will put a frame on the economic expansion of a country. Higher interest rates will also lower the inflation rate. The economy of a country can be damaged by high inflation rates as states by Min (2006). The economic uncertainty in a country will be effected negatively by high rates of inflation, which affects output negatively as indicated by Lucas (1973).

Kremer et al (2008) note that inflation will effect the economy negatively when it exceeds the 2% level for developed countries and when it exceeds 12% for developing countries. However some economists state that monetary policy alone is not sufficient to reach the economic goals for a country, it should at least be supported by fiscal policy as mentioned by Hanif and Arby (2003). Therefore it is better to say that monetary policy of a central bank puts direction and tendency in the economy. When combined with other government incentives for the economy the effect should be maximised. This way a country can move closer to it's economic goals. Let's now look at the monetary policy transmission mechanisms for the inflation and gross domestic product. Financial market prices of exchange rates, bond yield, interest rates is one monetary transmission channel via which the monetary transmission mechanism happens. When the central bank reduces for example the interest rate, the exchange rates will decrease and this will enhance the net exports of the country. The real investments and consumption will also change with a changing interest rate. Investing in plant, property and equipment or buying real estate for example will be influenced by the interest rate.

2.4 Effect of Monetary Policy on Firm Investments

Now we will take a look how the balance sheet of a company is effected by monetary policy change of the central bank. Investments are of particular importance. Monetary policy change effect companies balance sheet mostly by the interest rate channel and also the credit channel can play a role. The effect of monetary policy change on firms balance sheet characteristic happens in Japan mainly through the interest rate channel as noted by Nagahata and Sekine (2005). Agung (2000) uses in Indonesia the Euler equation investment model and finds support for the credit channel of monetary transmission because firms face in Indonesia financial constraints in raising external funds. Financial structures of a company, size of the firm and credit frictions are therefore the three factors that determine the response of investments to monetary policy in Indonesia. Under firm financial constraints the effect of monetary policy on firm investments is heterogeneous.

This can easily be observed by looking at the effect of monetary policy on large firms and small firms. Zulkefly (2010) notes that small firms have more financial constraints and therefore the effect of monetary policy on small firms is larger. So the credit channel is more at play for smaller companies in case of a monetary policy change.

The effect of monetary policy on firms investments is thus mostly via the interest rate and broad credit channels. The broad credit channel is also called the balance sheet channel. In other words the user cost of capital and financial constraints of a firm do shape the investment reaction on monetary policy change of that firm. The user cost of capital plays a large and significant role in influencing the firm investment. Therefore the monetary authorities will have a bigger effect on firm investments by focussing on the interest rate channel. Secondly, monetary policy is more effective for firms that face tighter financial constraints, in particular small firms. Therefore it is also suggested for monetary authorities to look at the micro economic conditions of a firm in formulating their monetary policy.

2.5 The impact of unconventional monetary policy on firm financing constraints, Foley-Fisher et al (2015).

This is the main paper where this research setup is based on. The effect on financial constraints of monetary policy change is researched by the paper of Foley-Fisher et al (2015). Quantitative easing and large asset repurchases were implemented by the Federal Reserve and central banks internationally to help the economy after the 2008-2009 crises. The authors here want to understand how the financial constraint is effected by monetary policy change. They look at the maturity extension program (MEP), that is announced on September 21, 2011. In this case more credit availability and lower interest rates would relieve financial constraints on firms.

Hiring activities, stock prices and investments are all effected due to the monetary extension program as reported by Foley-Fisher et al (2015). All of them do increase during this monetary easing program. Foley-Fisher et al (2015) note that the impact is the strongest for firms more relying on long term debt. Because the monetary extension program reduces primarily the cost of long term debt. Foley-Fisher et al (2015) do use the difference-in-difference methodology to examine the effect of the monetary extension program on companies. They do this by using balanced panel data and use a multiple regression with interaction term, which is a dummy variable multiplied by factor that represents a firm characteristic. They also include firm fixed effects and industry fixed effects.

This research tries to mimic the research setup of Foley-Fisher (2015). This research is also like their paper based on panel data while using the difference-in-difference methodology. This means that this research also uses the interaction terms in the multiple regression analysis, the dummy variable multiplied by factor that represents a firms balance sheet characteristic. Dummy variable equals one in the post-period and zero in the pre-period. Firm fixed effects and industry fixed effects are also included in the regression. Of course the difference is that this research focus on emerging market firms with US dollar debt. Also for comparison firms without US dollar debt are included in this research.

3. Data and Methodology

In this part the research of monetary policy effect of the Federal Reserve on the investments of emerging market firms in international context will be conducted. The main aim is to get insight into how the investments of emerging market firms with US dollar debt are affected by change in monetary policy of the Federal Reserve, the central bank of the United States. This is also compared with effect on investments of emerging market firms without US dollar debt.

Data

This research aims to use multiple regression analysis to test the effect of several firm specific characteristics on the investments of the firms during period of monetary policy change of the Federal Reserve. The research makes use of panel data that contain cross sectional and time series data. The data consists of 125 firms and 7 years. The dataset consists of 125 firms because it is not very easy to find emerging market firms with visible US dollar debt dependence. With great effort 125 emerging market firms are found internationally that have enough in US dollar debt dependence. And also data for 100 emerging market firms without US dollar debt is collected. The firms are emerging market firms in international context, from countries like China, India, Russia, Brazil, Mexico, Turkey, South Africa, South Korea, Saudi Arabia, United Arab Emirates, Kuwait, Argentine, Malaysia, Indonesia, Nigeria and Columbia. The research is conducted during the period 2013 until 2018.

The data is collected from databases Orbis and Thompson Reuters Eikon. This research uses annual data. Orbis is used to get firm balance sheet data denoted in dollars. While Thompson Reuters Eikon is used to download data to compute the U.S. dollar debt of the relevant companies.

The data of dollar debt issuances of emerging market firms is dowloaded from Thompson Reuters Eikon and from there the U.S. dollar debt amount of the firm for each year is calculated. Therefore for emerging market firms without US dollar debt only Orbis is used. By calculating the U.S. dollar debt amount for each year we take into consideration the debt issuance year and maturity year of the debt. Also sometimes there are duplicates of the U.S. dollar debt issuances in Thompson Reuters Eikon which are corrected for in this research to get U.S. dollar debt as accurate as possible and to avoid duplicates.

The dependent variable is plant, property and equipment normalised by total assets. The explanatory variables are cash stock, US dollar debt, total debt, net income, market capitalisation, total assets, book-to-market ratio and Q for emerging market firm with US dollar debt. For emerging market firms without US dollar debt the factor US dollar debt is missing. The variables cash stock, total debt and net income are normalised by total assets. The variable U.S. dollar debt is normalised by total debt. The variables total assets and market capitalisation are denoted in billions. The variable plant, property and equipment normalised by total assets. The variable total assets is a proxy for size. The variable U.S. dollar debt normalised by total debt is a proxy for U.S. dollar debt dependence of the firm. The variable total debt normalised by total assets is a proxy for debt dependence of the firm. The variable total assets is a proxy for firm size and the variable market capitalisation is a proxy for firm valuation. The variable net income normalised by total assets is a proxy for return on assets of the firm. The variable cash stock normalised by total assets is a proxy of cash stock of the company. Tobin's Q is a proxy for a firms investment opportunity. And book-to-market ratio is a proxy for firm growth. Here are the summary statistics of the relevant variables reported.

Table 1: Summary statistics emerging market firms with US dollar debt

Variable	Obs	Mean	Std. Dev.	Min	Max
PPE	748	-.0056	0.0614	-0.4633	0.1455
Dollar Debt	748	0.0145	0.0850	-0.3037	0.4352
Total Debt	748	0.0051	0.0452	-0.1316	0.1944
Total Assets	748	6.0619	26.5682	-24.349	223.77
Cash Stock	748	6.0619	26.5682	-24.349	223.77
Net Income	748	-0.0031	0.0317	-0.1589	0.1027
MarketCap	748	0.4688	13.3039	-46.7244	76.1576
BM	748	0.0672	0.3592	-1.1637	1.5790
Q	748	-0.0387	0.5369	-2.6745	2.1422

The variables are normalised. This research uses the method of first differences of the variables. The data is also winsorised to remove extreme outliers from the dataset. Both the reported summary statistics is based on this transformed data.

Table 2: Summary statistics emerging market firms without US dollar debt

Variable	Obs	Mean	Std. Dev.	Min	Max
PPE	600	-0.0044	0.1486	-1.05	0.65
Total Debt	600	0.0047	0.0047	-0.95	0.69
Total Assets	600	0.0103	0.0103	-8.23	4.60
Cash Stock	600	0.0227	0.0227	-4.07	4.95
Net Income	600	-0.0054	-0.0054	-0.35	0.37
MarketCap	600	0.0332	0.0332	-13.49	12.71
BM	600	0.0687	0.0687	-3.86	4
Q	600	0.0060	0.0060	-2.31	1.93

Methodology

The study is based on balanced panel data. In other words each cross sectional entity have data for the same years over the whole sample. The research makes use of pooled ordinary least squares for statistical analysis. First differences of the variables are taken. Data is obtained from 2012 to 2018. Due to the process of first differencing the year 2012 data is lost and the research is conducted over the period 2013 to 2018. The statistical software used to analyse the data is Stata. In Stata the simple regression analysis is used to gain the research output. Also the option diagnostics, scatterplot and histogram is used in Stata to check whether the assumptions with respect to the residuals of the regression output do hold.

The multiple pooled OLS regression model is as follows:

$$PPE = a + b_1(DollarDebt) + b_2(TotalDebt) + b_3(TotalAssets) + b_4(CashStock) + b_5(NetIncome) + b_6(MarketCap) + b_7(Book\text{-}to\text{-}Market) + b_8(Q) + b_9D(DollarDebt) + b_{10}D(TotalAssets) + b_{11}D(CashStock) + b_{12}D(NetIncome) + b_{13}D(MarketCap) + b_{14}D(Book\text{-}to\text{-}Market) + b_{15}D(Q) + b_{16}ID + b_{17}Postperiod + b_{18}Industry + e$$

The equation above is for emerging market firms with US dollar debt. For emerging market firms without US dollar debt drop the variable Dollar Debt from the regression model. There are two periods in this research. The pre-treatment period and the post-treatment period. The whole period is between 2013 and 2018. The Federal Reserve announced in December 2015 that it will raise the interest rates. The pre-period lasts from 2013 to 2015 and the treatment and post-period lasts from 2016 to 2018. The effect of the explanatory variables in the post-period are calculated in the regression analysis by using dummy variables. These dummy variables do interact with the explanatory variables data from 2016 to 2018. By looking at the post-period effects we get the difference-in-difference results. ID variable indicates firm fixed effects, post period indicate (post)period fixed effects and Industry indicates industry fixed effects. ID variables just gives each firm an ID number.

Period fixed effects takes value of 1 during the years of 2016, 2017, 2018 and zero otherwise. Industry fixed effects do classify firms in industries by using the first two digits of SIC code. The SIC code is a four digit code that classifies industries used by the United States Security and Exchange Commission (Marozzi, 2013). The first two digits of the SIC code do indicate the major industry group (Marozzi, 2013).

Data is winsorised at 1% level to remove peak outliers and the error terms are clustered robust standard error terms. Top 1% peak outliers are thus removed from the dataset for each variable. After correcting and transforming the dataset this way, the regression with the option clustered standard robust errors is run in Stata. The results of the regression analysis are checked for Pooled OLS assumptions using first differences.

According to Wooldridge (2016) the pooled OLS assumptions are:

- We have a random sample from the cross section
- The independent variables do change and there is no perfect collinearity
- The expected value of the residuals over time is zero
- The differenced error terms do have homoskedastic variance
- No serial correlation in the differences of the error terms
- The error terms are normally distributed

When these assumptions do hold it means that the output of the regression analysis are reliable and consistent. Also the significant tests can be trusted when these assumptions do hold.

4. Results

In this chapter the results of this research are reported. The results of emerging market firms with US dollar debt and without US dollar debt are reported. Also a check for the reliability and significance of the results obtained is performed.

4.1 Emerging market firms with US dollar debt

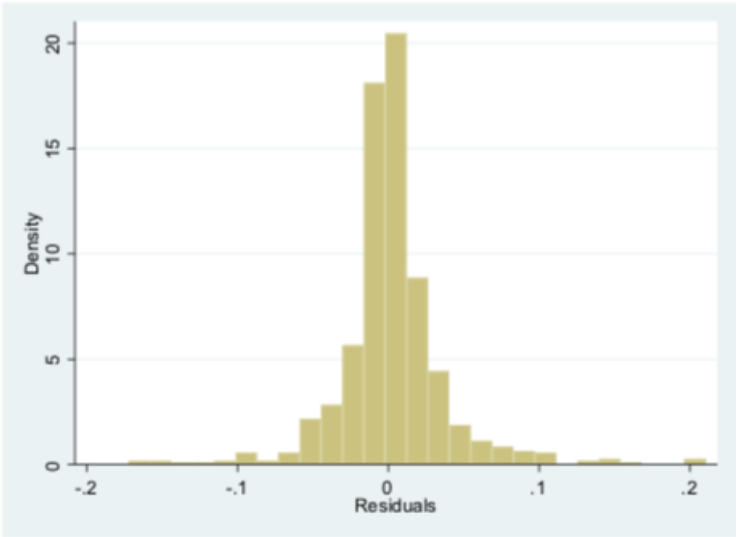
Table 3: Regression output

PPE	Coef.	Robust Std. Err.	T	P > |t|
Dollar Debt	-0.0297	0.0311	-0.95	0.34
Total Assets	0.0372	0.8812	0.42	0.95
Cash Stock	0	0	0	0
Net Income	0	0	0.84	0.40
Market Cap	0.0753	0.0893	0.82	0.42
BM	-0.0062	0.0053	-1.16	0.25
Q	0.0012	0.0053	0.22	0.83
Postperiod	-0.0089	0.0038	-2.38	0.02
MT Dollar Debt	0.0472	0.0559	0.84	0.40
MT Total Debt	0.0087	0.1370	0.06	0.95
MT Total Assets	0.0004	0.0002	2.42	0.02
MT Cash Stock	-0.0167	0.1076	-0.16	0.88
MT Market Cap	0	0.0002	0.22	0.83
MT Net Income	-0.0129	0.1377	-0.92	0.36
MT BM	0.0062	0.0070	0.89	0.37
MT Q	-0.0130	0.0081	-1.60	0.11

This regression is based on 748 observations. The R-square of this regression output equals 0.6832. The proportion of variance in the dependent variable that is explained by the explanatory variables is explained by the R-square measure.

The dependent variable is plant, property and equipment. The main independent variables is Dollar Debt and it's interaction term with the dummy MT. The others interaction variables are control variables. This regression includes firm fixed effects, period fixed effects and industry fixed effects. The dummy variable MT indicates the period of monetary tightening. During the pre-period there is no explanatory variable that is significant. We see that firms significantly invest less during the post-period of monetary tightening. Larger firms significantly invest more during the monetary tightening period. This can be explained by the fact that smaller firms are more sensitive to monetary tightening as indicated by Zulkefly (2010), compared to large firms. Smaller firms are more vulnerable to higher cost of capital than larger firms. Also smaller firms are more negatively influenced by the broad credit channel in case of monetary tightening compared to larger firms, this because smaller firms do face tighter financial constraints compared with large firms. In the post period when the interest rates are higher due to monetary tightening of the Federal Reserve larger firms can therefore significantly invest more relative to smaller firms. Smaller firms are vulnerable for more tight financial constraints and high cost of capital. This makes the coefficient of Total Assets factor that is a proxy for firm size in this regression analysis positive and significant at 5% significance level during the period of monetary tightening. Here the assumption checks of a pooled OLS based on first differencing are reported. If they hold than the research output is qualitative.

Figure 3: Distribution of the residuals



Here we can see that the residuals are approximately normally distributed.

Figure 4: Scatterplot of the residuals

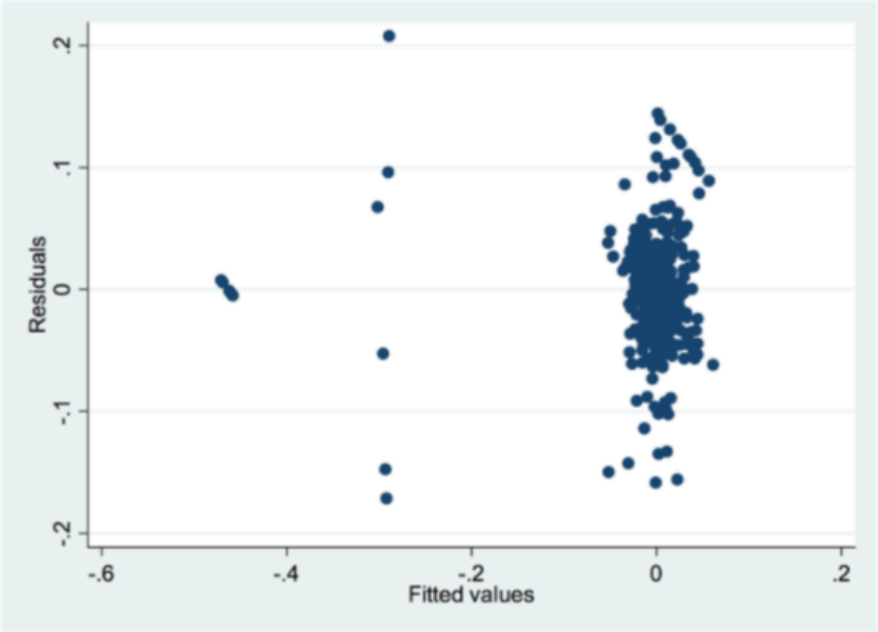


Table 4: Correlation between the variables

	PPE	Dollar Debt	Total Debt	Total Assets	Cash Stock	Net Income	Market Cap	BM	Q
PPE	1								
Dollar Debt	0.0068	1							
Total Debt	0.0436	-0.1188	1						
Total Assets	0.0162	-0.0883	-0.0089	1					
Cash Stock	0.0162	-0.0883	-0.0089	1	1				
Net Income	-0.0053	-0.0355	-0.2756	0.0387	0.0387	1			
MarketCap	0.0194	-0.0739	-0.0591	0.2282	0.2282	0.1078	1		
BM	-0.0044	-0.0062	-0.0526	-0.0316	-0.0316	-0.0969	-0.2646	1	
Q	-0.0206	-0.1323	0.0593	0.0899	0.0899	0.0807	0.4284	-0.22	1

We see here that the expected value of the residuals is zero. We see here the correlation between each variable is less than 0.8. Thus there is no perfect collinearity nor strong multicollinearity between the variables. Furthermore the tests in Stata also indicate no heteroskedasticity nor serial correlation of the residuals. The residuals are thus homoskedastic. All the assumptions of a pooled OLS with first differenced data holds this way. This makes the coefficients and reported statistical significance levels reliable and accurate.

4.2 Emerging market firms without US dollar debt

Table 5: Regression output

PPE	Coef.	Robust Std. Err.	T	P > |t|
Total Assets	-0.0015	0.0032	-0.48	0.6340
Total Debt	0.0651	0.0939	0.69	0.4900
Cash	0.01638	0.0248	0.66	0.5110
Net Income	-0.0973	0.1371	-0.71	0.4790
Q	0.0083	0.0083	0.84	0.4020
Market Cap	0.0004	0.0007	0.60	0.5510
BM	-0.0245	-0.0245	-1.78	0.0780
Postperiod	-0.0134	0.0203	-0.66	0.5120
MT Total Debt	0.0520	0.0520	0.26	0.7980
MT Total Assets	0.0104	0.0077	1.34	0.1840
MT Cash Stock	0.0240	0.0433	0.55	0.5810
MT Market Cap	-0.0028	0.0016	-1.67	0.0980
MT Net Income	-0.0191	0.1762	-0.11	0.9140
MT BM	0.0217	0.0120	1.81	0.0730
MT Q	0.0109	0.0214	0.51	0.6110

This regression is based on 600 observations. The R-square of this regression output equals 0.1959. The proportion of variance in the dependent variable that is explained by the explanatory variables is determined by the R-square measure. This regression analysis is about emerging market firms without US dollar debt. The dependent variable is plant, property and equipment, which is a proxy for firm investments. The main independent variable of the regression of emerging market firms with US dollar debt is now missing, that is the variable US dollar debt. In this regression the independent variables are Total Assets, Total Debt, Cash, Net Income, Q, Market capitalisation, BM and post period. This regression includes firm fixed effects, period fixed effects and industry fixed effects.

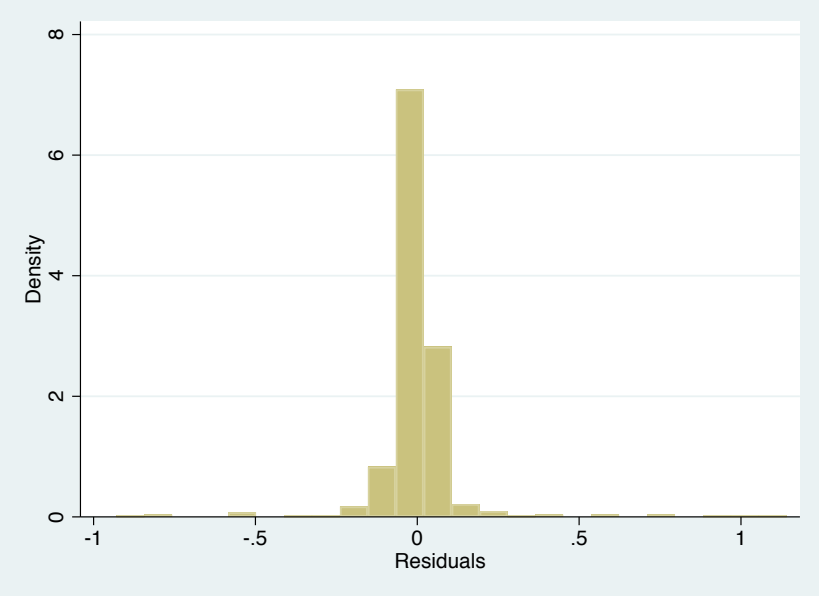
The dummy variable Post period indicates the period of monetary tightening. In the pre period the variable BM is negative and significant at the 10% level. During the post period the variable Market Capitalisation is negative and the variable BM is positive and significant at the 10% level. No rational explanation why this pattern is seen.

The conclusion from this regression is that firms that have less growth, in other words a higher book-to-market ratio do invest less during the pre period before monetary tightening. During the period of monetary tightening firms that have less growth, in other words a higher book-to-market ratio, do invest more. It remains a puzzle why this is the case. Also during the period of monetary tightening a higher market capitalisation means less investments. This can be related to book-to-market ratio, more growth firms are valued also more on the stock market. We have already seen that more growth means less investments during the period of monetary tightening. Therefore the negative effect of higher market capitalisation on investments during monetary tightening is related to this phenomenon and also can not be explained by rationality. One would expect the opposite to happen.

The difference of the regression analysis of emerging market firms with US dollar debt compared with emerging market firms without US dollar debt is that for emerging market firms with US dollar debt non of the variables are significant in the pre period. But in the post period the period fixed effect and size are significant, where period fixed effect is negative and size is positive. While for emerging market firms without US dollar debt the variable book-to-market ratio is significantly negative in the pre period and positive in the post period and in addition the variable market capitalisation is negative and significant in the post period.This relative analysis is an additional confirmation that indeed emerging market firms with US dollar debt do invest significantly less during period of higher interest rates compared to emerging market firms without US dollar debt, indicated by negative post period fixed effect for emerging market firms with US dollar debt.

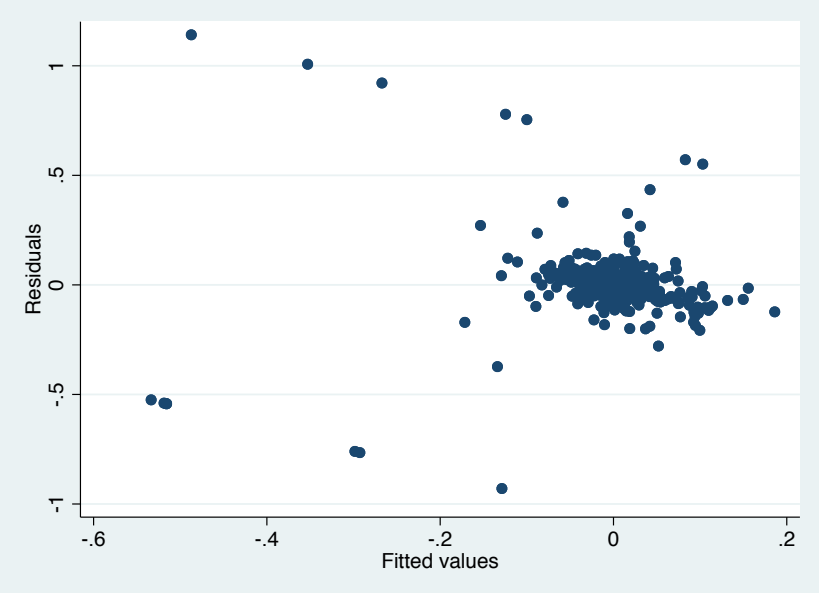
Here the assumption checks of a pooled OLS based on first differencing are reported. If they hold than the research output is qualitative.

Figure 5: Distribution of the residuals



Here we can see that the residuals are approximately normally distributed.

Figure 6: Scatterplot of the residuals



Here we see that the expected value of the residuals is close to zero.

Table 6: Correlation between the variables

	PPE	Totalassets	Totaldebt	Cashstock	NetIncome	Q	BM	Marketcap
PPE	1							
Totalassets	0.0534	1						
Totaldebt	0.0534	-0.1074	1					
CashStock	0.0867	-0.0072	0.0035	1				
NetIncome	-0.0704	0.0409	-0.1733	0.0276	1			
Q	0.0517	-0.0796	0.1718	-0.0293	-0.0355	1		
BM	-0.0889	0.0442	-0.2363	-0.0048	0.0795	-0.2573	1	
Mtcap	-0.0122	0.0624	0.0705	-0.0287	-0.0454	0.0339	0.0287	1

We see here the correlation between each variable is less than 0.8. Thus there is no perfect collinearity nor strong multicollinearity between the variables. Furthermore the tests in Stata also indicate no heteroskedasticity nor serial correlation of the residuals. The residuals are thus homoskedastic. All the assumptions of a pooled OLS with first differenced data holds this way. This makes the coefficients and reported statistical significance levels reliable and accurate.

5. Conclusion

The research question is: How does FED policy change effect the investments of emerging market firms with US dollar debt?

The hypothesis used to answer the research question are:

Hypothesis 1: Emerging market firms with more US dollar debt dependence will invest less when Federal Reserve tightens monetary policy

Hypothesis 2: In the post period after monetary tightening emerging market firms with US dollar debt do significantly invest less

It is a trend that emerging market firms are more and more exposed to US dollar debt. This means that emerging market firms are becoming more and more exposed to the policy of the Federal Reserve, the central bank of the United States. It is important to know how the change in monetary policy of the Federal Reserve will effect emerging market firms economic activities.

This research aims to understand how the change in monetary policy of the Federal Reserve will effect the investments of emerging market firms. The research is conducted by using balanced panel data and using pooled OLS statistical approach in order to see how a change in monetary policy of the Federal Reserve effects emerging market firms investments. The assumptions of first differenced pooled OLS approach are also checked.

It is concluded that during the post period emerging market firms with US dollar debt significantly invest less compared with the pre period before monetary tightening. But the factor US dollar debt is insignificant, indicating the the extend of US dollar debt for emerging market firms have no effect on investments. Also small sized firms significantly invest less in the post period after monetary tightening of the Federal Reserve compared with large firms.

Small sized firms are thus more sensitive to monetary tightening than large firms, this can be explained by the fact that small firms have more financial constraint than large firms. In addition the results are also compared to emerging market firms with no US dollar debt. Emerging market firms with no US dollar debt at all do not significantly invest less after monetary tightening announcement is made at the end of 2015. However, in contrast to emerging market firms with US dollar debt, they are sensitive to book-to-market ratio and market capitalisation during the post period, which are proxies for market valuation and firm growth. This can not be explained in rational sense. The results are thus different. There is constant variance of the error terms, expected value of the error term is zero, the error terms are normally distributed and there is no perfect collinearity nor strong multicollinearity among the explanatory variables for both regression analysis.

In this research the research question is answered by using pooled OLS statistical approach. A suggestion for future research is to use also other statistical approaches for panel data to answer the research question. For example the advanced panel data methods like the fixed effect estimation or random effect methods can be a good alternative. Also separating the sample of emerging market firms with US dollar debt into small and large sized companies can be helpful to gain more insight about the reaction of emerging market firm investments of different size to monetary policy change of the Federal Reserve. Of course this can also be done for other firm characteristics.

References

Agung, J. (2000). Financial Constraint, firms' investments and the channel of monetary policy in Indonesia. *Applied Economics, 32*(13), 1637-1646.

Allayannis, G., Brown, G., and Klapper, L. (2003). Capital Structure and Financial Risk: Evidence from Foreign Debt Use in East Asia. *The Journal of Finance, 58(*4*),* 1445-1468.

Avdjiev, S., Chui, M., and Shin, H. (2014). Non-Financial Corporations from Emerging Market Economies and Capital Flows. *BIS Quarterly Review, 11,* 67-77.

Bruno, V., and Shin, H. (2015). Capital flows and the risk-taking channel of monetary policy. *Journal of Monetary Economics, 71,* 119-132.

Chatelian, J., Generale, A., Vermeulen, P., Ehrmann, M., Martinez-Pages, J., and Worms, A. (2006). Monetary policy transmission in the euro area: New evidence from micro data on firms and banks. *Journal of the European Economic Association, 1*(2), 731-742.

Chung, K., Park, H., and Shin, S. (2015). Mitigating systemic spillovers from currency hedging. *National Institute Economic Review, 221(*1), 44-56.

Dueker, M. (1993). Can nominal GDP targeting rules stabilise the economy? Review, *The Federal Reserve Bank of St. Louis, May.*

Foley-Fisher, N., Ramcharan, R., and Yu, E. (2016). The impact of unconventional monetary policy on firms financing constraints: Evidence from the maturity extension program. *Journal of Financial Economics. 122,* 409-429.

Gozzi, J., Levine, R., and Schmukler, S. (2009). Patterns of International Capital Raisings. *Journal of International Economics, 80(*1), 45-57.

Hanif, M., and Arby, M. (2003). Monetary and Fiscal Policy Coordination. *The Journal of National Institute of Management.* 41-72.

Ivanova, M. (2016). Quantitative Easing: A Postmortem. *Cambridge Journal of Economics, 27,* 575-584.

Kremer, S. (2008). *Inflation and Growth: New Evidence From a Panel Threshold Analysis. Department of Money and Macroeconomics,* Goethe University Frankfurt.

Kofanova, S., and Hatzvi, E. (2015). US dollar Debt of Emerging Market Firms. *RBA Bulletin, Reserve bank of Australia. Sydney.* 49-58.

Lucas, R. (1973). Some International Evidence on Output-Inflation Tradeoffs. *The American Economic Review, 63*(3), 326-334.

Marozzi, M. (2013). A method to address the effectiveness of the SIC code for selecting comparable firms. *Applied Journal of Applied Statistical Analysis, 6(2),* 186-201.

McCauley, R., McGuire, P., and Sushko, V. (2015). Dollar Credit to Emerging Market Economies. *BIS Quarterly Review, 15,* 27-41.

Min, L. (2006). *Inflation and Economic Growth: Threshold Effect and Transmission Mechanisms.* Department of Economics, University of Alberta.

Myers, S. (1984). The Capital Structure Puzzle. *The Journal of Finance, 39(*3*),* 574-592.

Myers, S., and Majluf, N. (1984). Corporate Financing and Investment Decisions When Firms Have Information The Investors Do Not Have. *NBER Working Paper Series.*

Nagahata, T., and Sekine, T. (2005). Firm investment, monetary transmission and balance-sheet problems in Japan: an investigation using macro data. *Japan and the World Economy, 17*(3), 345-369.

Turner, G. (2014). *Is Global Collapse Imminent? An updated Comparison of The Limits to Growth with Historical Data.* Melbourne Sustainable Society Institute, University of Melbourne.

Wooldridge, J. (2016). *Introductory Econometrics: A Modern Approach.* Cengage Learning.

Zulkefly, A. (2010). *Monetary policy and firms investment: Dynamic panel data evidence from Malaysia.* University of Munich.