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United States Monetary Policy as a Determinant of Capital Flows to Emerging Market Economies: A Study on Portfolio Investment to the BRICS Countries

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By

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Abstract

Following the global financial crisis in 2008, the Federal Reserve implemented unconventional monetary policy through near-zero interest rates and quantitative easing. This unprecedented policy has had unintended consequences, including effects on capital flows to emerging market economies. This paper studies the effect of U.S. monetary policy on portfolio investment in the BRICS countries. Using exogenous and endogenous variables as determinants of capital flows, I use a series of panel regression models that includes U.S. monetary policy as an explanatory variable of portfolio investment in the BRICS countries. My results suggest that U.S. monetary policy is not a significant determinant of capital flows in the BRICS countries, however they do suggest that interest rate spreads on BRICS sovereign bonds and U.S. treasuries are significant determinants.

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1. INTRODUCTION

The United States Federal Reserve System has a powerful influence over the global economy. The Federal Reserve's dual mandate of domestic price stability and employment maximization is the central objective that drives its actions. However, as the central bank to the world's largest economy, the Federal Reserve's policy decisions impact economies and markets globally. Because of the global impact of its polices, the state of the world economy is a significant factor that the Federal Reserve must consider when making policy decisions. The unprecedented combination of increasing complexity of the world economy as a result of globalization and the severity of the Great Recession required the Federal Reserve to implement unprecedented policies to fulfill its dual mandate and consider its implications to foreign economies. While the Great Recession demonstrated how shocks to the United States can affect the global economy, it also showed how the Federal Reserve can dampen the impact of financial failure internationally. When the Federal Reserve shifted to a highly accommodative monetary policy in 2008 dropping rates to the zero-lower bound and resorting to a large-scale asset purchasing program, more commonly known as quantitative easing, they accommodated a long and tepid recovery period that much of the global economy is still enduring. Now, the Federal Reserve is starting to normalize policy with the end of quantitative easing in October 2014, the first raising of the federal funds target rate of interest by 25 basis points in December 2015, December 2016, and March 2017. While it is favorable news that the U.S. economy is strong enough to handle a raise in the federal funds rate target, the Federal Reserve must consider how these policy changes affect developing foreign economies.

Many economists have started to examine this topic and have found that this highly accommodative policy in the United States has resulted in large capital inflows to emerging market

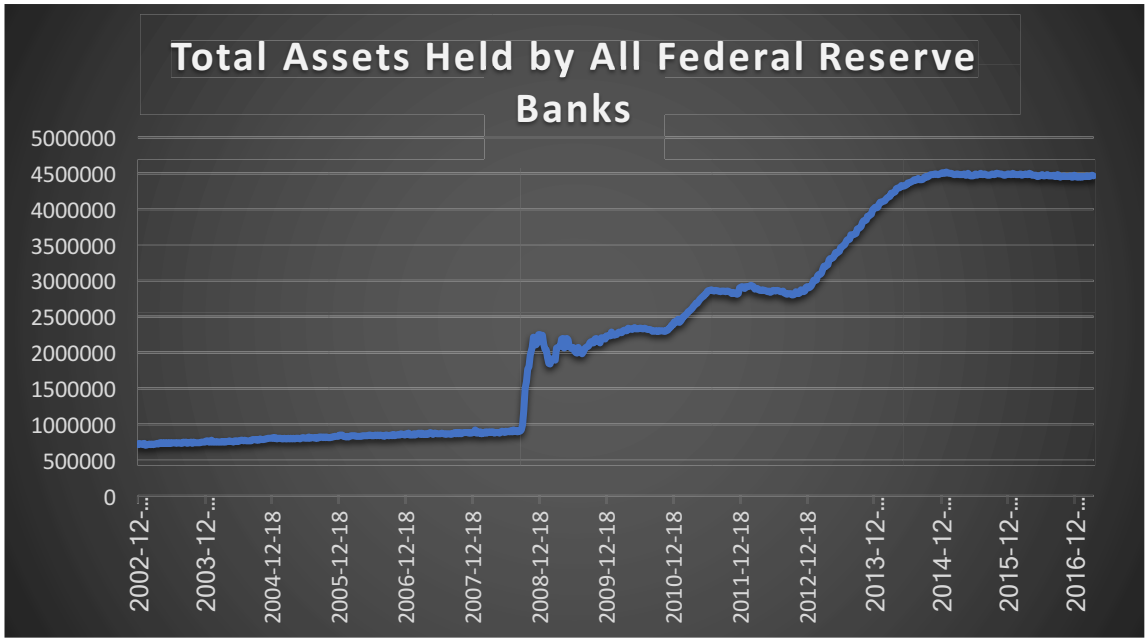
economies (Arora & Cerisola, 2001; Bernanke, 2016; Bowman, Londono, & Sapriza, 2014; Chen, Mancini-Griffoli, & Sahay, 2014; Georgiadis, 2016; Maćkowiak, 2007; McKinnon, 2013). Because interest rates in the U.S. were lowered to the zero-lower bound and remain low at 75 to 100 basis points, investors receive little-to-no return on their investment. Investors then reallocate significant portions of their portfolios to emerging market economies because they produce higher returns. As banks in these emerging markets receive inflows, they have more reserves to lend out to consumers and to businesses looking to expand. More workers are then hired to accommodate growing businesses, thus lowering unemployment. As more people have disposable income, demand for goods and services increases, consequently expanding the economy. The worry of leaders in emerging market economies is that as the U.S. tightens policy, money will start to flow out of emerging market economies, causing currency depreciation, higher unemployment, lower demand for goods and services, and upward pressure on inflation (Bowman et al., 2014; Chen et al., 2014; Arora & Cerisola, 2001).

In a speech in 2013, Ben Bernanke discussed how unconventional policy implemented in advanced economies, specifically in the U.S., has affected emerging market economies via complex channels. He describes how emerging market economies are concerned with:

> …not only the level of domestic demand (as needed to achieve objectives for employment and inflation) but with other considerations as well. First, because in recent decades many of these countries have pursued an export-led strategy for industrialization, they may be leery of expansionary policies in the advanced economies that, all else being equal, tend to cause the currencies of emerging market economies to appreciate, restraining their exports. Second, because many emerging market economies have financial sectors that are small or less developed by global standards but open to foreign investors, they may perceive themselves to be vulnerable to asset bubbles and financial imbalances caused by heavy and volatile capital inflows, including those arising from low interest rates in the advanced economies (Bernanke, 2013).

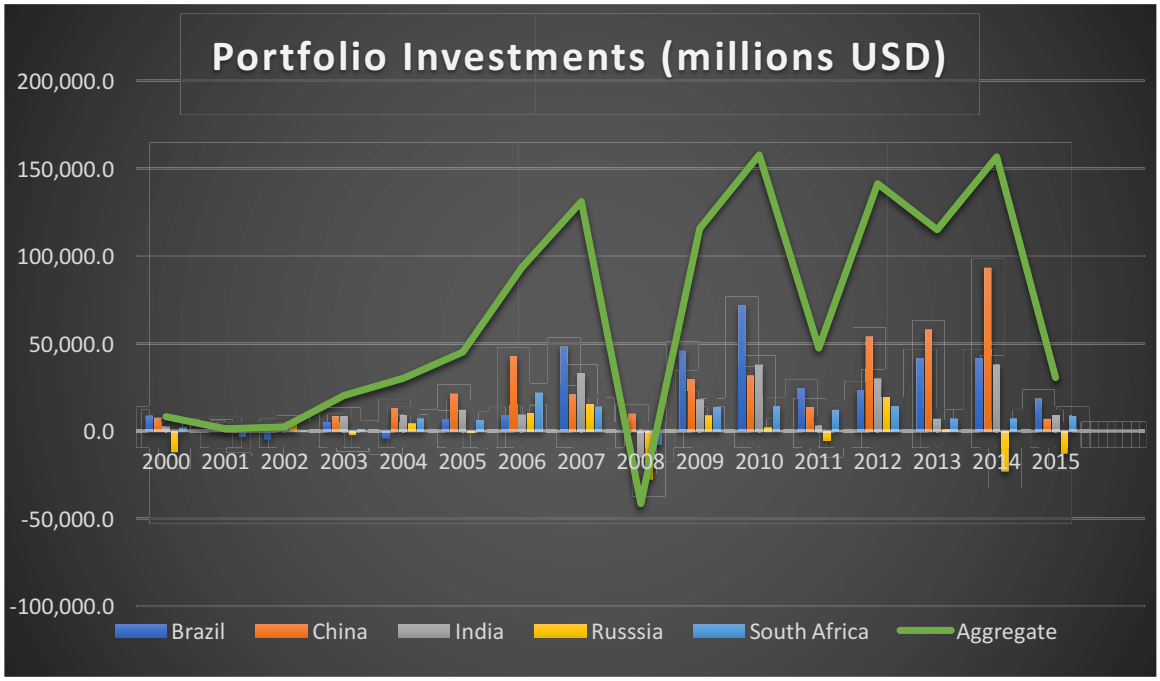
While the inflow of capital brings many benefits to emerging markets as previously discussed, the developing nature of emerging market economies creates complex reactions to easing in advanced economies, both positive and negative. The externalities of tightening policy in advanced economies causes greater concern than the direct effects of accommodative policy in advanced economies on emerging markets (Chen et al., 2015; McKinnon, 2013). Figures 1 and 2 show how portfolio flows have responded to the Federal Reserve's large-scale asset purchasing program. Figure 1 displays how the Federal Reserve's balance sheet increased significantly in 2008 when the Federal Reserve began quantitative easing (FRED, 2016). Figure 2 shows how portfolio flows of the BRICS countries have been volatile since the Great Recession and the implementation of accommodative policy, which were less volatile before 2000.

Figure 1: Federal Reserve Total Assets



Source: Federal Reserve Economic Data

Figure 2: Portfolio Investments, BRICS



Source: IMF, Balance of Payments Statistics

William Dudley, the president of the Federal Reserve Bank of New York and the vice-chairman of the Federal Open Market Committee (FOMC), discussed this issue in a speech in 2014 when the Federal Reserve was starting to normalize monetary policy by cutting back quantitative easing. He stated, "the scaling back of the Federal Reserve's asset purchase program...has created significant challenges for many emerging market economies." Even though the Federal Reserve's mandate is confined to domestic goals, the role of the dollar as the global reserve currency gives the Federal Reserve a unique responsibility to implement policy such that it advances global financial stability (Dudley, 2014). The Federal Reserve must also recognize that the financial stability of the world economy has implications that affect the U.S. economy. In another speech Dudley gave in April 2015, he reinforced the importance of emerging markets' economic health and how the Federal Reserve must keep in mind the spillover effects of its policy. Specifically, he

emphasized how "our monetary policy actions have global implications that feed back into the U.S. economy and financial markets. In some cases, these feedback effects can be disruptive" (Dudley, 2015).

To examine the relationship between U.S. monetary policy and capital flows to emerging market economies that could have disruptive feedback effects in the global economy, I study U.S. monetary policy as a determinant of capital flows to five of the largest emerging markets: Brazil, Russia, India, China, and South Africa (BRICS). I compare the effects of concurrent shocks with lagged shocks by constructing a series of panel regressions, controlling for both time and country fixed effects. The first panel regression model measures concurrent shocks with portfolio investments to the BRICS countries as a fraction of BRICS GDP as the dependent variable, with the monetary policy rate differential between the BRICS and the U.S. federal funds rate target and large-scale asset purchases as explanatory variables, along with GDP growth differential, sovereign spreads, inflation, and capital controls. My results show that, when controlling for time fixed effects, the GDP growth differential is positive and significant. As GDP growth of the BRICS countries increase by 1% relative to U.S. GDP, portfolio investments to the BRICS countries as a fraction of GDP increase by 1.1%. When controlling for country fixed effects, the policy rate differential is positive and significant. As the policy rates of the BRICS increase by 1% relative to the federal funds rate target, portfolio investments as a percent of GDP increase by 0.6%. When controlling for both time and fixed effects, all variables appear to be insignificant. The second panel regression implements one lag period for the policy rate differential and large-scale asset purchases. When controlling for time fixed effects, both the GDP growth differential and the lagged policy rate differential are positive and significant. As the GDP growth of the BRICS countries in the current period increases by 1% relative to US GDP growth, portfolio investments

to the BRICS countries as a percentage of GDP increase by 1.4%. As policy rates in the BRICS in the previous period increase by 1% relative to the federal funds rate target, portfolio investments as a percentage of GDP in the BRICS increase by 0.7%. When controlling for both time and country fixed effects all variables appear insignificant, however the coefficients are generally in the predicated direction.

This paper contributes to the literature by comparing concurrent and lagged monetary policy shocks while most papers solely focus on lagged shocks or concurrent shocks. Also, this paper focuses on the relationship between the U.S. and the BRICS countries, which are the largest developing economies in the world. How these countries react to U.S. monetary policy could have a large influence on the global economy and could feed back into the U.S.

The rest of the paper is structured as follows: Section 2 discusses reviewed literature concerning U.S. monetary policy shocks' effect on emerging markets; Section 3 discusses the data used in my empirical analysis; Section 4 discusses methodology and specification of the model; Section 5 includes my empirical results and how they compare to previous findings; Section 6 discusses globalization and policy implications; Section 7 concludes and provides suggestions for further research.

2. LITERATURE REVIEW

I hypothesize that U.S. monetary shocks have significant spillover effects on the BRICS countries, with larger spillover effects occurring after the Great Recession in 2008 when the Federal Reserve implemented unconventional monetary policy such as near-zero interest rates and quantitative easing. I divide the reviewed literature into four sections: the effect of U.S. monetary policy on capital flows, the effect of monetary policy shocks on asset prices in emerging market

economies, the determinants of monetary policy spillovers into emerging markets, and the spillover effects of U.S. unconventional monetary policy.

2.1 Capital Flows

Significant empirical studies have been conducted that provide evidence of U.S. monetary policy spillover effects on capital flows to emerging markets. Ahmed and Zlate (2014) examine the determinants of net private capital inflows to emerging market economies and if the behaviors of capital flows from before the Great Recession differ from the behavior of capital flows after the Great Recession. Their model differs from other current literature covering similar topics because they use a panel regression rather than a vector autoregressive model. Many authors studying this topic use a vector autoregression (VAR) model because it captures the dynamic nature of the relationship between capital flows and monetary policy. A VAR model captures the interdependencies within multivariate time series and allows for multiple dynamic variables. Ahmed and Zlate (2014) however, use a panel regression. This provides justification for my use of a panel regression. They use GDP growth differentials between emerging market economies and advanced economies, monetary policy rate differentials between emerging market economies and advanced economies, large-scale asset purchases as a measure of unconventional U.S. monetary policy, global risk aversion measured by the Chicago Board Options Exchange Volatility Index (VIX), and capital controls as explanatory variables for net private investment as a share of GDP in a particular developing country. They use panel data from 2002-2013 with countries from Latin America and Asia (Argentina, Brazil, Chile, India, Indonesia, South Korea, Malaysia, Mexico, the Philippines, and Thailand). They conclude that growth and interest rate differentials between emerging market economies and advanced economies as well as global risk appetite are significant drivers of net private capital inflows to emerging market economies (Ahmed & Zlate,

2014). They also find that since the financial crisis, investors have been more sensitive to interest rate differentials between emerging markets and advanced economies, showing that slight changes in interest rate differentials provoke large changes in capital flows. Unlike previous studies, Ahmed and Zlate (2014) incorporate capital controls into their model and find that capital controls implemented post-crisis have significantly dampened net inflows to emerging market economies.

While Ahmed and Zlate (2014) integrated new explanatory variables into their model, it remains unclear why they chose to examine the countries they did, as these countries appear to be selected randomly. They briefly discuss how emerging markets' fundamentals are determinants of capital flows, however they do not include any country characteristics in their model besides capital controls. Also, their model assumes that interest rates in emerging markets are independent of the U.S. federal funds rate, while some may be pegged to the U.S. rate. The authors show that a study on this topic can be done without a VAR model, providing justification for why I am using a panel regression. However, I include country characteristics in my model.

McKinnon (2013) presents a theoretical argument discussing the "hot money" inflows emerging market economies receive when advanced economies implement highly accommodative policy. The term hot money refers to capital that flows through financial markets from countries with low interest rates to countries with high interest rates. McKinnon (2013) criticizes advanced economies for taking on accommodative policies by lowering interest rates to the zero-lower bound and focuses on the negative effects of large capital inflows on the global economy, which is a unique approach compared to other current literature. His main argument centers around carry traders who borrow money in low-interest rate economies and invest in countries with a higher rate of return. These types of trades explain how the majority of capital inflows to emerging market economies originate. When the interest rate differential between the U.S. and emerging markets is

large, capital flows from the U.S. to emerging market economies increase, creating inflationary pressures and currency appreciation in emerging market economies. Central banks in emerging market economies are then forced to stabilize their exchange rate to keep exports competitive. McKinnon (2013) focuses his argument on the U.S. and China, discussing China's exchange rate stabilization. He argues that China is forced to buy U.S. dollars to avoid currency appreciation caused by large capital inflows from the U.S. (McKinnon, 2013). McKinnon (2013) continues to argue that highly accommodative monetary policy in the U.S. is causing financial repression, which refers to the actions governments take to reduce debt, in the U.S. and in China. However, his arguments are strictly negative and fail to acknowledge the findings of current literature that state how accommodative policy has had some positive effects on emerging market economies. He does state valid points explaining the mechanics of capital flows from advanced economies to emerging market economies that are relevant to this paper, such as the contribution carry traders have towards capital flows. Also, McKinnon (2013) justifies my implementation of interest rate differentials between the U.S. and BRICS interest rates as an explanatory variable in my model.

Banerjee et al. (2016) question the effectiveness of "self-oriented" monetary policy that is implemented across the globe. Advanced economies like the U.S. that are at the "financial center" of the global economy fulfill a domestic mandate that exclusively takes into account national considerations (Banerjee et al., 2016). They specifically examine how U.S. monetary shocks affect emerging markets' GDP, policy rates, and capital flows. They implement a core-periphery dynamic stochastic general equilibrium (DSGE) model integrating monetary policy and financial shocks in the core country whose currency dictates the flows of capital across borders to the periphery countries. Banerjee et al. (2016) find that an unexpected tightening of U.S. monetary policy (the core country) leads to decline in emerging markets' (the periphery countries) GDP, a

rise in policy rates, currency depreciation, and a fall in capital flows. These findings are consistent with my hypothesis and further support my reasoning for predicting that a loosening of U.S. monetary policy increases capital inflows from the U.S. into emerging markets like the BRICS countries.

The recent spike in volatility in cross-country capital flows has provoked many economists to examine the consequences of these large swings in capital flows from advanced to emerging market economies, including influences on asset prices, which will be discussed in detail in the next section. Chen et al. (2014) study how both capital flows and asset prices in emerging market economies are affected by U.S. monetary policy shocks. They also examine if unconventional U.S. monetary policy and conventional U.S. monetary policy have similar spillover effects and how domestic economic conditions within emerging markets affect spillovers (Chen et al., 2014). In this section I look at the contributions Chen et al. (2014) have made to literature concerning U.S. monetary policy effects on capital flows and asset prices in emerging market economies, however I will discuss the rest of their methodology and findings concerning unconventional policy in Section IId. Chen et al. (2014) conduct an event study of U.S. monetary policy surprises, defining the surprise as the difference in yield of the next expiring futures of the federal funds just before an FOMC announcement and the target federal funds rate announced. The event study focuses more on the short-term effects rather than the overall long-term trend that a VAR model captures. They look at 21 countries, chosen based on market liquidity and international financia integration. Chen et al. (2014) look at the day before and after a U.S. monetary policy announcement over three time periods: January 2000 to July 2007 to capture conventional monetary policy, November 2008 to May 2013 to capture unconventional monetary policy while the Federal Reserve was increasing quantitative easing, and May 2013 to May 2014 to capture unconventional monetary

policy when the Federal Reserve was taper quantitative easing. Unlike previous event studies on this topic, Chen et al. (2014) extend the time horizon across the yield curve, studying 1-year to 30-year maturities. They also use two factors to explain the variation in U.S. bond yields: market factor and signal factor. Market factor captures the portfolio rebalancing channel of monetary policy, as well as forward guidance provided by the Federal Reserve. This communicates long-term risks or uncertainty about inflation, growth, or changes in central bank preferences (Chen et al., 2014). Signal factor encompasses shorter-term indications concerning interest rate levels. Because the Federal Reserve does not communicate their interest rate target plans for more than three to five years in advance, signal factor captures changes in short-term bonds up to 5-year maturities while market factor captures the rest (Chen et al., 2014). These two factors explained 99% of the variation in U.S. bond yields (Chen et al., 2014). To test the effect of U.S. monetary policy on asset prices and capital flows, they use asset prices or capital flows as the dependent variable and U.S. monetary surprises corresponding to market and signal factors as their independent variables. Chen et al. (2014) then introduce country characteristics as standalone variables and interaction terms.

Chen et al. (2014) conclude that U.S. monetary policy shocks significantly affect capital flows and asset price variation in emerging market economies. Volatility in emerging markets was especially significant when the Federal Reserve announced that it would begin tapering its quantitative easing program in 2013 (Chen et al., 2014). Forward guidance from the Federal Reserve concerning the future course of policy rates triggered larger spillover effects than information that affects longer-term U.S. bond yields (Chen et al., 2014). Finally, Chen et al. (2014) conclude that emerging market economies with stronger fundamentals receive smaller spillovers from the U.S. More specifically, they find that higher real GDP growth, lower inflation,

strong external current account positions, and more liquid local capital markets significantly dampen the effects of U.S. monetary policy spillovers (Chen et al., 2014). I extend on this paper by explaining why the U.S. must consider its monetary policy spillover effects on the BRICS countries as the Federal Reserve begins to tighten policy and move away from accommodative policy.

The literature discussed in this section supports my hypothesis that capital flows in emerging markets are significantly affected by changes in U.S. monetary policy. This paper fits in with this literature because I incorporate explanatory variables from all of these articles, including the U.S. federal funds target rate, capital controls, and country characteristics like the GDP growth gap and interest rate of the BRICS countries. I add to this literature by comparing the effects of concurrent U.S. monetary policy shocks and lagged U.S. monetary policy shocks. Volatile capital flows have unintended consequences in emerging market economies, namely influencing asset prices and macroeconomic variables. The next section focuses on how asset prices and macroeconomic variables in emerging markets are affected by changes in capital flows that are caused by new U.S. monetary policy implementation.

2.2 Asset Prices

The strand of literature that focuses specifically on the influence of U.S. monetary policy on asset prices and macroeconomic variables in emerging market economies relates to my research as well. Many of these effects on asset prices are caused by the large fluctuations in capital flows into emerging market economies from developed economies. I am not specifically examining the effect of U.S. monetary policy on asset prices and macroeconomic variables in this paper, however this section shows the effects large capital inflows and outflows can have on emerging market economies and why capital flows are an important topic. Arora and Cerisola (2001) evaluate how

country risk is influenced by U.S. monetary policy, country-specific fundamentals, and conditions in global capital markets. Unlike other literature on this topic, Arora and Cerisola (2001) look at secondary market sovereign spreads rather than the spread of new issuances. They also use the U.S. federal funds target rate to isolate the effects of U.S. monetary policy specifically rather than a yield on a U.S. treasury security. As theory predicts, a rate hike in the federal funds target rate would also raise emerging market spreads (Arora & Cerisola, 2001). Because emerging markets typically have a higher risk of default, and therefore are more risky, emerging markets spreads will increase by more than the risk-free rate (or U.S. rates) rises (Arora & Cerisola, 2001). This compensates investors for the risk they are taking by purchasing emerging markets assets. Rising U.S. rates could also increase investors' risk aversion, causing them to reduce their exposure to emerging markets' assets and leading to an increase in capital outflows from emerging market economies (Arora & Cerisola, 2001).

Arora and Cerisola's (2001) results suggest that levels of U.S. interest rates have significant positive effects on sovereign bond spreads in emerging market economies. Also, they find that both domestic fundamentals and whether the Federal Reserve is more accommodative or contractionary are crucial to determining country risk (Arora & Cerisola, 2001). The authors discuss globalization extensively, pointing out that the global integration of the world economy has emerging markets' dependence on the U.S. economy (Arora & Cerisola, 2001). As I discuss in my policy implications section later, globalization has led to the increased integration of global capital markets, which forces developing and advanced economies to take into account the policies of other nations while determining their own.

Maćkowiak (2007) studies asset prices and how much external shocks account for the variation in macroeconomic variables in emerging market economies. His primary focus is

whether U.S. monetary policy shocks have a larger effect in emerging markets than the U.S. and if these shocks are transmitted quickly or with delay. Mackowiak (2007) constructs a structural VAR model to estimate the effect of U.S. monetary policy shocks on eight emerging market economies. He uses two variables: the first is a vector of macroeconomic variables in the emerging market and the second is a vector of variables external to the emerging market. The first vector includes a short-term interest rate of the emerging market being tested, the exchange rate with the U.S. dollar, a measure of real aggregate output, and a measure of the aggregate price level. The second variable is a vector including the federal funds rate, a measure of world commodity prices, a measure of the U.S. money stock, a measure of U.S. real aggregate output, and a measure of the U.S. aggregate price level. He runs his model for eight emerging markets (Korea, Malaysia, the Philippines, Thailand, Hong Kong, Singapore, Chile, and Mexico).

Mackowiak's (2007) results show that external shocks are an important source of macroeconomic variation in emerging markets and are robust for all eight emerging markets tested. They account for about one half of the variation in the exchange rate and the price level, two fifths of the variation in real output, and one third of the variation in the short-term interest rate. If the Federal Reserve raises interest rates (a contractionary policy), the currency of emerging market economies depreciates and induces rapid inflation, which is consistent with my hypothesis (Mackowiak, 2007). He also finds that U.S. monetary policy shocks have sizeable spillover effects but are not as important for emerging markets compared to other kinds of external shocks. U.S. monetary policy shocks also explain a larger fraction of the variance in the price level and real output in emerging markets than the price level and real output in the U.S. (Mackowiak, 2007).

The significant impacts U.S. monetary policy has on asset prices in emerging markets, as shown by Mackowiak (2007) and Arora and Cerisola (2001), highlight why this is an important

field of study. Policymakers in the U.S. and other advanced economies should be aware of the global effects their changes in policy have on emerging markets and other nations abroad because, as explained by William Dudley of the Federal Reserve during a speech in 2015, "...our monetary policy actions have global implications that feed back into the U.S. economy and financial markets. In some cases, these feedback effects can be disruptive."

2.3 Determinants

Another strand of literature that pertains to my study is identifying determinants of U.S. monetary policy spillovers into emerging market economies, and whether these determinants are exogenous or endogenous factors. Bowman, Londono, and Sapriza (2014) examine determinants of U.S. unconventional monetary policy spillovers on emerging market economies and how the magnitude of these effects differ depending on country-specific characteristics. Using a VAR model, Bowman et al. (2014) investigate sovereign bond yields, foreign exchange rates, and stock prices in 17 emerging market economies and identify country characteristics that make emerging market economies more vulnerable to U.S. monetary policy changes. To capture different channels of monetary transmissions, they implement explanatory variables, including the 10-year U.S. treasury yield to represent the interest rate channel and the 10-year U.S. high-yield bond yield to capture the risk channel (Bowman et al., 2014). They also integrate a control variable that includes the Chicago Board Options Exchange (CBOE) Volatility Index (VIX), a commodity price index, and the return of the S&P 500. Country characteristics are broken down into four groups: macro/fiscal stability, financial openness, currency related, and bank vulnerability. Macro/fiscal stability includes the short-term policy rate, the 5-year credit default swap (CDS) spread, 1-month sovereign bond yield, government debt to GDP ratio, real GDP growth, the output gap, and the differential between the local 1-month interest rate and the U.S. 1-month interest rate; financial

openness includes the Chinn-Ito measure of financial openness[1], current account to GDP deficit, total local stock market capitalization to GDP ratio, and total exports to the U.S. to GDP ratio; currency related includes a dummy variable that equals 1 if there is an exchange rate regime in place and a variable that captures whether the emerging market economy has a floating exchange rate; bank vulnerability includes the asset weighted average of 5-year expected default frequency (EDF) and asset weighted average of Moody's 5-year spot credit category (Bowman et al., 2014).

Bowman et al. (2014) find that emerging market economies with high long-term interest rates, 5-year CDS spreads, inflation rate, or current account deficit, and more vulnerable banking systems receive larger monetary transmissions with a change in U.S. interest rates. Emerging markets that are perceived as riskier are also more vulnerable to fluctuations in U.S. sovereign and high-yield bond yields (Bowman et al., 2014). In addition to domestic factors affecting the magnitude of spillovers, Bowman et al. (2014) conclude that U.S. monetary shocks have significant influences on asset prices in emerging markets, especially sovereign yields in local currency. More specifically, if a U.S. monetary policy shocks leads to a fall in U.S. sovereign yields, emerging markets sovereign yields will also fall (Bowman et al., 2014). Bowman et al. (2014) findings are consistent with my hypothesis that U.S. monetary policy shocks affect emerging market asset prices, and I discuss their findings concerning unconventional policy in the next section. Additionally, I use the U.S. federal funds target rate to capture U.S. monetary policy rather than the 10-year U.S. treasury yield.

Georgiadis (2016) examines the determinants of global output spillovers from U.S. monetary policy on emerging market economies. Differing from current literature, Georgiadis

[1] The Chinn-Ito index of financial openness measures a country's degree of capital account openness. It is based on "the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions." (Chinn & Ito, 2014).

(2016) implements a global VAR (GVAR) model between two countries, adding the dimension of transmission channels and magnitude by incorporating country-specific characteristics. He finds that the effects of U.S. monetary policy shocks are significant, and even larger in emerging markets than in the U.S. economy. Georgiadis (2016) concludes that country characteristics such as financial integration, trade openness, exchange rate controls, industry structure, domestic financial market development, and labor market rigidities largely affect the magnitude of cross-country monetary spillovers from advanced economies to emerging markets. For example, economies that are more integrated in global capital markets, less integrated in trade, have higher labor market rigidities, less developed domestic capital markets, and have manufacturing industries as a large share of output will experience larger spillovers (Georgiadis, 2016). Also, the determinants of the magnitude of spillovers differ across advanced economies and developing economies (Georgiadis, 2016). For example, advanced economies with strict exchange rate controls experience smaller spillovers while developing economies that are more financially open are faced with larger spillovers (Georgiadis, 2016).

Georgiadis (2016) discusses in depth the policy implications of his research. He argues that emerging market economies can dampen the effects of monetary spillovers from advanced economies by increasing trade integration, liberalizing exchange rates, developing domestic financial markets, and reducing frictions in labor markets (Georgiadis, 2016). Unlike existing literature which briefly mentions globalization, Georgiadis (2016) considers globalization to be a primary cause of U.S. monetary policy spillovers into emerging markets. He cites how Ben Bernanke's announcement in 2013 that the Federal Reserve would consider tapering the amount of large scale asset purchases it was conducting triggered global volatility and sell-offs of emerging market economies' securities (Georgiadis, 2016). Also, Georgiadis (2016) claims that because the

U.S. has a unique role due to the dollar acting as the global reserve currency, U.S. policymakers should consider internalizing monetary spillovers to increase global welfare. The question of whether countries should coordinate monetary policy to reduce negative spillover effects is also raised because spillover effects from advanced economies tend to have larger effects on emerging markets than on their domestic economies (Georgiadis, 2016). Georgiadis (2016) provides valuable insight on determinants of global spillovers from U.S. monetary shocks into emerging market economies, providing evidence in line with my hypothesis that I can apply to the BRICS countries.

Sarno et al. (2016) also analyze the determinants of spillovers, but look specifically at whether push factors or pull factors have a greater influence on portfolio flows from advanced economies to emerging markets. Push factors capture global, external factors that "push capital from the U.S. to other countries," including low U.S. interest rates, low potential U.S. growth, and high risk appetite of global investors (Sarno et al., 2016). Pull factors, on the other hand, reflect domestic economic forces that attract investors to buy assets of a particular country relative to others, including high domestic interest rates, low domestic inflation, high growth potential, and trade openness (Sarno et al., 2016). Sarno et al. (2016) conclude that for both bond and equity flows, push factors explain more than 80% of capital flows movements while pull factors explain less than 20%. These findings highlight how international economic forces dominate domestic forces when interpreting variation in global portfolio flows (Sarno et al., 2016). More specifically, Sarno et al. (2016) find that the most significant push factors are U.S. economic variables, including U.S. output gap, the U.S. interest rates, and U.S. stock market performance. They find that the most significant pull factors are domestic economic variables such as the recipient's output

gap, interest rates, and financial openness (Sarno et al., 2016). The theories and results presented by Sarno et al. (2016) justify the use of many push and pull factors in my empirical analysis.

Byrne and Fiess (2016) conduct a similar study to that of Sarno et al. (2016) in which they study whether global or domestic factors influence capital flows to emerging market economies. Where this paper differs from Sarno et al. (2016) is that Byrne and Fiess (2016) additionally determine which country-specific characteristics are most relevant to movements in capital flows. Their results show that the main determinants for capital flows to emerging market economies include both global and national factors. External factors consist of U.S. long-term bond rates and global risk appetite (Byrne & Fiess, 2016). If U.S. long-term bond rates fall, capital will flow out of the U.S. and investors will direct their capital to emerging market economies. If there is an increase in global risk appetite, investors will also shift towards emerging market economies (Byrne & Fiess, 2016). In line with other literature, Byrne and Fiess (2016) find that the determining domestic factor of capital flows is financial openness. They also find that the quality of institutions within an emerging market economy is significant, however I focus on financial openness in this paper.

Reinhardt et al. (2013) also justify why financial openness is a significant determinant of capital flows. In their study, they revisit the Lucas paradox which claims, contrary to neoclassical theory, that capital does not flow from rich to poor countries even though developing countries have lower levels of capital per worker (Lucas, 1990). Reinhardt et al. (2013) account for the role of capital account openness and aim to explain the "failure" of the neoclassical model, which predicts that capital flows freely across countries. Their results suggest that the prediction of the neoclassical model does hold true when incorporating capital account openness. Among countries that have capital account openness, developed economies experience capital outflows while

emerging market economies experience capital inflows (Reinhardt et al., 2013). On the other hand, for countries that have closed capital account, the development of a country has no relationship with the behavior of its capital flows (Reinhardt et al., 2013). Byrne and Fiess (2016) and Reinhardt et al. (2013) provide justification for why capital controls are a significant determinant of capital flows and why I include them in my empirical analysis.

Canova (2005) studies determinants of U.S. monetary policy spillovers specifically in Latin America, looking at whether policy transmissions occur through the interest rate or trade channel. The author aims to quantify the contribution of U.S. shocks to domestic economic fluctuations in Latin America (Canova, 2005). Canova (2005) implements a VAR model with a block of U.S. variables, a block of each country's variables, and a block of global variables that aim to capture any comovements that occur that are not due to developments in the U.S. economy. His model also includes an index of commodity prices, the emerging market bond index, and the emerging market equity index to capture the state of the world economy or those influences independent of the U.S. and Latin American developments that may cause comovements in the two regions (Canova, 2005). His results show that U.S. monetary spillovers trigger large and significant responses from Latin American macroeconomic variables. The interest rate channel, he concludes, is a significant transmitter of U.S. monetary spillovers while the trade channel has lesser significance (Canova, 2005). More specifically, U.S. disturbances also account for a significant portion of the volatility in Latin American continental output and inflation comovements (Canova, 2005). U.S. transmissions also have important destabilizing effects on nominal exchange rates (Canova, 2005). The theories presented in these papers are relevant to my argument concerning how spillovers are transmitted from the U.S. into developing economies. However, I aim to extend

these theories to the BRICS countries, as well as compare U.S. spillovers from conventional and unconventional U.S. monetary policy.

2.4 Unconventional Policy

When the Federal Reserve lowered interest rates to the zero lower bound but still needed to further stimulate the economy, they resorted to buying large amounts of longer-term government securities and mortgage-backed securities while also providing increased forward guidance. These unprecedented actions are called unconventional monetary policy. This section considers findings about the effects of unconventional monetary policy spillovers on emerging market economies from papers that were discussed in previous sections. It is important for policymakers in advanced economies to know whether spillovers effects differ based on which monetary policy tool is implemented. The "taper tantrum" in 2013, which refers to fleeing of capital from emerging markets that occurred when Ben Bernanke hinted that the Federal Reserve would slow down quantitative easing, sparked economists to study the effects of unconventional policy on emerging market economies. In this section I will examine three articles that were discussed in previous sections, however I will look solely at their results concerning unconventional U.S. monetary policy.

Bowman et al. (2014) specifically examine the effect of U.S. unconventional monetary policy on asset prices in emerging market economies and how the magnitude of these effects differs depending on country-specific characteristics. They conduct an event study and calculate the 2-day changes in sovereign yields, foreign exchange rates, and stock prices around U.S. unconventional monetary policy announcement dates (from the day before the announcement to the day after the announcement). Implementing an event study in this context captures the short-term effects of U.S. monetary policy, in contrast to the long-term effects VAR models capture

through lags. They find that U.S. unconventional policies have significant impacts on emerging market economies, however this impact is not unusually different from typical spillovers that occur during the conventional policy phase (Bowman et al., 2014). Bowman et al. (2014) results show emerging markets' aggregate sovereign yields index fell, currencies appreciated, and stock prices rose after the first few Federal Reserve announcements concerning quantitative easing.

Chen et al. (2014) produce conflicting results, finding that unconventional policies result in larger spillovers into emerging market economies compared to conventional policy spillovers. Chen et al. (2014) study how capital flows and asset prices in emerging market economies are affected by U.S. monetary policy shocks, however they additionally examine if unconventional U.S. monetary policy and conventional U.S. monetary policy have similar spillover effects. Chen et al. (2014) study three time frames: the conventional monetary policy phase (CMP) from January 2000 to July 2007, the unconventional monetary policy phase when the Federal Reserve announced bond purchasing (UMP-P) from November 2008 to May 2013, and the UMP phase when talks of tapering began (UMP-T) from May 2013 to March 2014. They looked at 74 announcements during the CMP phase, 42 over the UMP-P phase, and 9 over the UMP-T phase, broken down into signal factors (capture expectations of future short-term policy rates) and market factors (capture the portfolio rebalancing channel of monetary policy, as well as forward guidance provided by the Federal Reserve communicating long-term risks or uncertainty about inflation, growth, or changes in central bank preferences).

Chen et al. (2014) find that during the CMP phase, signal and market surprises were of about equal size. During the UMP-P and UMP-T phases, market surprises were much larger than the CMP phase, and signal surprises decreased to levels smaller than market surprises (Chen et al., 2014). These results suggest that unconventional policy mostly conveyed information affecting

longer-term bonds (Chen et al., 2014). Chen et al. (2014) conclude that spillover effects per unit of U.S. monetary surprise are larger for unconventional policy shocks compared to conventional policy shocks, with average and maximum UMP-T surprises smaller than UMP-P surprise for both signal and market factors. These findings opposed Bowman et al. (2014) results.

Ahmed and Zlate (2014) analyze the effect of unconventional U.S. monetary policy on capital inflows to emerging market economies. Using large-scale asset purchases as their measure of unconventional U.S. monetary policy, they find a positive and significant effect on net capital inflows, concluding that unconventional policies and conventional policies transmit through the interest rate channel (Ahmed and Zlate, 2014). The authors also included the 10-year Treasury bond yield within their explanatory variables for describing unconventional U.S. monetary policy, finding a negative effect that suggests as long-term U.S. Treasury yields fall net inflows to emerging market economies increase (Ahmed and Zlate, 2014). Overall, Ahmed and Zlate (2014) conclude that interest rate and growth differentials, global risk aversion, capital controls, and unconventional U.S. monetary policy are main determinants of net capital inflows to emerging market economies, however do not explicitly compare spillovers between unconventional and conventional monetary policies.

2.5 Contributions

My study relates to the reviewed literature by adapting Ahmed and Zlate's (2014) model and incorporating many of the variables used by the discussed studies. As mentioned in the introduction, my main contributions include comparing concurrent U.S. monetary policy shocks with lagged U.S. monetary policy shocks, incorporating country characteristics into Ahmed and Zlate's (2014) model, and focusing on the most dominant emerging market economies, the BRICS economies. Because the BRICS countries are the largest developing economies in the world, the

effect of U.S. monetary policy on these large economies affects the overall health of the global economy. While this sample of countries may not be representative of all emerging markets, especially small nations, I am not aiming to produce results that represent the entirety of emerging market economies, but rather to show how U.S. monetary policy effects some of the most important nations in the global economy.

3. METHODOLOGY

My empirical methods are based on Ahmed and Zlate's (2014) methodology. Portfolio investment to the BRICS as a proportion of GDP measures capital flows from the U.S. to the BRICS. I implement the GDP growth rate differential between the BRICS countries and the U.S., the monetary policy rate differential between the BRICS and the U.S., and U.S. large-scale asset purchases as explanatory variables of capital flows. Ahmed and Zlate (2014) and Arora and Cerisola (2001) implement these variables in their models. Reinhardt (2013), Bowman et al. (2014), Byrne and Fiess (2016), and Sarno (2016) all find that financial openness or the use of capital controls is a significant determinant of capital flows into emerging markets, so I use Andres, Klein, Rebucci, Schindler, and Uribe's (2016) measure of capital controls. McKinnon (2013) thoroughly discusses the importance of interest rate differentials to capital flows from the U.S. to emerging markets. I use the interest rate differential between the U.S. 10-year treasury and the 10-year sovereign bond of the BRICS countries as an explanatory variable as well. Bowman et al. (2014), Georgiadis (2016), and Byrne and Fiess (2016) find that domestic characteristics are important determinants of capital flows, leading me to include CPI to measure inflation and further justifies the use of the GDP growth differential to capture any endogenous factors that could explain capital flows from the U.S. to the BRICS countries.

Most of the reviewed literature implements VAR models to study monetary policy and capital flows because it captures the complex and dynamic nature of the relationship of these variables. VAR models incorporate each variable as a function of past lags of other variables and past lags of itself. While I use a panel regression rather than a VAR model, which is justified by Ahmed and Zlate (2014), I implement lagged variables in a second model to capture similar effects of a VAR model. Because monetary policy can have a delayed effect on capital flows and asset prices in foreign countries, it is important to incorporate time lags of the independent variables into the model.

I also incorporate fixed effects into both the non-lagged and the lagged regressions to control for heterogeneity. I run three non-lagged regressions and three lagged regressions, each controlling for various fixed effects. I then compare the two sets of three regressions to see whether the lagged had a larger influence on capital flows than the non-lagged.[2]

3.1 Specification

The models adapted from Ahmed and Zlate (2014) are:

$$\frac{PI_{it}}{Y_{it}} = \alpha_0 + \beta_1(GDP_{it} - GDP_t^{US}) + \beta_2(R_{it} - R_t^{US}) + \beta_3 IRS_{it} + \beta_4 LSAP_{US_t} + \beta_5 CC_{it} + \beta_6 CPI_{it} + \phi_i + \gamma_t + \varepsilon_{it} \quad (1)$$

$$\frac{PI_{it}}{Y_{it}} = \alpha_0 + \beta_1\left(GDP_{it} - GDP_t^{US}\right) + \beta_2 L.\left(R_{it} - R_t^{US}\right) + \beta_3 IRS_{it} + \beta_4 L.LSAP_{US_t} + \beta_5 CC_{it} + \beta_6 CPI_{it} + \phi_i + \gamma_t + \varepsilon_{it} \quad (2)$$

where Equation 1 examines concurrent shocks and Equation 2 examines lagged shocks. The dependent variable $\frac{PI_{it}}{Y_{it}}$ is the portfolio investments in a country *i* during time *t* as a proportion of GDP (*Y*); $GDP_{it} - GDP_t^{US}$ represents the GDP growth rate of one of the BRICS countries minus the U.S. GDP growth rate; $R_{it} - R_t^{US}$ represents the central bank policy rate of one of the BRICS countries minus the U.S. federal funds rate target; $L.(R_{it} - R_t^{US})$ represents the central bank policy

[2] I also ran three regressions incorporating the lagged monetary policy rate differential, lagged LSAP, the non-lagged policy rate differential, and non-lagged LSAP. The results are basically the same as those of the lagged regressions so I do not include a separate discussion and results table.

rate differential lagged by one year; IRS_{it} represents the interest rate spread between the yield of the BRICS 10-year sovereign bonds and the 10-year U.S. treasury yield. $LSAP_{US_t}$ represents the total assets held by the Federal Reserve and aims to capture unconventional U.S. monetary policy; $L.LSAP_{US_t}$ represent large-scale asset purchases lagged by one year; CC_{it} represents the capital controls implemented by a country; CPI_{it} represents inflation measure of a country; ϕ_i captures country fixed effects, γ_t captures time fixed effects, and ε_{it} is a stochastic error term capturing other factors that influence portfolio investments into the BRICS countries. The models are estimated with robust standard errors. I hypothesize that the policy rate differential, the GDP growth differential, the interest rate spread, and large-scale asset purchases will have a positive effect on portfolio investments while capital controls and CPI will have a negative effect on portfolio investments. These hypotheses are supported by the reviewed literature, specifically Ahmed and Zlate (2014), Bowman et al. (2014), McKinnon (2013), Chen et al. (2014), and Sarno (2016). I run a total of six regressions: three examining concurrent shocks and three examining lagged shocks. Each set of three controls for fixed effects: the first with time fixed effects, the second with country fixed effects, and the third with both time and country fixed effects. Nearly all the sources cited in this paper use a VAR model to capture lags and the dynamic nature of multivariate time series. I use a panel regression for the specification, similarly to Ahmed and Zlate (2014).

4. DATA

I combine multiple datasets from numerous sources to create the dataset that includes all the variables in the model. I use annual panel data from 2000 to 2014, yielding 65 observations. Many datasets used exceeded this date range, however, I am limited to a common range of years in which

all datasets overlapped. I considered looking at a subset of the BRICS to include a longer time frame, but the dependent variable, portfolio investments, constrained me to this time period. Portfolio investments data was collected from the Balance of Payments Statistics Yearbook from the International Monetary Fund (IMF), accessed through the World Bank World Development Indicators: Economic Policy and Debt. I choose portfolio investments as a measure of capital flows rather than a more general measure like capital account because this data specifically covers equity securities and debt securities transactions, capturing the behavior of investors. GDP data for both the U.S. and BRICS is collected by the World Bank Global Economic Monitor and is seasonally adjusted. Central bank policy rate data is from the International Monetary Fund's International Financial Statistics dataset. This dataset was quarterly so I average the four quarters of each year to create annual data. Also, Russia only began reporting monetary policy rates in 2011, so I do not have complete data for Russian policy rates. The interest rate spread data measures the amount of basis points BRICS sovereign 10-year bonds are over the U.S. 10-year treasury. This annual data is collected by the World Bank Global Economic Monitor. Data for large-scale asset purchases is collected by the Federal Reserve Economic Data (FRED) from the Federal Reserve Bank of St. Louis, using total assets held by all Federal Reserve banks to capture the effect of unconventional policy. The capital controls measure was collected from a dataset created by Fernández, Klein, Rebucci, Schindler, and Uribe (2015) in an IMF working paper. This dataset has extensive capital controls information regarding specific types of capital flows and whether they are inflows or outflows. In this paper, I implement the Overall Restrictions Index that they created, which is calculated by the average of total capital inflows and outflow of a country and captures all asset

categories.[3] I extracted this variable for the BRICS countries to use for my model. CPI data for the BRICS countries was collected from the World Bank Global Economic Monitor. Table 1 shows summary statistics for all the variables.[4]

Table 1: Summary Statistics

VARIABLES	OBS	MEAN	STD. DEV.	MIN	MAX
Year	75	2007	4.35	2000	2014
Country code	75	3	1.42	1	5
Portfolio investments	75	-0.013	0.049	-0.243	0.163
CPI	75	88.553	24.363	31.741	142.588
GDP growth differential (%)	75	4.40	4.06	-5.04	14.19
Interest rate spread (bps)	75	284.33	249.29	56.91	1372.68
Policy rate differential (%)	64	6.074	4.915	-2.998	23.327
LSAP (millions $)	65	1,831,262	1,188,021	725,800.5	4,337,664
Capital controls	70	0.728	0.235	0.2	1

5. RESULTS AND DISCUSSION

5.1 Concurrent Monetary Policy Shocks

My first set of regressions examines concurrent U.S. monetary policy shocks, studying the immediate effects of U.S. monetary policy on portfolio investments into the BRICS countries. I run three regressions: the first controlling for time fixed effects, the second controlling for country fixed effects, and the third controlling for both time and fixed effects. When running the first regression with time fixed effects, the estimated coefficient for the GDP growth differential is positive and statistically significant at the 5% level. The coefficients for the policy rate differential, LSAP, and CPI are positive but insignificant, while the coefficients for the interest rate spread and

[3] Fernández, Klein, Rebucci, Schindler, and Uribe (2015) measure capital controls by codifying the IMF's Annual Report on Exchange Rate Arrangements and Restrictions. They combine 55 different categories of restrictions, ranging from bond and equity restrictions to real estate restrictions.

[4] A note on variable units: GDP growth differential and policy rate differential are both in percentages while the interest rate spread is in basis points. Portfolio flows is a proportion of GDP, so it is a percentage. LSAP are in millions of USD.

capital controls are negative and insignificant. The results from the second regression, controlling for country fixed effects, producing different results. The policy rate differential is positive and statistically significant at the 10% level. All other variables are insignificant. The coefficient for GDP growth differential is negative, along with the interest rate spread and LSAP. When controlling for both time and country fixed effects, all estimated coefficients appear to be insignificant. However, most of the coefficients have the predicted direction. The GDP growth differential and the policy rate differential both have positive coefficients, which is consistent with my hypothesis. Table 2 shows the coefficients and the standard error in parentheses for each variable, with asterisks indicating significance level.

Table 2: Results for Concurrent Shocks

	Time Fixed Effects	Country Fixed Effects	Time and Country Fixed Effects
	(1)	(2)	(3)
VARIABLES	$\frac{Portfolio\ Investments}{GDP}$	$\frac{Portfolio\ Investments}{GDP}$	$\frac{Portfolio\ Investments}{GDP}$
GDP growth differential	0.011**	-9.46e-05	0.006
	(0.004)	(0.004)	(0.007)
Policy rate differential	0.003	0.006*	0.003
	(0.003)	(0.003)	(0.005)
Interest rate spread	-6.09e-09	-2.54e-08	-9.76e-09
	(2.00e-08)	(2.32e-08)	(2.10e-08)
LSAP	2.37e-06	-1.41e-06	-2.50e-05
	(6.87e-05)	(4.89e-05)	(6.19e-05)
Capital controls	-0.077	0.029	-0.034
	(0.068)	(0.042)	(0.111)
CPI	0.0004	0.002	0.0002
	(0.0011)	(0.0014)	(0.0011)
Constant	-0.035	-0.161	-0.011
	(0.094)	(0.138)	(0.114)
Observations	51	51	51
R-squared	0.430	0.334	0.505

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Although the results are mostly insignificant, they show interesting information about capital flows from the U.S. to the BRICS countries. Theory and current literature suggest that the GDP growth differential is a significant determinant of portfolio flows to emerging market economies. In the recent low-interest rate environment in advanced economies, investors looking for higher-returning assets shift towards developing countries with higher growth rates (Ahmed and Zlate, 2014; McKinnon, 2013). The results show that the GDP growth differential has a significant positive effect on portfolio investment when controlling for time fixed effects. As the growth differential increases by 1%, portfolio investments as a percentage of GDP will increase by 1.1%. These results are consistent with Ahmed and Zlate (2014) and McKinnon's (2013) findings who find that the growth differential between emerging market economies and advanced economies is a significant driver of capital flows to emerging markets. While the growth differential appears to be negative when controlling for country fixed effects, the coefficient is extremely small, showing that even though the coefficient is in not in the predicted direction, it is little effect on portfolio investment. The policy rate differential, while it is only statistically significant when controlling solely for country fixed effects, has positive coefficients for all three regressions. As the policy rates of the BRICS increase by 1% relative to the federal funds rate target, portfolio investments as a percent of GDP will increase by 0.6%. Ahmed and Zlate (2014) support these findings in their study, showing that the monetary policy rate differential in their model is significant and positive.

Current literature suggests that as large-scale asset purchases (LSAP) by the Federal Reserve increase, signaling that the Federal Reserve plans to continue to employ accommodative policy and low interest rates in the U.S., capital flows to the emerging market economies would increase (Ahmed and Zlate, 2014; Chen et al., 2014). However, my results mostly suggest the

opposite and are insignificant. When controlling for time and country fixed effects, portfolio flows to the BRICS as a percentage of GDP decrease by 0.0025% as LSAP increases by $1. While this is an extremely small increase, LSAP occurs in massive quantities, so this could have somewhat of a large impact. Also, these results are counterintuitive and oppose the findings of the current literature concerning the effects of unconventional U.S. monetary policy on capital flows to emerging market economies. Because I am aggregating and using panel data of five large countries that differ greatly in characteristics. Each country is facing different economic conditions and they are in turn implementing policy that is specific their situation. For example, Brazil has been enduring political instability along with high unemployment (13.2% as of February 2017) and high inflation. The Central Bank of Brazil, whose priorities focus on the purchasing power of the Brazilian real and a sound financial system, has been focused on bringing down the inflation rate over the past year, and it has succeeded bringing it down from 9.32% in May 2016 to 4.57% in March 2017 (Central Bank of Brazil, 2017). Other factors within each BRICS economy could affect how the BRICS countries conduct policy as well. The Russian and Brazilian economies are similar in the sense that both rely on oil prices and have been struggling recently due to low oil prices. Russia and China both have highly regulated economies that are controlled by the government, which can have an impact on capital flows into their economy (Hutt, 2016). China's economy is also much larger than the other four BRICS economies, while South Africa is significantly smaller. India surpassed China in economic growth in 2016 and has lower corruption than Brazil, Russia, and South Africa (World Economic Forum, 2016). These factors affect the attractiveness of each individual country to investors, and therefore can affect the volume of capital flows to these countries (McKinnon, 2013). Because the political and regulatory characteristics of the BRICS countries are so heterogeneous, my results are insignificant and inconsistent with

current literature. Also, because the BRICS are such large countries, if one country has negative results and other has positive, they could cancel each other out and lead to no significance. Additionally, if I had access to data for a longer time period, I would expect the results to be more supportive of my hypothesis.

The results show that CPI is insignificant but has a positive effect on portfolio investments. However, I expect the coefficient to be negative. This finding opposes the findings of Sarno et al. (2016) but support Bowman et al. (2014). Sarno et al. (2016) find that low domestic inflation attracts investors to buy assets of a particular country. On the other hand, Bowman et al. (2014) suggest that emerging markets with high inflation rate receive larger capital flows with a change in U.S. interest rates. Mackowiak (2007) and Chen et al. (2014) generate results that can explain the results I present in this paper regarding CPI. They find that higher inflation causes emerging market economies to be more susceptible to capital flows and that increased capital flows induce high inflation.

Capital controls are insignificant for all three regressions; however, the coefficient is negative when controlling for time and country fixed effects, which supports my hypothesis that as a country implements more capital controls, capital flows into that country will decrease. Reinhardt (2013), Ahmed and Zlate (2014), Bowman et al. (2014), Byrne and Fiess (2016), and Sarno (2016) all find capital controls or financial openness to be significant determinants of capital flows. Increased financial openness (decreased capital controls) allows for a more integrated global economy and possibly larger spillover effects.

5.2 Lagged Monetary Policy Shocks

My second set of regressions implements lag variables, specifically the two variables capturing U.S. monetary policy, the policy rate differential and large-scale asset purchases, by one

period. Because changes in U.S. monetary policy may not affect portfolio investments immediately, implementing lags captures the delay in reaction time in portfolio investments. I run three regressions, as I did for concurrent shocks; the first controlling for time fixed effects, the second controlling for country fixed effects, and the third controlling for both time and fixed effects. When controlling for time fixed effects, the estimated coefficients for the current GDP growth differential and the lagged policy rate differential are positive and statistically significant at the 5% level and the 10% level, respectively. LSAP is insignificant, however the coefficient is positive, which is in line with my hypothesis that as Federal Reserve LSAP increases, portfolio investments in the BRICS countries increase. Capital controls, CPI, and the interest rate spread are not significant. When controlling for country fixed effects, none of the estimated coefficients are statistically significant However, the coefficients for the GDP growth differential, policy rate differential, interest rate spread, and capital controls are all positive, which is in line with my hypothesis. When controlling for time and country fixed effects, none of the coefficients are statistically significant, however, all are in the hypothesized direction except the interest rate spread. Table 3 shows the coefficients and the standard error in parentheses for each variable, with asterisks indicating significance level.

Table 3: Results for Lagged Shocks

	Time Fixed Effects	Country Fixed Effects	Time and Country Fixed Effects
VARIABLES	(1) $Portfolio\ Investmen$	(2) $Po\ \ tfolio\ Investment$	(3) $Portfolio\ Investmen$
	GDP	GDP	GDP
GDP growth differential	0.014**	0.003	0.011
	(0.005)	(0.005)	(0.009)
Policy rate differential (lag)	0.007*	0.001	0.010
	(0.004)	(0.003)	(0.007)
LSAP (lag)	1.82e-08	-2.19e-08	2.84e-08
	(3.20e-08)	(2.25e-08)	(3.49e-08)
Interest rate spread	-2.04e-05	0.001	-7.80e-05
	(9.10e-05)	(0.001)	(0.001)
Capital controls	-0.061	0.003	0.015
	(0.081)	(0.045)	(0.101)
CPI	-7.06e-05	0.0012	-0.001
	(0.002)	(0.002)	(0.001)
Constant	-0.092	-0.148	-0.098
	(0.116)	(0.145)	(0.143)
Observations	46	46	46
R-squared	0.507	0.346	0.568

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The main difference between the concurrent monetary policy shocks regressions and the lagged monetary policy shocks regression is that the estimated coefficients in the lagged regressions are mostly larger than those in the concurrent shocks regressions. This difference can be seen in the two significant variables, the GDP growth differential and the monetary policy rate differential. In the non-lagged regression, the estimated coefficient for the GDP growth differential is 0.011 and for the lagged regression is 0.014. For the policy rate differential, the significant non-lagged coefficient is 0.006 and the lagged is 0.007. Because the estimated coefficients are larger in the lagged regression, U.S. monetary policy shocks, specifically changes in the federal funds rate, have a larger effect on portfolio investment to the BRICS countries when lagged.

My results show that when controlling for time fixed effects, the GDP growth differential is positive and significant. When the GDP growth differential increases by 1%, portfolio investment as a percentage of GDP increases by 1.4%. While the estimated coefficients for the growth differential are insignificant when controlling for country fixed effects and both time and country fixed effects, the direction is positive. These results support my hypothesis and are in line with the findings of Ahmed and Zlate (2014) and McKinnon (2013). The lagged policy rate differential is positive and significant when controlling for time fixed effects. As the policy rate differential of the year increase by 1%, portfolio investment as a percentage of GDP increases by 0.7%. The policy rate differential is insignificant when controlling for country fixed effects and when controlling for both time and country fixed effects, however both coefficients are positive which supports my hypothesis. Ahmed and Zlate (2014), Arora and Cerisola (2001), Banerjee et al. (2016), Bowman et al. (2014), and Chen et al. (2014) support this finding that the policy rate in the U.S. and in emerging markets is a determining factor of capital flows.

My results concerning lagged LSAP are similar to those of concurrent LSAP, however the coefficient is smaller when LSAP is lagged by one period. The lagged LSAP variable is insignificant for all three regressions. The coefficient is positive when controlling for time fixed effects and both time and country fixed effects, but negative when solely controlling for country fixed effects. Current literature finds that as LSAP increases, capital flows to emerging markets increase (Ahmed and Zlate, 2014; Chen et al., 2014). The results for the interest rate spread, capital controls, and CPI are all insignificant and the direction of their coefficients is inconsistent across the three regressions. I hypothesize that the interest rate spread is positive and CPI and capital controls are negative. In the regression that controls for both time and country fixed effects, the coefficient for CPI is negative, showing that as CPI decreases in the BRICS, portfolio investment

increases. This supports my hypothesis and differs from the concurrent shocks results. The coefficient for the interest rate spread is negative when controlling for time and country fixed effects, which opposes my hypothesis and is consistent with the concurrent shocks results. Capital controls is positive when accounting for time and country fixed effects, again opposing my hypothesis and differing from the concurrent shocks results. The reasoning for my results is similar to that explained in the concurrent shocks regressions. Because I am aggregating five large economies that are heterogeneous, the results are scattered. Also, as Chen et al. (2014) mentioned, larger countries receive smaller U.S. monetary policy transmissions because of their stronger fundamentals. Because these are the five largest emerging market economies, U.S. monetary policy may not affect them in the way that smaller countries are affected by monetary policy transmissions.

There are limitations to my study that can be improved for future research. Firstly, my sample size is small. As the results show due to the lack of significance when controlling for country fixed effects, heterogeneity is present among the BRICS countries. Also, implementing a panel regression rather than a VAR model could be a limitation as well. My models fail to capture the feedback effects that a VAR model captures. Future research should incorporate a model that does capture the important feedback effects of U.S. monetary policy shocks with a sample that is less heterogeneous.

6. GLOBALIZATION AND POLICY IMPLICATIONS

The dramatic increase in globalization over the past few decades has led to the interconnectedness of the world's financial markets (Arora and Cerisola, 2001; Georgiadis, 2016). We are witnessing a "substantive deepening of trade and financial integration and associated

increase in the relevance of spillovers to the domestic economy from shocks in other economies" (Georgiadis, 2016). This integration highlights the importance of monetary policy spillovers and the feedback effects they can have on advanced economies (Dudley, 2015). Georgiadis (2016) also finds that, due to increased globalization, the spillover effects for emerging market economies are larger than the domestic effects in the U.S. The magnitude of the spillovers largely depends on characteristics of the country, including financial integration, trade openness, exchange rate controls, industry structure, financial market development, and labor market rigidities (Georgiadis, 2016). This is consistent with my results, showing that country characteristics are significant determinants of capital flows. Emerging market economies experience larger monetary policy spillovers from advanced economies when they have more integrated global financial markets and less integrated in trade. Because these policies produce more rigid labor and less developed domestic capital markets, manufacturing industries account for a high share of their output, causing these countries to experience larger spillovers (Georgiadis, 2016).

As globalization continues to expand, financial markets and economies will become increasingly intertwined and heavily reliant on one another. Arora and Cerisola (2001) argue that the "increased globalization of the world economy over the past decade has been reflected in the increased dependency of emerging markets on developments in the U.S. economy." Investors have been pumping capital into emerging markets to diversify their portfolio and gain higher returns because of changing conditions in developed economies (Chen, Mancini, & Sahay, 2015; McKinnon 2013). Because of these intense capital inflows emerging markets are experiencing, interest rate spreads have generally "moved in the same direction as changes in the U.S. interest rates" (Arora & Cerisola, 2001). Emerging markets are increasingly influenced by changes in U.S. monetary policy given the integration of global capital markets. Many of these changes are felt by

emerging market economies through effects on the cost and availability of funds (Arora & Cerisola, 2001). Also, they provide empirical evidence showing how U.S. monetary policy influence country risk in several developing regions including Latin America, Asia, and Eastern Europe. Arora and Cerisola (2001) obtain results that suggest U.S. interest rate levels have a direct positive relationship with sovereign bond spreads.

Both the United States and emerging market economies can take measures to lessen the effects of monetary policy spillovers (Georgiadis, 2016). My results suggest that central banks in emerging market economies should be aware of the behavior of the Federal Reserve, specifically on the movements of the federal funds target rate. Also, they should closely monitor the U.S. GDP growth rate in relation to their own. Both of these indicators could determine changes in capital flows in and out of EMEs. Also, increased forward guidance from the Federal Reserve would help leaders in emerging market economies plan their own policy changes to combat high volatility of capital flows. Other literature finds that emerging market economies can diminish their vulnerability to US monetary policy by promoting domestic capital market development, integrated global trade, and loosening exchange rate regulations (Georgiadis, 2016). Mishkin and Savastano (2002) discuss the advantages and disadvantages of three possible monetary policy strategies for emerging market economies in their case study on Latin America: hard currency pegs, inflation targeting, and monetary targeting. Hard pegs, such as a currency board or full dollarization, can be beneficial if there is already a sound banking and financial system as well as sustainable fiscal policies in place (Mishkin & Savastano, 2002). For emerging market countries that do not have the political and economic systems in place to support an independent central bank, hard pegs may be the only suitable option for monetary policy. However, for other emerging market economies, pegged currencies are "ill-equipped" to counter country-specific shocks and

are difficult to exit (Mishkin & Savastano, 2002). For the five countries Mishkin and Savastano (2002) examined, they view inflation targeting as a viable option for medium-term price stability. As with hard pegs, a stable banking system is necessary for inflation targeting to be successful. If emerging market economies are able to implement inflation targeting in coordination with the government, it can help promote fiscal discipline. Mishkin and Savastano (2002) examine monetary targeting but find that it is not a viable option for most emerging market economies because of the inconsistency of the relationship between monetary aggregates and inflation. Also, emerging markets would most likely come across the similar difficulties the U.S. did when targeting the money supply, for example, defining and controlling the monetary aggregate they were targeting (Mishkin & Savastano, 2002).

While the mandate of the Federal Reserve is specifically domestic, policymakers must consider the interconnectedness of our global economy and financial markets given the role of the dollar as the global reserve currency (Georgiadis, 2016). Evidence shows that changes in U.S. monetary policy have significant effects on capital flows in emerging market economies which then can feed back into the U.S. economy (Dudley, 2015). The implementation of accommodative policy in the U.S. has forced investors to reach for yield, thus allocating more capital towards emerging markets and causing large sums of money to flow into developing economies (Arora & Cerisola, 2001; Bowman et al., 2014; Chen et al., 2014; Georgiadis, 2016; Maćkowiak, 2007; McKinnon, 2013). As the U.S. tightens policy, capital flows will reverse and have serious implications on the domestic economies of emerging markets, including currency depreciation, upward pressure on inflation, and market volatility (Bowman et al., 2014; Chen et al., 2014; Arora & Cerisola, 2001).

7. CONCLUSION

U.S. monetary policy has spillover effects to foreign nations, specifically volatile capital flows to vulnerable emerging market economies. While the Federal Reserve's mandate is domestic, it is important for the central bank to consider the effects its policies have abroad. Volatile capital flows can have unintended consequences in vulnerable emerging market economies, for example, increasing inflation, depreciating local currencies, and affecting asset prices (Mackowiak, 2007; McKinnon, 2013; Ahmed and Zlate, 2014; Bowman et al., 2014; Chen et al., 2014). While my results do not confirm that U.S. monetary policy is a significant determinant of capital flows (contrary to previous studies), this is likely due to constraints in my study and there are many opportunities for further research to be done on this topic. Because the BRICS countries differ greatly from one another, my results are scattered. Using a longer time frame of data and investigating a larger number of countries to make the data more representative of all emerging market economies would help produce results that are more in line with my hypothesis and other literature. Also, it would be interesting to see how capital flows to emerging market economies behave since the Federal Reserve has started to tighten policy. I predict that emerging market economies will experience outflows due to tightening U.S. monetary policy, however many emerging market economies have stronger fundamentals that could make these countries less vulnerable to changes in U.S. policy (Dudley, 2015).

As globalization continues to increase (unless the protectionist/isolationist movement in the U.S. and Europe continues), understanding how policies in advanced economies affect developing nations is important because these nations could have feedback effects into the U.S. economy. The key for monetary policy stability and absorbing foreign monetary policy spillovers in emerging market economies is to implement a strategy to achieve long-term price stability

(Mishkin & Savastano, 2002). While not all monetary policy strategies will be successful for all emerging market economies, it is crucial that governments of emerging market economies develop a stable and sustainable institutional environment for its banking and financial system (Mishkin & Savastano, 2002). Also, policymakers in emerging market economies can closely monitor the federal funds target rate and the GDP growth in the U.S. because, according to my results, determine the behavior of capital flows into the BRICS countries. From the perspective of the United States, the Federal Reserve can continue to increase transparency through forward guidance, providing leaders of emerging market economies guidance on the Federal Reserve policy strategies.

References

About Banco Central do Brasil. (2017). *Banco Central do Brasil.*

Ahmed, S., & Zlate, A. (2014). Capital flows to emerging market economies: A brave new world? *Journal of International Money and Finance, 48, Part B*, 221-248.

Andres, F., Klein, M., Rebucci, A., Schindler, M., Uribe, M. (2016). Capital control measures: A new dataset. *IMF Economic Review 64*, 548-574.

Banerjee, R., Devereux, M. B., & Lombardo, G. (2016). Self-oriented monetary policy, global financial markets and excess volatility of international capital flows. *Journal of International Money and Finance, 68*, 275-297.

Board of Governors of the Federal Reserve System. (2017). All Federal Reserve Banks: Total Assets [WALCL], retrieved from FRED, Federal Reserve Bank of St. Louis.

Bowman, D., Londono, J. M., & Sapriza, H. (2014). U.S. unconventional monetary policy and transmission to emerging market economies. *International Finance Discussion Papers.* (1109). Board of Governors of the Federal Reserve System.

Byrne, J. P., & Fiess, N. (2016). International capital flows to emerging markets: National and global determinants. *Journal of International Money and Finance, 61*, 82-100.

Canova, F. (2005). The transmission of U.S. shocks to Latin America. *Journal of Applied Econometrics, 20*(2), 229-251.

Chen, J., Mancini-Griffoli, T., & Sahay, R. (2014). Spillovers from United States monetary policy on emerging markets: Different this time? *IMF Working Paper*, (14), 240.

Chen, J., Mancini-Griffoli, T., & Sahay, R. (2015). Spill over: The Federal Reserve's recent unconventional monetary policies seem to have affected emerging markets more than traditional policies. *Finance and Development, 52(3)*, 40-43.

Dudley, W. (2014). *U.S. Monetary Policy and Emerging Market Economies*. Speech presented at Three Decades of Crises: What Have We Learned?, New York City.

Dudley, W. (2015). *The U.S. Monetary Policy Outlook and its Global Implications.* Speech presented at the Bloomberg Americas Monetary Summit. New York City.

Georgiadis, G. (2016). Determinants of global spillovers from U.S. monetary policy. *Journal of International Money and Finance, 67*, 41-61.

Global competitiveness index. (2016). *World Economic Forum.*

Hutt, R. (2016). Six things to know about Russia's economy. *World Economic Forum*.

International Monetary Fund (2017). Balance of Payments: Portfolio Investment | Countries: Brazil, Russia, India, China, and South Africa, 2000-2014 | International Monetary Fund Subject: Portfolio investment | Code 3B9AA, 1990-2015. Data-Planet™ Statistical Datasets by Conquest Systems, Inc. [Data-file]. Dataset-ID: 056-006-010.

International Monetary Fund (2017). International Financial Statistics: Interest Rates | Countries: Brazil, Russia, India, China, and South Africa, 2000-2014.

Lucas, R. E. (1990). Why doesn't capital flow from rich to poor countries? *American Economic Review, 80*(2), 92-96.

Maćkowiak, B. (2007). External shocks, U.S. monetary policy and macroeconomic fluctuations in emerging markets. *Journal of Monetary Economics, 54*(8), 2512-2520.

McKinnon, R. (2013). Hot money flows, commodity price cycles and financial repression in the USA and china: The consequences of near-zero U.S. interest rates. *China & World Economy,* (4), 1.

Mishkin, Frederic S. and Miguel A. Savastano (2002). Monetary policy strategies for emerging market countries: Lessons from Latin America. *Chinese Economic Studies*, *44*(2), 45-82.

Reinhardt, D., Ricci, L. A., & Tressel, T. (2013). International capital flows and development: Financial openness matters. *Journal of International Economics, 91*(2), 235-251.

Sarno, L., Tsiakas, I., & Ulloa, B. (2016). What drives international portfolio flows? *Journal of International Money and Finance, 60*, 53-72.

Vivek Arora, & Martin Cerisola. (2001). How does U.S. monetary policy influence sovereign spreads in emerging markets? *IMF Staff Papers, 48*(3), 474-498.

World Bank (2017). World Development Indicators: Economic Policy and Debt | Socioeconomic Indicator: GDP growth (annual %), 2000-2014. Data-Planet™ Statistical Datasets by Conquest Systems, Inc. [Data-file]. Dataset-ID: 051-001-035.

World Bank (2016). Global Economic Monitor: CPI Price, Nominal, not Seasonally Adjusted | Countries: Brazil, Russia, India, China, and South Africa, 2000-2014. Data-Planet™ Statistical Datasets by Conquest Systems, Inc. [Data-file]. Dataset-ID: 051-003-006.

World Bank (2016). Global Economic Monitor: Sovereign Bond Interest Rate Spreads, Basis Points over U.S. Treasuries [Archive] | Countries: Brazil, Russia, India, China, and South Africa, 2000-2014. Data-Planet™ Statistical Datasets by Conquest Systems, Inc. [Data-file]. Dataset-ID: 051-003-032.