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**Impact of the Global Financial Crisis on
Developing and Advanced Countries' Reserves Holdings**

An honors thesis presented to the
Department of Finance
University at Albany, State University of New York
in partial fulfillment of the requirements
for graduation with honors in business
and
graduation from The Honors College

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Abstract

The reserve holdings held by the central bank of a country, and more importantly, the changes in those holdings as a percentage of the country's Gross Domestic Product, can indicate a lot about the financial health of an economy. In this paper, we examine the cross-sectional differences between emerging and advanced economies' reserve holdings as well as their variations over time, around the global financial crisis of 2008. It is apparent that countries hold reserves for various reasons, primarily for insurance and to attract future investment, and that they are more crucial to emerging economies than developed.

Acknowledgements

I thank God for leading me to where I am today.

I would like to thank my ENTIRE family: parents, grandparents, aunts, uncles, cousins, siblings, etc. for their unwavering support in all that I do!

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Introduction

Reserves are liquid assets held by a bank, company, or government in order to meet expected future payments and/or emergency needs (Financial Glossary). Countries hold reserves in their central banks to control exchange rates – primarily to keep the rates stable, which in turn, improves a government’s economic environment and protects it from volatile currency movements (Bedell 2013). Levels of reserves held by a government and changes in those reserves are watched closely by the entire global business community: by institutional and private investors and traders, by other governments and by policy makers at home and abroad, to name a few. Why? A country’s ability to repay foreign debt and thereby the country’s credit rating can be derived from examining its reserve holdings, more specifically, as a percentage of its Gross Domestic Product (GDP). The rate at which countries’ reserves change is monitored closely because it is an imperative indicator of a country’s currency value, which may lead to speculative attacks ¹. Advanced or developed countries, generally have more stable currencies and hold their reserves in their home currencies and in a mix of the world’s leading currencies, such as the US Dollar, or the Euro or the Japanese Yen. Emerging or less developed countries, on the other hand, tend to not hold any significant proportion of their reserves in their own currencies but in more stable currencies, essentially in the leading currencies previously mentioned. These emerging economies are often susceptible to the threat of a speculative attack when the value of the local currency depreciates against the currency of the reserves.

¹ Speculative attack – hot money flowing in and out of currencies, securities, real estate, and commodities. When speculators believe the value of a currency will depreciate, they begin exchanging the currency for another thereby furthering the devaluation. Adapted from (Eiteman, Stonehill and Moffett n.d.)

Economists have been trying to pinpoint an accurate measure of the opportunity cost of accumulating reserves since research began in this area. Potential costs include per capita income, because capital is scarcer in developing countries which leads to a higher opportunity cost, net foreign indebtedness, the government bond yield, and the spread between the government bond yield and short-term interest rates (De Beaufort Wjinholds and Kapetyn 2001). Economies can adopt a floating exchange rate which decreases the amount of required reserves (De Beaufort Wjinholds and Kapetyn 2001). Even with less required reserves, they are still costly to hold, especially for countries with debt-servicing difficulties. Changes in the international financial markets can significantly increase the interest rates countries pay on international borrowing (Landell-Mills 1989).

The rate of reserves held as a percentage of GDP vary according to global economic conditions such as changes in trade or investments. The global financial crisis began in the United States and Europe in 2007 and spread to most other economies throughout 2008. Unsustainable appreciation in real estate markets and overly-accessible credit led to the collapse of the financial system. Emerging markets were most negatively impacted through the financial channels, specifically through high-leverage and short-term debt, which was further instigated by pegged exchange rates (Berkmen, et al. 2012). Thus, the 2008 global financial crisis changed countries' saving patterns. The objective of this paper is to examine the impact of the Global Financial Crisis (GFC) on countries' reserves and to specifically examine if the impact was different on developed countries versus emerging economies. Using a sample of 46 countries' annual reserve holdings during the period 2003 to 2017, and a simple comparative analysis, this paper finds differences between the two groups of countries. To further observe the effects of the crisis on reserve adequacy, this study analyzes reserves held from 2003-2007, 2008-2013, and 2013-2017.

Separating the overall sample period into these time segments allows for analysis of the pre-crisis period, crisis period, and post-crisis period. Preliminary results show that there is indeed a differential impact of the GFC on countries' reserve holdings: emerging economies saw a significant drop in their reserves holdings as a percentage of GDP, post-crisis, compared to advanced countries. The greatest disparities in reserve accumulation are found in the cross-cultural analyses. Whereas advanced economies' reserve adequacy stayed constant, or even decreased following the crisis, emerging economies rapidly increased reserve holdings as a percent of GDP. The differences are especially noted between both advanced and emerging Asian economies vs the rest of the continents.

Literature Review and Context:

Why Do Countries Accumulate Reserves?

Countries' demand for reserves are positively and negatively correlated to certain economic factors, as described in a World Economic Output report from September 2003. The positive factors include economic size, current account vulnerability, and capital account vulnerability. On the other hand, exchange rate flexibility and opportunity cost negatively correspond (Edison 2003). For example, when exchange rate depreciation is projected to improve the balance-of-payments, the necessity for international reserves is likely to decrease (Shevchuk 2015). The negative elasticity of the reserve demand was confirmed for 13 industrial countries (Bahmani-Oskooee and Niroomand 1998). From a dataset using 100 countries' reserve accumulations from 1975-2004, the determinants of traditional macro variables, financial variables, and institutional variables did not hold the same weight of importance among different countries (Cheung and Ito 2009). The traditional macro variables relate to the factors mentioned earlier from the World Economic Report that are typically associated with reserve behavior such

as imports, volatility of exports, opportunity cost of holding international reserves, and per capita GDP (Cheung and Ito 2009). The second category includes money supply, external debts and capital flows (Cheung and Ito 2009). Fear of low reserve holdings leads to speculation and furthers capital outflows causing an “internal drain” i.e. capital flight by speculators (De Beaufort Wjinholds and Kapetyn 2001). A spike in capital outflows typically leads to the depreciation of currency. In that case, monetary authorities can “(1) allow the exchange rate to depreciate, (2) use foreign reserves to defend the exchange rate, (3) raise the interest rate in the hope that a higher interest rate will discourage capital outflows, (4) impose capital controls, or (5) use a combination of all of the above” (Dominguez, Hashimoto and Ito 2012). The third category is institutional variables which includes corruption, political stability, and capital controls (Cheung and Ito 2009).

Most countries hold their reserves in the form of low-yielding short-term US Treasury securities. This proposes an opportunity cost for countries with different currencies. It also makes these emerging economies sensitive to US monetary policy through changing exchange rates (Davis, Crowley and Morris 2018). The Turkish lira, for example, fell from about 1 lira = 0.67 US Dollars on January 4, 2010 to 1 lira = 0.19 US Dollars on January 2, 2019 (XE Currency Converter - Live Rates n.d.). The more this value continues to drop, the more expensive it is for the country to finance its debts. The cost also increases due to investors requiring higher yields based on the riskiness of lending to countries in crisis. In countries, such as Turkey, which are synonymous with political corruption, the required level of reserves is even higher. Less corrupt countries traditionally hold a lower level of international reserves because they do not need to validate their trustworthiness as much as their more relatively corrupt counterparts do (Aizenman and Marion 2002) (Davis, Crowley and Morris 2018). Therefore, the traditional belief is that developing countries with a high level of exposure to external financing should accumulate a

strong level of international reserves to protect themselves from financial crises and support the value of local currencies (Aizenman, Lee and Rhee 2004). Contrastingly, there is an alternative consideration for capital flows and international reserves. It is argued that emerging market economies increase reserve holdings to secure foreign direct investments (FDI) from the most developed countries, specifically the US (Dooley, Folkerts-Landau and Garber 2008). This implies that the better developing economies perform financially, the more the countries should accumulate in international reserves.

In the case of Asian economies, many of which are on the IMF list of developing nations, forex reserves have been soaring since the Asian financial crisis of 1997-1998. Out of fear of unexpected shortages of foreign exchange and currency crisis paired with distrust of the IMF following the Asian crisis, the nations have been holding above-optimal level reserves (Park and Estrada 2009). The term “above optimal” refers to the amount suggested by the Guidotti-Greenspan rule introduced in 1999 for emerging market economies. It recommends that developing economies “should have sufficient reserves to cover full amortization for up to one year without access to foreign credit” (Greenspan 1999). Additionally, numerous Asian countries participate in extensive trade with other nations. The trade practices make these nations highly susceptible to external shocks thereby increasing the level of demanded reserves (Shevchuk 2015).

What differentiates the 2008 financial crisis from previous crises is how much it effected the global economy (unlike the series of crises in Mexico, Asia, Russia, Brazil, etc. in the 1990s). Those crises arguably did not significantly affect the economy on a universal scale because when the Mexican crises led to increased reserves in Mexico, East Asian reserves were unchanged and vice versa (Aizenman and Jaewoo 2007). Yet, after the series of crises, developing economies’ foreign reserves increased overall as a form of self-insurance (Vieia 2017).

The global financial crisis began in developed countries towards the end of 2007 and then spread to emerging economies by mid-late 2008 (Dominguez, Hashimoto and Ito 2012). Authorities allowed for either their currency value to depreciate or devalue and also allowed their reserves to deplete when capital outflows suddenly increased during the past crises years (per the aforementioned monetary policy options). However, data suggests many authorities were obliged to do *both* during the global financial crisis (Dominguez, Hashimoto and Ito 2012). The Fed implemented a system to provide liquidity to the interbank dollar market in response to this crisis. Furthermore, The Fed created the Term Auction Facility to provide funding to US banks and swap lines to other central banks (Dominguez, Hashimoto and Ito 2012). The funds obtained through the swap lines trickled their way down to commercial banks in their respective countries (Fleming and Klagge 2010). The same study found a positive relationship, though notably, not causation, between countries that used their reserves during the global financial crisis and faster GDP recovery (Dominguez, Hashimoto and Ito 2012).

Based on previous literature, it is evident that countries could be forced to lower their reserves after a crisis due to economic circumstances leading to capital outflows. Contrastingly, countries also could take a stance to build up reserves as insurance. Since both are possible, this study empirically tests whether advanced economies handle crises differently than emerging economies.

Data and Analysis

The International Monetary Fund, IMF from this point forward, collects data and reports financial metrics on nearly all of its 189 member-countries. The organization has classified lists of “Advanced Economies” and “Developing Economies”. The graphs and tables in this paper use the countries that fall under the IMF’s advanced and developing lists. The IMF placed countries in the

advanced group if they fit certain characteristics including “relatively high income levels, well-developed financial markets, and high degrees of financial intermediation and diversified economic structures with rapidly growing service sectors” (Nielsen 2013). As another frame of reference for developed/emerging markets, Morgan Stanley Capital International, referred to as MSCI from this point forward, categorizes the countries based on openness to foreign ownership, ease of capital inflows/outflows, efficiency of the operational framework, market organization, market infrastructure, and stability of institutional framework (Barra 2010).

Overview: Complete Sample Period 2003-2017

The GDP and the reserve holdings of the selected economies from the IMF Advanced Economies and Developing Economies were extracted from the Federal Reserve Bank of St. Louis and from the World Bank Global Economic Monitor, in US Dollars. In a simple calculation, the reserve holdings were divided by the GDP of each economy for every year in the data set to arrive at the reserves held as a percentage of GDP. It is necessary to state that reserve adequacy levels can be equally influenced by an increase in amount of reserves *and/or* a decrease in GDP. However, in this dataset, increases in reserve adequacy as a percentage of GDP were largely attributable to a higher dollar amount of reserves. This conclusion is apparent when observing the raw data of GDP for each country compared to the amount, in dollars, of reported reserves.

In *Figure 1.1*, emerging economies’ reserves/GDP are plotted over the time period 2003-2017. Reserve adequacy had an average of 19.46% of GDP with an average standard deviation of 11.75% for the series, as depicted in *Figure 1.2*. The developing countries are separated by continent to highlight the cross-cultural differences in reserve accumulation behavior. Asia remains the highest; however we observe that developing European economies start to increase

reserves following the crisis to nearly Asian-levels. China, Thailand, and Malaysia were among the highest reserve holders as they have been accumulating above-optimal reserves since the Asian Financial Crisis, as mentioned in the earlier section. It is worth highlighting the median of the developing economies and separating reserves by continent because the average is skewed to the right due to the few countries with extraordinarily high reserve adequacy. It is also worth noting the African sector only includes South Africa as that was the only African country to be included on IMF's developing economies list. Figure 1.2 displays the average vs the median for the sample. In general, there is a positive trend in reserve accumulation over time.

Figure 2.1 depicts reserves/GDP for developed economies over 2003-2017. Holdings as a percentage had an average of 7.45% of GDP over the series with a standard deviation of 7.92%. By separating the developing countries by continent, we observe a significant difference between Asia (although only made up of Japan as that is the only Asian country on IMF's list of advanced nations) and the other continents in reserve behavior. In general, Developed Europe's reserves fell over the series and settled around 5% as Developed North America rose from 3% and settled to about 4%. Asia began at approximately 21% and increased until falling again to the low 20s. The median is also imperative in this dataset as it reflects the general developing economies' behavior more accurately than the average. The median, as depicted in *Figure 2.2*, sits at 4.53% for the period at large.

When comparing *Figures 1.1* and *2.1*, the differences in savings patterns among developing economies and advanced economies becomes apparent. As expected, reserve proportions for developed countries are significantly lower than their developing counterparts. To recap, this is because emerging economies need to prove their ability to repay debts more to attract investment and to protect the value of the local currency.

Based on a paired t-test and a difference of means test, the differences in reserve holdings as a percentage of GDP for the advanced economies vs emerging economies was confirmed for the period reviewed.

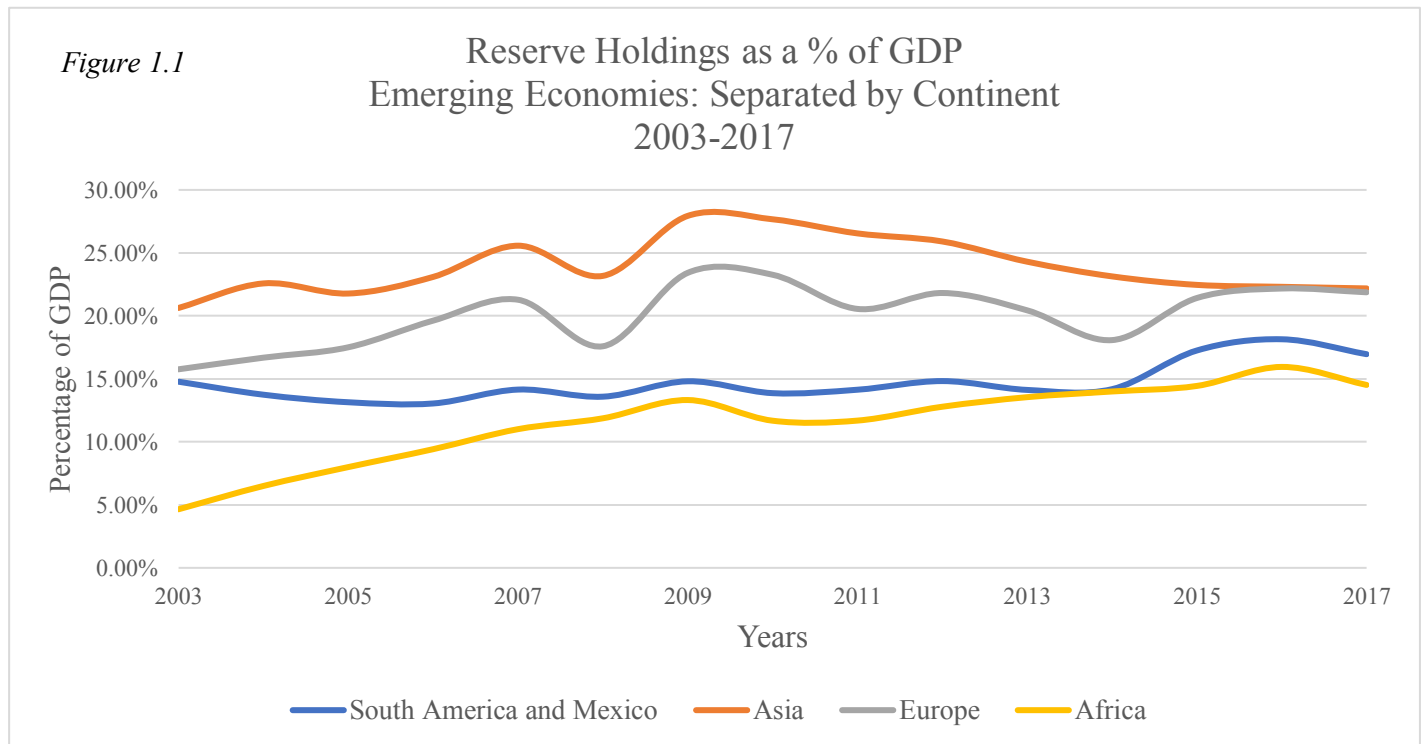


Figure 1.2

Year	Emerging Economies		
	Mean Holdings	Standard Deviation	Median
2003	16.67%	9.03%	15.46%
2004	17.40%	11.20%	14.97%
2005	17.25%	10.67%	14.13%
2006	18.39%	11.62%	14.06%
2007	20.16%	12.84%	15.32%
2008	18.07%	11.31%	12.85%
2009	21.93%	13.57%	14.67%
2010	21.43%	13.48%	13.06%
2011	20.30%	12.91%	16.27%
2012	20.72%	13.02%	15.14%
2013	19.56%	12.42%	14.51%
2014	18.47%	11.10%	14.89%
2015	20.34%	10.72%	16.35%

2016	20.84%	10.88%	16.66%
2017	20.31%	11.45%	16.26%
Average	19.46%	11.75%	14.97%

Figure 2.1

Reserve Holding as a % of GDP
Developed Economies: Separated by Continent
2003-2017

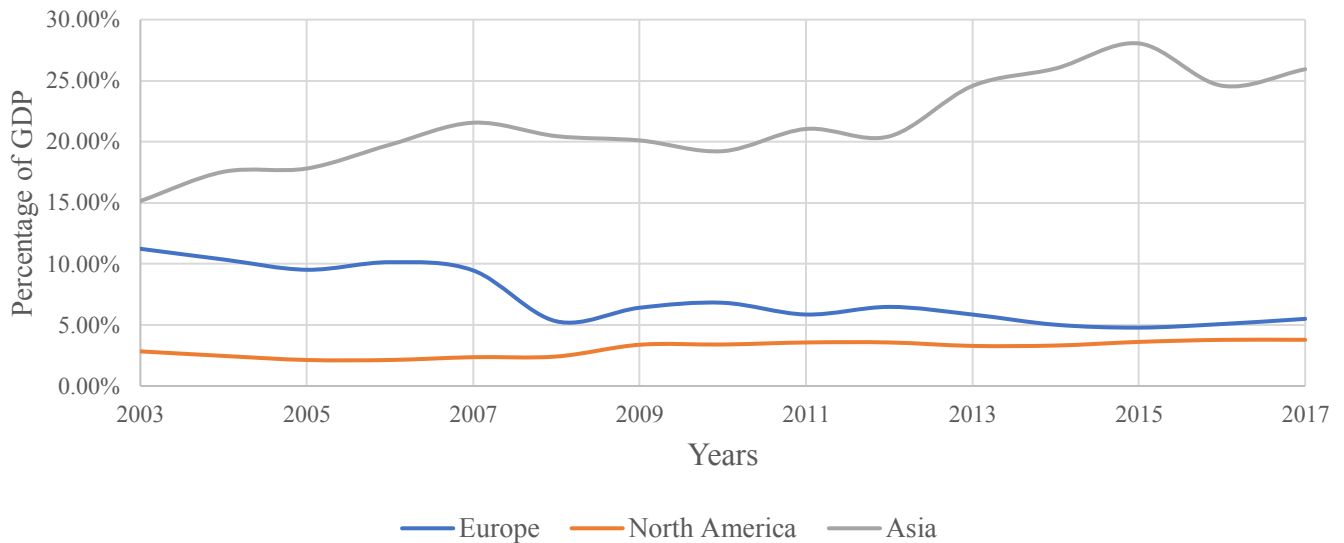


Figure 2.2

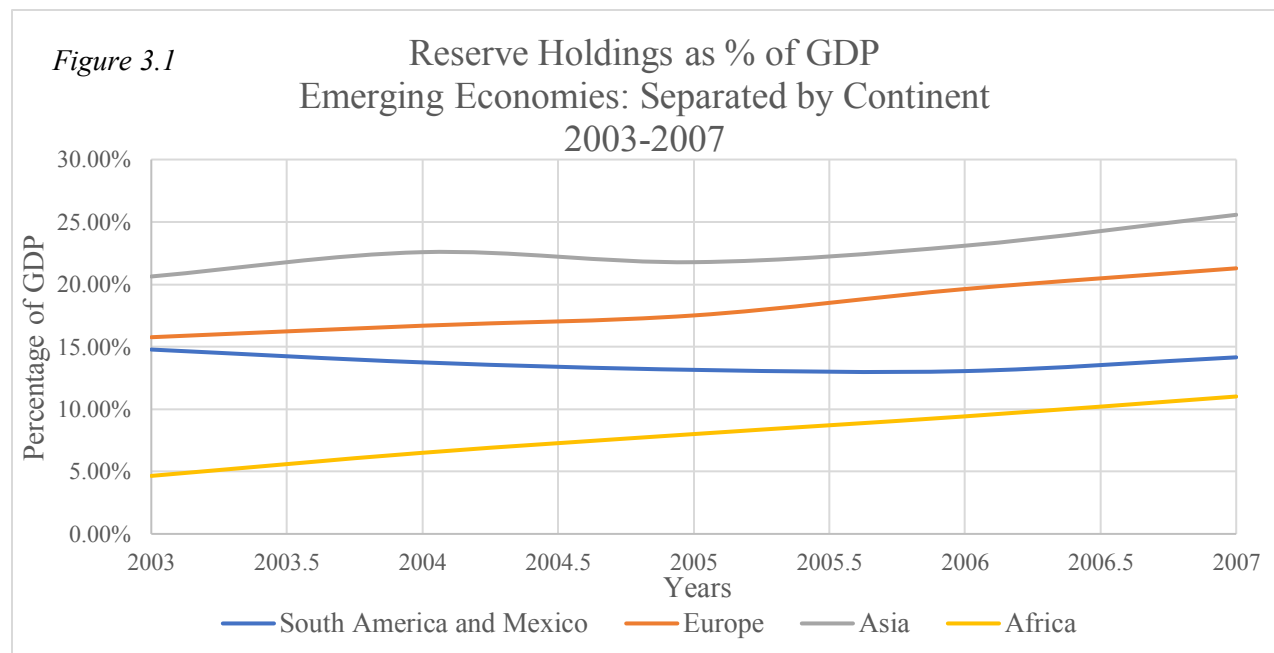
Developed Economies

Year	Mean Holdings	Standard Deviation	Median
2003	10.67%	11.91%	4.53%
2004	9.98%	11.26%	3.77
2005	9.24%	10.45%	4.56%
2006	9.86%	11.36%	3.84%
2007	9.37%	11.80%	3.90%
2008	5.70%	6.21%	3.54%
2009	6.74%	7.06%	4.54%
2010	7.06%	7.26%	4.90%
2011	6.32%	6.17%	4.33%
2012	6.83%	6.77%	4.32%
2013	6.44%	6.85%	4.18%
2014	5.78%	5.71%	4.15%

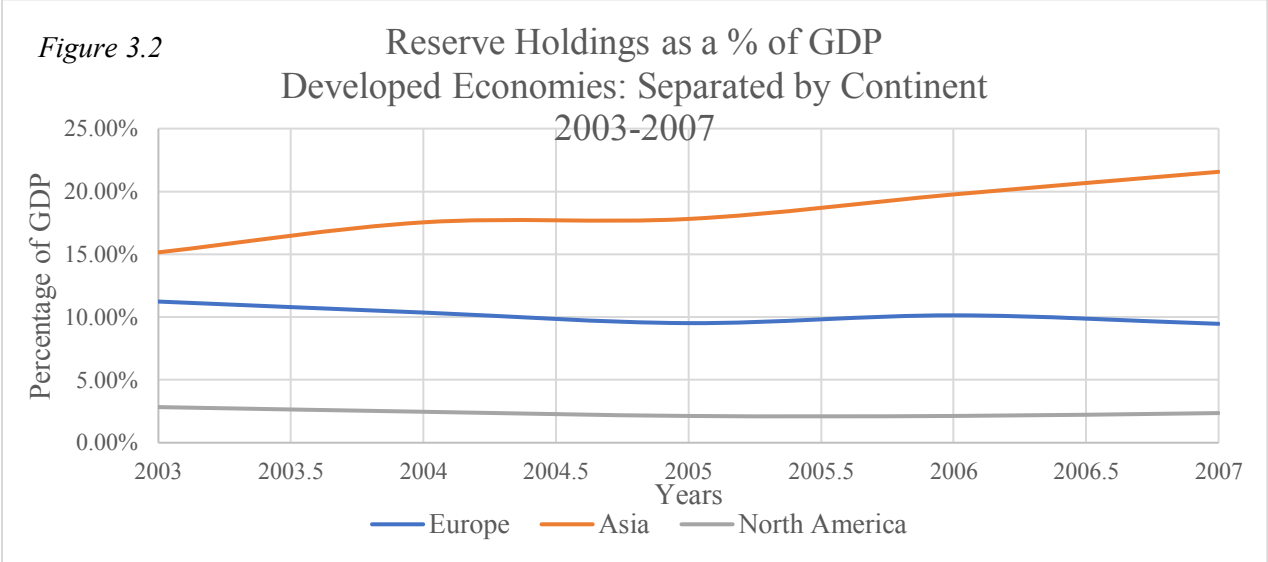
2015	5.69%	5.56%	4.57%
2016	5.81%	5.02%	5.02%
2017	6.24%	5.44%	5.24%
Average	7.45%	7.92%	4.53%

The Pre-Crisis Period: 2003-2007

Figure 3.1 demonstrates emerging economies' reserve adequacy over the time series 2003-2007, referred to as pre-crisis from this point forward. This pre-crisis time however, followed shortly after the crises of the 90s. Nearly all participating countries in the highlighted continents increased their reserve holdings in this time. The median was 12.85% of GDP in 2003 and rose to 15.14% of GDP in 2007. Numerous Asian nations i.e. China, Malaysia, and Thailand, experienced a currency *inflation* against the US Dollar in the early 2000s which may have contributed to the affordability of accumulating reserves in this time. In 2003, \$1 USD was the equivalent of 41.48 Thai baht. Four years later, \$1 USD had deflated to 34.52 baht (International Monetary Fund). The increase in reserves strengthened the local currency sparking a cyclical movement of more affordable reserve accumulation. *Figure 3.2* is the developing economies' reserve adequacy over



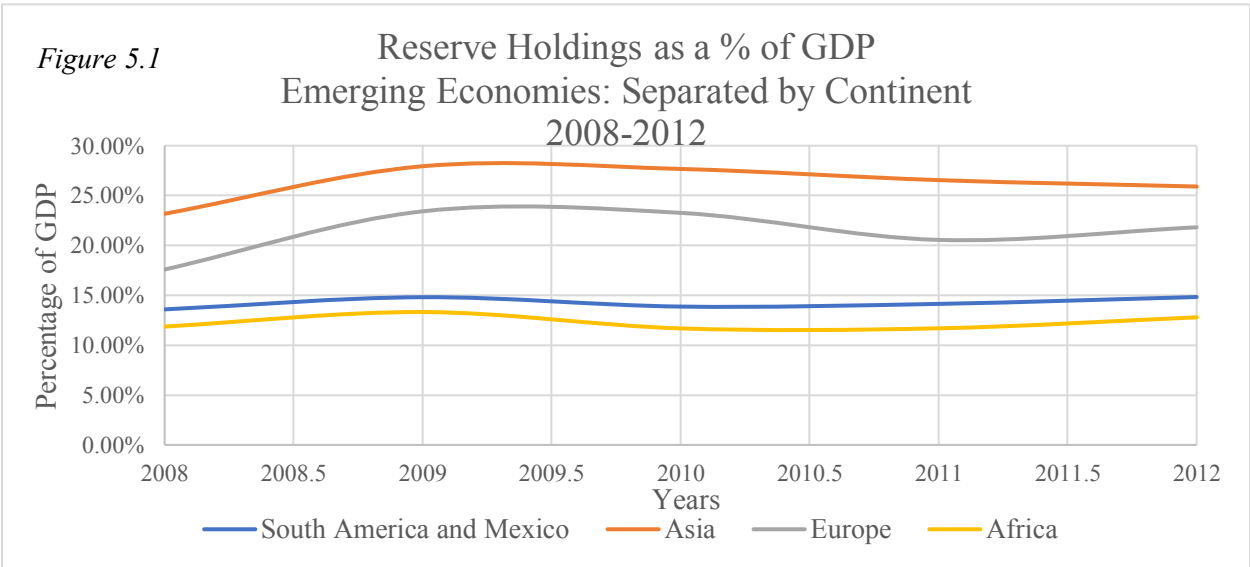
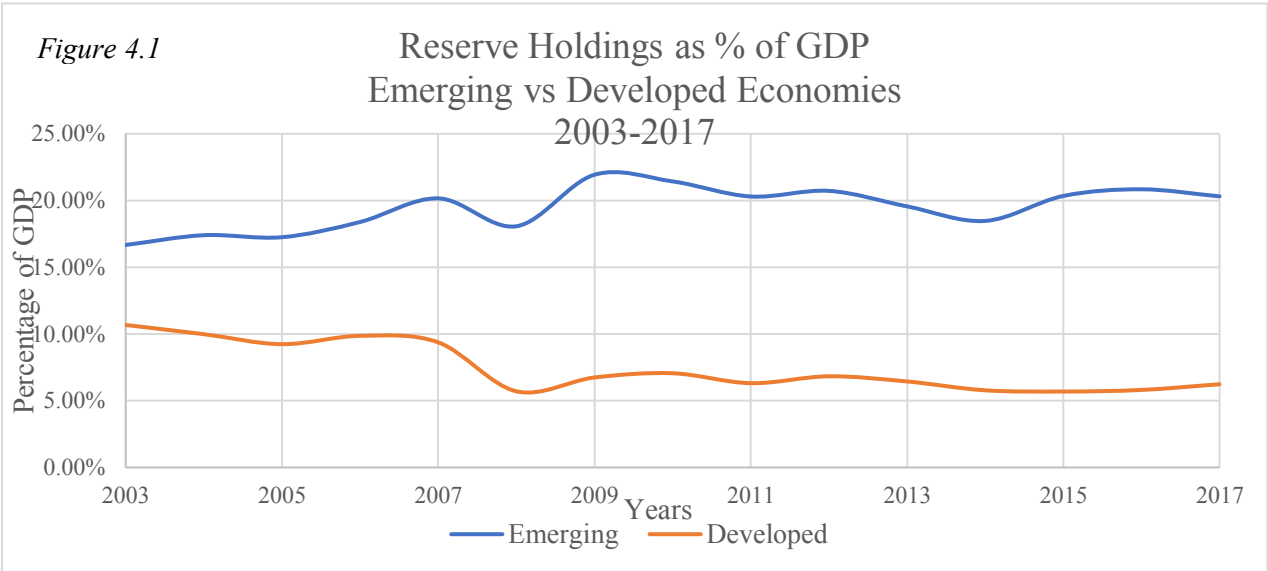
the same series. Europe and North American developed countries experienced very little change over this series. The outlier, Japan, increased reserve adequacy even though the yen experienced volatility ranging from ¥108.19 to ¥117.75 (International Monetary Fund) following the pattern of its other Asian counterparts.

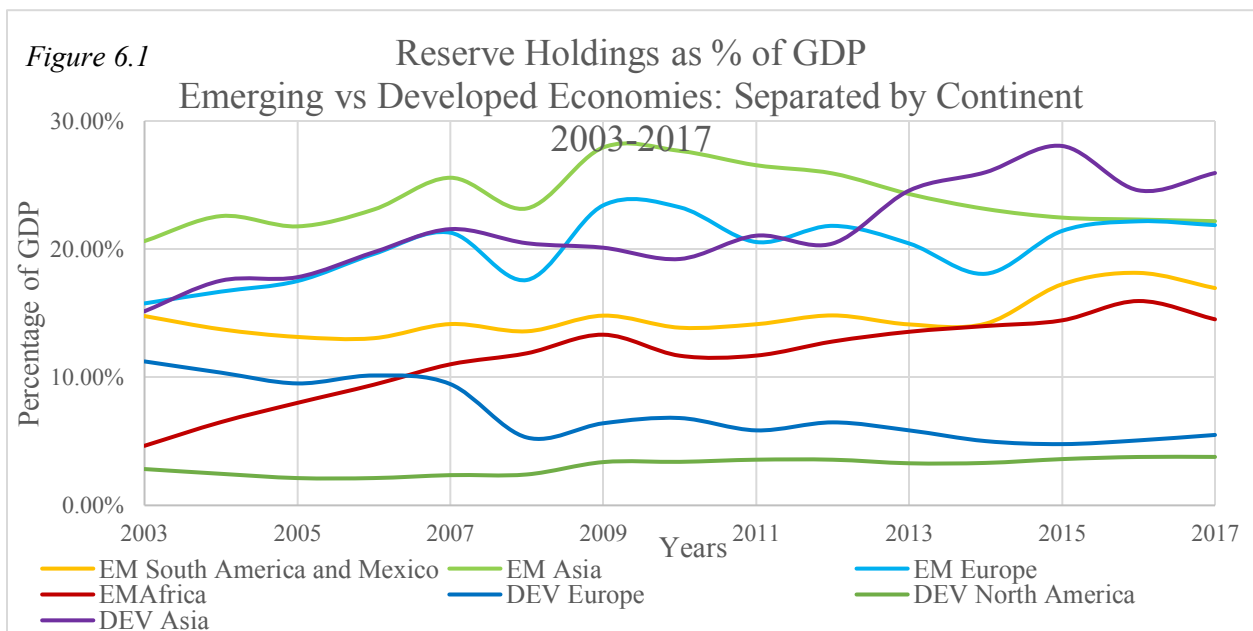
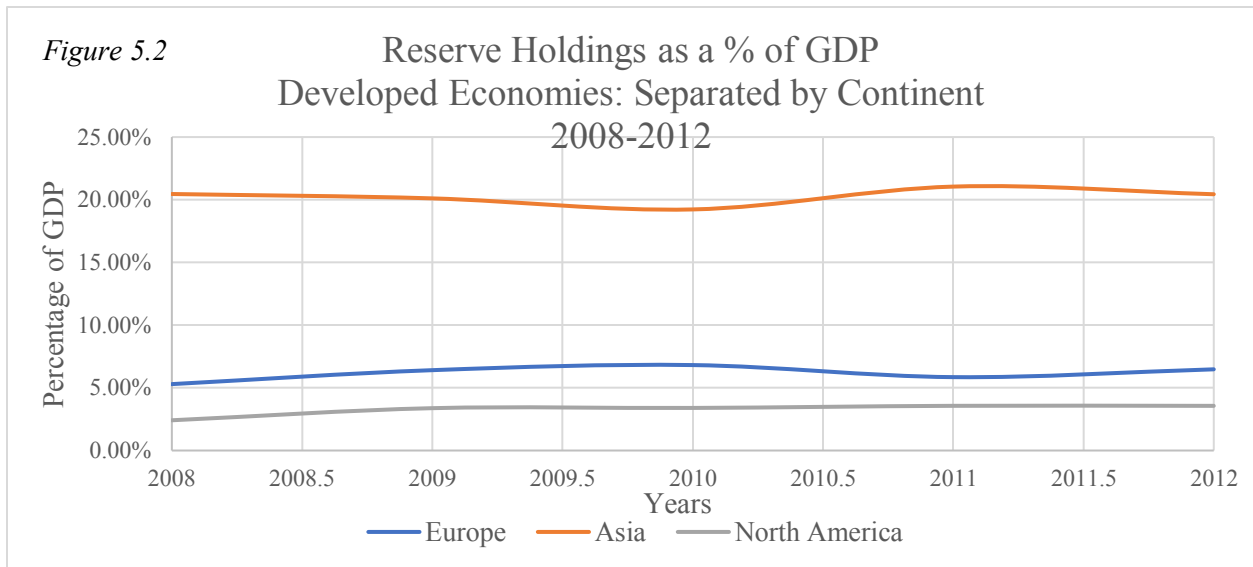


The Crisis Period: 2008-2012

The effects of the crisis are immediately recognizable from a macro standpoint as represented in *Figure 4.1*. Slightly unexpectedly, the developed markets experienced a greater loss between 2007-2008 as a result than the emerging markets. This could be due to the fact that the crisis began in Europe and the United States in 2007 – sparked by extremely accessible credit and unsustainable property appreciation – and eventually streamed down to emerging economies in 2008. Both developed and emerging Europe observed a decrease by approximately 5% during the crisis. Emerging Europe was able to recover reserve adequacy in the following year (although short-lived and partly explained by a drop in GDP) along with developing Asia, as seen in *Figure 5.1* (World Bank). The advanced economies remained fairly neutral in holdings until the end of this time segmented period, represented in *Figure 5.2*. In terms of exchange rates, the dollar

appreciated an average of 12.49% against other currencies (primarily developing economy currencies) between the 2003-2007 and 2008-2012 periods (International Monetary Fund). The capital flight that took place during the crisis devalued the local currencies of many emerging economies. The advanced nations (excluding Japan) kept reserves below a maximum of 8% of GDP even after the crisis whereas emerging countries accumulated and maintained reserves above 11%, although typically much higher (Figure 6.1).

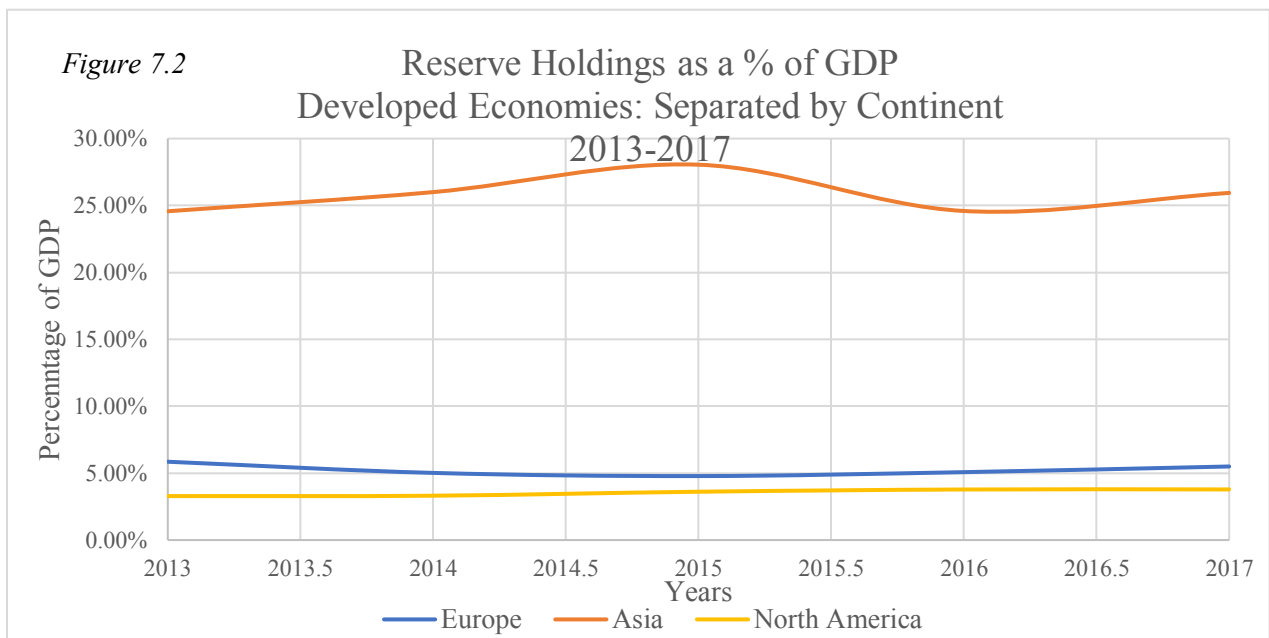
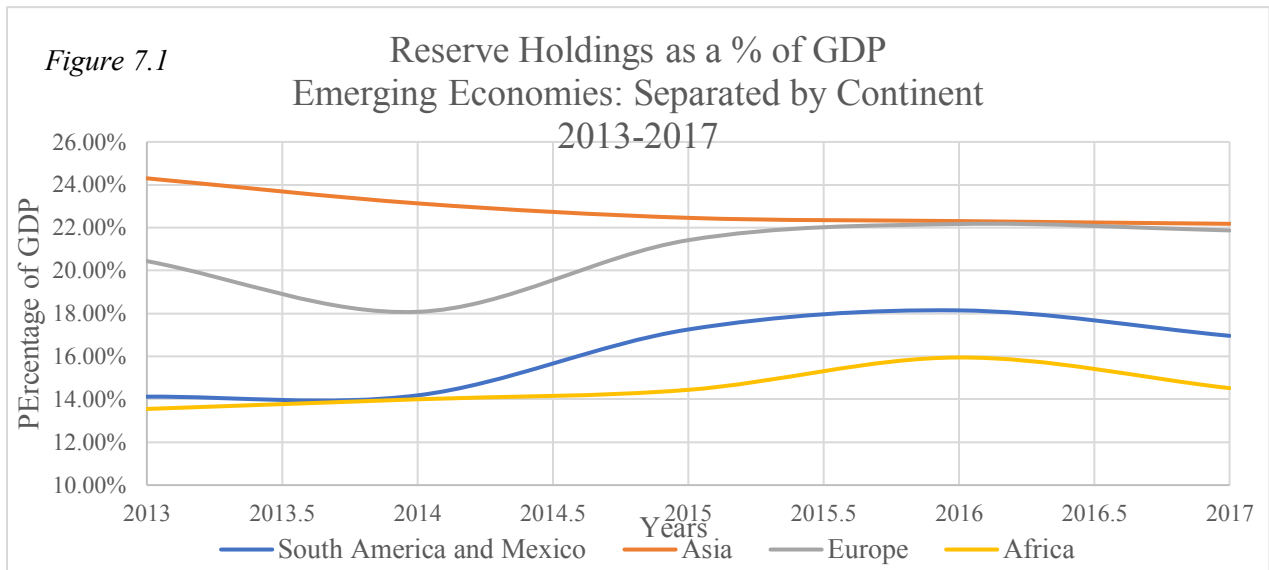




The Post-Crisis Period: 2013 – 2017

Disparities in reserve adequacy between emerging market continents minimized in the 2013 – 2017 time series. Asia’s reserves decreased as developing Europe’s increased – even neutralizing in 2016 – as depicted by the graph in *Figure 7.1*. As the developing economies grew more similar in behavior, the difference in percentage of holdings was the second largest of the whole time series between advanced economies and developing (15.19% in 2009 and 15.03% in

2016) (Figure 4.1). Developed North American and European reserves experienced virtually no change. Japan continued to hold above-optimal levels even reaching about 28.05% in 2015 (Figure 7.2). This level allowed Japan to surpass the developing Asian economies in holding percentages.



Summary and Conclusions

From the difference in means test and paired T-test, it is evident that the changes in reserve holdings as a percentage of GDP for emerging economies and developed economies is statistically significant. This provides insight of the saving behavior of these countries. This study is quite elementary in terms of data analysis. There is no control factor or other variable factors analyzed that could affect reserves as a percentage of GDP (such as political turmoil, domestic economic cycles, etc.). A more detailed approach to analyzing exchange rate variations may also lead to a better understanding of reserve volatility. However, a wholesome conclusion can be extracted from this analysis that provides an opportunity for further, more in-depth research.

We observe that the previous research in regard to reserves as a form of insurance is still applicable to emerging economies post-Global Financial Crisis. It is possible the developed economies did not behave the same way because they do need the increased insurance. It is apparent that Asian nations are still excessively accumulating reserves since the Asian crisis of the 90s. The Fed's post-crisis plan lifted the depressed economies and led the countries to a near-seamless recovery which lowered the requirement for reserve accumulations. In times of economic turmoil, emerging economies are still obligated to maintain a high percentage of reserves whereas developed economies are not – at least they do not behave like they do. Overall, emerging economies rose holding percentages from 17.25% in 2003 and ended the series at 20.31%. Oppositely, developed economies started at 10.67% in 2003 and fell to 6.24% by 2017. Reserve holdings as a percentage of GDP remains an imperative indicator to help both understand current financial conditions and to forecast financial behavior of varying economies.

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