

Trends in the Accumulation of Net Foreign Reserves since World War II

By Austin Kwon

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The Studies in Applied Economics series is under the general direction of Prof. Steve Hanke, co-director of the Johns Hopkins Institute for Applied Economics, Global Health, and the Study of Business Enterprise (hanke@jhu.edu). The authors are mainly students at The Johns Hopkins University in Baltimore.

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Abstract

Taking a historical perspective, this paper observes the trend in net foreign reserves by examining data that extend as far back as 1948. It looks broadly at how reserve coverage has changed over time and the benefits and costs of holding such reserves. Moreover, it studies which countries are the biggest holders of reserves and how much they have as well as the reasons why they hold these amounts. An accompanying spreadsheet workbook contains the data for the graphs and analysis of this paper. Data come mainly from the International Monetary Fund's International Financial Statistics database, supplemented in some cases by national sources.

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Introduction

The last 20 years have witnessed an enormous increase in central bank and other official holdings of foreign reserves. Emerging market economies, primarily those in Asia, now hold a significant share of world foreign reserves to protect themselves from the risks associated with global financial integration and future crises. Some of these countries, notably China, have accumulated large foreign reserves as a byproduct of their rapid, export-led economic growth with more or less rigid exchange rates. Periods of high oil prices from 2004-2008 and 2010-2014 generated substantial increases in foreign reserves for oil exporters. The size and pace of reserve accumulation, the degree of concentration of ownership, and the geographical distribution of the accumulation in world foreign reserves have shifted drastically since the years shortly after World War II.

Brief History of Foreign Exchange Reserves in the International Monetary System

The accumulation of foreign exchange reserves, as opposed to gold or silver, first started between 1899 and 1913. Central banks and treasuries held foreign exchange reserves to reassure lenders and to hedge against interruptions to the flow of foreign investment. Foreign currency balances were used as buffers to shield the domestic economy from volatility generated by fluctuations in global capital flows. The expansion of international financial transactions and the associated market liquidity, combined with the stability provided by the gold standard, gave rise to foreign currency balances as an attractive alternative and supplement to gold to support domestic circulation. Therefore, countries such as Austria, Russia and Japan sought changes to their gold standard systems to allow their central banks to acquire this desirable and profitable form of backing. Foreign exchange reserves were held in interest-earning securities or bank balances, whereas gold and silver earned no interest, and in fact were costly to store and handle.

Before World War I, the pound sterling was the dominant international currency. However, the U.S. dollar began to quickly rival sterling as a foreign reserve asset with the introduction of the Federal Reserve Act, which was intended to provide the United States with a safer, more flexible, and more stable monetary and financial system. Along with the substantial negative shocks to sterling because of World War I, this increased the attractiveness of dollar assets for foreigners.

Prior to 1913, foreign exchange reserves only made up roughly 10 percent of the reserves of central banks and governments (Eichengreen 2014: 7). In contrast, the 1920s saw governments actively promoting the system of supplementing gold with foreign exchange reserves. With inflation increasing rapidly during World War I and the considerable inelasticity of gold supplies, many countries began to fear that there would be a global gold shortage. The shift towards accumulating foreign exchange as reserve assets was evident at two postwar monetary conferences sponsored by the League of Nations, in Brussels in 1920 and Genoa in 1922. Many central banks, especially in Central Europe and Latin America, were established or restructured and were allowed to hold foreign exchange as part of their reserves.

In 1928, the peak of the interwar gold-exchange standard, the contribution of foreign exchange in the combined gold and foreign exchange reserves of 28 European countries was altogether 42 percent (Eichengreen 2014: 8). Countries such as Austria, Sweden, Finland, Portugal, Latvia, Estonia, Lithuania, Czechoslovakia, Albania and, beyond Europe, Ecuador, Chile, and India now kept most of their reserves in this fashion. The dollar and sterling were the predominant foreign reserve currencies.

Key Events Related to Foreign Reserves since World War II	
1946	Bretton Woods system of pegged exchange rates comes into effect as IMF begins operations; IMF members include most independent noncommunist countries
1946-75	Western colonialism comes to a close; most newly independent states replace previous monetary authorities with national central banks and join the IMF
1949	Devaluation of pound sterling and other Western European currencies
1950	European Payments Union (EPU) improves convertibility of member currencies
1958	EPU dissolves as members successfully move to current account convertibility
1961	Central bank "gold pool" instituted to keep market price near official price of \$35 per troy ounce
1967	Devaluation of pound sterling and currencies linked to it
1968	Central bank "gold pool" ends; market price of gold moves above official price
1969	IMF creates Special Drawing Rights
1971	U.S. devalues, abandons gold standard; Bretton Woods system effectively ends
1972	Pound sterling floats and many currencies cease to link to it
1973	Final collapse of Bretton Woods system; major advanced economy currencies float; rise in oil price leads to extensive reserve accumulation by oil exporters
1978	IMF Second Amendment excludes gold as a monetary anchor
1980	Gold peaks at \$843 per troy ounce (versus Bretton Woods era price of \$35)
1980s	Growth in advanced economies; a "lost decade" in many Latin American and African countries, with sovereign defaults and high inflation
1989-91	Communism collapses in Eastern Europe; post-communist states move to establish financial systems like those in capitalist countries
1994-95	"Tequila" crisis results in large devaluation of the Mexican peso, leading to bank runs, capital flight, and sharp recession in Argentina
1997-98	East Asian financial crisis, followed by crises in Russia, Brazil, Argentina, and Turkey up through 2002, spurs reassessment of exchange rate and reserve policies in emerging markets
1999	The euro comes into existence after some failed earlier attempts at European currency unification
2008-09	Great Recession in North America and Europe largely spares emerging markets

The Great Depression and World War II fragmented currencies into a number of blocs, based on the pound sterling, the French franc, the Japanese yen, the German mark, and some less important currencies. Foreign exchange reserves were centralized within the bloc and various

degrees of exchange control applied to transactions outside the bloc. The U.S. dollar was not officially part of a bloc, although the term “dollar bloc” was applied to the United States and other countries where there were relatively few prewar exchange controls. The ravages of World War II on other major countries left the United States with roughly half of global GDP and holding most of the world’s monetary gold — a degree of dominance never equaled before or since. It was apparent that the dollar would be the key currency of the postwar monetary system.

The international monetary conference by the World War II Allied nations at Bretton Woods, New Hampshire in 1944 began a new era. Although the pegged exchange rates of the Bretton Woods agreement have not endured, the underlying philosophy of increasing monetary and economic integration has. Early in the Bretton Woods era, sterling became the most held foreign currency because of special circumstances arising from the war. British Empire territories, Iraq, and Egypt accumulated large claims in sterling by supplying Britain with war materiel. Sterling accounted for more than 80 percent of foreign exchange reserves (Eichengreen 2014: 14). However, many holders of sterling wanted to convert these claims into other reserve assets, especially U.S. dollars. They also sought to purchase merchandise to liquidate their sterling balances, which they did over time as such actions were allowed. Consequently, by the early 1950s, sterling holdings fell. The dollar became the most widely held foreign reserve asset. It also continued to be the key currency of the international monetary system because it was the only major currency that was convertible into gold by foreign holders for current-account and capital-account transactions alike. The dollar’s share continued to grow through the mid 1970s.

From the end of Bretton Woods period in the early 1970s until the mid 2000s, reserve assets increased by a factor of 45 (ECB 2006: 10).¹ They have continued to rise since. Sterling continued to decline as a share of global reserves. In 1972, the United Kingdom floated the exchange rate of sterling and ended preferential exchange controls with currencies tied to sterling except for a few minor British overseas territories. Currencies that had been linked to sterling soon switched to another anchor currency or floated. On the other hand, the 1970s saw the German mark become an anchor currency within Western Europe, leading to a rise in its share in foreign reserve holdings. Except for the Netherlands, countries that pegged to the mark had difficulty maintaining sufficient discipline to avoid devaluation. Ultimately the solution they arrived at was to merge their own currencies and the mark into a single new currency, the euro, which immediately became the world’s second-leading currency.

With the ever-growing global economy that is set to outpace the growth of the United States itself, other sources of international liquidity are now being considered. Some observers think that the Chinese yuan can challenge the dollar, but there are also those who argue that the Chinese financial markets still do not have the size, stability, and liquidity to support a global

¹ During this time, global reserves including gold reserves have multiplied by a factor of only 28, if gold is valued at its historical price of SDR 35 per ounce.

foreign reserve asset. So, what do the data say of the dollar's importance as a major reserve currency?

The IMF's World Currency Composition of Foreign Exchange Reserves (COFER) database, which excludes gold, shows what currencies countries hold in the aggregate. It provides evidence of the continuing importance of the dollar as the major reserve currency, accounting for more than 60 percent of reserves whose composition is reported. The euro trails behind in second place at about 20 percent. A number of countries do not report the specific currency composition of their reserves. The standard assumption by the IMF and other researchers is that those reserves have the same percentage composition as the reserves whose currency composition is reported.

It is conceivable, however, that the Chinese yuan and the Indian rupee could achieve reserve currency status in the coming decades because of their large populations and strong economic growth, but there is no other realistic prospective challenger for reserve currency status unless a group of smaller countries bands together as the euro area countries did. As of 2017 Q2, world-allocated reserves by currency in percentage was: U.S. Dollar – 63.79%, euro – 19.91%, yuan – 1.07%, yen – 4.64%, sterling – 4.41%, Canadian dollar – 1.95%, Australian dollar – 1.77%, Swiss Franc – 0.17%, and other currencies – 2.30%.

Benefits and Costs of Holding Foreign Reserves

Why do countries hold foreign reserves? Before proceeding to analyze the data, it is important to understand the rationale. The main benefit of holding foreign reserves is their ability to provide a diversified portfolio. Foreign reserves are generally selected to be assets that are easily sold with only minor markdowns. When economic or political domestic crises arise, this feature of holding foreign reserves is especially important. In many countries, domestic assets are less liquid than high-grade securities of the major advanced economies and during a crisis are only saleable at a large discount in price. The main cost of holding foreign reserves is that they provide lower returns than domestic assets. Therefore, a trade-off exists: foreign reserves provide protection against crises at the opportunity cost of greater returns from domestic assets.

In the last 20 years, a dramatic accumulation of foreign exchange reserves has occurred in developing countries, especially those in Asia and the Middle East. Theoretically, countries whose currencies float freely, without foreign exchange intervention, do not need to hold foreign reserves. This is because the central bank does not respond to the exchange rate fluctuations, since they are determined by the market. Hence, the expected trend since the end of the Bretton Woods system should be a decrease in reserves. However, if we observe the data, even countries with freely floating exchange rate regimes, such as Australia, New Zealand, Canada, Brazil, Mexico, South Africa, Algeria, Korea, and Japan, have increased their reserve holdings rapidly in the past two decades. For example, in 1985, Japan had foreign exchange reserves of \$27 billion, versus \$1,188 billion as of 2016 (an increase of more than 4,000 percent). Between 2000 and 2005, emerging market economies increased reserves at an annual

rate of \$250 billion, or 3.5 percent of their annual combined GDP (Mohanty and Turner 2006: 40). Shifting the distribution of government and private debt to longer maturities to reduce the frequency and associated risk of refinancing was one popular strategy proposed by economists for protection against crises, but many nations in practice placed greater emphasis on increasing foreign reserves. The recent rapid increases in reserves were accelerated by the desire of policymakers in many countries to avoid currency appreciation and keep their tradable sectors competitive.

Using a simple open economy model shows that increasing foreign exchange reserves decreases the costs of liquidity risk and increases the capacity to issue both liquid and total debt, while reducing debt maturity. Furthermore, with forex reserve interest rates low, increased foreign reserves results in a permanent decrease in consumption and shifts labor from the non-tradable to the tradable sector, although economic and investment growth may strengthen when there is a capital-intensive tradable sector (Fukudua and Kon 2010: 19). Substantial accumulation of foreign exchange reserves affects central bank balance sheets and therefore impacts the banking system as well as the private sector. Consequently, accumulation of foreign reserves can have large macroeconomic effects, depending on how risks are handled and how intervention is funded. One possible effect is that it can decrease the effectiveness of sterilization, with potentially inflationary implications. High costs of intervention, monetary imbalances, overheated credit and asset markets, and extremely liquid and conceivably distorted banking systems are other possible effects (Mohanty and Turner 2006: 40).

Monetary Aggregates and Reserves Data

As mentioned before, an accompanying spreadsheet workbook contains the data for the graphs and analysis of this paper. Data come mainly from the International Monetary Fund's International Financial Statistics database, supplemented in some cases by national sources. The IMF's "new presentation" of monetary data is used except for years where only the "old presentation" of data was available. The differences between the two presentations are not enough to change the analysis at the highly aggregated level here.

IMF data often do not start for a country until it became an IMF member. For many former British colonies, the transition from colonialism to independence was approximately contemporary with a transition from a currency board to a central bank. For the Bretton Woods period, the data understate the number of monetary authorities that held high reserves because they omit most of the colonial currency boards. The data are still informative, though, because they reflect what central banks were doing. Almost all noncommunist countries with central banks were IMF members in the Bretton Woods period. Since then, IMF membership has expanded to include almost all independent countries, the great majority of which have central banks. So, the data about reserve ratios are good measures of how the behavior of central banks as a group has changed over time.²

² Note that at the country level, large swings in reserve ratios are often the result of big changes in the exchange rate. For instance, a devaluation of the currency from 1 peso per US dollar to 2 pesos per dollar makes dollar-

All data are annual. The earliest data year is 1948. All data except GDP are for the end of the period. In the monetary base (M0) spreadsheets, some data for members of the euro area beginning before their membership in the euro area are represented in euros by the underlying sources, so they are converted into dollars via their permanently fixed rates with the euro. To avoid duplication, in the calculations sheets, data for constituent countries of a monetary union are omitted when data for the union begin.

The data are more complete the nearer they approach the present. The notable gaps in the older years (before 1992) are for most communist bloc countries; colonies or dependencies whose statistics are by custom not included with the metropolitan country, such as Bermuda, the Cayman Islands, French Polynesia, etc.; and some countries before they replaced currency boards or other institutions with central banks. Gaps in data may also be present for the years before countries became IMF members and for independent countries that currently are not IMF members, notably Taiwan, North Korea, and Cuba.

I collected data for these aggregates:

- The monetary base, M0, which is the number of notes and coins in circulation plus demand liabilities of financial institutions at the central bank.
- Broad money, M2, which is the number of notes and coins held by the public plus the sum of demand deposits and time deposits of commercial banks.
- Merchandise imports.
- Reserves, discussed more below.

Data are for the end of the year (or, for merchandise imports, the whole year) and are converted into U.S. dollars using year-end exchange rates if not reported in dollars. Calculations for reserves to M0 and reserves to M2 are represented in millions of US dollars. Reserve-to-GDP calculations have also been computed using nominal GDP values.³

The data and the history of net foreign reserves since World War II fall into three periods: the Bretton Woods period of pegged exchange rates (1945-1973); the period of widespread floating exchange rates up to just before the East Asian financial crisis (1974-1996); and the East Asian financial crisis to the present (1997-2016).

Central Bank Foreign Reserves vs. Official Foreign Reserves

denominated foreign reserves now worth twice as many pesos, so, if the monetary base is unchanged, the ratio of foreign reserves to the monetary base doubles.

³ Sovereign wealth funds are not included in reserves but for some countries they constitute a possible back-up source of assets.

It is crucial to note the difference between central bank foreign reserves and official foreign reserves. Central bank foreign reserves are reserve assets kept by the central bank that are denominated in foreign currencies, and which may be used to redeem the currency have issued as well as to support monetary policy. Official foreign reserves, however, include reserves held by treasuries and other government bodies as well. For some countries, including China, Japan, and the United States, official reserves held outside the central bank are large and therefore the data include those reserves. Official reserves exclude sovereign wealth funds, which have no direct connection to monetary policy and often invest in less liquid assets.

Another important distinction to make is the difference between gross and net reserves. Paragraph 6.64 of the IMF's *Balance of Payments Manual*, 6th edition, defines gross international reserves as: "external assets that are readily available to and controlled by the monetary authorities for meeting balance of payments financing needs, for intervention in exchange rate markets to affect the currency exchange rate, and for other related purposes (such as maintaining confidence in the currency and the economy, and serving as a basis for foreign borrowing)" (IMF 2010: 111).⁴ Gross reserves include monetary gold, SDRs (Special Drawing Rights), a country's reserve position at the IMF, and other reserve assets that include currency and deposits, claims on monetary authorities and other entities, securities, and financial derivatives. Net foreign reserves, however, strip out short-term, reserve-related liabilities to foreigners. They are therefore a more accurate measure of how much ability a country has to use reserves to intervene in foreign-exchange markets. In a notorious case, the Bank of Thailand had large gross foreign reserves before it triggered the East Asian currency crisis of 1997, but its net reserves were much smaller because it had extensive, undisclosed foreign liabilities. As a result, its net worth turned negative in 1997 and 1998 (Bank of Thailand annual report 1998: 165-169).

An important difference between the way this paper measures reserves and the way some other papers do is that this paper includes gold at market value. Many central banks assess their gold at a book value far lower than the market value. The U.S. government, for example, values its gold at \$42.2222 per fine troy ounce, whereas the market value at the end of 2016 was \$1,248.99, nearly 30 times as much. The market for gold is not as large and liquid as the market for government securities of the major advanced economies, so a large sale might only be possible at a discount of several percent from the market price. Still, the market price is a more realistic valuation than the book values many countries use.

Trends in Reserve Holding Under the Bretton Woods System (1945-1973)

Following World War II, the introduction of the Bretton Woods system gave rise to new views on international liquidity (Eichengreen 2008: 94). The system was driven mainly by a wartime compromise between the United States and the United Kingdom. The British aimed to bring back sterling's convertibility for current account transactions (such as trade-related payments),

⁴ For dollarized countries, the need to have reserves to take part in exchange markets is irrelevant for defining the reserve assets of these economies.

which they had suspended at the outbreak of World War II. They agreed to end trade preferences for British Empire goods in exchange for financial aid from the United States and acknowledgement of the UK's intent to achieve full employment. This gave rise to the opposing Keynes and White plans during World War II for the postwar international monetary system. The Keynes plan proposed adjustable exchange rates and exchange and trade restrictions to obtain full employment, while the White Plan aimed to achieve a system of pegged currencies with fewer controls, managed by an international organization with the right to control changes in parity. The Keynes plan proposed a Clearing Union offering substantial balance-of-payments funds to fend off deflationary pressures that would increase unemployment. The United States, at the time the country with the biggest balance of payments surplus, would have had unlimited liability to fund countries with balance of payments deficits under the Keynes plan. The White plan accordingly proposed an International Stabilization Fund with more modest lending capacity.

The United States was the economically and financially stronger country, with the better bargaining position, so the Articles of Agreement establishing the IMF were most heavily influenced by U.S. views. The IMF became the more limited organization proposed by White rather than the de facto world central bank proposed by Keynes. However, the Articles of Agreement did not clearly define foreign reserves, nor did they specify a theory to help determine what would be an adequate level of reserves. They did state that official reserves of official authority contained "gold and currencies readily convertible into gold held by monetary authorities" along with other assets kept by the monetary authorities "which can perform the deficit-financing function," including inconvertible currencies, credit balances in bilateral or multilateral payments agreements, and debt-type securities payable in foreign currencies (Monnet and Puy 2015: 7). Article XX of the Articles of Agreement ordered countries to specify par values for their currencies in terms of gold or a currency convertible into gold (which essentially meant the dollar, the only major currency that met the criterion) and to hold their exchange rates within 1 percent of those levels. Par values could also be adjusted to rectify a "fundamental disequilibrium" within a 10 percent band of the par level after notifying the IMF, and could be adjusted beyond the 10 percent band after negotiating with the IMF (Eichengreen 2008: 95).⁵ Furthermore, the Articles of Agreement allowed the maintenance of controls on capital movements. Currencies were to be exchangeable at official rates, and all members were to avoid discriminatory currency arrangements.

With no various definitions of reserves being used by different countries, the IMF experienced difficulties in obtaining data on reserves. Although the IMF and economists of the time lacked a well-developed theory of how to measure the adequacy of reserves, in 1953 the IMF attempted to quantify the adequacy of reserves by using a ratio of reserves to imports. An IMF report of that year concluded that "the adequacy of reserves is a matter of judgment—depending on the country, on the time, and on the purpose for which the reserves are intended" (International Monetary Fund 1953: 195). The United States specified the value of the dollar in terms of gold so that one troy ounce of gold was equivalent to \$35. Other IMF members had to define the

⁵ The meaning of "fundamental disequilibrium" was never defined.

value of their money according to what was known as the “par value system” in terms of U.S. dollars or gold. With numerous European countries having problems with debt after the impact of World War II, they needed to send substantial amounts of gold into the United States — or to delay payment, or receive offsetting American aid, both of which they did. As a result, the dollar became unquestionably the world’s dominant currency, instead of sharing that role with sterling as it had done before World War II.

The decolonization between 1946 and 1975 is an important background trend to keep in mind. It began with the independence of the Philippines in 1946, which the United States had promised in the 1930s. It continued until 1975, when Portuguese colonies became independent. By then, colonialism was limited to small places like Bermuda that did not want independence. Most newly independent countries established national central banks if they did not previously have them and joined the IMF. The IMF in fact had a Central Banking Department to guide the formation of new central banks.

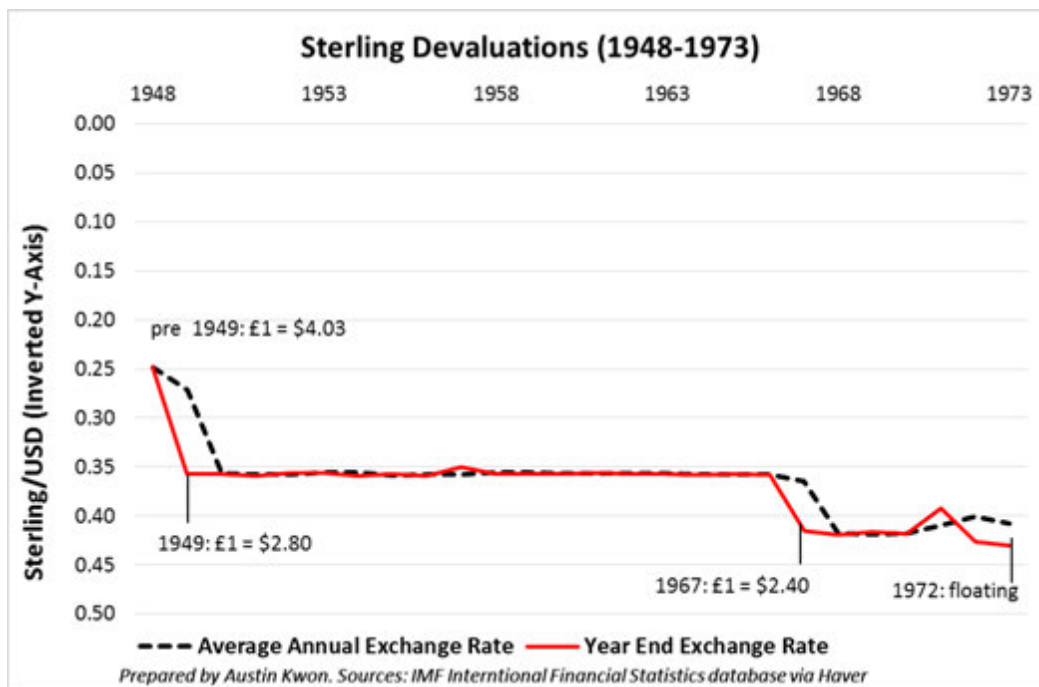
In the 1950s, Western Europe, having recovered from the war, grew fast until the early 1970s. Much of the rest of the world also experienced fast growth. Although the world economy was doing very well, increasing strain on the US dollar and loss of U.S. gold reserves occurred in the 1960s as the Federal Reserve was unwilling to tighten monetary policy sufficiently.

The Decline of Sterling as a Reserve Currency

There was not enough gold in the world for each currency to hold adequate reserves at existing exchange rates. Official reserves were accumulating at a much faster pace than world gold production, though the link to gold imposes some discipline on the system. The “sterling area” (currency bloc) helped sterling to maintain some importance in currency markets, but sterling ultimately became an unpopular reserve currency. After the war, many countries expected a devaluation in sterling and thus converted their pounds to dollars. Moreover, postwar Europe faced large unsatisfied demands for food consumption, capital goods, and other products manufactured in the United States and a restricted volume of goods for export. Its overall trade deficit with the rest of the world increased to \$5.8 billion in 1946 and \$7.5 billion in 1947 – substantial sums for the time (Eichengreen 2008: 96). British colonies in the sterling area demanded consumer goods, which the UK was not able to offer as its economy was still operating under quasi wartime procedures, with extensive rationing and heavy government control of industry. As a result, these countries shifted to the United States and the dollar for consumer products, which further had a negative impact on the British economy and sterling. With the UK struggling with its postwar balance of payments deficit, central banks turned to dollars instead of pounds as their preferred foreign asset.

Sterling’s position as a reserve currency pegged at an overvalued exchange rate led to a decline in the competitiveness of UK exports and manufacturing prominence. Meanwhile, the U.S. economy was booming and as more and more reserves were converted from pounds to dollars, sterling weakened further. Sterling was devalued from \$4.03 to \$2.80 in 1949 and to \$2.40 in

1967 before being floated in 1972, at which time the UK ended preferential arrangements for countries that used sterling as their anchor currency, other than a few small British colonies.



From Dollar Shortage to Dollar Surplus (1945-1960)

World War II left the United States as the only major industrial country that had not suffered extensive damage to its economy from wartime attack. Demand for American goods to help rebuild war-damaged countries was great. During the late 1940s, the United States ran large current account surpluses, and its gold reserves grew. Europe continued to struggle, hampered by a “dollar shortage.” Most European countries undertook postwar monetary reforms, but they did not reduce their money supplies or devalue their exchange rates sufficiently to clear the market. Instead, they propped up overvalued exchange rates by continuing many of the exchange controls they had imposed during war.

The United States desired to restore an open multilateral trading system, which it believed would reduce tensions between France and Germany. Trade would spark economic recovery and provide Europe the means to purchase raw materials and capital goods. This would in turn allow Europe to increase its exports and recover from the dollar shortage, maintaining the system of convertible currencies. The IMF and IBRD (World Bank) lacked sufficient funds for the task. It was necessary for the United States to run current account deficits to allow European countries a sufficient supply of dollars. The Marshall Plan of U.S. aid was part of the answer. Another part, connected to the Marshall Plan, was the European Payments Union (EPU). It allowed for multilateral clearing, settling excess balances in dollars. Most Western European countries joined, and European colonies were indirectly part of the EPU through their metropolitan countries, so the EPU liberalized trade payments across a large part of the world.

by enabling transactions not possible solely with bilateral clearing between inconvertible currencies.

Economic growth in Western Europe increased local incomes and demand for national currencies, to the extent that in 1958 members of the EPU dismantled it because they were able to establish current account convertibility for their currencies. (Unlike the dollar, though, no major Western European currency was convertible for capital account transactions until the German mark in 1959; the pound sterling and French franc did not become fully convertible until after the Bretton Woods system ended.)

It was also in 1958 that Federal Reserve gold stocks began to decline from 600 million troy ounces or more (around 45 percent of the U.S. monetary base), where it had been since the end of World War II, to less than 500 million ounces (around 38 percent of the monetary base) by 1961. The Federal Reserve failed to contract monetary policy to reverse the outflow and the dollar shortage started to become a dollar surplus. Its gold stock would continue to fall, to under 300 million ounces (about 12 percent of the U.S. monetary base) by 1971 (Bao and Paine 2017).

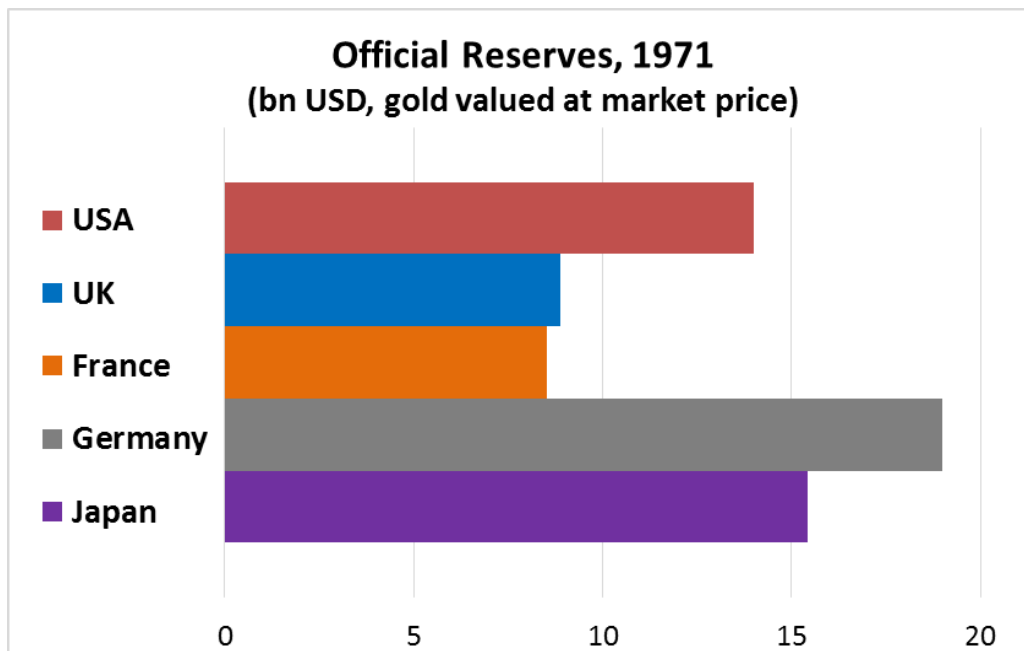
The Gold Pool (1961-1968)

Under a full-fledged gold standard that allowed the public to convert national currency into gold on demand, the market price would have remained close to the official price of \$35 per troy ounce, or the equivalent in other currencies, without any need for intervention. In the Bretton Woods system, central banks settled balances in gold; the public had no right to demand payment in gold from central banks. Restrictions on arbitrage between the central bank price of gold and the market price, plus the Federal Reserve's insufficiently restrictive monetary policy, led to the market price moving noticeably above the official price.

To counteract the divergence, the Federal Reserve and seven Western European central banks formed a gold pool to operate in the London market, the center of world gold trading. The gold pool began in secret in 1961, though its existence was divulged by a Swiss newspaper the next year. The Gold Pool proved to be effective for roughly seven years, but as large financial losses occurred and many central banks ceased participation in it, the system collapsed (Bordo, Monnet, and Naef 2017: 2). The market price of gold moved permanently above the official price of \$35 an ounce.

From Fixed to Float (1969-1973)

In 1969, IMF members agreed to create a new reserve asset, the Special Drawing Right (SDR). Sometimes dubbed "paper gold," the SDR was created to address a supposed shortage of liquid reserve assets. However, the dollar was, if anything, in surplus. Countries that wanted to accumulate reserves did not seem to have difficulty accumulating them: by 1971, the official reserves of Germany and Japan exceeded those of the United States.



Meanwhile, in the United States annual inflation moved from below 2 percent in the early 1960s to above 5 percent in 1969 and 1970. The Federal Reserve raised its policy interest rate to 6 percent, a level not seen since 1929. Gold reserves increased during the U.S. recession of December 1969 to November 1970, then fell again as the Federal Reserve cut the policy rate to 4.75 percent by February 1971. Federal Reserve chairman Arthur Burns was aware that keeping monetary policy tight might endanger the prospects of his political patron, President Richard Nixon, who would be running for re-election in 1972. As mentioned above, U.S. gold reserves fell from about 45 percent of the monetary base in the 1950s to 12 percent in 1971. Faced with a prolonged tightening of monetary policy if he wanted to avoid devaluing the dollar, on August 15, 1971 Nixon ended the dollar's convertibility into gold (which, remember, had only been available to other central banks, not to the public). In December 1971 the Smithsonian Agreement, accepted by a group of 10 countries,⁶ resulted in exchange rates being pegged to the dollar. It was agreed that the dollar would remain inconvertible into gold, although the dollar was devalued to a notional price of \$38 per troy ounce of gold. The attempt to preserve the Bretton Woods system of exchange rates was a failure; speculation against the dollar continued. In February 1973, the dollar was again devalued, to a notional price of \$42.2222 per troy ounce—which remains the rate at which the U.S. government carries gold reserves on the books today. The next month, though, the era of generally pegged exchange rates against the dollar or gold ended as France, Germany, Japan, and other countries floated their currencies against the dollar to avoid importing U.S. levels of inflation. Japan had already begun floating in February and the United Kingdom had begun in June 1972. Unlike the advanced economies, most developing countries kept their currencies pegged to the dollar officially or in practice.

⁶ Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom, and the United States.

In a coda to the Bretton Woods system of pegged exchange rates, at an IMF conference in Jamaica in January 1976, member countries agreed to allow more flexible exchange rate arrangements and to reduce the role of gold in the international monetary system. In April 1978, the IMF Articles of Agreement were amended (the so-called Second Amendment) to incorporate this understanding, including a prohibition on pegging exchange rates to gold. The international monetary system was now officially what the Nobel Prize-winning economist Robert Mundell has dubbed a “nonsystem,” with no uniformity of exchange rate practice or monetary policy, and hence widely divergent practices with regard to holding foreign reserves.

The First Quarter Century of the “Nonsystem” (1973-1997)

In October 1973, an alliance of Arab countries tried but failed to overrun Israel in the Yom Kippur War. The Organization of Arab Petroleum Exporting Countries (the Arab members of OPEC plus Egypt and Syria) cut production and imposed an oil embargo on the United States and other countries considered to be supportive of Israel. The price of oil rose from about \$3 a barrel before the embargo to nearly \$12 by 1974. Middle Eastern oil producers received greatly increased revenue, part of which they used to greatly expand their foreign reserves.

In the United States, even though inflation fell in the mid 1970s, it began to gain momentum again after 1976. In 1979, President Jimmy Carter appointed Paul Volcker as chairman of the Federal Reserve. The Volcker Fed attacked inflation by targeting the quantity of bank reserves and raising the policy interest rate, ultimately to a record level of 14 percent in 1981. Also in 1979, the Iranian Revolution led to a reduction of about 4 percent in world oil supply that however resulted in a doubling of oil prices.

The result of the sea change in U.S. monetary policy and the jump in oil prices reverberated for a decade. In many developing countries that imported oil and borrowed in foreign currency, payments for oil and debt service soared, leading to extreme pressure on foreign reserves and then to a wave of debt defaults and currency depreciations. Oil exporters enjoyed a second unexpectedly large increase in revenue, part of which they again saved in foreign reserves. The U.S. dollar appreciated strongly as the combination of Volcker’s monetary policy to restrain inflation and President Ronald Reagan’s tax and regulatory policies generated renewed confidence in the dollar and cemented its role as the leading reserve currency of the post-Bretton Woods era.

Western European countries desired exchange rate flexibility against the dollar but a high degree of exchange rate stability among themselves, so they attempted to run cooperative currency pegs. During the 1970s, “they had attempted to maintain the 2¼ percent fluctuation bands of the Smithsonian Agreement in an arrangement known as the *European Snake*” (Eichengreen 2008: 136). To restrict exchange rate variability, they established the European Monetary System (EMS). However, with the end of most capital controls in the 1980s in member countries that still had them, the EMS progressively grew harder to operate. Systematic adjustments in parities grew impossible and nations with strong currencies were hesitant to support their partners with weak currencies. This was because with the increasing

liquidity in global financial markets due to the advancement of information processing technologies and immense capital mobility, support would need to be essentially endless for these partners. As European national central banks failed to cooperate, subsequent crises caused the United Kingdom to abandon the EMS in 1992 and the remaining countries to expand “the fluctuation bands of the EMS from 2¼ to 15 percent in 1993” (Eichengreen 2008: 136). To avoid the exchange rate problems that had blown up the Bretton Woods system and the EMS, EMS members decided to move to a single currency, the euro, an effort that would come to fruition in 1999.

Most developing nations, especially smaller ones, felt that floating exchange rates were too volatile and disruptive and continued to peg their currencies. In response to increased capital mobility, they kept tight capital controls in place. This was the case, for instance, in many Central American countries, which had long pegged their exchange rates to the dollar. Some countries even hardened their exchange rates by creating currency boards; examples include Hong Kong, Argentina, Estonia, Lithuania, and Bulgaria.

Two other major trends of the first quarter century of floating exchange rates were the collapse of communism and the rise of inflation targeting. China’s economic reforms starting in 1979 and the collapse of communism in the Soviet bloc from 1989 to 1991 brought a huge part of the world back into the market economy. No matter what their exchange rate policies, most formerly communist countries decided that they needed to hold substantial foreign reserves. Inflation targeting, first formally adopted in New Zealand in 1989, spread to both advanced and developing countries in the 1990s. Again, though, most countries that adopted it also held substantial foreign reserves.

The East Asian Financial Crisis and After (1997-Present)

Emerging markets in East Asia had generally avoided the problems that had led to debt crises in Latin America and Africa in the 1980s, and experienced solid growth. In the early and mid 1990s growth continued. Then, on July 2, 1997 Thailand floated its currency, resulting in an immediate depreciation of about 20 percent. The Thai central bank had not reported to the public certain liabilities in forward markets for foreign exchange, thus making its net foreign assets appear larger than they really were. After Thailand floated, speculation against officially or de facto pegged exchange rates in other developing East Asian countries surged. All that experienced heavy speculation except Hong Kong and China let their currencies depreciate. The depreciations were large: in Indonesia, the most severe case, about 85 percent (Sheng 2009: 218). The East Asian crisis was followed by crises and large exchange rate depreciations in Russia (1998), Brazil (1999), Argentina (1999-2002), and Turkey (2001).

The East Asian crisis came as complete shock to policymakers and market participants. It occurred in the fastest-growing region of the world, in countries with fairly low inflation and fiscal restraint. Even observers who had expected problems in Thailand did not expect that they would spread to every country in the region except Japan and North Korea, and that foreign exchange markets would prove to be so volatile and illiquid. (Perhaps the “tequila crisis” in

Mexico and Argentina in 1994-95 should have served as a warning, but it did not.) As we will see, the lesson that policy makers emerging markets drew from the East Asian crisis and subsequent crises was that they should substantially increase their foreign reserves.

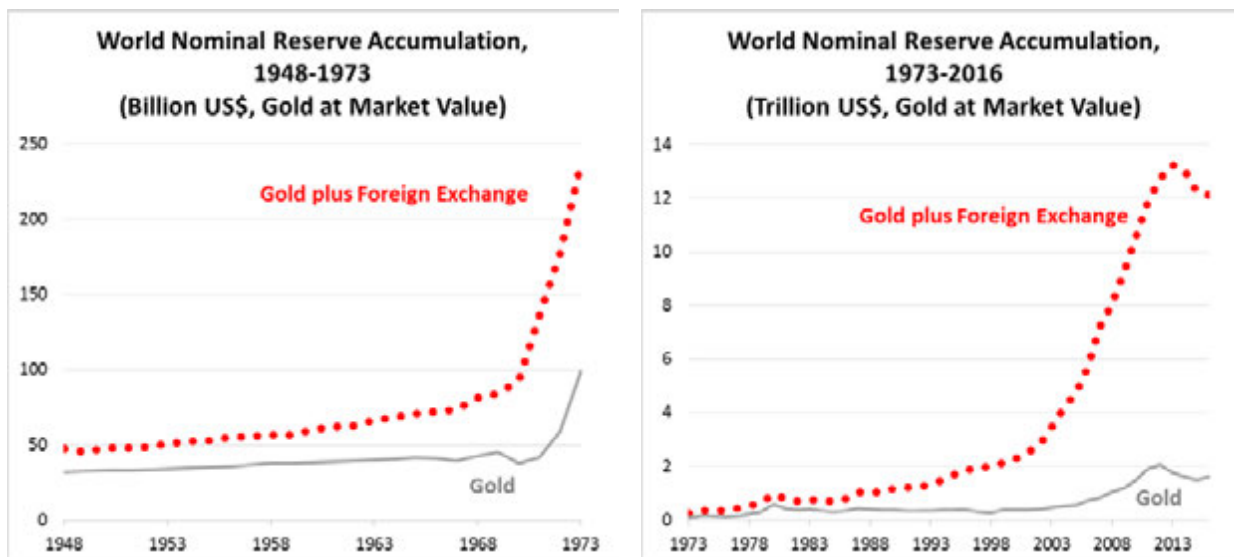
In the early and mid 2000s, a period of broadly shared worldwide growth, strongest in emerging markets, increased demand for oil pushed the price from under \$20 a barrel in 2002 to over \$140 at the peak in 2008 only weeks before the global financial crisis began. Oil exporters experienced again enjoyed an unexpectedly large inflow of funds and used part of it to increase their foreign reserves.

The global financial crisis (Great Recession) of 2007-08 did not strongly affect attitudes about foreign reserves. For the first time in a century, a major crisis was largely confined to the richest countries. Their financial systems experienced severe stress, but except in Iceland, one of the few advanced economies that had a pegged exchange rate, they did not suffer extreme currency depreciation and their foreign exchange markets remained liquid. The crisis did not persuade policy makers in advanced economies that they needed larger foreign reserves. It did however perhaps reinforce the perceived lesson of the East Asian crisis for policy makers in emerging markets.

World Reserve Accumulation over the Long Term

Fully flexible exchange rates, in contrast to pegged or fixed exchange rates, have no limitations set by the government on the level to which rates can fluctuate. Flexible exchange rates reduce pressures on foreign reserves by letting the exchange rate do the adjusting (Johnson 1969: 12-13). In principle, a country with a flexible exchange rate that is willing to forego intervention in foreign exchange markets does not need to hold foreign reserves. The move to flexible exchange rates in the 1970s was driven by the idea that the system would provide countries autonomy in their ability to control monetary, fiscal, and other policy tools. Furthermore, the shift was a response to the increase in international capital mobility. As the effectiveness of capital controls in providing protection against balance-of-payments strains for governments declined and as differentiating purchases and sales of foreign currency became increasingly problematic with the restoration of current account convertibility, many individuals discovered creative and novel approaches to overcome restrictions on international capital flows.

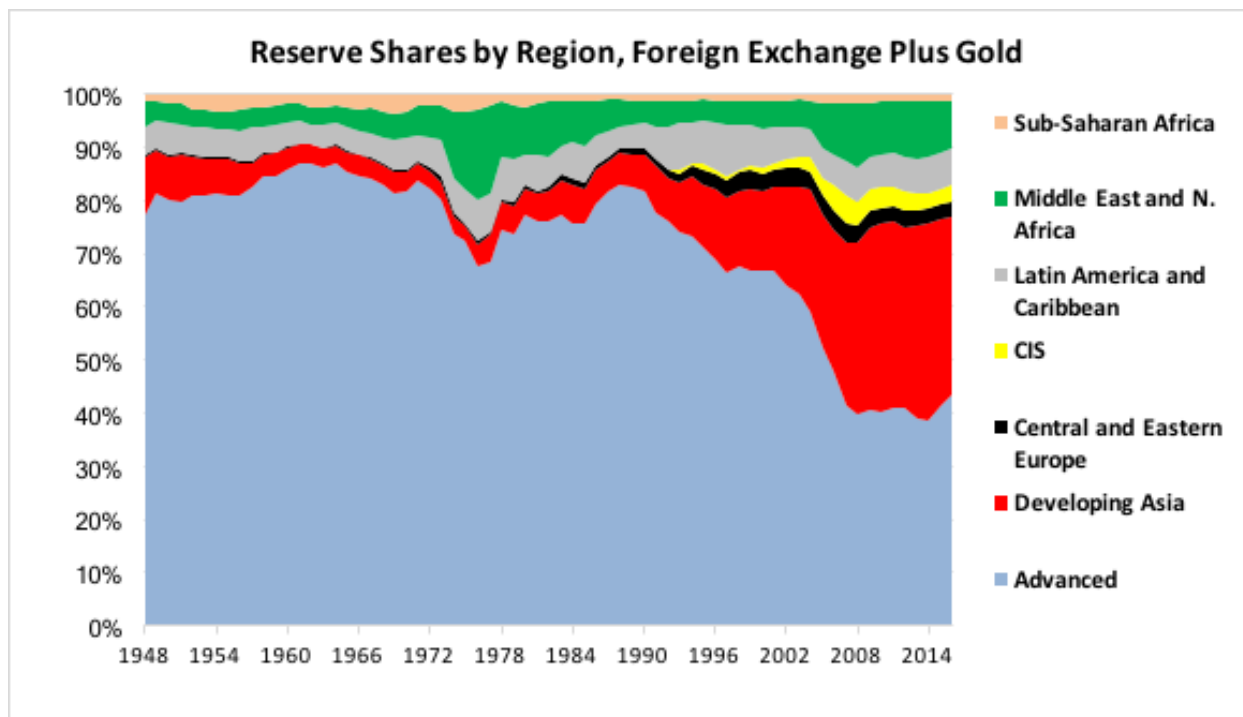
So, how has reserve coverage in the world changed since IMF data begin 1948, and especially since the movement to greater flexibility in the early 1970s? From 1948 to 2016, world reserves including foreign exchange and gold increased by more than 25,000 percent in nominal terms, from \$47 billion in 1948 to \$12 trillion in 1996. The greatest single-year percentage jump in reserves, 45 percent, occurred from 1970 to 1971 as a result of the devaluation of the U.S. dollar in 1971, which raised the value of gold and other nondollar reserves. The graphs below, which use different scales, show two sustained periods of rapid reserve accumulation, one in the 1970s and another in the 2000s.



Where Reserves are Held

Right after World War II most reserves were held by advanced countries. However, the 1970s saw a shift as the Middle East enjoyed heavy accumulation of foreign reserves, as described above. Furthermore, the financial crises in the 1990s and early 2000s caused many emerging market economies in Asia to accumulate foreign reserves to protect themselves from crises in the long term. In response to the financial crises and drastic devaluation of their currencies in 1997-98, Asian economies also decided to engage in export-led growth as well by “anchoring their currency, de jure or de facto, to the US dollar” (ECB 2006: 7). With underdeveloped local financial systems, these emerging economies experienced difficulties in transmitting domestic private savings to investment and encountered inefficient and expensive hedging markets. Other features of the domestic financial systems of these economies also played a key factor such as the trend towards dollarization of official and/or private cross-border assets on the part of certain creditor emerging market economies and from a macroeconomic perspective, a surplus of domestic savings over investment brought about by either an excess of savings or a lack of investment (ECB 2006: 7).

The table two pages below shows the top ten holders of net official reserves every ten years starting in 1950, plus 2016. In 1950, reserves of countries reporting to the IMF amounted to \$47.9 billion, with advanced countries, as defined by the IMF, holding 80 percent of the reserves. The United States held just over half of all reserves, a degree of dominance never since equaled. Two countries in the top ten were what we would now call emerging markets: India and Egypt.



In 1960 there were no emerging markets in the top ten. India, Egypt, and Australia fall outside the top ten, while Japan, the Netherlands, and Germany enter. India would return to the top ten later, but Egypt and Australia never would. The sudden liberalization of prices and introduction of a new currency in 1948 had begun the German “economic miracle.” Germany quickly eliminated its trade deficit and started to run a trade surplus. Germany returned to its prewar status as a manufacturing powerhouse and piled up reserves from strong exports.

Like 1960, 1970 had no emerging markets in the top ten. We see the beginnings of Japan’s accumulation of reserves and the increasing unattractiveness of the sterling with the associated fall in rank of the United Kingdom. The United States still remained at its number one spot; however, it faced growing competitive pressures with the rise of Germany and the mark. It is also important to note the steady increase in the level of reserves for Italy as it moved from tenth place in 1950 to third place in 1970. Advanced economies held 82 percent of total reserves.

By 1980, Saudi Arabia had emerged as a top reserve holder thanks to some years of high prices for oil. Canada fell outside the ranks after three decades. The United States and Germany still held their positions at the top, and France climbed to third place, surpassing Italy and Switzerland. Monetary authorities in both industrial and developing countries during this time maintained fairly stable and consistent levels of reserves in terms of GDP, roughly 4 percent. In nominal terms, though, reserves rose 940 percent from 1970, their greatest ten-year increase.

Table. Top Reserve Holders

1950	Billion \$	%	1960	Billion \$	%	1970	Billion \$	%
USA	24.3	50.6	USA	19.5	32.6	USA	14.8	15.9
UK	3.4	7.2	Germany	7.1	11.8	Germany	13.7	14.8
India	2.1	4.3	UK	3.7	6.3	Italy	5.4	5.8
Canada	1.8	3.9	Italy	3.3	5.5	Switzerland	5.2	5.6
Switzerland	1.6	3.3	Switzerland	2.3	3.9	France	5.1	5.4
Australia	1.5	3.1	France	2.3	3.8	Japan	4.9	5.2
Egypt	1.0	2.1	Canada	2.0	3.4	Canada	4.7	5.1
Belgium	0.8	1.8	Japan	2.0	3.3	Netherlands	3.3	3.5
France	0.8	1.7	Netherlands	1.9	3.1	Belgium	2.9	3.1
Italy	0.7	1.6	Belgium	1.5	2.5	UK	2.9	3.1
World total	47.9	100	World total	59.7	100	World total	93.0	100
1980	Billion \$	%	1990	Billion \$	%	2000	Billion \$	%
USA	176.3	18.2	USA	172.7	14.5	Japan	361.8	16.0
Germany	106.4	11.0	Germany	104.4	8.8	ECB	353.8	15.6
France	77.1	8.0	Italy	88.5	7.4	China	171.8	7.6
Switzerland	66.3	6.9	Japan	87.8	7.4	USA	129.6	5.7
Italy	63.7	6.6	France	68.2	5.7	Taiwan	110.5	4.9
Japan	39.4	4.1	Switzerland	61.2	5.1	Hong Kong	107.6	4.8
Netherlands	38.4	4.0	Spain	57.2	4.8	S. Korea	96.3	4.3
UK	32.1	3.3	UK	43.1	3.6	Singapore	81.1	3.6
Belgium	28.6	3.0	China	34.5	2.9	Switzerland	54.0	2.4
Saudi Arabia	26.2	2.7	Netherlands	34.3	2.9	UK	43.1	1.9
World total	967.2	100	World total	1,189.3	100	World total	2,265.6	100
2010	Billion \$	%	2016	Billion \$	%	Top 10*	Billion \$	%**
China	2,907.6	27.5	China	3,103.7	25.6	1950	38.1	79.4
Japan	1,091.6	10.3	Japan	1,219.1	10.1	1960	45.5	76.2
ECB	725.2	6.9	ECB	777.5	6.4	1970	62.8	67.5
Saudi Arabia	457.4	4.3	Switzerland	682.4	5.6	1980	654.4	67.7
USA	441.6	4.2	Saudi Arabia	548.3	4.5	1990	751.8	63.2
Taiwan	398.7	3.8	Taiwan	451.2	3.7	2000	1,196.9	66.6
Russia	319.1	3.0	USA	432.9	3.6	2010	6,762.5	68.3
India	297.2	2.8	Hong Kong	386.3	3.2	2016	7,923.1	68.8
S. Korea	292.1	2.8	S. Korea	370.5	3.1	Average		69.7
Brazil	288.4	2.7	Brazil	365.2	3.0	Std. dev.		5.3
World total	10,556.3	100	World total	12,123.1	100	*Combined reserves **of total		

In 1990, advanced countries held 82 percent of reserves. Japan moved up in the ranks to fourth place and Spain entered the top ten list for the first time at seventh place. China also entered the list for the first time, reflecting early signs of the change in size and pace of reserve accumulation, the degree of concentration of ownership, and the regional distribution of the accumulation in world foreign reserves. Belgium, however, having consistently been one of the top reserve holding countries each decade since 1950, fell off the list along with Saudi Arabia.

From 1990 onwards, we witness a whole new international monetary landscape. China began to liberalize its trading sector to shift towards a more capitalist market system and used its large current account surplus from high domestic savings to accumulate reserves. As the world economy continued to grow and financial markets became more globally integrated with each other, reserve accumulation in the East Asian “tiger economies” of Hong Kong, Singapore, South Korea, and Taiwan picked up at the turn of the 21st century.

India returned to the top ten list in 2000, and the United States no longer owned the status of the largest reserve holder. The share of total reserves held by advanced countries fell to 66 percent. The European Central Bank (ECB) appears for the first time, accounting for 16 percent of reserves. The euro had come into existence the year before.

In 2010, Saudi Arabia returned to the top ten list at third place on the strength of the high oil prices that had prevailed before the global financial crisis began. Brazil and Russia also made the list. Advanced countries no longer had the majority share in total world reserves, accounting for only 40 percent of the total.

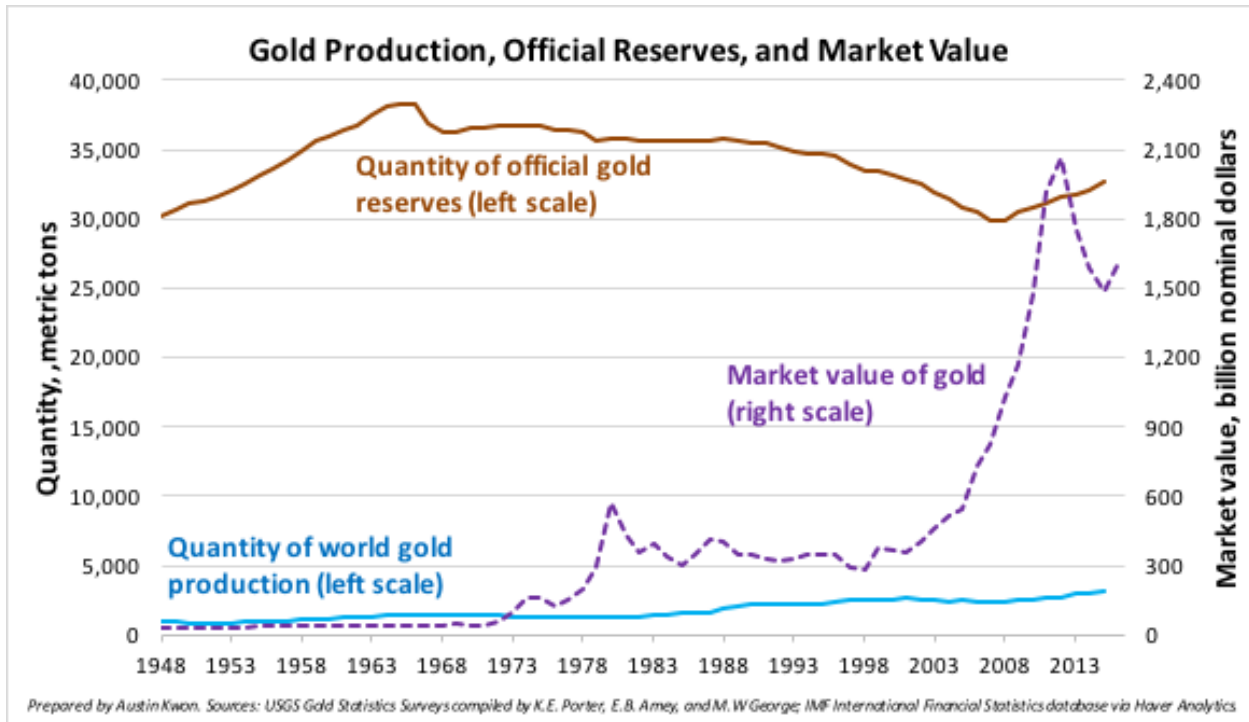
In 2016 total reserves stood at \$12.1 trillion, falling from the peak in 2013 when they were \$13.2 trillion. Advanced countries held 43 percent of reserves, while Developing Asia accounted for 34 percent of reserves. Switzerland jumped into the list because of its effort to limit the appreciation of the Swiss franc against the euro by intervening in foreign exchange markets.

The Composition of Reserves

During the early 20th century, gold reserves were held as a store of value to back the value of national currencies and also as a guarantee to redeem agreements to pay depositors, individuals with paper money, or trading partners. Gold was and still is regarded as a safe haven during times of monetary and political uncertainty. However, The Gold Reserve Act of 1934, signed by President Franklin D. Roosevelt, transferred ownership of all monetary gold⁷ in the United States to the U.S. Treasury and prohibited the Treasury and financial institutions from redeeming dollars for gold, which reversed the system that was in place since the 19th century. This policy made the trade and possession of gold a criminal offence for residents in the United States until the Gold Act of 1975 when Americans could again freely own and trade gold. Furthermore, with the revaluation of the price of gold to an overvalued \$35 an ounce from \$20.67 in order to devalue the dollar, the United States Treasury used the increased profits as a

⁷ Monetary gold included all coins and bullion held by individuals and institutions as well as the Federal Reserve.

stabilization fund and for the retirement of national bank notes. The United States held the majority of the world's gold reserves up until 1958, when it had a share of 52 percent, falling from 72 percent in 1948.

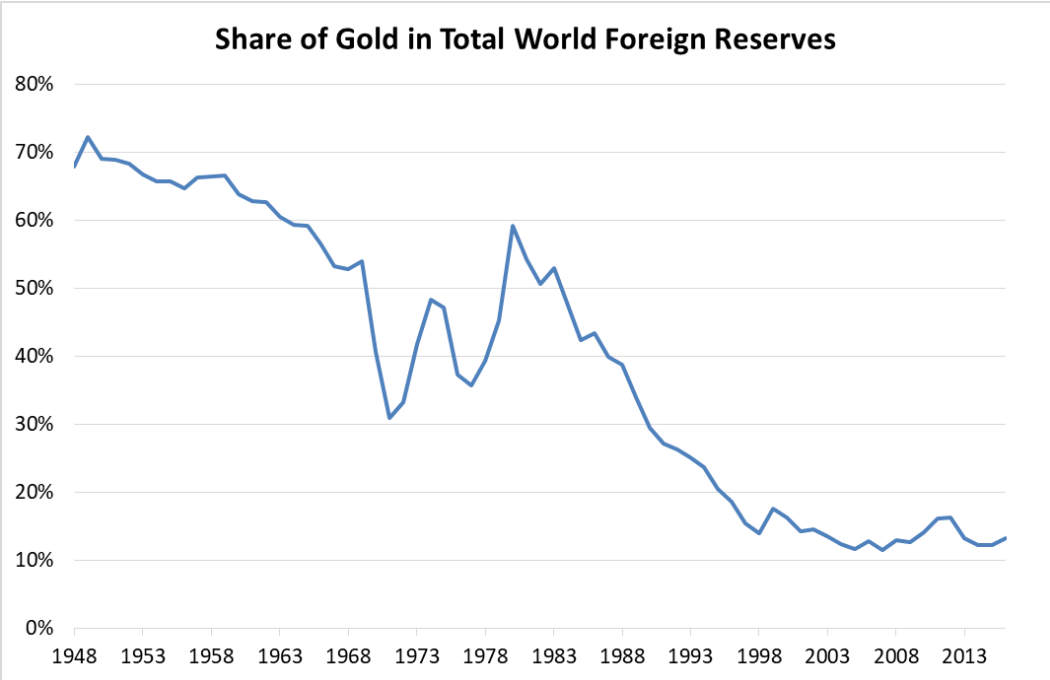


Sharp gold price swings in response to world geopolitical tensions also brought about falling official holdings of gold. In 1948, the world had just 970.4 million troy ounces of gold, which peaked in 1965 at 1232.88 million troy ounces. In 2016, the world had 1069.75 million troy ounces.

The study of how gold behaves during times of recession has been an interesting and controversial topic. In theory, as a country's economic growth lags, recessionary pressures tend to support a accommodative monetary policies from central banks, leading to increases in gold prices. Some research conducted by the World Gold Council that examines the growth rate of GDP to gold prices, however, has shown that gold can experience high demand in both recessionary and expansionary cycles. The reason why gold acts unpredictably to various recessions can be due to the evolving nature of dynamic business cycles and to three factors on the demand side, which includes consumers of jewelry and technology, investors (bars, coins, gold backed financial products) and central banks. Depending on the severity of the recessions, the impact of these factors on gold prices can substantially vary. Looking back, recessions only up to the 1980s saw great appreciation of gold prices such as the 85% increase in prices during the recession in the 1970s.

As the Federal Reserve placed great emphasis on carrying out quantitative easing policies, it substantially devalued the U.S. dollar and gold prices rapidly rose, peaking around \$1800 during

the Great Recession. Gold has been discovered to be inversely related to the dollar as a stronger dollar leads to a fall in prices of oil (Dempster 2008: 7). This can be seen in the recession of the 1970s as the U.S. shifted away from the gold standard but gold prices still surged, confirming the degree of confidence investors had in it. Thus, even with the drastic increase in the market value of gold since 2000, the lessons learned from previous crises and the Great Recession of 2008 along with the attractive aspects of the commodity led central banks to once again shift back to accumulating gold reserves in addition to foreign exchange reserves.



Gold made up a significant portion of total world foreign reserves in the early years of the Bretton Woods era, peaking in 1949 at 72 percent; however, it has steadily declined since then except for the 1970s. From 1948-1973, 1974-1996, and 1997-2016 the percentage of gold in total world foreign reserves averaged 59, 39, and 14 percent, respectively. In 2016, gold reserves only made up 13 percent of total foreign reserves.

The Future of the Dollar

There was a time when central banks had started to move away from the dollar in order to diversify their portfolios. However, commercial banks such as those in Japan, Germany, France, and the United Kingdom now possess even more dollar-denominated liabilities than those in their own currencies (Sindreu and Bird 2017). After the dollar was unpegged to gold in 1971 along with the later establishment of the euro in 1999 and the rapid growth of China’s economy, many people believed that the composition of currencies would become more equal. However, the European debt crisis and China’s capital controls that pegged the yuan led to the unpopularity of these currencies among investors. Following the Great Recession, the dollar

regained its dominance in global trade and over other currencies such as the yuan and euro, which have not been widely accepted.

Going forward, with the increasing post-recession regulations in place, which have led to a rise in the cost of short-term lending, along with the Fed's decision to reduce the amount of dollars circulating in the world's financial system, we may experience a scarcity of dollars in the world. Another sign expressing this view points to the growing spreads on derivatives contracts known as cross-currency basis swaps, which investors and firms use to receive dollars. As a result, this will make it more difficult to receive financing and credit and will in turn make the eurodollar market an attractive place to source dollars, yet many still question its reliability of meeting the immense demand for dollars. Foreign banks will also face difficulties in the coming years as the demand for dollars will make them more expensive to borrow.

Reserve Adequacy

Those are the basic numbers on official reserves. How can we tell if reserves are too small, about right, or excessive? There have been various methods used for assessing reserve adequacy, focused on different potential sources of demand for official reserves. They arrive at different answers (U.S. Department of the Treasury 2017: 29).

- For nations with capital controls, **imports** have been commonly used as a measure, with reserve coverage equal to at least three months of imports being the common standard. Six months of coverage is a comfortable level by this standard.
- The ratio of **reserves to short-term debt** has been used to measure crisis risk in nations with access to open markets and those with substantial short-term overseas financial transactions. A commonly used benchmark for emerging market economies has been the "Greenspan-Guidotti" rule of 100 percent cover of short-term debt (IMF 2016: 23).
- An idea from the 19th century is that for a country that maintains an inflexible exchange rate, **foreign reserves equal to the monetary base (M0)** will ensure that assets always exist to meet any demand to convert local currency into the anchor currency. This is the idea behind currency boards. Measures of reserve adequacy that propose amounts of reserves beyond 100 percent of M0 assume that the government needs reserves for purposes that are not strictly monetary, such as having a bank bailout fund or a buffer to protect against the possibility that when the government rolls over or increases its debt, it may not be able to sell all the debt it wants.
- Another measure of reserve adequacy for countries with extensive banking sectors and open capital accounts has been the ratio of **reserves to broad money**. M2 has been generally used to factor in the movement of capital and transfer of assets overseas. The rationale for this measure is that many recent crises have seen outflows of residents' deposits. The upper end of a prudent range for reserve holdings is usually thought to be 20 percent; however, a threshold of approximately 5 percent is more common (IMF

2016: 23). For this measure, foreign reserves of commercial banks, nonfinancial corporations, and other holders should perhaps figure in the calculation as well.

The import and short-term foreign debt ratios have been criticized on the grounds that instead of being based on historical events, they use overly general ideas not related to actual reserve demand in previous current and capital account crises. Furthermore, these traditional metrics ignored some important sources of risk (U.S. Department of Treasury 2017: 29). Moreover, a problem with reserve adequacy measures that include short-term debt is that the long-term historical data have not been collected, so it is only possible to evaluate that measure for more recent years. Therefore, it has been omitted from the analysis below.

The accuracy of model-based measures to project reserve demand or examine the relative costs and benefits of accumulating reserves depend heavily on underlying assumptions. Accordingly, in 2011 the IMF revealed a method for assessing reserve adequacy in emerging market economies that blends traditional ways of assessing reserve adequacy along with a historical perspective (see Appendix I). I leave it to others to do historical calculations using the IMF's method, because it requires data on short-term debt. I now consider the export, monetary base, and broad money measures of reserve adequacy, as well as reserves to GDP.

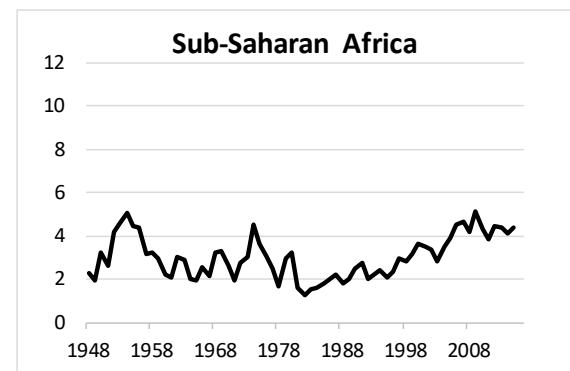
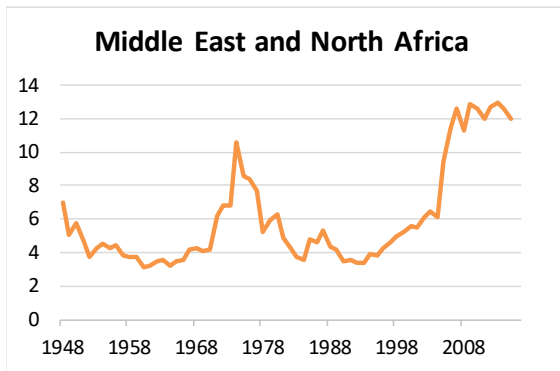
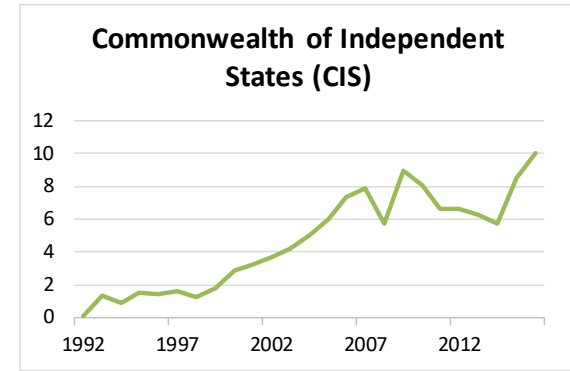
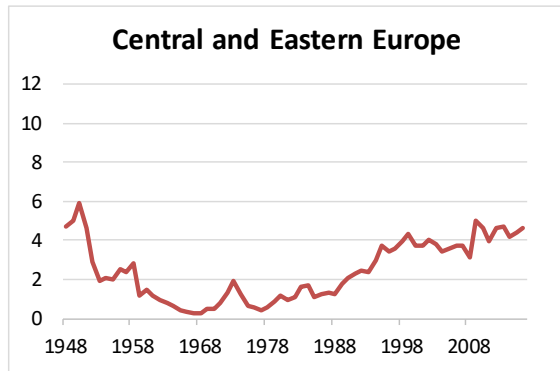
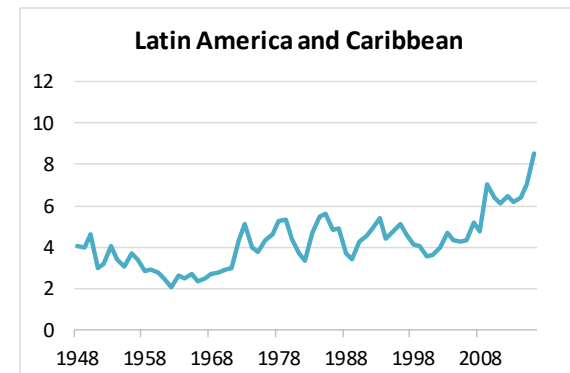
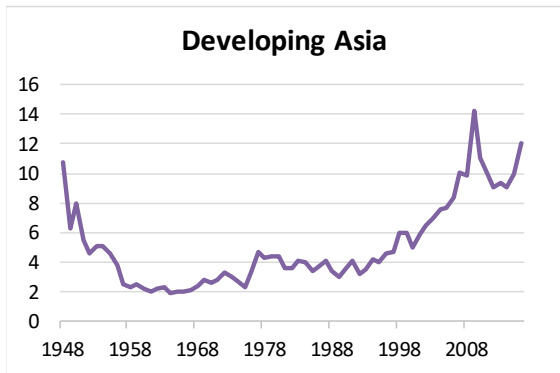
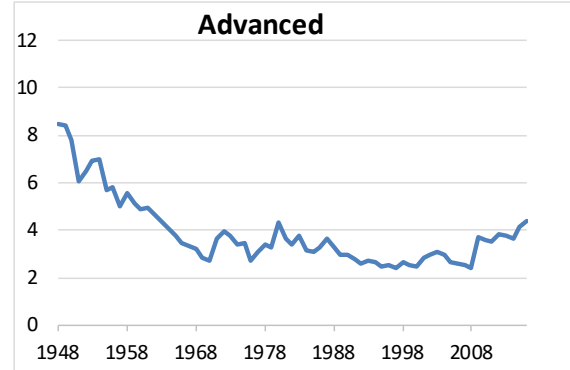
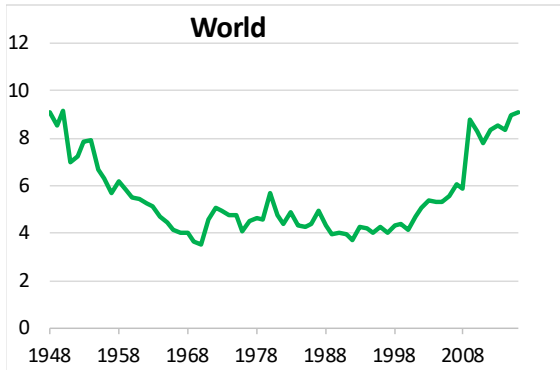
Readers should remember that all the calculations that follow, like those previously, value gold at its market price rather than its typically much lower official price.

Ratio of Reserves to Imports

Looking at the ratio of reserves to imports (reserves, in months of imports), we can see that the world ratio consistently declined from 1948 to 1970, remained fairly constant at around 4 months from 1967 to 2000, then after the East Asian and other emerging market financial crises rose to about 9 months in 2016, near where it initially was in 1948.

Advanced countries, Central and Eastern Europe, Developing Asia, Latin America and Caribbean and to a certain extent the Middle East and North Africa all experienced a fall in their ratios during the Bretton Wood era. However, after the end of the convertibility of the dollar to gold, emerging market economies in many regions began to experience a short phase when their ratios rose, and the East Asian financial crisis and global financial crisis (Great Recession) later had even a greater impact on the increase in their ratios. After the East Asian financial crisis, all regions have increased their ratios reflecting the use of reserves as a way to insure against future recessions. Emerging market economies have increased their ratios at a much faster pace than advanced economies, except in Central and Eastern Europe and Sub-Saharan Africa.

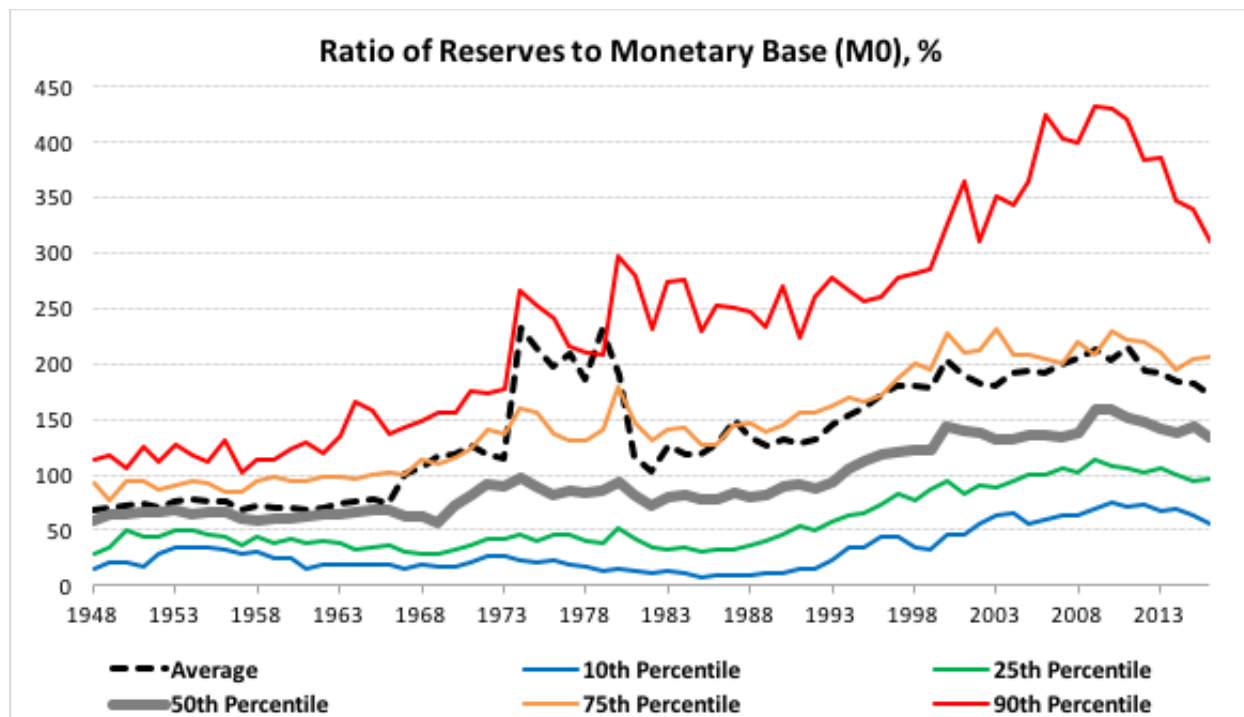
Reserves, in Months of Import Coverage



Note: No data exist for the Commonwealth of Independent States before 1992.

Ratio of World Reserves to the Monetary Base

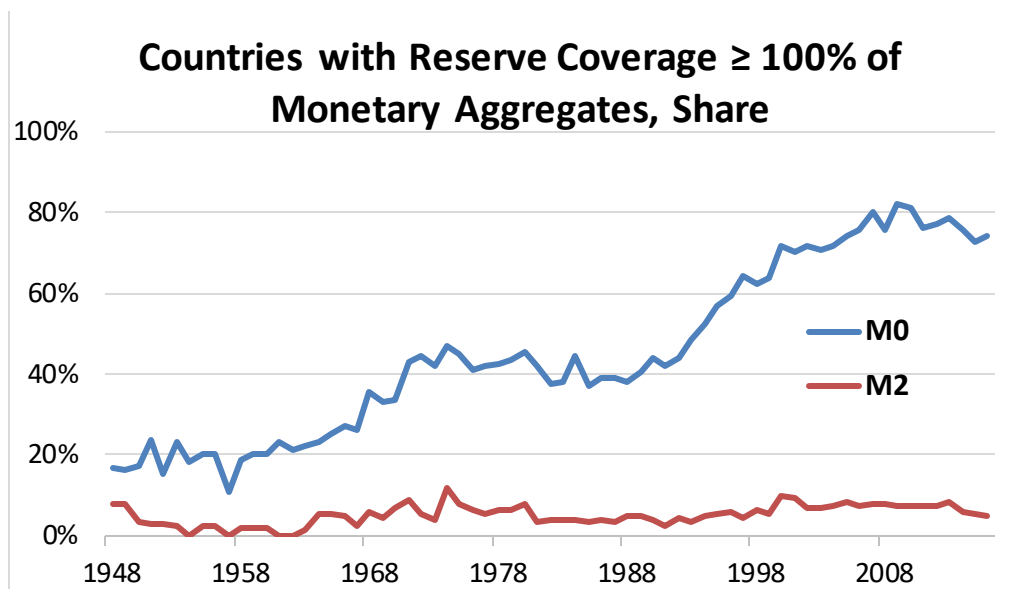
The ratios of reserves as a percentage of the monetary base (M0) show a much different story about the Bretton Woods era than the import ratios do. The 50th percentile ratio of reserves and average ratios were both roughly constant at around 65 percent until near the end of the era, rather than declining steadily as the import ratios did.



Breaking down the ratio of reserves to monetary base in percentiles we can see the steady long-term rise over the decades in the 90th percentile and the 50th percentile ratio of reserves. On the other hand, the average ratio expresses the jump in reserves in the 1970s and approximately equivalent decline throughout the late 1970s and early 1980s. Big devaluations of the pound sterling in 1949 and 1967, and of some other Western European currencies in 1949, boosted their reserve ratios because suddenly their foreign reserves were worth more in local currency. For instance, Cyprus experienced a big jump up in 1967 because its currency was tied to sterling at the time, so its nonsterling reserves appreciated overnight by nearly 17 percent.

The chart above clearly shows that since the mid 1990s, the 50th percentile ratio of reserves has exceeded 100 percent of the monetary base. What share of countries has had reserve coverage greater than or equal to 100 percent? The answer is that nowadays, as the chart on the next page shows, most countries have enough foreign reserves to establish currency boards or to dollarize immediately. That is so even though over time, there has been an increase in the number of countries that have flexible exchange rates, ranging from managed floats where the central bank intervenes often, to free floats as in the U.S, euro area, or Canada, where central

bank intervention in the foreign exchange market to influence the exchange rate directly is rare.



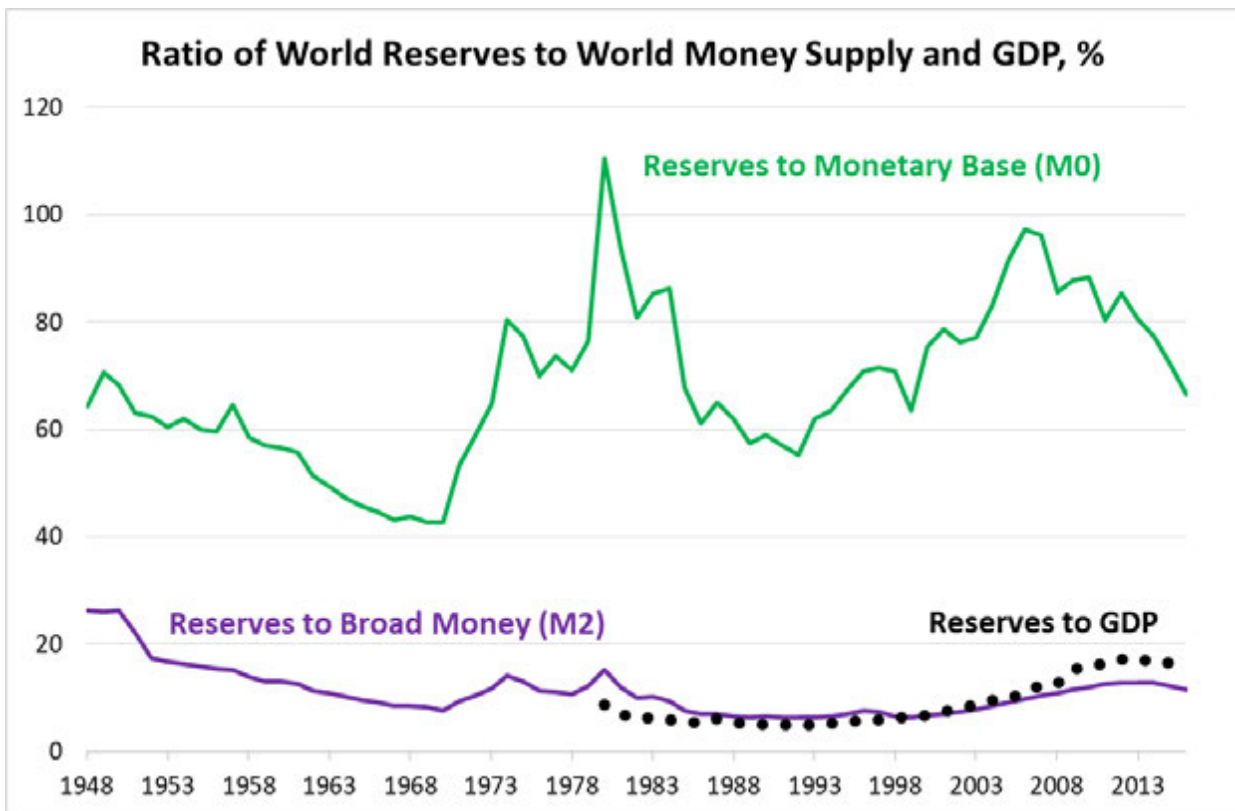
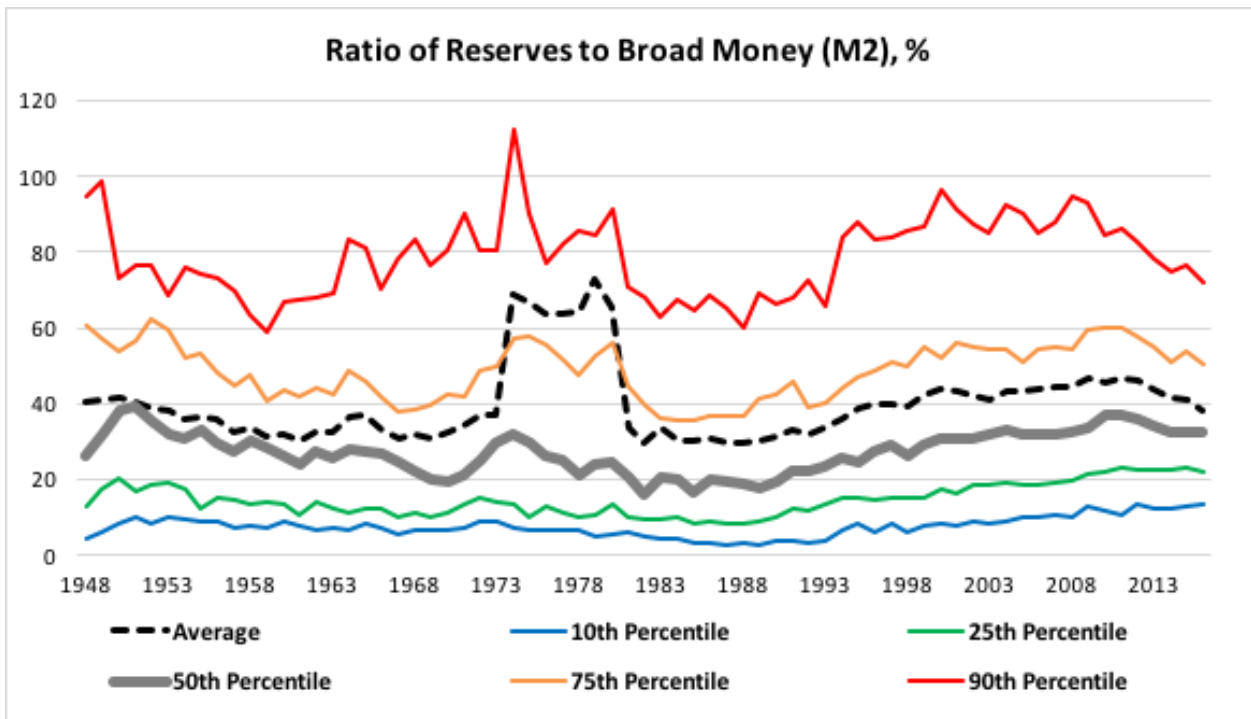
Ratio of World Reserves to Broad Money

The world ratio of reserves to broad money (M2) depicts a different view of the accumulation of total reserves. In contrast to the steady long-term rise in the ratio of reserves to the monetary base, it has remained fairly constant and does not show a clear increase. The percentages are much lower compared to those using monetary base and in 2016 the median was 32 percent. This is because broad money has components besides the monetary base held by the public; it also includes demand deposits at commercial banks and other monies kept in accounts that are easily accessible.

As with the ratio of reserves to the monetary base, there is a sharp jump up in the average ratio of reserves to broad money in the 1970s in the top figure on the previous page. Appendix II discusses the details.

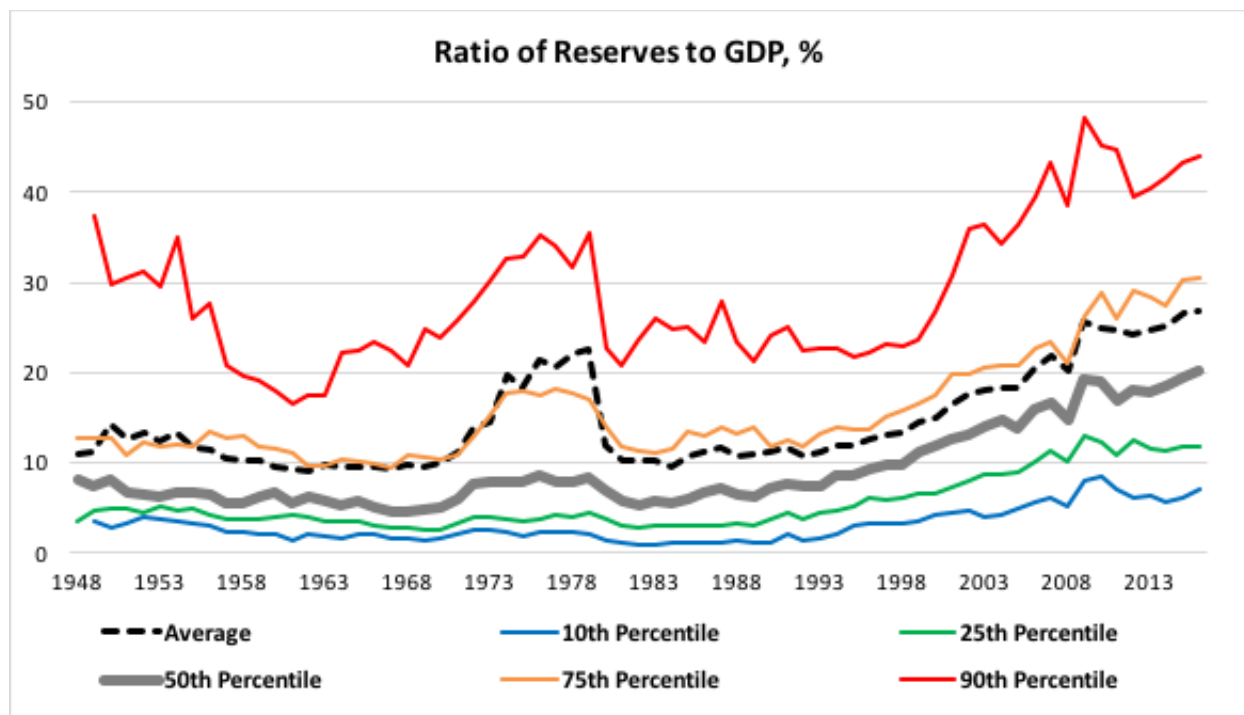
The bottom figure on the next page considers the world as a whole rather than country by country. Both the ratio of reserves to the monetary base and the ratio of reserves to broad money are lower than the averages or the medians in the percentile graphs because there are some large economies, notably the United States, the euro area, and China, that are in the lower percentiles. The ratio of reserves to broad money was 26 percent in the early years after the Bretton Woods era. It decreased steadily to about 8 percent until near the end of the era. It bumped up in the turbulence of the 1970s, fell again in the 1980s and 1990s, which for the largest economies were calmer years, and started to rise again after the East Asian financial crisis. The ratio of reserves to the monetary base, in contrast, declined after the global financial

crisis because quantitative easing in the United States and the euro area did not require any additional reserves, since both economies issued reserve currencies that floated.



Ratio of World Reserves to GDP

The ratio of reserves to GDP ratio shows a similar pattern to the monetary measures: the post-World War II economic expansion and the Golden Age of Capitalism outpaced reserve growth until the 1973-1975 recession hit, explaining the fall in the ratio of reserves to GDP in the Bretton Woods era. Representing the data once again in percentiles to avoid distortion by extreme results, an upward trend since the early 1980s is evident. The upward trend continued after the East Asian financial crisis and was interrupted only briefly by the global financial crisis.

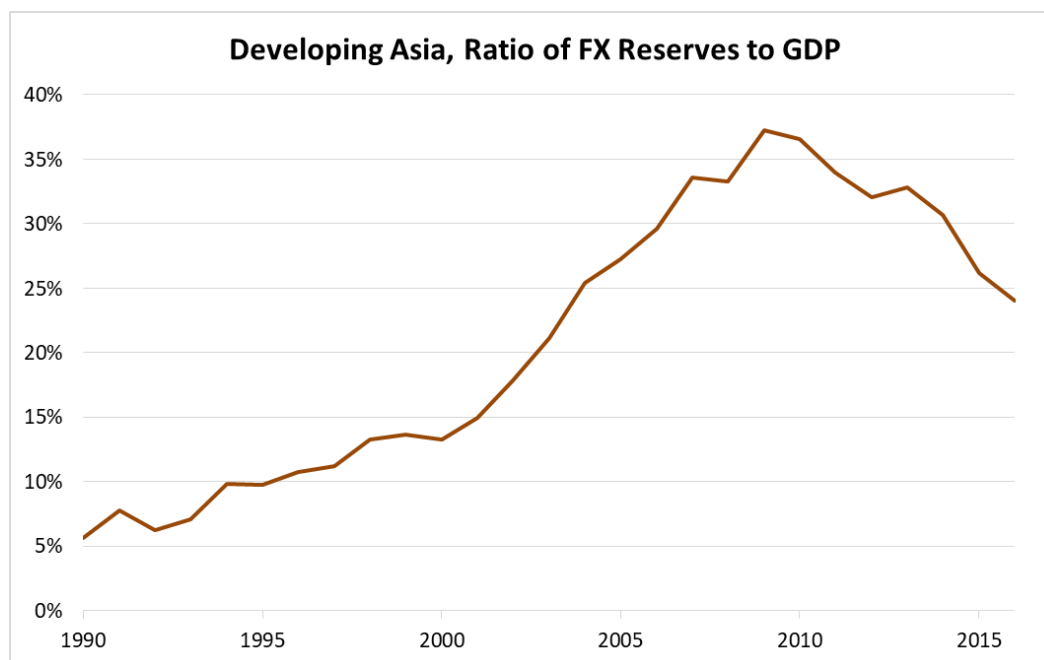


The bottom figure on the previous page shows combined world reserves as a share of world GDP. For the years for which data are available, the trend is similar to that for the ratio of reserves to broad money. Many nations learned the lessons of the crisis and held large balances of reserves to insure against future crises. In 1980, the world ratio of reserves to GDP was 8.7 percent; by 2016 it had risen to 16.1. The underlying data show the impact of the accumulation of reserves in emerging market economies.

Ratio of Developing Asia FX Reserves to GDP

Taking a closer look at Developing Asia, we can observe the rapid accumulation of the ratio of forex reserves to GDP. Developing Asia's ratio of FX reserves to GDP grew from 13.1 percent in 1990 to 21.9 percent in 2000 and further to 40.2 percent in 2008 (Park and Estrada 2009: 4). We obtain the same kind of upward trend from 1990-2008 using our data with developing Asia's ratio of FX reserves to GDP growing from 5.6 percent in 1990 to 13.3 percent in 2000 and

more to 33.2% in 2008.⁸ However, we have extended the analysis to 2016 in order to show the fall in reserves after the Great Recession. After peaking in 2009 at 37.2%, the ratio of forex reserves to GDP has fallen to 24.0% in 2016.



Conclusion

In the post-Bretton Woods era, emerging markets struggled to deal with the outburst of capital mobility and political democracy. This made it difficult for emerging market economies to have autonomous monetary policy and at the same time preserve a steady exchange rate absent with fluctuations. Furthermore, at the same time, political pressures made it difficult to prioritize currency stabilization over monetary policy. Capital mobility put more strain on nations with weak currencies that sought to support their pegs and many governments were forced to float their currencies. Beginning in the late 1990s, many emerging market economies in Latin America, Asia, and parts of Europe favored more currency flexibility. They included Brazil, Mexico, India, and South Korea. With the exchange rate no longer being regarded as the main objective of monetary policy, central banks instead began to target inflation.

Asian countries, however, were the slowest to change, as they were skeptical about adopting a new system having seen their currencies fall during the crises as well as afraid to see their currencies appreciate against the increasingly important Chinese yuan. Unlike other Asian countries, China did not feel that it had to increase its exchange rate flexibility. With no democracy and having capital controls in place, its monetary policy is closer to Bretton Woods-era policy than to the current norm for other large economies.

⁸ Differences in percentages may be due to missing data for some countries.

In principle, one of the main advantages of floating exchange rates was supposed to be the need to hold fewer reserves. In practice, few countries have pure floating rates. Some countries fix or peg, while many that float have heavily managed floats involving intervention in foreign exchange markets. Policy makers observed with concern the problems that many emerging markets experienced during the East Asian financial crisis and those that followed soon afterwards, affecting even countries previously considered sound. The lesson they drew was that they needed to hold larger net foreign assets. One way to roughly estimate the cost is by looking at the ratio of reserves to GDP. In the Bretton Woods era (1948-1972 in the annual data), the median ratio of net foreign reserves to GDP averaged about 6 percent. In the post-Bretton Woods period it has averaged 11 percent, and has been climbing so that in 2016 it was 20 percent. The post-Bretton Woods system, however, requires two or even three times as much in reserves as the Bretton Woods system in proportion to GDP.

Appendix I: The IMF's Reserve Adequacy (ARA EM) Measure

The IMF's proposed method for calculating reserve adequacy takes into account four components: export earnings, broad money, short-term debt, and medium- and long-term debt along with equity liabilities. These factors are weighted and provide information of foreign financing risk by considering prior crises on balance of payments. Export earnings are used to factor in the risk of external demand and broad money is used to reflect domestic assets that could be transferred to other countries. Moreover, long-term debt and equity liabilities are included to represent "flight risk of portfolio and bank flows" (U.S. Department of Treasury 2017: 30).

Outflows of previous balance of payments crises are used to reflect the relative degrees of risk of these potential sources of pressures and the proper coverage ratio for each factor. Furthermore, the metric is adjusted accordingly depending on whether there is a fixed or floating exchange rate regime along with the presence of capital.

The proposed metric by the IMF for fixed and floating regimes without calibrating for capital controls can be determined by:

Fixed FX Regime: Suggested Reserves = $10\% \times \text{Exports} + 10\% \times \text{Broad Money} + 30\% \times \text{Short-term Debt} + 20\% \times \text{Other Liabilities}$

Floating FX Regime: Suggested Reserves = $5\% \times \text{Exports} + 5\% \times \text{Broad Money} + 30\% \times \text{Short-term Debt} + 15\% \times \text{Other Liabilities}$

While the proposed metric adjusting for capital controls is given by:

Fixed FX Regime: Suggested Reserves = $10\% \times \text{Exports} + 5\% \times \text{Broad Money} + 30\% \times \text{Short-term Debt} + 20\% \times \text{Other Liabilities}$

Floating FX Regime = $5\% \times \text{Exports} + 2.5\% \times \text{Broad Money} + 30\% \times \text{Short-term debt} + 15\% \times \text{Other Liabilities}$

Provided the ambiguities of measuring reserve adequacy, the IMF conservatively states that the level of reserves is sufficient if they fall within a range of 100 to 150 percent of the metric (U.S. Department of Treasury 2017: 30).

Appendix II: The 1970s Jump in Average Reserves

What was causing the jump in reserves in the 1970s? Taking a closer look at the period 1970-1980 and calculating the annual percentage change in official reserves (FX and gold), we observe that countries in emerging market economies experienced the fastest growth rates. However, when considering the actual contribution to the gross increase in world reserves, advanced countries were the main players. During this decade, the United States, Germany, France, Switzerland, Italy, the Netherlands, Japan, the UK, Belgium, and Saudi Arabia had gross increases in millions USD of 161481, 92732.8, 72038.6, 61073.2, 58222.8, 35066.5, 34509.4, 29238.2, 25712.8, and 25547.9, respectively. Other large contributors to the gross increase world reserves just outside the top ten countries were Spain, Austria, Libya, Portugal, and Iran.

In terms of accumulation growth during this period, emerging market economies concentrated in Sub-Saharan Africa, the Middle East, and Latin America and Caribbean regions had the highest growth rates. Many of these countries had poor economies at the time and many were oil exporters and members of OPEC. The table below ranks the countries with the highest growth rates.⁹

Country (IMF Region Classification)	Average Annual Growth Rate (%)	10-Year Cumulative Growth (%)
Chad (Sub-Saharan Africa; CEMAC)	175	419
Central African Republic (Sub-Saharan Africa; CEMAC)	130	4,254
Nigeria (Sub-Saharan Africa)	116	4,687
Trinidad (Latin America and Caribbean)	100	6,443
Iran (Middle East and North Africa)	86	5,981
Gabon (Sub-Saharan Africa; CEMAC)	72	681
Mauritania (Middle East and North Africa)	63	4,483
Indonesia (Developing Asia)	64	4,177
Saudi Arabia (Middle East and North Africa)	60	3,841
Congo, Rep. (Sub-Saharan Africa)	56	945
Oman (Middle East and North Africa)	53	5,545
United Kingdom (Other Advanced)	52	1,021
Argentina (Latin America and Caribbean)	51	1,286
Rwanda (Sub-Saharan Africa)	49	2,446
Mali (Sub-Saharan Africa; WAEMU)	49	2,783

The jump in reserve ratios in the 1970s was also from the value of gold reserves jumping because the price of gold surged. Furthermore, world reserve growth including both FX and gold had an average annual growth rate of 23 percent from 1970-1980 compared to only 13 percent for world monetary base (M0). The subsequent decline in the reserve ratios during the 1980s experienced the opposite as the average annual growth rate during 1980-1990 for world

⁹ Countries with missing data in any of the years during 1970-1980 were excluded from the calculations

reserves dwindled to 3 percent and annual growth monetary base decreased slightly to 9 percent, outpacing the growth in reserves. These results reflect the impact of the oil glut and the early 1980s recessions. After prices of oil soared during 1970s energy crises, declining demand and a rise in production from non-OPEC countries such as the Soviet Union in the 1980s gave rise to a surplus on the world market. Oil prices which had peaked in 1980 at over \$35 per barrel fell drastically in 1986 from \$27 to less than \$10. The reduction in oil prices led to decreases in inflation in the 1980s, and many countries increased their money supplies to a greater extent than accumulating reserves to implement expansionary monetary policies with lower interest rates.

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