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LINKING GLOBAL MONEY SUPPLY TO GOLD AND TO FUTURE INFLATION

Many investors are raising concerns that strategies put in place by central banks across the globe – including what is commonly referred to as *quantitative easing* – to reactivate the world economy and steer it away from a depression will ultimately debase fiat currencies and result in inflation.

In order to study the relationship that movements in the price of gold have to inflation, we focus on its roots: money supply and velocity of money. We find that positive growth in money supply can explain increments in the price of gold from 6 to 9 months in advance, on average. Money supply can grow as a byproduct of economic growth – like in an emerging economy, but it also can increase as monetary policy is used to re-activate an economy in recession – like in the current economic environment. In this case, where money supply growth is being used to prop up the financial and economic system, rather than to fuel strong economic growth, the price of gold bears a relationship to the growth of money supply and may be a leading indicator of a recovery in velocity and a rise in inflation pressures. In either case, we observe a correlation to the price of gold. However, we also find that the relation of money supply and the price of gold do not occur in isolation, but as an interaction in the global economy. Gold is an asset that is affected by many factors and in many markets. We find that a 1% change in US money supply growth six months prior, in turn has an impact of 0.9% in the price of gold, on average. We also find that a 1% change in money supply in India and Europe six months prior, affects the price of gold by 0.7% and 0.5%, respectively. Money supply in Turkey has a small but significant impact on the future price of gold. Consequently, part of the surge in the price of gold can be explained as a result of the substantial increment in global money supply over the past year, and as money supply levels remain high, we expect it to provide further support for gold demand.

We also discuss the relationship between velocity of money and its link to inflation, to change in the price of gold. We find that an increase in the price of gold can be interpreted as a signal by the market that velocity of money is poised to increase in the future and, consequently, be a signal of future inflation.

A recessionary side effect: money supply and its impact in the gold market

The financial crisis that started to unravel in the summer of 2007, as the decline of the US real estate market produced stress fractures in securitized products such as asset-backed securities gave way to the financial meltdown

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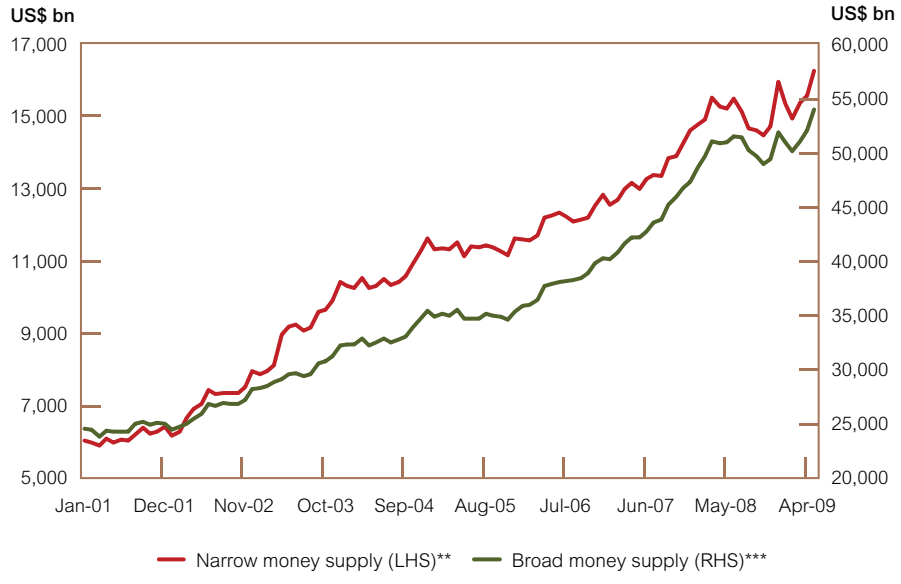
and, eventually, the Great Recession. The world's worst recessionary period in many decades saw advanced economies GDP grow by only 0.6% in 2008. Growth is expected to be minus 3.4% in 2009.[1] Moreover, wealth was destroyed in the order of trillions of dollars worldwide and formidable measures were put in place by central banks around the globe to steer the world economy from an even worse collapse.

In particular, the Federal Reserve along with the US Treasury opened up new credit facilities, bailed out crippled financial institutions, and lowered interest rates to a record low 0-0.25% range, backed by over $700bn dollars in bailouts approved by the US government to achieve this enormous task.

The US did not act alone. Governments and central banks implemented unprecedented measures – in advanced and developing economies alike – to contain the risks of a global meltdown. The ECB, the Bank of England, Japan, Russia and China, to name a few, used a mix of monetary policy and fiscal stimulus to smooth the fall and to jumpstart the global economy.

There are signs that the prompt and coordinated response implemented by governments across the globe to soften the economic contraction and to generate some recovery has started to emerge. However, this has not come without a cost. In particular, the global money supply drastically increased during 2008 and, with it, the concerns of a number of market participants that inflationary pressures loom. But not all investors agree on the extent that the measures implemented during the financial crisis will have on the magnitude and timing of future inflation. Nevertheless, what cannot be denied is that more

*Chart 1: Aggregate money supply (US$ billion) in various countries/regions**



* Includes US, Euro zone, UK, Japan, Australia, China, India Russia, Brazil, and Turkey.

** Narrow money supply corresponds to M1 for all countries, except for the UK for which M0 is used. Similarly, broad money supply corresponds to M3, except for the UK for which M4 is used.

Source: IMF, country data, WGC

[1] International Monetary Fund, *World Economic Outlook*, October 2009.

money is in the system, peace time deficits will soon hit new record highs as a proportion of GDP and that alone is a strong enough argument for many to flock to hard assets.

In a US-centric world, gold defies the mould

Anecdotal evidence suggests that investors, especially in the US, equate the performance of gold to particular trends of investment flows, inflation, or growth in the US. While there is good reason to assert that the state of the US economy is indeed relevant to the gold market – from 2004 to 2008, 11% of the global demand for gold including jewellery, investment, and industrial applications came from the US – it is by no means, the whole picture.

The structure of the global demand for gold is very diverse. Over the past 5 years, 68% of average annual demand comes from jewellery, with more than 50% of this demand stemming from India, China, Turkey, and the Middle East. Investment demand, on average, accounts for 20% where India, Europe, and the US play an eminent role. Finally, the remaining 12% average comes from industrial demand, especially from Japan.

Consequently, looking at the impact variables such as money supply, inflation, or velocity of money have in the price of gold, while focusing only in the US misses the whole picture. It is important to study the behaviour of gold prices in a context of global economics and taking into account that there are many forces and many countries that shape its performance.

Gold and money supply

Gold has proven to be an asset that has low correlation to most financial assets, both in expansionary and recessionary periods. There are, however, some important relationships that can explain, in part, the behaviour of gold over the short- or long-run. For example, gold exhibits a strong negative correlation to the dollar. Gold can also be shown to outperform other assets such as stocks and bonds in times when inflation is on the rise. In this note, we analyse the impact that money supply has on the performance of gold, in a global context.

There are two main reasons why there can be a surge in money supply. First, it can increase as a consequence of economic growth (e.g., in an emerging economy), which in turn may not result in higher inflation. Conversely, if central banks increase the money supply to induce growth – as they have done as a result of the financial crisis that started unfold in 2007 – and too much money is introduced into the economy for too long, this may result in inflationary pressures, according to classic economic theories of monetarism.

Intuitively, a positive relationship between money supply and gold can exist in either case. First, if money supply is accompanied by economic growth, the increase in wealth and access to capital can increase demand for luxury consumer goods, including gold. Second, as excess money enters the system and the economy remains stagnant, inflation pressures may prompt investors to safeguard their wealth by increasing their exposure to hard assets, such as gold.

In this note we show empirical evidence that positive money supply growth accompanies higher gold prices. However, our goal is not to present a forecasting

model for the price of gold, but rather show an empirical mechanism in which gold and money supply relate.

Description of the data

We analyse the impact money supply has in performance of gold, as measured by year-over-year percentage changes in the spot price of gold (US$/oz), at 5PM in New York, as well as year-over-year percentage changes in money supply measures in the following countries: the United States, Europe (represented by the Euro-zone and the United Kingdom), India, and Turkey.[2] For each country, we considered two measures of money supply: broad and narrow. Given that not all countries use the same definitions, or do not calculate, all of the traditional measures of money supply (M0, M1, M2, etc.), we used the individual M1 data in each country as a measure of narrow money, when available, and M0 for the UK. Similarly, we chose the country's M3 measure as a measure of broad money supply, except for the UK for which we use M4.

For each country, all money supply measures were expressed in US dollars using the average FX rate for each month. Given that the price of gold is quoted in dollars, we want to be able take into account the effect of currency appreciation/depreciation in the analysis. In other words, we want to ensure that the purchasing power of each country is comparable to the others, relative to the price of gold.

Finally, we chose the start date of the analysis as of January 1975 given that money supply information for Europe and Turkey was not readily available prior to that date. Moreover, the price of gold was fixed relative to the dollar prior to 1971, followed by 2 years of a two tiered market, thus making the early years of gold trading subject to distortions.

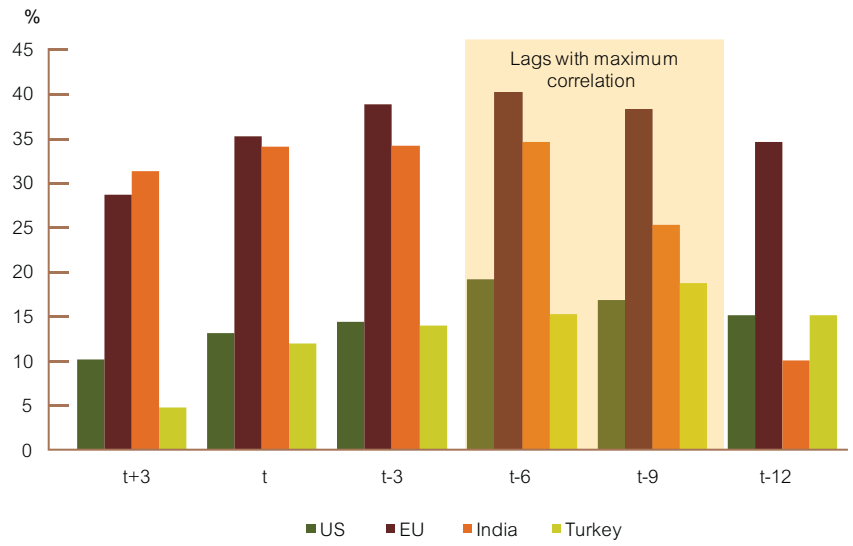
Lead-lag relationship to gold

As expected, on an individual basis, money supply growth in each country was positively correlated to percentage changes in the price of gold, ranging from 0.1 to 0.35. However, a more interesting result is that a 6-month to 9-month lag in money supply growth increased the corresponding correlation to a range of 0.15 to 0.4. In other words, there is evidence that money supply growth has an impact on future gold performance.[3]

[2] We also analysed the impact of money supply in Canada, Japan, Australia, China, Russia, and Brazil to the performance of gold, without statistically significant results once the effect of the other countries was taken into consideration. There were two main reasons for this. For some countries like Canada, Japan, and China, the effect of their money supply considered in isolation showed a positive relationship with respect to gold, however, once the other countries were included in the model, their effect was no longer statistically significant. This was, in turn, a byproduct of high correlations between money supply of the countries considered (or the so-called multicolinearity), so the extra variables were redundant. For other countries, such Russia and Brazil, the available historical money supply data was much shorter and would have consequently restricted the analysis. We therefore restrict our discussion to countries with significant results.

[3] The maximum correlation occurs around the 6-month lag for most, if not all, countries. For simplicity of the analysis, however, we chose to use exactly a 6-month lag for all countries as the differences from using other lags did not prove significantly different from a statistical point of view.

*Chart 2: Correlation between year-on-year growth in the gold price and year-on-year growth in money supply at different time lags (in months), for various countries**



* For each country/region, a given bar represents the correlation between year-on-year percentage changes in the price of gold for a given month (*t*) and year-on-year growth in money supply on the same month (time t), three months prior (*t*-3), six months prior (*t*-6), etc.

Source: IMF, Bloomberg, WGC

Global money supply and the performance of gold

As we previously mentioned, analysing the impact of macroeconomic variables in individual countries to the performance of gold only gives a partial view. Gold prices move as a result of a myriad of factors that affect different parts of the world in different ways. In turn, one variable alone cannot be expected to fully explain the behaviour in the gold price, especially if that variable represents a single country.

With that in mind, we analysed the performance of gold, as defined by year-over-year growth in the price of gold (US$/oz) relative to year-over-year percentage changes in money supply in US, Europe, India, and Turkey, in a multivariate context. In other words, we study the performance money supply in a give country has on gold once the effect of other countries has been taken into account.[4]

We find that gold is not only positively correlated to money supply growth, but that the emerging economies included (India and Turkey) are statistically significant and increase the explanatory power of the model without inducing multicolinearity (which occurs when there is a high degree of correlation among the explanatory variables – in this case, money supply growth in all the countries/regions included in the model).

[4] We analysed both the effect of narrow and broad money supply, but we concentrate in the narrow money supply results. The relationship between gold and both narrow and broad money supply, as well as the results were similar. However, the narrow money supply model produced a better fit to the data. Moreover, narrow money supply makes the interpretation of the results easier, as double counting occurs in many broad money measures.

We fit a multiple regression model, using a time lag of 6 months in money supply for simplicity. Namely,

$$gold_t = \beta_0 + \beta_1 US.MS_{t-6} + \beta_2 EU.MS_{t-6} + \beta_3 India.MS_{t-6} + \beta_4 Turkey.MS_{t=6} + \varepsilon_t$$

Where

$goldt_t$ =	year-on-year growth in the price of gold (US$/oz) in a given month,
$US.MS_{t-6}$ =	year-on-year growth in United States money supply six months prior
$EU.MS_{t-6}$ =	year-on-year growth in the Euro zone plus United Kingdom money supply six months prior (in US$)
$India.MS_{t-6}$ =	year-on-year growth in India money supply six months prior (in US$)
$Turkey.MS_{t-6}$ =	year-on-year growth in India money supply six months prior (in US$)

Table 1 below shows the coefficient estimates for the multiple-regression model. These coefficients (also called *betas* or *sensitivities*) represent the expected impact a small change in the one of the explanatory variables (in this case, money supply in a given country) has on the response variable (in this case, the price of gold), by holding the effect of the all the other explanatory variables unchanged (in this case, all the other countries/regions money supply).

Table 1: Coefficient estimates for the sensitivities of changes in the price of gold to changes in money supply

Country	Coefficient	Estimate	T-stat	Implication*
US	β_1	0.94	3.5	A 1% increase in US money supply tends to increase the price of gold by 0.9%
Europe	β_2	0.52	5.1	A 1% increase in Europe money supply tends to increase the price of gold by 0.5%
India	β_3	0.69	5.3	A 1% increase in India money supply tends to increase the price of gold by 0.7%
Turkey	β_4	0.05	2.4	A 1% increase in Turkey money supply tends to increase the price of gold by 0.05%

* A classic interpretation of the "beta" or sensitivity, assumes that all other variables are held constant

The analysis suggests that a 1% change in money supply in the United States six month ago produces, on average, a 0.9% increase in the price of gold today, assuming the money supply in the other regions does not change. Similarly, a 1% change in money supply six months ago in the European Union (Euro Zone and UK) will tend to increase the price of gold by 0.5%, while a 1% change in the money supply of India six months ago increases by 0.7% on average the price of gold. Finally, a 1% increase in money supply six months ago in Turkey tends to increase the price of gold by 0.05%.

While a change in the United States money supply has the largest individual impact in the price of gold, changes in money supply in other countries, especially in countries where gold has a preeminent cultural role like India, is very important.

The model has an R-squared of 0.29 (which would be equivalent to a correlation of about 0.54 if we were to compare it to only one factor). In other words, changes in the money supply of the US, EU, India, and Turkey together explain only about 29% of the total variation in the price of gold. Thus, while money supply does exhibit a positive relationship with the price of gold, it only explains a portion of why gold moves. It is just part, albeit relevant, of a larger array of factors and influences that affect the price of gold.

Gold and velocity of money

Many central banks across the globe base their monetary policies using the principle that inflation can be regulated by the amount of money supply pumped into the economy. This so-called monetarism has its roots in theories developed by Milton Friedman and that continue to resonate to this day, especially when it comes to policy making. While some of the measures and models to relate inflation and money supply may be up for debate, it is mostly accepted that as the velocity of money increases, this creates inflationary pressures in the economy, holding everything else constant.

When the global economy started to contract as a result of the financial crisis, most central banks needed to use unprecedented measures to veer the economy away from a global depression. These included lowering benchmark rates to record lows and adopting quantitative easing in one form or another. However, these same measures are prompting fears that inflation may loom on the horizon.

A common, albeit simplistic, way to measure the velocity of money (not an easy task) is to compare the gross domestic product of a country to money supply. In other words, one compares the output an economy is producing relative to the money available. Using this simple approach, we compare the price of gold versus velocity of money in the US and find that, gold is usually a leading indicator of such a measure, with an average 1-year lag. In other words, a gold price increase can be interpreted as a signal by the market that the velocity of money and thus, inflation, may raise in the future.

Lack of availability of GDP data from the European Central Bank, India, and Turkey prior to the '90s implies the analysis can only be carried out for US going back to 1975. Using a shorter time series may bias the results, given that the past 20 years have been characterized by relatively tame inflation. A simple empirical regression model tells us that a 10% increase in the price of gold tends to increase the velocity of money in the US by about 0.4% in 12 months time. In other words, the present price of gold is a signal that the market is expecting velocity to pickup in a year, on average. However, the explanatory power of the model is small – about a 17% R-squared – as a single country (the US) is used.

Intuitively, one of the reasons why movements in the price of gold precede changes in velocity has to do with the fact that GDP is used to compute velocity. An increment in money supply to reactivate the economy does not translate in an immediate GDP growth. As future growth starts fuelled by the availability of money, it increases velocity with a lag. Thus, creating future inflation may follow. Empirically we observe that a increase in the price of gold can also be interpreted as a signal by the market that velocity may rise in the future which in turn can produce inflation forward.

Conclusions

We find that money supply can have an effect on the price of gold. As the money supply increases, the gold price rises. This effect has a lag of about 6 months. Moreover, we find that changes in the US money supply do not solely explain the changes in the price of gold. On the contrary, gold is impacted by many factors world-wide and as such, money supply changes in places like India, Europe, and Turkey also have an effect on its performance. In particular, a 1% change in money supply in the US, the European Union and United Kingdom, India, and Turkey tend to correlate to an increment in the price of gold by 0.9%, 0.5%, 0.7%, and 0.05%, respectively.

We also find that gold is an indicator of future velocity of money, in particular in the US. In other words, the gold price can be interpreted as a signal that the market expects the velocity of money to increase, thus raising future inflation.

Our analysis suggests, firstly that gold is a leading indicator of velocity and therefore inflation and secondly that despite of a large output gap around the world and anaemic economic recovery, investors are justified in their concern that quantitative easing policies resulting in rapid money supply growth will eventually lead to an increase in the velocity of money and of inflation.

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