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The Value of the US Dollar in the Current Exchange Rate Crisis

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Abstract: The aim of this paper is to discuss the crisis of the international financial system and the necessity of reforming it by new anchor or benchmark for the international currency, a money-commodity. The need for understanding the definition of a numéraire is a first necessity. The first section analyses the definition and meaning of a numéraire for the international currency and the justification for a variable standard of value which can be gold or oil. Looking at both trends, gold is the prefered one. In the second section, the market value of the US dollar is analysed by looking at new forms of value -financial derivative products- the dollar as a safe haven, and the role of SDRs in reforming the international monetary system. The third section is devoted to the specification od an econometric model and a graphical analysis of the data. There is a clear indication that an inverse relation exists between the value of the US dollar and the price of gold. In the fourth section, after estimating many different specifications of the model –linear stepwise regression, cointegration analysis- the main econometric result is that there is a strong link between the price of gold and the value of the US dollar. There are also a positive relation between gold price and inflation. An inverse significant relation between gold price and the monetary policy is revealed by applying a dynamic model (cointegration with 2 lags).

Keywords : Money, value, benchmark, gold, dollar, regression, cointegration.

Introduction

Nowadays, most economists reject any connection between money and a particular commodity (gold) and postulate state money. They ignore the need of the *international currency* to be linked to the real world by a benchmark as a standard of values or prices. Following Ricardo's thinking, they consider money as a mean of circulation and forget or minimize the store of value function. The whole idea of a store of value is completely ignored in a Walrasian general equilibrium for money because if money supply and money demand are in equilibrium, there is no excess of money as a store of value. The money store of value function is also incompatible with an equilibrium circuit of money so frequently postulated by some post-Keynesians[1].

Through the *exchange rate system*, each domestic currency is linked to this international currency, and, consequently, is linked to such a benchmark elected as a general equivalent. One must distinguish here between a "*de jure*" and a "*de facto*" situation. From a "de jure" viewpoint, there is no link between the international currency and a commodity (gold) since 1971. From a "*de facto"* viewpoint, the link still exists. The main point is how the market defines a benchmark and, if necessary, can it be changed or reinterpreted? Two recent publications invite us to rethink the problem in terms of money-commodity: P. Patnaik (2009), *The Value of Money*, and D. Bryan & M. Rafferty (2006), *Capitalism with Derivatives*. Patnaik's conclusion is that oil is the money benchmark while Bryan and Rafferty's conclusion is that derivatives are the new "commodity" (risk as a meta-commodity) serving as a benchmark for money. Robert Zoellick, president of the World Bank, declared last November

"This new system is likely to need to involve the dollar, the euro, the yen, the pound and a renminbi [yuan] that moves towards internationalisation. The system should also consider employing gold as an international reference point of market expectations about inflation, deflation and future currency values." [2]

Robert Mundel (1997) predicted a comeback of gold in the early 21st century. "More likely, gold will be used at some point, maybe in 10 or 15 years when it has been banalized among central bankers, and they are not so timid to speak about its use as an asset that can circulate between central banks. Not necessarily at fixed price, but a market price".[3]

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[1] The question of disequilibrium in the circuit of capital has already been looked at in Loranger (1982, 1986, 1991).

[2] R. Zoellick ,Financial Times (11/08/10).

[3] R. A. Mundel (1997). Underlining is ours.

The first aim of this paper is to discuss the value of the US dollar as an international currency reserve and the necessity of reforming the international monetary system by choosing a new unit anchored to a commodity connecting it to the real world. Three types of commodities are usually recognized as benchmark:

- Labour power as a commodity. This is the preferred choice of most Keynesian and Marxist economists, although from very different hypotheses.
- Gold as a fixed or variable standard of value. This will be our preferred with R. Zoellick and R. Mundel.
- Oil as an alternative standard preferred by some economists like P.Patnaik.

The need for understanding the definition of a numéraire is a first necessity. We will demonstrate the exact correspondence between Walras' and Marx's numéraire which is defined as a quantum of a certain commodity assumed to be gold in Marx's form IV. Although most economists reject any connection between money and a particular commodity (gold) – because of the existence of legal tender money in every country – it will be shown that it is equivalent to reduce the real space to an abstract number (usually assumed 1) in order to postulate that money is neutral. *This is sheer nonsense because the equivalence between money and the real world is cut off.* A second interest of this paper is to give some theoretical foundation to the recent Chinese position (which is shared also by many other countries (like France, Russia, India, Brazil) in favour of replacing the US dollar as an international currency by SDRs based on a basket of other currencies. This may be a necessary but not a sufficient condition. The sufficient condition is to have a market value for SDRs where the price of gold or any other commodity chosen as general equivalent is expressed in SDR and a larger role of the IMF as lender of last resort that can establish confidence in the world money. That would imply the surrender of the hegemonic role of the superpower money. Finally, with the help of an econometric model, a third aim is to show that a strong link exists between the price of gold and the value of the US dollar and other key financial variables such as the interest rate and inflation. Therefore, it will be shown that demonetarization of gold is a myth in theory as well as in reality.

This paper is divided into four sections. The first section analyses the definition and meaning of a numéraire for the international currency and the justification for a variable standard of value (a "*de facto*" situation). In the second section, the market value of the US dollar is analysed by looking at new forms of value - derivative products- the dollar as a safe haven, and the role of SDRs in reforming the international monetary system. In the third section, empirical evidence between the price of gold and other related variables is presented and an econometric model is specified to fit those data. The lengthy last section contains various econometric results. After

estimating many different specifications of the model –linear stepwise regression, proportional variation regression, error correction model- the main econometric result is that there is a significant link between the price of gold, the value of the US dollar, the inflation rate, the Dow Jones index and the interest rate.

1.0 Numéraire and variable standard of value

Many if not most economists (and bankers) prefer to avoid the discussion about a numéraire by limiting their conception of money within a national framework, thus avoiding the discussion of the international reserve currency. They assume that the central bank is the highest authority and imposes a consensus by declaring the domestic currency legal tender money. This legal tender status is extended to private commercial banks because the central bank acts as the lender of last resort. Nobody denies that fact but it is no excuse to remain silent about the exchange rate and the need for an international currency connected to the real world.

1.1 Definition of Walras' and Marx's numéraire

Refering to Kindleberger's article (1971) of the N-1 problem, let

$[x_1 , x_2 , \text{---------}, x_{n-1} , x_n]$ be a bundle of goods

$[p_1 , p_2 , \text{---------}, p_{n-1} , p_n]$ be their absolute prices

Assume that x_n is chosen as the general equivalent good (numéraire)

The (n-1) relative prices are $[p_1 /p_n, p_2 /p_n, \text{-----}, p_{n-1} /p_n]$

Assume that $p_n = 1$, a usual assumption in an elementary macroeconomic course.

The relative prices are $[p_1, p_2, \text{---------}, p_{n-1}]$, and they are now expressed *in absolute money prices*.

According to the definition of a price, it is a quantity of money per unit of a particular commodity. In dimensional analysis, let assume that M is money and x_n is gold G.[4]

$[p_n] = [M/x_n] = 1 \rightarrow [M] = [x_n]= [G]$. Therefore, money M is gold G. For most economists, this is an unacceptable statement. In order to avoid it, they refuse to discuss the absolute price system and prefer to stick to the relative price system, avoiding committing themselves to choose a particular commodity. In a Walrasian equilibrium, prices are determined when there is no excess supply and demand for any commodity. Such an equilibrium rules out the possibility that money can function as a store of value. Many economists think that by assuming $p_n =1$, they have defined a purely abstract numéraire with no real foundation. Then x_n should be an abstract

[4] A good introduction to dimensional analysis is F.J. De Jong (1967). In economics, there are four fundamental dimensions: M, R, T and [1] for money, real object, time and abstract number without dimension. All other variables have secondary dimensions derived from the fundamental ones.

number [1], which is a contradiction with respect to the real space to which it belongs by definition[5].

The Marxian formulation starts with value form instead of prices.

Let xA ↔ yB ↔---------↔wD ↔ zC be equivalence relations between commodities

Let [A, B, -------D, C] be the bundle of commodities

and [x, y, ---------w, z] be their absolute values

Assume that C is chosen as the general equivalent commodity (numéraire).

The relative form of values are [x/z, y/z, ------ w/z]. Assume that z = 1.

The relative values become [x, y, ---------w] and they are now expressed *in absolute money form values.* According to the definition of a money form value, it is a quantity of money per unit of a particular commodity. Assume that M is money defined in a value space and C is in the space of real world. Hence, z = [M/C] = 1 → [M] = [C]. C belongs to the space of physical dimension -for instance a quantum of gold. Therefore, there is no difference between Walras' and Marx's numéraire. The numéraire cannot be an abstract number equal to unity: money is linked to the real world and, hence, money matters!

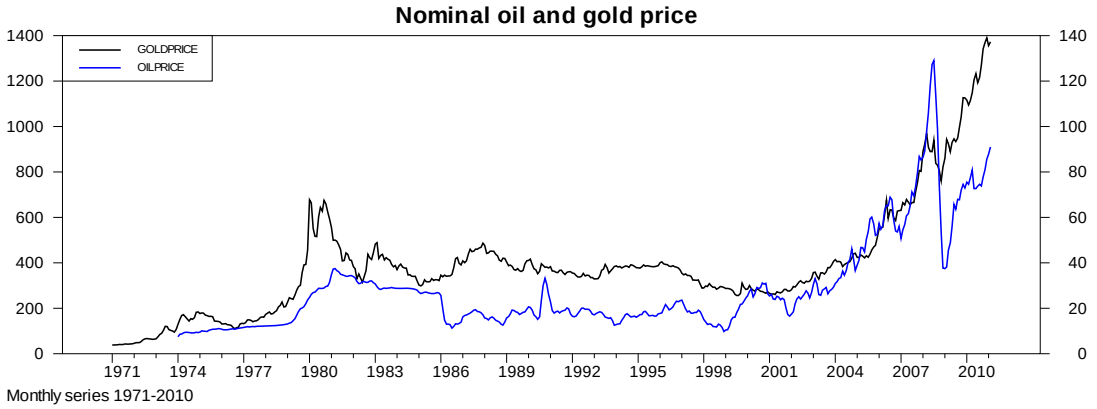
1.2 Oil or gold as a variable standard of value

Let us first define a *variable* standard of value for G which is *elected* the general (universal) equivalent for all the other commodities. The word elected means chosen and accepted universally by people around the world[6]. This may not be the case any longer. One could speak instead of Marx's form II – total or expanded form of value – where each commodity is taken as a specific equivalent for other commodities –it could be gold, petroleum, etc- Speculation on certain basic commodities such as oil, potash, aluminum, copper, silver and gold cannot be understood otherwise. Speculators are seeking to protect the value of their wealth by exchanging money for these commodities quoted in US dollar. This is a clear indication that the US dollar maintains a link with the real world of commodities. Money is not neutral or abstract for speculators!

Graph 1

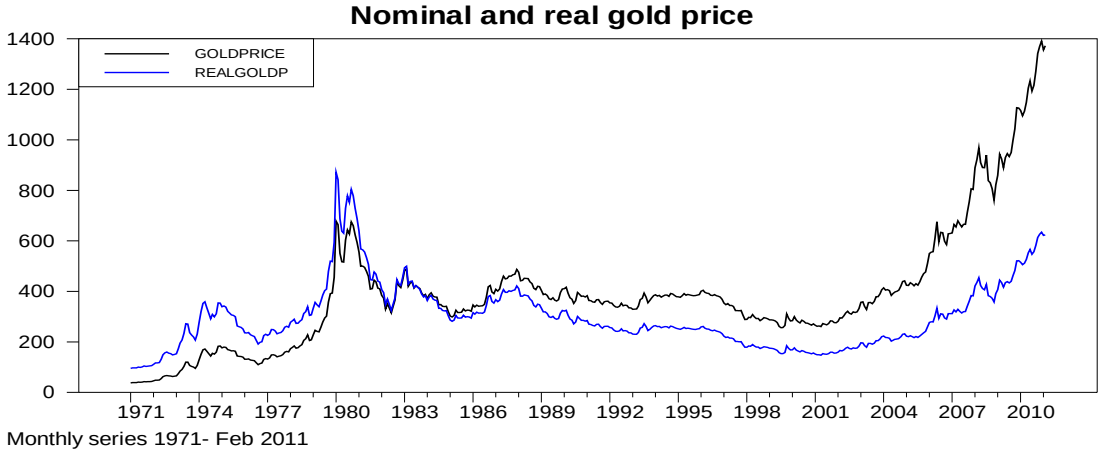
[5] The real space cannot contain an abstract number. Another embarrassing question is how can x_n be a universal equivalent outside the community of economists if it is an abstract number with no particular reference to the real world? It would boil down to assume that a dollar is a dollar, a tautological statement.

[6] Bryan and Rafferty (2006) in a note on page 150 outline that Menger (1892) saw money as a commodity selected by the market, not nominated by the state. "It is the marketable characteristics of the commodity money …that sets it apart from other possible money: a process of natural selection by market processes. Menger contended that it was these sorts of qualities, not state decree, that saw precious metals be nominated as money."



If one compares for instance the price of oil and the price of gold between 1979 and 2010, the price of oil was around $20 a barrel at the end of 1979[7] while the market price of gold was around $375 an ounce, an increase of 8.2 times its official price ($46). In 2010, the price of oil was around $88 while the price of gold reached $1200 - an increase of 4.4 times for the price of oil compared to an increase of 3.2 times for the price of gold. Which of these two commodities can be the best standard of value, reflecting successive devaluations of the international currency (US$)? If stability is a desirable quality for a standard of value, gold is more stable than oil. One observes a wild gyration of the price of oil during the great financial crisis moving from $60 in 2007 to above $130 in 2008, falling back to $40 in 2009 and climbing up again to above $100 by the end of March 2011. During the great financial crisis, gold was chosen as a safe haven and its price reflects uncertainty concerning the US$ as a currency reserve and successive devaluations of the latter since its value is close to inflation rate.

Graph 2



[7] The price of oil doubled after Komeiny's takeover in 1978.

This can be observed from graph 2 where the nominal and the real price of gold are downward sloping parallel curves between 1985 and 2005. Another way to look at the parallel evolution between the price of gold and inflation is to look at the period 1983 and 2007 in order to avoid wild fluctuations of the last great financial crisis. The consumer price index in the USA based 100 in 1982-1983 is 206 in 2007. Its value increased by 2.1 times between 1982 and 2007. The price of gold in mid-1983 was $413 and $697 in 2007, its increased value is only 1.7 times during the same period. Hence, inflation grew more rapidly than the price of gold during that 25 year period. Even by including the last 3 years, the CPI is 220 at the end of 2010 (an increase of 2.2 times its 1982-83 value) while the price of gold is around 1225 in 2010 (an increase of 3 times its 1982-83 value). Since the price index is based in 1982-83, nominal and real value of gold are the same, around 413. The real value of gold at the end of 2010 is 557 which represent an increase of 35% over the 28 year period, an average annual growth of 1.25%[8]. This fact is in accordance with what many observers noted about gold: in the long run: gold is a conservative investment because its price, after adjustment for inflation, gives a low yield and constitutes a rather stable store of value.

Moreover, the quantity of world gold reserve, which was around 1150 millions ounces in 1971, felt to 950 millions in 1979 and remained at that level up to 1988. Although "demonetarisation" of gold was proclaimed, central banks continued to keep a large reserve of gold until 1988 (36%). This level has dropped to 10% over the last twenty years. [9] When calculated in tons, the decrease is around 150 tons per year during the last 20 years. Central banks, which have been net sellers of gold in the past (on average of 400 to 500 tonnes per year), have now reversed the trend: they sold almost nothing in 2009 and were net buyers of near 100 tonnes in 2010.

Table 1 Gold demand (Tonnes)

	Coins, bars & ETF		Jewel. & technology		Total
2001	357	(10%)	3372	(90%)	3729
2005	601	(16%)	3151	(84%)	3753
2006	676	(20%)	2760	(80%)	3435
2007	688	(19%)	2882	(81%)	3571
2008	1181	(31%)	2631	(69%)	3812

[8] Even including the value of 1400 reached by gold at the end of February, its real value would be 636, which represent an average annual increase of 1.9%

8 That proportion was 30% in 1971, 38% in 1978, 36% in 1988, 17% in 1998 and 10% in 2008 (IMF 2008).

2009	1360	(39%)	2133	(61%)	3493
2010	1333	(35%)	2480	(65%)	3812

Source: World Gold Council, Gold Demand Trends, table 10

As reported by the World Gold Council (2011), estimated total gold demand for 2001 was 3729 t and 10 years later was almost the same (3812 t). However, the demand change between industrial use and investment as a safe haven is substantial: the proportion of demand for gold as a money commodity moved from 10% in 2001 to 35% in 2010, with a peak of 39% in 2009. Note the jump of near 100% in gold demand for investment between 2007 and 2009, a period of great uncertainty created by the financial crisis. This gold rush will continue after the announcement by the FED in November 2010 of a quantitative easing of 600 billions for the year ahead and the price of gold is now over 1400 $US. Therefore, gold remains a safe haven and its price remains important and deserves some explanation.

1.3 Specification of a variable standard of value

Assume z(t) is the *variable price* of gold which is equal to a number ≠ 1. We now add a third fundamental dimension [T] for time or [1/T] per period of time. z(t) = a(t) = [M(t)/G] or [M/T] = [a/T] [G]. What does this mean? Simply that a certain quantity of money per period [M/T] is equal to a certain quantity [a/T] of G for the same period. It is easy to see that, if the price of G is constant over time – for example in a discrete time period - the dimension T cancels itself on both sides of the equality and we have M = aG, that is M is a certain (fixed) proportion of G during that discrete time period. What is the particular nature of G? Marx pointed out clearly (Book1,1967) that G has two use values : one as an *ordinary commodity* with its price related to its cost measured in term of labour power (congealed and living labour); the second as an *extraordinary commodity* used as a general equivalent and its price is not related to its cost price. One can call it the speculative or market price as a reserve of value. *It is this price which links the foundation of money with the real world.*

This view is in total contradiction with the Post-Keynesian economists who say that state money is the only reality. The Chartalist post-Keynesian school[10], following Knapp (1924) and Kaldor (1964), argues that, even if central bank money is a debt, there is no obligation to reimburse it because …"The general acceptability of both state and bank money derives from their usefulness in settling tax and other liabilities to the state. This… enables them to circulate widely as means of payment and media of exchange" (Bell, 2001, 161)[11]. A similar view is also found in Smithin

[10] The term chartalist derives from a latin word meaning ticket or token (Knapp 1924).
[11] Note in passing the absence of any reference to money as a store of value.

(2009). When applied to the US economy, this concept is equivalent to assume that the US dollar is the numéraire for the whole world. How can a state be a benchmark accepted universally? How can a superpower be a good unit of measurement for value?

The idea of a variable standard of value is not new in the literature. For instance, Keynes' assumption of a fixed wage rate in the short term is the basic assumption for grounding money to the real world. Indeed, the commodity behind that assumption is labour power and the stability of money rests upon the discipline of the labour force. Money and finance capital are in a permanent trade off and here lies the foundation of class struggle.

Strangely enough, many Marxists share a similar viewpoint when they argue that the monetary expression of labour time (MELT) is defined by the ratio of value added in money terms to the value created by the labour power. Money is then grounded to the real world by the labour force as a commodity. However, the labour theory of value, which is the foundation of the Marxist approach, assumes that the MELT equation is validated because the numerator and the denominator are measured in abstract unit of labour time. But money is not an abstraction: it requires to be connected to the real world. By taking concrete labour time in the denominator, one has to specify how the nominal wage rate is determined in the numerator. Is it fixed as Keynes assumed or is it determined with other prices?[12] Marx understood very well the difficulty and that is the reason why he felt obliged to define the value of money with respect to a commodity, a step that modern Marxists are not ready to make and remains a big flaw in understanding the value of money in the real world.

Finally, the labour force assumption as a commodity is usually accepted in a closed economy. It cannot be relevant to open economies unless the necessary arbitrages are done through exchange rates with respect to the dominant economy. But the dominant economy is not always ready to discipline its labour force, especially when it can attract savings from the rest of the world at a near zero cost.

2.0 The market value of the US dollar

2.1 The form of the universal currency

In ancient times, each empire had the power to create its own money, allow it to circulate in other countries and support it by conquering the wealth of other nations. Nowadays, the situation is not so different, but *the form of value is much more sophisticated with the financial innovations around the U.S. dollar*. In the 80s when I wrote my first essays on that topic, the international financial markets were not as sophisticated as they are today. We witnessed the development of

[12] See for instance Loranger (2004) where the wage rate is determined simultaneously with prices when the profit rate is invariant in the transformation of values into prices.

the eurodollar phenomenon which allowed private banks or other investors to have access outside their domestic financial markets and borrow dollars on the world market. This was particularly useful for countries that had enough credit worthiness and were able to escape the control of the IMF and the World Bank for their development. However, this was insufficient since many developing countries were forced to accept structural adjustment plans with strict conditionality. Continuous deregulation starting in the early 80s with the Reagan administration, led to uninhibited development of financial markets, the emergence of many kinds of derivative products and the securisation of debts (slicing and repackaging debts). The risk factor became a new commodity that could be exchanged on a market like any other financial products. Therefore, ABS, ABCP, CDO, CDS[13] etc… became the new craze developed by Wall Street bankers and their imitators across Europe and in other countries that had enough financial strength to issue and sell them. Since many of these products were difficult to price according to their risk factor, their market brutally collapsed and created the biggest financial meltdown at the world level.[14]

2.2 Expansion of financial derivatives

The notional value of a derivative contract corresponds to the value of the underlying security (shares, bonds, etc.). Since the underlying security is related to a physical capital asset, the notional value of a derivative is simply another measure derived from that asset which transcends time and space. Therefore, the market value of the derivative contract is the amount of money required to buy the derivative instead of buying the security. This has an important advantage for banks, other financial institutions (hedge funds), firms and individuals. It gives them a leverage to buy large amounts of notional capital with a small quantity of liquidities or by borrowing instead of reducing their liquidity[15]. Securities can be unbundled, repackaged and sold as another security where the risk is divided and spread over many other investors who buy ABS, ABCP, CDO, CDS. Bryan and Rafferty (2006) see these financial instruments as a new way to value the firm assets in time and space.

"The commensuration properties of financial derivatives mean that the logic of capital is driven to the center of corporate policy making. Assets that do not meet profit-making benchmarks must

[13] These acronyms are for Asset Back Securities, Asset Back Commercial Papers, Collateralized Debt Obligations, Credit Default Swaps.

[14] The market collapse for these products was not supposed to happen because all traders were using financial econometric models based on the assumption of risk randomness. Their model could not incorporate the systemic risk derived from the mimetic behaviour of investors and concentrated the risk on certain financial institutions. They totally ignored Minsky (1982) hypothesis of financial fragility where risky behaviour (Ponzi finance) increases with the length of the business cycle. See in particular Barbera (2009).

[15] Because derivatives are contingent values, they are not reported in the balance sheet of firms. But the accounting rules might change if there is a financial reform at the world level.

be depreciated, restructured and/or sold. The decision not to do so is now more readily exposed to market scrutiny, as investment bankers use derivatives and derivatives' prices to unbundle the performance of the different assets and liabilities of firms" (B.&R p.66).

Table 1 shows the importance of the development of derivatives over the last ten years. Their phenomenal expansion is an indication of the volatility of the financial markets and in particular the uncertainty generated by the floating exchange rate system. It is no surprise that a crisis of exchange rates is now developing around the globe and a reform of the international monetary system becomes necessary.

Table 2 Importance of financial derivatives

Outstanding Derivative contracts Notional amount Dec. (trillions $,)								
	2001		2004		2007		2009	
OTC (Over the Counter)	111	82%	220	84%	596	89%	688	90%
Organised Exchanges	24	18%	47	16%	72	11%	73	10%
Total	135	100%	295	100%	668	100%	688	100%
Market value	3.8		6.4		15.8		21.6	
Distribution by type of contract in 2009: Interest 73%, Foreign Exchange 8%, CDS 5%, equity-linked and commodity 1.5%, others (unallocated) 12.5%								
Foreign exchange market and daily turnover								
Notional amount (OTC)	16.7		31.5		57.6		49.2	
Market value (Dec.)	0.7		1.9		3.3		4.0	
Daily turnover (April)	1.5		2.1		3.4		4.1	
Annual turnover (240days)	360		456		792		960	
Source: BIS, Triennial Survey 2010, Quarterly Review, various quarters								

There is no unanimous consent about the definition and measurement of derivatives. According to the Bank of International Settlements (BIS), the notional amount of OTC derivatives contracts and the notional amount on organised exchanges totalised 688 trillions of dollars at the end of December 2009.The largest part of these transactions is with interest rate (73%). Financial derivatives (interest rate, foreign exchange and CDS contracts) account for more than 85% of all the derivative contracts. The growth over the 7 year period (2001-2007) is 410%, which represents an average annual growth of 59%. One can observe however that the financial meltdown 2008-09 has brutally stopped that growth which is only 3% since December 2007.

However, the market value of these derivatives has increased by 37% since 2007. Another interesting characteristic of this phenomenon is that transactions on organised markets are continuously loosing ground and represent since 2007 only 10% of the total value of derivative contracts. Since OTC contracts are done by banks, the power of the latter is more concentrated than ever.

Even if the foreign exchange contracts represent only 8% of the total transactions, the interest of studying this subsector is in terms of turnover if one wants to impose a tax on this particular type of transaction. It also reveals the increasing volatility of the value of monies and the numerous exchange rate crises that cannot be stopped without reforming the International Monetary System. One observes a rapid growth of the **notional** foreign exchange contracts between 2001 and 2007, but this growth stopped and even turned negative (-15%) between 2007 and 2009 moving from 57.6T to 49.2T. However, the **market value** had an accelerated growth for the period 2001-2007 moving from 0.7T in 2001 to 3.3T in 2007 and a reduced average annual growth rate for the last two years (10%). The yearly turnover of foreign exchange derivatives is now hovering to 1000 trillions. A Tobin tax of one tenth of one percent would give revenue of one trillion dollars. The scale of these transactions may appear to be exaggerated because hedging in financial derivatives (offsetting an existing position) is quite frequent. "Unwinding positions (by means of an opposite trade) in exchange-traded markets tends to result in a growth in turnover, while in OTC markets it tends to add to the notional principal amounts" (B&R p. 57). Anyhow, since the world GDP is estimated around 60T in 2009,[16] it is about ten times less than the notional figure of OTC derivative contracts.

According to Bryan and Rafferty, it is not possible neither desirable to eliminate these financial derivatives because they are the new vehicles for storing the value of money. They consider that derivatives are the new standard of value and form of holding wealth which changes in time and space (a variable standard of value).

"…valuation across space, time, and between different asset forms is the stuff of derivatives. Derivative traders….operate in a world of perceived equivalence but, and this is critical, it is not a fixed equivalence – for if equivalence were fixed, there would be no need for derivatives" (p. 36).

"[Derivatives] are commodities that manage risk. And because risk exposure is so changeable, the market for these risk management commodities has acquired a high level of liquidity (volume and mobility) with many of the characteristics of money…. Derivatives constitute new private global money (page 38)".

[16] World Economic Outlook, IMF, April 2010.

If derivatives were a benchmark for money, they would constitute universal money like gold. But this is assumption does not stand in the real world. Outside financial institutions and firms, derivatives are useless as means of exchange and means of payment for ordinary people. It would be more accurate to describe derivatives as a new form of money such as coins, bills, credit cards and credit money that are preferred as a means of exchange and means of payment in particular situations. In fact, Bryan and Rafferty affirm that there is no difference between derivatives and money, and derivatives are a benchmark for unknowable fundamental values. In Marxian analysis, abstract labour values are unknowable values and money is the *raison d'être* for revealing these values through the market place. Derivatives play a similar role but the problem of the definition of the standard of value or benchmark for money remains an unresolved problem in the Bryan-Rafferty approach.

It would be foolish to eliminate these financial instruments without a major overhaul of the international financial system, because the origin of that new way of trading uncertainty and risks emerged with the regime of fluctuating exchange rates and deregulation in all directions of banking and financial institutions at the world level. The most important cause is the end of the fixed definition of the US dollar with gold proclaimed in 1971. The Chicago Mercantile Exchange introduced the first derivative on currency in 1972. The Chicago Board of Trade introduced the first derivative on interest rate in 1975 and the Chicago Board Option Exchange (CBOE) was created in 1973 as a market for options that were previously exchanged as OTC (B&R. p. 94). All these new financial institutions were created to counteract the volatility on exchange rates and other financial instruments (shares, bonds…) after the collapse of the Bretton Woods Agreement.

2.3 The strength of the U.S. dollar

Since the variable exchange rate regime is the consequence of the abandonment of any **official** link between the US dollar and gold, what is then the value benchmark of the dollar as a currency reserve? A bad answer is to state that the value of a dollar is defined by a basket of strong currencies such as euro, yen, Swiss franc, sterling pound, etc …That boils down to say a tautology: a dollar is a dollar! Unfortunately, this is the standard teaching in most macroeconomic courses. Economists are unable to justify a fundamental dimension in economics: money - which is at the basis of the definition and measurement of value expressed by market prices - has lost its function of a standard of value and, hence, its function of store of value because its unit of measurement is undefined. As already mentioned previously, this mainstream opinion has been challenged by Patnaik (2009) and Bryan and Rafferty (2006). Since the latter's opinion was presented in the previous section, our observations will be limited to Patnaik's viewpoint.

"A monetary world necessarily requires….. the fixity of the value of what is used as money vis-à-vis *some* commodity, be it gold or silver or labour power… Fiat money is as much commodity money as money fixed against gold; it is just that the commodities in the two cases are different. The world has never succeeded in getting out of commodity money" (Patnaik, pp.163-64). The propertyist view assumes that money is determined outside supply and demand, a view contrary to the monetarist approach and to the post-Keynesian concept of state money.

"State backing can at best confer juridical acceptability, but for it to actually function in the economy in a meaningful manner something more is needed and this something is the fact that it has a commodity backing, of the commodity labour power, through the fixity of the money wage rate in any single period" (p.164).

In Patnaik's view, the stability of the US dollar is nowadays based on the oil price.

"It follows that the present currency arrangement hinges crucially on the stability of the price of the dollar in terms of oil, in the sense at least of the absence of persistent declines in it, which is why it can be called the oil-dollar standard. No matter what the "de jure" situation, the world has not moved away from commodity money" (p.208).

Patnaik finished writing his book in June 2008, just before the start of the financial meltdown that had a tremendous impact on the oil price fluctuating wildly from $140 to a low of $40 and now above $100. Patnaik's hypothesis about oil-dollar standard is not supported by the recent economic situation. However, he has a long-term view about the price of oil: USA is an imperialist power and will want to keep control over the production and flow of oil from the Middle-East countries, including Iran, and will wage war, if necessary, to keep control over the price of that resource.

This is a unique advantage for an imperialist power: even if its financial system is in a fragile state, the US economy can finance their restructuring debt at a near 0 interest rate with savings coming from the rest of the world. Any other country in such a situation would be declared a failed state. Look at what is happening in the Euro zone. This crisis will last as long as financial instability continues. *It is Happening Again* as would have written the late H.P. Minsky (1982).

2.4 Reform of the International Monetary System

In March 2009, the governor of the Central Bank of China, Zhou Xiaochuan, launched a call in favour of the need of reforming the International Monetary System. This call received the support of other countries such as India, Russia, France, Brazil, to name only a few of them. The main proposition made by Mr. Zhou is to give an enlarged role to the SDRs as the new reserve currency which would be independent from major currency economies. "As an international

currency, the SDR should be anchored to a stable benchmark and issued according to a clear set of rules". The main question is how do we define the benchmark? It cannot be simply defined as a basket of other strong currencies as the SDR is actually defined. Mr. Zhou seems to favour Keynes' proposition of the Bancor …"based on the value of 30 representative commodities". Therefore, in Mr. Zhou's view, the Bancor would not be simply fiat money as proclaimed by Keynesian and post-Keynesian economists. Is it necessary to have 30 commodities instead of one like gold or oil? The economic acceptability of a numéraire depends on the market and not on law or regulation by a superpower or an international institution like the IMF[17].

Therefore, the market price of gold in SDR is all that is necessary for grounding the international currency to the real world. The importance of a variable price of SDR in gold is to show to the world that a particular commodity is backing the value of money in SDR. This might be seen purely symbolic, but symbols are important in real life. The management of the supply of SDR and its price will depend on a large consensus of the international community to give a larger role to the IMF and, in particular, on the will of the United States to accept that their currency is to be confined to the exclusive role of a national currency. IMF would control the change of the market value of the SDR in a similar way that each country can control the exchange rate of its money. For instance, IMF could favour a controlled devaluation of the SDR in the same way as it can augment the quantity of SDRs like any central bank does when it wants to augment the liquidity in the system. *This position is not a return to a gold standard or a gold exchange standard. It is the continuation of the existing state (a variable standard) with a new independent currency*. After a transition period, international financial transactions should be done in SDRs instead of US dollars. Then a new international monetary system will bring more stability in the financial markets.

Recall that the suppression of any official link between gold and the international currency reserve of the US dollar caused the phenomenal expansion of derivatives the role of which is to counter balance the risk generated by uncertainty about the store of value function of the international currency. It has also been stated that volatility of financial markets cannot be reduced unless there is a major change in the international monetary system and a new set of regulations. Mr. Zhou seems to share a similar viewpoint.

"The centralized management of part of the global reserve by a trustworthy international institution with a reasonable return to encourage participation will be more effective in deterring speculation and stabilizing financial markets…With its universal membership, its unique mandate of maintaining monetary and financial stability, and as an international 'supervisor' on the

[17] See footnote 8. See also the quotation of R.A. Mundel on page2.

macroeconomic policy of its member countries, the IMF, equipped with its expertise, is endowed with a natural advantage to act as the manager of its member countries reserves (Z. Xiaochuan, p.4, 2009).

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3.0 Model and data

3.1 An econometric model

The interesting point here is not gold as such, but its variable standard a(t). What are the determinants of a(t)? There are countless numbers of determinants. As usual in economics, the ability of an economist is to select the most important ones and add a random variable for the others.

Therefore, let $a(t) = f[X'(t); u(t)]$

where X(t) is a column vector of the most significant determinants of the price of gold and u(t) a random variable which accounts for all other (stochastic) influences on the price of gold. With the data chosen, the vector of explanatory variables is

X'(t) = (Txch, DJ, CPI, Txint) where TxCh is the exchange rate of the US dollar with respect to another currency such as Euro or a broad index of other currencies. This is the key variable linking gold and the US dollar. Other determinants such as the Dow Jones index, the consumer price index and the interest rate are added as a complementary explanation of the variance of gold price. Therefore, the linear regression of the price of gold on these four determinants is:

$z(t) = \alpha + \beta' X(t) + u(t)$

where X(t) is a column vector of 4 components, β' is a line vector of 4 parameters, z(t), u(t) and α are scalars.

Of course, this specification can be complicated in many ways depending upon the assumptions made about u(t) and X(t). If for instance u(t) and X(t) are not independent from each other because of multicollinearity between the explanatory variables, then the model could be transformed into a simultaneous model of two or more equations. It is also quite likely that it is not as much the simultaneous interdependence which matters most, but the lagged response of the price of gold to the various determinants. Some of these determinants could be expected values instead of actual values. In which case, the model could take the form of

$z(t) = \alpha + \beta'[H(L) X(t)] + u(t)$

where H(L) is an infinite polynomial in the lag operator L. This can always be approximated by a rational function of two finite polynomials A(L) and B(L) of order m and n respectively. Hence,

$z(t) = \alpha + \beta'[A(L)/B(L)]X(t) + u(t)$ or

$B(L)z(t) = \alpha' + \beta'[A(L)X(t)] + v(t)$. With autocorrelated residuals, one particular specification that will be privileged will be the Hildreth-Lu specification, $(1-L)z(t) = \alpha' + \beta'X(t) + v(t)$. Therefore, an autoregressive and/or a moving average process can be specified. One can also specify that the vector X(t) is stochastic and an Error Correction Model would be the proper specification (co-integration analysis).

3.2 The data

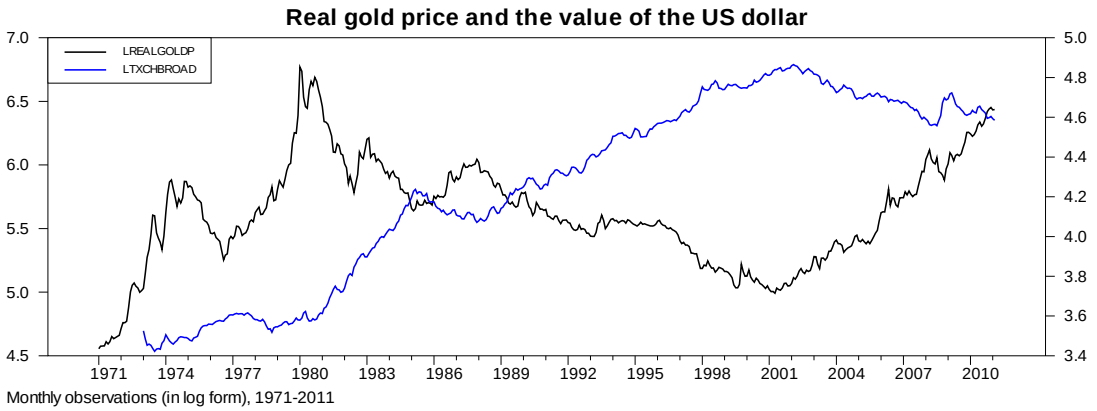
The data used are monthly series:

- Gold price, Dow Jones, CPI (consumer price index, 1982-84=100) and interest rate, Jan1971 – Feb 2011
- Broad exchange rate per US dollar, Jan 1973 – Feb 2011
- Exchange rate US$/Euro Jan1999 – Feb 2011.

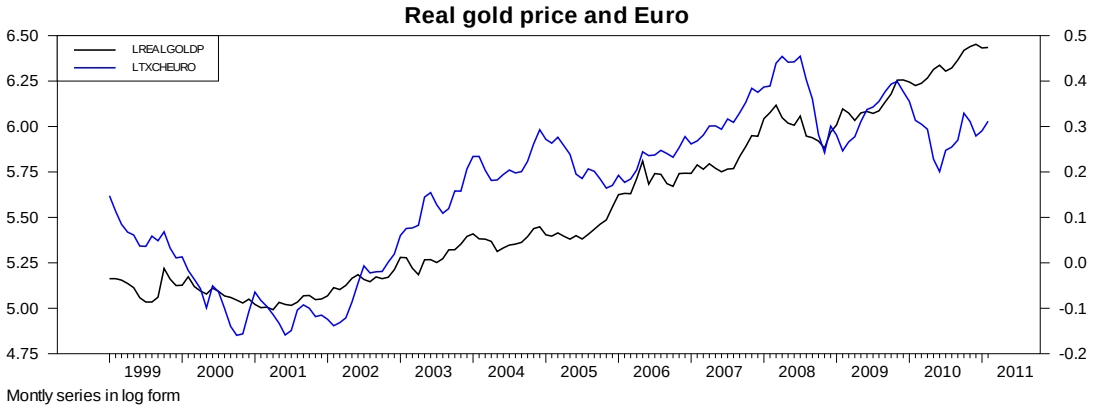
Note an inverse correlation between Broad/US$ and US$/Euro, that is, when the latter increases, it means a depreciation of the dollar. Therefore, a positive correlation is expected between gold price and the exchange rate US$/Euro. The contrary is expected with the exchange rate Broad/US$, that is a negative correlation is expected between the gold price and the exchange rate index.

1971 was picked because it was the year when the US administration (Nixon) decided to free the US dollar from any link to gold by putting an end to the Bretton Woods Agreement. Note from graph 2 a sharp increase in the gold price followed from 1971 to 1982 when the Reagan administration decided to jack up the interest rate in 1981 to 18% in order to save the value of the US dollar.

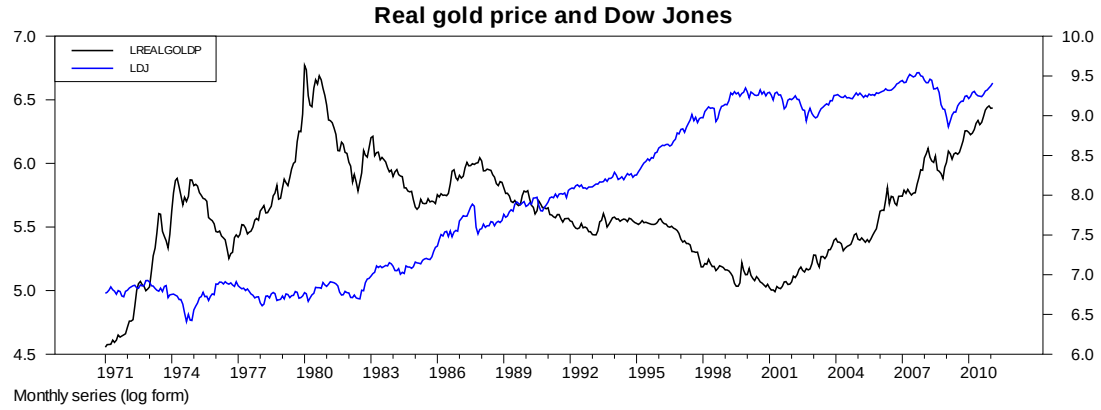
Graph 3



Graph 4



Graph 5



The data in the above graphs are in log form and the slope of a cure expresses the rate of growth of a particular variable. One thing seems quite obvious: those series are non stationary and a first difference would most likely transform them as stationary series. Therefore, a cointegration analysis will be well indicated after the regression analysis. There is no interest to graph series in first differences because they will look like white noise.

From graph 3 above, one observes a negative correlation between gold price and the value of the US dollar. This strong link is particularly obvious from 1985: when the value of the US dollar is increasing, the real value of the gold price is diminishing. Because Euro exists since 1999 only, it is interesting to concentrate the analysis on that last period because it corresponds to a decrease of the value of the US dollar and a positive relation between gold price and the value of a Euro is observed in graph 4. Note however that the value of Euro in 2010 becomes less reliable as a reserve currency to reflect the devaluation of the US dollar because of speculative attacks against Euro. The interest of graph 5 is to observe an inverse relation between the gold price and the Dow Jones index. The DJ index is a measure expressing the degree of optimism or pessimism. It is inversely correlated with a fear index such as VOX or VIX (Loranger, 2010).

4.0 Regression analysis

4.1 Simple regression

Let us start with a check on monetary policy by regressing interest rate on inflation. Variables are transformed in log difference in order to avoid non stationary series.

Table 3 Regression of interest rate on inflation

Regression with AR1 - Estimation by Hildreth-Lu Search
Dependent Variable DLTXINT
Usable Observations 480 Degrees of Freedom 477
Centered R**2 0.323643 R Bar **2 0.320807
Durbin-Watson Statistic 1.822664

Variable	Coeff	Std Error	T-Stat	Signif
1. Constant	-0.025812291	0.008645607	-2.98560	0.00297574
2. DLPCI	5.416313829	1.196761932	4.52581	0.00000761
3. RHO	0.509116778	0.039578363	12.86351	0.00000000

The relation between interest rate and inflation is positive and significant with a DW equals to 1.8. Note the high elasticity coefficient (5.41) that reflects the sensitivity of monetary policy to inflation. The fact that the explained variance is 32% with a rho coefficient of 0.51 and a significant constant term indicates that there are other determinants explaining the variation of the interest rate, but inflation is a major one, specifically in terms of lagged response. This also gives the central bank a chance to have a monetary policy focused on other determinants such as output growth. Does US monetary policy have an impact on the price of gold? That question will be examined later.

In order to maintain a parallel with a previous study (Loranger, 2010), we will first regress gold price on Euro, although the Euro series is much shorter, since the latter was created in 1999.

Results reported here will be only those following an AR(1) process. The price of gold is significantly and positively linked with the value of the Euro defined with respect to the US dollar. Therefore, the price of gold is positively influenced by the value of Euro or negatively influenced by the value of the US dollar.

Table 4 Hildreth-Lu regression on Euro

Regression with AR1 - Estimation by Hildreth-Lu Search
Dependent Variable GOLDPRICE
Usable Observations 145 Degrees of Freedom 142
Centered R**2 0.993656 R Bar **2 0.993566
Durbin-Watson Statistic 1.823899

Variable	Coeff	Std Error	T-Stat	Signif
1. Constant	70631.205	21387.066	3.30252	0.00121240

2. EURO	311.531893	67.729580	4.59964	0.00000929
3. RHO	0.999900	0.007927	126.1446	0.00000000

The high value of the rho coefficient is an indication that the gold price series has a unit root and is non stationary. It is important to take the first difference in order to transform that series into a stationary one. The results observed in the next table reveal that the positive and significant link between gold price and euro is maintained.

Table 5 Regression of gold price variation on Euro

Dependent Variable DGOLDPRICE
Usable Observations 146 Degrees of Freedom 144
Centered R**2 0.034673 R Bar **2 0.027969
Durbin-Watson Statistic 1.882584

Variable	Coeff	Std Error	T-Stat	Signif
1. Constant	-23.69736262	13.85580553	-1.71028	0.08936700
2. EURO	26.10671480	11.47924354	2.27425	0.02442855

Another estimate was done by regressing gold price on a Broad index for the value of the US dollar. That has the particular advantage of a longer series of observations starting in 1973, two years after the US dollar was cut off from gold as a money commodity. Since the weighted average value of other currencies is defined with respect to the US$, the expected sign between gold price and the US dollar should be negative, a result validated by the negative significant sign of the Broad coefficient in the next table. Therefore, when the US dollar is appreciating, the gold price is decreasing. Note in passing that results obtained by taking the real value of gold price are not very different from those in nominal terms. With a value of rho near unity, the real gold price series remains non stationary. This problem will be examined further down.

Table 6 Regression of gold price on Broad index of the US dollar

Regression with AR1 - Estimation by Hildreth-Lu Search
Dependent Variable REALGOLDP
Usable Observations 457 Degrees of Freedom 454
Centered R**2 0.968570 R Bar **2 0.968432
Durbin-Watson Statistic 1.520112

Variable	Coeff	Std Error	T-Stat	Signif
1. Constant	825.3355	137.1085	6.01958	0.00000000
2. BROAD	-4.4717136	0.942604	-4.74400	0.00000281
3. RHO	0.9902103	0.007262	136.3486	0.00000000

4.2 Multiple regression

A positive and significant link has already been established between interest rate and inflation. In order to eliminate multicollinearity among these two explanatory variables, the dependent variable chosen is real gold price. All variables are significant with proper expected sign. Note in particular that the US monetary policy has a significant impact on gold price: when the Fed increases interest rate, the price of gold diminishes.

Table 7 Multiple regression of gold price on all other determinants

Regression with AR1 - Estimation by Hildreth-Lu Search
Dependent Variable REALGOLDP
Usable Observations 457 Degrees of Freedom 452
Centered R**2 0.969187 R Bar **2 0.968914
Durbin-Watson Statistic 1.551094

Variable	Coeff	Std Error	T-Stat	Signif
1. Constant	986.7088	173.3320	5.69259	0.00000002
2. BROAD	-4.8458639	0.9728512	-4.98109	0.00000090
3. DJ	-0.0066181	0.0037943	-1.74424	0.08179751
4. TXINT	-4.1923589	1.6861878	-2.48629	0.01326824
5. RHO	0.9924988	0.0063143	157.18305	0.00000000

However, the rho value is a clear indication that coefficients are estimated from non stationary series. It is necessary to re-estimate the model from series transformed into first differences.

4.3 Elasticity of gold price

Up to now the analysis has been conducted in terms of level instead of relative change of the variables. Each series was tested for unit root by applying the ADF procedure and they all had one unit root (see table below). Therefore, in order to transform non stationary series into stationary ones, variables are transformed in log and, by taking the first differences, elasticity coefficients are obtained and are independent of the unit of measurement of variables –a prefix DL is added to each variable. The coefficient will now indicate which determinant has the greatest impact on the variation of gold price. Starting with a simple regression, all variables have a significant expected sign but the elasticity of gold price with respect to Euro is (0.63) compared with the Broad index which is greater than one (-1.38). Note also that the value of the US dollar accounts for only 13 to 16% of gold price variations. Other determinants are necessary.

Table 8 Regression of gold price on Euro and on Broad

a)Dependent Variable DLGOLDPRICE
Usable Observations 145 Degrees of Freedom 143
Centered R**2 0.164016 R Bar **2 0.158170
Durbin-Watson Statistic 1.949029

Variable	Coeff	Std Error	T-Stat	Signif

1. Constant	0.010	0.0030820535	3.27075	0.00134426
2. DLEURO	0.6290	0.1187568886	5.29679	0.00000044

b)Dependent Variable DLGOLDPRICE
Usable Observations 457 Degrees of Freedom 455
Centered R**2 0.127684 R Bar **2 0.125766
Durbin-Watson Statistic 1.518189

Variable	Coeff	Std Error	T-Stat	Signif
1. Constant	0.009880069	0.002284416	4.32499	0.00001876
2. DLBROAD	-1.384846997	0.169693621	-8.16087	0.00000000

In order to avoid multicollinearity, real gold price is used instead of nominal gold price. Results are not substantially changed when compared to the previous one. The elasticity with respect to Euro is slightly increased from 0.63 to 0.67, the DJ index is negatively correlated with gold price but with a weak elasticity coefficient (0.20). That reflects that a decrease of fear or an increase of optimism marginally reduce the price of gold. There is no autocorrelation of the residual with a DW = 1.88. Note however that that variation of the interest rate is not significant since it does not appear in the stepwise regression. The degree of explained variance of the dependent variable increased to 19%.

Table 9 Stepwise regression of gold price on other determinants

Dependent Variable DLREALGOLDP
Monthly Data From 1999:02 To 2011:02
Usable Observations 145 Degrees of Freedom 142
Centered R**2 0.203797 R Bar **2 0.192583
Durbin-Watson Statistic 1.875949

Variable	Coeff	Std Error	T-Stat	Signif
1. Constant	0.008385019	0.002980229	2.81355	0.00559500
2. DLEURO	0.666160057	0.116575023	5.71443	0.00000006
3. DLDJ	-0.198513754	0.068575828	-2.89481	0.00439374

Dependent Variable DLREALGOLDP
Monthly Data From 1973:02 To 2011:02
Usable Observations 457 Degrees of Freedom 454
Centered R**2 0.139426 R Bar **2 0.135635
Durbin-Watson Statistic 1.528639

Variable	Coeff	Std Error	T-Stat	Signif
1. Constant	0.007078165	0.002276294	3.10951	0.00199185
2. DLBROAD	-1.435918003	0.169195184	-8.48675	0.00000000
3. DLDJ	-0.123013187	0.049467072	-2.48677	0.01324919

Results obtained with a Broad index give similar results. The elasticity with respect to the value of the US dollar slightly increased from -1.38 to -1.43 and only the DJ index is significant with the expected sign. Although it has been said previously that interaction between gold price and the value of the US dollar is mostly a simultaneous one, the fact that the contemporaneous change of interest rate is non significant is an indication of the need to specify a dynamic model. This will be achieved by cointegration analysis.

4.4 Cointegration analysis

The results obtained above are based on the assumption that the series observed on gold price and and other variables are stationary –no unit root- and exogenous variables are non stochastic regressors. These assumptions must be abandoned after carrying unit root tests on all variables.

Table 10 Unit root test ADF with 6 lags

Variables	Calculated T
Gold price	1.796
Euro	-1.121
Broad	-1.456
DJ	-0.115
CPI	-0.139
Txint	-1.529
Critical value 5%	-2.867

All calculated T values are above the critical algebraic value, hence the null hypothesis (0 unit root) must be rejected. A co integration relation is defined as a stationary linear combination of variables where some or all of them are non stationary. The number of cointegration relation r and the number of unit roots (p-r) are determined by a rank test. The tested hypothesis is to reject (p-r) unit roots if the trace of the cointegration matrix is above the critical value at 5% level and accept it when it is below the critical level. At least, one cointegration relation must correspond to the gold price equation. With more than one cointegration relation, there is an identification problem. The solution is to specify a priori constraints or restrictions on some parameters of the cointegration matrix. The model is a dynamic one and a number of lags need to be specified in order to estimate short-run matrices for each lag. By separating short-term effects from long-run equilibrium relations, the aim of the model is to estimate a stable relation between the set of chosen variables. Short-run results will not be reported here and our analysis will be concentrated to equilibrium (long-run) relations among variables. It has been established in other studies[18] that the reaction of gold price to other variables is rather quick. Nonetheless, the change in monetary

[18] F. Capie, T.C.Mills, G.Wood, « Gold as a Hedge against the US Dollar », World Gold Council, Research Study no 30, September 2004.

policy (interest rate) can have an impact on a longer period, and two adjustment periods (2 and 4 months) will be specified

Table 11 Model summary with BROAD and 2 LAGS

Sample: 1973:01 to 2011:02 (458 observations)
Effective Sample: 1973:03 to 2011:02 (456 observations)
Obs. - No. of variables: 445
System variables: LGOLDP LBROAD LDJ LCPI LTXINT
Constant/Trend: Unrestricted Constant
Lags in VAR: 2
Rank test

p-r	r	Eig.Value	Trace	Trace*	Frac95	P-Value	P-Value*
5	0	0.139	115.675	112.121	69.611	0.000	0.000
4	1	0.049	47.578	32.496	47.707	0.051	0.589
3	2	0.034	24.837	16.498	29.804	0.173	0.684
2	3	0.019	8.873	6.004	15.408	0.384	0.698
1	4	0.000	0.057	0.036	3.841	0.812	0.849

* Trace and P=Value with a star are calculated values for small sample.

Unrestricted
BETA(transposed)

	LGOLDP	LBROAD	LDJ	LCPI	LTXINT
Beta(1)	-0.201	1.000	-0.366	0.458	-0.116
Beta(2)	1.000	2.610	-0.174	-3.021	0.047

Restricted
BETA(transposed)

	LGOLDP	LBROAD	LDJ	LCPI	LTXINT
Beta(1)	-0.036	1.000	-0.281	0.000	-0.078
	(-0.672)	(.NA)	(-8.910)	(.NA)	(-2.604)
Beta(2)	1.000	1.950	0.000	-2.956	0.093
	(.NA)	(7.611)	(.NA)	(-11.108)	(2.157)

The rank test indicates that there is at least one cointegration relation and a possibility of 2 since the calculated trace value (47.578) is very close to its critical value at 5% level. In other words, there is only a 5% chance that the model has 4 unit roots. Two cointegration relations were specified and the unconstrained estimated results appearing in the previous table indicate that the second cointegration relation is well identified with the gold price equation with the expected sign, except perhaps the DJ coefficient. Remember that a cointegration relation is a stationary linear combination of non stationary variables and coefficients change sign when moved to the right-hand side of the equation. The reading is as follow: gold price is decreasing (-2.61) when the value of the US dollar is increasing or when the monetary policy becomes stiffer or the interest rate is increasing (-0.047). Gold price is increasing with inflation (3.021). Gold price would increase with the DJ, a result contrary with previous specifications.

Turning now to the first cointegration relation identified with the value of the US dollar (broad index), gold price has a positive feedback on the value of the US dollar. This result is contrary to expectation because if gold is preferred to the US dollar as the ultimate safe haven, the feedback (if there is any) should be negative. Inflation is negatively correlated with the Broad index (-0.458) and a tight monetary policy impacts positively on the value of the US dollar (0.116). We can judge now the importance of specifying a dynamic model of a few periods of adjustment which gives a significant role of the FED monetary policy.

The imposition of one constraint in each cointegration relation is another way to check the identification with a two equation model. Since the coefficient of DJ seems doubtful, a 0 restriction is imposed on this coefficient in the second relation and, in order to have an exactly identified model, a 0 restriction is also imposed on the coefficient of the price index in the first relation. The estimated results are not very different for the gold price equation but they differ substantially with the Broad equation: the gold price coefficient is no more significant from 0. This result casts doubts about the existence of two significant cointegration relations. A better specification is perhaps the use of real gold price instead of nominal gold price. That will be taken into consideration later on with a model specified with the Euro variable.

Table 12 Model summary with BROAD and 4 LAGS

Sample: 1973:01 to 2011:02 (458 observations)
Effective Sample: 1973:05 to 2011:02 (454 observations)
Obs. - No. of variables: 433
System variables: LGOLDP LBROAD LDJ LCPI LTXINT
Constant/Trend: Unrestricted Constant
Lags in VAR: 4
Rank test

p-r	r	Eig.Value	Trace	Trace*	Frac95	P-Value	P-Value*
5	0	0.137	109.714	103.719	69.611	0.000	0.000
4	1	0.040	42.797	31.578	47.707	0.138	0.638
3	2	0.031	24.301	16.796	29.804	0.194	0.663
2	3	0.020	10.072	6.066	15.408	0.280	0.691
1	4	0.002	0.711	0.460	3.841	0.399	0.498

LGOLDP	LBROAD	LDJ	LCPI	LTXINT
1.000	-5.356	2.072	-2.198	0.685
(.NA)	(-3.738)	(4.004)	(-2.057)	(3.669)

LGOLDP	LBROAD	LDJ	LCPI	LTXINT
-0.187	1.000	-0.387	0.410	-0.128
(-1.762)	(.NA)	(-3.983)	(1.454)	(-3.538)

With a dynamic model of 4 lags, the rank test rejects the hypothesis of 0 cointegration relation but accept the probability of 4 unit roots and one cointegration relation. The estimated results are bad for the hypothesis of a negative relation between the price of gold and the value of the US dollar. This result shows how sensitive the estimated results can be to (a bad) dynamic specification.

Let us now turn to a dynamic specification with real gold price and Euro variables.

Table 13 Model summary with EURO and 2 LAGS

Sample: 1999:01 to 2011:02 (146 observations)
Effective Sample: 1999:03 to 2011:02 (144 observations)
Obs. - No. of variables: 135
System variables: LRGOLDP LEURO LDJ LTXINT
Constant/Trend: Unrestricted Constant
Lags in VAR: 2
Rank test

p-r	r	Eig.Value	Trace	Trace*	Frac95	P-Value	P-Value*
4	0	0.128	29.738	27.730	47.707	0.733	0.824
3	1	0.036	10.017	9.312	29.804	0.976	0.985
2	2	0.023	4.699	3.991	15.408	0.837	0.898
1	3	0.009	1.292	0.998	3.841	0.256	0.318

a) Unrestricted cointegration relation

	LRGOLDP	LEURO	LDJ	LTXINT
Beta(1)	1.000	-0.603	-2.554	0.300
	(.NA)	(-1.742)	(-5.415)	(5.949)

b) Restricted cointegration relation

	LRGOLDP	LEURO	LDJ	LTXINT
Beta(1)	1.000	-2.574	0.000	0.234
	(.NA)	(-7.624)	(.NA)	(4.558)

Looking at the P-Value, there is a probability of more than 25% that the hypothesis of 4 unit roots can be rejected and, hence, one cointegration relation is accepted. Real gold price is positively related to Euro with a significant coefficient. Hence, a devaluation of the US dollar increases gold price (0.603). Similarly, a tight monetary policy decreases the price of gold (-0.300). The DJ remains positively correlated with gold price. By imposing a 0 restriction on the coefficient of the DJ variable, the cointegration is well identified with the gold price equation. The estimation with a 4 lag model does not add more information than what was already achieved with a two lag specification. The advantage of using a 2 lag dynamic model over the contemporaneous model is to reveal the importance of the monetary policy of the FED on gold price and the value of the US dollar.

Conclusion

The aim of the paper was to show that the value of money cannot be understood without reference to the real world and a commodity in particular. Since the US dollar as a reserve currency has been de jure disconnected from gold in 1971, the main hypothesis to be tested is gold remains a variable standard of value for the US dollar as a de facto situation. This has been illustrated by choosing monthly series since 1973, two years after the Nixon administration decided to abolish the Bretton Woods Agreement. With the value of the US dollar defined by a broad index, series start in 1973 and when defined with respect to Euro, the monthly series start in 1999, the year when the Euro was created. The simple inspection of a few graphs reveals an obvious significant link between the value of the US dollar and the price of gold: when the value of the US dollar is decreasing, gold price is increasing. There is a de facto link between these two variables. The value of the US dollar has never been cut off from the real world and gold remains the preferred commodity as a variable standard of value. This fact is important to remember when discussing the reform of the international monetary system: the value of SDR should be expressed in terms of gold price. Whether it will be a fixed or a variable standard must be decided by a new international agreement and administered by the IMF under the control of the most important countries.

The econometric analysis either by regression or by cointegraion validates that hypothesis of a strong link between the value of the US dollar and the price of gold.. The main findings are:

1. Series are non stationary but can be transformed into stationary ones by regression with data transformed into first differences (growth model). The short-run model (or simultaneous model) is sufficient to validate the relation of gold price and the other explanatory variables except for the interest rate.
2. The use of a dynamic model with a few lags reveals a significant link between gold price and other explanatory variables, in particular, with respect to interest rate: a tight monetary policy impacts negatively on gold price after a few periods.
3. Various rank tests indicate that there is only one cointegration relation identified with the gold price equation.
4. The main finding is a strong link between the value of the US dollar and gold price: gold price is increasing when the value of the US dollar is decreasing.
5. Gold price is strongly linked with inflation: gold price decreases when inflation increases.
6. Finally, the relation between gold price and the DJ is negative: gold price decreases when the DJ increases because the latter measures the investor optimism or the reduction of the fear in the future.

This approach has been very successful to validate the hypothesis of a strong link between the value of the US dollar and the price of gold. Therefore, gold remains a de facto variable standard expressing the value of the US dollar with respect to the real world.

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