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AHAMED KAMEEL MYDIN MEERA

REAL MONEY

Money and Payment Systems from an Islamic Perspective

IIUM Press

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CONTENTS

Preface

Seigniorage of Fiat Money and the *Maqāṣid al-Sharī'ah*: The Unattainableness of the Maqāṣid 1
by Ahamed Kameel Mydin Meera and Moussa Larbani

Seigniorage of Fiat Money and the *Maqāṣid al-Sharī'ah*: The Compatibility of the Gold Dinar with the Maqāṣid 35
by Ahamed Kameel Mydin Meera and Moussa Larbani

Ownership Effects of Fractional Reserve Banking: An Islamic Perspective 61
by Ahamed Kameel Mydin Meera and Moussa Larbani

Ribā and the Muslim Destiny: A Political Economy Perspective 91
by Ahamed Kameel Mydin Meera,Aziuddin Ahmad and Hikmatullah Babu Sahib

Money, Interest and Environment 111
by Ahamed Kameel Mydin Meera

Transition Issues in Monetary Reform 119
by Tarek El Diwany

The End of Money and the Liberation of Exchange 191
by Thomas H. Greco Jr.

Integrating al-Rahn with the Gold Dinar: The initial building-blocks towards a gold-based economy 221
by Ahamed Kameel Mydin Meera

Gold Dinar: The Next Component in Islamic Economics, Banking and Finance 237
by Ahamed Kameel Mydin Meera and Moussa Larbani

The Implementation of an Islamic Gold Dinar Economy: A Practical Experience of Indonesia 273
by Zaim Saidi

Islamic Home Financing through Mushārakah Mutanāqiṣah and al-Bay' bi-Thaman Ājil Contracts: A Comparative Analysis 285
by Ahamed Kameel Mydin Meera and Dzuljastri Abdul Razak

The Mushārakah Mutanāqiṣah Contract: Some Practical Issues 319
by Ahamed Kameel Mydin Meera & Dzuljastri Abdul Razak

Monetary Dynamics and the Gold Dinar: An Empirical Perspective 345
by Mansor H. Ibrahim

Gold Investment As An Inflationary Hedge: The Malaysian Evidence 373
by Mansor H. Ibrahim and Raditya Sukmana

Managing Foreign Exchange Risk: Malaysian Experience With Respect to the 1997 Financial Crisis 389
by *Chong Foo Lim & Ahamed Kameel Mydin Meera*

Index 429

Gold Dinar: The Next Component in Islamic Economics, Banking and Finance

Ahamed Kameel Mydin Meera and Moussa Larbani

Abstract

Islamic banking started with the objective of providing a banking system that conforms to the *Sharī'ah*, with the absence of interest or *ribā*. Nonetheless, it has increasingly become evident that a convergence is taking place between the conventional and Islamic banking systems. Indeed, most Islamic financial contracts are now tied to the market interest rate- the very thing they were supposed to avoid. This paper argues that convergence is indeed likely to happen due to arbitrage opportunities between the two systems. This paper reasons that the use of real monies like the gold dinar, like that which existed during the Prophet's time, as necessary for realizing a stable and just Islamic economic and monetary system. Fiat money, with all its negative socio-economic effects, is simply not compatible with the *maqāṣid al-Sharī'ah*. This theoretical paper argues in favour of the gold dinar and for its initial application in international trade settlement. It develops a mathematical model, i.e. a non-linear optimization problem to determine an efficient trading matrix that requires the minimum gold to settle the trade balances among participating countries. The solution to the problem also provides each country with a target gold holding for the trading period.

1. Introduction

In the present fiat money interest-based system, it can be easily reasoned that Islamic banks cannot be independent from interest rates and, therefore, the conventional banking system. The pricing of Islamic financial products is likely to be tied to the market interest rates, for if there are price differentials between the two, then arbitrage opportunities would set in, thereby, enabling market participants to make riskless profits. Arbitrage between the two banking systems would, in turn, bring about a convergence between the two banking systems. This convergence is no fault of the Islamic bank, but rather the result of its co-existence with the conventional banks, both of which are linked through the fiat money interest-based system. The Malaysian experience is a good example. Since its inception in Malaysia in 1983, for example, both the Islamic banking and the conventional banking systems have responded to each other and, thereby, have attained some degree of convergence.

Consider home financing. During the initial phase of Islamic banking, a home buyer would start paying the instalments to the bank only after the house has been completed, i.e. about two years from the time of signing the sales and purchase agreement. The buyer need not pay any interim payments (during the construction period), as is the case with conventional financing. The interim payments are indeed interest charges for payments made by the bank to the developer during the house construction period. During this phase of Islamic banking, the non-existence of interim payments in the Islamic home financing, made it cheaper than the conventional one, thereby increasing the demand for such financing.[1] This increase in demand, of course, put pressure on the Islamic bank to increase its financing rate. Currently, those wishing to finance homes using Islamic principles would have to pay an initial deposit equal to three-months'

[1] In fact, many non-Muslim buyers were financing their homes using Islamic financing during this period. At times the number of non-Muslims who financed their homes using Islamic modes exceeded that of even the Muslims!

payment into an investment account[2] and, additionally, also required to pay the first instalment in the month immediately after the bank releases the first payment to the housing developer.[3] These changes to the financing conditions made Islamic financing more expensive than the conventional ones and, thereby, made people to opt for the conventional mode or refinance the existing ones. This is an example of how the two banking systems moved towards convergence.

Another example of arbitrage between the Islamic banking and conventional banking is as illustrated below. This example is the application of rate swaps between the two markets. Today Islamic banking is predominantly a fixed-rate market while the conventional banking is characterized by variable rates. The difference in financing costs for borrowers in both markets can create arbitrage opportunities. Consider the following example: say two corporations A and B are faced with the following financing costs in the 'Islamic' fixed-rate market and the conventional floating-rate market (See Figure 1). Corporation A that enjoys a better credit rating can borrow cheaper in both the fixed- and floating-rate markets compared with corporation B. In the 'Islamic' fixed-rate market, A can borrow at 8 percent per annum while B can borrow at 9 percent, a difference of 1 percentage point. In the conventional floating rate market, A can borrow at KLIBOR[4] plus 0.5 percent while B can borrow at best KLIBOR plus 3.5 percent, a difference of 3 percentage points. Therefore, corporation A enjoys an absolute advantage in both markets relative to corporation B, but however, it has a comparative advantage in the floating rate market where it can borrow at a much lower rate than corporation B. This inversely gives corporation B a comparative advantage in the 'Islamic' fixed-rate market. The existence of comparative advantages make possible for arbitrage

[2] That pays a return lower than the cost of financing.
[3] This first payment is only about 10 percent of the total price of the house, paid when the foundation for the house had been completed.
[4] Kuala Lumpur Interbank Offer Rate.

profits to be made by means of rate swaps between the Islamic and the conventional markets.[5]

Assume that an investment banker is aware of the above borrowing costs of its two client corporations, A and B. Additionally, the banker has ascertained that each party would be indifferent to borrowing fixed or floating and will sign a rate swap agreement if offered a 0.5 percent benefit.

FIGURE 1

AN ARBITRAGE EXAMPLE BETWEEN THE 'ISLAMIC' FIXED-RATE MARKET AND THE CONVENTIONAL FLOATING-RATE MARKET

Corp.	Islamic Financing Fixed-rate	Conventional Financing Floating-rate
A	8%	KLIBOR + 0.5%
B	9%	KLIBOR + 3.5%
Difference	1%	3%

A enjoys absolute advantages in both markets

The difference between the two here is 2 percentage point. Since A can borrow much cheaper in the floating rate market, it therefore has a comparative advantage in the floating rate market.

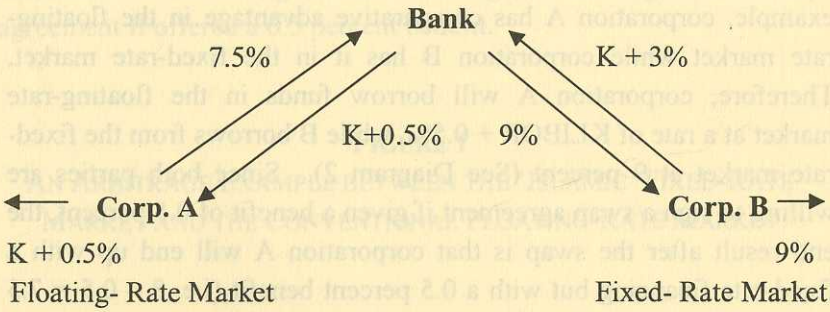
[5] With differences in credit worthiness among corporations and, thereby, credit ratings by rating agencies, absolute advantages and comparative advantages are likely to occur. On top of that, in the present dual banking system, many corporations are indifferent between borrowing in the Islamic fixed rate market or the conventional floating rate market. Therefore, corporations may engage in rate swaps in order to benefit from the difference, dealings that may even be assisted by bankers themselves for a share in the pie.

The difference between the differences is 3% - 1% = 2%. This 2-percentage point is the arbitrage "pie" that can be shared between the bank and both the corporations A and B, in terms of lower borrowing costs.

The way to go about this is by first determining which corporation has comparative advantage in which market. In our example, corporation A has comparative advantage in the floating-rate market while corporation B has it in the fixed-rate market. Therefore, corporation A will borrow funds in the floating-rate market at a rate of KLIBOR + 0.5%, while B borrows from the fixed-rate market at 9 percent (See Diagram 2). Since both parties are willing to sign a swap agreement if given a benefit of 0.5 percent, the end result after the swap is that corporation A will end up with a fixed-rate financing but with a 0.5 percent benefit (i.e. 8 – 0.5 = 7.5 percent), while B will end up with a floating rate but also with a 0.5 percent benefit (i.e. KLIBOR + 3%). The bank may, thus, arrange for swap agreements to be signed as shown in Figure 2.

FIGURE 2

RATE SWAPS BETWEEN THE 'ISLAMIC' FIXED-RATE MARKET AND THE CONVENTIONAL FLOATING-RATE MARKET



Cost after swap: A: 7.5 percent B: K + 3 percent

Corporation A borrows from the floating- rate market at KLIBOR + 0.5% and then signs a swap agreement with the bank, where the bank pays Corporation A the KLIBOR + 0.5% while A pays the bank 7.5%. Therefore, the net cost to A is 7.5% fixed. Note that, in swapping, no actual principal amount is involved; only the difference within the rates is settled among them.

Corporation B, on the other hand, borrows from the 'Islamic' fixed-rate market at 9 percent and then signs a swap agreement with the bank where the bank pays Corporation B the 9 percent, while B pays the bank KLIBOR + 3%, so that the net cost to B is KLIBOR + 3 percent.

Note that while corporations A and B were able to reduce their borrowing costs by 0.5 percent each through the swap arrangements, the bank made a spread of 1 percent from the whole deal (the bank paid KLIBOR + 0.5% and 9 percent but received 7.5

percent and KLIBOR + 3%). Therefore all the three parties were able to benefit from this arbitrage rate swap.[6] Such arbitrage between the markets is likely to contribute towards a convergence between the Islamic and conventional banking systems.[7]

Operating within the fiat money and fractional reserve banking system, the Islamic bank, just like its conventional counterpart, also **does create money** out of thin air, but lend out the money using Islamic principles though. Islamic banks are, therefore, also responsible for the numerous socio-economic problems[8] caused by the fiat monetary system, instead of being solution providers. The fiat money is also a major cause for inflation[9] and destabilization[10] of the current global economy because it allowed the United States to accumulate huge trade deficits which otherwise would have been impossible under the gold standard.[11] Additionally, the introduction

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[6] This principle is similar to the application of the concepts of absolute advantage and comparative advantage in international trade. Countries are to produce items in which they have comparative advantage and then exchange them for others through trade. Such specialization and exchange benefit all parties.

[7] In the current global financial scenario, where major economies are faced with negative real interest rates, the Islamic banking which still provides a positive real return seems attractive even to conventional bankers. Hence, we see prominent international bankers going big-time into Islamic banking. With globalization and financial liberalization, indeed, Islamic banks are faced with the threat of a 'hijack' by the international big players.

[8] Meera (2002a) discusses these socio-economic implications of fiat money. From the Islamic perspective, fiat money has an element of injustice that pre-empts the realization of *maqāṣid al-Sharī'ah*, particularly 1) equitable distribution of income and wealth, and 2) stability. See Chapra (1992) for a discussion on economics and *maqāṣid al-Sharī'ah*. Indeed, in the global fiat monetary system, many nations, particularly the developing ones, lose their sovereignty. With sovereignty lost, protection of wealth, culture and religion are also lost.

[9] Janssen, Nolan and Thomas (2002), for example, used a 300-year time series data to analyse how monetary and fiscal policies affect UK price level, and found the price level to be closely related to the evolution in base money supply. Mundell (1997) calls the Federal Reserve, which creates the major international currency, i.e. the dollar, as the greatest engine of inflation ever created!

[10] Cronin and Dowd (2001) argues that since modern money has neither intrinsic value nor fixed exchange value against goods and services, factors that affect its demand could have implications for price and monetary stability. The paper suggests that there is, indeed, a very likely possibility of such instability.

[11] See Duncan (2003).

of fiat money into the economy in the form of debt (i.e. through multiple credit creation) has significant implications on the overall capital structure in an economy. Corporations and governments would ultimately fall into the debt trap.[12]

The 1997 East Asian financial crisis made apparent the importance of managing foreign exchange risk. The magnificent Asian Tigers[13] were caught off-guard, and scrambled to save themselves in the wake of deadly speculative attacks on their currencies. The attacks on the ringgit, for example, almost devastated the Malaysian economy, were it not for the quick and bold counter actions taken by the Malaysian government, particularly in checking the offshore ringgit transactions.[14] A huge amount of national wealth was lost due to speculative and arbitrage activities, which led to failing businesses, bankruptcies, retrenchments and political turmoil. This, of course, opened the eyes of many on the need to check currency speculation and for prudent foreign exchange risk management. Similarly was the case for the other Tigers, including Thailand, Indonesia and South Korea. Those countries lost billions of dollars due to the collapse of their respective currencies. Currency crises are, nevertheless, not a new phenomenon. Just within the last decade a number of countries have experienced monetary crises, including Russia in 1991-92 (and again in 1998), Mexico in 1994, Brazil in 1999, Argentina and Turkey recently. Many monetary experts also predict a high possibility of a dollar crash in the near future.[15] Furthermore, the surprisingly large number of countries facing monetary crises simultaneously is something unseen before, and is also very worrying, while raising questions about the stability

[12] See Meera (2002c).

[13] A nick-name given to the then fast growing Asian countries, like Malaysia, Thailand and Singapore.

[14] The term 'offshore' is somewhat misleading since it seems to suggest that the ringgit transactions take place outside the shores of the nation. In truth, speculative transactions take place inside the country with ringgit being transferred between accounts held in the local banks.

[15] For example, see Lietaer (2001), p. 15 and Duncan (2003).

of the global financial system. Major world economies, i.e. the United States, Japan and the Europe are in simultaneous economic distress, as never before. The huge speculative activities in the international currency market and the high volatility of exchange rates have become of much concern.

Exchange rate risk has, therefore, become a marked phenomenon in the current floating exchange rate regime, ever since the collapse of Bretton Woods in 1971.[16] Many international investment, trade and financial dealings are shelved due to the unwillingness of parties concerned to bear the inherent foreign exchange risk. It has become imperative, therefore, for businesses to manage this risk so that they may concentrate on what they are good at (i.e. in the area they have the skill and comparative advantage) and eliminate or minimize a risk that is not their trade. The currency derivatives, i.e. the forward, futures and options contracts are financial tools used for hedging against foreign exchange risk. However, in many nations including Malaysia, futures and options on currencies are not available. In countries where currency derivative markets do exist, not all derivatives on all currencies are traded; derivatives are available only on selected major world currencies like the yen, pound sterling, Australian dollar etc. against the dollar mostly. There are no formal tools for hedging foreign exchange risk for most other world currencies including those of almost all developing nations.

Furthermore, developing nations also loose significantly through the seigniorage of international reserve currencies. The dollar, for example, enjoys immense benefit from its status as the dominant international currency. This is because the dollar being a fiat currency, i.e. created out of nothing,[17] has purchasing power

[16] Mundell (2002) argues that flexible exchange rates had led to increased international monetary instability and that the present system suffers from some major deficiencies which include the absence of an international unit of account and a mechanism for stabilizing exchange rates.

[17] Just like any other currency anyway.

practically throughout the whole world. It can purchase things even in the Far East including India, Uzbekistan etc., but not vice versa. In fact, in some countries, an international currency like the dollar is more trusted and enjoys a better status than even the local currencies themselves. If one analyses deeper, one cannot escape concluding that the developing nations, indeed, indirectly lose their national wealth and sovereignty through such seigniorage.[18] International debt, currency speculation, currency rigging, currency arbitrage, etc. are means through which the wealth of developing nations is being plundered easily. Nations are forced to acquire dollar reserves for international trade, and for managing their currency exchange rates.

2. Objectives

This paper discusses a possible means of protecting against this, focusing on the gold dinar and its applicability in Bilateral Payment Arrangements (BPAs) and Multilateral Payment Arrangements (MPAs). Currently, most developing nations have neither large dollar reserves nor large gold holdings. Therefore, maximizing trade with the given small reserves within a stable monetary environment is of much concern. In this article we propose a prototype mathematical model for the determination of an efficient multilateral trade matrix for implementing the gold dinar. Indeed, we transform the problem into a non-linear optimization problem that is solved by optimization techniques. The solution to the optimization problem also provides each country with a target gold holding for the trading period, within the efficient multilateral trading arrangement.

3. The Gold Solution: A Stable and Just Global Monetary System

Gold is currently a much talked about viable solution to the problems and woes of the fiat monetary system, including the highly destabilizing nature of flexible exchange rates. Other possible

[18] Globalization and liberalization are speeding up this threat. Stiglitz (2002) vividly reveals the threat of globalization on developing nations.

solutions suggested in the literature include monetary unions.[19] Khaw (2000), for example, indicated that the overdependence on the dollar had created significant downside risks, as the Asian financial crisis had shown; and identified common currency as one possible solution in minimizing the exchange rate risk and enhancing regional economic and financial stability. Gold played the role of money in one way or another for centuries until it lost this role in 1971 after the demise at Bretton Woods. Nevertheless, the current global scenario plagued with financial instability, crises and chaos, has rekindled a renewed interest in gold, that it is now being looked-upon again as a possible savior in these troubled times. Some prominent figures, including Nobel Laureate, Robert A. Mundell, predict that gold will again be part of the international monetary system in the 21st century,[20] providing a stable international unit of account that is missing since World War I.[21] Mundell (2001) asserts that the best path to international monetary reform is through a new international currency based on a G-3 monetary union (i.e. the dollar, euro and yen) possibly linked to gold.

Gold has also attracted leaders of nations that were hit by currency crises. Recently, the former Prime Minister of Malaysia, Dr. Mahathir Mohamad, mooted the idea of using the gold dinar[22] to settle bilateral and multilateral trades among countries and thereby eliminate dependence on international reserve currencies and risk

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[19] The gold dinar is, in fact, a form of monetary union.

[20] See Mundell (1997). The paper is available from Mundell's webpage, under the 'Gold' link: www.robertmundell.net

[21] Mundell. (2000).

[22] The word "dinar" simply refers to a unit weight of gold, i.e. 4.25 grams (of 916 gold) that was the monetary standard of the Muslim world of the past. One may call the gold system with whatever name one wishes, e.g. dinar, sovereign or others, since what matters is that the system must refer to some physical unit of gold and not some instruments backed by gold. Indeed, the Prophet Muhammad (peace be upon him) accepted the Roman gold coin (the dinar) and the Persian silver coin (the dirham) as the monetary unit for Muslims when the *Sharī'ah* principles were being established. In this, there is wisdom, because the acceptance is despite the fact that the Prophet (peace be upon him) brought forth significant socio-economic transformation.

from foreign exchange fluctuations. Indeed, Malaysia has succeeded in placing this idea as among the economic action plan for the OIC countries during the 2003 Islamic Summit Conference, 11-18 October, 2003, Putrajaya, Malaysia.[23]

Indeed, the role of gold and silver as money has been stressed by many prominent Islamic scholars of the past. Ibn Khaldūn asserts in his theory of social cycles in the *Muqaddimah* that God had created gold and silver as the measure of value for all things, and the importance for using these two metals for that purpose. Al-Maqrīzī in his *Ighāthah*, Qudāmah Ibn Ja'far in *Kharāj* and al-Ghazālī, concurred that God created the two metals to circulate among men as a medium of exchange and a measure of value.[24] Indeed, price levels based on gold and silver have been shown to be remarkably stable over long periods of time.[25]

In the gold payment system, gold is to be used as a medium of exchange and as a unit of account, in the place of the national or international reserve currencies, for settling international trade balances. The price of exports and imports are to be quoted in weights of gold. It is important that in this structure, gold itself is used for pricing and not national currencies backed by gold, for otherwise it would not then be different from the gold standard of the past. As we asserted earlier, instruments backed by gold are vulnerable to easy abuse, which brought about the failure of the gold standard.

In the gold dinar system, the central bank would play an important role of keeping the national trade accounts and providing a secure place to keep gold. When Malaysia trades with Indonesia for

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[23] As a result of which, Malaysia has signed MOU's with some countries to settle bilateral trade using gold.

[24] See Sanusi (2002).

[25] Al-Maqrizi shows this in his book *Igathah*. Also, Jastram (1977) showed that price levels based on gold were extremely stable. Using four hundred-year wholesale price index data, Professor Jastram concluded that the stability was not because gold moved towards commodity prices, but because commodity prices eventually returned to gold.

example, the gold account is kept through the medium of the central banks of both countries and only the net difference between the two is settled periodically. Nevertheless, every transaction, in essence, involves gold "movement." Since bilateral and multilateral trades are ongoing processes, any gold that needs to be settled can always be brought forward and be used for future transactions and settlements. On the ground, commercial banks that support gold accounts are viable partners in the implementation of the gold dinar system. International trade and finance participants would deal with their respective commercial banks that provide such gold accounts. These commercial banks would, in turn, have gold accounts with their respective central banks. The above structure may sound a lot like the gold standard, but it is not. Gold itself and not any gold backed instrument is the medium here.

As an example, consider that Malaysia exports 100 million gold dinar (GD) worth of goods and services to Indonesia while importing 80 million GD worth of goods and services. Hence Malaysia has a surplus trade of 20 million GD. Indonesia needs to settle only this difference of 20 million GD. However, this amount could be brought forward for settling future trade imbalances between the countries and, therefore, a physical gold movement between the countries is not necessary. Note that this simple structure eliminates exchange rate risk. This means there is no need for forward, futures or options arrangements on currencies. Countries, including those without derivative markets, can enjoy this benefit. After all, developing a derivative market is costly, time consuming and also introduces inefficiency into the market since additional transaction costs need to be incurred. Unlike the forward, futures and options markets, the gold dinar does not depend on speculators for increased market liquidity. By being acceptable globally,[26] gold is capable of providing the needed liquidity without

[26] Gold has been treasured by mankind since antiquity. Peter Bernstein could write a 400-page book just on the history of gold! See Bernstein (2000).

bestowing any "unfair" seigniorage to any particular currency.[27] Moreover, unlike imperfections of hedging that are likely to happen with forward, futures and options contracts, due to the standardized nature of these contracts, the gold dinar does not introduce such imperfections.

With the gold dinar the hedging cost is fixed against gold, but note that even when hedging is done in any currency denomination, there is still risk from the fluctuation of that currency. Gold is superior here since, unlike fiat currencies, it has intrinsic value of its own. A hedger also pays neither the initial margin nor daily variation margins as is the case with currency futures, which are potential cash flow burdens for hedgers.

Even though the international gold price may fluctuate, the participants in a gold dinar system realize that unlike national currencies, gold has stable intrinsic value that can be depended upon for continuous trade into the future.[28] At this juncture, one may ask the question, how does this structure differ from a simple barter trade between countries? The advantage here is that gold acts as a unit of account and thereby eliminates problems associated with barter.

Similar to a common currency, the gold dinar would also reduce speculation and arbitrage between national currencies. For example, if three countries agree to use the gold payment system, then it is imperative that the three currencies become a single currency. Accordingly, speculation and arbitrage among these three currencies will be reduced or even eliminated, thus contributing to greater economic efficiency.[29] Such "unification" of currencies through the gold dinar provides diversification benefits just like a

[27] In today's totally unbacked fiat monetary system, an international currency like the dollar draws immense benefit from its seigniorage.

[28] Speculation, arbitrage and gold price fluctuations could tempt a participating country to redeem or sell its gold, but it should resist such temptations for the sake of stable and continuous future trade. A regulation requiring that the gold stock with the central banks can be used only for settling real transactions may be necessary.

[29] European Union countries enjoy this benefit through the euro as their common currency. Furstenberg (2003) argues that regional monetary unions protect against price risks and contribute to greater uniformity and efficiency in price-setting.

portfolio of shares. In fact, since people of every race, creed and nationality treasure gold, gold is a suitable global currency that enjoys global diversification. This means no single country's unique risk may be significantly embedded in gold. However, the gold dinar system does entail legal obligations between parties concerned, just like in the forward and futures contracts; and it may not be easy for a trader to remove this obligation easily, as is possible with futures.

The gold dinar is likely to reduce transaction costs too, since only accounting records need to be kept. Transactions can be executed by means of electronic mediums with minimal cost. Hence, for international trades in this system, one no longer needs to incur exchange rate transaction costs (i.e. the different buying and selling rates for currencies)[30] or even face exchange rate risk.[31] In other words, the gold dinar can be expected to bring about exchange rate stability. Nobel Laureate, Robert Mundell contends that exchange rate volatility is a major threat to world prosperity.[32] Taggart and Taggart (1999) show that exchange rate stability brings about sustained long-run competitive advantage for firms located within a currency area.

The gold dinar system also reduces the need to create large amounts of national currencies through multiple credit creation in the banking sector.[33] This, therefore, reduces the possibility of excessive speculation and future attacks on national currencies. The current global financial system is showing signs of serious instability, which is partly but significantly due to the fiat nature of money. The problem lies with its attribute that fiat money is created out of

[30] Cooper and Kempf (2003) show that monetary unions not only bring about reduced transactions costs but also lower inflation.

[31] In order to realize this fully, goods and services must be priced in gold itself and not in national currencies.

[32] This can be inferred from many of Mundell's works but a most direct quote can be found in Mundell's official webpage: www.robertmundell.net/default.asp

[33] Hassan and Choudhury (2002) provide policy recommendations for transformation into a 100 percent reserve requirement monetary system with the gold-backed micro-money. 100 percent reserve requirement negates money creation through multiple credit creation and, thereby, harmonizes the monetary sector with the real sector.

nothing and gets destroyed in certain circumstances. Gold on the other hand, has all the characteristics of a good money; it is desired and highly valued for its own sake; it is homogeneous, stable, durable, divisible, mobile, etc., and can neither be created nor destroyed. It can, thus, play the role of a stable international unit of account that is profoundly missing in the current floating exchange rate system. As such, gold can be expected to significantly increase trade. Indeed, empirical works have shown monetary unions to increase trade. For example, Lopez-Cordova and Meissner (2003) found commodity money regimes and monetary unions to strongly correlate with large trade increases. Rose and Engel (2002) showed that monetary union members not only enjoyed more trade but also less volatile real exchange rates than countries with their own monies.

4. Implementing the Gold Dinar in Bilateral Payment Arrangements (BPA's) and Multilateral Payment Arrangements (MPA's)[34]

The question now is how to implement the gold dinar in the present fiat monetary system. Of course, it is always wise to implement changes gradually so as not to rock the present set-up drastically. Abrupt changes may bring more harm than good. With small changes, one may be able to monitor the impact of the changes and take necessary action where needed. Problems could be tackled while small and be ironed-out before embarking on further changes.

Implementing the gold dinar initially for settling international trade balances is probably the wisest, since this action only replaces international reserve currencies like the dollar with little implications for the national currency. In the trade settlement

[34] This section makes use of materials presented by Tan Sri Nor Mohamed Yakcop, the special economic adviser to the Prime Minister of Malaysia, who first demonstrated the advantages of using the gold dinar in international trade, in a keynote address delivered for the *2002 International Conference on Stable and Just Global Monetary System*, held in Kuala Lumpur on the 19th and 20thof August, 2002.

system, the gold dinar need not exist in its physical form. However, external trade needs to be denominated in dinar, i.e. a standard unit weight of gold. The historical standard was that one dinar was equal to 4.25 grams of gold (22K or 916 gold). For convenience though, we may denominate one ounce of gold as the standard international unit for trade since currently the international gold price is quoted in dollars per ounce.

All external trade transactions pass through the central banks that keep the trade accounts. Exporters will be paid in gold or in their own national currencies by their respective central banks on the due date of exports, based on the gold dinar exchange rate prevailing at the time of the transaction. Similarly, the importers will make payments to their respective central banks. The commercial banks are viable intermediaries between the importers and exporters, on one side, and the central bank, on the other.

5. Bilateral Payment Arrangement (BPA)

When Malaysia trades with Iran for example, the gold accounting is kept through the medium of the central banks and only the net difference between the two is settled periodically by transferring an equivalent amount of gold. Hence every transaction in essence involves gold "movement." Nonetheless, a physical transfer of gold from one country to another is not necessary, but only a transfer of beneficial ownership in a gold custodian's account. The custodian role can be played by reputable banks like the Islamic Development Bank (IDB), the Bank of England or the like. The role of the custodian could be expected to decrease the default risk and, thereby, increase confidence in the system. However, as mentioned earlier any gold that needs to be settled can always be brought forward for settling future transactions. Where it is not possible to transfer gold, payment can be made by way of an equivalent amount in other acceptable currencies using the real-time gold price.

As an example, consider that Malaysia and Iran sign a bilateral payments arrangement. Trade balances are to be settled

every three months. Say, in a particular three-month cycle, Malaysia exports 3 million GD worth of goods and services to Iran while importing 2.8 million GD's worth. Hence Malaysia has a surplus trade of 0.2 million GD with Iran. Therefore, Iran needs to settle only this difference of 0.2 million GD. The actual payment can be by way of the Iranian Central Bank transferring 0.2 million GD in its custodian's account, say in the Islamic Development Bank (IDB), to Bank Negara Malaysia's account with the same custodian. However, the amount of 0.2 million GD could be used for settling future trade imbalances between the countries and hence a physical gold transfer between the countries is not necessary. The important point to note here is that, under this mechanism, a relatively small amount of 0.2 million GD is able to support a total trade value of 5.8 million GD.[35] In other words, we optimize on the use of foreign exchange. Therefore in the gold dinar mechanism, even countries with little or no foreign exchange reserves can participate significantly in international trade. This, undoubtedly, is an invaluable advantage.

6. Multilateral Payment Arrangement (MPA)

The MPA functions in a similar fashion as the BPA, but it involves more than two countries; and thereby makes the whole system more efficient. Let us illustrate using three countries, namely Malaysia, Iran and Indonesia. Let's assume that the volume of trade between Malaysia and Iran was the same as in the BPA example, but we now add the additional trade of these two countries with Indonesia, as shown in Table 1 below.

[35] Under the gross settlement mechanism, 5.8 million GD would be needed, but with the BPA 0.2 million GD suffices. Therefore, the BPA has advantages even if implemented under the current international reserve system.

TABLE 1
GOLD IN MULTILATERAL TRADE ARRANGEMENT

	Gold Dinar (million)			
Export to	Malaysia	Iran	Indonesia	Total Export
Malaysia	X	3.0	2.0	5.0
Iran	2.8	X	4.0	6.8
Indonesia	2.2	3.7	X	5.9
Total Import	5.0	6.7	6.0	17.7

	Gold Dinar (million)		
	Export	Import	Net payment
Malaysia	5.0	5.0	Nil
Iran	6.8	6.7	+0.1
Indonesia	5.9	6.0	-0.1

Note that a total trade of 17.7 million GD takes place among the three countries but with a net payment of only 0.1 million GD, i.e. the only payment required is for Indonesia to pay Iran 0.1 million GD.

We may refine the mechanism further, whereby the credit or debit outstanding at the end of each quarter be forwarded to the subsequent quarters and the final settlement is made, say, only at the end of the year. The advantage of this refinement is that a net import position for a country during a particular quarter may be offset by a net export position in the subsequent quarter, so that, for the year as a whole, the payment flows are further minimized.

The above example answers the often asked question: Is the existing gold reserves enough to support the growing volume of international trade? The answer is that in most cases gold would only play the role as a unit of account. Only the net balance remaining in the matrix of trade needs to be settled in gold. David Ricardo, the famous supply-side economist of the 19th century, wrote in his *Principles of Political Economy and Taxation* (London, 1817), that

when money is working at the peak of efficiency, the central bank need hold no gold. We may not expect such peak efficiency, thus some gold should be held for settling balances. Nevertheless, central banks need not hoard large amounts of gold like in Fort Knox. The efficiency of this system can be further improved if trade experts sit together and analyze the export potentials and import needs of every participating country and thereby come up with a more efficient trade matrix. The next section deals with this.

Accordingly, in the gold dinar system, central banks need not stock-up gold reserves as suggested by some international agencies. It would be better to start small with whatever gold reserves countries have, within a small group of participating countries. Countries with little gold reserves could trade with gold producing countries like South Africa, Mali, Russia, etc. in order to increase their gold stock. In this way we can iron-out problems while they are still small without placing undue demand pressure on the existing gold market. If countries rush into implementing the gold dinar, this may bring about an upward pressure on the international gold price.

7. Determining an Efficient Trade Matrix

The above Multilateral Payment Arrangement suggests that as trade between participating countries gets more efficient, a smaller amount of gold can settle a larger trade matrix. Countries should aim for such efficient trade so that the system need not stock up large amounts of gold. Some amount of gold should, nevertheless, be held, so that settlements can be made whenever necessary. Since gold holdings of developing nations are relatively small, it is desirable to find ways to maximize trade with the given gold amount. In this section we formulate this issue as an optimization problem and solve it using non-linear mathematical programming techniques to determine an efficient trading matrix, which requires the minimum gold to settle the trade balances. The model is flexible in terms of the number of participating countries and the number of products involved. To keep things simple, the model ignores taxation and

transportation costs. Both the bilateral and the multilateral cases are modeled.

8. The Models

A) The Multi-Bilateral case

Let

(1) $i = \{1,2,3,.....,n\}$ be the set of countries involved in the multi-bilateral trade,

(2) $k = \{1,2,3,.....,m\}$ be the set of products traded between these countries,

(3) $x_{ij}^k =$ the quantity of product k taken from country i to country j

$i = 1,2,...,n \qquad j = 1,2,...,n \qquad k = 1,2,...,m$

(4) $p_i^k =$ the quantity of product k available in country i (or the export potential of country i of product k)

(5) $b_i^k =$ the minimum quantity of product k needed by country i

(6) $t_i^k =$ the maximum quantity of product k needed by country i

(7) $c_k =$ the price in gold dinar per unit of the product k

It is to be noted that if a country i wants a precise quantity of a product k, say a then in the model we take $b_i^k = a-\varepsilon$, and $t_i^k = a+\varepsilon$, where ε is a small positive number, which indicates the desired precision.

Conditions of the Model

In order to satisfy the needs of each country involved, we have to assume that the total needs of any product k has to be less than the total quantity available of the product. In other words we should have

$$(8) \qquad \sum_{i=1}^{n} t_i^k \leq \sum_{i=1}^{n} p_i^k \qquad k = 1,2,....,m$$

If this condition is not satisfied, then

a) the countries importing the product k have to decrease t_i^k (the maximum needed quantity) and may be also b_i^k,

b) the countries exporting the product k have to increase their export potential p_i^k,

c) both (a) and (b)

The constraints of the Model

According to (3), (5) and (6), we have

$$(9) \qquad b_j^k \le \sum_{\substack{i=1 \\ i \ne j}}^{n} x_{ij}^k \le t_j^k \qquad j = 1,2,...,n \qquad k = 1,2,...,m$$

This inequality means that the quantity of product k imported by country j from all other countries has to be between b_j^k and t_j^k.

According to (3) and (4) we have

$$(10) \qquad \sum_{\substack{i=1 \\ i \ne j}}^{n} x_{ij}^k \le p_i^k \qquad i = 1,2,...,n \qquad k = 1,2,...,m$$

We have also the natural constraints $x_{ij}^k \ge 0$.

The inequality 10 means that the quantity of product k exported from a country i should not exceed its export potential on product k.

The Objective Function of the Model

The amount of Gold Dinar due to country i by country j is

$$(11) \qquad \sum_{k=1}^{m} c_k x_{ij}^k$$

The net payment between countries i and j is the module of the difference between the amounts due by each country to the other:

(12) $$\left|\sum_{k=1}^{m} c_k x_{ij}^k - \sum_{k=1}^{m} c_k x_{ji}^k\right| = N_{ij}$$

- If $\sum_{k=1}^{m} c_k x_{ij}^k > \sum_{k=1}^{m} c_k x_{ji}^k$ then country j has to pay the amount of N_{ij} in gold dinar to country i.

- If $\sum_{k=1}^{m} c_k x_{ij}^k < \sum_{k=1}^{m} c_k x_{ji}^k$ then country i has to pay the amount of N_{ij} in gold dinar to country j.

- If $\sum_{k=1}^{m} c_k x_{ij}^k = \sum_{k=1}^{m} c_k x_{ji}^k$ then no country has to pay anything.

Thus by taking into account (8), we obtain the following optimizing problem for a multi-bilateral payments set-up.

(13) $$\min \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \left| \left(\sum_{k=1}^{m} c_k x_{ij}^k - \sum_{k=1}^{m} c_k x_{ji}^k \right) \right|$$

subject to constraints

(14) $$b_j^k \le \sum_{\substack{i=1 \\ i \ne j}}^{n} x_{ij}^k \le t_j^k \qquad j = 1,2,...,n \qquad k = 1,2,...,m$$

(15) $$\sum_{\substack{i=1 \\ i \ne j}}^{n} x_{ij}^k \le p_i^k \qquad i = 1,2,...,n \qquad k = 1,2,...,m$$

$$(16) \quad x_{ij}^{k} \geq 0 \qquad i = 1,2,...,n \qquad j = 1,2,...,n \qquad j \neq i$$
$$k = 1,2,...,m$$

The problem (13) to (16) is a non-linear programming problem. By solving it we get

a) The minimum quantity of Gold Dinar needed for the multi-bilateral trade to take place is

$$\sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \left| \left(\sum_{k=1}^{m} c_k x_{ij}^{k} - \sum_{k=1}^{m} c_k x_{ji}^{k} \right) \right|$$

b) The quantity x_{ij}^{k} , that any country i has to export to any country j, of product k.

c) $N_{ij} = \left| \sum_{k=1}^{m} c_k x_{ij}^{k} - \sum_{k=1}^{m} c_k x_{ji}^{k} \right|$, the net payment between any couple of countries i,j.

d) The minimum amount of Gold Dinar holdings needed by each country i to participate for the considered trading period.

B) The Multilateral Case

The conditions and constraints of the model are the same, there are changes only in the objective function. We obtain the following model

$$(17) \quad \text{Min } ½ \sum_{i=1}^{n} \left| \sum_{k=1}^{m} \sum_{j \neq i}^{n} \left(c^{k} x_{ij}^{k} - c^{k} x_{ji}^{k} \right) \right|$$

Subject to constraints

(14)-(16).

Remark. The term $\left|\sum_{k=1}^{m}\sum_{j\neq i}^{n}\left(c^k x_{ij}^k - c^k x_{ji}^k\right)\right|$ represents the net payment between country i and the remaining countries. The coefficient ½ is introduced in the objective function (17) because the amount of gold dinars paid (by countries which have to pay) is the same as the amount of gold dinars received (by countries which receive) in the multilateral arrangement.

The next section provides an illustrative example. The solutions to the optimization problems involved are obtained using the software Nimbus Miettinen and Mäklä (2000).

9. An Illustrative Example (or implementation of the model)
Suppose that in our trade problem we have 3 countries say Malaysia, Indonesia and Iran; 3 products are traded: Rice, Wheat and Palm oil. The monthly average prices of these products are:

December 2002 (World Bank)	
Rice	\$174 / ton
Wheat	\$162 / ton
Palm oil	\$465 / ton

Those prices in gold dinar are (approximate):

Rice	≈	1.48 GD / ton
Wheat	≈	1.38 GD / ton
Palm oil	≈	3.69 GD / ton

The data of the problem are given in 1000 tons. We assume prices are fixed for the trading period.

Potential export:

	Rice	Wheat	Palm Oil
Malaysia	$p_1^1 = 0$	$p_1^2 = 0$	$p_1^3 = 45$
Indonesia	$p_2^1 = 60$	$p_2^2 = 0$	$p_2^3 = 10$
Iran	$p_3^1 = 0$	$p_3^2 = 25$	$p_3^3 = 0$

Import (maximum quantity needed)

	Rice	Wheat	Palm Oil
Malaysia	$b_1^1 = 30$	$b_1^2 = 5$	$b_1^3 = 0$
Indonesia	$b_2^1 = 0$	$b_2^2 = 20$	$b_2^3 = 0$
Iran	$b_3^1 = 20$	$b_3^2 = 0$	$b_3^3 = 40$

Import (minimum quantity needed)

	Rice	Wheat	Palm Oil
Malaysia	$t_1^1 = 28$	$t_1^2 = 4$	$t_1^3 = 0$
Indonesia	$t_2^1 = 0$	$t_2^2 = 17$	$t_2^3 = 0$
Iran	$t_3^1 = 17$	$t_3^2 = 0$	$t_3^3 = 28$

It is easy to verify that the condition

$$\sum_{i=1}^{3} b_i^k \le \sum_{i=1}^{3} p_i^k \qquad k = 1,2,3$$

takes place.

According to the data given above, we have

$$x_{31}^3 = 0 \qquad x_{21}^3 = 0 \qquad x_{12}^1 = 0$$
$$x_{32}^1 = 0 \qquad x_{12}^3 = 0 \qquad x_{32}^3 = 0$$
$$x_{13}^2 = 0 \qquad x_{23}^2 = 0 \qquad x_{13}^1 = 0$$
$$x_{31}^1 = 0 \qquad x_{21}^2 = 0 \qquad x_{12}^2 = 0$$

These conditions express the facts that a country cannot export a product if it has no potential export on this product, and a country will not import a product if it doesn't need it. Hence we will consider only the following variables:

$x_{21}^1,\ x_{23}^1,\ x_{31}^2,\ x_{32}^2,\ x_{13}^3,\ x_{23}^3$.

Multi-Bilateral Payment Arrangement

For the above example, the optimization problem to solve is

$$\text{Min} \left\{ \left| -c_1 x_{21}^1 \right| + \left| (c_3 x_{13}^3 - c_2 x_{31}^2) \right| + \left| (c_1 x_{23}^1 + c_3 x_{23}^3 - c_2 x_{32}^2) \right| \right\}$$

s.c.

$$x_{21}^1 + x_{23}^1 \le p_1^1 + p_2^1 + p_3^1 = 60$$
$$x_{31}^2 + x_{32}^2 \le p_1^2 + p_2^2 + p_3^2 = 25$$
$$x_{13}^3 + x_{23}^3 \le p_1^3 + p_2^3 + p_3^3 = 55$$
$$28 \le x_{21}^1 \le 30$$
$$4 \le x_{31}^2 \le 5$$

$$17 \le x_{32}^{2} \le 20$$

$$17 \le x_{23}^{1} \le 20$$

$$28 \le x_{23}^{3} + x_{13}^{3} \le 40$$

$$x_{ij}^{k} \ge 0, \qquad i = 1,2,3 \qquad j = 1,2,3 \qquad j \ne 1 \qquad k = 1,2,3$$

c_1 = Price of 1000 ton of rice in Gold Dinar

c_2 = Price of 1000 ton of wheat in Gold Dinar

c_3 = Price of 1000 ton of palm oil in Gold Dinar

Results for the Multi-Bilateral Payments Arrangement (BPAs)
(In 1000 of tons)
The solution to the optimization problem gives the following values:

$$x_{21}^{1} = 28 \qquad x_{23}^{1} = 17 \qquad x_{31}^{2} = 5$$

$$x_{32}^{2} = 20 \qquad x_{13}^{3} = 1.876431 \qquad x_{23}^{3} = 26.12357$$

Putting these in a matrix (Table 2) gives us the minimum gold dinar needed as 135,420 GD for a total trade of 204,419.97 GD. This is in a multi-bilateral setup. Malaysia pays Indonesia 41,440 GD, Iran pays Indonesia 93,955.97 GD and Iran pays Malaysia 24 GD.

Table 2: Results for the Multi-Bilateral Payments Arrangement

Trade in Gold Dinar

	Malaysia	Indonesia	Iran	Total
Malaysia		0	0	0
		0	0	0
		0	6,924	6,924
		0	**6,924**	**6,924**
Indonesia	41,440		25,160	66,600
	0		0	0
	0		96,395.97	96,395.97
	41,440		**121,555.97**	**162,995.97**
Iran	0	0		0
	6,900	27,600		34,500
	0	0		0
	6,900	**27,600**		**34,500**
	48,340	**27,600**	**128,420**	**204,419.97**

Bilateral Payment Arrangement

Malaysia pays Indonesia	41,440
Iran pays Indonesia	93,955.97
Iran pays Malaysia	24
Minimum Gold Dinar Needed	**135,419.97**

Multilateral Payments Arrangement (MPAs)

In the case of a multilateral payments arrangement, the optimization problem to solve is

$$\text{Min } \tfrac{1}{2}\left|c_3x_{13}^3 - c_1x_{21}^1 - c_2x_{31}^2\right| + \left|c_1x_{21}^1 + c_1x_{23}^1 + c_3x_{23}^3 - c_2x_{32}^2\right| + \left|c_2x_{32}^2 + c_2x_{31}^2 - c_1x_{23}^1 - c_3x_{13}^3 - c_3x_{23}^3\right|$$

s.c.

$$x_{21}^1 + x_{23}^1 \le p_1^1 + p_2^1 + p_3^1 = 60$$
$$x_{31}^2 + x_{32}^2 \le p_1^2 + p_2^2 + p_3^2 = 25$$
$$x_{13}^3 + x_{23}^3 \le p_1^3 + p_2^3 + p_3^3 = 55$$
$$28 \le x_{21}^1 \le 30$$
$$4 \le x_{31}^2 \le 5$$
$$17 \le x_{32}^2 \le 20$$
$$17 \le x_{23}^1 \le 20$$
$$28 \le x_{23}^3 + x_{13}^3 \le 40$$

$$x_{ij}^k \ge 0, \qquad i = 1,2,3 \qquad j = 1,2,3 \qquad j \ne 1 \quad k = 1,2,3$$

Results for Multilateral Payments Arrangement
(In 1000 of tons)

The solution to the optimization problem gives the following values:

$x_{21}^1 = 28$ $\quad x_{23}^1 = 17$ $\quad x_{31}^2 = 5$
$x_{32}^2 = 20$ $\quad x_{13}^3 = 14$ $\quad x_{23}^3 = 14$

The minimum of the objective function is 93,980 GD (Table 3). Thus, the minimum amount of gold dinars needed is 93,980 GD for a total trade of 204,420 GD. Putting these results in a matrix gives us the multilateral setup. Only Iran needs to pay, i.e. 3,320GD and 90,660GD to Malaysia and Indonesia, respectively. It is clear that the amount of gold needed to settle trade balances diminishes as we move from gross settlement to bilateral to multilateral trade arrangements, confirming that cooperation pays. Note that, the solution to the optimization problem also provides each country with

a target gold holding (for the trading period), within the efficient multilateral trading arrangement.

For a larger matrix involving more countries, the trade balances can be easily settled through the intermediation of a clearing house. The role of the clearing house can be played by a custodian bank, like the Islamic Development Bank (IDB) or the Bank of England, that would keep the gold holdings of the central banks of the participating countries. In total however, the negative and positive trade balances would cancel out.

Table 3: Results for Multilateral Payments Arrangement

Trade in Gold Dinar

	Malaysia	Indonesia	Iran	Total
Malaysia		0	0	0
		0	0	0
		0	51,660	51,660
		0	**51,660**	**51,660**
Indonesia	41,440		25,160	66,600
	0		0	0
	0		51,660	51,660
	41,440		**76,820**	**118,260**
Iran	0	0		0
	6,900	27,600		34,500
	0	0		0
	6,900	**27,600**		**34,500**
	48,340	**27,60**	**128,480**	**204,420**

Multilateral Payment Arrangement

	Export	Import	Net
Malaysia	51,660	48,340	**3,320**
Indonesia	118,260	27,600	**90,660**
Iran	34,500	128,48	**-93,980**
Minimum Gold Dinar Needed			**93,980**

If one compares the results, one sees that the multilateral setup requires less amount of Gold Dinar than the multi-bilateral. Indeed, in the multilateral arrangement only 93,980 GD are needed while in the multi-bilateral 135,420 GD are required, a significant difference of 41,440 GD. In the case of gross settlement, 204,420 GD are required!

10. Conclusion

The gold dinar in a multilateral payment arrangement can thus be used to maximize trade for a given amount of gold holdings. Using gold instead of national currencies eliminates exchange rate risk[36] while allowing countries without even any international reserves to trade freely. The non-linear optimization model developed in this paper solves for the efficient trade matrix among participating countries, which minimizes the amount of gold needed, that fulfills the national trade requirements. The optimization technique can determine the amount of gold needed by each country in a bilateral or multilateral setup (that minimizes the amount of gold needed within the whole system). Our example shows the expected result that compared to gross settlement or bilateral payment arrangements, the multilateral payment arrangement is more efficient and requires a much lower amount of gold for settling the trade balances. The solution to the optimization problem also provides the target gold holding for each participating country, for the trading period

[36] Also reduces greatly (if not eliminate entirely) speculative and arbitrage activities among the currencies of the participating countries.

concerned. The overall benefits are thus monetary stability, justice, increased trade and economic prosperity with minimum international reserves, i.e. things that are very much at stake in the current highly 'overblown,' vulnerable global fiat monetary system.

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