

The role of SDR-denominated securities in official and private portfolios

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1. Introduction

This paper examines the role that securities denominated in special drawing rights (SDRs) could play in the management of large institutional portfolios. We find such securities could reduce portfolio variance and could provide a convenient method of diversification. While a nascent market for SDR-denominated bonds began in the early 1980s, it did not develop and remained very small relative to global bond issuance. Yet China's recent call to expand the use of the SDR could provide the impetus for a renewed effort to use the SDR as a unit of account for short-term deposits and fixed income obligations. China's initiative has been supported by Russia and Brazil, among others.

In light of the comments by some of their sponsor governments, sovereign wealth funds (SWFs) and highly diversified monetary authorities (central banks that acquire risk assets) are well-positioned to promote the development of a market for certificates of deposit and bonds denominated in SDRs. While several technical issues like liquidity provision remain to be resolved, the evolution of the European Currency Unit (ECU) bond market provides some evidence that a market in SDR-denominated bonds could develop. Although ECU-denominated bonds at their peak never accounted for more than 10 percent of the issuance of all international bonds (Dammers and McCauley 2006), as with SDRs, both a private and official market for ECUs existed.

An investor can synthetically replicate the weights of an SDR-denominated bond, but a security denominated in SDRs is self-rebalancing and is likely to minimize rebalancing costs. Additional research, particularly on the coordination problem (which limits liquidity) and operational issues, including settlement, can facilitate the development of an SDR-denominated bond market. Williamson (2009a) suggests that greater private use of the SDR could possibly facilitate greater official use, including the pegging of currencies to the SDR rather than to a basket of currencies or to some bilateral exchange rate.

It is important for investors to understand the distinction between "private" SDRs, in which the SDR serves as a unit of account, and "official" SDRs, which are official reserve assets. In this paper, we focus on the use of the private SDR as a unit of account. However, as the private SDR relies on the portfolio composition and value of the official SDR, we will first briefly discuss the official SDR.

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2. Background

The most severe financial crisis since the Great Depression has led to massive global policy interventions and renewed calls to re-examine the global financial architecture. In addition, some holders of U.S. Treasury bills and bonds have become concerned about potential losses on their holdings. For example, in March 2009 Chinese Premier Wen Jiabao stated that: “We have lent a huge amount of money to the U.S. Of course we are concerned about the safety of our assets. To be honest, I am definitely a little bit worried.”² He reiterated his concerns the following month at the Boao Forum for Asia. Further, in March 2009, the People’s Bank of China (PBOC) posted a speech by Governor Zhou Xiaochuan entitled “Reform the International Monetary System.” Among other initiatives, Zhou emphasized:

1. Reforming the international monetary system and creating an international reserve currency that “is disconnected from individual nations and is able to remain stable in the long run, thus removing the inherent deficiencies caused by using credit-based national currencies” (p.1, Sec II).
2. Entrusting part of member countries’ reserves to the centralized management of the International Monetary Fund (IMF).
3. Expanding the use of the IMF’s SDRs, including as a means of payment, currency of denomination of securities, commodity denomination and reserve currency.
4. Expanding the basket of currencies forming the basis for SDR valuation to include currencies of all major economies, and including GDP as a factor in currency selection for the SDR.

China currently holds approximately \$2.2 trillion in gold and foreign exchange reserves and about \$800 billion in U.S. Treasuries, as well as an estimated \$500 billion in U.S. Agency debt. The rapid build-up in reserves, however, is not limited to China. Williamson (2009b) points out that global foreign exchange reserves from 1975 to 2008 grew roughly 2.2 times as fast as global nominal GDP, and 1.10 times as fast as world trade. According to the June 2009 IMF COFER data, the dollar’s share of allocated foreign exchange reserves now stands at about 63 percent, versus 66 percent in 2002–2003. As of the same date, for emerging and developed countries the dollar comprises about 48 percent of allocated foreign exchange reserves, versus 54 percent at the end of 2003 (IMF 2009a).

In April 2009, the G-20 countries agreed to a roughly \$250 billion allocation of official SDRs, or newly created reserves. On August 28, 2009, members of the IMF that were participants in the Special Drawing Rights Department (currently all 186 members) duly received their official SDR allocations. In addition, the Fourth Amendment to the IMF Articles of Agreement provided a one-time allocation of SDRs equal to approximately \$33 billion. This allocation had been delayed, but was finally acted upon in 2009. After the special and general allocations the cumulative total of SDR allocations totals roughly SDR 204 billion, or about \$316 billion. SDR assets will thus represent roughly 4 percent of global foreign exchange as of the 2009:Q3. The United States, with an allocation of about 17 percent, is currently the largest official holder of SDRs followed by Japan at 6 percent (IMF 2009b).

Furthermore, on July 1, 2009, the IMF Executive Board approved a framework for the issuance of notes to member countries and their central banks. The principal of the notes will be denominated in SDRs, the Fund’s unit of account. The notes will be tradable in the official sector, which includes all IMF members, their central banks, and 15 “prescribed holders” of

² Wines, Michael, Keith Bradsher, and Mark Landler, “China’s Leader Says He is ‘Worried’ Over U.S. Treasuries,” *New York Times*, March 14, 2009, A1, www.nytimes.com/2009/03/14/world/asia/14china.html?_r=1&scp=1&sq=china's%20leader%20says&st=cse.

SDRs, which include four regional central banks, three intergovernmental monetary agencies, and eight development institutions. A permitted purchaser of the notes could also include a member's "fiscal agency" (2009b). Because in some cases the demarcation between a monetary authority and a sovereign wealth fund is not explicit, it is possible that a sovereign wealth fund will in fact purchase some of these notes. For example, some highly diversified monetary agencies, such as the Saudi Arabian Monetary Authority (SAMA) and the Hong Kong Monetary Authority (HKMA), while not explicitly SWFs, may possibly hold a portion of their portfolios in risk assets. The notes will have an initial maturity of three months, extendable to a maximum maturity of five years, and interest payments will be made quarterly. China has executed a note purchase agreement for up to \$50 billion, and Brazil, India and Russia have indicated their intention to purchase up to \$10 billion each. Per the IMF's website, as of October 23, 2009, the Fund has entered into SDR-denominated borrowings from several countries and placed some SDR-denominated notes with China.

In the past 18 months, several prominent economists, including Joseph Stiglitz and Robert Mundell, have suggested that the SDR should play a greater role in the international system. Stiglitz has argued that the proposal for the SDR as a new global reserve currency is "a good idea for many reasons." He has also suggested that replacing the dollar with a new global currency is "very much in the long-term interest of the [United States]" (Stiglitz 2009: p. 1). Mundell (2009) has advocated a large official SDR issuance, while Bergsten (2009) has proposed annual official SDR issues. Eichengreen (2009a) points out that "attempts in the 1980s to promote a private SDR bond market were not particularly successful, in part because "[t]he coordination problem – that many prospective issuers were reluctant to issue SDR-denominated claims in the absence of evidence that others were prepared to likewise – was substantial" (p. 11). He suggests that the IMF could possibly serve as a market-maker for SDR-denominated bonds.

Because the private SDR relies on the portfolio constituency and the value of the official SDR, in the next section we briefly examine the history and properties of the official SDR.

3. The definition and role of Special Drawing Rights

Public SDRs

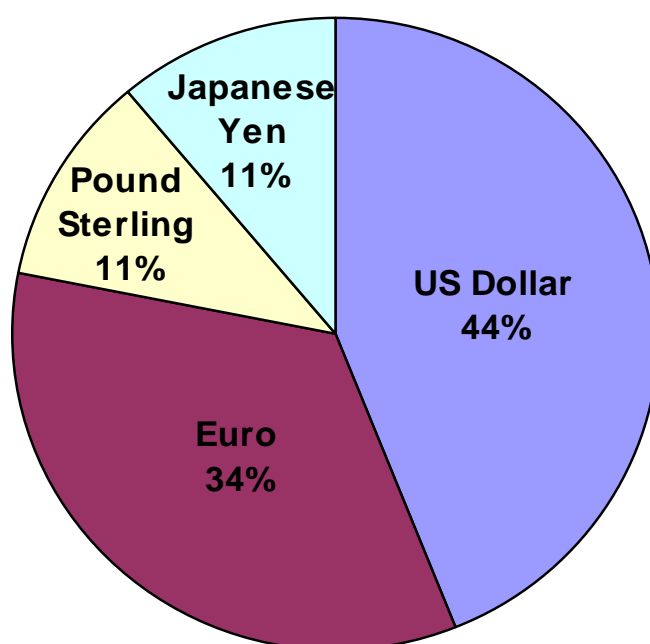
SDRs are an arcane and complex topic.³ According to the IMF's website, "the SDR is an international reserve asset, created by the IMF in 1969 to supplement the existing official reserves of member countries" (IMF 2009c: p. 1). With the agreement of the Executive Board, the Fund periodically allocates official SDRs to member countries in proportion to their IMF quotas. A basket of currencies comprise the SDR. The Fund and the Board review the currencies included in the SDR every five years. Presently, the currencies included in the SDR are those currencies issued by Fund members whose exports of goods and services during the five-year period ending 12 months before the effective review date had the largest value and that are "*freely useable*" (IMF 2005: p. 6). SDR weights are currently based on the value of exports and the amount of reserves denominated in the respective currencies.

At the latest review in 2005, the Fund established the weights for the SDR as illustrated in Figure 1 below.

³ For a fuller discussion, see the IMF's Articles of Agreement (IMF 1990) as well as Clark and Polak (2002). Margaret Garritson de Vries also wrote about SDRs for the IMF in 1976 and 1985, and in 1987 the IMF issued an occasional paper devoted to the topic, "The Role of the SDR in the International Monetary System."

Figure 1

Composition of the Special Drawing Right (SDR)



Five-year review period beginning January 1, 2006.

Source: International Monetary Fund.

At each five-year review, the IMF Board establishes the initial weights of the currencies in the IMF basket, but *during* the five-year period the weights change on a daily basis as a function of movements in exchange rates in the constituent currencies. For example, appreciating currencies gain a larger share of the basket and depreciating currencies a smaller share. Since 1969 the constituent currencies in the SDR and their weights have varied from time to time during sequential five-year periods. The next official reconstitution of the SDR will be in 2010 and will take effect in 2011.

SDRs are an official reserve asset and bear interest which is based on the weighted average interest rate of the representative short-term money market rates of the SDR basket currencies. As of October 23, 2009 the interest rate on SDRs is 0.27 percent. Coats (1990) suggests that the “[t]he official SDR can be thought of as an interest-bearing security that has the special quality that it can be transferred like a currency to settle obligations” (p. 979). Under XXII in the IMF’s Articles of Agreement, “each participant undertakes to participate with the Fund with the objective of making the SDR the principal reserve asset in the international monetary system” (IMF 1990). In this context, Governor Zhou’s statement may be seen as advocating that the international community implement already agreed upon – if not yet implemented – objectives.

The official SDR is neither a currency unit nor a claim on the IMF. Rather, it is a potential claim on the freely useable currencies of IMF members. The Fund and the Board can agree to create official SDRs, but only with 85 percent of the shareholders approving this creation. Therefore, the United States, with its roughly 16.8 percent vote in the IMF, exercises a de facto veto on the creation of official SDRs.

Up until 2009 and the current allocation, the issuance of official SDRs has been modest, with the IMF having issued only SDR 21.4 billion in official SDRs. This total represented around

0.3 percent of current world reserves. The recent allocation of SDRs will raise this percentage to roughly 4 percent but, as Williamson (2009a) points out, at the end of 1972 SDRs accounted for 9.5 percent of the world's stock of non-gold reserve assets.

Currently the Fund has voluntary arrangements to buy and sell SDRs with 13 IMF member participants and one prescribed holder (market-maker). However, the IMF (2009d) reports that as of May 2009 the buying and selling capacity of the market-maker, a prescribed institution, was less than SDR 3 billion.

Private SDRs

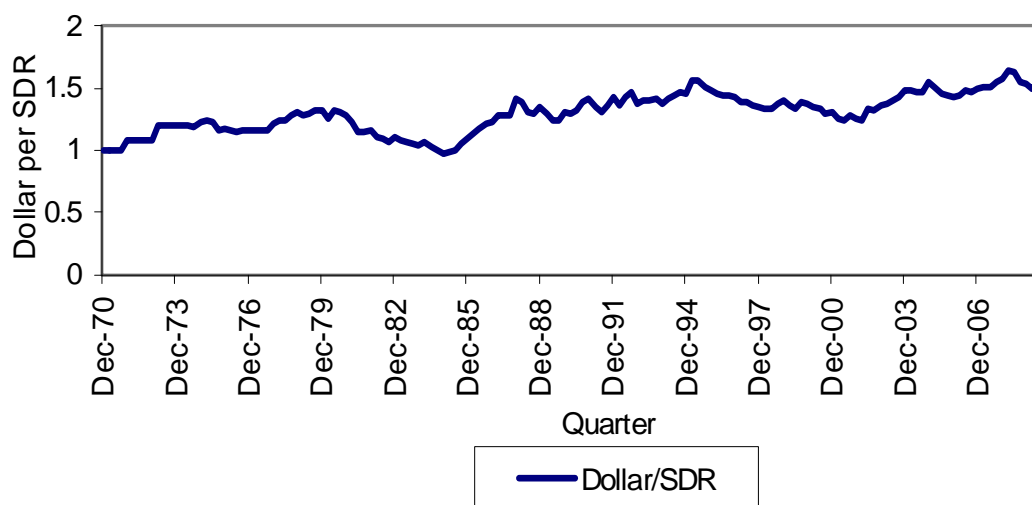
The IMF created SDRs in 1969 as an international reserve asset meant to support the Bretton Woods fixed exchange rate system by supplementing the existing reserves of member countries. Since 1972 the Fund has also used the SDR as its basic unit of account. Over time, the SDR has found a number of applications outside the IMF official framework. Current accounting uses of the SDR include:

- Transit fees in the Suez Canal are denominated in SDRs.
- Some airlines now designate charges for overweight baggage in SDRs.
- A number of international organizations maintain their accounts in SDRs or accounting units linked to the SDR. The Arab Monetary Fund, for instance, maintains its accounts in Arab Accounting Dinars (AAD), which are linked to the SDR.
- In the past, some countries, such as Latvia, have pegged their currency to the SDR.

Coats (1990) suggests that the SDR's attractiveness as a unit of account for private sector use derives from the stability of its value relative to values of alternative units. By virtue of their currency composition, SDR-denominated securities can serve as a diversification vehicle and as a partial hedge against currency risk. For example, at the time the first SDR was created in 1969, 1 SDR was equivalent to 0.888 grams of fine gold and/or \$1.00. However, as of Sept 30, 2009, 1 SDR is equivalent to roughly \$1.58. Figure 2 outlines the dollar/SDR parity since 1970.

Figure 2

Dollar per SDR 1970-Q3 2009



Source: Bloomberg.

Although its uses outside the official circle have been modest so far, information about the SDR is available on some commercial platforms. For example, the SDR has been assigned the ISO 4217 currency code XDR, and it is quoted on Bloomberg regularly (SDR Currency <GO>). The IMF determines the SDR's interest rate on a weekly basis. The IMF also updates the SDR every 20 minutes, although it does not quote an SDR rate on Saturday or Sunday, EST.

Sobol (1981) notes that private markets in SDR-denominated instruments first emerged in 1975 and included commercial bank deposits, syndicated credits, certificates of deposit (CDs), floating rate CDs, Eurobonds and floating rate notes. Interest grew in the SDR as a unit of account as the dollar weakened in 1977-1978. Sweden issued an SDR-denominated credit in 1981, and several other borrowers followed its lead. Sobol notes that JP Morgan offered demand deposits in SDRs and the ability to debit and credit accounts directly in SDRs without having first to convert the SDR into its component parts. The SDR thus served as limited means of payment. Banks also developed a secondary market in SDR-denominated CDs, and Euroclear and Cedel developed systems to accept assets in SDRs. Madura (1982) notes that banks in the United States, the United Kingdom and Japan issued SDR-denominated CDs.

No comprehensive data base of SDR-denominated bonds outstanding appears to exist, but Mingqi (2006) reports that, according to Bank for International Settlements (BIS) data, roughly SDR 594 million in bonds were issued by 13 different issuers in the 1970s and the 1980s. The private use of the SDR has not grown, even though Medeiros and Nocera (1988) observed more than 20 years ago that “the variance of the SDR exchange rate will always be lower than the weighted average of the variances of the component currencies in the basket” (p. 9). They suggested that SDR-denominated securities had a role to play in the construction of efficient portfolios.

Over time, the SDR has evolved in the composition of its basket of currencies, and the methodologies for setting its exchange value and interest rates have been refined. Likewise, the last couple of decades have witnessed substantial structural changes in the global economy due to regional economic integration, the creation of the euro, the globalization of trade and finance, and the emergence of China as an economic power. In light of the tremendous changes the world has undergone, it would be instructive to reevaluate if the desirable qualities of the SDR are as relevant today as they were in the past, a consideration that we take up in the following section. Despite the changing times, the SDR's potential to enhance the stability of portfolios' investment returns appears to be an enduring attribute.

4. The risk-return properties of SDR-denominated investments

As a basket currency, the SDR derives its exchange value from the exchange rates of its constituent currencies; currently the SDR is comprised of the U.S. dollar, the euro, the pound sterling and the Japanese yen. In this section, we present an analysis of the investment properties of the SDR, emphasizing its stability, to illustrate the potential benefits of SDR-denominated fixed income instruments in comparison to instruments denominated in the individual currencies within the SDR basket.

The analysis covers the period from January 1999, when the euro was introduced, through June 2009. Over this period, we consider hypothetical investments in short-term fixed income instruments, from the perspective of investors that use each of the component securities and the SDR as the base currency. The analysis evaluates the alternatives of investing in short-term instruments denominated in the local base currency, in the three other component currencies, and in the SDR itself. The total nominal returns to an investment strategy would consist of interest income accrued in the investment currency in which the instrument is denominated and exchange rate gains or losses in converting between the base currencies

and investing currency. For each investor of a given base currency, the streams of total returns of each of the investment strategies are simulated and contrasted against each other, in terms of average returns, volatility of returns and reward per unit of risk.

The bilateral exchange rates used are monthly closing rates as reported by Reuters, obtained from Datastream. The investment instruments are assumed to be short-term government securities that currently constitute the SDR interest rate basket as well as an instrument denominated in SDRs which pays the SDR market interest rate.⁴ We use market yields on three-month U.S. Treasury bills, three-month U.K. Treasury bills, the three-month Euro rate and three-month Japanese Financing bills, all obtained from Datastream. SDR interest rates are determined weekly as a weighted average of the yields on the securities in the SDR basket. The data on market interest rates on SDR are available on a monthly frequency, reported at mid-month, in the IMF's International Finance Series via Datastream.

The principal attraction of an SDR-based financial instrument, as for any other basket instruments, lies in the superior stability of returns it is capable of providing due to the diversification of currency risk, as well as in its convenience and cost advantage. The SDR serves as a convenient risk diversifier, because as a basket its value is based on component instruments that are imperfectly correlated with each other. As the total returns from such investment include both the currency gains/losses and the interest income in the investment currency, the SDR risk-reduction property accrues from both currency returns and interest income.

From the exchange risk perspective, the SDR's stability primarily results from the fact that exchange rate shifts among the currencies in the SDR basket tend to offset one another, depending on the degree of correlations among the component currencies. To the extent that movements in the exchange rates of the currencies within the basket are not perfectly positively correlated, changes in the value of one currency could be partially offset by smaller changes, if the correlations are positive, or by opposite changes in the values of the remaining currencies. As movements in the exchange rates of currencies in the SDR basket are not perfectly correlated, the volatility of the SDR's value in terms of any one of the component currencies (e.g., the U.S. dollar) would be less than the average of the volatilities of the values of all the other SDR-component currencies in terms of that particular currency. Similarly, the SDR's interest rate is a weighted average of the nominal interest rates of the constituent currencies.

Table 1 presents the pair-wise correlation coefficients of changes in the exchange rates, expressed in terms of the SDR and of the component currencies in the SDR basket, as well as the correlations in changes in the interest rates of the currencies.

⁴ The SDR interest rate is set on a weekly basis as a weighted average of the market interest rates on short-term domestic financial instruments denominated in the four component currencies. The instruments are the three-month U.S. Treasury bill, the three-month U.K. Treasury bill, the three-month Euro rate and the three-month Japanese Discount bill.

Table 1
Correlation Coefficients

Panel A: Changes in Exchange Rates (in terms of the SDR)				
	U.S. Dollar	Euro	Pound Sterling	Japanese Yen
U.S. Dollar	1.0000			
Euro	-0.8255	1.0000		
Pound Sterling	-0.2233	0.0793	1.0000	
Japanese Yen	-0.0302	-0.3832	-0.3829	1.0000
Panel B: Interest Rate Changes				
	U.S. Dollar	Euro	Pound Sterling	Japanese Yen
U.S. Dollar	1.0000			
Euro	0.3706	1.0000		
Pound Sterling	0.3562	0.7047	1.0000	
Japanese Yen	0.1848	0.3419	0.2211	1.0000

The table exhibits correlation coefficients in exchange rates and interest rates over the period from January 1999 through June 2009. Panel A shows the pair-wise correlations among exchange rates where the exchange rates are stated as SDR per unit of the currency. Panel B displays pair-wise correlations among the nominal interest rates of short-term government securities in the respective currencies.

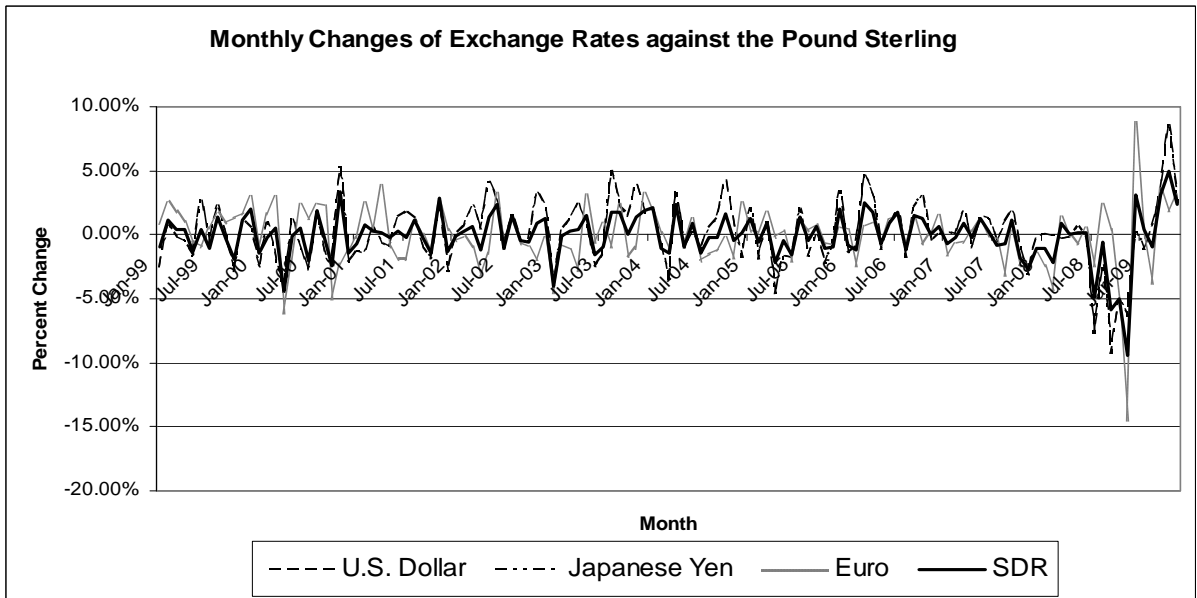
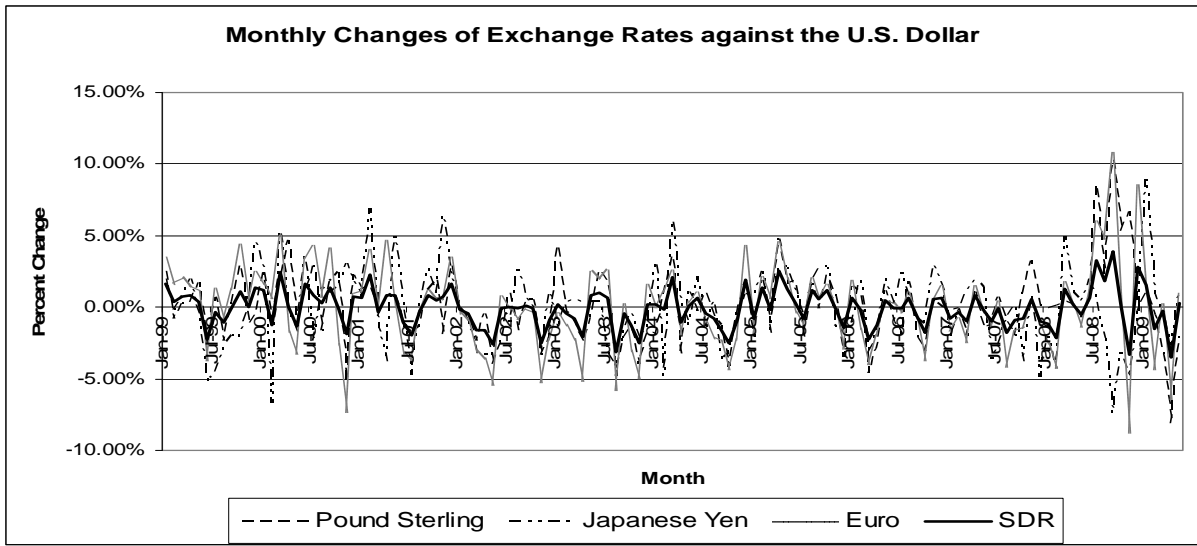
Source: Authors' calculations using Datastream.

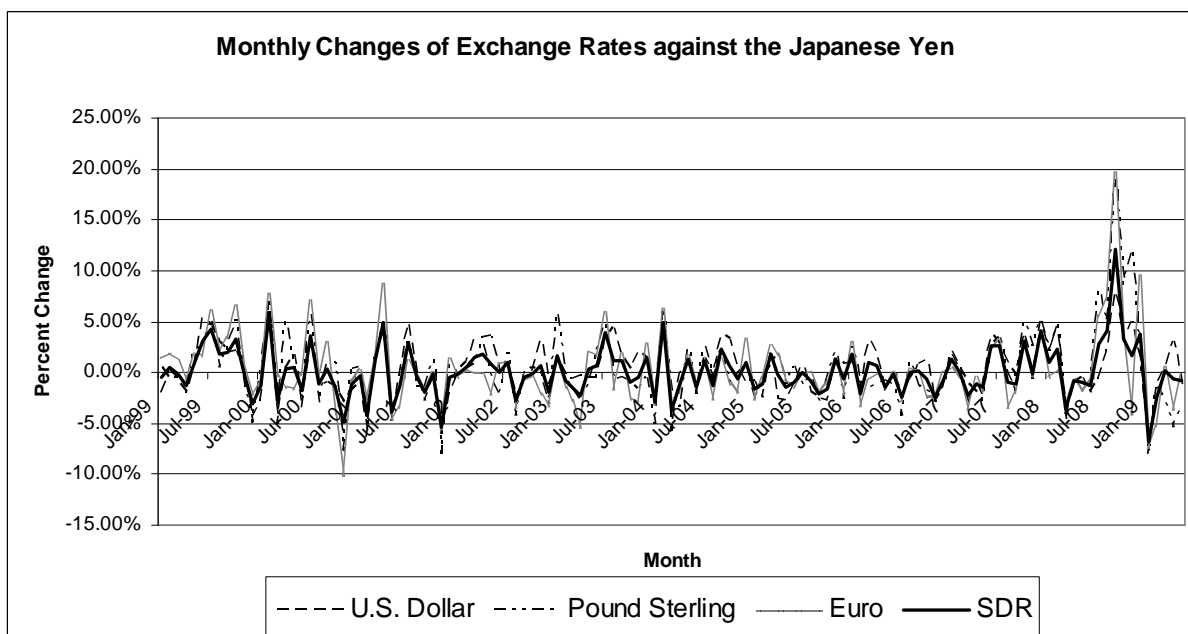
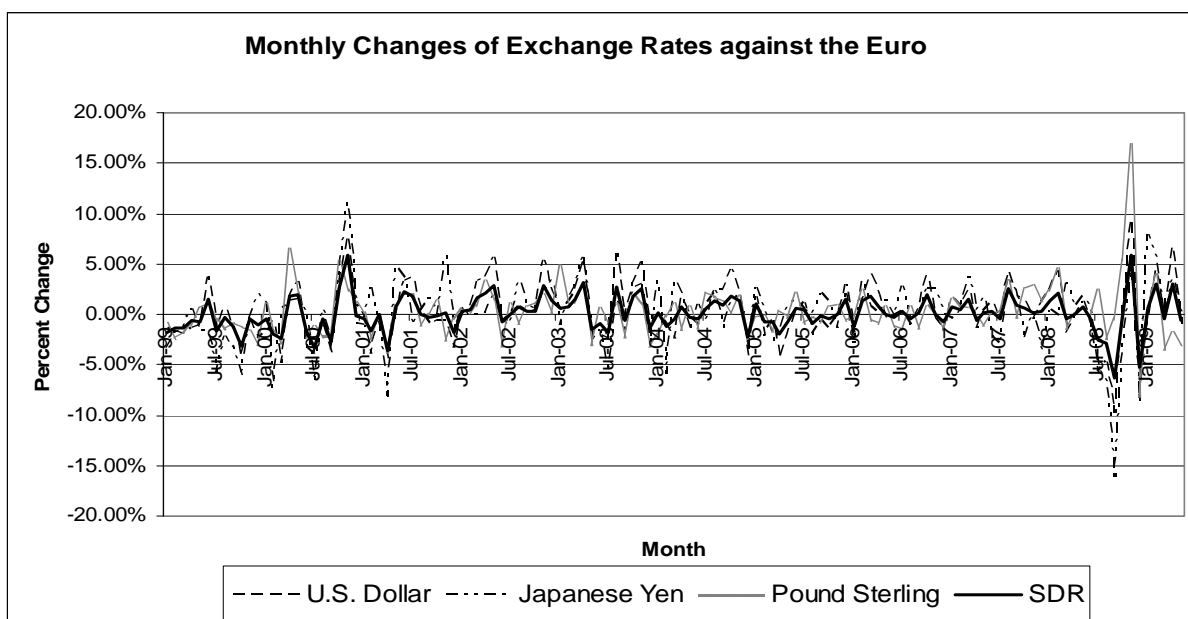
In Panel A, a large number of the pair-wise correlation coefficients of the shifts in the exchange rates are strongly negative, meaning that the exchange rates within the SDR basket are imperfectly and negatively correlated. For example, under the first column the U.S. dollar exhibits large negative correlations against each of the non-dollar currencies in the basket. As it is a dominant currency in the world economy, movements in the dollar are primarily determined by domestic events. The dollar's appreciation against the SDR would imply that the SDR would appreciate against at least one of the remaining currencies in the basket, resulting in a negative correlation. However, the degree of correlations varies from currency to currency, with the euro exhibiting the largest, and the yen the smallest. Given the imperfect and largely negative correlations in movements of exchange rates within the basket, changes in the value of one currency would be partially offset by opposite changes in the values of the remaining currencies, leaving the SDR as the least volatile in terms of its exchange rate value.

While exchange rate changes display largely negative correlations, panel B shows that changes in interest rates, while imperfectly correlated, tend to display positive co-movements. Though interest rates respond to a variety of unique domestic economic events, they also respond to a number of common factors. Thus, as Van Den Boogaerde (1984) argues, in terms of interest rates the risk-reduction property of the SDR primarily derives from the fact that its interest rate is an average of the constituent rates, and less so from offsetting opposite movements in interest rates within the SDR basket. The stability property of the SDR in terms of reducing exchange rate volatility is further illustrated in Figure 3, which plots the monthly changes in exchange rates of the basket's three remaining constituent currencies and the SDR in terms of the selected base currency.

Figure 3

Monthly Changes in Bilateral Exchange Rates





Source: Authors' calculations using Datastream.

For example, taking the U.S. dollar as the base currency, the chart above shows that the SDR exchange rate, depicted by the thick line, displays the least variability over time compared to the constituent currencies. Similarly, expressing the exchange rates in terms of, respectively, the pound sterling, the Japanese yen and the euro as base currencies, the SDR's exchange rate is the least volatile.

4.1 Comparison of investments in single-currency denominations versus in the SDR

The total returns to an investor in a foreign-currency denominated instrument constitute the gain/loss in converting to the base currency from the investment currency and the interest income accruing from the investment currency. To further illustrate the relative performance of the SDR in terms of total return opportunities, the returns to an investor of a given base

currency alternatively in the SDR and each of the remaining three currencies in the SDR basket were simulated and the results are presented in Table 2.

Table 2
Comparison of SDR and component currency denominated strategies

Panel A: Dollar-based Investor					
	Mean		Standard Deviation		
U.S Dollar	0.25%		0.15%		
Pound Sterling	0.41%		2.53%		
Japanese Yen	0.20%		2.80%		
Euro	0.55%		2.99%		
SDR	0.34%		1.34%		

Correlation of Total Returns					
	U.S Dollar	Pound Sterling	Japanese Yen	Euro	SDR
U.S Dollar	1.000				
Pound Sterling	-0.012	1.000			
Japanese Yen	-0.090	0.104	1.000		
Euro	-0.089	0.597	0.272	1.000	
SDR	-0.038	0.686	0.510	0.940	1.000

Panel B: Euro-based Investor					
	Mean		Standard Deviation		
Euro	0.26%		0.08%		
U.S. Dollar	0.13%		3.00%		
Pound Sterling	0.24%		2.44%		
Japanese Yen	0.06%		3.57%		
SDR	0.17%		1.78%		

Correlation of Total Returns					
	Euro	U.S. Dollar	Pound Sterling	Japanese Yen	SDR
Euro	1.000				
U.S. Dollar	0.141	1.000			
Pound Sterling	-0.058	0.577	1.000		
Japanese Yen	0.093	0.639	0.318	1.000	
SDR	0.125	0.967	0.648	0.774	1.000

Panel C: Pound Sterling-based Investor

	Mean	Standard Deviation			
Pound Sterling	0.38%	0.10%			
U.S. Dollar	0.28%	2.59%			
Japanese Yen	0.23%	3.68%			
Euro	0.51%	2.59%			
SDR	0.34%	1.94%			

Correlation of Total Returns					
	Pound Sterling	U.S. Dollar	Japanese Yen	Euro	SDR
Pound Sterling	1.000				
U.S. Dollar	0.220	1.000			
Japanese Yen	0.121	0.640	1.000		
Euro	0.022	0.320	0.397	1.000	
SDR	0.172	0.859	0.788	0.719	1.000

Panel D: Japanese Yen-based Investor

	Mean	Standard Deviation			
Japanese Yen	0.01%	0.02%			
U.S. Dollar	0.14%	2.82%			
Pound Sterling	0.29%	3.51%			
Euro	0.37%	3.46%			
SDR	0.21%	2.38%			

Correlation of Total Returns					
	Japanese Yen	U.S. Dollar	Pound Sterling	Euro	SDR
Japanese Yen	1.000				
U.S. Dollar	-0.020	1.000			
Pound Sterling	-0.151	0.710	1.000		
Euro	-0.027	0.573	0.751	1.000	
SDR	-0.051	0.881	0.872	0.881	1.000

The table shows monthly average returns, standard deviation and pair-wise correlation of total returns of instruments denominated in the SDR and component securities over the period from January 1999 through June 2009.

Source: Authors' calculations using Datastream.

As noted earlier, the investment instruments which constitute the SDR interest rate basket are short-term government fixed income securities. The holding period is assumed to be monthly, with the underlying instruments being rolled over at month's end. The total returns in currency i , in investing in an instrument denominated in currency j , are measured as the sum of the interest earnings accrued over the month's holding period and the exchange rate gain or loss at month's end. To simulate the return streams at the end of the month, the investments are rolled over by closing the old positions and taking equivalent positions at the current market yield.

Table 2 summarizes the average annualized total returns and the volatilities of returns, measured in terms of standard deviation, of the investment strategies for investors of different base currencies. As a general observation, across all the investment strategies for every investor type, investments denominated in the investor's base domestic currency tends to be by far the lowest risk investment strategy. The reason for this is that such strategies are immune to the substantial exchange rate risk exposure faced by the foreign-currency denominated strategies.

Excluding the strategies in the respective domestic base currencies, among the strategies that invest in foreign instruments the SDR provides the most stable return streams as reflected in lowest volatilities, regardless of the investor's currency base. If the desired investment objective is stable returns, as is the case in most long-term investment strategies, the SDR provides relatively stronger performance compared with investments in the single-currency individual instruments. In some cases, the SDR portfolio also generates the highest returns. Taking a dollar-based investor, for example, the SDR portfolio provides not only the lowest volatility, but also the highest yield, thus generating the highest rewards per unit of volatility among the foreign-denominated instruments.

Table 2's panel A summarizes the return and risk profile of the simulated strategies for a U.S. dollar-based investor. Between January 1999 and June 2009, the study period, such an investor would have had the highest returns investing in the euro, reflecting its strengthening, followed by the pound sterling, but both at a relatively higher risk. The lowest risk, as measured by the standard deviation, would have been realized by investing in SDR-denominated securities and assets. The U.S. dollar, accounting for the largest share in the SDR basket (as shown in Table 1 above), exhibits strongly negative correlations with the basket's non-dollar currencies, thus providing the SDR with a potentially natural hedge. The volatility of exchange rates from investing in any of the three non-dollar currencies would have been at least 1.6 times that of the SDR. In all, despite relatively lower average returns, the SDR instrument would have provided the highest return per unit of risk during this ten-year period. Of course, this period witnessed great volatility in financial markets, including the NASDAQ boom and bust, the worst financial crisis since the Great Depression, and the ensuing Great Recession.

Panel B shows that, during this period, a euro holder investing in foreign-currency denominated instruments would have realized the highest returns by investing in the pound sterling (0.19 percent per month), closely followed by the SDR (0.17 percent per month). The investor, however, would have obtained the greatest stability in returns, as measured by standard deviations of total returns, from SDR-based instruments. For a euro-based investor, the yen instrument would have been both a low-yield and high-risk instrument.

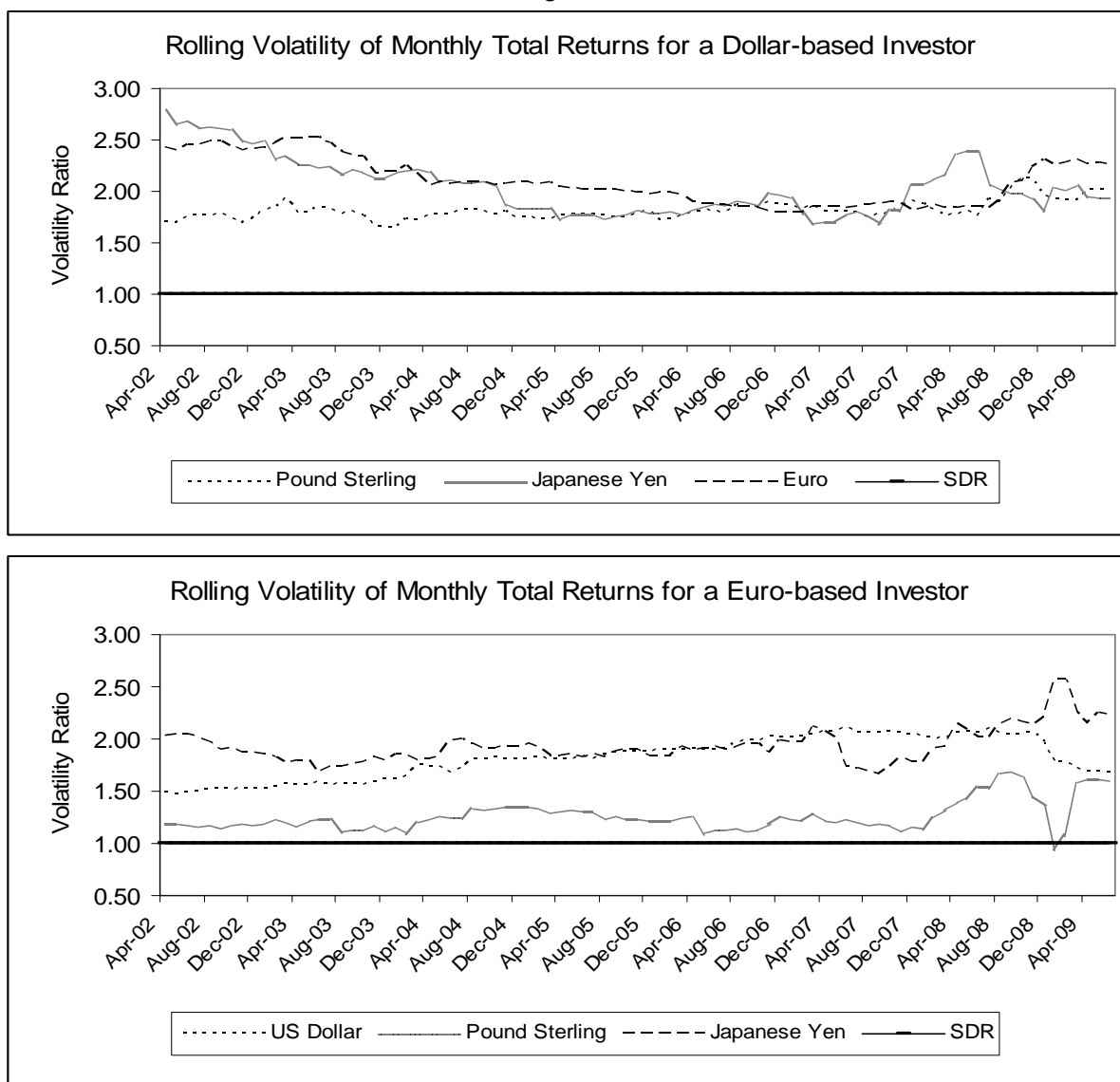
Panel C in Table 2 summarizes the risk-return profiles of the simulated investment alternatives from an investor using the pound sterling as her base currency. Again, a sterling holder investing in foreign-currency denominated instruments would achieve the highest level of stability by holding an SDR-based instrument. Furthermore, although not the highest-yielding, the SDR instrument would have generated above-average total returns. Reflecting the substantial appreciation of the euro during the study period, a euro-denominated instrument would provide the highest yield, but such an investment would have been more volatile. In all, despite lower yields, the risk-reduction advantage of the SDR instrument is such that it provides comparable yield per unit of risk as the high-yielding euro would have.

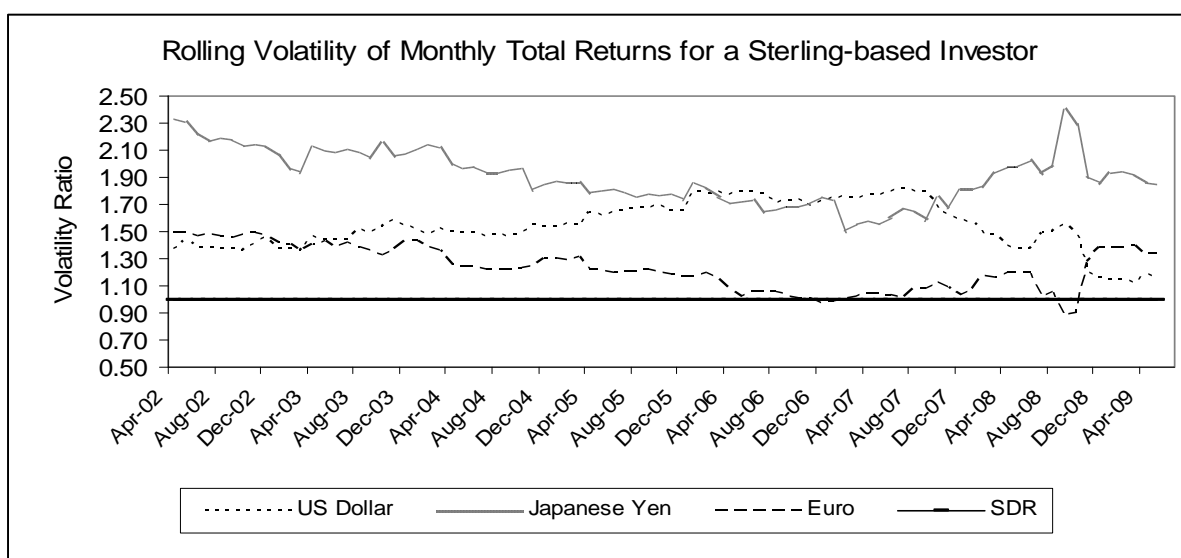
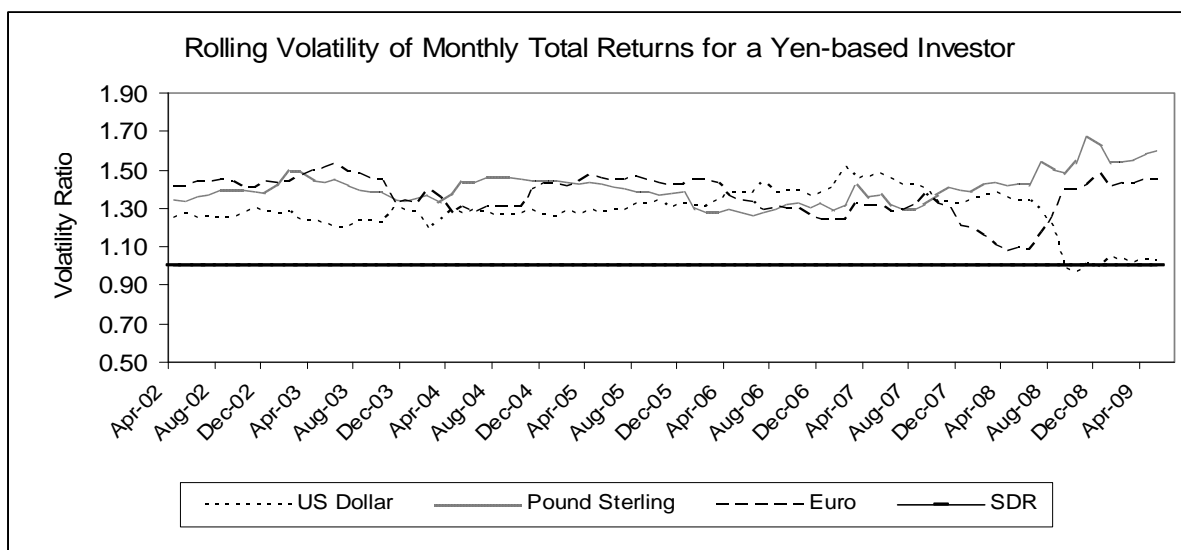
Panel D extends the comparison for a yen-based investor. The highest-yielding instrument would have been the euro and the pound sterling followed by the SDR and the dollar. In the risk category, however, the SDR instrument would have generated the least volatile total returns.

Figure 4 illustrates the risk-reduction potential of the SDR by plotting the total return volatilities of each of the three single-currency denominated instruments against that of the SDR. Volatilities, in standard deviation form, are computed over rolling 36-month windows

and expressed as a ratio of the SDR's volatility. As an example, for a dollar-based investor, the volatility in total returns of the single-currency denominated instruments ranges between 1.6 (for the pound sterling) and 2.8 (for the Japanese yen) times the volatility of the SDR-denominated instrument, results that clearly indicate the SDR's potential risk-reduction properties. The results are qualitatively similar across all base currencies. From the euro-based investor's perspective, the SDR's volatility is the lowest, followed by that of the pound sterling, as it is for sterling and yen-based investors. For a sterling-based investor, however, while the SDR is the least volatile, during the study period the euro appears to provide comparable stability, perhaps reflecting the much closer economic integration within Europe as well as the shared co-movements of the euro and the pound sterling against the U.S. dollar, the basket's other major currency.

Figure 4





Source: Authors' calculations using Datastream.

In summary, irrespective of the base currency, the SDR has been the most stable among the foreign-currency denominated instruments and, by and large, has generated above-average total returns. If the objective is achieving stable investment returns, the SDR clearly wins as the strongest performer. However, the SDR may not generate the highest possible returns in some cases. During the period from January 1999 through June 2009, a yen-based investor would have realized substantially higher yields from the euro, despite the stability of returns an SDR instrument would have afforded.

An alternative convenient ranking that incorporates such tradeoffs between expected yield and low volatility might be to use the returns per unit of risk, as measured by the average returns of the investment divided by its volatility. Table 3 provides the average reward per unit of volatility for instruments based on the SDR and component currencies. The reward per risk is the highest along the diagonal for investments denominated in the respective base currencies. This finding is a reflection of the fact that such instruments are devoid of exchange rate risk exposure. For all investment alternatives other than the ones denominated in the domestic currency, investors would have substantially benefited from the SDR instrument. The table's last row shows that as an instrument the SDR ranked high, on

reward per unit of risk basis (at least for dollar-based and euro-based investors), ranking in the top two across all strategies. From the yen- and sterling-based perspective, the SDR ranks second to the euro. Given that the SDR has been the lowest-risk instrument for sterling and yen-based investors, the euro's slight edge in those cases is attributable to the euro's higher yields due to its unprecedented appreciation in recent times. In sum, the foregoing descriptive statistics provide confirmation that the SDR could serve as a viable and superior vehicle, with a potential to generate above-average returns with the lowest variability.

Table 3
Reward-to-risk ratios

Base Currency	Dollar	Pound	Euro	Yen
Dollar	1.684	0.109	0.042	0.050
Pound	0.163	3.976	0.099	0.084
Euro	0.183	0.198	3.042	0.107
Yen	0.072	0.062	0.016	0.783
SDR	0.251	0.177	0.098	0.087

Source: Authors' calculations using Datastream.

4.2 Diversification: prepackaged versus customized portfolios

While some investors with the objective of improving expected returns may prefer to adopt a more active strategy of switching among their investments' currency denominations, the stated objectives of most investors oriented towards the long term might be a conservative strategy of preserving the stability of their investment returns. For such investors, including reserve managers and many institutional investors, the use of a prepackaged diversifying instrument such as an SDR would have an added advantage of convenience and low cost. As Dammers and McCauley (2006) note, the ready-made diversification through prepackaged portfolios could also prove advantageous to retail investors. Otherwise, for such investors, reasonable diversification would require both higher committed capital and buying a number of single-currency denominated instruments.

A counterargument against prepackaged portfolios as risk diversifiers is that in the set of potential portfolios of the constituent currencies that can be constructed, the ready-made portfolio (in this case, the SDR weights) may not represent the absolute minimum risk portfolio. It may as well be argued that if investors prefer to hold a portfolio of currencies as a hedge, they could customize one to their unique needs, reflecting their desired currency composition and unique constraints. With active currency markets, this can be accomplished through periodically rebalancing the hedge portfolio to tailor it to the desired investment objective.

It might be true that the SDR portfolio may not constitute the minimum variance portfolio even within the universe of current SDR constituent currencies, let alone within a larger set of currencies in which an investor may have interest. Nonetheless, despite the relative efficiency loss from the SDR basket, there are a number of practical advantages to a strategy of using the prepackaged SDR. First, customizing involves large transaction costs from the continuous rebalancing needed. Depending on the set of currencies in the customized portfolio and the degree of how active the investment strategy is, there could be substantial transaction costs incurred when moving away from a prepackaged portfolio denominated in the SDR to the customized one; such costs might not justify the potential efficiency gain. Moreover, the constituent currencies that denominate the SDR represent an overwhelmingly large amount of total global trade and investment transactions.

In addition, given that many other currencies are anchored through a peg and other mechanisms to these SDR basket currencies, any customized portfolio would more likely be a composition of the SDR currencies. Finally, within the set of the SDR currencies, the efficiency loss of using the SDR basket instead of a customized portfolio depends on the individual investor's base currency and constraints. Abstracting away from an investor's unique constraints, it can be shown that the SDR portfolio would be the closest to the efficient set compared to the constituent single-currency alternatives. In a similar study evaluating the SDR's role in reserve management, Medeiros and Nocera (1988) find that, depending on the base currency, the minimum variance portfolios, by and large, assign substantial weights to the SDR. It could, therefore, be argued that the efficiency loss of the prepackaged SDR portfolio relative to the customized version may not need to be as large in order to justify the complexity and higher costs of customizing it for many investors.

5. Pros and cons of SDR-denominated instruments

For the private SDR market to develop it must provide advantages to both issuers of and investors in the SDR. One of the SDR's advantages is that it is a prepackaged portfolio. The possible benefits from private SDR-denominated securities are delineated below.

5.1 Issuers

Exchange rate hedging: because the SDR is less volatile than its constituent currencies, it allows borrowers to hedge against mismatches of inflows and outflows. For example, a U.S.-based multinational corporation that sells in countries whose currencies help comprise the SDR basket could hedge its foreign receipts through the issuance of multicurrency liabilities.

Lower underwriting costs: the costs of underwriting an SDR-denominated bond may be lower than issuing four different currency-denominated bonds. In addition, privately placed SDR-denominated bonds could avoid the administrative and other costs associated with a public issue.

Potentially lower credit spreads: to the extent that a corporation's credit spreads differ by the currency market, the spread over an SDR-denominated instrument could possibly be lower than the weighted average of single-currency credit spreads.

Arbitrage opportunities: related to the above, an SDR bond, being a composite currency bond, could facilitate arbitrage opportunities from floating bonds denominated in the component currencies.

A framework to promote the SDR: if a holder of official SDRs would like to promote the development of the SDR as an alternative to other reserve currencies, it would be advantageous to promote private markets in SDR-denominated securities, perhaps as a primary issuer and as an investor, either at market rates or as an investor providing a modest subsidy.

Broadening the market: retail investors may find the SDR instruments a convenient way to diversify and could possibly open a new market for issues.

5.2 Investors

Prepackaged diversification: SDR-denominated securities provide official reserve holders and other investors exposed to particular currencies a convenient way to diversify the exchange risk exposure. Such securities may also incentivize a private investor with currency exposures in the SDR component currencies to reduce risk conveniently and at least cost.

Lower volatility: an investment's return and its realized Sharpe ratio can only be known after the fact. For private investors who may be subject to criticism by boards of directors and other parties for poor currency selection, SDR-denominated securities can reduce "currency regret."

Greater portfolio stability: as an overall portfolio diversifier, Chopra and Ziemba (1993) found that at the risk tolerance of a typical institutional investor, a mean-variance optimizer is most sensitive to estimates of means, then to variances and then to co-variances. In the estimation of optimizer inputs, errors in variance estimates are roughly twice as important as errors in co-variances. The lower variance of SDR securities can contribute to portfolio stability and facilitate the estimation of optimizer inputs.

An alternative reserve currency: the private use of the SDR may also provide opportunities to promote and brand the SDR as an alternative to other reserve currencies. A large official holder of reserves may wish to invest in private SDR-denominated bonds to facilitate greater official use of the SDR. In this sense, the IMF's recent issuance of SDR-denominated notes could possibly be viewed as a precursor to issuance by other official entities. While the notes are not publicly tradable (and are not newly issued public SDRs), because they can be traded among designated parties they appear to be more liquid than traditional private placements.

The potential challenges or "cons" of private SDR-denominated securities are delineated below. As a general observation, these issues are inevitable given the still-nascent state of a market for private securities denominated in SDRs, but will need to be confronted if a robust market is to develop.

Liquidity constraints: a public issuer of SDR-denominated bonds will have to pay a liquidity premium, and the first buyers of SDR instruments will enter an illiquid market. However, if several SWFs and/or other investors collectively agreed to purchase SDR instruments (say as a percentage of total cash and fixed income assets), then the liquidity of an SDR investment market could improve.

Uncertainty: the economic benefits the SDR will provide to issuers and investors are uncertain, at least at the outset of trying to create a more robust market in these securities. From an issuer's perspective, it is not clear that issuing SDR-denominated bonds will solve a pressing problem that cannot be dealt with otherwise.

The official sector's political will: it may take a subsidy from countries that wish to promote the SDR as a reserve currency to promote the beginning of a robust market in SDR-denominated securities, and relying on the political will of the official sector is an uncertain proposition from the standpoint of potential investors.

The absence of central bank participation: currently, central banks do not act as official issuers of SDRs and lenders of last resort for markets involving these instruments.

The current lack of a market: because the market for SDRs has yet to really develop, trade in these instruments lacks continuous pricing and market-making mechanisms. The complexity of the instrument and its reconstitution process make it an uncertain vehicle for many investors.

6. Expanding the market for SDR-denominated deposits and bonds

For a broad and deep market in publicly traded SDR-denominated securities to develop, at the very least the following need to be present:

- Multiple market-makers
- Continuous and transparent pricing

- Efficient financing mechanisms, including repurchase mechanisms
- Derivatives, such as swaps
- Hedging mechanisms
- Technology infrastructure, including Bloomberg/FactSet/Reuters
- An emergency lender, such as the IMF

Sobol (1981) points out the need for legal clarification on technical issues such as safeguard clauses (to cover, for example, recalculation of the SDR components or cessation of the SDR's use by the IMF; currencies to use in repaying interest and principal; and potential foreign exchange controls on SDR securities).

In short, several current impediments exist to the development of an SDR-denominated securities market, but historical precedent exists for such a market, and the emergence of large SWFs suggests that an additional class of investor is available to promote the use of SDR-denominated-instruments. Sovereign wealth funds and highly diversified monetary authorities could help develop a market by investing in SDR-denominated deposits and bonds, denominating their accounts in SDRs and potentially borrowing in SDRs. They could also make markets.

Conclusion

Dammers and McCauley (2006) point out that four basket currencies have been used since the second half of the twentieth century to denominate bonds: the European Unit of Account (EUA), the Euro, the SDR and the ECU. They report that the first Eurobond was denominated in EUA, and observe that three out of the four basket currencies “turned out not to have much staying power” (p. 80).

The ECU was the most successful postwar basket currency, and preceded the euro by 20 years. The ECU served as a unit of account for target European food prices under the Common Agricultural Policy and served in 1979 as a unit of account for the currency area designated as the European Monetary System. As is the case currently with the SDR, there were at one point both private and public ECUs.

Allen (1986) observed that the ECU had many advantages over the SDR as a basket currency, among these being that:

1. the economy in the European Community (EC) was becoming increasingly integrated.
2. most EC currencies have been more stable against the ECU than against the SDR.
3. the SDR, with the dollar comprising about 40 percent of its value, is a relatively poor instrument for hedging or speculating against the dollar.

Eichengreen and Frankel (1996) refer to the SDR as the “Esperanto” of international currencies, contending that it lacks a natural constituency. Furthermore, Coats (2009) points out that most central bank transactions are not with other central banks but with the market. He argues that greater official use of the SDR will require greater linkages between the private and official SDR. Eichengreen (2009b) further points out that the SDR's limitations as an intervention and vehicle currency for foreign exchange transactions depends on the IMF's ability to issue SDRs rapidly in the case of a global liquidity shortage.

The IMF's recent increased issuance of SDR-denominated notes represents a new development in the SDR's evolution, and modestly blurs the distinction between private and official SDRs. Despite the recent global financial crisis and draw-down in some countries'

reserves, many nations continue to accumulate reserves at a healthy pace. However, the IMF (Blanchard, Faruqee and Klyuev 2009) suggests that the current crisis may raise the precautionary demand for reserves. Thus currency selection will continue to be important for large official pools of capital. SDR-denominated securities can offer potential advantages to investors, but several structural impediments exist in developing a market. However, the desires expressed by some sponsors of large SWFs to diversify their currency exposures suggest that SWFs acting collectively could promote such a market.

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