

## USE OF TECHNOLOGY IN MANAGING CURRENCY EXCHANGE RATE EXPOSURE IN THE PUBLIC SECTOR

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### **P**URPOSE

MANY government agencies face the risk of exchange-rate fluctuations between different currencies much like private companies that operate internationally. Managing the financial risks resulting from the exchange-rate fluctuations is as important an issue in the public sector as it is in the private sector. Given the scope of worldwide operations, federal government agencies of the United States have much to gain from the use of currency risk management techniques. In this paper, we discuss currency exchange-rate exposure in the public sector, analyze the role of risk management in mitigating such exposure, and present the information-technology tools that can help in supporting the risk-management interventions. In essence, this paper lays the foundation for the U.S. federal government in taking a more active role in hedging exchange-rate exposure by using a wide range of technology and related tools.

**Purpose:** The purpose of this paper is to demonstrate that exchange rate exposure is just as relevant in the public sector as it is in the private sector although efforts taken to mitigate such exposure is lacking in the public sector. This paper suggests mitigation techniques that public sector agencies can use to reduce exchange rate exposure rather than passing on such costs to the U.S. taxpayer since this is an aspect of federal government operations with budgetary and tax implications.

**Design/Methodology/Approach:** The methodology of this paper is largely qualitative. First, the authors lay out a case for exchange rate exposure in the public sector and then present a list, although by no means an exhaustive one, of software tools that are available to public sector agencies to mitigate exchange rate exposure.

**Findings:** Although the public sector of the United States has access to a variety of tools to mitigate their exchange rate exposure, such tools are not utilized. Our paper puts forth arguments to suggest why the public sector should be more proactive when it comes to mitigating exchange rate exposure.

**Research Limitations/Implications:** One of the limitations of this study is that it is more qualitative than quantitative. Future extensions of this study could endeavor to develop quantitative extensions of the ideas set forth in this paper.

**Practical Implications:** Private sector firms are answerable to the firm's shareholders. For public sector firms, the U.S. taxpayer is the "shareholder" and their best interests need to be kept in mind with respect to policy making. Mitigating exchange rate exposure is an important policy issue in the

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*U.S. public sector with far reaching budgetary consequences. It is the hope of the authors that U.S. public sector agencies, particularly those with extensive international operations such as the Depts. of Defense and State, will be able to utilize the results of this study to actively reduce their exchange rate exposure.*

**Originality/Value:** *Although the usage of currency derivatives has been extensively investigated in the private sector, it has not been fully investigated in the public sector. This is due to the fact that publicly available data is limited in the public sector. This paper is the first of its kind to put forth exchange rate mitigation tools that public sector agencies can use to reduce their exchange rate exposure. The information contained in this paper was obtained, to some extent, by invoking FOIA (Freedom of Information Act)*

**Key Words:** *DOD, USAID, State Department, Exchange Rate Exposure, Mitigation Tools.*

## **Introduction**

Currency exchange rates are a major source of uncertainty for multinationals as an appreciation of the U.S. dollar impacts the ability to sustain operations and trade profitably. Since an appreciation of the U.S. dollar makes foreign imports relatively inexpensive compared to U.S. goods, fluctuations in the value of the dollar can impact a company even if it does not do business outside the home country. The topic of exchange-rate exposure has been thoroughly investigated in the private sector; however, the stream of research with respect to the public sector is scant at best. This paper tackles this issue in the context of three U.S. federal government agencies including the Agency for International Development (USAID), the Department of State, and the Department of Defense (DOD). All three agencies have extensive worldwide operations and are vulnerable to exchange-rate exposure.

Currency exchange-rates are typically four times as volatile as interest rates and ten times as volatile as inflation (Jorion, 1990). Hence, mitigating exchange-rate exposure is a critical decision area for any organization with international operations. Prior to discussing exchange-rate exposure in the public sector, this paper presents a brief summary of the issues, as it applies to the private sector. We take this approach to demonstrate that the issues faced by the public sector are not far removed from the issues pertaining to multinational corporations.

Multinational corporations (MNCs) are exposed to exchange-rate fluctuations by the nature of their business. MNCs that have outstanding obligations denominated in other currencies are subject to gains or losses due to exchange-rate movements that take place before the transaction in-question is consummated. For conglomerate firms, such gains and losses can potentially be measured in billions of dollars. Hence, many MNCs attempt to shield themselves from exchange-rate exposure through the effective use of derivative instruments, such as currency futures and forward contracts. Such instruments often mitigate the effects of unfavorable exchange-rate movements by locking in a predetermined rate. These contracts are usually executed through a financial intermediary. Furthermore, many MNCs attempt to use “natural or geographic hedges” to shield themselves from unfavorable exchange-rate movements. In doing so, companies diversify themselves across many countries and currencies so that exchange-rate movements that affect their operations, and subsequently their profits, may have some neutralising effects.

The issues discussed above have been addressed in the international finance literature extensively. On the other hand, only a small handful of studies have addressed the implications of exchange-rate exposure in the public sector. This paper builds on earlier work that investigated exchange-rate exposure in three federal government agencies: The DOD, Department of State, and the USAID (Krishnamoorthy and Shetterly, 2008). According to previous studies in the field, the federal government does not take steps to actively mitigate their currency exposure (Krishnamoorthy and Shetterly, 2008). However, each agency has some discretion when it comes to managing its level of exposure. The reason these three agencies were studied is because they are particularly vulnerable to exchange-rate exposure due to their extensive global operations. The USAID is especially vulnerable to exchange-rate exposure

since it is exposed almost exclusively to highly volatile and unstable currencies since its mission is developmental assistance in developing countries.

The paper begins by analyzing the types of exchange-rate issues faced by these three federal agencies. The paper then scrutinizes techniques currently employed by these agencies to mitigate their exposure to currency fluctuations. We also illustrate that there is a significant gap between what is currently being practiced and mitigation techniques that could potentially be used by the federal government. The paper goes on to present and classify a variety of tools that are available for public agencies to use in order to mitigate their exchange-rate risk. In the final section, we provide concluding remarks.

### **U.S. Agency for International Development**

In this subsection, we analyze the exchange-rate exposure faced by the U.S. Agency for International Development (USAID) and the agency's policies related to the exposure.

#### ***USAID's Exchange-rate Exposure***

The mission and objectives of the USAID reveals the magnitude of currency exposure faced by the USAID. The USAID is a quasi-autonomous federal government agency. Their work supports long-term and equitable economic growth and advances U.S. foreign policy objectives by supporting the following global initiatives: economic growth, agriculture, trade, global health, democracy, conflict prevention and humanitarian assistance (USAID, 1987). With headquarters in Washington, DC, USAID maintains field offices in four regions of the world: Sub-Saharan Africa; Asia and the Near East; Latin America and the Caribbean; and Europe and Eurasia. The agency works in close partnership with private voluntary organizations, indigenous organizations, universities, American businesses, international agencies, foreign governments and other U.S. government agencies and has operations in over 100 developing countries around the globe (USAID, 1991).

Overseas, the agency provides assistance in the following areas: Technical assistance, capacity building, training, scholarships, food aid, disaster relief, infrastructure development, small business loans, budget support and credit guarantees. In order to provide needed assistance in an efficient manner, the agency maintains both geographic and functional bureaus. Maintaining infrastructure for overseas field offices involves expending cash in foreign currencies for such items as rent and utility payments. Although the U.S. employees stationed at overseas locations are paid in dollars, they are compensated for cost of living adjustments (COLA) caused by fluctuating exchange rates. However, local employees who work for the USAID, at overseas locations, are typically paid in the local currency.

In addition to the basic causes of exposure, the USAID has to deal with one more issue that increases its vulnerability. Much of their operations are based in LDC countries and/or countries that are in the midst of profound political and economic reforms. Hence, the USAID is primarily exposed to the currencies of LDCs. The currencies of LDC tend to be more volatile than those of highly developed economies such as the UK, Australia and Japan to name a few. The highly volatile nature of LDC currencies tends to further increase the exchange-rate exposure faced by the USAID.

The preceding paragraphs have provided an overview of the worldwide operations of the USAID. The very nature of their operation makes them vulnerable to exchange-rate volatility. Much of their activities in foreign countries, such as providing small business loans and infrastructure development, involve expending funds in the local currency of the country in question.

#### ***USAID's Policy on Managing Exchange-rate Exposure***

Throughout its 45-year history, the agency's exchange-rate policy has been aimed at encouraging foreign governments to adopt and move towards unified exchange rates at realistic levels (Krishnamoorthy and Shetterly, 2007). The agency strongly believes that adoption of market-determined exchange rates for all transactions is a key element for stabilizing economies and stimulating economic growth (USAID, 1991). However, in many of the countries in which the

USAID has operations, this is unrealistic and so the agency has felt the need to address ways to mitigate its exposure. Standard USAID project grant and loan agreements provide that U.S. funds be exchanged for local currency at the highest rate per USD, hereafter referred to as the HR, which at the time of the transaction is not unlawful in the recipient country. This policy is applicable to all project and non-project assistance and mission operating expenses in which U.S. dollars are exchanged for local currencies.

For local currency expenditures that are not directly related to project and non-project assistance, the appropriate exchange rate to use for conversion is the rate of exchange determined by the U.S. government's disbursement officer (USDO) on the day the voucher is prepared. The U.S. Treasury Financial Manual Volume 1 published at the end of fiscal year 2001 (Sept. 30, 2002) and is retroactive for fiscal year 2001 lists the protocol for federal agencies when determining an appropriate exchange rate. The manual also clearly defines an acceptable rate of exchange as "the most favorable rate legally available to the U.S. government for the acquisition of foreign exchange for U.S. Government official disbursement and accommodation exchange transactions" (Treasury Financial Manual, 2002). Elsewhere, the USDO rate for commercial transactions is defined to be the highest legal rate obtainable from a legally authorized exchange dealer. If the USDO rate is lower than the HR, USAID dollars are to be exchanged at the USDO rate until such time as a satisfactory solution to exchange USAID dollars at a higher rate, be it the HR or not, can be negotiated with the recipient government.

As mentioned earlier, local currency expenditures that are tied to project and non-project assistance involve converting U.S. dollars into foreign currencies at the HR. In countries where a unified exchange rate that is determined by market forces exists, the HR is the unified exchange rate. In countries where a freely competitive auction system for foreign exchange has been developed, the HR is the auction rate. USAID funds can be auctioned off or sold at the current auction rate. In countries where financial institutions are allowed to engage in foreign exchange transactions without being subject to penalties, the HR is the commercial bank rate.

In countries where foreign exchange transactions are controlled, but commercial bank exchange rates and unofficial markets also exist, the HR is the higher of the commercial bank rate, the unofficial rate or the controlled official rate. In countries where foreign exchange transactions are strictly controlled under a single and official rate and where no unofficial market exists, the HR is the controlled official exchange rate.

In some foreign locations, it is not feasible to rely solely on the HR policy. In such locations, the appropriate exchange rate is determined by arm's length negotiation between two parties. Insistence on an exchange rate equal to the HR in such circumstances may be counterproductive and inhibit the orderly conduct of business transactions and the increased rate of economic growth that the USAID seeks to stimulate (<http://www.usaid.gov>, 2012).

Finally, the USAID has significant operations in some countries that are subject to hyperinflation. At such locations, USAID missions negotiate with appropriate host government officials, or private party borrowers, USD disbursement schemes based on need. Gradual disbursements of dollars would reduce the problem of rapid depreciation of local currencies deposited into special accounts (USAID, 1987).

### **Department of State**

In this subsection, we analyze the exchange-rate exposure faced by the U.S. Department of State and the agency's policies related to the exposure.

#### ***Department-of-State's Exchange-rate Exposure***

The U.S. Government maintains diplomatic relations with about 180 countries with more than 250 posts throughout the world (<http://www.state.gov>, 2012). Embassies, consulates and other

diplomatic missions are manned by Foreign Service and career civil service employees and perform a variety of functions. Embassies and consulates are analogous to small communities with infrastructure support that requires expenditures within local economies. Maintenance of residential facilities and other family support units mandates funding in local currencies. Furthermore, high-ranking diplomatic officials, such as Ambassadors and Consul Generals, are entitled to domestic help such as chauffeurs and maids at their respective locations. In addition, embassies and consulates rely on local residents for cultural and language services and such infrastructure needs as facility security. Although some local employees, commonly referred to as Foreign Service Nationals, may be paid in U.S. dollars, a majority of them are paid in the local currency thereby increasing the State Department's exchange-rate exposure. In summary, the annual maintenance expenditure associated with carrying out U.S. foreign policy worldwide amounts to billions of dollars of transactions annually that are denominated in foreign currencies.

#### ***Department-of-State's Policy on Managing Exchange-rate Exposure***

The State Department uses a revolving fund from which exchange-rate losses are covered; the fund is periodically replenished by gains due to favorable currency movements. At the beginning of each fiscal year (October 1), financial plan allocations are adjusted for prior year exchange-rate fluctuations and the current spot rates for each post. Exchange rate changes during the year are calculated for each post with an allowance made for hyperinflation. Financial plans may be revised based on a quarterly financial review. Exchange-rate gains are held in a central fund for decision on disposition. Withdrawing from this centrally managed fund generally covers losses. However, they are sometimes accommodated by reprioritization of existing financial plan allocations (Krishnamoorthy and Shetterly, 2006).

Decisions are made on the use of exchange-rate gains and the source of funds for exchange-rate losses within the context of quarterly financial plan reviews including consideration of all funding demands. The quarterly financial plan reviews reprioritize financial plan allocations by considering funding availability, including exchange-rate gains or losses, against the approved level of operations. Approved level of operations for the purposes of this policy is considered to be the level of activity for the department envisioned in the authorization and appropriation acts. Decisions regarding the allocation of gains to cover losses or the reprioritization of financial plans require clearance from the Office of Management and Budget (Krishnamoorthy and Shetterly, 2003).

#### **Department of Defense**

In this subsection, we analyze the exchange-rate exposure faced by the Department of Defense (DOD) and the department's policies related to the exposure.

#### ***DOD's Exchange-rate Exposure***

The DOD projects forces throughout the world. The maintenance of massive military infrastructure overseas leaves it vulnerable to currency volatility. To accomplish force projection, the DOD operates within the framework of nine unified commands. The United States Pacific Command is an example of a unified command. It is headed by a four star general and has jurisdiction over 43 countries and 10 U.S. territories and employs about 300,000 military personnel. In order to carry out its mission, the DOD maintains military bases in numerous countries around the world. A military base is like a small American town. It has shopping centers, schools, convenience stores, a fitness center and the like. Expenditures associated with these bases often need to be paid in local currencies and can amount to billions of U.S. dollars annually (<http://www.defense.gov>, 2012).

The maintenance of military bases overseas requires the consent of the host government. This consent is given on the basis of two considerations: Security and Economics. In addition to carrying out U.S. interests overseas, the DOD is also responsible for providing security to host nations. For example, part of the mission of United States Forces Korea is to protect South Korea from an attack launched by its northern neighbor. Furthermore, the presence of the U.S. military overseas provides employment for host country nationals and thereby stimulates their economy. Often times,

local employees who work at on-post positions are paid in the local currency thereby increasing the exchange-rate exposure faced by the DOD.

In summary, the DOD is exposed to foreign currency fluctuations due to the nature of their operations. As mentioned earlier, the maintenance of infrastructure, plus the employment of local nationals creates exposures that can potentially amount to billions of dollars annually.

#### ***DOD's Policy on Managing Exchange-rate Exposure***

Congress established current policy on managing exposure in the DOD appropriations Act of 1979. The approach involves the use of a revolving fund into which gains from currency fluctuations are transferred and from which military installations may withdraw funds to cover losses. In 1987, Congress amended this piece of legislation to include construction, housing and NATO infrastructure.

Furthermore, the DOD maintains what is referred to as a Centrally Managed Allotment (CMA). At the start of each fiscal year, the CMA is replenished in accordance with the department's budget for the given fiscal year. Funds in the CMA can be used to cover losses resulting from exchange-rate movements. Any gains resulting from favorable currency movements must be transferred into the CMA. Unlike the USAID and the Department of State, DOD internal memorandums do make a reference to hedging their exposure. The DOD can utilize forward contracts with prior approval from the U.S. Treasury Department. However, there is no evidence that they have ever taken advantage of this privilege (Krishnamoorthy and Shetterly, 2003).

### **Currency Risk Management in the Public Sector**

The Departments of State and Defense employ similar policies with respect to exchange-rate exposure. In short, their policy involves a revolving fund that is used to cover losses due to unfavorable exchange-rate movements; gains resulting from favorable currency movements are used to replenish the fund. This fund is adjusted on October 1 of each year, which marks the beginning of the federal government's fiscal year, and is based on exchange-rate movements during the previous fiscal year. Neither agency engages in active risk management to mitigate its exposure resulting from currency volatility.

As indicated above, neither the DOD nor the State Department has engaged in active risk management techniques. However, the DOD can use forward contracts with prior approval from the U.S. Treasury. According to State Department internal memorandums, there is no such provision in the department's charter. The USAID, on the other hand, follows a slightly different procedure. This is owing to the fact that the USAID, by decree, has more autonomy than the State and Defense Departments within the executive branch of the U.S. federal government. Hence, it has more latitude in various facets of its operations include managing its exchange-rate exposure. Standard USAID project grant and loan agreements provide that U.S. funds be exchanged for local currency at the highest rate per USD which, at the time of the transaction, is not unlawful in the recipient country. Hence, the USAID ensures that it receives the most favorable treatment possible in its foreign currency transactions.

As mentioned earlier in the paper, the USAID engages in lengthy negotiations with foreign governments for the best rate of exchange. This is especially true in countries where there is not one official rate of exchange and/or countries where hyperinflation exists. Hence, the agency is not totally at the mercy of spot exchange rates at the time a given transaction is executed. Research results indicate that the USAID is more active in managing its exchange-rate exposure than the Department of State and the DOD. However, it is still at a much lower level than techniques employed by the private sector. The federal government should be more actively involved in mitigating their exchange-rate exposure since there are some taxpayer implications as explained in the concluding section.

#### ***Derivative Usage, or Lack Thereof, in the Public Sector***

Thus far, the paper has presented policies on managing exchange-rate exposure in three U.S. federal government agencies: The USAID, the Department of State and the DOD. As mentioned earlier, these three agencies were selected due to their extensive international operations and

consequently their significant transaction exposure to foreign currencies, which is typically several billion-dollars, annually.

The previous sections, particularly data collected from internal policy memorandums that in some cases were obtained by invoking the FOIA, illustrated that mitigation techniques employed by the public sector are ad hoc at best. In other words, unlike the private sector, formal and sophisticated tools for managing exchange rate risk are not utilized in the U.S. public sector. This is despite the fact that the level of exposure of the three federal government agencies discussed in this paper mirrors that of many private sector multinationals. The lack of formal and sophisticated tools for managing exchange-rate risk sets the stage for the latter part of this paper as explained in the succeeding paragraph.

The remainder of this paper discusses a variety of tools that the U.S. federal can adopt to better manage its exchange-rate exposure. Although the use of such tools are not uncommon in the private sector, their usage is practically non-existent in the public sector. As mentioned in the preceding paragraph, the implications of the federal government's "laissez faire approach" regarding management of their exchange-rate exposure have the potential to negatively affect the U.S. taxpayer. This issue is discussed in the last section of the paper.

## **Managing Risk Resulting from Exchange-Rate Exposure**

In this section, we present tools and techniques that the federal government can use to manage the financial risks resulting from exchange-rate fluctuations.

### **Risk Management Principles**

This subsection illustrates that given the risk associated with exchange-rate exposure, how public organizations can lessen such exposure using the risk management principles and practices. A comprehensive risk management strategy for a business includes risk modeling and risk assessment (Haimes, 2004). Haimes (2004) provides comprehensive details of risk modeling methods. In addition, the National Institute of Standards and Technology provides a high-level framework for assessing and mitigating risks identified within Information Technology systems (Stoneburner, 2002; Goguen, and Feringa, 2002).

Risk assessment is usually the first, the toughest, and the most error-prone step in the risk management process. Risk or revenue loss is assessed by estimating two quantities, namely, the magnitude of the potential loss  $L$ , and the probability ( $p$ ) that the loss will occur. The risk or revenue loss  $R$  is calculated as follows:

$$R_i = L_i p(L_i)$$

$$R_{total} = \sum_i L_i p(L_i)$$

Obtaining both,  $L$ , and  $p$ , accurately is difficult for each risk-prone occurrence  $i$  because of uncertainties in the measurements. For example, the accuracy of  $L$  and  $p$  depends upon the ability of risk experts, economists, managers, and engineers to estimate the impact of events. These personnel also need to accurately estimate the impacts on the events of different probabilities. To make the calculation more challenging, risk management involves multiple metrics because of the interrelationship between these two quantities. That is, a risk-prone event with a high probability and small potential loss requires to be treated differently than the case of a risk-prone event with a low probability but a large potential loss. To help account for this interrelationship, the loss exceedance probability (EP) curves are sometimes used. The EP curves depict the loss  $L$  versus the probability  $p(L)$  that losses will exceed  $L$  (Kunreuther, 2001). Using the probabilistic risk analysis, the set of events that could produce a given dollar loss amount  $L$  are combined and the resulting probability of this loss are determined. In addition to the magnitude of losses in terms of a dollar figure, the EP

curves incorporate the uncertainty in the probability of an event occurring within 5% and 95% confidence interval curves. Based on these estimate curves, the mean exceedance probability curve is constructed.

While evaluating the risks of currency fluctuations, it should be considered that fluctuating currency-values are not simple to calculate. There are different degrees of volatility in addition to the fact that fluctuation depends on the time period. Measures such as standard deviation, beta coefficient, largest monthly loss, down market, and Sharpe ratio should be examined closely to predict financial risks.

The main argument for hedging is that it reduces a portfolio's volatility resulting from currency fluctuation. However, hedging costs tend to reduce overall returns over time, compared with an unhedged portfolio. Some organizations choose not to hedge currency exchange-rate exposure since there is a correlation between the performance of a foreign equity market and strength of the foreign currency. Another argument for not hedging is that currency fluctuations tend to wash out over an extended period of time. For organizations that do choose to hedge, numerous options are available such as forward contracts and options. Some organizations also tend to use natural hedges. In doing so, they diversify their operations globally and consequently diversify their exchange-rate exposure since currencies do not move in tandem with one another. With respect to the three federal agencies discussed in this paper, natural hedging applies to the State Department more than the DOD and the USAID. This is due to the fact that embassies and consulates constitute a worldwide operation.

### **Risk-Management Methods**

Organizations use various techniques to prevent losses resulting from currency fluctuations. This subsection lists such techniques and illustrates how such techniques work. Private companies have been using derivatives, hedging, and the revolving fund techniques for many years. However, the public sector organizations have been employing only the revolving fund technique.

Derivatives are used to shield companies from exchange-rate exposure through the effective use of various derivative instruments. Such instruments often times mitigate the effects of unfavorable exchange-rate movements by locking in a predetermined rate. These contracts are usually executed through a financial intermediary. The instruments include currency futures and forward contracts. Currency futures are traded instruments that are standardized. Forward contracts are typically negotiated through a bank and generally tend to be customized instruments.

In hedging, an organization tries to shield itself from financial losses by diversifying their business. Companies diversify themselves across many countries and currencies so that exchange-rate movements that affect their operations and subsequently their profits may have some canceling effects. Software tools that can help in hedging include spot transactions, forward outright contracts, swaps, options, and zero-cost collars. The term "spot" is used to refer to the price of one currency in terms of another. Organizations benefit or lose based on the rate of devaluation or appreciation. A forward rate is the price of one currency in terms of another for settlement on a date other than spot. In other words, the spot rate is adjusted by accounting for the interest rate differential between two currencies. Swap is a contract to exchange two currencies at one time. This helps exchange back to each company's original position in the future since the contract includes a predetermined price. An option gives the option holder the right to buy/sell an asset at a price that has been predetermined, within a time limit. A forward contract is an obligation to conduct transaction while an option is not. An option provides insurance from disadvantageous currency movements. A zero cost collar is made up of the purchase of one option and sale of another, both for the same amount, for the same time period, at the same time. A zero cost collar provides a guaranteed protection against adverse currency moves beyond a certain level is paid for by giving up gains beyond a more favorable rate.

### **Risk-Management Tools**

Software programs can be used to augment traditional trading calculations by making calculations and predictions automated. A software tool for currency exchange rate is a program that helps with foreign exchange by making exchanges fast, easy and less error-prone. For example, these tools can provide flexibility and convenience of initiating foreign exchange transactions. The tools typically perform financial calculations using conventional trading models, such as, Stochastics, Fibonacci, MacD, and moving averages. Many of these tools are available on the Internet and can be accessed with a PC with a browser, without requiring any special software. The functionality of these software tools ranges from providing only the calculation help to providing a comprehensive means and instruments for risk management. In this section, we categorize, list and describe the tools that are available for the currency-fluctuation risk management. The categories include tools for Forex, calculators, tools for futures, tools for forward and options contracts, and comprehensive tools. Each of the categories is described in the following paragraphs. The comprehensive tools are those tools which help with more than one areas of foreign exchange by making foreign exchange tasks automated, convenient and effective. We describe four comprehensive tools in detail in the last subsection.

The tools for Forex help with performing Forex-related tasks such as making predictions and performing actual trading. Such tools include Forex Killer, Forex Ambush, Forex Robot, Fap Turbo, Forex Auto Pilot, The Forex Megadroid, Forex Automoney, Forex Monster, Ivybot, and Global View.

Exclusive calculators can include currency converters, Fibonacci calculators, and futures calculators. There are many calculators available in the market which helps with general calculations related to currency-futures. Calculators are also available for foreign exchange forward contracts. We also found that Global View lists Fibonacci Calculator for retracement levels, Futures Calculators for converting futures to spot and back and International Monetary Market spot for spots where the swap dates correlate to the International Money Market cycles dates.

We found two interesting tools that help with tasks related to futures trading. (a) BESTDirect MetaTrader 4 is useful in providing risk-analysis, especially futures trading. (b) OptionsXpress provide a wide variety of futures analysis tools.

A tool named OptionsLogiX (Options, 2011) is software that helps model option strategies. A forward and option contract is an agreement on a conversion rate with an international trade to take proceeds of a future sale, and deliver U.S. dollars or foreign currency in exchange. Banks such as First National Bank provide international trade services. The advantages of using the foreign-exchange forward and option contracts are to (a) lock in a specific local currency's value for receivables denominated in foreign currency, (b) establish a fixed local currency price for payables denominated in a foreign currency, and (c) preserve the local currency value of foreign assets or liabilities.

Forward and futures contracts both allow organizations to buy or sell a specific type of asset at a specific time at a given price. Since futures contracts are exchange-traded, they are standardized contracts as opposed to forward contracts which are private agreements between two parties, forward contracts are not as rigid as futures contracts in terms and conditions. The forward contracts can default and might not be suitable to public agencies. The future contracts are guaranteed by the clearing house and therefore more suitable to public/government agencies (<http://www.optionslogix.com>, 2012).

The comprehensive tools help with more than one area of foreign exchange transactions by making foreign exchange tasks automated, convenient and effective. We describe four comprehensive tools below.

- (a) *ScotiaFX*: Scotia Capital's automated foreign exchange trading system ScotiaFX (ScotiaFX-a, 2010; ScotiaFX-b, 2010) enables company's customers to conduct foreign exchange business over the Internet. ScotiaFX provides live market rates for spot, forward contracts and swaps.

ScotiaFX provides online support for global foreign exchange dealings by providing real-time currency quotes, transaction history, and programs for transact spot, forwards and swaps in approximately 35 currencies. A software demo is available on-line for the following:

- A spot transaction: A spot transaction is a standard currency trade where settlement occurs next business day for (USD/CAD) trades and two business days for all other currencies.

Requesting a Forward Quote: A forward contract is the price of one currency in terms of another, for settlement on a future date. The spot rate is adjusted by accounting for the interest rate differential between two currencies as illustrated in the example below. A time option provides for optional delivery for a maximum of 30 days prior to maturity date.

- Swap: A swap is a foreign exchange deal which consists of a simultaneous purchase and sale of the same currency pair for different maturity dates. Even and uneven swaps can be executed on ScotiaFX.com

- Customer Transaction-History: Historical data is retained for 400 days past trade maturity.

- (b) *VantagePoint*: VantagePoint (Vantage, 2010) provides currency futures trading software. VantagePoint Intermarket Analysis Software, created by Louis Mendelsohn, forecasts Futures, Stocks, Forex, and ETF markets including currencies and claims to have up to 80% accuracy. VantagePoint 8.0, software for futures, tool has ability to forecast moving averages. It helps to predict what is likely to happen in the market. The crossover indicator flashes an early warning that the currency futures market is likely to make a top or bottom. VantagePoint 8.0 uses neural networks and intermarket analysis to arrive at its predicted forecasts. It helps predict market direction. VantagePoint for Forex forecasts 20 currency pairs arranged in two groups – Major Pairs (for example, Australian dollar and US dollar) and Cross Pairs (for example, British pound and Canadian Dollar). Users can select a package with either one or both groups depending on their trading interests (<http://www.vp.tradertech.com>, 2012).
- (c) *MFX Solutions*: Established in October 2008, MFX Solutions Inc. (“MFX”) operates globally, with headquarters in Washington, D.C. (MFX-a, 2010). MFX provides hedging and analytical tools to microfinance lenders to help them manage currency and interest rate risk (MFX-b, 2010). MFX, a new company dedicated to managing global currency risk. As per a press release, MFX, for the first time, makes the modern hedging instruments accessible in developing markets which is especially useful to the USAID since most of their work is focused on developing countries. MFX Solutions Inc. is an industry effort to address currency risk. The company attempts to do so by improving understanding of the problem and introducing better tools to hedge currency risk. The company provides decision-support tools to organizations to help them analyze their risks and better plan their funding. MFX Solutions offer cross currency swaps, interest rate swaps and forward contracts. The company offers tools that allow MFIs to stress test their balance sheets under different economic scenarios to see the consequences of currency and interest rate mismatch. These tools are available free of cost on the Internet.

What allows MFX to offer hedging in exotic high-risk currencies is their partnership with a new USD 600 million fund named TCX (The Currency Exchange Fund). TCX is innovative because it operates fundamentally differently than a bank, which can only provide a swap when it can do the opposite transaction in the market to offset its risk. TCX takes a diversification approach to risk. By taking local currency positions in say 25 or 30 currencies, it brings the overall risk down as invariably some currencies will go up and some will go down. This means TCX can provide hedges in really any country with a measurable interest rate benchmark - whether or not there is a liquid swap market. MFX has access to this special resource as an investor in TCX. For its hedging clients, MFX offer currency swap and forward contracts in high-risk currencies in regions like Sub-Saharan Africa where hedging is currently unavailable (<http://www.mfxsolutions.com>, 2012).

- (d) *The Liabilities Planning Tool*: The Liabilities Planning Tool (LPT) was developed by MFX and SimArch. It is an easy-to-use decision-support tool to assist organizations assess and value

different local and hard currency loan options using their own situation and balance sheet data (MFX-c, 2010).

Government agencies often have multiple options for funding such as local capital markets either via loans or deposits, hard currency loans from abroad and in some cases, local currency loans from international lenders who are able to hedge their currency risk. However, they do not have simple, understandable tools for evaluating their choices in a way that captures all of the implications and risks of a particular funding decision. In addition, they do not have a way to look at options under different economic scenarios so that they are able to do proper contingency planning.

The LPT tool helps organizations compare various loan offerings in different currencies and terms, evaluate a variety of complex factors – potential currency and interest rate volatility, how each option would offset or augment the risk of the organization’s existing liabilities, how it would match existing or expected assets, and so forth. The tool allows for the decision-maker to make sense of all of these factors, and come up with a clear picture of the financial trade-offs involved with a particular choice. For example, an organization looking at a 3-year dollar floating rate loan at LIBOR+3% vs. 2-year fixed local currency loan at 12% might find that a lower rate hard currency loan is better for profitability but at the same time requires that additional capital be set aside for regulatory capital adequacy. Or a decision that might make sense in the near-term might change the institution’s credit rating by adding currency risk, raising its cost of funds in the future. The tool allows the user to weigh these factors and attach a cost to them. In this way, the organization can compare the impact of a hard currency loan and a local currency loan with different terms and features.

LPT allows the manager to test various scenarios- with different interest rate and currency fluctuations- and assess the likelihood and implications of various outcomes. The tool is not designed to give “the correct answer”, but it allows the user to make informed decisions. Therefore, the tool is an important planning device for organizations developing their funding strategy. It is particularly useful for institutions that are in the process of transforming into full-fledged regulated. The tool is also configured so that the user is able to use it to quantify the effect of local currency lending on its own credit profile, helping the user to provide risk-appropriate pricing on the local currency loans they offer.

LPT gets some information from the user and it calculates the rest, which area as follows. First, a user completes free, online registration. The user then loads assets, liabilities, and any other items such as other income and expenses. Then, the user enters the forecast-period. The tool calculates the current-quarter assets but the use is required to enter the forecasted growth per annum as well as a yield per annum for user assets. Next, the tool calculates the current liabilities but the user is required to forecast the liabilities by entering the growth and yield per annum for the period that the user selects. The tool calculates the current other-item but the user is asked to forecast other-income, operating expenses and a marginal tax rate.

The user can specify capital adequacy, which is typically used by a regulated company, by entering risk-weights. The user can also specify the required minimum capital. The tool calculates Risk-Weighted Assets (RWA) and capital ratios for every quarter by covering the forecast period selected by the user. Any change in the forecasts or in the economic indicators is immediately updated and used in the calculations. The tool calculates funding gap per quarter for the forecast period. A foreign exchange gain or loss is calculated. This FX gain is included in the net-income-after-tax figure per quarter. The FX gain/loss and net-income-after-tax are merely for information purposes. These numbers are used to calculate certain ratios but do form part of the funding gap. The following functions are available and can be used when trying to fill the user’s funding gap:

- Forecast (Assets, Liabilities & Other Items can be amended from here)
- Economic Environment (Users can View and Amend economic indicators per Year or per Quarter)
- Reporting (Users can run reports from here)

The LPT tool displays a line item called FX Exposure (in %) under the funding-gap. A barometer indicating whether the FX Exposure is High, Medium or Low is also displayed. The reading is recalculated every time a loan is added, edited or deleted. The currency risk varies country by country and is highly dependent on whether the user is in a high volatility country vs. a low volatility country. The formula for FX Exposure is:  $(\text{Net Hard Currency Assets and Liabilities} \times \text{FX volatility (for all currencies)}) / \text{Equity}$ . Equity equals Tier 1 Capital.

As the LPT program is all about forecasting and preventing foreign currency risk, the economic forecast calculations are very important. As with all forecasting screens in the program, there's an economic forecast by year and a forecast by quarter. These screens are available on the menu bar on the main page, and on the menu bar on the funding gap page. All menu items on the funding gap page open pages in a new window so users can see both users' economic environment and users' funding gap. This way it's much easier to simulate changes in the economy, and examine the effect on the users' funding gap, without too much closing and opening of pages. These calculations are revised automatically.

The economic data is split into 2 parts: historical data and forecasted data. The historical data contains actual reported data. The historical data is only available by year, and the data is not updateable. The historical indicators are always the data as at the end of the year. The forecasted data is available by year and by quarter. The GDP and inflation ratios are the officially reported forecasts (forecasts available at the time of the last update of the economic data of the program generally from the IMF). All other ratios are calculated by the program. Therefore, users do not need to update any of the ratios if they have more recent and/or more accurate information available.

To assist users in making user forecasts, the tool contains a few calculators: There's a relation between the inflation of the users' country, US inflation and FX/USD. There's also a relation between the inflation of users' country, Europe inflation and FX/EUR. Users can calculate the FX rates if the user enters inflation data (local, US and Europe) and then clicks on the button 'Forecast FX rates'. Users can also calculate the local inflation out of the FX/USD rate: input FX/USD rate (and US Inflation), click on the button 'Forecast Inflation' and local inflation and FX/EUR are calculated.

## **Conclusion**

Risk management has been a challenge faced by almost all organizations in this global economy and a major cause of worldwide downturn of many countries' economies. However, few methods have been used by government agencies that could help them alleviate financial losses resulting from currency fluctuations. In this paper, we analyzed the risk of exchange-rate fluctuations faced by three government agencies, which were the USAID, the Department of State, and the DOD. We presented different currency risk-minimization methods that can be used by these agencies. Then, we presented software tools that can be valuable devices for estimating, managing, and minimizing their financial risks that result from exchange-rate fluctuations. We also put the tools in different categories depending on the types of uses, and provided the details of how these tools work, including ScotiaFX, VantagePoint, MFX, and the LPT.

Mitigating exchange-rate risk has been actively employed by the private sector for decades since failure to do so would elicit sharp criticism from shareholders. With respect to the public sector, the American taxpayer is the "shareholder." Losses resulting from lax exchange-rate management are typically passed on to taxpayers in the form of higher taxes. The U.S. taxpayer should be very interested in this study since it demonstrates yet one more expense they are picking up which could be avoided with the adoption of some formal and sophisticated risk management techniques as opposed to the ad hoc procedures that are currently in place. The authors envision that the research presented in this paper, and future research on this topic, will thrust the U.S. federal government in taking a more active role in hedging exchange-rate exposure. We consider this impetus to be the primary contribution of this paper.

## References

- Haimes, Y. (2004), *“Risk Modeling, Assessment, and Management”*, Hoboken, NJ, Wiley-Interscience.  
<http://www.defense.gov>, accessed on June 20, 2012.  
<http://www.mfxsolutions.com>, accessed on June 20, 2012.  
<http://www.optionslogix.com/index.php>, accessed on June 20, 2012.  
<http://www.state.gov>, accessed on June 20, 2012.  
<http://www.usaid.gov>, accessed on June 20, 2012.  
<http://www.vp.tradertech.com/vantagepoint/default.asp>, accessed on June 20, 2012.
- Jorion, P. (1990), *“The Exchange-rate Exposure of U.S. Multinationals”*, *Journal of Business*, Vol. 63, pp.331-345.
- Krishnamoorthy, A. and Shetterly, D. (2003), *“Exchange-rate Exposure, Financial Derivatives and the U.S. Department of Defense”*, *Published in the 2003 Academy of Finance Proceedings*.
- Krishnamoorthy, A. and Shetterly, D. (2006), *“Exchange-rate Exposure in the Public Sector: A Study of the U.S. Department of State”*, *Published in the 2006 International Management Development Association Proceedings*.
- Krishnamoorthy, A. and Shetterly, D. (2007), *“Currency Risk Management in the Public Sector: A Study of the U.S. Agency for International Development, Presented at the 2007 International Management Development Association Meeting, Maastricht, Netherlands*.
- Krishnamoorthy, A. and Shetterly, D. (2008), *“Best Practices in Currency Risk Management in the Public Sector”*, *Published in the 2008 International Management Development Association Proceedings*.
- Kunreuther, H. (2001), *“Mitigation and Financial Risk Management for Natural Hazards”*, *The Geneva Papers on Risk and Insurance*, Vol. 26, No. 2, pp.276-295.
- Stoneburner, G., Goguen, A., and Feringa, A. (2002), *“Risk Management Guide for Information Technology Systems”*, NIST Special Publication 800-30, July, Falls Church, VA.
- Treasury Financial Manual (2002), <http://www.fms.treas.gov/tfm/vol1/01-07.pdf>, accessed on June 20, 2012.
- USAID (1987), U.S. Agency for International Development Exchange Rate Policy Guidance, State 1860822, June 17.
- USAID (1991) U.S. Agency for International Development Policy Determination – Local Currency, PD-18, July 30.