Vehicle Currency Choice for Small Firm Exporters

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This study offers short-term (1 to 3 months) and medium term (3 to 12 months) vehicle currency candidates to help small firm exporters hedge against US dollar value and volatility. A visual inspection of exchange rate trends, simple linear regression, standard deviation and risk-adjusted value change (RAVC) applied to seven major currency exchange rates over a six-month period (September 2008 to February 2009) favors the Japanese yen as the short-term vehicle currency. Using 10-year exchange rate data (April 1999 to February 2009), two time-varying volatility models; GARCH(1,1) and the Ornstein-Uhlenbeck process together with RVAC identify the Japanese yen, Canadian dollar and Swiss franc as medium-term vehicle currencies. Ongoing analysis to select short- and medium-term vehicle currencies benefits the small firm exporter by aligning selection with their time horizons and would ideally be a service of the United Nations, World Bank or the International Monetary Fund.

INTRODUCTION

Over the past century, the global trading currency of choice has shifted from the pound Sterling to the US dollar (Broz, 1997) which has experienced considerable volatility as a result of the 2007 subprime mortgage crisis and resulting global financial crisis (Mathis et al, 2009). Small firm exporters exposed to local currencies of limited liquidity and unpredictable value, and invoices denominated in US dollars may gain advantage by identifying a vehicle (non-local) currency outperforming their US dollar cash holding. The contribution of this study is to offer the small firm exporter a choice in vehicle currency selection; for short-term (1 to 3 months) and medium-term (3 to 12 months) advantage after US dollar denominated invoice payment has been received.

Managing Currency Risk

Various forces shape the exporter's trade contract choice of an invoicing currency which may be influenced by the locus of power exerted by the buyer (Carse et al, 1980, Friberg & Wilander, 2009); exporter (Gehrmann et al, 1978); administrative ease and tradition (Fukuda & Ono, 2006;

Piercy, 1983); market position and competition (Javaid, 1985); and industry features and country size (Goldberg & Tille, 2009). Acquiescing to the buyer's currency choice for payment is a suboptimal choice resulting in a lower level of export profit margins (Samiee & Anckar, 1998). Complicating currency choice is the exporter's strategic posture, from interest in strategic alliances (Perdue & Summers, 1991) to a one-time transaction with each customer (Samiee & Walters, 1991).

Though portfolio and related approaches advocate multi-currency distributed risk, a single vehicle currency offers the small firm exporter simplicity in selection, management and short- to medium-term advantage. This is consistent with transaction cost theory and medium of exchange role (Black, 1991; Krugman, 1980) which advocates use of a monopoly international currency.

A viable non-US dollar vehicle currency should reflect high foreign exchange liquidity, low transaction costs (Swoboda, 1969; Rey, 2001) and a vehicle currency's host-country with the least volatile monetary shocks (Devereuz et al, 2004; Giovannini, 1988). As a group, small firm exporters trading in specialized (homogenous goods) markets are likely to be invoiced in a single low transaction currency (McKinnon, 1979) leading to inertia against an alternative pricing currency (Krugman, 1980). In addition, there is a herding effect wherein exporters limit their invoice currency to that used by their competitors (Bacchetta & van Wincoop, 2005) with the added drawback of setting export prices before the exchange rates are known (Fukuda & Ono, 2006). In contrast to the existing literature which focuses on invoice price setting (Baron, 1976; Donnenfeld & Zilcha, 1991; Friberg, 1997), the complexity of behavioral and technical hurdles against invoice currency specification by small firm exporters and advances in global banking technology encourage a simple response, to switch to a vehicle currency immediately *after* the US dollar invoice is cashed. The following sections examine seven currency data to identify suitable short- and medium-term vehicle currencies.

METHOD

Data

Of the $3.5 trillion in allocated foreign exchange reserves, the International Monetary Fund (2009) reports the notable currencies and their proportion of official foreign exchange reserves in the third quarter of 2008 (preliminary estimates) as the US dollar (65.3%), Euro (25.1%), British pound (4.4%), Japanese yen (2.9%) and Swiss franc (0.2%). According to Investopedia (2008), the US dollar index (USDX) is a weighted geometric mean of the dollar's value compared to six currencies; the Euro, Japanese yen, British pound, Canadian dollar, Swiss franc and Swedish krona. We add the Australian dollar such that all seven currencies mirror the US Federal Reserve's major currency index (Federal Reserve Board, 2005). We use the US dollar as the base currency for each exchange rate even though exchange rates do vary according to the selected numeraire currency (Hovanov et al, 2004). This exchange rate nuance is not considered in this study given the predominance of the US dollar in world trade.

The seven-currency exchange rate data were sourced from the Federal Reserve Bank of New York based on a sample of noon buying rates in New York for cable transfers payable in foreign currencies (Federal Reserve Board, 2009). The seven-currency daily exchange rate series spans the period April 1, 1999 to February 27, 2009. The data analysis and findings are divided into two parts; the first focuses on short-term (1 to 3 months) vehicle currency candidates based on the most recent 12-month exchange rates, and the second part on medium-term (3 to 12 months) vehicle currency candidates using the entire 10-year exchange rate time series.

ANALYSIS AND FINDINGS

Short-Term Vehicle Currency Selection: Simple Regression Analysis

We start with a visual inspection of the 12-month exchange rate time series for each of the seven currencies from March 2, 2008 to February 27, 2009 as shown in Figure 1. Panels A1 to G1 show the daily exchange rate numeraire as the US dollar, and panels A2 to G2 report daily exchange rate standard deviations. With the exception of the Japanese Yen, all currencies exhibit a marked increase in exchange rate volatility and weakening against the US dollar starting in September 2008 (See Figure 1).

We therefore limited the analysis to the most recent 6-month period, September 2, 2008 to February 27, 2009. Table 1 presents each currency's best fit linear model with R^2 in the 4% to 84% range with significant F statistics ($p<.05$). Based on the strength of the t-statistic (H_0: $\beta_1 = 0$), all the currencies report significant ($p<.05$) non-zero slopes (β_1). The Japanese yen is the only currency with desirable a negative slope indicating a strengthening valuation against the US dollar (See Table 1).

Given exchange rate dispersion is likely to have a significant role in any forecast; each exchange rate standard deviation time series was divided by its mean to remove differences in the magnitude of exchange rate among the currencies. The currencies with the lowest dispersion are the Japanese yen and Swiss franc.

Based on data from Table 1, Table 2 ranks each currency's value (regression slope), volatility (series standard deviation) and Risk-Adjusted Value Change (RAVC) defined as: RAVC = C/R.

Where C is a currency's daily log returns against the US dollar, and R is the corresponding currency's average volatility.

RAVC provides a currency's appreciation or depreciation per unit of risk, with the Japanese yen the sole appreciating short-term currency. Results from Table 2 all point to the Japanese yen as the vehicle currency of choice for the short-term of 1 to 3 months (See Table 2).

Medium-Term Vehicle Currency Selection: Time-Varying Volatility Analysis

To isolate vehicle currencies exhibiting the lowest medium-term (3 to 12 month) volatility, we use the GARCH (1, 1) model, ostensibly one of the most popular volatility models offering implied long-run average volatility. This is followed with the Ornstein-Uhlenbeck process which reports long-run average volatility. GARCH (1,1) is expressed as follows.

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 \tag{1}$$

$$\sigma_L = \frac{\alpha_0}{1 - \alpha_1 - \alpha_2} \tag{2}$$

Where σ_t is the volatility (standard deviation) on day t, ε_t is the percentage change in the exchange rate on day t, and σ_L is the long-run average volatility implied by GARCH (1,1). The Ornstein-Uhlenbeck process is expressed as the following continuous-time stochastic differential equation.

$$d\sigma_t = \lambda(\mu - \sigma_t)dt + \varphi dW_t \tag{3}$$

Where σ_t is the volatility, λ is the speed adjustment, μ is the long-run average volatility, φ is the volatility of σ_t, and dW_t is the Wiener process that follows the Gaussian distribution with a mean of zero and a variance of dt. Given the use of daily exchange rate data, using exact discretization, we convert the continuous-time process into a discrete-time process (Gourieroux & Jasiak, 2001; Klebaner, 1998).

$$\sigma_t = \mu(1 - e^{-\lambda}) + e^{-\lambda}\sigma_{t-1} + \varphi\sqrt{\frac{1-e^{-2\lambda}}{2\lambda}}\eta_t \quad (4)$$

Where η_t is a standard Gaussian white noise because using daily data produces the variance of the Wiener process equal to one. Therefore, for our estimation purpose, equations (1) and (4) are used. We calculate daily log returns to estimate GARCH (1, 1) and daily standard deviations to estimate the Ornstein-Uhlenbeck process using 30-day log return series.

We apply the iterative maximum likelihood method proposed by Hull (2006) to estimate parameters of GARCH (1,1) and the regular maximum likelihood method to estimate parameters of the Ornstein-Uhlenbeck process. Panels A and B in Table 3 show estimation results for GARCH (1, 1) and the Ornstein-Uhlenbeck process (See Table 3).

Table 3 shows the Canadian dollar dominating the other currencies for the entire time series data in terms of long-run average volatility and RAVC, while the Swiss franc and the Japanese yen compete on the basis of RAVC. Specifically, in Table 3, Panel B, the high value of the speed adjustment (λ) for the Swiss franc and the Japanese yen suggests that the volatility of these two currencies tends to stabilize rapidly relative to the other currencies. As a result, RAVC and volatility stability support the Canadian dollar, Swiss franc, and Japanese yen as the medium term (3 to 12 months) vehicle currency.

CONCLUSIONS

For short-term vehicle currency selection, we have purposely limited the computational level to the use of a PC spreadsheet and online access to the Federal Reserve Bank's exchange rate data to parallel the limited technological and financial expertise most small exporters possess. It would therefore be feasible for those small exporters to repeat this approach on a monthly basis and use the results to make any necessary adjustments to their vehicle currency choice.

Visual examination of the seven currency exchange rate trends, simple regression slopes, standard deviations and RAVCs all support the Japanese yen as the short-term (1 to 3 months) vehicle currency for small firm exporters once their US dollar contracts are cashed. For the medium-term (3 to 12 months) the GARCH (1,1), the Ornstein-Uhlenbeck process and RAVC support the Canadian dollar, Swiss franc, and Japanese yen.

Managerial Implications

We summarize with the following scenario. Assume a small firm exporter is interested in capital expenditures and possess US dollar denominated cash reserves as a result of recent payment receipts. To hedge against a value volatile US dollar, our vehicle currency results encourage the small firm exporter to convert their US dollar cash into Japanese yen over the short-term (1 to 3 months); the Canadian dollar, Swiss franc, or Japanese yen for the medium term (3 to 12 months). Clearly, if the small firm exporter wishes to limit their selection to a one-time vehicle currency over a 12 month period, we recommend the Japanese yen.

In sum, this paper ignores daily or weekly cash flow currency management by focusing on the preservation of cash for investments over a 1 to 12 month future time frame. By offering graphic exchange rate trends, simple regression, standard deviation, and risk-adjusted value change as a viable tools for vehicle currency selection, the analysis and results could be offered on an ongoing basis in various languages via the Internet. To assure widespread distribution and support, we envision sponsorship by organizations such as the United Nations, World Bank or International Monetary Fund benefiting small firm exporters world-wide with short- and medium term vehicle currency selections. There are two lingering issues regarding such an initiative – institutional and methodological trust. The ongoing global financial woes challenge hitherto institutions of questionable ethic to offer value to small firm exporters who employ locally and engage in global trade. We deliberately selected exchange rate charts, simple linear regression, standard deviation and RAVC as tools for short-term vehicle currency selection likely to engender trust by virtue of its widespread use and ease of interpretation.

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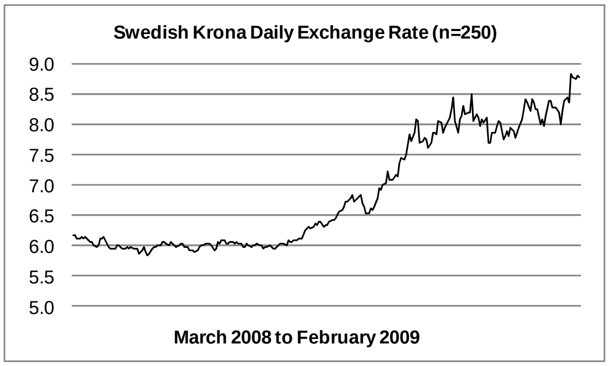
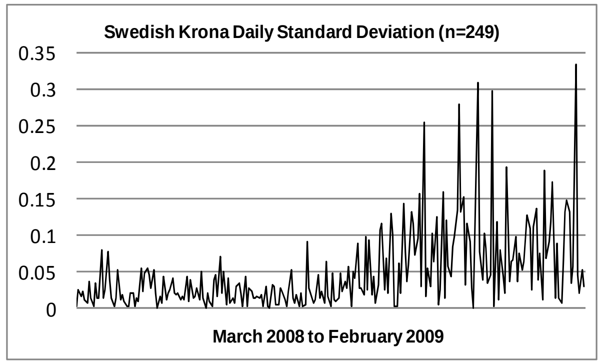
FIGURE 1
MULTI-CURRENCY DAILY EXCHANGE RATE AND DAILY EXCHANGE RATE STANDARD DEVIATION PER US DOLLAR

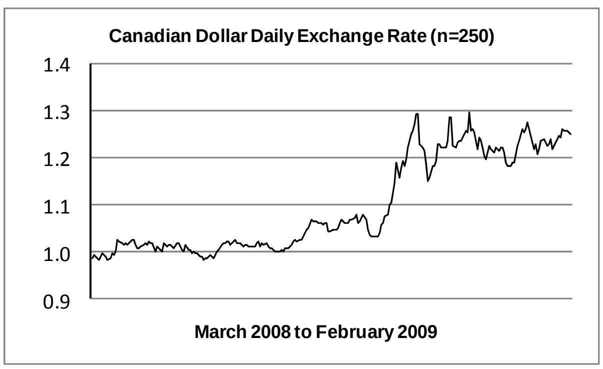
Panel A1. Swedish Krona daily exchange rate



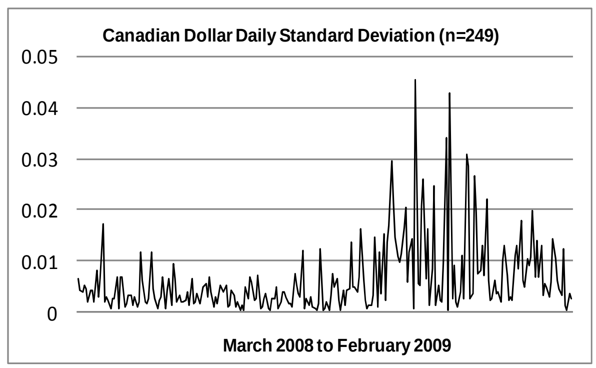
Panel A2. Swedish Krona daily SD



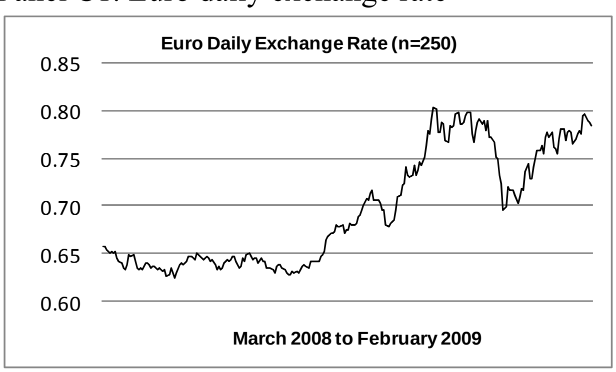
Panel B1. Canadian Dollar daily exchange rate



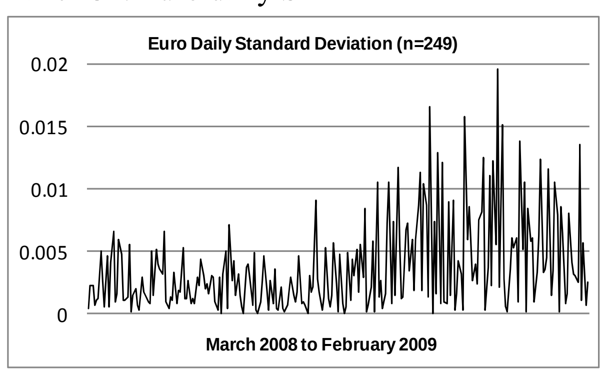
Panel B2. Canadian Dollar daily SD



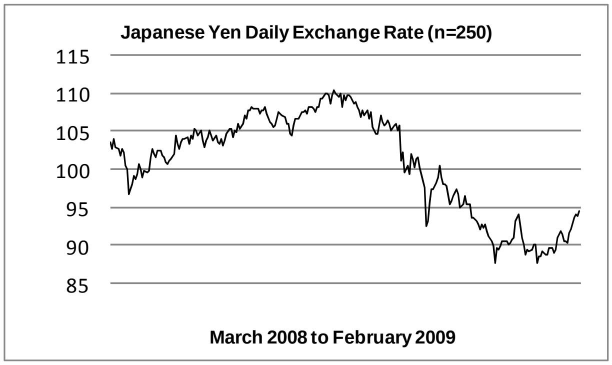
Panel C1. Euro daily exchange rate



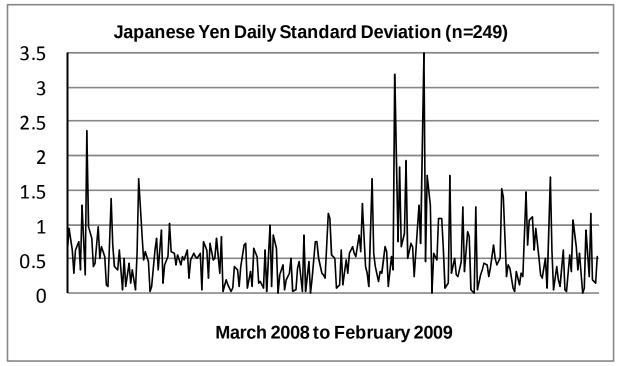
Panel C2. Euro daily SD



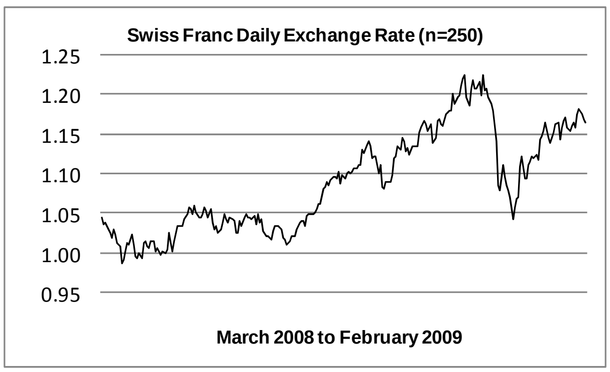
Panel D1. Japanese Yen daily exchange rate



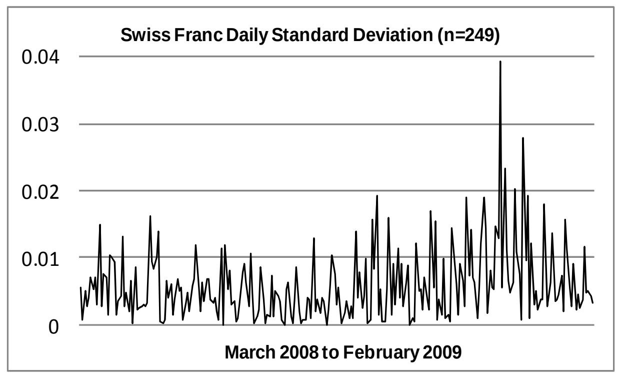
Panel D2. Japanese Yen daily SD



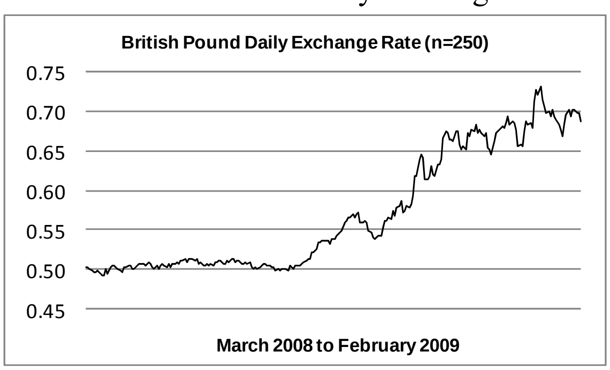
Panel E1. Swiss Franc daily exchange rate



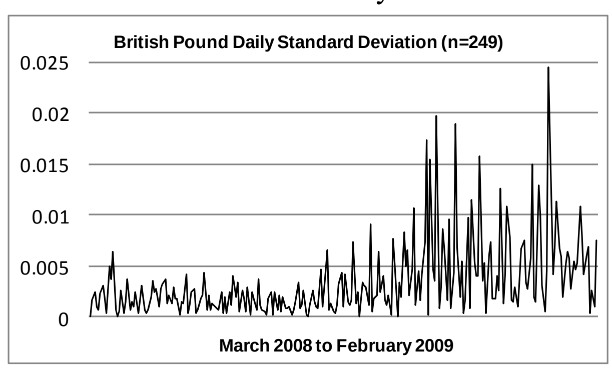
Panel E2. Swiss Franc daily SD



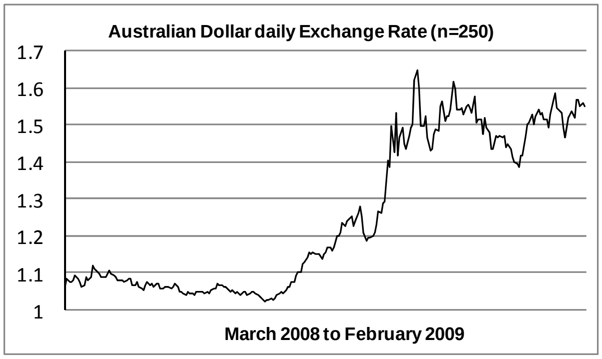
Panel F1. British Pound daily exchange rate



Panel F2. British Pound daily SD



Panel G1. Australian Dollar daily exchange rate



Panel G2. Australian Dollar daily SD

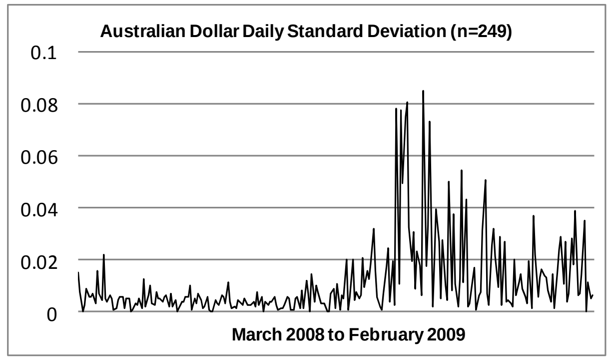


TABLE 1
MULTI-CURRENCY DAILY EXCHANGE† RATE SLOPE AND STANDARD DEVIATION†† (SEPTEMBER 2, 2008 TO FEBRUARY 27, 2009; n=122)

Currency	Linear model	R^2	F	t	df	SD
JPY: Japanese yen	-4.9x + 527.8	71.7%	304.7**	-17.5**	121	.0064
SEK: Swedish krona	48.8x – 317.9	78.9%	449.8**	21.21**	121	.0101
CHF: Swiss franc	171.9x – 135.3	3.7%	4.7*	2.16*	121	.0064
AUD: Australian dollar	202.2x – 231.6	47.0%	106.2**	10.31**	121	.0128
CAD: Canadian dollar	355.9x – 362.9	55.5%	149.8**	12.24**	121	.0076
EUR: Euro dollar	526.5x – 334.03	28.0%	46.7**	6.84**	121	.0069
GBP: British pound	587.8x – 316.0	83.6%	611.1**	24.7**	121	.0081

†The daily exchange rate is expressed as units of currency per US dollar
††Exchange rates were divided by their mean before computing standard deviations.
*p<.05, **p<.0001

TABLE 2
MULTI-CURRENCY VALUE, VOLATILITY AND RISK-ADJUSTED VALUE CHANGE (RAVC) RANKS AND SCORES (SEPT. 2, 2008 TO FEB. 27, 2009)

Currency	Value		Volatility		RAVC	
	Rank†	Score	Rank††	Score	Rank	Score
JPY	1	1	1	1	1	-0.0014
SEK	2	55	6	1.58	2	0.0359
CHF	3	178	1	1	3	0.0666
AUD	4	208	7	2	4	0.1295
CAD	5	362	4	1.19	5	0.1618
EUR	6	532	3	1.08	6	0.2374
GBP	7	594	5	1.26	7	0.3848

†Slope estimates from Table 1 transformed to assign 1 for the best exchange rate going forward.
††Mean exchange rate standard deviation from Table 1 is transformed to assign 1 for the lowest risk.

TABLE 3
PARAMETER ESTIMATION AND LONG-RUN AVERAGE VOLATILITY FOR GARCH (1, 1) AND ORNSTEIN-UHLENBECK PROCESS

Panel A: GARCH(1, 1): April 1, 1999 to February 27, 2009 exchange rates data							
Parameter	CAD	EUR	CHF	GBP	SEK	JPY	AUD
α_0	.00000071	.00000050	.00000082	.00000069	.00000044	.00000070	.0000009
α_1	.07126118	.03820762	.04184231	.06039571	.04781435	.03803434	.0581394
α_2	.90000001	.94976165	.94124346	.91823755	.94604535	.94616874	.9274462
σ_L (Annualized σ_L)	.00496596 (.0788321)	.00641592 (.1018497)	.00695508 (.1104084)	.00566339 (.0899035)	.00845201 (.13417150)	.00663663 (.10535324)	.0079154 (.125653)
RAVC	-.0145	-.0042	-.0089	.0103	.0055	-.0081	-.0019
Panel B: Ornstein-Uhlenbeck: April 1, 1999 to February 27, 2009 exchange rates data							
Parameter	CAD	EUR	CHF	GBP	SEK	JPY	AUD
μ (Annualized μ)	.00497717 (.07901012)	.00604049 (.0958898)	.00656039 (.1041429)	.00536836 (.0852200)	.00679105 (.10780458)	.00636560 (.10105077)	.0073772 (.117110)
λ	.00450140	.00861469	.01031238	.00792144	.00923132	.00902775	.0049560
φ	.00022186	.00024407	.00026895	.00023288	.00029332	.00029709	.0004031
RAVC	-.0144	-.0045	-.0094	.0109	.0068	-.0085	-.0020

We use the maximum likelihood method to estimate parameters. We convert μ and σ_L into the annualized long-run average volatility by multiplying it by the square root of 252. The risk-adjusted value change (RAVC) is calculated as the ratio of the daily average of change in each currency value to the long-run average volatility obtained by each model, where a negative value indicates currency appreciation, and positive value for currency depreciation.