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The Determinants of Exchange Rate Regime and Impacts upon the Stability of Economy: Experiences from Australia

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This paper aims to detect the determinants of the Australian Dollar-U.S. Dollar exchange rate regime and identify the relationship between the exchange rate dynamics and the stability of Australian economy. The hypothesis of whether the exchange rate regime liberalization influences the volatilities of Australian exchange rate and Australian GDP growth rate significantly is tested based on data from 1970 to 2011 with quarterly frequency. The methodology involves a series of econometric tests including the Binary Choice Model, the Exponential Generalized Auto-Regression Conditional Heteroskedasticity Model and the Generalized Auto-Regressive Conditional Heteroskedasticity Model. The conclusions are that Australian exchange volatility transfers to Australian GDP growth rate volatility not only directly but also indirectly through other macroeconomic variables and exchange rate regime liberalization stables Australian GDP growth at the cost of increased exchange rate volatility in the short run while decreases exchange rate volatility at the cost of increased Australian GDP growth rate volatility in the long run. Thus, policy makers need to set both direct and intermediate targets to conduct monetary policies and balance between Australian GDP growth rate volatility and Australian exchange rate volatility.

1. Introduction

As an important macroeconomic indicator, the Australian Dollar-U.S. Dollar exchange rate regime has developed from the fixed regime (Q1, 1945 to Q4, 1973), through the managed floating (Q1, 1974 to Q3, 1983), to the independently floating (Q4, 1983 to present). The current Australian exchange rate regime is market-oriented since nearly all foreign exchange controls in Australia are removed, although the Reserve Bank of Australia still retains discretionary power to intervene in the exchange market.

Extensive research has been conduct about modeling the choice of exchange rate regime and its influence mechanism upon Gross Domestic Product (GDP) growth. However, modeling the interaction mechanism between exchange rate regime choice and GDP growth endogenously within the same system has been researched rarely and remains as a research gap in the literature.

This paper endogenizes the determinants of the exchange rate regime, the exchange rate dynamics and GDP growth within one system to capture their interaction mechanism jointly. The findings will fill in the research gap and shed light on policy makers about choosing the optimal exchange rate regime to benefit the economic development ultimately.

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The paper is organized as follows. The first part reviews literature in modeling exchange rate dynamics and GDP growth; the second and the third parts involve theoretic modeling and empirical analysis; and the final part concludes the main findings.

2. Literature Review

On the one hand, the impacts of GDP growth upon the choice of exchange rate regime have been discussed heatedly among scholars. Rizzo (1998) identified that for developing countries, the choice of exchange rate regime tends to be fixed, which stemmed from the level of economic development, the degree of openness and geographical diversification of foreign trade; while for the developed country whose trade were diversified, flexible exchange rate regime was preferred since this flexibility facilitated the absorption of foreign shocks. Hagen and Zhou (2002) analyzed exchange rate regime choices of the 25 transition economies to conclude that a credible exchange rate peg was essential in the determination of exchange rate regimes. Juhn and Mauro (2002) found that the level of economic growth was associated with the exchange rate regime choice in terms of positive correlation with floats and negative correlation with pegs, although the relationships were not robust. Rogoff, Husain, Mody, Brooks and Bordo (2003) stated that both industrialized and emerging economies tend to adopt a managed float or intermediate exchange rate regime due to economic development and integration. Oomes (2003) summarized that as the economy matured, the value of exchange rate flexibility rose, specifically, for countries with lower financial development and integration, fixed or relatively rigid exchange rate regimes offered anti-inflation credibility gain, while for countries with advanced development, flexible exchange rate regimes were preferred. Güçlü (2008) revealed that the choice of exchange rate regime was influenced more by the level of economic development, inflation differential and political factors, and less by the current account deficit/surplus and capital account openness.

On the other hand, the influence of exchange rate regime choice upon GDP growth has been researched extensively in the literature. Sturm and Haan (2001) indicated that inappropriate choice in exchange rate regime induced higher volatility in exchange rate dynamics, which in turn caused greater variations in GDP. Huang and Malhotra (2004) discovered that for advanced economies, choice of regime did not affect the economic growth and its variability significantly, although more flexible exchange rate regimes were associated with higher rate of growth; while for the developing and emerging economies, choice of regime affected the economic growth but did not affect its variability. Sokolov and Lee (2008) concluded that non-industrialized countries pursuing the matched floating exchange rate regime grew faster than those pursuing matched peg exchange rate regime and that the fear of floating exchange rate policy was the most growth promoting. Aghion, Bacchetta, Ranciere and Rogo (2008) demonstrated that for countries with lower financial development, flexible exchange rate and higher volatility of exchange rate generally reduced economic growth, while for countries with higher financial development, the choice of exchange does not generate significant impacts upon economic growth. Petreski (2009) elucidated that the exchange rate regime influenced the economic growth through the channels of trade, investment and productivity, he also recommended that policy makers should find a balance between reduction of exchange regime policy uncertainties and adjustment mechanism in time of shocks.

However, previous research used to either evaluate the choice of exchange rate regime under given level of economic development or analyze the impacts upon economic growth generated by presumed exchange rate regime. The simultaneous interaction mechanism between exchange rate regime and economic development has rarely been discussed. Hence, this paper fills in this research gap by modeling the choice of exchange rate regime and economic development within the same system both simultaneously and dynamically. Since Australia experiences the whole exchange rate liberalization process, this paper aims to test the hypothesis of whether exchange rate liberalization generates significant impacts upon exchange rate volatility and GDP growth through this endogenous and simultaneous model.

3. Theoretical Modeling

3.1. Model Specification

Define the nominal Australian Dollar-U.S. Dollar exchange rate as the variable Et and its simple return takes the form of $RE_t = \frac{E_t - E_{t-1}}{E_{t-1}}$; the Australian GDP as Yt and its growth takes the form of $RY_t = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$; the ten year government bond rate as RB_t; the inflation rate as $I_t = \frac{P_t - P_{t-1}}{P_{t-1}}$.

3.1.1. Binary Choice (Probit) Model

The binary choice (probit) model is presented to explain the rational reasons behind the choice of a flexible exchange rate regime for a developed country. The baseline model of regime choice is a variant of Markiewicz's (2006) model. The choices of exchange rate regimes are described using a discrete variable D_t with its specification below,

$$D_t = \begin{cases} 0 & \text{if a peg regime is chosen by Australia in year t} \\ 1 & \text{if a floating regime is chosen by Australia in year t} \end{cases}$$

Where the probabilities P_i for i=0, 1 satisfy the condition of $\sum_{i=0}^{1} P_i = 1$. The exchange rate regime choice is based on the continuous latent variable A_t^*, which measures the attractiveness of the floating exchange rate regime in year t and is formulated as a linear function of macroeconomic variables such that,

$$A_t^* = \delta_0 + \delta_1 RY_t + \delta_2 RE_t + \delta_3 I_t + \delta_4 RGB_t + \delta_5 RIC_t + V_t$$

Where the error term V_t is identically and independently distributed following a normal distribution function with mean 0 and variance $\frac{\pi^2}{3}$.

The likelihood of choosing peg regime or floating regime is defined as the probabilities of the underlying latent variables' values.

Assume the threshold is C, if the latent variable A_t^* falls below the threshold C, Australia chooses the peg regime; if the latent variable A_t^* falls above the thresholds C, Australia chooses the floating regime. Specifically,

$$D_t = \begin{cases} 0 & \text{if } A_t^* < C \\ 1 & \text{if } A_t^* > C \end{cases}$$

Hence,

$$\Pr(D_t = 0) = \Pr(A_t^* < C) = \Pr(\delta_0 + \delta_1 RY_t + \delta_2 RE_t + \delta_3 I_t + \delta_4 RGB_t + \delta_5 RIC_t + V_t < C)$$
$$\Pr(D_t = 1) = \Pr(A_t^* > C) = \Pr(\delta_0 + \delta_1 RY_t + \delta_2 RE_t + \delta_3 I_t + \delta_4 RGB_t + \delta_5 RIC_t + V_t > C)$$

The coefficient estimates of the explanatory variables and threshold C are obtained by maximizing the likelihood function via the quadratic hill climbing algorithm.

3.1.2. Volatility Measurement and Heteroskedasticity Test

The volatility of exchange rate is measured as the sample standard deviation in terms of $\hat{\sigma}_t^2 = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(r_t - \bar{r})^2}$, where $\bar{r}$ is defined as the sample average return over the T quarters in terms of $\bar{r} = \frac{1}{T}\sum_{t=1}^{T} r_t$.

Before applying the generalized autoregressive conditional heteroskedasticity (GARCH) model, the residuals of the exchange rate return series are examined against heteroskedasticity using the Lagrange Multiplier test proposed by Engle (1982).

Initially, run the ordinary least squares regression of the conditional mean equation which is a autoregressive moving average ARMA(1,1) process and obtain the residuals ε_t.

Conditional mean equation: $RE_t = \alpha_1 RE_{t-1} + \varepsilon_{E,t} + \beta_1 \varepsilon_{E,t-1}$

Then regress on the squared residuals $\varepsilon_t{}^2$ on a constant and 1 lag to obtain the following,

$$\varepsilon_{E,t}^2 = \gamma_0 + \gamma_1 \varepsilon_{E,t-1}^2 + \omega_t$$

The effect of ARCH (1,1) is tested.
$H_0;\ \gamma_1 = 0$
$H_1;\ \gamma_1 > 0$
The test statistics $T \cdot R^2$ follows approximately $\chi^2(1)$ distribution.

3.1.3. The Exponential Generalized Auto-Regressive Conditional Heteroskedasticity Model (EGARCH)

The EGARCH model is applied here to capture the exchange rate dynamics' volatility clustering, volatility persistence and the leverage effects in terms of volatility's asymmetric responses to positive and negative shocks. Both size and sign effects are examined in a non-linear formulation. The following EGARCH (1,1) specification is an extension of Nelson's model (1991).

EGARCH Model for the Exchange Rate E_t:
Mean equation:
$E_t = \mu_E + \varepsilon_{E,t} =$
$C_0 + C_1 \cdot \text{Australian GDP Growth}_t + C_2 \cdot \text{Australian Consumer Price Index}_t + C_3 \cdot \text{10 Year Government Bonde Interest Rate}_t + C_4 \cdot \text{RBA Interbank Cash Rate}_t + C_5 \cdot \text{Australian Labor Cost Index}_t + \varepsilon_{E,t}$

Variance equation: $\text{Ln}\left(\sigma_{E,t}^2\right) = \theta_0 + \theta_1 \text{Ln}\left(\sigma_{E,t-1}^2\right) + \theta_2 \left\{\left|\frac{\varepsilon_{E,t-1}}{\sigma_{E,t-1}}\right| - \sqrt{\frac{2}{\pi}}\right\} + \theta_3 \cdot \frac{\varepsilon_{E,t-1}}{\sigma_{E,t-1}}$

$$= \theta_0 - \theta_2 \cdot \sqrt{\frac{2}{\pi}} + \theta_1 \text{Ln}\left(\sigma_{E,t-1}^2\right) + \theta_2 \cdot \left|\frac{\varepsilon_{E,t-1}}{\sigma_{E,t-1}}\right| + \theta_3 \cdot \frac{\varepsilon_{E,t-1}}{\sigma_{E,t-1}}$$

EGARCH Model for the Australian GDP Growth Rate RY_t:
Mean equation:
$RY_t = \mu_Y + \varepsilon_{Y,t} = D_0 + D_1 \cdot E_t + D_2 \cdot \text{Australian Consumer Price Index}_t + D_3 \cdot \text{10 Year Government Bonde Interest Rate}_t + D_4 \cdot \text{RBA Interbank Cash Rate}_t + D_5 \cdot \text{Australian Labor Cost Index}_t + \varepsilon_{Y,t}$

Variance equation: $\text{Ln}\left(\sigma_{Y,t}^2\right) = \varphi_0 + \varphi_1 \cdot \text{Ln}\left(\sigma_{Y,t-1}^2\right) + \varphi_2 \left\{\left|\frac{\varepsilon_{Y,t-1}}{\sigma_{Y,t-1}}\right| - \sqrt{\frac{2}{\pi}}\right\} + \varphi_3 \cdot \frac{\varepsilon_{Y,t-1}}{\sigma_{Y,t-1}} = \varphi_0 - \varphi_2 \cdot \sqrt{\frac{2}{\pi}} + \varphi_1 \cdot \text{Ln}\left(\sigma_{Y,t-1}^2\right) + \varphi_2 \cdot \left|\frac{\varepsilon_{Y,t-1}}{\sigma_{Y,t-1}}\right| + \varphi_3 \cdot \frac{\varepsilon_{Y,t-1}}{\sigma_{Y,t-1}}$

3.1.4. Vector Auto-Regressive Model (VAR)

The vector auto-regression model is formulated to detect the simultaneous and endogenous interaction mechanism between the exchange rate dynamics and Australian GDP dynamics.

$$Y_t = M_0 + M_1 \cdot Y_{t-1} + M_2 \cdot Y_{t-2} + \epsilon_t$$

Where $M_0 = (\rho_1, \rho_2)'$, $M_1 = \begin{pmatrix} \tau_1 & \tau_2 \\ \tau_3 & \tau_4 \end{pmatrix}$, $M_2 = \begin{pmatrix} \theta_1 & \theta_2 \\ \theta_3 & \theta_4 \end{pmatrix}$ are coefficient matrices; $\epsilon_t = (\epsilon_{Yt}, \epsilon_{Et})'$ is disturbance vector; $Y_t = (RY_t, RE_t)'$, $Y_{t-1} = (RY_{t-1}, RE_{t-1})$ and $Y_{t-2} = (RY_{t-2}, RE_{t-2})'$ are endogenous variables vectors jointly determined by the system.

4. Empirical Analysis

4.1. Data Selection and Justification

The continuous macroeconomic variables involved are Australian GDP Growth Rate (%), Australian Dollar-U.S. Dollar Exchange Rate, Australian Consumer Price Index, RBA Interbank Cash Rate (%), 10-Year Government Bond Interest Rate (%) and Australian Labor Cost Index. There are two discrete variables defined to represent the two exchange rate regime transformation periods. The choices of sampling periods and frequencies depend on the purpose that data should cover the two transformation periods, the availability and consistency of data set.

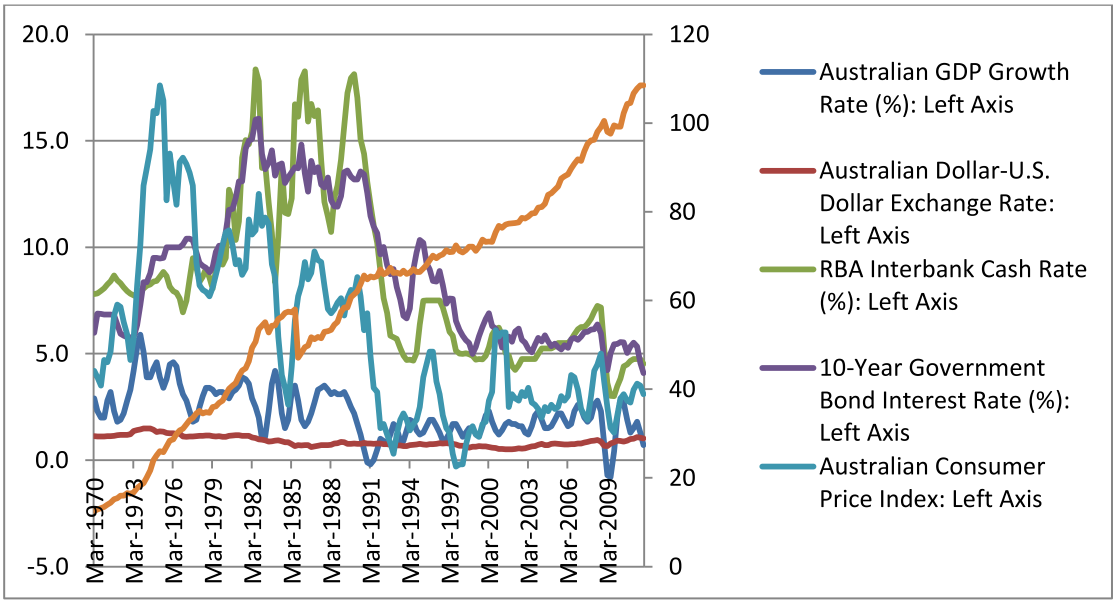
4.2. Statistical Summary

Table I. Statistical Summary of Variables

Statistics	Australian GDP Growth Rate (%)	Australian Dollar-U.S. Dollar Exchange rate	RBA Interbank Cash Rate (%)	10-Year Government Bond Interest Rate (%)	Australian Consumer Price Index	Australian Labor Cost Index
Mean	2.23	0.89	8.52	8.82	5.85	59.96
Median	2.00	0.79	7.70	8.38	4.65	65.30
Mode	1.90	1.19	4.75	9.50	2.50	66.30
Standard Deviation	1.1322	0.2391	3.9141	3.2374	4.0876	25.2521
Sample Variance	1.2818	0.0572	15.3201	10.4805	16.7084	637.6670
Kurtosis	0.4272	-0.4902	-0.0113	-1.1109	-0.1584	-0.7463
Skewness	0.3501	0.6377	0.9769	0.4846	0.7736	-0.1505
Range	6.70	0.98	15.36	11.94	17.90	96.00
Minimum	-0.80	0.51	3.00	4.09	-0.30	12.50
Maximum	5.90	1.49	18.36	16.03	17.60	108.50
Count	168	168	168	168	168	168

Data Source: Australian GDP Growth is from Australian Bureau of Statistics, Australian Dollar-U.S. Dollar Exchange Rate, RBA Interbank Cash Rate, 10-Year Government Bond Interest Rate, Australian Consumer Price Index and Australian Labor Cost Index are from the Reserve Bank of Australia.

Graph 1. Graph of Variables



4.3. Output of Binary Choice (Probit) Model

The binary choice (probit) models are formulated upon two subsamples in terms of Q1,1970 to Q3, 1983 and Q1, 1974 to Q4, 2011. Define two discrete variables as the following.

$$\mathrm{D_1} = \begin{cases} 0 & \text{if } \mathrm{A_t^*} < \mathrm{C_1}, \text{peg exchange rate regime, Q1, 1970– Q4, 1973} \\ 1 & \text{if } \mathrm{A_t^*} > \mathrm{C_1}, \text{managed floating exchange rate regime, Q1, 1974– Q3, 1983} \end{cases}$$

$$\mathrm{D_2} = \begin{cases} 0 & \text{if } \mathrm{A_t^*} < \mathrm{C_2}, \text{managed floating exchange rate regime, Q1, 1974– Q3, 1983} \\ 1 & \text{if } \mathrm{A_t^*} > \mathrm{C_2}, \text{independently floating exchange rate regimeQ3, 1983– Q4, 2011} \end{cases}$$

Run probit regression of $\mathrm{D_1}$ upon $\text{Australian GDP Growth}_t$, Exchange Rate_t $\text{Australian Consumer Price Index}_t$, $\text{10 Year Government Bonde Interest Rate}_t$, $\text{RBA Interbank Cash Rate}_t$ and $\text{Australian Labor Cost Index}_t$ for the subsample of Q1,1970 to Q3, 1983 to obtain below.

$$\widehat{\text{Probability}}(\mathrm{D_1} = 1) = -257.8530 - 0.8019 \cdot \text{Australian GDP}_t + 184.1690 \cdot \text{Exchange Rate}_t - 1.2681 \cdot \text{CPI}_t + 14.3150 \cdot \text{Government Bond Rate}_t - 4.5045 \cdot \text{Interbank Cash Rate}_t$$

Hence, holding other factors constant, the estimated probability of transferring from peg exchange rate regime to managed floating exchange rate regime is approximately 40.99%.

Run probit regression of $\mathrm{D_2}$ upon $\text{Australian GDP Growth}_t$, Exchange Rate_t $\text{Australian Consumer Price Index}_t$, $\text{10 Year Government Bonde Interest Rate}_t$, $\text{RBA Interbank Cash Rate}_t$ and $\text{Australian Labor Cost Index}_t$ for the subsample of Q1,1974 to Q4, 2011 to obtain below.

$$\widehat{\text{Probability}}(\mathrm{D_2} = 1) = 6806.775 + 178.0878 \cdot \text{Australian GDP}_t - 4060.516 \cdot \text{Exchange Rate}_t - 130.7852 \cdot \text{CPI}_t - 173.1156 \cdot \text{Government Bond Rate}_t - 30.2081 \cdot \text{Interbank Cash Rate}_t$$

Hence, holding other factors constant, the estimated probability of transferring from managed float exchange rate regime to independently floating exchange rate regime is approximately 73.88%.

4.4. Output of EGARCH Model

The sampling period of Q1, 1970 to Q4, 2011 is divided into three portions and exponential generalized autoregressive conditional heteroskedasticity models are formulated in each period.

For the fixed exchange rate regime from Q1, 1970 to Q4, 1973,

EGARCH Model for the Exchange Rate $\mathrm{E_t}$:

Mean equation:

$$\widehat{\mathrm{E_t}} = 2.3840 + 0.0440 \cdot \text{Australian GDP Growth Rate}_t$$

P value: (0.0001) (0.0001)
$+0.0469 \cdot \text{Australian Consumer Price Index}_t$
(0.0001)
$-0.0378 \cdot 10 \text{ Year Government Bond Interest Rate}_t$
(0.0019)
$-0.1251 \cdot \text{RBA Interbank Cash Rate}_t - 0.0215 \cdot \text{Australian Labor Cost Index}_t$
(0.0001) (0.0544)

Variance equation:

$$\widehat{\text{Ln}(\sigma^2_{E,t})} = -1.2033 + 0.7061 \cdot \text{Ln}(\sigma^2_{E,t-1}) + 0.9595 \cdot \left|\frac{\varepsilon_{E,t-1}}{\sigma_{E,t-1}}\right| - 0.3754 \cdot \frac{\varepsilon_{E,t-1}}{\sigma_{E,t-1}}$$

P value: (0.4108) (0.0000) (0.2318) (0.2779)

During this period and at 10% level of significance, Australian exchange rate is positively correlated with Australian GDP growth rate and Australian consumer price index but negatively correlated with 10 year government bond interest rate, RBA interbank cash rate and Australian labor cost index significantly. The current period's Australian exchange rate volatility is positively correlated with last period's Australian exchange rate volatility significantly. Good news in terms of positive innovations generate marginal effect of 0.9595-0.3754=0.5841, whose magnitude is smaller than the marginal effect of 0.9595+0.3754=1.3349 generated by bad news in terms of negative innovations, although both effects are insignificant.

EGARCH Model for the $\text{Australian GDP Growth Rate}_t$:

Mean equation:

$$\text{Australian } \widehat{\text{GDP}} \text{ Growth Rate}_t = -4.1206 + 7.1074 \cdot E_t$$

P value: (0.0460) (0.0001)
$+0.2392 \cdot \text{Australian Consumer Price Index}_t$
(0.0001)
$-0.2437 \cdot 10 \text{ Year Government Bond Interest Rate}_t$
(0.0017)
$-0.6371 \cdot \text{RBA Interbank Cash Rate}_t - 0.2174 \cdot \text{Australian Labor Cost Index}_t$
(0.0021) (0.0002)

Variance equation:

$$\text{Ln}(\sigma^2_{Y,t}) = -0.2843 - 0.1056 \cdot \text{Ln}(\sigma^2_{Y,t-1}) + 1.9141 \cdot \left|\frac{\varepsilon_{Y,t-1}}{\sigma_{Y,t-1}}\right| - 2.0686 \cdot \frac{\varepsilon_{Y,t-1}}{\sigma_{Y,t-1}}$$

P value: (0.8839) (0.9455) (0.6893) (0.4154)

During this period and at 10% level of significance, Australian GDP growth rate is positively correlated with Australian exchange rate and Australian consumer price index but negatively correlated with 10 year government bond interest rate, RBA interbank cash rate and Australian labor cost index significantly. The current period's Australian exchange rate volatility is positively correlated with last period's Australian exchange rate volatility significantly. Good news in terms of positive innovations generate marginal effect of 1.9141-2.0686=-0.1545 upon Australian GDP volatility, whose magnitude is smaller than the marginal effect of 2.0686+1.9141=3.9827 generated by bad news in terms of negative innovations, although both effects are insignificant.

For the managed floating exchange rate regime from Q1, 1974 to Q3, 1983,

EGARCH Model for the Exchange Rate $\mathrm{E_t}$:

Mean equation:

$\widehat{\mathrm{E_t}} = 0.4659 + 1.4483 \cdot \text{Australian GDP Growth Rate}_t$

P value: (0.4753) (0.0488)

$+0.1462 \cdot \text{Australian Consumer Price Index}_t$

(0.0001)

$-0.0350 \cdot \text{10 Year Government Bond Interest Rate}_t$

(0.5848)

$-0.0111 \cdot \text{RBA Interbank Cash Rate}_t - 0.0045 \cdot \text{Australian Labor Cost Index}_t$

(0.7497) (0.6261)

Variance equation:

$$\mathrm{Ln}\widehat{\left(\sigma^2_{E,t}\right)} = -1.3951 + 0.6169 \cdot \mathrm{Ln}\left(\sigma^2_{E,t-1}\right) + 1.1271 \cdot \left|\frac{\varepsilon_{E,t-1}}{\sigma_{E,t-1}}\right| - 0.2696 \cdot \frac{\varepsilon_{E,t-1}}{\sigma_{E,t-1}}$$

P value: (0.0001) (0.0025) (0.0015) (0.2273)

During this period and at 10% level of significance, Australian exchange rate is positively correlated with Australian GDP growth rate and Australian consumer price index significantly, while negatively correlated with 10 year government bond interest rate insignificantly and RBA interbank cash rate, Australian labor cost index significantly. The current period's Australian exchange rate volatility is positively correlated with last period's Australian exchange rate volatility insignificantly. Good news in terms of positive innovations generate significant marginal effect of 1.6293-0.1492=1.4801, whose magnitude is smaller than the marginal effect of 1.6293+0.1492=1.7785 generated by bad news in terms of negative innovations, whose effect is insignificant.

EGARCH Model for the $\text{Australian GDP Growth Rate}_t$:

Mean equation:

$\text{Australian}\ \widehat{\text{GDP}}\ \text{Growth Rate}_t = -1.0924 + 4.2065 \cdot \mathrm{E_t}$

P value: (0.7477) (0.0365)

$+0.1150 \cdot \text{Australian Consumer Price Index}_t$

(0.0217)

$-0.5415 \cdot \text{10 Year Government Bond Interest Rate}_t$

(0.0001)

$-0.2354 \cdot \text{RBA Interbank Cash Rate}_t - 0.0773 \cdot \text{Australian Labor Cost Index}_t$

(0.0032) (0.0206)

Variance equation:

$$\mathrm{Ln}\left(\sigma^2_{Y,t}\right) = -0.6126 + 5150 \cdot \mathrm{Ln}\left(\sigma^2_{Y,t-1}\right) + 0.2480 \cdot \left|\frac{\varepsilon_{Y,t-1}}{\sigma_{Y,t-1}}\right| - 0.6199 \cdot \frac{\varepsilon_{Y,t-1}}{\sigma_{Y,t-1}}$$

P value: (0.4220) (0.2694) (0.5613) (0.1570)

During this period and at 10% level of significance, Australian GDP growth rate is positively correlated with Australian exchange rate and Australian consumer price index significantly, while negatively correlated with 10 year government bond interest rate, RBA interbank cash rate and Australian labor cost index significantly. The current period's Australian exchange rate volatility is positively correlated with last period's Australian exchange rate volatility insignificantly. Good news in terms of positive innovations generate marginal effect of 0.2480-0.6199=-0.3719, whose magnitude is smaller than the marginal effect of 0.2480+0.6199=0.8679 generated by bad news in terms of negative innovations, although both effects are insignificant.

For the independently floating exchange rate regime from Q4, 1983 to Q4, 2011,

EGARCH Model for the Exchange Rate $\mathrm{E_t}$:

Mean equation:

$$\widehat{\mathrm{E_t}} = -0.3196 + 0.0186 \cdot \text{Australian GDP Growth}_t$$

P value: (0.0001) (0.0102)

$$+0.0258 \cdot \text{Australian Consumer Price Index}_t$$

(0.0001)

$$-0.0498 \cdot \text{10 Year Government Bond Interest Rate}_t$$

(0.0001)

$$-0.0024 \cdot \text{RBA Interbank Cash Rate}_t - 0.0093 \cdot \text{Australian Labor Cost Index}_t$$

(0.4356) (0.0001)

Variance equation:

$$\widehat{\mathrm{Ln}\left(\sigma^2_{E,t}\right)} = -4.1244 + 0.5020 \cdot \mathrm{Ln}\left(\sigma^2_{E,t-1}\right) + 1.4790 \cdot \left|\frac{\varepsilon_{E,t-1}}{\sigma_{E,t-1}}\right| - 0.0080 \cdot \frac{\varepsilon_{E,t-1}}{\sigma_{E,t-1}}$$

P value: (0.0001) (0.0018) (0.0001) (0.9742)

During this period and at 10% level of significance, Australian exchange rate positively correlated with Australian GDP growth rate and Australian consumer price index significantly but negatively correlated with 10 year government bond interest rate, Australian labor cost significantly and RBA interbank cash rate insignificantly. The current period's Australian exchange rate volatility is positively correlated with last period's Australian exchange rate volatility significantly. Good news in terms of positive innovations generate marginal effect of 1.4790-0.0080=1.4710, which is smaller than the marginal effect of 1.4790+0.0080=1.4870 generated by bad news in terms of negative innovations, although both effects are insignificant.

EGARCH Model for the $\text{Australian GDP Growth Rate}_t$:

Mean equation:

$\widehat{\text{Australian GDP Growth Rate}}_t = 0.4659 + 1.4483 \cdot E_t$

P value: (0.4753) (0.0488)

$+0.1462 \cdot \text{Australian Consumer Price Index}_t$

(0.0001)

$+0.0350 \cdot 10 \text{ Year Government Bond Interest Rate}_t$

(0.5848)

$+0.0111 \cdot \text{RBA Interbank Cash Rate}_t - 0.0045 \cdot \text{Australian Labor Cost Index}_t$

(0.7597) (0.6261)

Variance equation:

$\text{Ln}(\sigma^2_{Y,t}) = -1.3951 + 0.6169 \cdot \text{Ln}(\sigma^2_{Y,t-1}) + 1.1271 \cdot \left|\frac{\varepsilon_{Y,t-1}}{\sigma_{Y,t-1}}\right| - 0.2696 \cdot \frac{\varepsilon_{Y,t-1}}{\sigma_{Y,t-1}}$

P value: (0.0001) (0.0025) (0.0015) (0.2273)

During this period and at 10% level of significance, Australian GDP growth rate is positively correlated with Australian exchange rate and Australian consumer price index significantly but negatively correlated with 10 year government bond interest rate, RBA interbank cash rate and Australian labor cost index insignificantly. The current period's Australian exchange rate volatility is positively correlated with last period's Australian exchange rate volatility significantly. Good news in terms of positive innovations generate marginal effect of 1.1271-0.2696=0.8575, whose magnitude is smaller than the marginal effect of 1.1271+0.2696=1.3967 generated by bad news in terms of negative innovations, although both effects are insignificant.

To summarize, as the liberalization process of exchange rate regime proceeds, the general trend of Australian exchange rate volatility is increasing while the general trend of Australian GDP growth volatility is decreasing and stabilized. However, negative news impacts always generate greater volatility upon both exchange rate dynamics and Australian GDP growth dynamics than positive news impacts, and this asymmetry decays as the exchange rate liberalization proceeds.

During the transmission from peg exchange rate regime to managed floating exchange rate regime, the volatility of Australian exchange rate increases in response to both positive macroeconomic shocks and negative macroeconomic shocks and the volatility effects of positive shocks and negative shocks become less asymmetric. The volatility of Australian GDP growth decreases in response to positive macroeconomic shocks and increases in response to negative macroeconomic shocks; however, the volatility of Australian GDP growth during peg exchange rate regime is greater than the volatility of Australian GDP growth during managed floating exchange rate regime in response to shocks. Hence, it seems that the managed floating exchange rate regime stabilizes the Australian GDP growth rate at the cost of increasing exchange rate volatility compared with the peg exchange rate regime.

During the transmission from the managed floating exchange rate regime to independently floating exchange rate regime, the volatility of Australian exchange rate decreases in response to both positive macroeconomic shocks and negative macroeconomic shocks and the volatility effects of positive shocks and negative shocks become less asymmetric. The volatility of Australian GDP growth increases in response to both positive macroeconomic shocks and negative macroeconomic shocks; however, the volatility of Australian GDP growth during the managed floating exchange rate regime is smaller than the volatility of Australian GDP growth during independently floating exchange rate regime in response to shocks. Hence, it seems that the independently floating exchange rate regime reduces the Australian exchange rate volatility at the cost of increasing the volatility of Australian GDP.

Thus, the remaining sections will discuss the interaction and transmission mechanism between Australian exchange rate dynamics and Australian GDP growth dynamics to explain their volatility correlation phenomenon which I elucidated above.

4.5. Output of VAR Model

$\widehat{\text{Exchange}}\ \text{Rate}_t = 0.0743 + 1.2275 \cdot \text{Exchange Rate}_{t-1} - 0.2649 \cdot \text{Exchange Rate}_{t-2} +$

t value: [2.4986] [15.8191] [-0.4190]

$0.0023 \cdot \text{Australian GDP}_{t-1} - 0.0028 \cdot \text{Australian GDP}_{t-2} + 0.0003 \cdot \text{CPI}_t - 0.0035 \cdot$

[-0.4190] [0.1973] [0.1973] [-1.5765]

$\text{Government Bond Rate}_t + 0.0008 \cdot \text{Interbank Cash Rate}_t - 0.0003 \cdot \text{Labor Cost}_t$

[0.4652] [-1.6100]

$\widehat{\text{Australian}}\ \text{GDP}_t = 0.6615 + 2.5950 \cdot \text{Exchange Rate}_{t-1} - 2.3342 \cdot \text{Exchange Rate}_{t-2} +$

t value: [2.5622] [3.8524] [-3.3804]

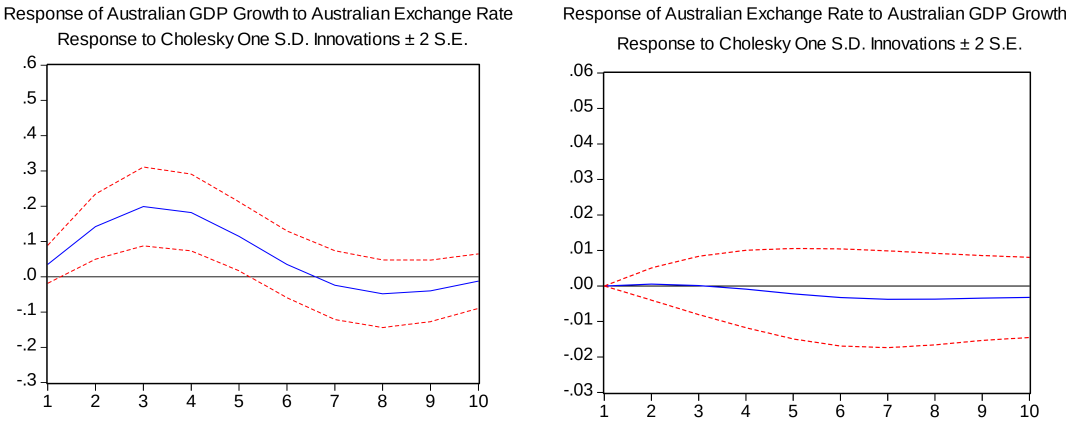
$1.3403 \cdot \text{Australian GDP}_{t-1} - 0.6984 \cdot \text{Australian GDP}_{t-2} + 0.0380 \cdot \text{CPI}_t + 0.0030 \cdot$

[24.1120] [-12.0884] [2.9172] [0.1529]

$\text{Government Bond Rate}_t - 0.0070 \cdot \text{Interbank Cash Rate}_t - 0.0047 \cdot \text{Labor Cost}_t$

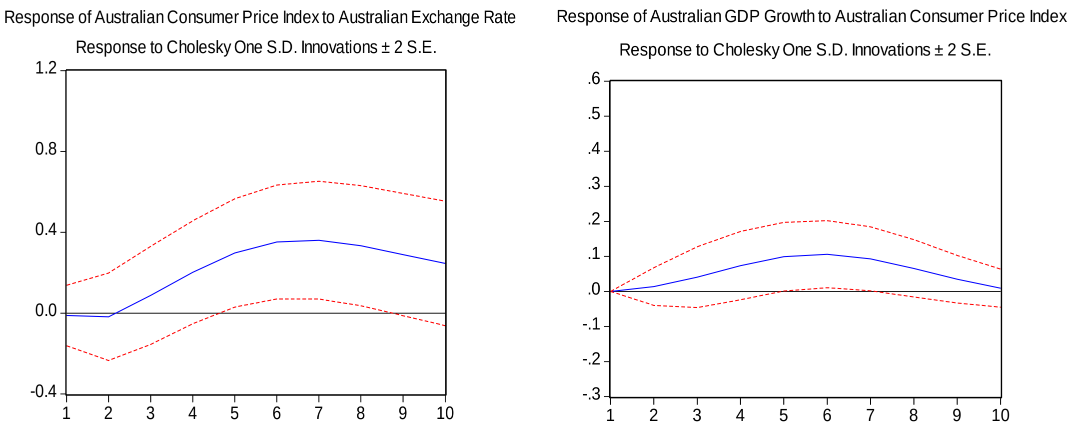
[-0.4449] [-2.8403]

Graph 2. Direct Volatility Transmission Between Australian GDP Growth and Australian Exchange Rate



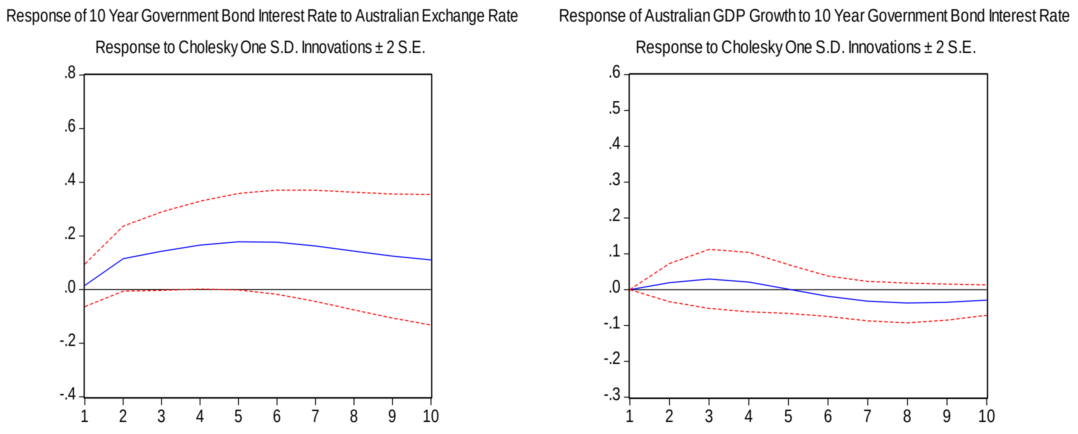
Australian GDP growth increases in response to Australian dollar appreciation in the short run significantly and decreases in response to Australian dollar appreciation in the long run. While Australian dollar appreciates slightly in response to Australian GDP growth increases in the short run and depreciates in response to Australian GDP growth increases in the long run.

Graph 3. Indirect Volatility Transmission from Australian Exchange Rate to Australian GDP Growth via Australian Consumer Price Index



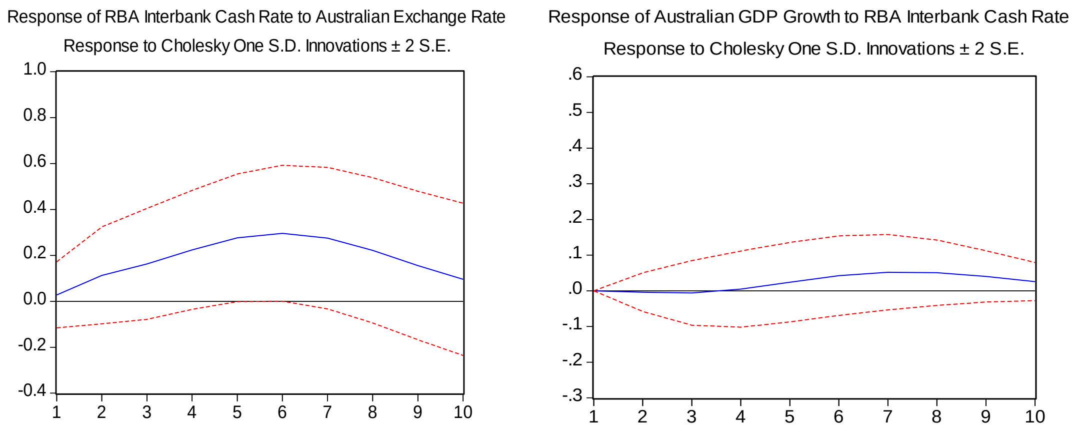
Australian consumer price index hardly changes initially in response to Australian dollar appreciation in the short run, but increases significantly in response to Australian dollar appreciation significantly in the long run with a decaying speed. Australian GDP growth rate increases in response to increases of Australian consumer price index caused by Australian dollar appreciation both in the short run and the long run, although the speed slows down in the long run.

Graph 4. Indirect Volatility Transmission from Australian Exchange Rate to Australian GDP Growth via 10 Year Government Bond Interest Rate



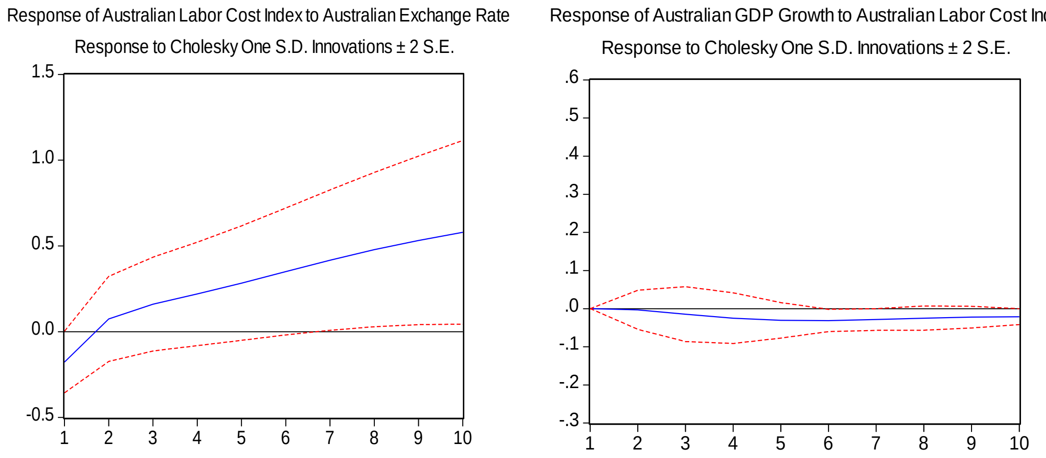
10 year government bond interest rate increases in response to Australian dollar appreciation significantly in the short run but increasing speed slows down in the long run. While Australian GDP growth rate increases in response to increases in 10 year government bond interest rate caused by Australian dollar appreciation in the short run but decreases significantly in response to increase in 10 year government bond interest rate caused by Australian dollar appreciation in the long run.

Graph 5. Indirect Volatility Transmission from Australian Exchange Rate to Australian GDP Growth via RBA Interbank Cash Rate



RBA interbank cash rate increases in response to Australian dollar appreciation in the short run significantly and decreases in response to Australian dollar appreciation in the long run. While Australian GDP growth rate is hardly changes in response to RBA interbank cash rate increases cause by Australian dollar appreciation in the short run but increases significantly in response to RBA interbank cash rate decreases caused by Australian dollar appreciation in the long run.

Graph 6. Indirect Volatility Transmission from Australian Exchange Rate to Australian GDP Growth via Australian Labor Cost Index



Australian labor index cost increases in response to Australian dollar appreciation both in the short run and in the long run significantly, although the speed of increasing slows down in the long run. While Australian GDP growth decreases in response to Australian dollar appreciation caused by labor cost increases both in the short run and the long run.

4.6. Model Justification and Comparison

Initially, the binary model in terms of probit model is formulated to test the appropriateness of each exchange rate regime during each economic development stage in Australian history; next, the EGARCH model is established to simulate the volatility interdependence between Australian exchange rate and GDP growth under each exchange rate regime in different periods; then, VAR models are employed to visualize the transmission mechanism from exchange rate volatility to GDP growth volatility both directly and indirectly. The results from the above three models are consistent with each other and demonstrated Australian government makes the appropriate exchange rate regime choice during each economic development period.

5. Conclusions

This paper aims to detect the nested determinants of the Australian Dollar-U.S. Dollar exchange rate regime and identify the relationship between the Australian exchange rate dynamics and the stability of Australian economy. The null hypothesis of the exchange rate regime liberalization influences the volatilities of Australian exchange rate and Australian GDP growth rate significantly is supported based on the analysis above.

The choice of Australian exchange rate regime and the development level of Australian GDP interact with each other simultaneously to determine the optimal concurrent exchange rate regime and GDP growth. Theoretically speaking, as Australia becomes more industrialized, more integrated in the global financial market, maintains broader financial sectors, promotes stronger prudential standards, produces and trades more diversified goods, independently floating exchange rate regime will ultimately replace both fixed exchange rate regime and managed floating exchange rate regime. Under the floating exchange rate regime, the exchange rate is determined by the supply and demand in the money market and its advantages include absorbing adverse shocks, immunity to currency crisis and independent monetary policy and while its disadvantages include short term volatilities, long term swings and inflationary bias.

Empirically speaking, this paper initially models the process of choosing the appropriate exchange rate regime via the binary (probit) choice model on a panel of macroeconomic variables and reaches the conclusion that the transmission from peg exchange rate regime, through managed exchange rate regime to independently floating exchange rate regime Is progressed by Australian GDP growth rate and the concurrent exchange rate volatility directly, while the exchange rate volatility influences the choice indirectly via other macroeconomic variables.

Then in accordance with history, this paper divides the sampling period (Q1, 1970 to Q4, 2011) into three portions in terms of the fixed exchange rate regime (Q1, 1970 to Q4, 1973), the managed floating exchange rate regime (Q1, 1974 to Q3, 1983) and the independently floating exchange rate regime (Q4, 1983 to Q4, 2011); for each period, the exponential generalized autro-regressive conditional heteroskedasticity models are formulated to capture macroeconomic effects specifically. As Australian exchange rate liberalization proceeds, the general trend of Australian exchange rate volatility is increasing while the general trend of Australian GDP growth volatility is decreasing and stabilized. Negative shocks always generate greater volatility upon both exchange rate dynamics and Australian GDP growth dynamics than positive shocks, and this asymmetry decays as the liberalization proceeds.

During the transmission from peg exchange rate regime to managed floating exchange rate regime, the Australian exchange rate volatility increases. The Australian GDP growth volatility during peg exchange rate regime is greater than that of managed floating exchange rate regime in response to shocks. Hence, managed floating exchange rate regime stabilizes the Australian GDP growth rate at the cost of increasing exchange rate volatility compared with the peg exchange rate regime.

During the transmission from the managed floating exchange rate regime to independently floating exchange rate regime, the Australian exchange rate volatility decreases. The volatility of Australian GDP growth during the managed floating exchange rate regime is smaller than that of independently floating exchange rate regime in response to shocks. Hence, the independently floating exchange rate regime reduces the Australian exchange rate volatility at the cost of increasing the Australian GDP volatility.

Finally, the interaction and transmission mechanism between Australian exchange rate dynamics and Australian GDP growth dynamics is examined to summarize the following:

I. The exchange rate volatility mainly influences Australian GDP growth volatility directly. As the exchange rate liberalization proceeds, floating exchange rate regimes stimulates the absorption of adverse shocks within the exchange rate dynamics, hence reduces the sources of exchange rate volatility.

II. The exchange rate volatility hardly influences Australian consumer price index, 10 year government bond interest rate. RBA interbank cash rate and Australian labor price index in the short run, but influences them positively and significantly in the long run, hence, Australian GDP growth volatility decreases during the transitional exchange rate liberalization stage in terms of managed floating exchange rate regime, but increases during the long run stage in terms of independently floating exchange rate regime.

These conclusions convey information to policy makers that Australian exchange volatility transfers to Australian GDP growth rate volatility not only directly but also indirectly through other macroeconomic variables and exchange rate regime liberalization stables Australian GDP growth at the cost of increased exchange rate volatility in the short run while decreases exchange rate volatility at the cost of increased Australian GDP growth rate volatility in the long run. Thus, policy makers need to set both direct target and intermediate targets to conduct monetary policies and identify a balance between Australian GDP growth rate volatility and Australian exchange rate volatility.

The limitations of this paper are that the transmission cost during exchange rate regime liberalization is not taken account for in choosing the optimal exchange rate regime and more intermediate macroeconomic variables should be examined in analyzing the effects of exchange rate volatility transmission. Thus, further research and extension should incorporate these factors into modeling volatility.

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