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Can portfolio home bias sources affect Foreign currency exposure ?

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Abstract—**This paper investigates how the sources of portfolio home bias affect foreign currency exposures in external balance sheets? We use panel data and the CCEP estimation method in Pesaran (2006). After controlling cross country dependence, empirical results indicate that (1) The convergence rates of aggregate foreign currency exposure increase when the model control the trilemma policy and institutional quality. This implies that country characteristics are important determinants of aggregate foreign currency exposure. (2) The sources of portfolio home bias have prominent effects on foreign currency exposure, and the robust results support the "international diversification puzzle". (3) It is noteworthy that the cross-country and time-series variation in aggregate foreign currency exposure appears to be consistent with the "original sin" argument. Our results are interesting since they point out that the sources of portfolio home bias are crucial to external valuation effects and to the external imbalance adjustment.**

Keywords- Aggregate Foreign Currency Exposure, International Diversification Puzzle, External Valuation Effects, Original Sin,Trilemma

I. INTRODUCTION

Portfolio home bias indicates investors hold a higher-than optimal portion of domestic assets. In the internatonal adjustment mechanism, there're three sorts of interrelated home bias, namely, home bias in equity holdings, home bias in currency holdings and home bias in consumption. Although capital flows across financial markets increase siginificantly, the portfolio home bias is still an siginificant feature in many countrys' financial markets. Existing literature points out two key stylized facts in industrialed countries. First, international portfolios are long in foreign currency assets and short in domestic currency, resulting in external valuation effects.[1] Second, home bias in equity. The above observations inspire a broad renewed consensuses on DSGE models with international portfolio choices.

The relationship between asset returns and real exchange rates are crucial to an investor's optimal portfolio allocations. Hedging real exchange rate fluctuations is the major reason leading to portfolio home bias. Nominal equity returns are heavily affected by nominal exchange-rate movement, representing that home equity bias entails home currency bias in some degree.[2] In other words, portfolio returns can be hedged against economic shocks by currency movements (Coeudacier and Guibaud, 2009; Obstfeld, 2007).

Related articles point out that the pattern of economic shocks and internationally trade assets is crucial to the currency exposure of an investor's optimal portfolio allocations. In other words, the covariance of output shocks and exchange rate is important to an investor's decision of holding long or short positions in foreign-currency assets.[3]

Conventional literature examines the above issue using the time series data of the covariance between the real exchange rate and the excess return on home relative to foreign equity divided by the variance of the excess return. The empirical results fail to explain the home bias in domestic portfolio investment (van Wincoop and Warnock, 2010 ; Coeurdacier and Gourinchas, 2008).

The main purpose of this paper is to examine the impact of portfolio home bias sources, on aggregate foreign currency exposures in a country's external balance sheet. The paper differs with conventional literature in its adopting of panel data analysis. To control the likely contemporaneous correlation in data, this paper adopts the CCEP estimators provided by Pesaran (2006). In contrast to Lane and Shambaugh (2010 b), this paper emphasizes the impact of the covariance-variance ratio of real exchange rate and excess return on aggregate foreign currency exposures.[4]

Aizeman et al. (2010) and Obstfeld et al. (2009) point out the close relationship among reserve levels, exchange rate policy and monetary independence policy. Even though countries have move more towards greater exchange rate flexibility, the international reserves relative to GDP (Reserve/GDP, TR) have also increased enormously. It represents that a country's net foreign assets are closely related to the international reserves holding, policy choices and the level of financial development. This paper uses the

[1] The depreciation of a country's exchange rate generates capital gains and losses on gross stocks of cross-border assets and liabilities, which have siginificant effect on the dynamics of countries' external asset positions.

[2] Obstfeld(2007) suggests that an important agenda for future research is to integrate portfolio behaviors with models of current account imbalances and adjustments.

[3] A long position in foreign-currency assets, that is to say, a country holds higher portion of foreign-currency assets than foreign-currency liability of the international balance sheet. Accordingly, a short position in foreign-currency assets reflects a country holds higher portion of foreign-currency liabilities than foreign-currency assets of the international balance sheet.

[4] Lane and Shambaugh (2010 b) discuss the impact of the covariance of real real exchange rate and output on aggregate foreign currency exposures.

trilemma indices in Aizeman et al. (2010)[5], namely, monetary independence, exchange rate stability, and financial openness, to explore how policy choices affect a counry's aggregate foreign currency exposures? We further consider the influence of financial development on aggregate foreign currency exposures.

After controlling cross-country dependence, this paper obtains several interesting results. First, the convergence rate of aggregate foreign currency exposure increases after controlling the trilemma policy and institutional quality. This implies that country characteristics are important determinants of aggregate foreign currency exposures. The persistence of aggregate currency exposures is consistent with the argument of buy and hold effect. Second, portfolio home bias sources have prominent effects on foreign currency exposures after controlling institutions and policy choices. This result is in sharp contrast to conventional literature adopting time-series data for a specific country. Third, the non-positive covariance-variance is associated with a longer position in foreign curriencies, providing a hedge against domestic lower returns. This result agrees with the prediction of existing literatures. Fourth, the cross-country and time-series variation in aggregate foreign currency exposure appears to be consistent with the "original sin" argument.

The organization of the paper is given as follows. Section 2 sets up the empirical model. Section 3 describes data construction and empirical results. Finally, section 4 concludes.

II. MODEL SET-UP

Tille and van Wincoop (2010) constructs a dynamic stochastic general equilibrium (DSGE) model with international portfolio choice and finds that portfolio allocation results from asset's time-varying expected returns and risk characteristics. These factors are also key sources of international capital flows. Tille and van Wincoop (2010) abstract from the algebraic details and get:[6]

$$k^D = 2\frac{\tau}{\gamma \mathrm{var}(er_{t+1})} + \frac{\gamma-1}{\gamma}\frac{\mathrm{cov}(p_{t+1}-p_{t+1}{*}, er_{t+1})}{\mathrm{var}(er_{t+1})} + \frac{(1-\psi)\mathrm{cov}(f_{Ht+1}-f_{Ft+1}, er_{t+1})}{\gamma \mathrm{var}(er_{t+1})} \quad (1)$$

where $er_{t+1} = r_{H,t+1} - r_{F,t+1}$ is the excess return on home equity. $f_H(S_{t+1})$ and $f_F(S_{t+1})$ are the value functions of Home and Foreign investors next period, capturing a hedge against changes in future expected portfolio returns. f_{Ht+1} and f_{Ft+1} are the first-order components of the functions $f_H(S_{t+1})$ and $f_F(S_{t+1})$ respectively.

Equation (1) points out that portfolio home bias results from the following three factors. First, the cost of investing abroad, τ. The higher the cost is, the more attractive for agents to invest in domestic equity. Second, the co-movements of the real exchange rate and excess return, $\mathrm{cov}(p_{t+1} - p^*_{t+1}, er_{t+1})$. Assuming γ is greater than one then home investors would like to invest more in home equity. That is to say, Home equity is a good hedge of real exchange rate risk. Third, a hedge against changes in future expected portfolio returns, which are captured by the functions $f_H(S_{t+1})$ and $f_F(S_{t+1})$ in the value function of Home and Foreign investors next period. The higher are the values of these functions, the lower are the future expected returns. If the excess return on Home equity is high in such states, then Home investors would like to invest more in Home equity.

Based on (1), the empirical specification of the paper focuses on "the cost of investing abroad", "the co-movements of the real exchange rate and excess return" and "the volatility of excess return". Lane and Shambaugh (2010a, b) define aggregate foreign currency exposure as follows:

$$FX^{AGG}_{it} = w^A_{it} * \left(\frac{A_{it}}{A_{it}+L_{it}}\right) - w^L_{it} * \left(\frac{L_{it}}{A_{it}+L_{it}}\right) \quad (2)$$

where w^A_{it} and w^L_{it} denote the share of foreign assets denominated in foreign currencies and the share of foreign liabilities denominated in foreign currencies respectively. The measure, FX^{AGG}_{it}, directly inspects the financial or balance sheet currency exposure, and capturing the sensitivity of a country's portfolio to a uniform currency movements by which the home currency moves proportionally against all forign currencies.[7] The range of FX^{AGG}_{it} is (-1,1), and the upper bound reflects a country with only foreign-currency assets and no foreign-currency liabilities, moreover, the lower bound shows a country with no foreign-currency assets and only foreign-currency liabilities.

$$w^A_{it} = \sum_{k=1}^{5} \lambda^{Ak}_{it} * w^{Ak}_{it} \quad w^L_{it} = \sum_{k=1}^{4} \lambda^{Lk}_{it} * w^{Lk}_{it}, \quad (3)$$

where λ^{Ak} and λ^{Lk} reflect the relative importance of the kth category of foreign assets in country i's assets and liabilities an period t. There are five categories of foreign assets, namely FDI, equity, debt, other and reserve. Accordingly, excluding reserves, there are only four categories of foreign liabilities. w^{Ak}_{it} and w^{Lk}_{it} show the weights of foreign-currency in period t in category k for country i's assets and liabilities respectively.

In addition, the product of FX^{AGG} and the gross scale of the international balance sheet (IFI) reflects the quantitative impact of a uniform currency movement. In this paper, we treat (4) as the measure of external valuation effects of a country's net foreign assets.

$$NETFX = FX^{AGG} * IFI \quad (4)$$

Where $IFI = (A+L)/GDP$ denotes the outstanding gross stock of foreign assets and foreign liabilities. In this paper, we compare FX^{AGG} and $NETFX$. Since the impact of portfolio home bias sources on foreign assets may be

[5] Trilemma represents that a country can simply adopt two out of the three policies.

[6] The detail model set-up see Tille and van Wincoop (2010).

[7] The real side impact of currency movements on trade flows is not considered here.

offseted by that of foreign liabilities, and hence the impact on FX^{AGG} may be weakened. This paper therefore examine how the home bias sources affect aggregate foreign currency exposures, foreign currency exposures in foreign asset, and foreign currency exposures in foreign liability, respectively.

III. EMPIRICAL STRATEGY AND DATA

A. Data description

The sample period starts from 1990 and ends in 2004. Data comes from Global Finanacial Data Base and IMF's CPIS and IFS, respectively. Aggregate foreign currency exposure (FX^{AGG}) is constructed based on the LASER dataset reported in Lane and Shambaugh (2010a). Due to the limitation of data, this paper constructs aggregate foreign currency exposure for 36 countries[8] over 1990-2004. The portfolio weights of outward investment holdings by domestic investors are needed to construct the covariance-variance ratio and the volatility. These weights are constructed based on IMF's CPIS dataset. Excess return are constructed based on the Total Return Index provided by World Bank's Global Financial Dataset.

Real exchange rate, $\ln(P_{t+1}) - \ln(P^*_{t+1})$, is the difference between home price index and foreign price index, in which P_i is Home CPI, and $P_i{}^*$ is the financial-weighted CPI of 20 outward investment destination countries in local currency. Excess return, namely er_{t+1}, is the difference between "total returns of inward investment from rest of the world" and "total returns of investing abroad".[9] This paper uses the monthly real exchange rate and excess return to construct annual the "covariance-variance ratio".

The volatility of excess return, $VAR(er_{t+1})$, is defined as the annual covariance of monthly excess return between home and foreign assets. The cost of investing aboad is measured by institutional factors which are provided by Kaufmann et al. (2009). The increase in the index implies the better-quality of domestic institutional environment, which help to reduce portfolio home bias and induce the investor to hold more foreign-currency assets. However the data starts from 1996 and are available only for even years before 2000. This paper therefore assumes that the data of odd years are the same as those of even years during the period of 1996-2000, and the data over 1990-1995 are the same as that for 1996.[10]

According to Aizeman et al. (2010), the paper constructs the three policies of trilemma: monetary independence (MI), exchange rate stability (ERS) and financial openness (KAOPEN). Following Aizeman et al. (2010) and Shambaugh (2004), this paper defines the exchange rate as "fixed" and assigns a value of one for the ERS index if the annual exchange-rate growth lies within $\pm 2\%$ band. $TR_{it} = (IR/GDP)_{it}$ is the level of international reserves (excluding gold) as a ratio to GDP.

B. Empirical results

1) . Results for FX^{AGG}

This paper first applies CD test[11] in Pesaran (2004) to examine the existence of cross sectional dependence. If there exists cross setion dependence, the common correlated effects pooled (CCEP) estimator proposed by Pasaran(2006) is applied to examine how portfolio home bias sources affect aggregate foreign currency exposure(FX^{AGG}),the quantitative impact of a uniform currency movement ($NETFX$). Based on (1), the baseline regression equation is given as follows:

$$\begin{aligned} FXAGG_{i,t} &= \alpha_i + \beta_0 FXAGG_{i,t-1} + \beta_1 (COV/VAR)_{it} \times 1_{COV>0} + \beta_2 (COV/VAR)_{it} \times 1_{COV\le 0} \\ &+ \beta_3 VAR_{it} + \beta_4 C(F_{it}) + \beta_5 TR_{it} + \beta_6 TLM_{it} + \beta_7 (TLM_{it} \times TR_{it}) \\ &+ \gamma_0 \overline{FXAGG}_t + \gamma_1 \overline{(COV/VAR)_t \times 1_{COV>0}} + \gamma_2 \overline{(COV/VAR)_t \times 1_{COV\le 0}} + \gamma_2 \overline{VAR}_t \\ &+ \gamma_3 C(\overline{F}_t) + \gamma_4 \overline{TR}_t + \gamma_5 \overline{TLM}_t + \gamma_6 (\overline{TLM_t \times TR_t}) + \varepsilon_{it} \end{aligned} \tag{5}$$

where FX^{AGG} is aggregate foreign currency exposure; $(COV/VAR)_{it}$ is the "covariance-variance ratio" between real exchange rate and excess returns; ($VAR(er)_{it}$) is the volatility of excess returns; TR_{it}, the level of international reserves (excluding gold) as a ratio to GDP; F_{it} denotes the set of the quality of domestic institutional environment, which is measured by the capacity of issuing domestic-currency liabilities and acquireing foreign-currency assets. (TLM_{it}) is a vector of any two of the three trilemma indices: MI, ERS, and KAOPEN; $\overline{X_t} = 1/N\sum_{i=1}^{N} X_{it}$ is the cross sectional mean of a variable X.

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[8] Our sample includes 22 advanced countries and 14 emerging countries. These countries are US, UK, Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Norway, Sweden, Swiss, Canada, Japan, Finland, Greece, Iceland, Ireland, Portugal, Spain, Turky, Australia, New Zealand, South Africa, Argetina, Mexico, Taiwan, Hong Kong, Indonesia, South Korea, Malaysia, Parkistain, Phillipine, Singapore, Thailand, and Portland.

[9] Excess return is the difference between " total returns of liability side" and " total returns of asset side" in a country's international balance sheet. The definition of excess return, that is $er_{t+!} = r^l - r^a = \sum_{i=1}^{3} w_i^l r_{i,t}^l - \sum_{i=1}^{3} w_i^a r_{i,t}^a$. We take " total returns of liability side" as "total returns of inward investment from rest of the world", and the corresponding portfolio-based country weights is the top 20 outward investment destination countries. We also take "total returns of asset side" as" total returns of investing abroad".

[10] It is the popular way which many empirical literatures adopt.To get more robust results, we try another two methods. (1) we use another institutional index, namely the Corruption Perception index, developed by Transparency international. (2) projecting new data. We smooth the index by applying the three-year moving average encompassing the preceding, concurrent, and following years (t-1,t,t+1) of observations, which reported since 1996. And moving average forward, we can get new data during 1990-1995 time periods. However, it turns out that the empirical findings of two methods are both statistically insiginificant. Hence, we only report the empirical results of taking the institutional index during 1990-1996 time period as the same with the index of 1996.

[11] The CD test based on $CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right)$, $\hat{\rho}_{ij} = \sum_{t=1}^{T}\hat{e}_{it}\hat{e}_{jt} \Big/ \left(\sum_{t=1}^{T}\hat{e}_{it}^2\right)^{1/2}\left(\sum_{t=1}^{T}e_{it}^2\right)^{1/2}$, which is equation (7) in Pesaran's (2004). The residual of OLS estimator is $e_{it} = y_{it} - \hat{\alpha}_u - \hat{\beta}_i' x_{it}$ ∘ $\hat{\rho}_{ij}$ is the sample estimate of the pair-wise correlation of the OLS residuals, where T is time and N is the number of countries. The null hypothesis is" there is no cross-section dependence".

It is interesting to explore the possible asymmetric effect of the covariance-variance ratio term on FX^{AGG}. For this purpose, this paper splits the samples into positive and non-positive "covariance-variance ratio" periods. $1_{COV>0}$ is a dummy which is one when the covariance-variance ratio is positive and zero otherwise, and $1_{COV\leq 0} = 1 - 1_{COV>0}$. According to the baseline specification, we expect we predict $\beta_1 < 0$, $\beta_2, \beta_3 > 0$, and $\beta_4 > 0$.[12]

Results from Table 1 indicate that the effect of the volatility of excess returns on FX^{AGG} and $NETFX$ are significant. However, the impact of the covariance-variance ratio on the above two independent variables are insiginificant. The above results from Table 1 could be due to the failure of controlling institutional and policy factors.

This paper therefore considers several expanded specifications that control the level of international reserve (excluding gold) to GDP (TR_{it})[13]; a vector of any two of the three trilemma indices, namely, MI, ERS and KAOPEN; an interaction term between the trilemma indices and the level of international reserves, or $(TLM_{it} \times TR_{it})$.[14]

After controlling for the cross-sectional dependence, results from Tables 2-5 indicate that the estimation coefficients of lagged dependence variable declines relative to that of Table1. In other words, the convergence rate of FX^{AGG}, $FX^{AGG}Asset$, $FX^{AGG}Liability$, and $NETFX$, respectively, to its steady-state path increases.[15]

The above results support the Buy and hold effect, and indicate that the institutional factors and the trilemma policy mix are important determinants of aggregate foreign currency exposure. Based on a portfolio choice model that emphasizes risk-sharing as a main motive for cross border asset trade, investors in advanced countries should bias his/her portfolio torwards assets of distant countries since returns in those countries are less correlated with domestic returns.

However, existing literatures found the opposite that investors of a country hold more financial assets from those markets having high correlation with the domestic market after controlling for the distance, informational frictions, institutional and cultural effects. In other words, diversification motives do not play a large role in explaining asset trade between industrialed countries (Aviat and Coeurdacier, 2007; Coeurdacier and Guibaud, 2009; Lewis, 1999; and Portes and Rey, 2005). This is called the "international diversification puzzle or correlation Puzzle".

Tables 2-4 indicate that both the covariance-variance ratio and the volatility of excess returns have siginificant effect on FX^{AGG}, $FX^{AGG}Asset$, and $FX^{AGG}Liability$, respectively. This tells us that portfolio home bias sources have prominent effect on FX^{AGG}. The most striking results are that the covariance-variance ratio term has the expected sign. Morover, the effect on FX^{AGG} increases for those countries that have experienced a non-increase in the covariance-variance term. This implies that it's attractive for home investors to invest in foreign assets when the excess return on foreign assets is high in states where expected future portfolio returns are low. The reason is that the relative price of Home goods rises at time t+1 and is then expected to fall, leading to an expected fall of the Home price index relative to Foreign price index. In shorts, results from Tables 2-4 indicate that portfolio bias towards domestic-currency assets, and that there is no evidenece that diversification matters for asset allocation. Our results are consistent with those in Coeurdacier and Gourinchas (2008), French and Porterba (1991) and Baxter and Jermann (1997).

Results from columns (5) and (6) of Table 2 point out that FX^{AGG} increases with exchange rate stability (ERS). Besides, results from columns (14) and (18) of Table 4 indicate that countries with more stable exchange rate hold more foreign liabilities denominated with domestic-currency. Lane and Shambaugh (2010 b) mentions that an increase in the volatiltity of exchange rate results in a decline in FX^{AGG}, that is, an exchange rate peg raises the domestic-currency share in foreign debt liabilities. Our results are consistent with their empirical findings.

The institutional environment and the level of financial development may alter the derived optimal net foreign currency position and/or restrict a country's ability to issue domestic-currency liabilities. Eichengreen et al. (2003) points out that emerging countries with weakness of policies and institutions would have more difficulties to borrow abroad with their own currencies. This observation is called as the "original sin". Countries with original sin that have net foreign debt will have a currency mismatch[16] on their national balance sheets, which in turn poses a serious threat to financial crisis (Burger and Warnock, 2006, 2007; Eichengreen and Hausmann, 2003; and Goldstein and Turner, 2004).

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[12] It is the expected estimating sign of FX^{AGG} and $FX^{AGG}Asset$. In the opposite direction, the expected estimating sign of $FX^{AGG}Liability$ is $\beta_1 > 0$, $\beta_2, \beta_3 < 0$. And $\beta_4 > 0$ is still the same.

[13] Aizeman et al.(2010) indicates that, as of 2006, the top 10 holders of international reserves are developing countries. Except Japan, the developing countries, including China, Russia, Korea and Taiwan, hold about 50% of world international reserves. The possible explanation is that, for the stability of exchange rate movement, countries accumulate TR rapidly. And it also helps to achieve some target combination of exchange ratestability, monetary policy autonomy, and financial openness. As a result, one cannot discuss the issue of the trilemma without incorporating the role for TR holding.

[14] The empirical findings in Aizeman et al. (2010) show that the three measures of the trilemma are linearly related. Hence, including two of the indices simultaneously is most appropriate, rather than individually or all three jointly.

[15] Except for the estimation coefficients(β_0) of lagged 1-period dependent variable in the column (14) of Table 5, which are not reduced. Rest of the estimation coefficients(β_0) of lagged 1-period dependent variable of Table 2-5, which are all reduced than ones in Table 1.

[16] Goldstein and Turner(2004) metion that：in financial markets today, countries, banks and households make and receive payments not only in domestic but also in foreign currency. Similarly, the currency composition of their assets and liabilities may differ. When an entity's net worth is sensitive to change in the exchange rate, it is called a "currency mismatch". The greater the degree of sensitivity of net worth to exchange rate changes, the greater the extent of the currency mismatch.

TABLE I.

Dependent varable,Y(t)	Exp	FX^{AGG} (1)	$NETFX$ (2)
Y(t-1)		0.51 † [8.93]	0.31 † [2.87]
cov(RER,er)/var(er)> 0	(−)	0.01 [1.14]	0.0002 [0.02]
cov(RER,er)/var(er)≦0	(+)	0.01 [0.42]	0.01 [0.44]
var(er)	(+)	0.06 † [2.62]	0.07* [2.13]
CD test		3.65	6.96

Note：Robust t statistics in brackets. * significant at 10%; ** significant at 5%; † significant at 1%.
Dependent variables include: FX^{AGG} and; Independent variables include: the one-period lag of dependent variable, Y(t-1); cov(RER, er) / var(er); var(er). The CD test is based on $CD=\sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right)$, which is Eqs. (7) in Pesaran's (2004). The CD test statistics detect whether the panel data has cross section dependence

TABLE II.

Dependent varable,Y(t)	Exp	FX^{AGG} (1)	(2)	(3)	(4)	(5)	(6)
Y (t-1)	(1)~(6)	0.32† [5.56]	0.12** [2.02]	0.24† [4.22]	0.14† [2.88]	0.27† [3.95]	0.21† [4.46]
cov(RER,er)/ var(er)> 0	(−)	-0.0003 [-0.05]	-0.002 [-0.30]	-0.003 [-0.45]	-0.01* [-1.69]	-0.01** [-2.15]	-0.02† [-2.58]
cov(RER,er)/ var(er)≦0	(+)	0.05† [2.69]	0.05** [1.99]	0.03* [1.92]	0.05† [2.88]	0.05** [2.45]	0.02 [1.23]
var(er)	(+)	0.05** [2.52]	0.34† [4.29]	0.04† [3.19]	0.08† [4.06]	0.02 [0.99]	0.01 [0.48]
Regularity Quality	(+)	-0.03 [-0.85]	-0.001 [-0.01]	0.05 [1.42]	0.12† [3.32]	-0.01 [-0.25]	0.09** [2.03]
Rule of Law	(+)	0.04 [0.77]	0.12 [1.13]	-0.09* [-1.87]	-0.17† [-3.54]	-0.04 [-0.71]	-0.13* [-1.88]
TR		0.47† [3.06]	1.46† [4.24]	0.36** [2.28]	0.77† [3.70]	0.36** [2.44]	1.08† [5.01]
KAOPEN				-0.02† [-3.83]	-0.003 [-0.26]	-0.01** [-2.21]	-0.001 [-0.06]
KAOPEN × TR					-0.38** [-2.41]		-0.06 [-0.98]
ERS		0.02 [1.10]	0.03 [0.87]			0.04** [2.31]	0.06† [2.77]
ERS × TR			0.11 [0.26]				-0.03 [-0.21]
MI		-0.03 [-1.33]	0.03 [1.36]	-0.03 [-1.62]	-0.01 [-0.25]		
MI × TR			-0.28† [-2.77]		0.35 [1.69]		

Note：Robust t statistics in brackets. * significant at 10%; ** significant at 5%; † significant at 1%.
Dependent variables include: FX^{AGG}; Independent variables include: the one-period lag of dependent variable, Y(t-1); cov(RER, er) / var(er); var(er); Regularity Quality and Rule of Law; Total international reserve excluding gold /GDP, TR; the trilemma indices;and the interaction of trlemma indices and TR

Tables 2-4 show that the local institutions have siginificant effect on FX^{AGG}, $FX^{AGG}\,Asset$, and $FX^{AGG}\,Liability$. A better institutional environment is associated with the increase of FX^{AGG} and net foreign assets, while the estimation coefficient on “Regularity Quality” is siginificantly positive. $FX^{AGG}\,Liability$ decreases for those countries having experienced an increase in “Regularity Quality”. These results appear to be consistent with the “original sin” argument (Eeichengreen et al.,2003; Burger and Warnock, 2007). Finally, results from Tables 2-4 indicate that the larger of TR holding is associated with a higher FX^{AGG}, and $FX^{AGG}\,Asset$, respectively. This could be that holding high TR prevents excessive currency devaluation. [17]

TABLE III.

Dependent varable,Y(t)	Exp	$FX^{AGG}\,Asset$ (7)	(8)	(9)	(10)	(11)	(12)
Y (t-1)	(7)~(12)	0.61† [16.09]	0.56† [10.71]	0.45† [10.33]	0.46† [6.94]	0.40† [7.98]	0.71† [12.97]
cov(RER,er)/ var(er)> 0	(−)	0.01** [1.98]	-0.002 [-0.34]	0.003 [1.00]	-0.01 [-1.48]	0.00002 [0.004]	0.01 [1.00]
cov(RER,er)/ var(er)≦0	(+)	0.05† [3.10]	0.15† [4.73]	0.02 [1.07]	0.03† [3.14]	-0.01 [-0.61]	0.05 [1.42]
var(er)	(+)	-0.05† [-10.63]	-0.06† [-6.14]	-0.03† [-6.29]	-0.03† [-4.38]	-0.04† [-6.98]	-0.04† [-7.90]
Regularity Quality	(+)	-0.0004 [-0.03]	-0.06** [-2.23]	-0.003 [-0.24]	-0.04** [-2.19]	0.01 [0.90]	0.001 [0.07]
Rule of Law	(+)	0.02 [1.51]	0.003 [0.09]	0.03** [2.24]	0.01 [0.42]	0.03 [1.52]	0.04** [2.02]
TR		0.19* [1.90]	0.32** [2.22]	0.23** [2.33]	0.67† [5.51]	0.18* [1.65]	0.41* [1.93]
KAOPEN				-0.02† [-4.11]	-0.02† [-3.30]	-0.02† [-2.83]	0.0002 [0.03]
KAOPEN × TR					0.24† [3.24]		-0.14 [-1.60]
ERS		-0.005 [-0.76]	-0.03* [-1.85]			-0.003 [-0.32]	-0.02 [-1.42]
ERS × TR			0.24 [1.29]				0.09 [0.46]
MI		0.01 [0.93]	0.04† [2.99]	-0.01 [-1.09]	-0.01 [-0.74]		
MI × TR			-0.12 [-1.25]		-0.48† [-5.90]		

Note：Robust t statistics in brackets. * significant at 10%; ** significant at 5%; † significant at 1%.
Dependent variables include: $FX^{AGG}\,Asset$; Independent variables include: the one-period lag of dependent variable, Y(t-1); cov(RER, er) / var(er); var(er); Regularity Quality and Rule of Law; Total international reserve excluding gold /GDP, TR; the trilemma indices;and the interaction of trlemma indices and TR.

TABLE IV.

Dependent varable,Y(t)	Exp	$FX^{AGG}\,Liability$ (13)	(14)	(15)	(16)	(17)	(18)
Y (t-1)	(13)~(18)	0.69† [6.35]	0.70† [7.94]	0.59† [4.65]	0.55† [5.48]	0.67† [5.06]	0.73† [8.86]
cov(RER,er)/ var(er)> 0	(+)	-0.004 [-0.78]	-0.01 [-1.32]	-0.004 [-0.67]	-0.02** [-2.40]	-0.002 [-0.31]	-0.002 [-0.35]
cov(RER,er)/ var(er)≦0	(−)	-0.06† [-3.81]	-0.06** [-2.56]	-0.05† [-3.44]	-0.03 [-1.51]	-0.06† [-3.23]	-0.02** [-2.39]
var(er)	(−)	-0.12† [-5.35]	-0.80** [-2.38]	-0.10† [-4.28]	-0.10† [-6.19]	-0.11† [-4.73]	-0.11† [-3.23]
Regularity Quality	(+)	0.03 [1.39]	-0.02 [-0.41]	-0.02 [-1.04]	-0.06** [-2.42]	0.01 [0.31]	-0.01 [-0.26]
Rule of Law	(+)	-0.004 [-0.10]	0.0003 [0.004]	0.07** [2.06]	0.12† [3.33]	0.04 [1.00]	0.09** [2.32]
TR		-0.06 [-0.62]	-0.88† [-4.58]	0.25** [2.52]	0.24** [2.01]	0.16 [1.50]	-0.12 [-0.74]
KAOPEN				-0.002 [-0.46]	-0.002 [-0.28]	-0.01 [-1.22]	-0.003 [-0.30]
KAOPEN × TR					0.26** [2.48]		-0.01 [-0.30]
ERS		-0.02 [-1.43]	-0.07† [-3.11]			-0.01 [-0.64]	-0.05† [-3.28]
ERS × TR			0.13 [0.71]				0.24† [3.17]
MI		0.003 [0.22]	-0.03* [-1.70]	0.02 [1.48]	0.01 [0.36]		
MI × TR			0.09 [1.18]		-0.31* [-1.73]		

Note：Robust t statistics in brackets. * significant at 10%; ** significant at 5%; † significant at 1%.
Dependent variables include: $FX^{AGG}\,Liability$; Independent variables include: the one-period lag of dependent variable, Y(t-1); cov(RER, er) / var(er); var(er); Regularity Quality and Rule of Law; Total international reserve excluding gold /GDP, TR; the trilemma indices;and the interaction of trlemma indices and TR

2) . Results for $NETFX$

Results in Table 5 are consistent with those in Tables 2-4. Results from columns (13)-(16) of Table 5 point out that the impact of home bias sources on $NETFX$ is enhanced if a country’s monetary independence decreases. This result is consistent with that in Lane and Shambaugh (2010b), which find that countries in EMU have less FX^{AGG}.Results from columns (13)-(16) of Table 5 indicate that $NETFX$ increases with the non-positive covariance-variance ratio but decreases with the positive covariance-variance ratio, which in turn

[17] For preventing a country from suffering serious currency depreciation, Obstfeld et al.(2009) mention that the main reason for a central nabk to hold reserves is to protect the domestic banking sector, and domestic credit markets more broadly.

implies that home bias sources have prominent effect on $NETFX$. These results are consistent with that in existing literatures. In short, results from Table 5 point out that the non-positive covariance-variance ratio between real

TABLE V.

Dependent varable,Y(t)	Exp	(13)	(14)	(15)	(16)	(17)	(18)
		NETFX					
Y (t-1)	**(13)~(18)**	0.27† [3.26]	0.37† [3.78]	0.17** [2.28]	0.06 [0.68]	0.17 [1.53]	0.10 [1.14]
cov(RER,er)/ var(er)> 0	(−)	-0.04* [-1.70]	-0.004 [-0.14]	-0.04** [-1.96]	-0.06** [-2.22]	-0.02 [-0.92]	-0.01 [-0.36]
cov(RER,er)/ var(er)≦0	(+)	0.11† [3.78]	0.09* [1.76]	0.10** [2.29]	0.15† [3.82]	0.03 [0.72]	-0.01 [-0.16]
var(er)	(+)	0.07† [2.67]	0.53 [0.96]	0.06† [2.97]	0.08† [3.31]	0.05 [1.47]	-0.10** [-2.35]
Regularity Quality	(+)	0.02 [0.16]	-0.25 [-1.15]	0.09 [0.80]	0.21** [1.99]	0.08 [0.64]	0.15 [1.04]
Rule of Law	(+)	-0.01 [-0.05]	0.91** [2.41]	-0.36* [-1.90]	-0.36** [-2.22]	-0.29 [-1.13]	-0.49 [-1.36]
TR		0.04 [0.08]	-0.08 [-0.07]	0.71 [1.13]	-0.35 [-0.57]	1.34** [1.96]	0.27 [0.57]
KAOPEN				0.005 [0.28]	-0.03 [-0.91]	0.03 [1.42]	-0.03 [-0.83]
KAOPEN × TR					0.67 [1.60]		0.11 [0.67]
ERS		0.02 [0.71]	-0.02 [-0.29]			0.03 [0.68]	0.11* [1.68]
ERS × TR			1.13 [0.73]				0.92* [1.67]
MI		-0.13 [-1.37]	-0.31† [-2.59]	-0.11* [-1.81]	-0.14* [-1.82]		
MI × TR			-1.27 [-1.37]		0.21 [0.22]		

Note：Robust t statistics in brackets. * significant at 10%; ** significant at 5%; † significant at 1%.

Dependent variables include: $NETFX$; Independent variables include: the one-period lag of dependent variable, Y(t-1); cov(RER, er) / var(er); var(er); Regularity Quality and Rule of Law; Total international reserve excluding gold /GDP, TR; the trilemma indices;and the interaction of trlemma indices and TR.

exchange rate and excess return has siginificant impact on $NFA/(A+L)$. This implies that the portfolio home bias sources are important factors of $NETFX$ and external imbalance adjustment.

IV. CONCLUSION

Our interesting results suggest that country characteristics are important determinants of aggregate foreign currency exposure. And the sources of portfolio home bias have prominent effects on foreign currency exposure, supporting the ”international diversification puzzle”. They especially figure out that the sources of portfolio home bias are crucial to external valuation effects and to the external imbalance adjustment.

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