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Foreign portfolio investment patterns: evidence from a gravity model

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Abstract

Cross-country capital flows have been widely studied in the literature; however, why some countries may form more similar foreign investment portfolios than others has not been investigated. Using data for a broad panel of countries during the period 2002–2015, we adopt gravity equations to estimate cross-country foreign portfolio investment patterns. The main empirical results reveal that countries are more likely to form similar foreign portfolio investment patterns if: (i) countries are geographically closer; (ii) countries share the same official language; and (iii) countries adopt fixed exchange rate regimes.

Keywords Foreign portfolio investment · Gravity · Exchange rate regimes

Mathematics Subject Classification F21 · F31 · F34

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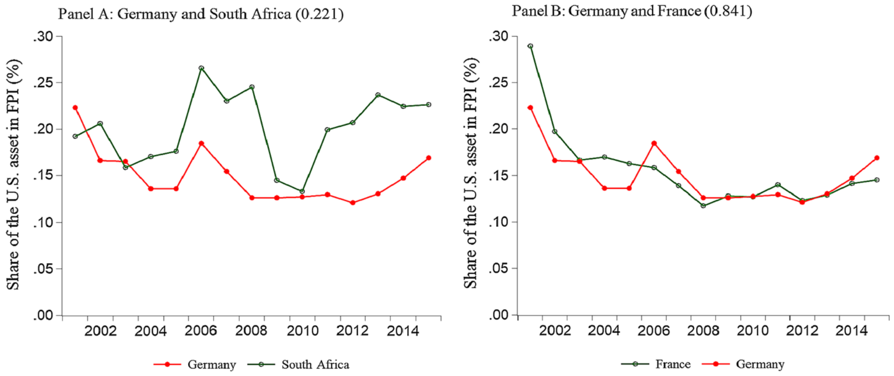

Fig. 1 Foreign portfolio investment, US assets (2001–2015). Note: The share of US assets in each country's foreign portfolio investment (FPI) is the authors' own calculation based on data for total portfolio investment from the International Monetary Fund's (IMF's) Coordinated Portfolio Investment Survey (CPIS) dataset

1 Introduction

Cross-border capital flows have been widely examined in international finance literature. Many studies adopt gravity models to empirically analyze the bilateral capital flow patterns between countries. To our knowledge, however, the existing international finance literature does not provide evidence whether countries may tend to form similar investments in foreign financial asset or not, and what factors may drive countries to invest similarly in foreign assets. We aim at filling this empirical void in the literature.

A better understanding of why countries may have similar foreign investment patterns can be crucial to examine important topics such as global imbalances. For instance, many economists are concerned that the rapid growth in China's US asset holdings could be an important reason for the US current account deficit. In theory, a two-country model is usually built to examine the impact of the rise of China on the US current account deficit. However, there are other countries investing like China, as we document in this paper. If a group of countries invests like China, one has to think of models with heterogeneous countries including subgroups that invest in a similar way, to capture quantitatively such dynamics.

Consider as an example the two pairs of countries in Fig. 1, we show that it is likely that the foreign investments of some countries are more similar than those of other countries. We compare US asset holding positions between two country pairs. In Panel A, we can see that South Africa's and Germany's US financial asset holdings diverge frequently. In particular, the statistical correlation of US asset holdings between the two countries is low (around 0.22). In Panel B, we clearly see a much higher statistical correlation (0.84) in the US financial asset holdings between two countries, France and Germany. This simple comparison suggests that country pairs such as France and Germany seem to form similar foreign portfolio investment (FPI) patterns, while others do not (country pairs such as South Africa and Germany). What are the key factors that drive the difference in FPI patterns across country pairs? In this paper, we empirically provide answers to this question.

To examine the similarity (or dissimilarity) in FPI patterns between any two countries, we adopt gravity model estimations. We compute the absolute difference in the shares of US financial assets (or other countries' financial assets) in the total FPI basket for the pairs of economies and use the absolute difference as the dependent variable. A low value means that two countries are more likely to hold similar shares of foreign financial assets. Controlling a set of macroeconomic and gravity variables, the results show that countries that are geographically closer, countries that share the same official language, or countries that adopt fixed exchange rates within a pair tend to form similar FPIs. The results are robust when we i) divide countries into different income groups, ii) consider different time periods, iii) add control variables, and iv) adopt alternative specifications. To deal with the potential endogeneity, we use the instrument variable for exchange rate regimes developed by Klein and Shambaugh (2006) and show that the main results still hold in the instrumental variable regressions.

The present paper is related to two streams of literature. The first literature stream uses the gravity estimation strategy in examining cross-country capital flows. In a pioneering study, Portes and Rey (2005) use a gravity model to analyze bilateral equity flows between 14 countries during the period from 1989 to 1996. The authors show that the gravity model explains international transactions in financial assets at least as well as goods trade transactions. A negative and significant impact of bilateral distance on bilateral equity flows is found in their empirical study. When proxies for information aspects, such as the volume of bilateral telephone call traffic, are included, the estimated impact of distance falls, but it remains statistically significant. Lane and Milesi-Ferretti (2008) use the Coordinated Portfolio Investment Survey (CPIS) data and find that bilateral equity investment is strongly correlated with the underlying patterns of trade in goods. Specifically, the authors find that information links, such as a common language and common legal origins, induce greater cross-border capital flows. Coeurdacier and Guibaud (2011) examine stock return correlations across countries and foreign investment. Using past stock return correlations (measured before the mid-1970s) as an instrument, they find that investors tend to hold foreign assets in countries that provide better diversification opportunities. Using the generalized method of moments (GMM), Vermeulen (2010) examines the year-to-year portfolio adjustment process in a dynamic panel system. Results suggest that investors adjust their international portfolio allocations by investing less in foreign stock markets that co-move strongly with their domestic one. To investigate foreign portfolio investment, Aggarwal et al. (2012) use the International Monetary Fund's (IMF's) CPIS of foreign debt and equity portfolios across 174 originating and 50 destination countries from 2001 to 2007. The authors find that the impact of cultural distance is positively associated with geographic distance. Moreover, greater levels of power distance and masculinity in the foreign investment destination country are positively related to more cross-border investment.

The second literature stream this paper is related to investigate the determinants of international capital flows. Some studies highlight the importance of global factors ("push" factors) as the main drivers of international capital flows (Cerutti et al. 2019; Forbes and Warnock 2012). For instance, Sarno and Taylor (1999) examine the relative importance of permanent and temporary components of capital flows to developing countries in Latin America and Asia during the period from 1988 to 1997. The authors show that international environments characterized by increasing liberalization, continuing technological progress, and financial innovation are the main drivers of foreign direct investment flows to developing countries. In contrast, others have emphasized the role of domestic factors ("pull" factors) in driving cross-border capital flows. Griffin et al. (2004) emphasize countries' financial market characteristics that affect equity inflows and find that (i) equity flows into a country usually increase when the returns in the destination country's stock market are high and (ii) equity inflows into small countries are positively correlated to US stock market returns. There are also studies that quantitatively compare the relative importance of push and pull factors. Using a dataset of portfolio capital flows at the fund level, Fratzscher (2012) shows that push factors are the major determinants of capital flows during crisis periods, whereas pull factors are dominant for capital flows in emerging market economies since 2009. Sarno et al. (2016) adopt a Bayesian dynamic latent factor model and find that more than 80 percent of the variation in bond and equity flows from the United States (US) to other countries can be explained by push factors.

Instead of studying the bilateral cross-border capital flows in a pair of countries, the present work contributes to the literature on international capital flows by providing explanations for cross-country similarities (or differences) in foreign portfolio investment. Specifically, we highlight the roles of the economic, the geographic, and the cultural connection in a pair of countries that affect the differences in countries' foreign asset portfolio choices. To the best of our knowledge, this is the first study that focuses on this perspective.

The remainder of the paper is organized as follows: In Sect. 2, we present the empirical approach used. In Sect. 3, we discuss the data and report empirical findings. In Sect. 4, we provide concluding remarks.

2 Empirical methodology

We adopt a gravity model in the empirical analysis to explore factors that drive countries that choose similar FPI patterns. The estimation specification is as follows:

$$\left|Y_{i,j,t}\right| = \beta_1 EX_{i,j,t} + \alpha \boldsymbol{Z}_{i,j} + \gamma \left|\boldsymbol{X}_{i,j,t}\right| + f_i + f_j + f_t + \varepsilon_{i,j,t} \tag{1}$$

where $\left|Y_{i,j,t}\right|$ denotes the absolute difference in the shares of one major foreign financial asset in the total FPI pattern between country i and country j in year t. In this paper, we consider foreign assets from the US, Japan, the United Kingdom (UK), Germany, and France, because foreign financial assets from those five economies represent the most important shares in total FPI for almost all countries in the world. $EX_{i,j,t}$ is a dummy variable which equals one if there is a fixed exchange rate between the two countries at time t (and zero otherwise). $\boldsymbol{Z}_{i,j}$ stands for a vector of gravity variables that do not vary over time. Specifically, it includes (i) the *Log bilateral distance* between the two biggest cities in countries i and j; (ii) *Common religion* which refers to the share of religions in both countries that are the same; (iii) *Contiguity*, a dummy variable that equals one if two countries share the same border; (iv) *Common official language*, a dummy variable that equals one if two countries have a common official language; and (v) *Common colonizer*, a dummy that takes a value of one if two countries have had a common colonizer after 1945. $\left|X_{i,j,t}\right|$ is a set of control variables that vary over time. For instance, it includes the absolute differences in log per capita GDP (*DGDP*) and log population size (*DPOP*)[1] between country i and country j.[2] f_i, f_j, and f_t capture the country i's, country j's, and year fixed effects, respectively.

We consider bilateral exchange rate regime choice as one of the key regressors in the estimation. The rationale is that a bilateral fixed exchange rate regime between countries i and j ties the domestic interest rates (as well as other macro-variables) in two countries together. As shown in standard macro- and finance theories, as long as the preferences of the agents do not differ much, they are likely to make similar (foreign) investment decisions when the agents face similar macroeconomic environments. As a result, we predict that $\beta_1 < 0$.

The second important set of regressors in the estimation is the set of gravity variables. Okawa and van Wincoop (2012) develop a theory on bilateral international asset holdings that provides guidance for inclusion of gravity variables in empirical studies on cross-border capital flows. As shown in previous empirical studies (Aviat and Coeurdacier 2007; Forbes 2010; Lane and Milesi-Ferretti 2008), gravity variables, such as common language, contiguity, common colony, and religion relationship, have a significant influence on financial flows and asset holdings. Thus, we include these variables in the regressions. Theoretically, when two economies are geographically closer and/or have similar cultures, agents in the two countries may share a common information set or cultural background. As a result, FPI patterns in the two economies may be similar. To be more specific, taking distance and common official language as two examples, we predict the coefficient on distance will be positive, while the coefficient on common official language will be negative.

3 Estimation

3.1 Description of data

The foreign financial asset data we use are from the CPIS, the same dataset used by Lane and Milesi-Ferretti (2008). We consider foreign assets are assets from the US,

[1] The control variables are included based on the following rationale. Real GDP per capita and population size are important measures of countries' fundamentals that may affect foreign investment decisions. For instance, the role of economic growth in the stock market performance is well established in the literature (King and Levine 1993; Levine 1991; Levine and Zervos 1998). Regarding population size, Abel (2000) adopts an overlapping generations (OLG) model to study the relationship between demographics and stock market and finds that a baby boom can increase the price of capital. As a result, we control the real GDP per capita and the population size of the source country and the host country in the regressions.

[2] The reason we control for the absolute differences in per capita incomes and populations sizes is to follow the Linder hypothesis. As analyzed by Frankel (1997), the Linder (1961) hypothesis predicts that countries with similar per capita incomes will have similar preferences and similar but differentiated products, and thus, will trade more with each other. The Linder hypothesis is usually described as predicting the effect of the absolute difference of per capita GDPs on trade (or capital flows in this paper). In the spirit of Linder (1961), Gruber and Vernon (1970) and Thursby and Thursby (1987) include the absolute difference in per capita incomes in the standard gravity estimation to analyze the differences in countries' consumption patterns. In line with these studies, we control for the absolute differences in log per capita GDPs and log population sizes in the estimations.

Japan, the UK, Germany, and France; therefore, we exclude these five economies from the sample. We use annual panel data that include 1904 country pairs from the period 2002 to 2015.[3] Table A1 in Online Appendix provides the list of countries in the estimations.

The dependent variable is constructed as follows. Taking US assets as an example, we first compute the share of US financial assets in country i's total FPI.[4] We then calculate the same statistic for country j. Finally, we take the absolute difference of the two shares in countries i and j and use it as the dependent variable.

Data for the gravity variables can be obtained from the gravity database in Centre d'Etudes Prospectives et Chaussées (CEPII). We adopt the bilateral exchange rate regime data from Klein and Shambaugh (2006) as in standard literature. Specifically, we use the dummy variable *kspeg* in their paper.[5] When *kspeg* takes a value of one, the two economies in a pair have a fixed exchange rate regime (otherwise; it is zero).[6]

GDP per capita data can be obtained from World Development Indicators (WDI) database. We use the 2011 purchasing power parity (PPP) international dollar measured GDP per capita index in the regressions. Table A2 in Online Appendix presents descriptive statistics for all variables used in this study. As shown in Table A2, the number of economies with common official languages is much larger than the number of countries that share common borders and colonial relations.

3.2 Results

Before showing the regression results, we provide some scatter plots. Due to the large number of observations, we adopt the binned scatter plot technique[7] and report the graphic results in Fig. 2. The binned scatter plots clearly show that there seems to exist (i) a negative correlation between the fixed exchange rate regime and the difference in US financial asset holdings between countries; (ii) a positive correlation between distance and the difference in US financial asset holdings; and (iii) a negative correlation between the common official language and difference in US financial

[3] Foreign financial asset data end in the year 2015.

[4] According to the IMF, the top 10 economies for foreign investment are the US, Japan, Luxembourg, the UK, Germany, France, Ireland, Cayman Islands, the Netherlands, and Hong Kong. In this paper, we construct the total FPI for each economy by summing up the investments spent on these economies' financial assets.

[5] The *kspeg* data are available on https://www2.gwu.edu/~iiep/about/faculty/jshambaugh/data.cfm .

[6] One potential problem in the *kspeg* index is that there are a large number of missing values (in 434 country pairs). This is mainly because the *kspeg* index considers only the direct peg between one country to a base country (such as the US). For instance, two countries i and j may peg to the US dollar; however, the relationship between countries i and j may be missing in the *kspeg* index. Thus, we revise the index by adding more information to pairs (i,j) that have missing values. For instance, for the pair (i,j), if they peg to some third country, we set *kspeg* to one; otherwise, it is set to zero.

[7] To construct a binned scatter plot between y and x, we first regress the y variable and the x variable on the same set of control variables, respectively, and collect residuals from two regressions. In the examples, the set of regressors we use to construct scatter plots is based on Column (1) in Table 1, after we exclude the two main variables y and x. We denote the residuals from the y variable regression and the x variable regression by e_y and e_x, respectively. Then, we divide e_x into 100 equal-sized bins and every e_y must fall into one bin. In each bin, we compute the means of e_y and e_x. Finally, we plot all the means of e_y against the means of e_x.

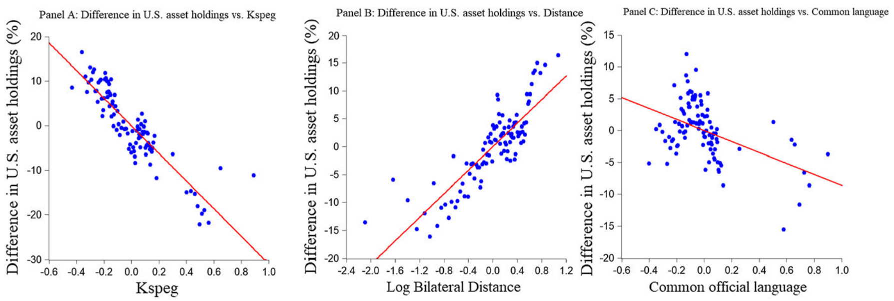

Fig. 2 US asset holdings versus exchange rate regime, bilateral distance, and common official language. Note: These figures represent nonparametric binned scatter plots of the relationship between the percentage difference in US asset holdings and the exchange rate regime, bilateral distance, common official language, respectively. All panels are based on the sample period 2002–2015

asset holdings. In fact, *kspeg* and *Log bilateral distance* are strongly correlated with differences in US financial asset holdings such that the fitted lines are nearly linear.

Next, we perform fixed effect (FE) estimations. The results are reported in Table 1. Consider the investment in US financial asset across countries. Column (1) shows that consistent with the theoretical prediction, there is a strong negative relationship between *kspeg* and the absolute difference in the shares of US financial assets in total FPI, which implies that when two countries have a fixed exchange rate, they are more likely to invest similar shares in US financial assets in total FPI. Not only is this effect is statistically significant (at the 1% level), but it is also economically significant that when two countries switch from a floating exchange rate regime to a pegged exchange rate regime, the absolute difference in the shares of US assets in total FPI will decrease by 26 percentage points.

We can also see that distance between countries plays an important role in determining the similarity of countries' foreign investment patterns. The positive coefficient on *Log bilateral distance* implies that when countries are closer to each other (a lower value of *Log bilateral distance*), they are more likely to form similar foreign investment patterns. This is also in line with the theoretical prediction that countries that are closer to each other may be more likely to share the same information set or common culture and thus make similar foreign investment decisions. This effect, according to Column (1), is also statistically significant (at the 1% level).

Another variable that significantly affects the difference in US financial asset holdings is the *Common official language* dummy. The negative coefficient means that as two countries share the same language, they are more likely to hold similar foreign assets. The effect is statistically significant (at 1% level) and economically significant. When two countries have the same official language, the difference in US asset holdings is more than 4 percentage points lower than when residents in two countries speak different official languages. Based on the same logic, if people in two countries speak the same official language, this reduces communication barriers. Therefore, their information sets can be very similar which in turn yield similar foreign asset investment.

Table 1 Foreign asset holdings versus exchange rate regime, gravity variables, FE regression

Dependent variable	diff_USA (1)	diff_JPN (2)	diff_DEU (3)	diff_FRA (4)	diff_GBR (5)
kspeg	−26.282***	−0.251***	−6.469***	−6.286***	0.770**
	(0.688)	(0.066)	(0.226)	(0.222)	(0.351)
Log bilateral distance	6.490***	0.098**	2.600***	1.296***	0.207
	(0.325)	(0.040)	(0.086)	(0.072)	(0.142)
Common official language	−4.412***	−0.139	−0.358**	−0.211	−1.432***
	(0.754)	(0.117)	(0.153)	(0.150)	(0.312)
Contiguity	−3.923***	−0.247**	1.295***	1.727***	−1.466***
	(1.086)	(0.119)	(0.355)	(0.288)	(0.513)
Common colonizer	1.061	0.601***	−2.189***	−0.212	−0.532
	(1.020)	(0.194)	(0.254)	(0.247)	(0.548)
Common religion	5.760***	−0.596***	2.396***	0.783***	−2.518***
	(0.789)	(0.107)	(0.263)	(0.207)	(0.357)
Log *DGDP*	−0.447**	0.141***	−0.325***	−0.360***	−0.061
	(0.190)	(0.033)	(0.059)	(0.048)	(0.087)
Log *DPOP*	−0.257	−0.110***	0.221***	0.392***	−0.0003
	(0.192)	(0.031)	(0.053)	(0.041)	(0.087)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.37	0.43	0.54	0.56	0.65
# Country Pairs	1904	1904	1904	1904	1904
Obs.	14758	14758	14758	14758	14758

Robust standard errors are reported in parentheses. ** and *** denote statistical significance at the 5% and 1% levels, respectively

When we examine how factors affect differences in other foreign asset holdings, Columns (2) to (4) show that *kspeg*, *Log bilateral distance*, and *Common official language* dummy are three variables that have the most robust signs in those regressions. For the variables *Contiguity* dummy,[8] *Common colonizer* dummy,[9] and *Common religion* dummy,[10] the signs change when we take different foreign asset investments as dependent variables. We can also see that most coefficients on *kspeg*, *Log bilateral distance* and *Common official language* in Columns (2) to (4) are still statistically significant when we change the dependent variable to different foreign assets. It is interesting to see that in Column (5), when we consider the foreign investment in UK financial assets, the coefficient on *kspeg* becomes positive, the coefficient on *Log bilateral distance* is now statistically insignificant although the coefficient on *Common official language* dummy is still negative and statistically significant. A theory may be needed to explain the cross-country investment pattern for UK assets.

[8] For the *Contiguity* index, countries that share the same border may not necessarily have similar cultures or economic situations. A country such as Russia that is geographically large is bordered by many countries. For instance, China is one of the neighboring countries of Russia; however, the cultures and economies of China and Russia are very different. This is one reason why we consider *Distance* is a better measure to capture the similarities between a pair of countries. According to the definition, *Distance* is the weighted bilateral distance (population weighted) between two countries. In this way, the measure puts greater weight on the bilateral distance between bigger cities (usually with larger population sizes). Note that trade and capital flows between big cities usually play very important roles in a country pair; thus, the *Distance* measure may well capture economic and culture exchanges across countries. As shown in the regression tables, the *Distance* index shows a more robust pattern than the *Contiguity* index.

[9] For the *Common colonizer* index, we consider that it may affect the regression results, but again, we do not think it is a perfect measure for capturing cultural similarities. Especially after controlling for indices such as common language, the effect of *Common colonizer* may become weaker. We also can see from the data that there are countries that have never been fully colonized. For pairs that include such countries, the *Common colonizer* index takes the value of zero; however, this does not mean the cultures of the countries in those pairs are not similar. For instance, China is considered one country that has not been fully colonized, but China and many Asian countries have cultural similarities. Thus, we include the *Common colonizer* index in the regressions only to control for the potential effect that might come from it; we do not treat this index as one of the key explanatory variables. In fact, previous studies such as Coeurdacier and Guibaud (2011) also find that the *Common colonizer* index does not have a robust effect on bilateral cross-border equity holdings, and its sign varies across model specifications.

[10] For the *Common religion* dummy, based on the definition, it is calculated by adding the products of the shares of Catholics, Protestants, and Muslims in a country pair. One reason that the *Common religion* dummy shows various effects when we focus on the foreign investment in different destination countries is that this index may not completely reflect the religious similarity between the countries in a pair. For instance, this dataset contains a number of East Asian countries, which have very small religious population based on this definition. Taking Korea as an example. According to Korea's 2015 national census, more than half of Koreans consider themselves not to be religious, and among the rest of the population, a large percentage are members of other religions that are not considered in the *Common religion* index. In fact, the value of the *Common religion* dummy is almost close to zero for country pairs that include Korea; however, Korea and other East Asian countries such as China share cultural similarities. To find the true effect of *Common religion* on foreign investment between countries, a better measure is needed. Unfortunately, at this stage, we are unable to find the perfect measure for common religion. Thus, we control only the index we have in regressions but do not treat it as one of the main variables that determine the foreign investment pattern across countries.

3.3 Instrumental variable regressions

One concern in the baseline FE regressions is the exchange rate regime variable can be endogenous. One can argue that exchange rate regime choices may respond to cross-country capital flows, which causes a potential endogeneity in estimations. To deal with this issue, we undertake an instrumental variable regression. An appropriate instrument for this study should predict whether a country pegs its currency, but the variable itself, outside its indirect impact through the channel of exchange rate regime choice, will have no direct influence on difference in foreign asset investment patterns between countries. In this paper, we use the instrument developed by Klein and Shambaugh (2006). Specifically, for a given country pair (i, j), if country i is the base country (that other countries may peg their currencies with), we calculate the percentage of countries in country j's region that are directly pegged with country i. This percentage serves as the instrumental variable.

The instrumental variable regression then follows a standard two-stage-least-squares estimation with the first-stage regression as:

$$EX_{i,j,t} = \gamma_0 + \gamma_1 F_{i,j,t}^I + \vartheta \left|\boldsymbol{X}_{i,j,t}\right| + \varphi \boldsymbol{Z}_{i,j} + \mu_{i,j,t} \tag{2}$$

where $F_{i,j,t}^I$ stands for the primary instrument used for *kspeg*; $\mu_{i,j,t}$ is the stochastic error term. Using the predicted values of $\hat{EX}_{i,j,t}$, we estimate the second-stage regression following the same form as Eq. (2).

The second-stage results are reported in Table 2. We obtain similar patterns as in the baseline regressions. In most regressions, (i) the coefficients on *kspeg* are negative and statistically significant; (ii) the coefficients on *Log bilateral distance* are positive and statistically significant; and (iii) the coefficients on the *Common official language* dummy are negative and statistically significant. In other words, the baseline results still hold in the instrumental variable estimations. To evaluate whether the instrumental variable we have selected is good or not, we examine the first-stage results. The first-stage regression outcome in Table 2 shows that the coefficient of $F_{i,j,t}^I$ is statistically significant at the 1% level, and the first-stage F-test is well above 10. These results suggest that $F_{i,j,t}^I$ is sufficiently correlated with the nominal exchange rate regime variable to act as a potentially good instrument.

3.4 Robustness checks

In this section, we conduct five types of robustness checks. First, we divide the sample into three subsamples based on country income. Second, we divide the sample into multiple sample periods to examine whether business cycle shocks may change the FPI patterns. Third, we examine how the main baseline regression results vary by adding more control variables. Fourth, we check the sensitivity of the benchmark results by separately controlling per capita GDPs and population sizes within a country pair (instead of using the absolute differences of the two measures). Last, we consider an alternative specification by including the country-pair fixed effect.

Table 2 Foreign asset holdings versus exchange rate regime, gravity variables, IV regression

Dependent variable	diff_USA (1)	diff_JPN (2)	diff_DEU (3)	diff_FRA (4)	diff_GBR (5)
kspeg	−24.460***	−0.941***	−4.945***	−3.362***	0.708
	(1.990)	(0.214)	(0.486)	(0.554)	(0.593)
Log bilateral distance	6.044***	0.263***	1.920***	1.065***	0.334
	(0.563)	(0.076)	(0.134)	(0.129)	(0.225)
Common official language	−4.238***	0.783***	−0.433*	0.279	−0.809*
	(1.077)	(0.210)	(0.235)	(0.243)	(0.422)
Contiguity	3.056	−0.253	1.644**	1.781***	−1.606*
	(2.152)	(0.305)	(0.642)	(0.467)	(0.968)
Common colonizer	−1.670	0.893***	−1.543***	−0.390	−1.180*
	(1.398)	(0.286)	(0.308)	(0.342)	(0.689)
Common religion	4.191***	−0.928***	1.724***	0.221	−1.036
	(1.424)	(0.211)	(0.411)	(0.364)	(0.677)
Log *DGDP*	−0.565*	0.271***	−0.445***	−0.468***	0.225*
	(0.322)	(0.060)	(0.090)	(0.082)	(0.132)
Log *DPOP*	−0.774***	−0.319***	0.288***	0.436***	−0.227*
	(0.289)	(0.052)	(0.076)	(0.066)	(0.129)
First-stage regressions					
$F^{I}_{i,j,t}$	0.010***	0.010***	0.010***	0.010***	0.010***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted R^2	0.68	0.68	0.68	0.68	0.68
1st stage F-test	1568.58	1568.58	1568.58	1568.58	1568.58
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.45	0.47	0.67	0.54	0.65
# Country Pairs	1208	1208	1208	1208	1208
Obs.	4493	4493	4493	4493	4493

Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively

3.4.1 Dividing the data sample into different income groups

One concern is that low-income countries and high-income countries may have different investment strategies. If this potential difference in foreign asset investment is not considered, the baseline estimation results may not be precise. To address this concern, we divide the sample into three subsamples. The first subsample contains only low-income countries in all country pairs. The second subsample contains high-income countries in all pairs. The last sample contains country pairs that includes one low-income country and one high-income country. In the classification, we use the median of real GDP per capita as the cutoff value above (below), which we define a country as a high-income country (low-income country).

Results are reported in Tables 3, 4, and 5. We can see that only for country pairs that contain one low-income country and one high-income country, some coefficients on *Common official language* become statistically insignificant or even positive. In the two other subsamples, the coefficients on *Common official language* are all negative, and most of them are also statistically significant, which is consistent with the baseline regression results. In all three tables, the coefficients on *kspeg* are mostly negative and statistically significant,[11] while the coefficients on *Log bilateral distance* are mostly positive and statistically significant. These results are consistent with the baseline estimation results. The scales of those coefficients are very similar as in the baseline regressions.

3.4.2 Dividing the data sample into different periods

In the second robustness check, we divide the data sample into multiple periods. This is to examine whether FPI decisions vary when global situations have changed. In the sample, there actually are at least two global external shocks that could cause significant changes in international capital flows: the 2007–2009 global financial crisis (GFC) and the 2010–2012 European debt crisis. To that end, we split the sample into two periods: the non-crisis period (2002–2006, 2013–2015) and the period under economic or financial shocks (2007–2012). Tables 6 and 7 report the regression results. Overall, we obtain similar estimation results as in the baseline regressions, which suggests that this FPI pattern is not quite affected by short-run business cycle characteristics.

3.4.3 Adding more control variables

In the third robustness check, we add more control variables to the baseline regressions. First, a proxy for information barriers that have been widely used in gravity models of trade and capital flows is included in the estimations. In particular, following Portes and Rey (2005) and Stein and Daude (2007), we use the time difference in hours between the countries' capitals to proxy for communication difficulties when the overlap between office hours is limited.[12]

[11] The foreign investment in UK financial assets is different from assets from other countries on which the coefficient on *kspeg* is positive but statistically insignificant.

[12] This variable varies from 0 to 12. We construct the variable based on standard time zones, abstracting from the issue of daylight savings. Data are obtained from https://www.timeanddate.com.

Table 3 Low-income countries in all country pairs

Dependent variable	diff_USA (1)	diff_JPN (2)	diff_DEU (3)	diff_FRA (4)	diff_GBR (5)
kspeg	−19.694***	−0.212	−6.176***	−3.104***	0.599
	(2.000)	(0.224)	(0.915)	(0.721)	(0.976)
Log bilateral distance	6.297***	0.260***	2.162***	0.845***	0.095
	(0.626)	(0.086)	(0.197)	(0.149)	(0.296)
Common official language	−6.211***	0.712**	−0.251	−0.079	−1.871***
	(1.555)	(0.308)	(0.361)	(0.273)	(0.617)
Contiguity	−0.672	0.162	0.622	1.414***	−1.015
	(1.980)	(0.226)	(0.590)	(0.465)	(0.847)
Common colonizer	8.471***	0.500	−2.795***	−1.084*	0.598
	(2.053)	(0.523)	(0.701)	(0.618)	(0.880)
Common religion	−13.060***	−0.993***	3.442***	−0.500	−4.171***
	(2.411)	(0.351)	(0.704)	(0.456)	(1.169)
Log *DGDP*	0.393	0.025	0.059	0.418***	0.203
	(0.682)	(0.125)	(0.200)	(0.140)	(0.336)
Log *DPOP*	−1.078*	−0.087	−0.132	0.038	−0.077
	(0.580)	(0.112)	(0.174)	(0.120)	(0.283)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.29	0.36	0.49	0.71	0.75
# Country Pairs	688	688	688	688	688
Obs.	3662	3662	3662	3662	3662

Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively

Table 4 High-income countries in all country pairs

Dependent variable	diff_USA (1)	diff_JPN (2)	diff_DEU (3)	diff_FRA (4)	diff_GBR (5)
kspeg	−27.446***	−0.888***	−5.912***	−7.865***	0.828
	(1.092)	(0.127)	(0.319)	(0.295)	(0.564)
Log bilateral distance	1.402*	0.569***	2.235***	0.430***	0.010
	(0.723)	(0.095)	(0.163)	(0.135)	(0.304)
Common official language	−17.612***	−0.526***	−1.321***	−0.782***	−1.896**
	(1.423)	(0.167)	(0.309)	(0.274)	(0.801)
Contiguity	−2.445*	0.281	−0.591	0.777*	−1.102
	(1.396)	(0.210)	(0.819)	(0.450)	(0.689)
Common colonizer	−13.954***	0.863***	−2.801***	−0.878**	−1.275
	(2.201)	(0.200)	(0.405)	(0.428)	(1.163)
Common religion	3.005***	0.062	2.689***	−0.437	−1.166**
	(1.158)	(0.164)	(0.488)	(0.424)	(0.514)
Log *DGDP*	−0.823*	0.602***	−0.702***	−0.178	−0.768***
	(0.476)	(0.071)	(0.142)	(0.135)	(0.251)
Log *DPOP*	−0.247	−0.446***	0.591***	−0.079	0.755***
	(0.580)	(0.085)	(0.151)	(0.142)	(0.261)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.51	0.53	0.63	0.48	0.54
# Country Pairs	531	531	531	531	531
Obs.	3679	3679	3679	3679	3679

Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively

Table 5 One low-income country and one high-income country in all country pairs

Dependent variable	diff_USA (1)	diff_JPN (2)	diff_DEU (3)	diff_FRA (4)	diff_GBR (5)
kspeg	−24.869***	−0.482***	−6.646***	−4.947***	−0.070
	(1.043)	(0.087)	(0.405)	(0.360)	(0.498)
Log bilateral distance	6.899***	0.061	2.846***	1.309***	0.624***
	(0.507)	(0.056)	(0.149)	(0.120)	(0.236)
Common official language	4.511***	−0.081	−0.591***	0.202	0.454
	(0.973)	(0.165)	(0.225)	(0.233)	(0.450)
Contiguity	−1.279	−0.103	3.686***	3.592***	−0.038
	(1.722)	(0.228)	(0.620)	(0.556)	(0.996)
Common colonizer	1.403	0.678**	−2.307***	−0.487	−0.833
	(1.448)	(0.288)	(0.308)	(0.333)	(0.756)
Common religion	13.879***	−0.294*	2.442***	1.854***	−2.402***
	(1.077)	(0.152)	(0.372)	(0.289)	(0.520)
Log *DGDP*	−0.022	0.085**	−0.276***	−0.269***	0.103
	(0.274)	(0.038)	(0.088)	(0.071)	(0.137)
Log *DPOP*	−0.911***	−0.087**	0.185**	0.186**	−0.304**
	(0.300)	(0.041)	(0.090)	(0.074)	(0.123)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.48	0.52	0.59	0.59	0.63
# Country Pairs	1187	1187	1187	1187	1187
Obs.	7417	7417	7417	7417	7417

Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively

Table 6 Regression during time periods 2002–2006 and 2013–2015

Dependent variable	diff_USA (1)	diff_JPN (2)	diff_DEU (3)	diff_FRA (4)	diff_GBR (5)
kspeg	−25.005***	−0.253**	−7.175***	−5.543***	0.449
	(0.935)	(0.099)	(0.324)	(0.294)	(0.322)
Log bilateral distance	6.135***	0.034	2.863***	1.221***	0.036
	(0.433)	(0.057)	(0.118)	(0.095)	(0.147)
Common official language	−3.534***	−0.051	−0.827**	−0.477**	−1.006***
	(0.992)	(0.174)	(0.210)	(0.208)	(0.323)
Contiguity	0.303	−0.378**	1.538***	1.774***	−0.959*
	(1.431)	(0.172)	(0.472)	(0.377)	(0.504)
Common colonizer	1.038	0.713**	−1.872***	0.241	−0.587
	(1.342)	(0.288)	(0.348)	(0.313)	(0.537)
Common religion	4.395***	−0.828***	2.984***	0.990***	−2.088***
	(1.043)	(0.152)	(0.373)	(0.273)	(0.359)
Log *DGDP*	−0.270	0.121**	−0.237***	−0.214***	−0.011
	(0.253)	(0.048)	(0.080)	(0.062)	(0.093)
Log *DPOP*	−0.131	−0.106**	0.142**	0.238***	0.088
	(0.249)	(0.043)	(0.071)	(0.054)	(0.100)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.35	0.45	0.54	0.62	0.74
# Country Pairs	1842	1842	1842	1842	1842
Obs.	8075	8075	8075	8075	8075

Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively

Table 7 Regression during time period 2007–2012

Dependent variable	diff_USA (1)	diff_JPN (2)	diff_DEU (3)	diff_FRA (4)	diff_GBR (5)
kspeg	−27.526***	−0.271***	−5.726***	−7.150***	0.962**
	(1.012)	(0.072)	(0.300)	(0.320)	(0.478)
Log bilateral distance	6.841***	0.167***	2.302***	1.338***	0.359*
	(0.492)	(0.046)	(0.118)	(0.103)	(0.190)
Common official language	−5.678***	−0.260**	0.276	0.102	−2.328***
	(1.171)	(0.105)	(0.214)	(0.200)	(0.612)
Contiguity	−9.168***	−0.103	0.979*	1.529***	−2.515***
	(1.650)	(0.136)	(0.506)	(0.411)	(0.956)
Common colonizer	0.789	0.348***	−2.521***	−0.976***	−0.187
	(1.578)	(0.127)	(0.331)	(0.347)	(0.717)
Common religion	7.607***	−0.319**	1.664***	0.545*	−2.682***
	(1.172)	(0.125)	(0.343)	(0.298)	(0.513)
Log *DGDP*	−0.705**	0.172***	−0.472***	−0.559***	−0.096
	(0.286)	(0.033)	(0.082)	(0.069)	(0.123)
Log *DPOP*	−0.370	−0.126***	0.351***	0.611***	−0.121
	(0.296)	(0.037)	(0.072)	(0.057)	(0.120)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.41	0.56	0.63	0.57	0.73
# Country Pairs	1464	1464	1464	1464	1464
Obs.	6683	6683	6683	6683	6683

Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively

Second, as in Davis et al. (2001), we add the correlation in annual GDP growth rates between countries within a pair. The logic is as follows. When two countries co-move strongly, their asset returns can be highly correlated. In this case, investors in the two countries may be more likely to seek similar assets to hedge risks.

Third, three factors that may affect investment decisions are included as further explanatory variables: the absolute difference in the real interest rate,[13] the difference in stock market returns,[14] and the absolute difference in capital account openness.[15] One potential issue when including the interest rate differential is, due to the large number of missing observations on the variable, the sample size shrinks from 14758 to 3853, which may significantly affect the estimation results. To overcome the issue of smaller sample size, we adopt the following strategy. We construct a dummy variable "*DummyInterest*" which takes a value of one if the observation of interest rate differential exists for a country pair in one period and zero otherwise. Then, we generate an interaction variable between the interest rate differential and *DummyInterest*. In the regressions, we control for the interaction variables (*Interest rate difference* × *DummyInterest*) and the dummy variable at the same time. In this way, we avoid losing a large number of observations, and we can still control the potential effects of the real interest rate differential on foreign investments to some degree.

Table 8 presents the regression results. Most coefficients on *kspeg* are still negative and statistically significant. Three out of five coefficients on *Log bilateral distance* are positive and statistically significant. For *Common language*, the signs on all coefficients are as expected, and two of them are also statistically significant. In sum, the baseline results still hold.

3.4.4 Controlling per capita GDPs and populations for countries within a pair

In the baseline estimation, we control for absolute differences in per capita GDPs and population sizes within a country pair. To verify this strategy does not drive the main results, in this robustness check, we replace the absolute differences by controlling the per capita GDPs and population sizes of both countries in a pair. Table 9 presents the regression results. The main results clearly still hold. In fact, the magnitudes of the coefficients on *kspeg* and *Log bilateral distance* are very close to the baseline estimation.

3.4.5 Alternative specifications

Although in the baseline regressions we control for a set of gravity variables, we may still miss some country pair characteristics (such as the similarity on the political

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[13] The real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator (which takes a value from 0 to 100). We converted the real interest rate into a decimal term. Data are obtained from the WDI database. In the regression, we use the absolute difference in the real interest rates within each pair of countries.

[14] Stock market return is the growth rate of the annual average stock market index. The data are obtained from the Global Financial Development database.

[15] Capital account openness is measured with the Chinn and Ito (2006) index and is retrieved from http://web.pdx.edu/~ito/Chinn-Ito_website.htm.

Table 8 Regression with additional control variables

Dependent variable	diff_USA (1)	diff_JPN (2)	diff_DEU (3)	diff_FRA (4)	diff_GBR (5)
kspeg	−33.591***	−0.600***	−5.865***	−7.408***	0.584
	(0.743)	(0.097)	(0.294)	(0.270)	(0.440)
Log bilateral distance	2.615***	0.082	3.749***	1.646***	−0.218
	(0.441)	(0.080)	(0.147)	(0.123)	(0.264)
Common official language	−2.593***	−0.167	−0.129	0.011	−2.018***
	(0.843)	(0.153)	(0.196)	(0.194)	(0.398)
Contiguity	−6.374***	−0.162	2.018***	2.044***	−2.108***
	(1.115)	(0.142)	(0.388)	(0.314)	(0.583)
Common colonizer	4.125***	0.623**	−1.234***	−0.198	−1.200
	(1.195)	(0.277)	(0.339)	(0.347)	(0.748)
Common religion	5.204***	−0.616***	2.141***	0.779***	−2.144***
	(0.816)	(0.119)	(0.274)	(0.223)	(0.384)
Interest rate difference × *DummyInterest*	−31.938***	2.348***	−6.386***	2.792**	−6.938***
	(4.365)	(0.733)	(1.166)	(1.100)	(1.862)
DummyInterest	3.965***	0.170	−1.163***	−1.246***	0.823**
	(0.755)	(0.116)	(0.240)	(0.184)	(0.376)
diff_stock	−0.007	0.003***	−0.001	0.002	0.002
	(0.005)	(0.001)	(0.001)	(0.001)	(0.002)
diff_KAOPEN	0.116	−0.065**	0.117**	0.015	−0.083
	(0.205)	(0.030)	(0.057)	(0.046)	(0.095)
Time difference	1.425***	0.040**	−0.352***	−0.113***	0.117**
	(0.120)	(0.020)	(0.031)	(0.025)	(0.051)

Table 8 continued

Dependent variable	diff_USA (1)	diff_JPN (2)	diff_DEU (3)	diff_FRA (4)	diff_GBR (5)
Correl. in growth rates	0.991**	−0.191**	0.298*	0.206	−0.062
	(0.506)	(0.078)	(0.157)	(0.148)	(0.322)
Log *DGDP*	−0.251	0.219***	−0.193***	−0.227***	−0.192*
	(0.207)	(0.040)	(0.073)	(0.063)	(0.110)
Log *DPOP*	−0.012	−0.150***	0.228***	0.487***	0.024
	(0.219)	(0.043)	(0.066)	(0.054)	(0.110)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.45	0.42	0.54	0.46	0.63
# Country Pairs	1252	1252	1252	1252	1252
Obs.	11706	11706	11706	11706	11706

Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively

Table 9 Regression separately controlling pair countries' per capita GDPs and populations

Dependent variable	diff_USA (1)	diff_JPN (2)	diff_DEU (3)	diff_FRA (4)	diff_GBR (5)
kspeg	−25.933***	−0.254***	−6.447***	−6.375***	0.803**
	(0.691)	(0.065)	(0.224)	(0.221)	(0.350)
Log bilateral distance	6.534***	0.093**	2.626***	1.331***	0.206
	(0.325)	(0.040)	(0.086)	(0.073)	(0.141)
Common official language	−4.545***	−0.142	−0.348**	−0.181	−1.442***
	(0.755)	(0.116)	(0.153)	(0.150)	(0.312)
Contiguity	−3.841***	−0.250**	1.334***	1.741***	−1.448***
	(1.089)	(0.119)	(0.358)	(0.288)	(0.513)
Common colonizer	1.573	0.573***	−2.046***	−0.227	−0.462
	(1.010)	(0.194)	(0.251)	(0.244)	(0.549)
Common religion	5.860***	−0.557***	2.328***	0.706***	−2.521***
	(0.788)	(0.106)	(0.264)	(0.208)	(0.356)
Log GDP_i	−1.084	−1.446***	0.329	−0.997**	1.364
	(2.242)	(0.277)	(0.571)	(0.487)	(0.983)
Log GDP_j	−8.680***	−1.999***	−0.396	0.565	−3.642***
	(2.179)	(0.290)	(0.597)	(0.517)	(1.045)
Log POP_i	−2.375	−1.119**	4.137***	−1.609	4.002**
	(3.247)	(0.519)	(1.192)	(0.996)	(1.760)
Log POP_j	−8.286**	−0.324	5.937***	−0.608	−1.015
	(3.965)	(0.532)	(1.378)	(1.273)	(2.156)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.37	0.43	0.54	0.56	0.65
# Country Pairs	1904	1904	1904	1904	1904
Obs.	14759	14759	14759	14759	14759

Robust standard errors are reported in parentheses. ** and *** denote statistical significance at the 5% and 1% levels, respectively side which might also affect the exchange rate regime choices between countries). Thus, we conduct the robustness check by controlling the country-pair fixed effect which captures all time-varying country pair characteristics. Note that this paper is not first to conduct estimations by using country-pair fixed effects. To overcome the issue of omitted variables at the country-pair level, Klein and Shambaugh (2006) adopt the same fixed effect estimation to examine the effect of the fixed exchange rate on bilateral trade. Specifically, we consider the following specification:

$$\left|Y_{i,j,t}\right| = \beta_1 EX_{i,j,t} + \gamma \left|\boldsymbol{X}_{i,j,t}\right| + f_{i,j} + f_t + \varepsilon_{i,j,t} \tag{3}$$

where $f_{i,j}$ is the country-pair fixed effect. $EX_{i,j,t}$ again is a dummy variable which equals one if there is a fixed exchange rate between the two countries at time t (and zero otherwise). $\left|\boldsymbol{X}_{i,j,t}\right|$ is the set of control variables in Eq. (2). By including the country-pair fixed effect, all time-invarying or long-run country-pair heterogeneities can be successfully controlled. However, with the country-pair fixed effect, gravity variables are all dropped out due to collinearity, and we are interested in coefficient β_1 on the nominal exchange rate regime.

Table 10 reports the regression results. In Columns (1) to (5), four out of five coefficients on *kspeg* are negative and statistically significant (at the 1% level), which implies that the main result for how the nominal exchange rate regime affects country differences in FPIs still holds.

4 Concluding remarks

Instead of analyzing how factors may affect cross-border capital flows between any two countries, in this paper we empirically investigate the factors that drive countries to form similar foreign investment patterns. Using data for a broad panel of countries during the period 2002–2015, we adopt a gravity model and show that exchange rate regime, country distance and common language are three important factors that influence foreign portfolio investment patterns: If countries (i) are geographically closer, (ii) adopt a fixed exchange rate regime, and (iii) share the same official language, they are more likely to form similar FPIs.

We conduct a number of robustness checks, such as dividing the data sample into three subsamples based on countries' income level, dividing the data sample into a normal period and periods with major global financial or economic crises, adding more control variables suggested by the literature, and adopting alternative specifications. The baseline results are quite robust to all those experiments. We also perform an instrumental variable analysis to see whether potential endogeneity issues may affect the estimation results. We find that the instrumental variable regressions confirm the baseline results.

The empirical findings in this paper have strong policy implications. The most important implication is that to fully understand the impact of the change in one country's current account on US current account deficit and make sound policies in international capital flows, the empirical results imply that a multi-country model is needed. The two-country model widely used in the literature to study US current

Table 10 Country-pair fixed effect regression

Dependent variable	diff_USA (1)	diff_JPN (2)	diff_DEU (3)	diff_FRA (4)	diff_GBR (5)
kspeg	−47.027***	14.176***	−12.888***	−26.656***	−59.521***
	(4.726)	(0.999)	(2.257)	(1.723)	(3.442)
Log *DGDP*	0.879*	0.114	0.231	0.044	0.635**
	(0.461)	(0.096)	(0.197)	(0.145)	(0.323)
Log *DPOP*	5.238***	−3.713***	−2.600***	1.427**	−3.388**
	(1.936)	(0.399)	(0.973)	(0.702)	(1.380)
Country Pair FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.79	0.60	0.72	0.74	0.74
Max # Years	14	14	14	14	14
# Country Pairs	1904	1904	1904	1904	1904
Obs.	14758	14758	14758	14758	14758

Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively

account deficit may underestimate this effect. In particular, if there are countries that are economically, geographically, and culturally close to each other, as we show in this paper, they may invest similarly in US financial asset. Then, one has to consider theoretical frameworks with multiple countries including subgroups that invest in a similar way, to capture the current account pattern in the USA.

There is potentially one limitation in this study. We have not provided a comprehensive theoretical framework for interpreting the data pattern we find in the gravity regressions. We leave this to our future research.

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Data Availability The data that supports the findings of this study are available in the supplementary material of this article.

Compliance with ethical standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by the authors.

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