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Jun Nagayasu

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Center for Data Science and Service Research
Graduate School of Economic and Management
Tohoku University
27-1 Kawauchi, Aobaku
Sendai 980-8576, JAPAN

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Jun Nagayasu[†]

Abstract

This paper empirically analyzes international financial flows between 2000 and 2016. Calculating a proxy for global interest rates using a factor model, we confirm that there are global elements in national real interest rates, particularly those of advanced countries. Consequently, interest rate differentials are insignificantly associated with financial flows in these countries. Instead, exchange rates and political integration have been more consistently influencing investors' decisions to form financial portfolios than interest rates.

Keywords: financial flows, global interest rate, uncovered interest rate parity
JEL classification: F2, F3

[†]Tohoku University, Graduate School of Economics and Management, Address: 27-1 Kawauchi, Aoba-ku, Sendai, Miyagi 980-8576 JAPAN, Email: jun.nagayasu.d8@tohoku.ac.jp, Tel: +81 22 795 6265, Fax: +81 22 795 6270. I would like to thank for useful comments Rui Chen, Charilaos Mertzanis, Alexis Stenfors, Richard Werner and other participants in the meetings of Cross Country Perspectives in Finance Conference in Chengdue (China) and Chiang Mai (Thailand). I also thank for research assistance Gabriel Cordoba.

1 Introduction

Since many countries face persistent and excessive imbalances in external flows, numerous studies have been conducted over the recent decades. Gourinchas and Rey (2010) reviewed transmission channels, such as trade channel and valuation changes, of external imbalances, and Lane and Milesi-Ferretti (2007) showed the increasing importance of equity investment in country portfolios. According to Bremus and Fratzscher (2015), the recent hike in global liquidity resulted from expansionary monetary policies of advanced countries, and the independence of the supervisory authorities affected cross-border bank credit flows.

Here, rather than focusing directly on trade and valuation channels, we study whether traditional economic and non-economic factors influence international financial flows. The financial account measures the cross-border acquisition and disposal of financial assets and liabilities, and consists of direct investments, portfolio investments, financial derivatives, other investments, and reserve assets. Global interest rates have been of interest because many advanced countries have adopted expansionary monetary policies at an unprecedented scale during this period, and reduced the model's dimension. Previously absent from economic analyses, we consider political integration of countries as a determinant.

2 Theoretical framework

This study's analytical framework is based on the interest rate parity condition (IPC), an important theory in international finance research analyzed by numerous researchers (Engel 2015); it links nominal exchange rates with interest rates. The uncovered IPC (UIPC) type suggests an equilibrium condition in international financial markets under which the expected returns from domestic and foreign investments are the same. The other type, covered IPC, replaces expected exchange rates with forward rates, so investors can minimize exchange rate risks. Our analysis is based on the UIPC because data on effective forward exchange rates are not readily available. Based on the UIPC, the difference in investment returns (DR) between domestic and foreign country strategies can be expressed as:

$$DR : s^e_{t+1} - s_t - (i_t - i^*_t) \quad (1)$$

The nominal effective exchange rate (s_t) measures a domestic currency against a single unit of foreign currencies at time t, and is expressed in natural logarithmic form; and nominal interest rates are shown as i_t. The expected value is denoted with the superscript (e), and the asterisk

(*) indicates a foreign variable. Under the UIPC, Eq. (1) yields a value of 0. This indicates that investors are indifferent to the location of investment; therefore, no movements occur in financial accounts. Financial movements occur when $DR \neq 0$. When $DR > 0$, there are contemporaneous outflows of net financial assets; when $DR < 0$, there are financial inflows. Therefore, this study focuses on adjustment periods when the market is not in equilibrium, and does not hinge strictly on the UIPC. Alternatively, using the definition of real exchange rates ($q_t \equiv s_t - p_t + p_t^*$ where p is a price), Eq. (1) can be restated as:

$$\Delta q_{t+1}^e - ((i_t - \Delta p_{t+1}^e) - (i_t^* - \Delta p_{t+1}^e)) \quad \text{or} \quad \Delta q_{t+1}^e - (R_t - R_t^*) \tag{2}$$

where nominal interest rates consist of real interest rates (R_t) and expected inflation following the Fisher equation ($i_t - \Delta p_{t+1}^e = R_t$). While the Fisher equation assumption is required to derive Eq. (2), it is mathematically equivalent to Eq. (1). However, unlike Eq. (1), we can lessen a potential nonlinearity in Eq. (2) caused by zero-bound nominal interest rates, which many advanced countries have experienced recently. Furthermore, assuming that Δq_t becomes proxy for Δq_{t+1}^e,[1] we study whether financial flows can be investigated using the following panel data specification:

$$NF_{it} = a + b\Delta q_{it} + c dif_{it} + d z_{it} + u_{it} \tag{3}$$

where subscript i represents countries. NF is the net financial flow and $dif_{it} = R_{it} - R_{it}^*$: a positive (negative) NF implies net lending (borrowing). Consistent with implications from the DR, the expected sign of the parameters is positive for b and negative for c, implying that a depreciation of home exchange rates and/or an increase in foreign interest rates will result in net financial outflows. It contains the residuals (u) that may represent expectation errors and risk premium (z) to generalize the UIPC. Eq. (3) is parsimonious, but captures the effect of carry trades that are designed to make profits by borrowing money in low-interest rate countries, and investing it in high-interest rate countries, during stable exchange rate periods (Bhansali 2007). Carry trades have been used to explain recent movements of some major currencies, such as Australian dollar, Japanese yen, and Swiss franc.

[1] We make this assumption because expected effective exchange rate data are not available. However, the overall results from other expectations formations (e.g., $\Delta q_{t+1}^e = \Delta q_{t+1}$) remain similar to the ones presented in this paper. Similar remarks apply to calculation of real interest rates.

3 Statistical method

A problem in global country analysis is the identification and creation of foreign variables. For example, while we can identify national interest rates individually, a proxy for foreign interest rates equivalent to global interest rate(s) is unobservable. In the absence of global interest rates, the model becomes complicated because all foreign variables enter into a specification individually, known as the curse of dimensionality. Thus, we estimate global interest rates using a factor model, which allows us to decompose interest rates into common and country-specific components.

Consequently, the initial task is to identify the number of common factors. There has been progress in identifying and estimating factor models (e.g., Bai and Ng (2002) for static factor models and Stock and Watson (2005) for dynamic factor models). We use the static factor model because it maps onto the dynamic factor model (Bai and Ng 2007). For countries ($i = 1, \ldots, N$) and time ($t = 1, \ldots, T$), the static factor model is:

$$X_{it} = \Lambda_i' F_t + e_{it} \tag{4}$$

The standardized data (X) is decomposed into the common component ($\Lambda_i' F_t$) and idiosyncratic component (e_{it}). Λ_i' is a vector of factor loadings and F_t is a vector of common factors. To find the appropriate number of common factors, Bai and Ng (2002) proposed the information criteria (IC) that consists of two components:

$$\text{IC}(k) = ln(V(k, F)) + kg(N, T) \tag{5}$$

The first component, $ln(V(k, F))$, is the average residual variance for k common factors: $V(k, F) = (NT)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} (X_{it} - \Lambda_i' F_t)^2$. The second component, $kg(N, T)$, is a penalty function to avoid over-fitting of the model. Several ICs can be constructed by different forms of the penalty function. Like the standard IC in time series analysis, the smallest IC corresponds to the model that fits the data most. It indicates the appropriate number of common components (r, $0 \leq r \leq k$). Here, the following two types of IC (IC1 and IC2) are used.

$$\text{IC1} = ln(V(\cdot)) + k((N + T)/NT) ln(NT/(N + T))$$
$$\text{IC2} = ln(V(\cdot)) + k((N + T)/NT) ln(min\{N, T\})$$

One potential problem associated with factor models is that, while theoretically correct, it becomes difficult to interpret each common factor ($F_t = [f_t^1, f_t^2, f_t^3, ..., f_t^r]$) in an economically meaningful way when r increases. In order to circumvent this problem, this study regards $\Lambda_i' F_t$, which is driven by global interest rates (f_t), as one variable. Thus, heterogeneous responses of countries to global factors are also included in our global variables.

4 Data

Quarterly data on the balance of payments (BoP) from 2000Q1 to 2016Q2 are collected from the BoP statistics of the International Monetary Fund (IMF). These data are compiled according to the Balance of Payments and International Investment Position Manual 6th edition. Increases in assets and liabilities are recorded with a positive sign. The net financial account balance is calculated as changes in assets minus changes in liabilities. As such, net lending–that is, the country supplies funds to the rest of the world–is recorded with a positive sign, and net borrowing, with a negative sign.

Data on effective exchange rates, interest rates, and prices are gathered from the IMF's International Financial Statistics (IFS). Prices are proxied by the consumer price index (CPI) and most nominal interest rates by market rates (see Table 1).[2] Following the Fischer equation, real interest rates are obtained by subtracting expected inflation from nominal interest rates. We calculate expected inflation (Δp_{t+1}^e) as Δp_t. The countries under investigation are selected purely due to data availability; they include both advanced and developing countries from a variety of geographical locations.

Table 2 provides summary statistics of key data. First, both financial and current accounts are negative on average, implying that both financial inflows and trade deficits have often coexisted. Second, the BoP is dominated by financial and current accounts, and the capital account constitutes only a small fraction of the total external balance. The average value of the financial, capital, and current balances implies that errors and omissions are significant in the BoP statistics. Third, the correlation coefficients show that the BoP components barely correlate with real exchange rate depreciation and real interest rates. In contrast, a high correlation between current and financial accounts is reported in the table. These are the reasons why we focus on financial, rather than capital accounts.

[2] In studies on the IPC, the London Interbank Offered Rates have often been used as benchmark (risk free) interest rates, but are not available for many countries analyzed in this study.

5 Empirical results

First, we calculate global interest rates for 51 countries using the factor model. Table 3 reports the number of common factors in real interest rates based on the ICs with $k = 10$. The appropriate number of common factors vary according to ICs, but we find at least one global rates in all models. The presence of global interest rates is consistent with previous studies using different statistical methodologies (Gagnon and Unferth 1995, Ratti and Vespignani 2015). Ratti and Vespignani (2015) also showed that a global interest rate is determined by changes in global monetary aggregates, oil prices, global output, and global prices. The difference between the average common and idiosyncratic components has diminished since the 2008 Lehman Shock (Figure 1).

Next, we study the determinants of financial flows based on Eq. (3) using instrument variables, such as a proxy for financial market openness (Chinn and Ito 2006) and the net current account balance. They are expected to be correlated with explanatory variables. This specification is estimated by fixed and random effects models in the panel data context –the former model is based on the two-stage least square (2SLS) method, while the latter on the error component 2SLS random-effects estimator (Baltagi 2008). Furthermore, the residuals in Eq. (3) are decomposed into two elements: $u_{it} = \mu_i + v_{it}$.

As a proxy for risk premiums, we use the VIX, known as a fear index. It is calculated by the Chicago Board Options Exchange from implied volatility of options prices in the US equity market. Similar statistics are obtained for Europe (VSTOXX) and Japan (VXJ) from the Datastream and Osaka University, respectively. Here, we create two kinds of crisis-related data –one is the VIX (vix), and the other is the average of three fear indexes (crisis).

The results from IV estimation methods are reported in Table 4. We find that there is a strong tendency for countries to have experienced capital outflow at times of financial crises. This is confirmed by a positive relationship between *NF* and vix (crisis) because the increase in fear indexes implies higher uncertainty in financial markets. This result may be partly because sizable global financial flows are conducted by large advanced economies, such as the US, Japan, and Germany. Furthermore, in line with theoretical predictions, interest rate spreads have often influenced *NF* negatively with some statistical significance (the 10 percent level). These results remain generally unchanged regardless of choice of crisis variables.

To check for robustness, we initially study whether our conclusion is sensitive to groups of countries (advanced and developing countries). Here, the definition of advanced countries is consistent with the IMF (http://www.imf.org/en/data), and non-advanced countries are named developing countries. The results, from the random effects model supported in the previous analysis, show that the interest rate differentials are more important determinants of *NF* in developing countries than in advanced countries (Table 5). While parameters of interest rate spreads are statistically significant and negative for developing countries, they are insignificant for advanced countries. Thus, global interest rates have moved more in tandem with interest rates of advanced countries, and more representatives of interest rates of these countries. This finding is consistent with the fact that country-specific factors, such as transaction costs, tax, uncertainty and constraints in borrowing and lending often discussed as reasons for a failure of IPC, are more prominent in developing countries.

We also analyze the role of global economic and political integration in the *NF* determination. We thus add their proxies, known as the KOF index of globalization (Dreher 2006), available through 2014. This comprehensive economic openness index is constructed by utilizing the trade-GDP ratio, foreign direct investment, portfolio investment, and income payments to foreign countries, as well as the restriction level of hidden import barriers, tariff rates, and capital account restrictions. The political globalization index is compiled by using the number of embassies, international treaties, and international organizations in countries, as well as personnel in the UN Security Council missions. According to these indexes, many European countries, such as the Netherlands, are ranked as highly globalized countries.

Using again the IV method, we confirm our previous conclusion regarding the relationship between *NF*, interest rates, and exchange rates (Table 6). Furthermore, it shows that globalized countries, in terms of economics, tend to have experienced financial outflows, but this effect is statistically insignificant. In contrast, political globalization influences *NF* significantly. Indeed, a strong political tie with other countries seems to have helped induce financial inflows. By the definition of this index, political globalization refers to high political transparency to the rest of the world. Therefore, high political integration seemingly functions to reduce country risk factors, and makes the country more attractive to foreign investors. Our result –that non-economic factors, such as institutional quality (i.e., transparency), are important determinants of *NF* in addition to economic factors –may be well-known to practitioners, but has not been investigated because of lack of indicators to represent institutional transparency. Our finding supplements Bremus and Fratzscher's (2015) study, which discussed how other non-economic factors, such as the independence of the regulators, affect credit flows.

6 Conclusion

Using a factor model, we show that there are indeed global elements in real interest rates. However, the financial flows are determined more significantly and consistently by the exchange rates and political transparency: the role of interest rate differentials is found to be weak in advanced countries. This result supports the convergence of real interest rates among these countries, and implies that carry trades, which provide a popular explanation for financial movements among selected advanced countries, are rather limited in the global context.

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Table 1: Country coverage and data

	CPI	Market rate	Deposit rate	Global interest rate analysis	Financial flow analysis	Advanced countries
Albania	✓		✓	✓		
Armenia, Republic of	✓	✓		✓	✓	
Australia	✓	✓		✓	✓	✓
Belize	✓		✓	✓	✓	
Bolivia	✓	✓		✓	✓	
Brazil	✓	✓		✓	✓	
Bulgaria	✓	✓		✓	✓	
Canada	✓	✓		✓	✓	✓
Cape Verde	✓		✓	✓		
China, P.R.: Hong Kong	✓	✓		✓		✓
Colombia	✓	✓		✓	✓	
Costa Rica	✓	✓		✓	✓	
Czech Republic	✓	✓		✓	✓	✓
Estonia	✓	✓		✓		✓
Euro Area	✓	✓		✓	✓	✓
Georgia	✓	✓		✓	✓	
Guatemala	✓	✓		✓		
Hungary	✓		✓	✓	✓	
Iceland	✓	✓		✓	✓	✓
Indonesia	✓	✓		✓		
Israel	✓		✓	✓	✓	✓
Japan	✓	✓		✓	✓	✓
Korea, Republic of	✓	✓		✓		✓
Lesotho	✓		✓	✓	✓	
Lithuania	✓	✓		✓		
Macedonia, FYR	✓		✓	✓	✓	
Mauritius	✓	✓		✓		
Mexico	✓	✓		✓	✓	
Moldova	✓	✓		✓	✓	
Mongolia	✓		✓	✓		
Nepal	✓		✓	✓		
New Zealand	✓	✓		✓	✓	✓
Nicaragua	✓		✓	✓	✓	
Norway	✓	✓		✓	✓	✓
Panama	✓		✓	✓		
Philippines	✓	✓		✓	✓	
Poland	✓	✓		✓	✓	
Romania	✓	✓		✓	✓	
Russian Federation	✓	✓		✓	✓	
Singapore	✓	✓		✓	✓	✓
Slovenia	✓	✓		✓		
South Africa	✓	✓		✓	✓	
Sweden	✓	✓		✓	✓	✓
Switzerland	✓	✓		✓	✓	✓
Thailand	✓	✓		✓		
Turkey	✓		✓	✓		
Ukraine	✓	✓		✓	✓	
United Kingdom	✓	✓		✓	✓	✓
United States	✓	✓		✓	✓	✓
Uruguay	✓	✓		✓	✓	
Vanuatu	✓	✓		✓		

Note: Data are obtained from the IMF. ✓ indicates that data are available.

Table 2: Summary statistics of key economic variables

		Mean	Std. Dev.	Min	Max
Financial account		-3533.58	29345.52	-298080.00	282609.30
Capital account		103.89	1743.15	-31782.10	15361.00
Current account		-2256.03	26264.00	-231748.00	125357.70
Correlation coefficient	Financial account	Capital account	Current account	Real exchange rate depreciation	Real interest rate
Financial account	1.000				
Capital account	-0.018	1.000			
Current account	0.813	-0.040	1.000		
Real exchange rate depreciation	0.012	0.028	0.017	1.000	
Real interest rate	0.027	0.011	0.014	0.100	1.000

Note: Note: The balance of payments statistics are expressed in millions of US dollars. Real effective exchange rates are based on the CPI and are indexes. Real interest rates are calculated using the Fisher equation (see the main text). Data are downloaded from http://data.imf.org.

Table 3: Number of common factors

	Real Interest Rate
IC1	7
IC2	1
Average no. of common factors	4
No. of countries	51

Note: Data are standardized, and the maximum number of common factors (k) are set as 10. Statistics (IC1 and IC2) are based on Bai and Ng (2002).

Table 4: Relationships between financial flows, exchange rates, and interest rate differentials

Full sample	Fixed Effects			Random Effects			Hausman Test
	Coef.	Std Err	p-value	Coef.	Std Err	p-value	p-value
r=7							
Δq	2.842	0.619	0.000	2.847	0.614	0.000	0.999
dif	-0.267	0.182	0.141	-0.268	0.180	0.137	
vix	0.313	0.099	0.002	0.313	0.098	0.001	
Constant	-12.751	2.346	0.000	-12.755	17.974	0.478	
σ_μ	23.252			103.178			
σ_v	30.036			30.036			
ρ	0.375			0.922			
r=4							
Δq	2.820	0.614	0.000	2.825	0.609	0.000	0.999
dif	-0.306	0.181	0.092	-0.307	0.180	0.089	
vix	0.313	0.099	0.002	0.313	0.098	0.001	
Constant	-12.699	2.332	0.000	-12.704	17.914	0.478	
σ_μ	23.249			102.839			
σ_v	29.855			29.855			
ρ	0.377			0.922			
r=1							
Δq	2.845	0.619	0.000	2.850	0.614	0.000	0.999
dif	-0.301	0.174	0.084	-0.302	0.173	0.081	
vix	0.315	0.099	0.002	0.315	0.099	0.001	
Constant	-12.757	2.348	0.000	-12.762	18.019	0.479	
σ_μ	23.254			103.439			
σ_v	30.047			30.047			
ρ	0.375			0.922			
r=7							
Δq	12.844	5.006	0.010	12.878	4.905	0.009	1.000
dif	-1.625	0.918	0.077	-1.626	0.903	0.072	
crisis	1.914	0.800	0.017	1.919	0.786	0.015	
Constant	-56.345	21.296	0.008	-56.455	27.362	0.039	
σ_μ	30.387			102.020			
σ_v	115.125			115.125			
ρ	0.065			0.440			
r=4							
Δq	12.954	5.081	0.011	12.978	4.970	0.009	1.000
dif	-1.848	0.981	0.060	-1.846	0.962	0.055	
crisis	1.944	0.816	0.017	1.947	0.801	0.015	
Constant	-56.900	21.638	0.009	-56.976	27.549	0.039	
σ_μ	30.522			101.658			
σ_v	116.011			116.011			
ρ	0.065			0.434			
r=1							
Δq	12.939	5.058	0.011	12.961	4.948	0.009	1.000
dif	-1.758	0.930	0.059	-1.756	0.913	0.054	
crisis	1.936	0.811	0.017	1.939	0.795	0.015	
Constant	-56.757	21.519	0.008	-56.824	27.525	0.039	
σ_μ	30.522			102.268			
σ_v	115.882			115.882			
ρ	0.065			0.438			

Note: Statistics based on the IV estimation. Instruments are net current account balances and a proxy for financial market openness. The number of common factors is denoted as r. The vix is the US fear index, and crisis represents the average of fear index of Japan, Germany and the USA. ρ measures a fraction of variance due to μ_i. σ_μ and σ_v are the standard deviation of μ_i and v_{it} respectively.

Table 5: The role of interest rate differentials in advanced and developing countries

Full sample	Advanced countries			Developing countries		
	Coef.	Std Err	p-value	Coef.	Std Err	p-value
r=7						
Δq	5.572	1.497	0.000	2.325	0.682	0.001
dif	-2.204	1.526	0.149	-0.383	0.144	0.008
crisis	0.458	0.252	0.069	0.533	0.155	0.001
Constant	-21.440	29.749	0.471	-15.464	4.025	0.000
σ_μ	105.181			1.516		
σ_v	45.756			40.102		
ρ	0.841			0.001		
r=4						
Δq	5.223	1.399	0.000	2.379	0.692	0.001
dif	-1.016	1.284	0.429	-0.424	0.152	0.005
crisis	0.457	0.241	0.058	0.547	0.159	0.001
Constant	-22.094	28.062	0.431	-15.776	4.107	0.000
σ_μ	99.062			1.635		
σ_v	43.671			40.050		
ρ	0.837			0.002		
r=1						
Δq	5.181	1.378	0.000	2.369	0.690	0.001
dif	-0.918	1.064	0.388	-0.405	0.147	0.006
crisis	0.439	0.241	0.068	0.547	0.159	0.001
Constant	-21.703	29.291	0.459	-15.795	4.108	0.000
σ_μ	103.632			1.646		
σ_v	43.419			39.889		
ρ	0.851			0.002		

Note: Statistics based on the random effects model and the IV estimation. Instruments are net current account balances and a proxy for financial market openness. The number of common factors is denoted as r.

Table 6: Financial flows and globalization

Full sample	Fixed effects			Random effects			Hausman test
	Coef.	Std Err	p-value	Coef.	Std Err	p-value	p-value
r=7							
Δq	2.486	4.370	0.000	2.510	0.558	0.000	0.036
dif	-0.250	-1.490	0.137	-0.258	0.168	0.124	
crisis	0.452	3.710	0.000	0.454	0.120	0.000	
EconGlobal	0.230	1.210	0.226	0.201	0.174	0.247	
PolitGlobal	-0.353	-2.110	0.035	-0.351	0.147	0.017	
Constant	-5.456	-0.360	0.720	-3.684	14.593	0.801	
σ_μ	22.683			27.384			
σ_v	27.287			27.287			
ρ	0.409			0.502			
r= 4							
Δq	2.503	4.350	0.000	2.530	0.564	0.000	0.102
dif	-0.288	-1.700	0.090	-0.296	0.169	0.080	
crisis	0.457	3.710	0.000	0.459	0.121	0.000	
EconGlob	0.226	1.190	0.236	0.198	0.174	0.257	
PolitGlobal	-0.356	-2.120	0.034	-0.353	0.148	0.017	
Constant	-4.996	-0.330	0.743	-3.309	14.619	0.821	
σ_μ	22.675			27.382			
σ_v	27.403			27.403			
ρ	0.406			0.500			
r= 1							
Δq	2.505	4.370	0.000	2.530	0.562	0.000	0.100
dif	-0.282	-1.740	0.082	-0.289	0.162	0.073	
crisis	0.457	3.720	0.000	0.458	0.121	0.000	
EconGlobal	0.226	1.180	0.237	0.197	0.174	0.258	
PolitGlobal	-0.360	-2.140	0.033	-0.356	0.148	0.016	
Constant	-4.635	-0.300	0.761	-3.015	14.622	0.837	
σ_μ	22.677			27.369			
σ_v	27.416			27.416			
ρ	0.406			0.499			

Note: Statistics based on the random effects model and the IV estimation. Instruments are net current account balances, a proxy for financial market openness, and the globalization index for culture proximity, personal contacts, information flows, and economic restriction (see Dreher 2006). The number of common factors is denoted as r.

Figure 1: Cross-country averages of common and idiosyncratic factors in real interest