Online Annexes[1]

Online Annex 2.1. Data

Online Annex Table 2.1.1. Data Sources

Indicator	Sources
Nominal US Dollar Trade-Weighted Index*	Retrieved from Haver Analytics based on the Nominal Advanced Foreign Economies US Dollar Index from Federal Reserve Economic Data (FRED), using goods and services trade weights. Values before 2006 are constructed with services trade data estimates from the Federal Reserve Board
Exchange Rates and Interest Rates	
Bilateral Exchange Rates	International Monetary Fund, Global Data Source (GDS)
Real Effective Exchange Rates	International Monetary Fund, Global Data Source (GDS)
Shadow Rate (average of advanced economies) 1/	Haver Analytics; Federal Reserve Board, Krippner (2015), De Rezende (2023)
Policy Rate* 2/	Bank for International Settlements (BIS) Central Bank Policy Rates; Haver Analytics
Short-Term Interest Rate	International Monetary Fund, Global Data Source (GDS)
Effective Federal Funds Rate* 3/	Federal Reserve Board, Wu-Xia Shadow Federal Funds Rate (Wu and Xia, 2016), Haver Analytics
Exchange Rate Adjustment 4/	Consensus Economics; Haver Analytics
Interest Rate Differential 5/	Refinitiv Datastream
Macro Aggregates and External Variables	
Real Gross Domestic Product (SA)	International Monetary Fund, Global Data Source (GDS)
Nominal Gross Domestic Product (SA)	International Monetary Fund, Global Data Source (GDS)
Exports of Goods and Services (SA)	International Monetary Fund, Balance of Payments Statistics (BOP)

[1] Prepared by Cian Allen, Rudolfs Bems, Lukas Boer, Allan Dizioli, Racha Moussa, Abreshmi Nowar, and Xiaohan Shao (all IMF staff).

Online Annex Table 2.1.1 *(continued)*

Imports of Goods and Services (SA)	International Monetary Fund, Balance of Payments Statistics (BOP)
Current Account Balance (SA)	International Monetary Fund, Global Data Source (GDS)
Real Gross Fixed Capital Formation (SA)	International Monetary Fund, Global Data Source (GDS)
Real Imports, Real Exports (SA)	International Monetary Fund, Global Data Source (GDS)
Economic Activity Factor 6/	International Monetary Fund, Global Data Source (GDS)
Private and Public Inflows 7/	Avdjiev and others (2022)
Domestic Credit	Credit to the Non-Financial Sector, Bank for International Settlements (BIS)
Domestic Investment 8/	International Monetary Fund, International Financial Statistics (IFS); Haver Analytics
Imports and Exports of Final Consumption, Capital Formation, Intermediate Consumption (SA)	Trade Data Monitor (TDM)
Net International Investment Position	International Monetary Fund, Balance of Payments Statistics (BOP)
Primary Income	International Monetary Fund, Balance of Payments Statistics (BOP)
Real GDP Forecast Error	International Monetary Fund, World Economic Outlook (WEO) April 2014, January 2022, April 2023
Global Balances 9/	International Monetary Fund, Global Data Source (GDS)
Prices and Financial Variables	
Adjusted National Financial Conditions index (ANFCI)*	Federal Reserve Economic Data (FRED)
Morgan Stanley MSCI Stock Price Index	International Monetary Fund, Global Data Source (GDS)
Terms of Trade (SA) 10/	International Monetary Fund, International Financial Statistics (IFS); Haver Analytics; CEIC Global Database
Consumer Price Index (SA)	International Monetary Fund, Global Data Source (GDS)
Uncovered Interest Parity (UIP) Deviation 11/	Consensus Economics; Refinitiv Datastream; Haver Analytics; Federal Reserve Board
Global Financial Cycle	Miranda-Agrippino, Nenova, and Rey (2020)

Online Annex Table 2.1.1 *(continued)*

Global Uncertainty Index	Davis (2016)
Chicago Board Options Exchange Volatility Index (VIX)	Haver Analytics
Commodity Prices	International Monetary Fund, Global Data Source (GDS)
Policies and Structural Features	
Emerging Market Economy Dummy	International Monetary Fund, World Economic Outlook (WEO)
Commodity Trade Balance	United Nations Statistics Division, UN Comtrade.
Share of Exports Invoiced in US dollars	Boz and others (2022)
Share of External Liabilities in US dollars 12/	Bénétrix and others (2019)
Monetary Policy Credibility	Bems and others (2021)
Exchange Rate Regime 13/	Ilzetzki, Reinhart, and Rogoff (2019); International Monetary Fund, The Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER, 2020, 2021)

Source: IMF staff compilation

SA: variables from GDS are seasonally adjusted using X-12, other variables are adjusted using X-13

*Monthly data converted to quarterly by averaging

1/ Calculated with shadow short rate point estimates of Australia, Canada, Euro Area, Japan, Switzerland, United Kingdom from Haver, with the merchandise weights from Federal Reserve Board.

2/ To fill missing data for Pakistan, the Call Money Rate is used from Haver Analytics. All rates are winsorized above the 95th percentile and below the 5th percentile.

3/ The shadow rate is used when the lower bound of the effective fed funds rate is zero.

4/ Calculated as the expected US dollar depreciation.

5/ Denotes the advanced economies deposit rate minus US deposit rate.

6/ The economic activity factor is constructed with the log of real GDP of 43 economies using static factor model. The economies include: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Chile, China, Colombia, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, India, Indonesia, Israel, Korea, Latvia, Lithuania, Luxembourg, Malaysia, Mexico, New Zealand, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Russia, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Taiwan Province of China, Thailand, The Netherlands, Türkiye, Ukraine.

7/ Private inflows are the sum of portfolio debt and other investment debt inflow of banks (except central bank) and corporates; public inflows are the sum of portfolio debt inflow and other investment debt inflow of general government and the central bank.

Online Annex Table 2.1.1 *(continued)*

8/ To fill missing data for Malaysia, Peru, Philippines, data from Haver Analytics are used. Domestic saving is calculated as the sum of the current account balance and domestic investment.

9/ Calculated as the absolute sum of current account balance divided by nominal GDP of all sample countries.

10/ Terms of trade are calculated by export price index over import price index. Data are from IFS for: Australia, Austria, Brazil, Czech Republic, Finland, Greece, Hungary, Korea, New Zealand, Philippines, Poland, South Africa, and Sweden. Dara are from Haver Analytics for: Argentina, Belgium, Chile, Denmark, Israel, Mexico, Netherlands, Norway, Portugal, Romania, Russia, Spain, and Türkiye. Data are aggregated from CEIC monthly data, using the average, for: Colombia, Indonesia, Thailand. India, Malaysia, Pakistan's terms of trade are directly from Haver Analytics. China and Peru's data are missing. For Portugal, seasonally adjusted data from Haver Analytics are used.

11/ UIP deviations are based on exchange rate forecasts from Consensus Economics, deposit rates from Refinitiv Datastream. Individual UIP deviations are aggregated with the merchandise weights from Federal Reserve Board. Data and code from Das, Kalemli-Ozcan, and Gopinath (2022) were kindly shared by the authors.

12/ Annual values are assumed to remain constant across quarters.

13/ Monthly data are aggregated to quarterly data by taking the maximum values. Classification into freely floating and other exchange rate regimes is extended through 2021 using the AREAER (IMF) as a guide. The AREAER classification between 2019 and 2021 changed only for Argentina (extended that it is dropped), China, Pakistan, and the Philippines (extended other exchange rate regime), and Switzerland (extended freely floating).

Online Annex 2.2. Empirical Framework

To interpret the nature of US dollar innovations that drive the spillovers in the local projection framework, changes in the US dollar index, Δs_t,against advanced economies[2] are regressed on the global factors that are established in the literature. This can be thought of as a first stage regression considering the local projection specification used in the analysis. The Global Dollar Cycle is defined as the cumulated residuals from this regression:

$$\Delta s_t = \alpha + \gamma' \Delta z_t + \sum_{l=1}^{p} \vartheta_l' \Delta x_{t-l} + \eta_t \ , \qquad (1)$$

where z is the vector of global controls. It includes: (i) the US effective federal funds rate (the shadow rate is used at the zero lower bound), (ii) the policy rate differential between the US and the weighted rate for the countries in the US dollar index against advanced foreign economies (using the same weights), (iii) the Chicago Fed's Adjusted National Financial Conditions Index, and (iv) a common factor for economic activity.[3] x includes lags of the US dollar index, the global factors in z and US GDP growth. The lag length p is 4. Results are presented in Online Annex Table 2.2.1.

Online Annex Table 2.2.1. First Stage Regression

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ΔUSD Index						
L. ΔUS Dollar Index	0.407***	0.463***					
	(0.134)	(0.107)					
US Financial Conditions (ΔANFCI)	3.624**		3.524***				
	(1.484)		(0.975)				
Monetary Policy							
ΔUS Shadow Rate	0.269			0.656			
	(1.269)			(0.817)			
ΔShadow Rate Differential	1.002				1.302*		
	(1.074)				(0.697)		
Economic Activity Factor	-0.275					-0.636**	
	(0.330)					(0.293)	
L. Δlog real US GDP	0.250						0.174
	(0.733)						(0.233)
Observations	91	92	91	92	92	91	92
Adjusted R2	0.194	0.151	0.121	-0.008	0.047	0.034	0.024
Up to lag 4	yes	yes	yes	yes	yes	yes	yes

Source: IMF staff calculations.

Standard errors in parentheses, all specifications include lags of each control, L. denotes first lag.

*** p<0.01 ** p<0.05 * p<0.10

[2] The 7 economies in the Fed's nominal advanced economies dollar index are: Australia, Canada, Euro Area, Japan, Sweden, Switzerland, and the United Kingdom.

[3] 43 economies are used for the economic activity factor: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Chile, China, Colombia, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, India, Indonesia, Israel, Korea, Latvia, Lithuania, Luxembourg, Malaysia, Mexico, New Zealand, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Russia, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Taiwan Province of China, Thailand, The Netherlands, Türkiye, and Ukraine.

Local Projections

Following Obstfeld and Zhou (2023), the analysis employs local projections (Jordà 2005) to estimate:

$$y_{i,t+h} - y_{i,t-1} = \mu_{i,h} + \beta_h \Delta s_t + \gamma_h^{'} \Delta z_t + \sum_{l=1}^{p} \delta_{h,l}^{'} \Delta w_{i,t-l} + \varepsilon_{i,h,t}, \qquad (2)$$

where the dependent variable, y, is the cumulative change in the variable of interest over the *t-1* to *t+h* horizon, with *h* extending to 12 quarters. The sample covers EBA countries subject to the availability of quarterly data, excluding the countries in the US dollar trade weighted index against advanced economies that have a weight larger than 4 percent in 2020. This results in a sample of 15 advanced economies and 19 emerging market economies.[4] The sample period covers 1999-2022 at the quarterly frequency, with variation based on the availability of data for different dependent variables.

Controls include country-horizon fixed effects, $\mu_{i,h}$, to allow for country-specific trends that vary with the horizon. Consistent with equation (1), Δs_t are changes to the trade-weighted nominal US dollar index against a set of advanced economies. Δz_t contains global controls as in (1). Δw contains country specific controls (real GDP growth, policy interest rate, bilateral exchange rate against the US dollar) and lagged controls for s, z, and y. p is set to 4.

To examine country heterogeneity, a state-dependent specification as in Ramey and Zubairy (2018) is estimated. Here, the effect of the US dollar appreciation is allowed to differ based on predetermined characteristics for the sample economies.[5]

$$\begin{aligned} y_{i,t+h} - y_{i,t-1} = {} & I_{j,t-1} \left[\mu_{A,i,h} + \beta_{A,h} \Delta s_t + \gamma_{A,h}^{\prime} \Delta z_t + \sum_{l=1}^{p} \delta_{A,h,l}^{\prime} \Delta w_{i,t-l} \right] \\ & + \left(1 - I_{j,t-1}\right) \left[\mu_{B,i,h} + \beta_{B,h} \Delta s_t + \gamma_{B,h}^{\prime} \Delta z_t + \sum_{l=1}^{p} \delta_{B,h,l}^{\prime} \Delta w_{i,t-l} \right] + \varepsilon_{i,h,t}, \qquad (3) \end{aligned}$$

where $I_{j,t-1}$ is an indicator for an aspect of heterogeneity. The results in the Empirical Analysis Section are estimated for I_j indicating whether an economy is advanced or emerging. $I_{j,t-1}$ is also used to indicate the policy and structural features examined.[6]

Global Balances

To examine the impact on global balances of an appreciation in the US dollar index against advanced economies, a time series local projection is estimated:

$$y_{t+h} - y_{t-1} = \alpha + \beta_h \Delta s_t + \gamma^{'} \Delta z_t + \sum_{l=1}^{p} \vartheta_l^{'} \Delta x_{t-l} + \eta_t, \qquad (4)$$

where y is global balances and the specification is the same as in (2) with the difference that Δw is replaced by Δx from (1), excluding any country-specific controls. The sample includes all countries in the local projection sample plus the countries in the US dollar index, and the United States.

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[4] 34 economies are used in the local projection sample. Advanced economies: Australia, Austria, Belgium, Czech Republic, Denmark, Finland, Greece, Israel, Korea, Netherlands, New Zealand, Norway, Portugal, Spain, and Sweden. Emerging markets: Argentina, Brazil, Chile, China, Colombia, Hungary, India, Indonesia, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Romania, Russia, South Africa, Thailand, and Türkiye.

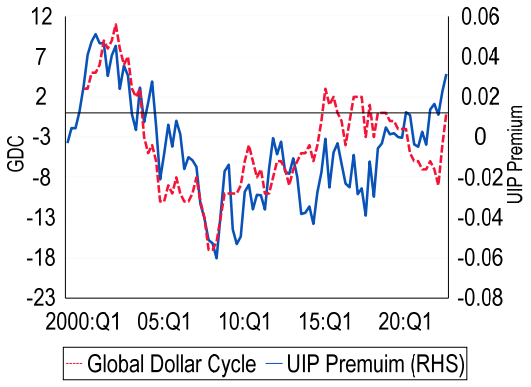
[5] The availability of the variables determining characteristics impacts the sample size.

[6] For policies and structural features that do not vary across time, the indicator is I_j.

Online Annex 2.3. The Global Dollar Cycle and Deviations from Uncovered Interest Parity

The global dollar cycle is closely correlated with the UIP premium between the US dollar and the trade-weighted average of the 7 advanced economy currencies included in the US dollar index (Online Annex Figure 2.3.1), offering a way to interpret the global dollar cycle. Given that the global dollar cycle is estimated as the unexplained part of US dollar fluctuations after controlling for economic and financial factors established in the literature, it would be reflecting other financial factors that influence the exchange rate. The UIP premium, i.e., a currency's excess return due to interest rate differentials and expected exchange rate adjustments that do not offset each other, is another object that captures financial factors that are not captured by the established factors. The literature has linked UIP premia to time varying risk premia, limits to arbitrage, or deviations from full information rational expectations (see, for example, Engel 2016; Kalemli-Özcan and Varela 2023; and Maggiori 2022).

Online Annex Figure 2.3.1. The Global Dollar Cycle and the UIP Premium with Major Advanced Economy Currencies

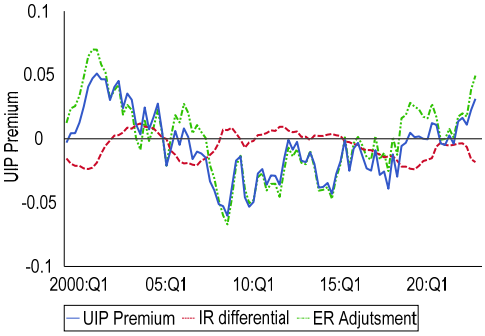


Sources: Haver Analytics; Consensus Forecast; Refinitiv Datastream; and IMF staff calculations.
Note: The UIP Premium is based on a weighted average of UIP premia based on 12-month deposit rates and consensus forecast exchange rate forecasts for the US against the 7 advanced economies in the Fed USD AE Index (Australia, Canada, the Euro Area, Japan, Sweden, Switzerland, and the UK). The correlation is 0.69. Using a 3-month horizon the correlation is 0.58.

The UIP premium is derived by calculating individual UIP deviations against the US dollar for each of the 7 advanced economy currencies included in the US dollar index and constructing a weighted average of these deviations using the US dollar index weights.[7]

The bulk of the variation in the UIP premium is related to the expected exchange rate adjustment and not to interest rate differentials which have been rather low and less volatile for advanced economies over the last 20 years (Online Annex Figure 2.3.2). Kalemli-Özcan (2019) and Kalemli-Özcan and Varela (2023) link the close comovement of the UIP Premium with the exchange rate adjustment term to global risk by showing significant correlations of UIP premia with the VIX for advanced economies.

Online Annex Figure 2.3.2. Decomposing the UIP Premium with Major Advanced Economy Currencies



Sources: Haver Analytics; Consensus Forecast; Refinitv Datastream; and IMF staff calculations.
Note: IR = interest rate; ER = exchange rate. Following Kalemi-Ozcan (2019) the UIP Premium is decomposed into an interest rate differential and an exchange rate adjustment term. IR differential denotes AE deposit rate minus US deposit rate. ER adjustment is the expected US dollar depreciation.

The advanced economy UIP premium could represent safe-haven and global liquidity demand as well as relative US macro expectations. We correlate the UIP premium for each individual country, $\lambda_t^i = i_t^i - i_t^{US} - \left(\ln\left(E\left(S_{t+12}^{LC/\$}\right)\right) - \ln\left(S_t^{LC/\$}\right)\right)$, with the bilateral nominal US dollar exchange rate. An appreciation of the US dollar is associated with an increase in advanced economies' excess returns against the US dollar as measured by the UIP premium—except for Switzerland

[7] For instance, the UIP premium for the GBP against the US dollar, i.e., the GBP excess return over the US dollar, is defined as the sum of two components: the interest rate differential between GBP and US dollar yields on a comparable asset and the expected US dollar depreciation against the GBP.

where the correlation is negative. The correlation is positive but small for Japan and the UK (Online Annex Table 2.3.1).

Online Annex Table 2.3.1. Correlations of Individual Country UIP Premia with the US dollar

	Correlations of λ_t^i with		
	LC/USD	USD index	λ_t^{AE}
Australia	0.73	0.63	0.81
Canada	0.66	0.65	0.79
Japan	0.39	0.08	0.31
Sweden	0.86	0.96	0.79
Switzerland	-0.32	0.27	0.16
United Kingdom	0.24	0.44	0.70
Euro Area	0.73	0.67	0.87
AE Index Average		0.81	1.00

Sources: Haver Analytics; Consensus Forecast; Refinitiv Datastream; and IMF staff calculations.

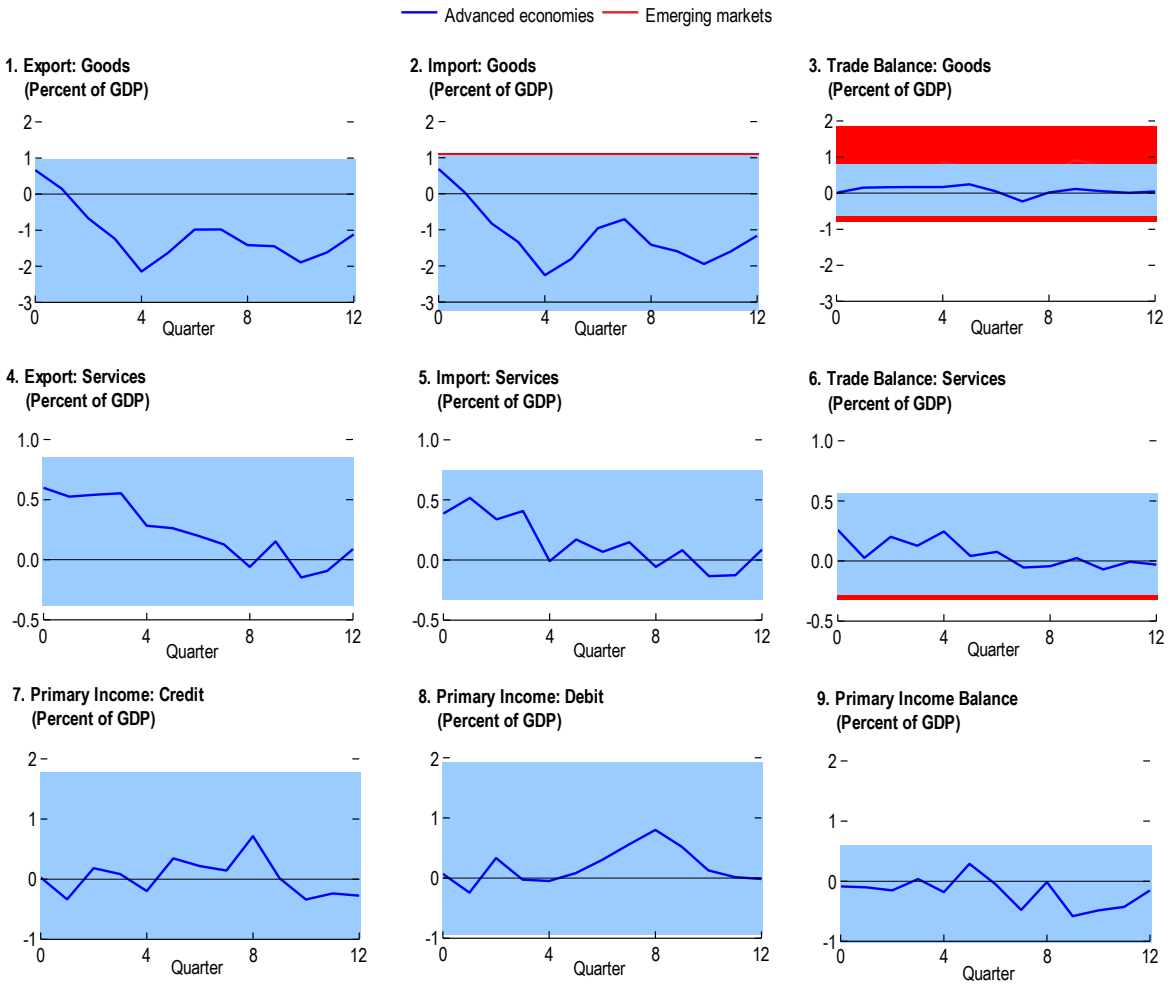
Note: λ_t^i is the UIP deviation as defined in the text. LC/USD denotes local currency per US dollar. USD index denotes the US dollar index against advanced economies. λ_t^{AE} is derived by calculating individual UIP deviations against the US dollar for each of the 7 advanced economy currencies included in the US dollar index and constructing a weighted average of these deviations using the US dollar index weights. The average weights for AEs in the index are: AUD 2.7%, CAD 30.4%, JPY 14.3%, SWK 1.3%, CHF 4.5%, GBP 10.6%, EUR 36%.

Online Annex 2.4. Additional Empirical Results

Current Account Breakdown

Online Annex Figure 2.4.1 presents the results for the regression in (3) with the dependent variables corresponding to the breakdown of the current account by goods, services, and income categories, conditional on being an emerging or advanced economy. These results show that for emerging markets, the increase in the trade balance for goods drives the increase in the current account after the initial quarters, and, in particular, the larger contraction in imports than exports. For advanced economies, the increase in the trade balance in services accounts for the increase in the current account in the initial quarters, driven by a larger increase in exports than imports.

Online Annex Figure 2.4.1. Spillovers from a US Dollar Appreciation: Current Account Details



Source: IMF staff calculations.
Note: Impulse responses show a 10 percent appreciation in the nominal US dollar Index with 90 percent confidence intervals. Advanced economies exclude countries with weights in the US dollar index that are larger than 4 percent in 2020: Canada, France, Germany, Ireland, Italy, Japan, Switzerland, and the United Kingdom.

Policy and Structural Features

Annex Table 2.4.1 presents the countries in each category of policies and structural features examined in the state-dependent local projections (Annex Table 2.4.2). Empty cells represent missing data. For ease of interpretation, features are defined such that '1' represents the category with a more negative GDP response. The table is constructed for 2017Q1 except for the feature 'high US dollar liability', which is time-varying. For presentational purposes, in this table 'high US dollar liability' is '1' if the country spent more than 12 quarters in the top quartile. The following features are not time-varying: emerging market/advanced economy status, commodity exporter/importer, below median anchoring, high US dollar export invoicing.

Online Annex Table 2.4.1. Sample Detail for State-Dependent Local Projections

	Emerging Market	Not Freely Floating	Below Median Trade Openness	Commodity Exporter	Below Median Anchoring	High US Dollar Export Invoicing	High US Dollar Liability
TUR	1	1	1	0	1	0	1
ZAF	1	0	1	0		0	0
ARG	1		1	1	1	1	1
BRA	1	1	1	0	1	1	1
CHL	1	1	1	1	0	1	1
COL	1	1	1	1	0	1	1
MEX	1	0	0	0	1		1
PER	1	1	1	1	1		1
IND	1	1	1	0	1	1	1
IDN	1	1	1	1	1	1	1
MYS	1	1	0	1	0	1	0
PAK	1	1	1	0		1	0
PHL	1	1	0	0		1	1
THA	1	1	0	0	1	1	0
RUS	1	1	1	1	1	1	1
CHN	1	1	1	0	1		0
HUN	1	0	0	0	0	0	0
POL	1	0	0	0	0	0	0
ROM	1	0	0	0	1	0	
AUT	0	0	0	0		0	0
BEL	0	0	0	0		0	0
DNK	0	0	0	0		0	0
NLD	0	0	0	0		0	0
NOR	0	0	0	1	0	0	0
SWE	0	0	0	0	0	0	0
FIN	0	0	0	0		0	0
GRC	0	0	0	0		0	0
PRT	0	0	0	0		0	0
ESP	0	0	0	0		0	0
AUS	0	0	1	1	0	1	0
NZL	0	0	1	1	0	0	0
ISR	0	1	1	0		1	0
KOR	0	1	0	0	0	1	0
CZE	0	0	0	0	0	0	0

Sources: Ilzetzki, Reinhart and Rogoff (2019); AREAER; IMF Balance of Payments Satistics and Global Data Source; UN COMTRADE; Bems and others (2021); Boz and others (2022); Bénétrix and others (2019); and IMF staff calculations.

Note: Features are defined such that 1 represents the category with a more negative GDP response. The table is constructed for 2017Q1 except for high US dollar liability, which is a time-varying feature. For presentational purposes, in this table high US dollar liability is 1 if the country spent more than 12 quarters in the top quartile. The following features are not time-varying: emerging market/advanced economy status, commodity exporter/importer, below median anchoring, high US dollar export invoicing.

Online Annex Table 2.4.2 Categorization of Countries by Policy Regimes and Structural Characteristics

Policies and Structural Features	Measure	Threshold
Exchange rate regime	The coarse classification from Ilzetzki, Reinhart, and Rogoff (2019)	Freely floating: 4; other regime: 1, 2, or 3
Monetary policy credibility	The country average of the measure in Bems and others (2021)	Median
US dollar liability exposure	The share of foreign liabilities in US dollars from Bénétrix and others (2019)	75th percentile
US dollar export invoicing	The country average of the share of exports invoiced in US dollars from Boz and others (2022)	75 percent of exports
Trade openness	(Exports + Imports)/GDP from the IMF's Balance of Payments Statistics	Median
Commodity exporter/importer	The country median trade balance in all commodities from UN Comtrade	5 percent of GDP

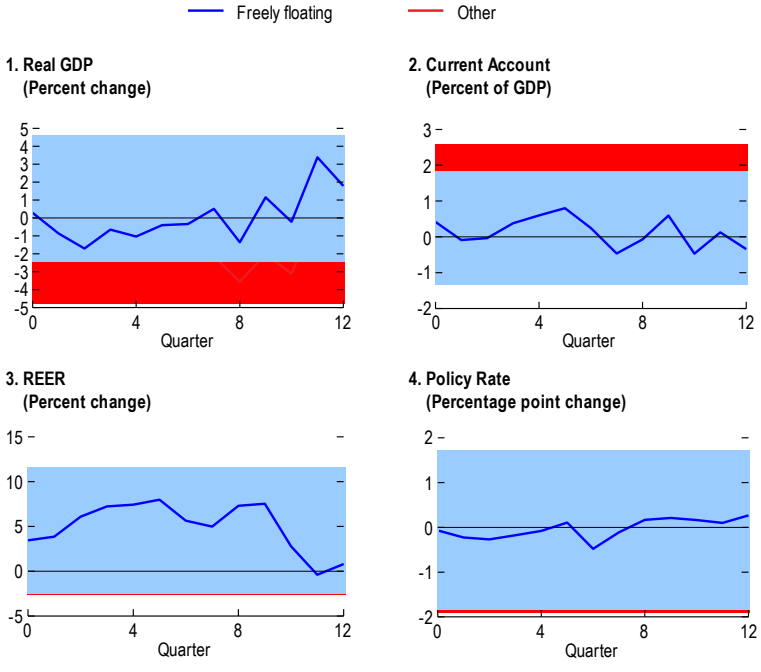
Sources: Bems and others (2021); Bénétrix and others (2019); Boz and others (2022); Ilzetzki, Reinhart, and Rogoff (2019); IMF, *Annual Report on Exchange Arrangements and Exchange Restrictions*; IMF, Balance of Payments Statistics; IMF, Global Data Source; UN, Comtrade; and IMF staff calculations.

Note: Coarse classification categories 5 and 6 are dropped. Countries with a coarse classification of 1, 2, or 3 that are anchored to a currency other than the US dollar that is freely floating against the US dollar are classified as freely floating. Classification into freely floating and other exchange rate regimes is extended through 2021 using the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* as a guide (see Online Annex Table 2.1.1 for details). The country average for the monetary policy credibility measure in Bems and others (2021) and the share of exports invoiced in US dollars from Boz and others (2022) is used for the whole sample period. The US dollar liability exposure classification is kept constant after 2017, given the end date of the measure in Bénétrix and others (2019). The classification of monetary policy credibility, US dollar export invoicing, and commodity exporter/importer do not vary over the sample period. The classification of exchange rate regime, US dollar liability exposure, and trade openness does vary across the sample period.

Results for the Exchange Rate Regime

Online Annex Figure 2.4.2 presents conditional impulse responses for freely floating and other exchange rate regimes for the emerging market sample only. Output recovers faster for countries with freely floating exchange rate regimes. The REER depreciates on impact and remains depreciated until the rebound in growth after the ninth quarter. It is important to note in interpreting these charts, that countries with freely floating exchange rate regimes are highly negatively correlated with countries that have a high share of exports indexed in US dollars (a correlation of -0.8 for the emerging market sample).

Online Annex Figure 2.4.2. Spillovers from a US Dollar Appreciation by Exchange Rate Regime



Source: IMF staff calculations.
Note: Emerging markets sample only. Impulse responses show a 10 percent appreciation in the nominal US dollar Index with 90 percent confidence intervals. Coarse classification from Ilzetzki, Reinhart and Rogoff (2019) where freely floating is 4 and other is 1, 2, or 3. An increase in the REER is a depreciation.

Robustness for First Stage

Several modifications to equation (1) were estimated to examine the robustness of the conclusion that established factors explain a limited share of the variation in the US dollar index against advanced economies:

- Substituting the policy rate differential between the US and the weighted average for advanced economies in the index with the 3-month, 12-month, and 10-year government bond differentials the adjusted R^2 are 0.22, 0.22, and 0.27, respectively.
- Substituting the ANFCI with the excess bond premium measure in Gilchrist and Zakrajšek (2012) yields an adjusted R^2 of 0.24. Substituting with the VIX, or adding the VIX as a global control does not increase the explained variation.
- Expanding the growth factor of emerging markets and smaller advanced economies in our sample to include the US and major advanced economies yields an adjusted R^2 of 0.22.
- Excluding the lagged US GDP regressor yields an adjusted R^2 of 0.187.
- Controlling, in addition to the controls in (1), for several monetary policy shocks, one at a time: Jarocinski & Karadi (2020) monetary policy and central bank information effect shock series; Bu, Rogers and Wu (2021) monetary policy shock and an associated orthogonal information effect shock; a surprise in interest rate expectations in a 30-minute window around FOMC meetings from Acosta (2023); and updated Gürkaynak et al. (2005) monetary policy shocks. The highest adjusted R^2 of 0.34 is obtained with the two Jarocinski & Karadi (2020) shocks.
- Controlling, in addition to the controls in (1), for oil supply shocks from Baumeister and Hamilton (2019) yields an adjusted R^2 of 0.23.
- Allowing for non-linear effects by including quadratic terms for all regressors in equation (1) yields an adjusted R^2 of 0.28, adding quadratic terms except for the lagged USD Index yields an adjusted R^2 of 0.32.
- We re-estimated the global dollar cycle by first explaining bilateral exchange rates (GBP, CHF, CAD, AUD, EUR, JPY and SKR against USD) with standard drivers and then aggregating the residuals using trade weights. The setup is as in equation (1) but uses the change in the bilateral exchange rate as the dependent variable and the bilateral shadow rate differential instead of the US versus the weighted average advanced economies' shadow rate differential. The resulting global dollar cycle is similar to our baseline measure with a correlation of 0.81.

Overall, these modifications to the baseline regression do not alter the chapter's finding that the established factors explain a limited share of the variation in the US dollar index against advanced economies.

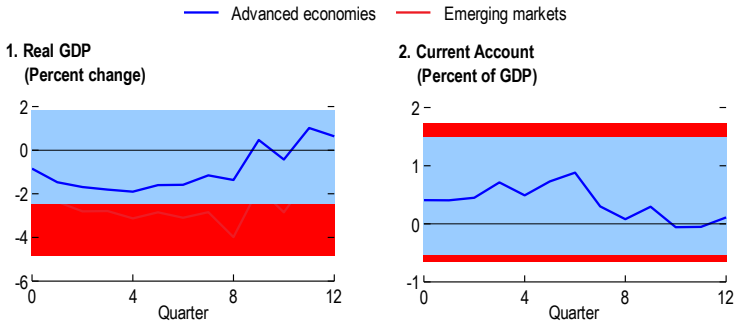
Robustness for Local Projections

Several modifications to equation (3) were estimated to examine the robustness of the impulse responses:

- Removing global controls increases the magnitude of the decline in output for both advanced and emerging economies, reflecting that these global controls explain some of the impact from a US dollar appreciation on growth (Online Annex Figure 2.4.3). It remains that advanced economies experience a shallower contraction in output that is shorter lived.

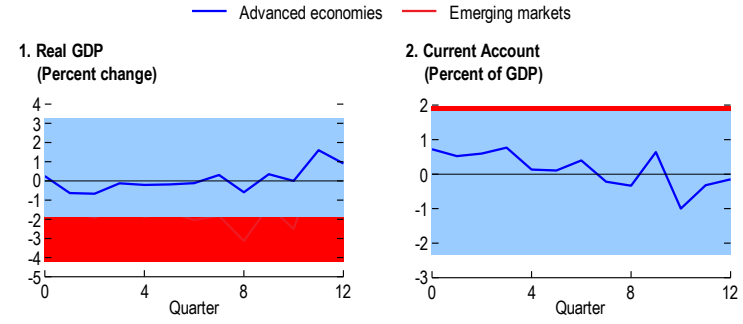
- Removing all the advanced economies that are included in the US dollar trade weighted index against advanced economies does not have a major impact on point estimates, although error bands expectedly increase with the smaller sample (Online Annex Figure 2.4.4). The countries excluded from the sample are Australia, Austria, Belgium, Finland, Greece, Netherlands, Portugal, Spain, and Sweden.

Online Annex Figure 2.4.3. Robustness: Removing Global Controls



Source: IMF staff calculations.
Note: Impulse responses show a 10 percent appreciation in the nominal US dollar Index with 90 percent confidence intervals. Advanced economies exclude countries with weights in the US dollar index that are larger than 4 percent in 2020: Canada, France, Germany, Ireland, Italy, Japan, Switzerland, and the United Kingdom.

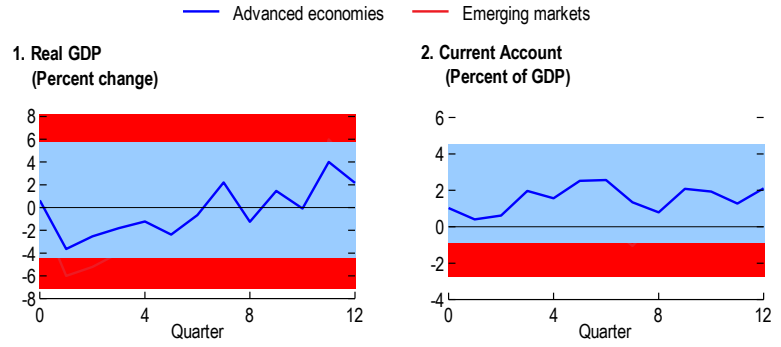
Online Annex Figure 2.4.4. Robustness: Removing all Advanced Economies Included in the US Dollar Trade-Weighted Index against AEs from the Sample



Source: IMF staff calculations.
Note: Impulse responses show a 10 percent appreciation in the nominal US dollar Index with 90 percent confidence intervals. Advanced economies exclude countries in the US dollar index: Australia, Austria, Belgium, Canada, Finland, France, Germany, Greece, Ireland, Italy, Japan, The Netherlands, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

- Replacing the US dollar index with the UIP premium calculated as in Annex 2.3 yields broadly similar results (Online Annex Figure 2.4.5). An increase in the UIP wedge results in negative spillovers to both advanced and emerging countries, with a more adverse impact on emerging market economies. Relative to the baseline, advanced economies exhibit a larger decline in output in the aftermath of the shock, but still recover around the seventh quarter. The output decline in emerging markets peaks sooner than in the baseline. With respect to the current account, advanced economies see a more persistent positive current account than in the baseline owing to investment which remains negative and does not rebound as in the baseline. In contrast, investment in emerging markets declines but reverts to zero, driving the current account toward zero, whereas in the baseline it remains negative.

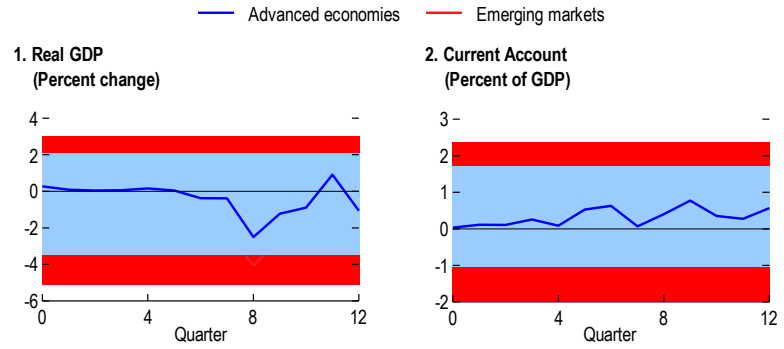
Online Annex Figure 2.4.5. Robustness: Replacing US Dollar Index with the UIP Deviation



Source: IMF staff calculations.
Note: Impulse responses show a 10 standard deviation increase in the UIP deviation with 90 percent confidence intervals. Advanced economies exclude countries with weights in the US dollar index that are larger than 4 percent in 2020: Canada, France, Germany, Ireland, Italy, Japan, Switzerland, and the United Kingdom.

- Controlling for Bu, Rogers and Wu (2021) monetary policy shock and the associated orthogonal information effect shock and for oil supply shocks from Baumeister and Hamilton (2019) yields similar results for emerging market economies as in our baseline (Online Annex Figure 2.4.6). Output declines in emerging market economies by more than for advanced economies, and the current account increases after a temporary initial decline. For advanced economies, output is stable in the aftermath of the shock, and the current account is positive but marginally significant.

Online Annex Figure 2.4.6. Robustness: Controlling for Oil Supply Shocks and Monetary Policy Shocks



Source: IMF staff calculations.
Note: Impulse responses show a 10 percent appreciation in the nominal US dollar Index with 90 percent confidence intervals. Advanced economies exclude countries with weights in the US dollar index that are larger than 4 percent in 2020: Canada, France, Germany, Ireland, Italy, Japan, Switzerland, and the United Kingdom.

Online Annex 2.5. Additional FSGM Details

All country/regional blocks are structurally identical, but with potentially different steady-state ratios of key macro aggregates and behavioral parameters.

Real GDP in the model is determined by a data driven calibration of the level of potential output in the long run, which is based on Cobb-Douglas production technology with trend total factor productivity, the steady-state labor force, the natural rate of unemployment, and the capital stock. In the short run, real GDP is determined by the sum of its demand components, where:

- The consumption block is micro founded and uses an overlapping generations (OLG) model with a fraction of liquidity constrained households that consume all their income each period, amplifying the non-Ricardian properties of the basic OLG framework.
- Private business investment is also micro founded, featuring forward-looking profit maximizing firms and limits to the pace of investment that slow down the transition after a shock.
- Government absorption consists of spending on consumption and investment goods. The government's overall deficit is determined by a fiscal rule.

For further details on FSGM are provided in Andrle and other (2015).

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