Theoretical Internet Appendix

Global Portfolio Rebalancing and Exchange Rates

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Appendix A: Model and Propositions

A.1. Model Asumptions

The world has two countries and a home and a foreign investor. Both investors are risk averse and can invest in risky home and risky foreign equity and a riskless domestic asset. The riskless asset (bond) is in fully price elastic supply and features for both countries a constant return (in local currency) given by $r = r^*$. Purchase of foreign assets by the home investor requires the acquisition of foreign balances as equity prices are purchased and sold in local currency. Similarly all foreign dividend income of the home investors is repatriated and generates a demand in the currency market. Investors do not hold any monetary balances and all their wealth is invested either in equity or their riskless (domestic) bond. The exchange rate is determined through a flow constraint which balances the currency demand of the two representative investors with a price elastic supply of forex balances on the part of financial institutions. The net currency demand by the two investors generates an exchange rate response and allows the liquidity suppliers to make an intertemporal trading profit.

The following 4 assumptions provide more detail on each element of the model structure. We start with the asset market structure:

Assumption 1: Asset Market Structure

A home (h) and a foreign ($f*$) stock market provide exogenous stochastic dividend flows D_t^h and D_t^{f*} in local currency. Home and foreign investors can invest in both stock markets. In addition, each investor can invest in a domestic riskless storage technology providing a riskless constant return r.

The domestic investor cannot access the foreign riskless investment opportunity. In particular they cannot acquire a short position in the foreign riskless storage investment. Markets are therefore incomplete and risk trading opportunities are generally not fully exploited. In particular, foreign exchange exposure from foreign stock investment is not fully eliminated as it would be in a complete market setting. We believe that incomplete hedging of foreign investment is the more realistic description compared to a world of full international exchange rate risk sharing.[1]

Investors in our model are risk averse and their objective is to find an optimal trade-off between expected profit flow of their asset position and the instantaneous profit risk. Each investor measures profits in home currency.

Assumption 2: Investor Behavior

Home and foreign investor are risk averse and maximize (in local currency terms) a myopic mean-variance objective for the profit flow. The home investors chooses portfolio weights $H_t = (H_t^h, H_t^f)$ and the foreign investor choose $H_t^* = (H_t^{f*}, H_t^{h*})$ so as to solve the two optimization problems

$$\begin{array}{lll} \max_{H_t^h, H_t^f} & \mathcal{E}_t \displaystyle\int_{s=t}^{\infty} e^{-r(s-t)} & \left[d\Pi_t - \frac{1}{2}\rho d\Pi_t^2\right] ds \\ \max_{H_t^{f*}, H_t^{h*}} & \mathcal{E}_t \displaystyle\int_{s=t}^{\infty} e^{-r(s-t)} & \left[d\Pi_t^* - \frac{1}{2}\rho d\Pi_t^{*2}\right] ds \end{array}, \qquad (1)$$

[1] See State Street Bank hedging ratios data.

where $\mathcal{E}_t$ denotes the rational expectation operator. Let $dR_t = (dR_t^h, dR_t^f)^T$ and $dR_t^* = (dR_t^{f*}, dR_t^{h*})^T$ denote the excess returns (in local currency) for home and foreign investors, respectively.

We define the excess stochastic profit flows for the domestic and foreign investor as

$$\begin{aligned} d\Pi_t &= H_t dR_t \\ d\Pi_t^* &= H_t^* dR_t^*, \end{aligned} \tag{2}$$

respectively. The investor risk aversion is given by ρ and the local discount rate is given by r.

The myopic investor behavior simplifies the asset demand equations to linear functions in the fundamentals. Hedging demand components are ignored under this utility specification. We highlight that both stock markets have to clear under the optimal asset demand. For simplicity we normalize the quantity of outstanding equity to one. This implies

$$\begin{aligned} H_t^h + H_t^{h*} &= 1 \\ H_t^f + H_t^{f*} &= 1 \end{aligned} \tag{3}$$

as the two asset market clearing conditions.

An additional market clearing condition applies to the foreign exchange market with an exchange rate E_t It is denominated as units of foreign per unit of home currency. We can measure the capital outflows dQ_t from the home country (in foreign currency terms) as

$$dQ_t = E_t H_t^{h*} D_t^h dt - H_t^f D_t^f dt + dH_t^f P_t^f - E_t dH_t^{h*} P_t^h. \tag{4}$$

The first two terms capture the outflow if all dividends are repatriated. But they can also increase their holdings of foreign equity assets. The net capital outflow due to changes in the foreign holdings, dH_t^f and dH_t^{h*} are captured by the third and fourth term. Let us for example denote the euro area as the home and the U.S. as the foreign country. Then dQ_t represents the net capital outflow out of the Eurozone into the US in dollar terms. It corresponds to a demand for dollar balances. An increase in E_t (denominated in dollars per euro) corresponds to a dollar depreciation against the euro. Any capital outflow in our model is identical to a net demand in foreign currency as all investment is assumed to occur in local currency. We can therefore also identify dQ_t with the demand for foreign currency in the foreign exchange (forex) market. Furthermore, the above investor capital outflow can be linearly approximated by

$$dQ_t^D = (E_t - \overline{E})\overline{H}\overline{D}dt + (H_t^{h*} - H_t^f)\overline{D}dt + (D_t^h - D_t^{f*})\overline{H}dt + (dH_t^f - dH_t^{h*})\overline{P}\ , \tag{5}$$

where the upper bar variables denote the unconditional means of the stochastic variables. We normalize $\overline{E}$ to 1. The linearization allows for a linear model and makes the analysis tractable.

The forex demand of the investors is absorbed by liquidity supplying banks which can buffer foreign exchange imbalances.[2] The following assumption characterizes the liquidity supply.

[2]A generalization of the model consists in allowing for additional current account imbalances given by $CA_t dt = \gamma\left(\overline{E} - E_t\right) dt$. The current account of the euro area is in deficit when the euro is strong and vice versa (γ is the exchange rate elasticity of the current account). This generalization is straightforward.

Assumption 3: Price Elastic Excess Supply of Foreign Exchange

The foreign exchange market clears for a price elastic excess supply curve with elasticity parameter κ. For an equilibrium exchange rate E_t, the excess supply of foreign exchange is given by

$$Q_t^S = -\kappa(E_t - \overline{E}), \tag{6}$$

where $\overline{E}$ denotes the steady state exchange rate level.

A increase in E_t (dollar depreciation) increases the excess supply of dollar balances. This exchange rate elastic excess supply may be generated by the intertemporal arbitrage of risk averse forex market makers, who sell dollars for euros when the exchange rate is high and buy dollars when the exchange rate is low. While it is possible to endogenize the elasticity parameter κ, we content here with the simpler parametric representation.

Market clearing in the forex market then requires $Q_t^S = Q_t^D$ and the foreign exchange rate is subject to the constraint

$$-\kappa dE_t = (E_t - \overline{E})\overline{H}\overline{D}dt + (H_t^{h*} - H_t^f)\overline{D}dt + (D_t^h - D_t^{f*})\overline{H}dt + (dH_t^f - dH_t^{h*})\overline{P}. \tag{7}$$

The exchange rate level is therefore tied to the relative dividend flows, $D_t^h - D_t^{f*}$, the relative level of foreign asset holdings $H_t^{h*} - H_t^f$, and their relative changes $dH_t^{h*} - dH_t^f$. Foreign asset holdings follow from the optimal foreign asset demand and depend on the stochastic characteristics of the exchange rate.

It is straightforward to express the payoff on a unit of domestic asset investment over the interval dt as dR_t^h. To characterize the foreign asset payoff dR_t^f in domestic currency we use a linear approximation around the steady state exchange rate $\overline{E}$ and the steady state price $\overline{P}$. The gross excess returns in home currency (of a unit of asset) are therefore

$$\begin{aligned} dR_t^h &= dP_t^h - rP_t^h dt + D_t^h dt && (8) \\ dR_t^f &\approx -dE_t\overline{P} + dP_t^{f*} - dE_t dP_t^{f*} - r\left[P_t^{f*} - \overline{P}(E_t - 1)\right]dt + \left[D_t^{f*} - \overline{D}(E_t - 1)\right]dt && (9) \end{aligned}$$

for the domestic and foreign asset returns, respectively. The return contribution of the exchange rate change dE_t on the foreign asset return is approximated by $-\overline{P}dE_t$.

Finally, we have to specify the stochastic structure of the state variables spelled out in the following assumption:

Assumption 5: Divident Structure

The home and foreign dividends follow independent Ornstein-Uhlenbeck processes with identical variance and mean reversion given by

$$\begin{aligned} dD_t^h &= \alpha_D(\overline{D} - D_t^h)dt + \sigma_D dw_t^h && (10) \\ dD_t^{f*} &= \alpha_D(\overline{D} - D_t^{f*})dt + \sigma_D dw_t^{f*}\ , && (11) \end{aligned}$$

The innovations dw_t^h and dw_t^{f*} in local currencies are independent.

The mean reversion of all stochastic processes simplify the analysis considerably. We can now introduce variables F_t^h and F_t^{f*} which denote the expected present value of the future discounted dividend flow,

$$F_t^h = \mathcal{E}_t \int_{s=t}^{\infty} D_t^h e^{-r(s-t)} ds = f_0 + f_D D_t^h \tag{12}$$

$$F_t^{f*} = \mathcal{E}_t \int_{s=t}^{\infty} D_t^{f*} e^{-r(s-t)} ds = f_0 + f_D D_t^{f*}, \tag{13}$$

with constant terms defined as $f_D = 1/(\alpha_D + r)$ and $f_0 = (r^{-1} - f_D)\overline{D}$. The risk aversion of the investors and the endogenous exchange rate variability and the prediction errors imply that the asset price will generally differ from this fundamental value.

A.2. Exchange Rate Dynamics

Next we discuss the exchange rate dynamics under incomplete markets. Two principle equilibrium forces shape this dynamics. The first equilibrium tendency is governed by the inelastic liquidity supply for forex order flow. Forex order flow dQ_t^D in equation (5) is accommodated by financial institutions which finance these home outflows according to an upward sloped supply curve. The elasticity of forex liquidity supply certainly influences the implact of net order flow on the exchange rate and indirectly the adjustment speed towards the steady state exchange rate, $\overline{E}$. We associate the supply induced mean reversion with a first characteristic root (labeled $z = -\alpha_\Lambda$). A second important parameter for the exchange rate dynamics is the mean reversion of the dividend processes. This mean reversion $\alpha_D > 0$ is exogenous and any feedback effect from the exchange rate dynamics to the dividend process is ruled out by assumption.

An important simplifying feature of our model is its symmetry between the home and foreign country. Symmetry implies that the exchange rate can depend only on differences between home and foreign country variables, but not on country specific variables itself. Otherwise the symmetry would be broken. The symmetry requirement also implies that the exchange rate can only be a function of current and past relative dividend innovations, $dw_s = w_s^h - w_s^{f*}$. These relative innovations are the only exogenous source of exchange rate dynamics.

Finally, we highlight the linearity of the model structure. The forex order flow constraint is linearized and the exogenous dividend dynamics is linear by assumption. Moreover, we have assumed a myopic mean-variance utility function which translates linear dividend, price and return processes into linear asset demands. It therefore seems justified to restrict attention to the class of linear exchange rate and price processes. The argument for two fundamental equilibrium forces justifies why we focus on two state variables Δ_t and Λ_t, both of which depend for reasons of model symmetry on current and past relative dividend innovations dw_s only.

The following proposition 4 states the conjectured exchange rate process and derives its implications for order flow constraint (7).

Proposition A1 (Exchange Rate Dynamics):

Assume that equity prices $P = (P_t^h, P_t^{f*})$ denominated in local currency and the exchange rate E_t have the following linear representation

$$P_t^h = p_0 + p_F F_t^h + p_\Delta \Delta_t + p_\Lambda \Lambda_t \tag{14}$$

$$P_t^{f*} = p_0 + p_F F_t^{f*} - p_\Delta \Delta_t - p_\Lambda \Lambda_t \tag{15}$$

$$E_t = 1 + e_\Delta \Delta_t + e_\Lambda \Lambda_t \tag{16}$$

with

$$\Delta_t = D_t^h - D_t^{f*} = \int_{-\infty}^{t} \exp[-\alpha_D(t-s)]\sigma_D dw_s \tag{17}$$

$$\Lambda_t = \int_{-\infty}^{t} \exp[z(t-s)]dw_s \tag{18}$$

where $z < 0$ and $dw_s = dw_s^h - dw_s^{f*}$.[3] Then the order flow constraint (7) implies for the exchange rate dynamics the following simple form

$$dE_t = k_1 \Delta_t dt + k_2 (E_t - 1) dt + k_3 dw_t, \tag{19}$$

where $k_1, k_2 = z$ and k_3 represent undetermined coefficients.

Proof of Proposition A1: We have to show that for a linear price and exchange rate equilibrium investor utility maximization implies optimal asset demands $H_t^h, H_t^f, dH_t^{f*}, dH_t^{h*}$such that hat the expression $(H_t^{h*} - H_t^f)\overline{D}dt + (dH_t^f - dH_t^{h*})\overline{P}$ in equation (7) is linear in $E_t - 1$, Δ_t and dw_t. The first-order condition for the investor asset demands (for risk aversion ρ) is given by

$$\begin{aligned}
\begin{pmatrix} H_t^h & H_t^f \\ H_t^{f*} & H_t^{h*} \end{pmatrix} &= \frac{1}{\rho dt}\mathcal{E}_t \begin{pmatrix} dR_t^h & dR_t^f \\ dR_t^{f*} & dR_t^{h*} \end{pmatrix} \Omega^{-1} \\
&= \frac{1}{\rho dt}\mathcal{E}_t \begin{pmatrix} dR_t^h\Omega_{11}^{-1} + dR_t^f\Omega_{21}^{-1} & dR_t^h\Omega_{12}^{-1} + dR_t^f\Omega_{22}^{-1} \\ dR_t^{f*}\Omega_{11}^{-1} + dR_t^{h*}\Omega_{21}^{-1} & dR_t^{f*}\Omega_{12}^{-1} + dR_t^{h*}\Omega_{22}^{-1} \end{pmatrix}.
\end{aligned} \tag{20}$$

The excess returns are for the form

$$dR_t^h = \alpha_0^h dt + \alpha_D^h D_t^h dt + \alpha_\Delta^h \Delta_t dt + \alpha_\Lambda^h \Lambda_t dt + p_F f_D \sigma_D dw_t^h + p_\Delta \sigma_\Delta dw_t + p_\Lambda \sigma_\Lambda dw_t \tag{21}$$

$$\begin{aligned}
dR_t^f &= \alpha_0^f dt + \alpha_D^f D_t^f dt + \alpha_\Delta^f \Delta_t dt + \alpha_\Lambda^f \Lambda_t dt \\
&\quad -\overline{P} e_\Delta \sigma_D dw_t - \overline{P} e_\Lambda \sigma_\Lambda dw_t + p_F f_D \sigma_D dw_t^f - p_\Delta \sigma_\Delta dw_t - p_\Lambda \sigma_\Lambda dw_t
\end{aligned} \tag{22}$$

$$dR_t^{f*} = \alpha_0^{f*} dt + \alpha_D^{f*} D_t^f dt + \alpha_\Delta^{f*} \Delta_t dt + \alpha_\Lambda^{f*} \Lambda_t dt + p_F f_D \sigma_D dw_t^f - p_\Delta \sigma_\Delta dw_t - p_\Lambda \sigma_\Lambda dw_t \tag{23}$$

$$\begin{aligned}
dR_t^{h*} &= \alpha_0^{h*} dt + \alpha_D^{h*} D_t^h dt + \alpha_\Delta^{h*} \Delta_t dt + \alpha_\Lambda^{h*} \Lambda_t dt \\
&\quad +\overline{P} e_\Delta \sigma_D dw_t + \overline{P} e_\Lambda \sigma_\Lambda dw_t - p_F f_D \sigma_D dw_t^h + p_\Delta \sigma_\Delta dw_t + p_\Lambda \sigma_\Lambda dw_t
\end{aligned} \tag{24}$$

[3] We note that the variance term σ_Λ can be scaled to $\sigma_\Lambda = 1$ without loss of generality as variation in σ_Λ is observationally equivalent to a rescaling of the coefficients $p'_\Lambda = p_\Lambda/\sigma_\Lambda$ and $e'_\Lambda = e_\Lambda/\sigma_\Lambda$.

where $\alpha_0^i, \alpha_D^i, \alpha_\Delta^i, \alpha_\Lambda^i$ are four sets of indices $i \in \{h, f, f*, h*\}$. Substitution then implies

$$\begin{aligned} H_t^{h*} - H_t^f &= \frac{1}{\rho dt}\mathcal{E}_t\left[dR_t^{f*}\Omega_{12}^{-1} + dR_t^{h*}\Omega_{22}^{-1} - dR_t^h\Omega_{12}^{-1} - dR_t^f\Omega_{22}^{-1}\right] \\ &= \frac{1}{\rho}\left[m_\Delta\Delta_t + m_\Lambda\Lambda_t\right]\ , \end{aligned} \tag{25}$$

where we define coefficients

$$m_\Delta = 2p_\Delta(\alpha_D + r)(\Omega_{12}^{-1} - \Omega_{22}^{-1}) - 2[(\alpha_D + r)\overline{P} - \overline{D}]e_\Delta\Omega_{22}^{-1} \tag{26}$$

$$m_\Lambda = 2p_\Lambda(-z + r)(\Omega_{12}^{-1} - \Omega_{22}^{-1}) - 2[\overline{P}(-z + r)\overline{P} - \overline{D}]e_\Lambda\Omega_{22}^{-1}. \tag{27}$$

Moreover

$$dH_t^{h*} - dH_t^f = \frac{1}{\rho}\left[-\alpha_D m_\Delta\Delta_t dt + z m_\Lambda\Lambda_t dt\right] + \frac{1}{\rho}\left[m_\Delta\sigma_\Delta + m_\Lambda\sigma_\Lambda\right]dw_t. \tag{28}$$

Finally, we substitute

$$\Lambda_t = \frac{1}{e_\Lambda}(E_t - \overline{E}) - \frac{e_\Delta}{e_\Lambda}\Delta_t \tag{29}$$

and find that the term $(H_t^{h*} - H_t^f)\overline{D}dt + (dH_t^f - dH_t^{h*})\overline{P}$ is linear in $E_t - \overline{E}$, Δ_t and dw_t. Substitution into the forex order flow constraint (7) implies a representation

$$dE_t = k_1\Delta_t + k_2(E_t - \overline{E}) + k_3 dw_t. \tag{30}$$

Under linearity of the price and exchange rate processes, the order flow constraint simplifies to a differential equation in only two state variables Δ_t and $E_t - 1$. This allows us to characterize the exchange rate dynamics as a system of two first-order differential equations,

$$\begin{pmatrix} d\Delta_t \\ dE_t \end{pmatrix} = \begin{pmatrix} -\alpha_D & 0 \\ k_1 & k_2 \end{pmatrix}\begin{pmatrix} \Delta_t \\ E_t - 1 \end{pmatrix}dt + \begin{pmatrix} \sigma_D \\ k_3 \end{pmatrix}dw_t, \tag{31}$$

The associated characteristic polynomial follows as

$$\begin{vmatrix} -\alpha_D - \lambda & 0 \\ k_1 & k_2 - \lambda \end{vmatrix} = (-\alpha_D - \lambda)(k_2 - \lambda) = 0 \tag{32}$$

with characteristic roots $\lambda' = k_2$ and $\lambda'' = -\alpha_D$. A stable solution requires $k_2 = z < 0$. The exchange rate solution can then be written as a linear combination $e_\Delta\Delta_t + e_\Lambda\Lambda_t$ of the two stochastic integrals

$$\Delta_t = \int_{-\infty}^t \exp[-\alpha_D(t-s)]\sigma_D dw_s \text{ and } \Lambda_t = \int_{-\infty}^t \exp[z(t-s)]dw_s \tag{33}$$

as conjectured in Proposition A1.

We can use the flow equation (7) and substitute the various terms

$$\begin{aligned} -\kappa dE_t &= (E_t - 1)\overline{HD}dt + (H_t^{h*} - H_t^f)\overline{D}dt + (D_t^h - D_t^{f*})\overline{H}dt + (dH_t^f - dH_t^{h*})\overline{P} = \\ &= (E_t - 1)\overline{HD}dt + \frac{1}{\rho}\left[m_\Delta\Delta_t + m_\Lambda\Lambda_t\right]\overline{D}dt + \Delta_t\overline{H}dt \\ &\quad -\frac{1}{\rho}\left[-\alpha_D m_\Delta\Delta_t dt + z m_\Lambda\Lambda_t dt\right]\overline{P} - \frac{1}{\rho}\left[m_\Delta\sigma_\Delta + m_\Lambda\right]\overline{P}dw_t \\ &= (E_t - 1)\overline{HD}dt + \left[\frac{1}{\rho}m_\Delta\overline{D} - \frac{1}{\rho} - \alpha_D m_\Delta\overline{P} + \overline{H}\right]\Delta_t dt \\ &\quad + \left[\frac{1}{\rho}m_\Lambda\overline{D} - \frac{1}{\rho}z m_\Lambda\overline{P}\right]\Lambda_t dt - \frac{1}{\rho}\left[m_\Delta\sigma_\Delta + m_\Lambda\right]\overline{P}dw_t\ . \end{aligned} \tag{34}$$

Next we use $\Lambda_t = \frac{1}{e_\Lambda}(E_t - 1) - \frac{e_\Delta}{e_\Lambda}\Delta_t$ to get

$$
\begin{aligned}
-\kappa dE_t &= (E_t-1)\overline{HD}dt + (H_t^{h*} - H_t^f)\overline{D}dt + (D_t^h - D_t^{f*})\overline{H}dt + (dH_t^f - dH_t^{h*})\overline{P} = \\
&= (E_t-1)\overline{HD}dt + \left[\frac{1}{\rho}m_\Delta \overline{D} - \frac{1}{\rho} - \alpha_D m_\Delta \overline{P} + \overline{H}\right]\Delta_t dt \\
&\quad + \left[\frac{1}{\rho}m_\Lambda \overline{D} - \frac{1}{\rho}z m_\Lambda \overline{P}\right]\Lambda_t dt - \frac{1}{\rho}\left[m_\Delta \sigma_\Delta + m_\Lambda\right]\overline{P}dw_t \\
&= (E_t-1)\overline{HD}dt + \left[\frac{1}{\rho}m_\Delta \overline{D} - \frac{1}{\rho} - \alpha_D m_\Delta \overline{P} + \overline{H}\right]\Delta_t dt \\
&\quad + \left[\frac{1}{\rho}m_\Lambda \overline{D} - \frac{1}{\rho}z m_\Lambda \overline{P}\right]\frac{1}{e_\Lambda}(E_t-1)dt - \left[\frac{1}{\rho}m_\Lambda \overline{D} - \frac{1}{\rho}z m_\Lambda \overline{P}\right]\frac{e_\Delta}{e_\Lambda}\Delta_t dt \\
&\quad - \frac{1}{\rho}\left[m_\Delta \sigma_\Delta + m_\Lambda\right]\overline{P}dw_t \\
&= \left\{\left[\frac{1}{\rho}m_\Lambda \overline{D} - \frac{1}{\rho}z m_\Lambda \overline{P}\right]\frac{1}{e_\Lambda} + \overline{HD}\right\}(E_t-1)dt + \\
&\quad \left\{\frac{1}{\rho}m_\Delta \overline{D} - \frac{1}{\rho} - \alpha_D m_\Delta \overline{P} + \overline{H} - \left[\frac{1}{\rho}m_\Lambda \overline{D} - \frac{1}{\rho}z m_\Lambda \overline{P}\right]\frac{e_\Delta}{e_\Lambda}\right\}\Delta_t dt \\
&\quad - \frac{1}{\rho}\left[m_\Delta \sigma_\Delta + m_\Lambda\right]\overline{P}dw_t \ .
\end{aligned} \tag{35}
$$

A comparison of coeffients with $dE_t = k_1\Delta_t + k_2(E_t - \overline{E}) + k_3 dw_t$ implies that

$$k_1 = -\frac{1}{\kappa}\left\{\frac{1}{\rho}m_\Delta \overline{D} - \frac{1}{\rho} - \alpha_D m_\Delta \overline{P} + \overline{H} - \left[\frac{1}{\rho}m_\Lambda \overline{D} - \frac{1}{\rho}z m_\Lambda \overline{P}\right]\frac{e_\Delta}{e_\Lambda}\right\} \tag{36}$$

$$k_2 = z = -\alpha_\Lambda = -\frac{1}{\kappa}\left\{\left[\frac{1}{\rho}m_\Lambda \overline{D} - \frac{1}{\rho}z m_\Lambda \overline{P}\right]\frac{1}{e_\Lambda} + \overline{HD}\right\} \tag{37}$$

$$k_3 = \frac{1}{\kappa\rho}\left[m_\Delta \sigma_\Delta + m_\Lambda\right]\overline{P} \ . \tag{38}$$

Using the equilibrium conjecture $E_t = 1 + e_\Delta \Delta_t + e_\Lambda \Lambda_t$, we can write

$$
\begin{aligned}
dE_t &= e_\Delta d\Delta_t + e_\Lambda d\Lambda_t = \\
&= e_\Delta(-\alpha_D \Delta_t dt + \sigma_D dw_t) + e_\Lambda(z\Lambda_t dt + dw_t) \\
&= -e_\Delta \alpha_D \Delta_t dt + e_\Lambda z \Lambda_t dt + (e_\Delta \sigma_D + e_\Lambda)dw_t \ .
\end{aligned} \tag{39}
$$

Using again $\Lambda_t = \frac{1}{e_\Lambda}(E_t - 1) - \frac{e_\Delta}{e_\Lambda}\Delta_t$, we obtain

$$
\begin{aligned}
dE_t &= e_\Delta d\Delta_t + e_\Lambda d\Lambda_t = \\
&= -e_\Delta \alpha_D \Delta_t dt + e_\Lambda z\left[\frac{1}{e_\Lambda}(E_t-1) - \frac{e_\Delta}{e_\Lambda}\Delta_t\right]dt + (e_\Delta \sigma_D + e_\Lambda)dw_t \\
&= z(E_t-1)dt - e_\Delta\left[\alpha_D + z\right]\Delta_t dt + (e_\Delta \sigma_D + e_\Lambda)dw_t,
\end{aligned} \tag{40}
$$

which implies $k_1 = -e_\Delta \alpha_D$, $k_2 = z$, and $k_3 = e_\Delta \sigma_D + e_\Lambda$. Combining the latter three expressing with the previous equations gives

$$-e_\Delta \alpha_D = -\frac{1}{\kappa}\left\{\frac{1}{\rho}m_\Delta \overline{D} - \frac{1}{\rho} - \alpha_D m_\Delta \overline{P} + \overline{H} - \left[\frac{1}{\rho}m_\Lambda \overline{D} - \frac{1}{\rho}z m_\Lambda \overline{P}\right]\frac{e_\Delta}{e_\Lambda}\right\} \tag{41}$$

$$z = -\alpha_\Lambda = -\frac{1}{\kappa}\left\{\left[\frac{1}{\rho}m_\Lambda \overline{D} - \frac{1}{\rho}z m_\Lambda \overline{P}\right]\frac{1}{e_\Lambda} + \overline{HD}\right\} \tag{42}$$

$$k_3 = e_\Delta \sigma_D + e_\Lambda = \frac{1}{\kappa\rho}\left[m_\Delta \sigma_\Delta + m_\Lambda\right]\overline{P}. \tag{43}$$

A.3. Market Equilibrium

In order to find the solution parameters $k_1, k_2 = z$ and k_3, we have to impose the market clearing conditions (3) and determine the steady state levels for the exchange rate, $\overline{E}$, the equity price, $\overline{P}$, and the foreign equity holding, $\overline{H}$. In order to obtain non-negative (steady state) prices ($\overline{P} > 0$) and positive (steady state) home and foreign holdings ($0 < \overline{H} < 1$), we have to restrict the parameter domain of your model. In particular we have to impose an upper bound $\overline{\rho}$ on the risk aversion and a lower bound $\underline{\kappa}$ on the elasticity of the forex liquidity supply. Proposition 5 characterizes the equilibrium properties:

Proposition A2 (Market Equilibrium):

Home and foreign investors make investment according to assumptions 1 to 4. For a sufficiently low risk aversion of the investors with $\rho < \overline{\rho}$ and a sufficiently price inelastic forex supply $\kappa > \underline{\kappa}$, there exists a unique stable linear equilibrium

$$\begin{aligned} P_t^h &= p_0 + p_F F_t^h + p_\Delta \Delta_t + p_\Lambda \Lambda_t & (44) \\ P_t^f &= p_0 + p_F F_t^f - p_\Delta \Delta_t - p_\Lambda \Lambda_t & (45) \\ E_t &= 1 + e_\Delta \Delta_t + e_\Lambda \Lambda_t & (46) \end{aligned}$$

where we define as F_t^h and F_t^f the expected present value of the future home and foreign dividend flows, respectively. The variable $\Delta_t = D_t^h - D_t^{f*}$ represents the relative dividend flows for the two countries and Λ_t a weighted average of past relative dividend innovations decaying at rate $z < 0$. For the price parameters we find

$$p_0 < 0, \ p_F = 1, \ p_\Delta > 0, \ e_\Delta < 0.$$

Portfolio holdings are given by

$$\begin{pmatrix} H_t^h & H_t^f \\ H_t^{f*} & H_t^{h*} \end{pmatrix} = \begin{pmatrix} 1-\overline{H} & \overline{H} \\ 1-\overline{H} & \overline{H} \end{pmatrix} + \begin{pmatrix} -1 & -1 \\ 1 & 1 \end{pmatrix} \frac{1}{2\rho} (m_\Delta \Delta_t + m_\Lambda \Lambda_t) \tag{47}$$

for the parameters $m_\Delta < 0$, and $m_\Lambda > 0$.

Proof of Proposition A2: The two market clearing conditions $H_t^h + H_t^{h*} = 1$ and $H_t^{f*} + H_t^f = 1$ imply each 4 symmetric parameter contraints (for $D_t^h, D_t^{f*}, \Lambda_t$, constant) given by

$$\begin{aligned} p_0 &= \frac{-\rho \det \Omega - \mathcal{E}_t(dE_t dP_t^{f*})(-\Omega_{12} + \Omega_{11})}{r(\Omega_{11} - 2\Omega_{12} + \Omega_{22})} & (48) \\ p_F &= 1 & (49) \\ p_\Delta &= -e_\Delta \frac{[(\alpha_D + r)\overline{P} - \overline{D}](\Omega_{21} + \Omega_{11})}{(\alpha_D + r)(\Omega_{11} + 2\Omega_{21} + \Omega_{22})} & (50) \\ p_\Lambda &= -e_\Lambda \frac{[(-z_2 + r)\overline{P} - \overline{D}](\Omega_{21} + \Omega_{11})}{(-z_2 + r)(\Omega_{11} + 2\Omega_{21} + \Omega_{22})} \ . & (51) \end{aligned}$$

The forex order flow constraint (7) implies an additional 3 constraints (for $\Delta_t, \Lambda_t, dw_t$) given by

$$e_\Delta \left(\overline{HD} - \kappa\alpha_D\right) + m_\Delta \frac{1}{\rho}\left(\overline{D} + \alpha_D \overline{P}\right) = -\overline{H} \tag{52}$$

$$e_\Lambda \left(\overline{HD} + \kappa z_2\right) + m_\Lambda \frac{1}{\rho}\left(\overline{D} - z_2 \overline{P}\right) = 0 \tag{53}$$

$$e_\Delta \kappa\sigma_D + e_\Lambda \kappa - m_\Delta \frac{1}{\rho}\overline{P}\sigma_\Delta - m_\Lambda \frac{1}{\rho}\overline{P} = 0 \ , \tag{54}$$

with

$$m_\Delta = 2p_\Delta(\alpha_D + r)(\Omega_{12}^{-1} - \Omega_{22}^{-1}) - 2[(\alpha_D + r)\overline{P} - \overline{D}]e_\Delta \Omega_{22}^{-1} \tag{55}$$

$$m_\Lambda = \left\{2p_\Lambda(-z_2 + r)(\Omega_{12}^{-1} - \Omega_{22}^{-1}) - 2[\overline{P}(-z_2 + r) - \overline{D}]e_\Lambda \Omega_{22}^{-1}\right\} \tag{56}$$

These 7 equations determine the 7 price parameters $p_0, p_F, p_\Delta, p_\Lambda, e_\Delta, e_\Lambda, z$.

Moreover, for steady state levels $\overline{P} > 0, \overline{D} > 0, \overline{\Lambda} = 0$ and $0 < \overline{H} < 1$ we require

$$\overline{P} = p_0 + \frac{\overline{D}}{r} + p_\Lambda \overline{\Lambda} = p_0 + \frac{\overline{D}}{r} \tag{57}$$

$$\overline{H} = \frac{\rho\left[\Omega_{11} - \Omega_{21}\right] - \mathcal{E}_t(dE_t dP_t^{f*})/dt}{\rho\left(\Omega_{11} - 2\Omega_{21} + \Omega_{22}\right)}. \tag{58}$$

The respective covariances are given by

$$\Omega_{11} = \left(f_D\sigma_D\right)^2 + 2[p_\Delta\sigma_\Delta + p_\Lambda]^2 + 2f_D\sigma_D[p_\Delta\sigma_\Delta + p_\Lambda] \tag{59}$$

$$\Omega_{12} = -2(p_\Delta\sigma_\Delta + p_\Lambda)^2 - \left[2(p_\Delta\sigma_\Delta + p_\Lambda) + f_D\sigma_D\right]\overline{P}\left(e_\Delta\sigma_D + e_\Lambda\right) - 2(p_\Delta\sigma_\Delta + p_\Lambda)f_D\sigma_D \tag{60}$$

$$\Omega_{22} = \left(f_D\sigma_D\right)^2 + 2[\overline{P}\left(e_\Delta\sigma_D + e_\Lambda\right) + p_\Delta\sigma_\Delta + p_\Lambda]^2 + 2f_D\sigma_D[\overline{P}\left(e_\Delta\sigma_D + e_\Lambda\right) + p_\Delta\sigma_\Delta + p_\Lambda] \tag{61}$$

and furthermore

$$\overline{\Omega} = 2\left(f_D\sigma_D\right)^2 + 2[\overline{P}\left(e_\Delta\sigma_D + e_\Lambda\right)]^2. \tag{62}$$

where we defined $\overline{\Omega} = \Omega_{11} + 2\Omega_{21} + \Omega_{22} > 0$ as the instantaneous varaince of the total market portfolio of all domestic and foreign equity.

Combining these equations (52) to (54) and (62) we obtain an expression which characterizes the root z of the system as

$$\frac{\rho}{2}\left(\overline{HD} + \kappa z\right)\overline{\Omega} = f(z), \tag{63}$$

where we define $f(z) = [(-z + r)\overline{P} - \overline{D}]\left(\overline{D} - z\overline{P}\right)$. The function $f(z)$ represents a convex parabola and has two intersects with the x-axes at $z_1 = -\overline{D}/\overline{P} + r \leq 0$ and $z_2 = \overline{D}/\overline{P} \geq 0$. Since $\frac{\rho}{2}\left(\overline{HD} + \kappa z\right)\overline{\Omega}$ is upward sloping, and positive for $z = 0$, it intersects the parabola twice. The first intersection z is negative and the second one it is positive. We discard the positive root because it is unstable.

Assume the forex supply is sufficiently price inelastic with $\kappa > \overline{\kappa} = \overline{HDP}/(\overline{D} - r\overline{P}) = \overline{HDP}/(-rp_0)$. Then $\frac{\rho}{2}\left(\overline{HD} + \kappa z\right)\overline{\Omega}(z)$ intersects the x-axis to the right of $z_1 = -\overline{D}/\overline{P} + r$ and the root z is confined to the interval $z \in [-\overline{D}/\overline{P} + r, -\overline{HD}/\kappa]$. This implies $(-z + r)\overline{P} - \overline{D} < 0$. Moreover, we require that the mean reversion parameter α_D of the dividend process is sufficiently large so that $-\alpha_D < -\overline{D}/\overline{P} + r$ or $(\alpha_D + r)\overline{P} - \overline{D} > 0$. The latter condition can be rewritten as $\alpha_D\overline{P} > -rp_0$, where $p_0 > 0$ represents the risk discount on the asset price. We can make p_0 sufficiently small by setting a low upper threshold value for the investor risk aversion, hence require $\overline{\rho} > \rho$.

With these two conditions on κ and ρ we can now sign the parameters. To simplify notation we define

$$k_1 = \frac{(\overline{HD} - \alpha_D\kappa)\overline{P}}{(\overline{D} + \alpha_D\overline{P})}, \qquad k_2 = \frac{(\overline{HD} + z\kappa)\overline{P}}{(\overline{D} - z\overline{P})} = z. \tag{64}$$

We can then rewrite the price coefficients as

$$e_\Delta = \frac{\overline{H}}{\left(\overline{HD} - \kappa\alpha_D\right)\left(1 - \frac{k_2[(\alpha_D + r)\overline{P} - \overline{D}]}{k_1[(-z_2 + r)\overline{P} - \overline{D}]}\right)} < 0 \tag{65}$$

$$p_\Delta = -e_\Delta\frac{[(\alpha_D + r)\overline{P} - \overline{D}](\Omega_{21} + \Omega_{11})}{(\alpha_D + r)\overline{\Omega}} > 0, \tag{66}$$

because $(\alpha_D + r)\overline{P} - \overline{D} > 0$, $(-z + r)\overline{P} - \overline{D} < 0$, $\overline{HD} - \kappa\alpha_D < \overline{HD} + \kappa z < 0$, $k_1 < 0$ and $k_2 < 0$.

A.4. Uniqueness of the Stable Equilibrium

We first note that there is a unique stable negative root $z < 0$. Moreover, equation (63) can be rewritten as

$$2\left(f_D\sigma_D\right)^2 + 2[\overline{P}\left(e_\Delta\sigma_D + e_\Lambda\right)]^2 = \frac{[(-z+r)\overline{P} - \overline{D}]\left(\overline{D} - z\overline{P}\right)}{\frac{\rho}{2}\left(\overline{HD} + \kappa z\right)} > 0. \tag{67}$$

A necessary condition for the existance of a real solution for $\overline{e} = e_\Delta\sigma_D + e_\Lambda$ is

$$V(\rho,\kappa) = \frac{[(-z+r)\overline{P} - \overline{D}]\left(\overline{D} - z\overline{P}\right)}{\rho\left(\overline{HD} + \kappa z\right)} - \left(f_D\sigma_D\right)^2 \geq 0. \tag{68}$$

This condition is satisfied only if $\rho\left(f_D\sigma_D\right)^2$ is sufficiently small or risk aversion is below as certain threshold $\rho < \overline{\rho}$. Given $\overline{e} \equiv e_\Delta\sigma_D + e_\Lambda < 0$ (shown in corollary 2), we can then rewrite equation (63) in linear form as

$$e_\Delta\sigma_D + e_\Lambda = -\frac{1}{\overline{P}}\sqrt{V(\rho,\kappa)} \tag{69}$$

We define a vector $\mathbf{e} = (e_\Delta, e_\Lambda, m_\Delta, m_\Lambda)$ and matrices

$$\mathbf{A} = \begin{pmatrix} \sigma_D & 1 & 0 & 0 \\ \left(\overline{HD} - \kappa\alpha_D\right) & 0 & \frac{1}{\rho}\left(\overline{D} + \alpha_D\overline{P}\right) & 0 \\ 0 & \left(\overline{HD} + \kappa z\right) & 0 & \frac{1}{\rho}\left(\overline{D} - z\overline{P}\right) \\ \kappa\sigma_\Delta & \kappa & -\frac{1}{\rho}\overline{P}\sigma_\Delta & -\frac{1}{\rho}\overline{P} \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} -\frac{1}{\overline{P}}\sqrt{V(\rho,\kappa)} \\ -V(\rho,\kappa) \\ 0 \\ 0 \end{pmatrix} \tag{70}$$

so that the linear system $\mathbf{Ae} = \mathbf{b}$ summarizes the 4 equations (52), (53), (54) and (69). For $\det(\mathbf{A}) \neq 0$ there exists a unique solution for $\mathbf{e}$.

$$\begin{aligned}
\det(\mathbf{A}) &= \sigma_D \begin{vmatrix} 0 & \frac{1}{\rho}\left(\overline{D} + \alpha_D\overline{P}\right) & 0 \\ \left(\overline{KD} + \kappa z\right) & 0 & \frac{1}{\rho}\left(\overline{D} - z\overline{P}\right) \\ \kappa & -\frac{1}{\rho}\overline{P}\sigma_\Delta & -\frac{1}{\rho}\overline{P} \end{vmatrix} - \begin{vmatrix} \left(\overline{KD} - \kappa\alpha_D\right) & \frac{1}{\rho}\left(\overline{D} + \alpha_D\overline{P}\right) & 0 \\ 0 & 0 & \frac{1}{\rho}\left(\overline{D} - z\overline{P}\right) \\ \kappa\sigma_\Delta & -\frac{1}{\rho}\overline{P}\sigma_\Delta & -\frac{1}{\rho}\overline{P} \end{vmatrix} \\
&= \sigma_D\left[\frac{1}{\rho}\left(\overline{D} + \alpha_D\overline{P}\right)\frac{1}{\rho}\left(\overline{D} - z\overline{P}\right)\kappa + \frac{1}{\rho}\overline{P}\left(\overline{HD} + \kappa z\right)\frac{1}{\rho}\left(\overline{D} + \alpha_D\overline{P}\right)\right] \\
&\quad -\sigma_\Delta\left[\frac{1}{\rho}\left(\overline{D} + \alpha_D\overline{P}\right)\frac{1}{\rho}\left(\overline{D} - z\overline{P}\right)\kappa + \frac{1}{\rho}\overline{P}\left(\overline{HD} - \kappa\alpha_D\right)\frac{1}{\rho}\left(\overline{D} - z\overline{P}\right)\right] \\
&= \frac{\overline{P}}{\rho^2}\sigma_D\left[\left(\overline{HD} + \kappa z\right)\left(\overline{D} + \alpha_D\overline{P}\right) - \left(\overline{KD} - \kappa\alpha_D\right)\left(\overline{D} - z\overline{P}\right)\right] \\
&= \frac{\overline{P}}{\rho^2}\sigma_D\left[\overline{HDD} + \overline{HD}\alpha_D\overline{P} + \kappa z\overline{D} + \kappa z\alpha_D\overline{P} - \overline{HDD} + \overline{HD}z\overline{P} + \kappa\alpha_D\overline{D} - \kappa\alpha_D z\overline{P}\right] \\
&= \frac{\overline{PD}}{\rho^2}\sigma_D(\alpha_D + z)(\overline{HP} + \kappa) > 0\ .
\end{aligned} \tag{71}$$

Next we show that this implies also a unique solution for the price coefficients $\mathbf{p} = (p_\Delta, p_\Lambda)$. Note that

$$(\Omega_{11} + \Omega_{12})/dt = \left(f_D\sigma_D\right)^2 - \left[2(p_\Delta\sigma_\Delta + p_\Lambda\sigma_\Lambda) + f_D\sigma_D\right]\overline{P}\left(e_\Delta\sigma_D + e_\Lambda\right) \tag{72}$$

is linear in $\mathbf{p}$ for a fixed vector $\mathbf{e}$. The equations (50) and (50) are therefore of the form $\mathbf{Cp} = \mathbf{d}$, where we define

$$\mathbf{C} = \begin{pmatrix} 2c_\Delta\overline{P}\overline{e}\sigma_\Delta - 1 & 2c_\Delta\overline{P}\overline{e} \\ 2c_\Lambda\overline{P}\overline{e}\sigma_\Delta & 2c_\Lambda\overline{P}\overline{e} - 1 \end{pmatrix}, \qquad \mathbf{d} = \begin{pmatrix} c_\Delta\left[\left(f_D\sigma_D\right)^2 - f_D\sigma_D\overline{P}\overline{e}\right] \\ c_\Lambda\left[\left(f_D\sigma_D\right)^2 - f_D\sigma_D\overline{P}\overline{e}\right] \end{pmatrix}$$

with $\overline{e} \equiv e_\Delta \sigma_D + e_\Lambda$, $\overline{\Omega} = \Omega_{11} + 2\Omega_{21} + \Omega_{22}$ and additional constants

$$c_\Delta = \frac{e_\Delta[(\alpha_D + r)\overline{P} - \overline{D}]}{(\alpha_D + r)\overline{\Omega}}, \qquad c_\Lambda = \frac{e_\Lambda[(-z + r)\overline{P} - \overline{D}]}{(-z + r)\overline{\Omega}}.$$

For $\det(\mathbf{C}) \neq 0$ we can invert $\mathbf{C}$ and obtain a unique solution for $\mathbf{p}$. Finally, the coefficient p_0 is uniquely determined by equation (48).

A.4. Additional Propositions

Corollary 1 (Rebalancing and Equity Return Differences):

The domestic investor rebalances her foreign investment portfolio toward home country equity if the return on her foreign equity holdings exceeds the return on her home equity investments. Formally, the foreign equity holding change dH_t^f and the excess return of the foreign equity over home equity $dr_t^f - dr_t^h = (dR_t^f - dR_t^h)/\overline{P}$ expressed in domestic currency feature a negative covariance given by

$$Cov(dH_t^f, dr_t^f - dr_t^h) = \kappa \frac{1}{\overline{P}} \left[\frac{1}{\overline{P}} f_D \sigma_D + 2p_\Delta \sigma_D + 2p_\Lambda + e_\Delta \sigma_D + e_\Lambda \right] (e_\Delta \sigma_D + e_\Lambda)\, dt < 0, \tag{73}$$

and for the home equity investment of the foreign investor we have $dH_t^{h*} = -dH_t^f$.

Proof of Corollary 1: Based on the price functions Eqs. (44)-(45) and the exchange rate return

$$\begin{aligned} dE_t &= e_\Delta d\Delta_t + e_\Lambda d\Lambda_t = \\ &= -e_\Delta \alpha_D \Delta_t dt + e_\Lambda z \left[\frac{1}{e_\Lambda}(E_t - 1) - \frac{e_\Delta}{e_\Lambda}\Delta_t \right] dt + (e_\Delta \sigma_D + e_\Lambda) dw_t \\ &= z(E_t - 1)dt - e_\Delta \left[\alpha_D + z\right] \Delta_t dt + (e_\Delta \sigma_D + e_\Lambda) dw_t \end{aligned} \tag{74}$$

we obtain for the excess returns

$$\begin{aligned} dR_t^h &= dP_t^h - rP_t^h dt + D_t^h dt \\ &= dP_t^h + \text{...(ignoring } dt \text{ terms)} \\ &= p_F dF_t^h + p_\Delta d\Delta_t + p_\Lambda d\Lambda_t \end{aligned} \tag{75}$$

$$\begin{aligned} dR_t^f &\approx -dE_t \overline{P} + dP_t^{f*} - dE_t dP_t^{f*} - r\left[P_t^{f*} - \overline{P}(E_t - 1)\right] dt + \left[D_t^{f*} - \overline{D}(E_t - 1)\right] dt \\ &= -dE_t \overline{P} + dP_t^{f*} + \text{.....(ignoring } dt \text{ terms)} \\ &= -\overline{P}(e_\Delta \sigma_D + e_\Lambda) dw_t + p_F dF_t^{f*} - p_\Delta d\Delta_t - p_\Lambda d\Lambda_t + \text{....(ignoring } dt \text{ terms)} \end{aligned} \tag{76}$$

$$\begin{aligned} dR_t^f - dR_t^h &= -\overline{P}(e_\Delta \sigma_D + e_\Lambda) dw_t + p_F \left[dF_t^{f*} - dF_t^h\right] - 2p_\Delta d\Delta_t - 2p_\Lambda d\Lambda_t + \text{...} \\ &= -\overline{P}(e_\Delta \sigma_D + e_\Lambda) dw_t - f_D d\Delta_t - 2p_\Delta d\Delta_t - 2p_\Lambda d\Lambda_t + \text{...} \\ &= -\overline{P}(e_\Delta \sigma_D + e_\Lambda) dw_t - \left[f_D + 2p_\Delta\right] \sigma_D dw_t - 2p_\Lambda dw_t + \text{...} \\ &= -\left[\overline{P}(e_\Delta \sigma_D + e_\Lambda) + f_D \sigma_D + 2p_\Delta \sigma_D + 2p_\Lambda\right] dw_t + \text{....(ignoring } dt \text{ terms)} \end{aligned} \tag{77}$$

$$dR_t^{f*} - dR_t^h = 2p_\Delta(\alpha_D + r)\Delta_t dt + 2p_\Lambda(-z + r)\Lambda_t dt - \left[f_D \sigma_D + 2p_\Delta \sigma_D + 2p_\Lambda\right] dw_t\ . \tag{78}$$

The instantaneous volatility of the excess return follows as

$$
\begin{aligned}
\mathcal{E}_t\left(dr_t^f - dr_t^h\right)\left(dr_t^f - dr_t^h\right) &= \frac{1}{\overline{P}^2}\mathcal{E}_t\left(dR_t^f - dR_t^h\right)\left(dR_t^f - dR_t^h\right) = \\
&= \frac{1}{\overline{P}^2}\left[\overline{P}(e_\Delta\sigma_D + e_\Lambda) + f_D\sigma_D + 2p_\Delta\sigma_D + 2p_\Lambda\right]^2 \mathcal{E}_t\left(dw_t dw_t\right) \\
&= \frac{2}{\overline{P}^2}\left[\overline{P}(e_\Delta\sigma_D + e_\Lambda) + f_D\sigma_D + 2p_\Delta\sigma_D + 2p_\Lambda\right]^2 dt. \qquad (79)
\end{aligned}
$$

For holding changes we find

$$
dH_t^f = \frac{1}{2\rho}\left(m_\Delta d\Delta_t + m_\Lambda d\Lambda_t\right) = \frac{1}{2\rho}\left(m_\Delta\sigma_D + m_\Lambda\right)dw_t + ... \qquad (80)
$$

which implies

$$
\begin{aligned}
Cov\left(dH_t^f, dr_t^f - dr_t^h\right) &= \frac{1}{2\rho}\left(m_\Delta\sigma_D + m_\Lambda\right)\frac{2}{\overline{P}}\left[\overline{P}(e_\Delta\sigma_D + e_\Lambda) + f_D\sigma_D + 2p_\Delta\sigma_D + 2p_\Lambda\right]dt \\
&= \left(e_\Delta\sigma_D + e_\Lambda\right)\frac{\kappa}{\overline{P}^2}\left[\overline{P}(e_\Delta\sigma_D + e_\Lambda) + f_D\sigma_D + 2p_\Delta\sigma_D + 2p_\Lambda\right]dt \\
&= \frac{\kappa}{\overline{P}^2}\left[\overline{P}(e_\Delta\sigma_D + e_\Lambda)^2 + (e_\Delta\sigma_D + e_\Lambda)\left(f_D\sigma_D + 2p_\Delta\sigma_D + 2p_\Lambda\right)\right]dt \qquad (81)
\end{aligned}
$$

and also

$$
\begin{aligned}
\beta &= \frac{Cov\left(dH_t^f, dr_t^f - dr_t^h\right)}{Var\left(dr_t^f - dr_t^h\right)} = \frac{\left(m_\Delta\sigma_D + m_\Lambda\right)\overline{P}}{2\rho\left[\overline{P}(e_\Delta\sigma_D + e_\Lambda) + f_D\sigma_D + 2p_\Delta\sigma_D + 2p_\Lambda\right]} \\
&= \frac{\kappa\left(e_\Delta\sigma_D + e_\Lambda\right)}{2\left[\overline{P}(e_\Delta\sigma_D + e_\Lambda) + f_D\sigma_D + 2p_\Delta\sigma_D + 2p_\Lambda\right]} < 0 \qquad (82)
\end{aligned}
$$

because $\left(e_\Delta\sigma_D + e_\Lambda\right)\frac{\kappa\rho}{\overline{P}} = m_\Delta\sigma_\Delta + m_\Lambda < 0$. Symmetry of the model implies $\mathcal{E}_t(dE_t dR_t^h) = -\mathcal{E}_t(dE_t dR_t^{f*})$. Furthermore,

$$
\mathcal{E}_t(dE_t dR_t^h)/dt = \left(e_\Delta\sigma_D + e_\Lambda\right)\left[f_D\sigma_D + 2\left(p_\Delta\sigma_D + p_\Lambda\right)\right] < 0
$$

amounts to showing that $\overline{e} \equiv e_\Delta\sigma_D + e_\Lambda < 0$ as long as $f_D\sigma_D + 2\left(p_\Delta\sigma_D + p_\Lambda\right) > 0$. To simplify notation we define

$$
k_1 = \frac{(\overline{HD} - \alpha_D\kappa)\overline{P}}{(\overline{D} + \alpha_D\overline{P})}, \qquad k_2 = \frac{(\overline{HD} + z\kappa)\overline{P}}{(\overline{D} - z\overline{P})}.
$$

Clearly, $k_1 < 0$ and $k_2 < 0$ under the parameter constraints of proposition 5. Moreover, $k_1 - k_2 < 0$, because (for $\alpha_D > -z$) we find

$$
(\overline{D} - z\overline{P})(\overline{HD} - \alpha_D\kappa) - (\overline{D} + \alpha_D\overline{P})(\overline{HD} + z\kappa) = -(\alpha_D + z)\left[\overline{D}\kappa + \overline{PHD}\right] < 0.
$$

Substituting equations (52) and (53) into (54) implies

$$
e_\Delta\sigma_\Delta\left[\kappa + k_1\right] + e_\Lambda\left[\kappa + k_2\right] = \frac{-\overline{HP}\sigma_\Delta}{(\overline{D} + \alpha_D\overline{P})} < 0.
$$

Subtracting the term $e_\Delta\sigma_\Delta(k_1 - k_2) > 0$ (because $e_\Delta < 0$) from the left hand side implies $e_\Delta\sigma_\Delta\left[\kappa + k_2\right] + e_\Lambda\left[\kappa + k_2\right] < 0$ and also $e_\Delta\sigma_\Delta + e_\Lambda < 0$, since $\kappa + k_2 > 0$ is trivially fulfilled (for $\kappa > 0, \overline{H} > 0, \overline{D} > 0, \overline{P} > 0$).

Empirical Internet Appendix

Global Portfolio Rebalancing and Exchange Rates

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Table A1: Equity Fund Rebalancing for Non-Dividend Adjusted Returns

Fund rebalancing of the foreign investment share $\Delta h^f_{j,t}$ of fund j in quarter t (measured in percentages) is regressed on non-dividend adjusted excess returns of the foreign over the domestic investment share, $r^f_{j,t} - r^h_{j,t}$, and its lagged values $r^f_{j,t-l} - r^h_{j,t-l}$ for lags $l = 1, 2$. In Column (1) we report OLS regression results without fixed effects, Columns (2)–(7) add interacted time and fund domicile fixed effects, and Columns (3)-(7) add additional fund fixed effects. Column (5) splits the excess return on the foreign portfolio share into positive and negative realizations to test for symmetry of the rebalancing behavior. In Columns (6)–(7) we report the baseline regression of Column (3) for the subsample until June 2008 (Period I) and thereafter (Period II). We report robust standard errors clustered at the fund level for specification (1) and use ***, **, and * to denote statistical significance at the 1%, 5%, and 10% level respectively.

Dependent variable:	Fund Level Rebalancing $\Delta h^f_{j,t}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$r^f_{j,t} - r^h_{j,t}$	-1.781^{***}	-2.469^{***}	-2.397^{***}	-2.455^{***}		-1.952^{***}	-2.435^{***}
	(0.240)	(0.249)	(0.263)	(0.278)		(0.555)	(0.305)
$r^f_{j,t-1} - r^h_{j,t-1}$		-1.682^{***}	-1.503^{***}	-1.703^{***}		-1.717^{***}	-1.420^{***}
		(0.249)	(0.262)	(0.276)		(0.579)	(0.301)
$r^f_{j,t-2} - r^h_{j,t-2}$				-0.996^{***}			
				(0.274)			
$(r^f_{j,t} - r^h_{j,t}) \times 1_{\geq 0}$					-3.400^{***}		
					(0.453)		
$(r^f_{j,t} - r^h_{j,t}) \times 1_{<0}$					-1.359^{***}		
					(0.466)		
$(r^f_{j,t-1} - r^h_{j,t-1}) \times 1_{\geq 0}$					-0.557		
					(0.447)		
$(r^f_{j,t-1} - r^h_{j,t-1}) \times 1_{<0}$					-2.543^{***}		
					(0.470)		
Time×Fund Domicile FEs	No	Yes	Yes	Yes	Yes	Yes	Yes
Fund FEs	No	No	Yes	Yes	Yes	Yes	Yes
F-statistic	55.045	10.690	10.115	10.157	10.107	4.073	12.717
Observations	101,234	89,170	89,170	79,426	89,170	15,981	73,189
Adjusted R^2	0.001	0.065	0.133	0.142	0.134	0.168	0.141
Sample	Full	Full	Full	Full	Full	Until June 2008	After June 2008

Table A2: Fund Rebalancing Trimming Robustness

Regressions results in Tables 4 and 5 are shown for different levels of trimming of data outliers for the fund rebalancing variables $\Delta h^{f}_{j,t}$ or $\Delta h^{h*}_{j,t}$. We use ***, **, and * to denote statistical significance at the 1%, 5%, and 10% level, respectively.

	OLS Results (Table 4)		2SLS Results (Table 5)		
Trimming	Coefficient	R^2	GIV2		
at			First-Stage	Second-Stage	Elasticity
0%	0.739**	4.1%	1.222***	0.437	2.29
1%	0.896**	4.5%	1.298***	0.524	1.91
2%	1.003***	5.5%	1.390***	0.800*	1.25
2.5%	1.046***	5.7%	1.429***	0.926**	1.08
3%	1.060***	5.7%	1.439***	1.037**	0.96
4%	1.144***	5.4%	1.403***	1.156**	0.87
5%	1.229***	5.9%	1.421***	1.207**	0.83

Table A3: Filtering Fund Rebalancing

Fund rebalancing terms $\Delta h^{f}_{j,t}$ and $\Delta h^{h*}_{j,t}$ of fund j in quarter t (measured as percentage) are regressed on fund size [$ln(Assets)_{j,t-1}$], the Herfindahl–Hirschman Index of fund concentration ($HHI_{j,t-1}$), and their interaction with a fund's foreign excess return $r^{f}_{j,t} - r^{h}_{j,t}$ and $r^{h*}_{j,t} - r^{f*}_{j,t}$, respectively. In specification (1), we use as dependent variable $\Delta h^{f}_{j,t}$ the fund-level rebalancing of home funds (domiciled in currency area c) toward foreign equity (i.e., portfolio outflows from currency area c). In specification (2), we use as dependent variable $\Delta h^{h*}_{j,t}$, the rebalancing of foreign domiciled funds from foreign equity positions into equity in currency area c (i.e., portfolio inflows into currency area c). Specifications (1) and (2) filter fund heterogeneity in rebalancing for GIV2. The respective regression residuals are then used for the construction of the granular instrumental variables. We report robust standard errors clustered at the fund level for all specifications and use ***, **, and * to denote statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent variable:	Fund Level Rebalancing $\Delta h^{f}_{j,t}$	Fund Level Rebalancing $\Delta h^{h*}_{j,t}$
	GIV2	GIV2
	(1)	(2)
$ln(Assets)_{j,t-1}$	0.006	0.029^{***}
	(0.017)	(0.007)
$HHI_{j,t-1}$	4.627^{***}	1.330^{*}
	(1.492)	(0.740)
$(r^{f}_{j,t} - r^{h}_{j,t}) \times ln(Assets)_{j,t-1}$	-0.061^{***}	
	(0.010)	
$(r^{h*}_{j,t} - r^{f*}_{j,t}) \times ln(Assets)_{j,t-1}$		-0.026^{***}
		(0.003)
$(r^{f}_{j,t} - r^{h}_{j,t}) \times HHI_{j,t-1}$	-19.805^{***}	
	(5.833)	
$(r^{h*}_{j,t} - r^{f*}_{j,t}) \times HHI_{j,t-1}$		-3.129^{*}
		(1.711)
Time FEs	No	No
Fund FEs	Yes	Yes
F-statistic	43.800	83.653
Observations	104,012	236,697
Adjusted R^2	0.088	0.042

Table A4: Aggregate Equity Rebalancing and the Exchange Rate - Country Group Analysis

The effective (log) foreign currency appreciation $-\Delta E_{c,t}$ in quarter t (scaled by a factor of 100) for the four currency areas c (i.e., U.S., U.K., Eurozone, Canada) is regressed on the net equity rebalancing flows (expressed in percentages of the average foreign equity positions). We pool data for the U.S. and U.K. currency in odd columns characterized by higher reporting completeness and alternatively for the Eurozone (EZ) and Canada (CA) currency in even columns characterized by lower reporting quality. In Columns (1)-(2) we use the full period sample and in Columns (3)-(6) we present subsample results. In Column (1), we report OLS regression coefficients for the aggregate rebalancing $\Delta H^f_{c,t}$ of the foreign portfolio share of all funds domiciled in c and the aggregate rebalancing $\Delta H^{h*}_{c,t}$ of the portfolio share invested in c by equity funds domiciled outside c. Column (2) combines both terms to the net aggregate equity outflow $\Delta H^{Net}_{c,t} = 2\mu_{c,t-1}\Delta H^f_{c,t} - 2(1-\mu_{c,t-1})\Delta H^{h*}_{c,t}$ from currency area c, where $\mu_{c,t-1}$ denotes the ratio of aggregate outbound to the sum of aggregate outbond and inbound equity investments. Columns (3)-(6) repeat the regressions in Columns (1)-(2) for a pre-crisis 1999-2007 subsample and a crisis/post-crisis 2008-2015 subsample. We use ***, **, and * to denote statistical significance at the 1%, 5%, and 10% level, respectively.

Dependent var.:	Effective Quarterly Foreign Currency Appreciation, $-\Delta E_{c,t}$					
	Full Sample		Period 1999-2007		Period 2008-2015	
	U.S. and U.K.	EZ and CA	U.S. and U.K.	EZ and CA	U.S. and U.K.	EZ and CA
	OLS	OLS	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta H^{Net}_{c,t}$	0.982**	1.273*	0.350	0.202	1.899***	1.305
	(0.397)	(0.711)	(0.511)	(1.138)	(0.664)	(0.897)
F-statistic	6.111	3.209	0.468	0.032	8.180	2.119
Observations	72	71	17	19	55	52
Adjusted R^2	0.080	0.044	0.030	0.002	0.134	0.041

Table A5: Narrative Approach to Large Fund Shocks

We follow the narrative approach proposed by Gabaix and Koijen (July 2021, page 15) and look for the narratives behind the largest fund-level shocks to equity inflows and outflows for the U.S. and the Eurozone. More specifically, we regress the (percentage) fund rebalancing terms $\Delta h^f_{j,t}$ and $\Delta h^{h*}_{j,t}$ on a single constant (separately for each currency) and collect the residuals $\breve{u}_{jt}$ of the eight respective panels. The residuals are re-scaled by a factor corresponding to the relative fund size to obtain an absolute flow measure. For outflows, we re-scale the residuals by $S^f_{jt} = A^f_{jt}/\sum_j(A^f_{jt})$, i.e. the dollar value invested in non-domestic assets by fund j divided by the total dollar invested by all funds in the panel in non-domestic assets; for inflows, we re-scale the residual by $S^{h*}_{jt} = A^{h*}_{jt}/\sum_j(A^{h*}_{jt})$, i.e. the dollar value invested in domestic assets by foreign fund j divided by the total dollar value invested by all foreign funds in domestic assets. The ten largest fund shocks for each currency are then selected by ranking (absolute) fund outflows $S^f_{jt} \times |\breve{u}_{jt}|$ and (absolute) fund inflows $S^{h*}_{jt} \times |\breve{u}_{jt}|$. We search the Factiva data set for news events that can explain these large shocks and report the quarter in Column (1), the size of the corresponding GIV shock in Column (2), the fund name in Column (3), the fund residence in Column (4), the relevant article link in Column (5), the article date in Colmun (6), and article source in Column (7), the rebalancing reason and explanation in Columns (8) and (9), respectively. Panels A and B concern outflow and inflow shocks for the U.S., respectively; Panels C and D the outflow and inflow shocks for the Eurozone, respectively. Appendix Figures 1 and 2 link these largest idosyncratic fund shock to the Granular Instrumental Variable (GIV1) series for the U.S. and the Eurozone, respectively.

Panel A: Largest Fund Shocks and U.S. Outflows

Quarter	GIV shock size	Fund Name	Fund Country	Article Links	Article Dates	Article Source	Reason	Explanation
2003q4	0.885	Janus Capital Management LLC	US	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=FTCOM00020031230dzcj000c2&cat=a&ep=ASE	19-12-2003	Financial Times	Mutual Fund Scandal	"Janus Capital, one of the first fund groups to become embroiled in New York attorney-general Eliot Spitzer's crackdown on mutual fund trading scandals, has offered to return $31.5m to its investors as compensation for the improper trading that took place in its funds."
2004q1	-0.457	New Jersey Division of Investment	US	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=DJ00000020040202e022000c8&cat=a&ep=ASE	02-02-2004	DowJones Newswire	For the first time, an outside consultant was hired to manage the pension fund	"Opening a new era in New Jersey's investment history, the state has hired an outside firm to advise it on managing its $66.9 billion pension funds"
2008q1	-0.334	Capital Research & Management Co. (Global Investors)	US	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=INVN000020080314e43a00007&cat=a&ep=ASE	10-03-2008	Invest-ment News	Law suit dropped	"California Attorney General Jerry Brown said last month that the state has dropped a long-running lawsuit against the nation's biggest mutual fund group over an alleged failure to adequately disclose revenue-sharing and directed-brokerage agreements, also known as "shelf space" payments."
2005q2	0.333	Capital Research & Management Co. (Global Investors)	US	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=KRTMR00020050412e14c0002t&cat=a&ep=ASE	12-04-2005	Morning-star Column	Charges made by regulators	"We're watching developments at American Funds closely in light of recent charges made by regulators. At this point, none of the parties involved in the cases have offered up any evidence, so we haven't drawn conclusions yet. The charges don't reach the level of seriousness of many of the market-timing cases, but they do raise important issues that should be explored"
2004q3	0.315	Capital Research & Management Co. (World Investors)	US	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=EFIN000020040705e073000jg&cat=a&ep=ASE; https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=FTFT000020040921e09l0001h&cat=a&ep=ASE	03-07-2004 21-09-2004	Financial News; Financial Times	1) Restructuring of the management teams; 2) Departure of Jon Lovelace, the son of the founder	"Capital Research & Management, part of the US Capital Group, is dividing its team of portfolio managers into two separate groups." ; "Jon Lovelace, the son of the founder whose single-minded vision built the company, recently retired after many years of holding various senior roles in the company. He seemed almost obsessive about sharing control with others, but there is no doubt that with his departure the group has lost a guiding presence, and also a symbolic one, who maintained and shaped Capital's corporate culture."

Panel B: Largest Fund Shocks and U.S. Inflows

Quarter	GIV shock size	Fund Name	Fund Country	Article Links	Article Dates	Article Source	Reason	Explanation
2006q3	0.760	Deutsche Asset Management Investment GmbH	EZ	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=LBA0000020060928e29s002a4&cat=a&ep=ASE; https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=BWR0000020061221e2cl007ka&cat=a&ep=ASE	28-09-2006; 21-12-2006	Reuters News; Business Wire	1) Settlement with SEC; 2) Between January and December 2006, details of the settlement between DB and the SEC for market timing wrongdoing were made public	"The U.S. asset management arm of Deutsche Bank AG has agreed to pay $19.3 million to settle a case involving directed brokerage and the Scudder Funds, U.S. regulators and the company said on Thursday."; "Deutsche Asset Management (DeAM), a unit of Deutsche Bank (XETRA: DBKGn.DE / NYSE: DB), today confirmed it has settled proceedings with the Securities and Exchange Commission (SEC) and the New York Attorney General (NYAG) on behalf of Deutsche Asset Management Inc. (DAMI) and Deutsche Investment Management Americas Inc. (DIMA), the investment advisors to many of the DWS Scudder Funds, regarding allegedly improper market timing. The general terms of these settlements were first disclosed by Deutsche Bank in January 2006 and the full settlement amounts have been included in prior legal reserves. No further financial impact is anticipated."
2006q2	0.494	Deutsche Asset Management Investment GmbH	EZ	https://annualreport.deutsche-bank.com/2006/ar/servicepages/downloads/files/dbfy2006_stakeholders.pdf https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=DJ00000020060705e275000cu&cat=a&ep=ASE	03-2007; 05-07-2006	2006 Annual Report Deutsche Bank, Chapter "Share-holders"; Dow Jones Newswires	1) DWS launched in the US in February; 2) hiring of many new sales and product personnel	"The DWS brand was also introduced in the U.S. with the launch of DWS Scudder in February."; "Deutsche Asset Management said Wednesday it has added 19 people to the sales and product development team at DWS Scudder, the mutual-fund arm of Deutsche Bank AG's (DB) asset-management business in the U.S. The move, which follows the hiring earlier this year of 16 sales professionals, is part of the asset manager's drive to focus on U.S. distribution of products via the advisor channel"
2005q2	-0.487	State Street Global Advisors France SA	EZ	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=EFIN000020050505e1530000c&cat=a&ep=ASE	03-05-2005	Financial News	Change of fund managers	"State Street Global Advisors promoted Paul Duncombe to take over its UK business following the departure of Nigel Wightman in March. Duncombe has been global head of currency management for the past nine years. State Street also hired Valerie Nicholson from F&C Asset Management as director of marketing and consultant liaison. Nicholson will be based in the UK."
2007q3	0.480	Natixis Asset Management SA	EZ	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=CPNYEN0020070629e36t000m9&cat=a&ep=ASE	29-06-2007	Company News	NATIXIS expands its asset management business in the United States	"IXIS Asset Management US Group, a subsidiary of Natixis, agrees to acquire Gateway Investment Advisers, L P. IXIS Asset Management US Group announced today that it has entered into an agreement to acquire Gateway Investment Advisers, a Cincinnati-based investment manager with $7.5 billion in Assets under Management (as of March 31, 2007), including the Gateway Fund, as well as a variety of sub-advised mandates and private accounts. The terms of the transaction were not disclosed. Completion of the transaction is subject to customary closing conditions, including obtaining any necessary regulatory and other approvals."
2004q1	-0.466	BBVA Asset Management SA SGIIC	EZ	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=FTFT000020040203e0230004x&cat=a&ep=ASE	03-02-2004	Financial Times	BBVA buys Mexican Bank	"Banco Bilbao Vizcaya Argentaria, Spain's second-largest bank, yesterday unveiled a Euros 3.3bn (Dollars 4.1bn) deal to buy the remaining 40.6 per cent of BBVA-Bancomer, the Mexican bank in which it first took a stake almost four years ago."

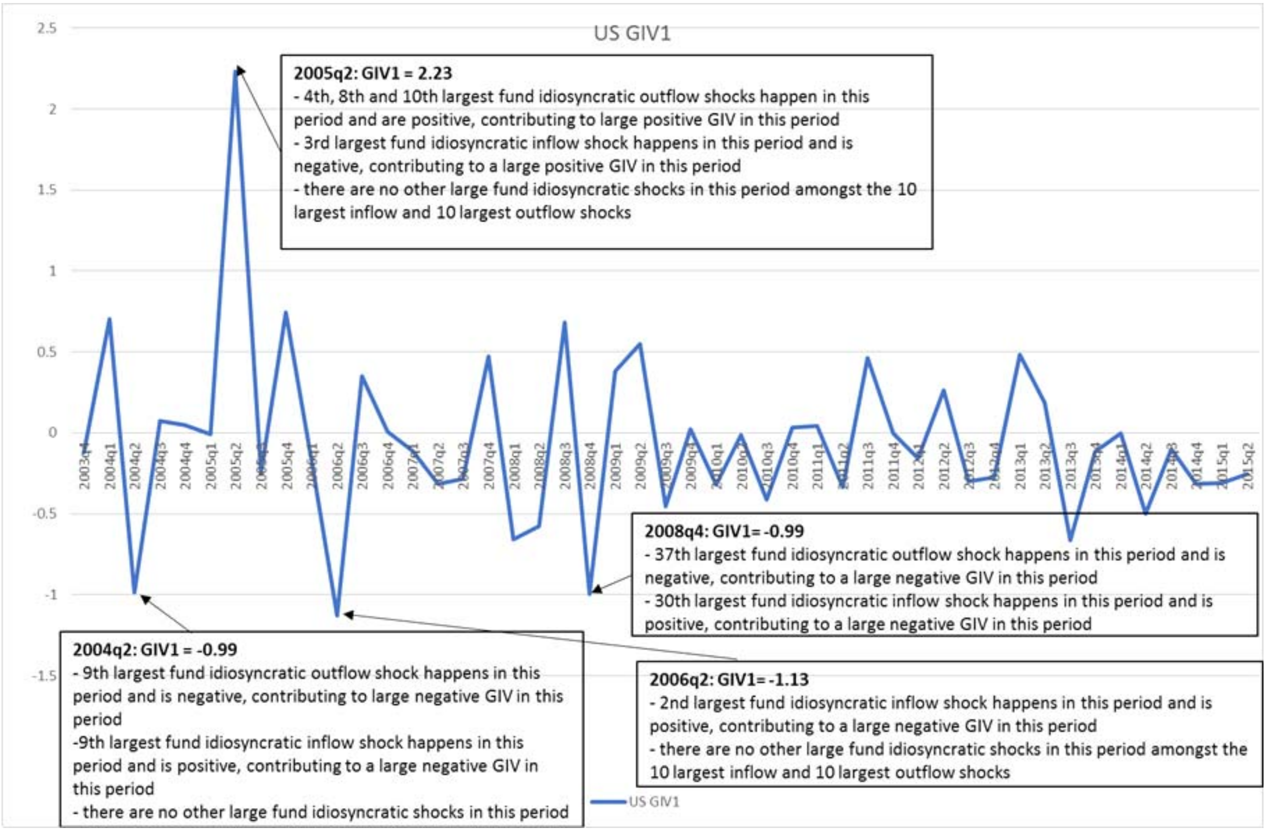
Panel C: Largest Fund Shocks and Eurozone Outflows

Quarter	GIV shock size	Fund Name	Fund Country	Article Links	Article Dates	Article Source	Reason	Explanation
2015q2	0.530	APG Asset Management NV	EZ	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=DJDN000020150303eb33002fv&cat=a&ep=ASE	03-03-2015	Dow Jones News-wires	Accenture enters into agreement with APG to further Optimize the Pension Provider's Operations	"Accenture (NYSE: ACN) will support APG, the largest Dutch pension provider, to further optimize its current operations, under a multi-year agreement, making Accenture one of APG's first business partners of choice. The agreement supports APG's existing strategy to further improve operational and cost efficiency, while maintaining high quality products and services for its customers, in an evolving pension market, driven by regulatory changes and increasing digital consumer needs."
2006q4	-0.507	Deutsche Asset Management Investment GmbH	EZ	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=LBA0000020061004e2a400wi&cat=a&ep=ASE	04-10-2006	Reuters News	Change of head of DB fund DWS	"The head of Germany's largest retail fund business, Deutsche Bank's DWS, is to step down, a source familiar with the situation told Reuters on Wednesday. Axel Benkner, global head of DWS, the retail fund business of Deutsche Asset Management, is expected to leave the post in part due to a difference of opinion on how closely the highly profitable DWS should be integrated into Deutsche's asset management operations, the source said. A possible candidate to replace Benkner is Klaus Kaldemorgen, currently global head of equities at DWS, the source said, adding that a decision had yet to be taken."
2003q3	-0.413	BBVA Asset Management SA SGIIC	EZ	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=lba0000020030610dz6a00fr4&cat=a&ep=ASE	10-06-2003	Reuters News	Divestiture from Brazilian assets; it could be rebalancing out of Brazil due to Brazilian currency depreciation	"Spain's second-biggest bank BBVA (BBVA.MC) said on Tuesday it had completed the sale of its Brazilian division to Bradesco (BBDC4.SA), worth around $900 million (2.63 billion real)."
2014q2	0.359	APG Asset Management NV	EZ	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=SHND000020140530ea5u00007&cat=a&ep=ASE	30-05-2014	Shanghai Daily	Investment in a Chinese warehouse operator	"DUTCH pension fund APG Asset Management will pay up to US$650 million for about a 20 percent stake in Chinese warehouse operator e-Shang to ride the e-commerce boom."
2006q3	0.353	Deutsche Asset Management Investment GmbH	EZ	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=LBA0000020060928e29s002a4&cat=a&ep=ASE; https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=BWR0000020061221e2cl007ka&cat=a&ep=ASE	28-09-2006; 21-12-2006	Reuters News; Business Wire	1) Settlement with SEC; 2)Between January and December 2006, details of the settlement between DB and the SEC for market timing wrongdoing were made public	Same as #1 US inflows "The U.S. asset management arm of Deutsche Bank AG has agreed to pay $19.3 million to settle a case involving directed brokerage and the Scudder Funds, U.S. regulators and the company said on Thursday."; "Deutsche Asset Management (DeAM), a unit of Deutsche Bank (XETRA: DBKGn.DE / NYSE: DB), today confirmed it has settled proceedings with the Securities and Exchange Commission (SEC) and the New York Attorney General (NYAG) on behalf of Deutsche Asset Management Inc. (DAMI) and Deutsche Investment Management Americas Inc. (DIMA), the investment advisors to many of the DWS Scudder Funds, regarding allegedly improper market timing. The general terms of these settlements were first disclosed by Deutsche Bank in January 2006 and the full settlement amounts have been included in prior legal reserves. No further financial impact is anticipated."

Panel D: Largest Fund Shocks and Eurozone Inflows

Quarter	GIV shock size	Fund Name	Fund Country	Article Links	Article Dates	Article Source	Reason	Explanation
2004q1	-0.658	Janus Capital Management LLC	US	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=B000000020040214e02g0000t&cat=a&ep=ASE	16-02-2004	Barron's	Asset Restructuring in the aftermath of the Mutual Fund Scandal (see shock #2 below)	"In the aftermath of these embarrassments, Denver-based Janus is striving to put its other face forward. Late last year the company said it will compensate its funds and fund holders for $31.5 million of lost gains and other costs related to market timing. As a result of trading shares in DST Systems, a fund-industry servicer, for a DST unit with $1 billion of cash, Janus will be able to cut its debt load to less than 30% of capital. Management has been selling non-strategic assets, broadening the company's product lineup, and taking other steps to restore investor confidence."
2003q4	0.554	Janus Capital Management LLC	US	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=FTCOM00020031230dzcj000c2&cat=a&ep=ASE	19-12-2003	Financial Times	Mutual Fund Scandal (same shock as shock #1 US outflows)	"Janus Capital, one of the first fund groups to become embroiled in New York attorney-general Eliot Spitzer's crackdown on mutual fund trading scandals, has offered to return $31.5m to its investors as compensation for the improper trading that took place in its funds."
2009q1	0.426	Capital Research & Management Co. (Global Investors)	US	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=FTFT000020090323e53n0000x&cat=a&ep=ASE	23-03-2009	Financial Times	More job losses at money managers	"Capital Group, the parent of one of the largest managers, American Funds, has told employees in an internal memo that it will eliminate more jobs, its third round of cuts in the past six months. The latest move is part of a cost-cutting plan that includes a freeze on pay rises, Capital said. It has already cut close to 600 people, or 6 per cent of its staff. Before the current crisis, the group had only cut jobs once in its 78-year history. The memo said: "Given the continuing business decline, deeper cost-cutting measures will need to be pursued. Unfortunately, these will include the elimination of jobs across many groups."
2005q2	0.409	Capital Research & Management Co. (World Investors)	US	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=KRTMR00020050412e14c0002t&cat=a&ep=ASE	12-04-2005	Morningstar Column	charges made by regulators	Same as #4 US outflows "We're watching developments at American Funds closely in light of recent charges made by regulators. At this point, none of the parties involved in the cases have offered up any evidence, so we haven't drawn conclusions yet. The charges don't reach the level of seriousness of many of the market-timing cases, but they do raise important issues that should be explored"
2009q3	-0.325	Capital Research & Management Co. (Global Investors)	US	https://global-factiva-com.ezproxy.library.qmul.ac.uk/redir/default.aspx?P=sa&an=DJI0000020090319e53j000du&cat=a&ep=ASE	19-03-2009	DowJones Newswires	Capital Group Stake In Vallourec Drops Below 5% Threshold	"Acting as an investment adviser, Capital Group held 4.78% of Vallourec's capital and 4.77% of its voting rights as of March 13, according to the filing. That is down from the 5.02% of capital and 5.01% of voting rights Capital Group said it owned in a previous filing published Feb. 13."

Appendix Figure 1:
GIV Time Series for U.S. Net Outflows and Largest Fund Flow Events



Appendix Figure 2

GIV Time Series for the Eurozone Net Outflows and Largest Fund Events