Global Business and Financial Cycles: A Tale of Two Capital Account Regimes

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*The views expressed in this paper are those of the authors.

Motivation

- Rey (2013): There is a global financial cycle (GFC) in capital flows, asset prices, and in credit growth. The cycle comoves with the VIX Index, a measure of uncertainty and risk aversion of the markets.
- Cerutti, Claessens, and Rose (2018): Our evidence seems mostly inconsistent with a significant and conspicuous GFC for capital flows. ... Succinctly, most variation in capital flows does not seem to be the result of common shocks nor stem from observables in a central country like the United States.
- Neither, as well as much of the ensued literature, evaluates the importance of the GFC for real outcomes, such as output or consumption.

This paper

- Focuses on comovement in both equity returns and output growths.
- Identifies global business cycle and financial shocks from a large cross section of countries and focuses on two countries with very different policy regimes from a trilemma's perspective: China and South Korea.
- Quantifies the importance of GFC shocks on countries' financial and business cycles, relative to the *international business cycle*, *country-specific* shocks and *spillovers* from other countries cycles.

Main Findings

- New estimate of the global financial cycle that tracks very well the updated GFC measure of Miranda-Agrippino and Rey (2020).
- We find evidence of a conspicuous GFC in *equity returns*: GFC shocks explain about 50% of volatility in the typical economy
  - Korea's exposure is similar to that of the average economy in the sample, even China's exposure is a whopping 20%.
- However, GFC shocks explain only about 10% of the forecast error variance of the typical country business cycle, and *virtually nothing* in the case of China.
- Some evidence of a possible trade-off between diversification of idiosyncratic risks and exposure to global financial risk.
- Puzzling result on Korea's vulnerability to domestic financial shocks. Possible role of exchange rate regime?

Outline

[1] **Empirical framework**

[2] **Data & Empirical results**

[3] **Conclusions**

Empirical Framework

A multi-country factor model for equity market returns and the business cycle

- Panel vector autoregressive (PVAR) model in r_{it} and Δy_{it} for $i = 1, 2, ..., N$:

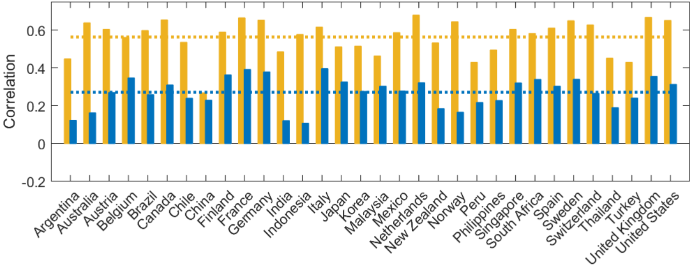
$$
\begin{aligned}
r_{it} &= a_{ir} + \phi_{i,11} r_{i,t-1} + \phi_{i,12} \Delta y_{i,t-1} + e_{ir,t}, && (1) \\
\Delta y_{it} &= a_{iy} + \phi_{i,21} r_{i,t-1} + \phi_{i,22} \Delta y_{i,t-1} + e_{iy,t} && (2)
\end{aligned}
$$

- Consistent with standard consumption-based asset pricing theory and stylized facts of the data (see Cesa-Bianchi, Pesaran, and Rebucci, RFS, 2020), we posit the following unobservable common-factor representation for $e_{ir,t}$ and $e_{iy,t}$:

$$
\begin{aligned}
e_{ir,t} &= \lambda_i \zeta_t + \theta_i \xi_t + \eta_{it}, && (3) \\
e_{iy,t} &= \gamma_i \zeta_t + \varepsilon_{it} && (4)
\end{aligned}
$$

Why this is a reasonable assumption: stylized facts of the data

Figure: Average pairwise correlation of returns (yellow bars) and GDP growths (blue bars).

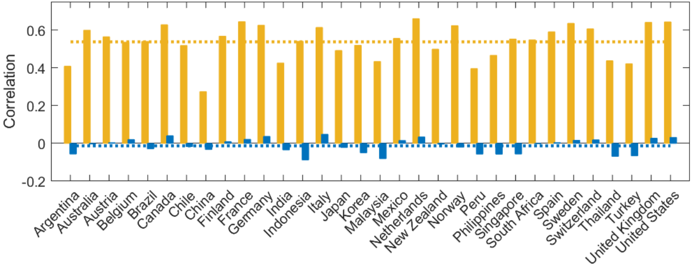


NOTE. For each country, the yellow and the blue bar show the average pairwise correlation with the remaining countries in the sample, for equity return and GDP growth series, respectively ($\bar{\rho}_i$). The dotted lines correspond to the overall average across all countries, equal to 0.56 and 0.27, respectively ($\bar{\rho}_N$). Sample period: 1994:Q4-2016:Q4.

Why this is a reasonable assumption (cont.): assume one common factor only

- Estimate country models with growth shock ($\hat{\zeta}_t$) only:

$$\begin{aligned} r_{it} &= \beta_{i,11}\hat{\zeta}_t + \text{lagged cross-section averages and lagged endogenous values} + u_{it}, \\ \Delta y_{it} &= \beta_{i,21}\hat{\zeta}_t + \text{lagged cross-section averages and lagged endogenous values} + \varepsilon_{it} \end{aligned}$$



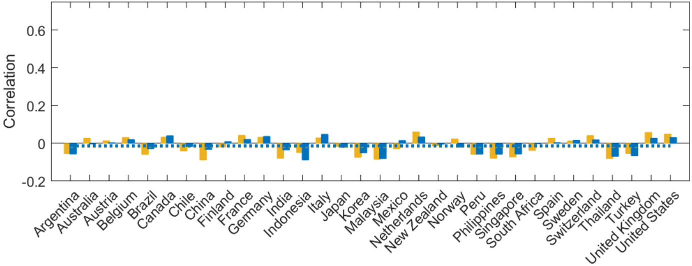
NOTE. Average pairwise correlation of the u_{it} (yellow bars) and the ε_{it} (blue bars).

Why this is a reasonable assumption (cont.): two factors with triangular loadings

- Estimate country models with growth ($\hat{\zeta}_t$) and financial ($\hat{\xi}_t$) shocks:

$$r_{it} = \beta_{i,11}\hat{\zeta}_t + \beta_{i,12}\hat{\xi}_t + \text{lagged cross-section averages and lagged endogenous values} + \eta_{it},$$

$$\Delta y_{it} = \beta_{i,21}\hat{\zeta}_t + \text{lagged cross-section averages and lagged endogenous values} + \varepsilon_{it}$$



NOTE. Average pairwise correlation of the η_{it} (yellow bars) and the ε_{it} (blue bars).

Identification

Identifying assumptions

1. Common shocks & Loadings: pervasive factors (ζ_t for both returns and activity, ξ_t for returns only).
2. Weights: granularity (no country is large enough to affect the aggregate).
3. Cross-sectional correlations: weak dependence of country-specific innovations (pairwise correlations of ε_{it} and η_{it} tend to zero; max eigenvalue of covariance matrix is bounded).

Note

We allow for within- and across-country correlation of innovations (ε_{it} and η_{it}). Compute Generalized FEVD with threshold covariance matrix.

Details

Data & Empirical Results

Data & Empirical results

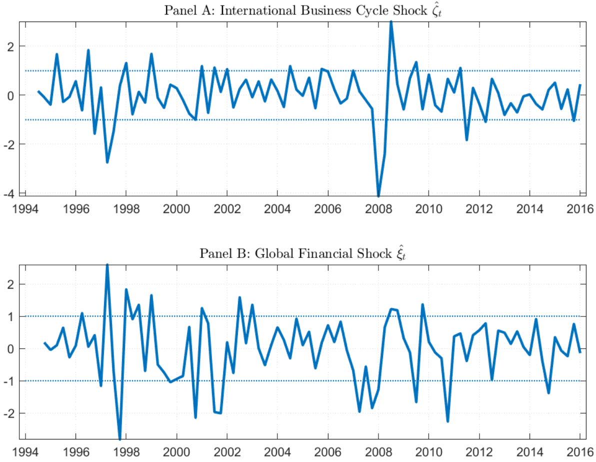
Data

- Balanced panel data for 32 advanced and emerging countries, from 1994:Q4 to 2016:Q4, for real GDP growth and stock market equity returns. Countries

Empirical results

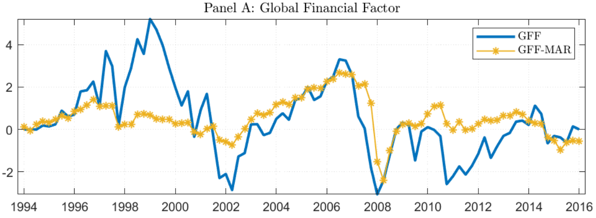
- Global financial and business cycle factors estimates.
- VDs to common and idiosyncratic financial and business cycle shocks.
- Compare Korea and China.

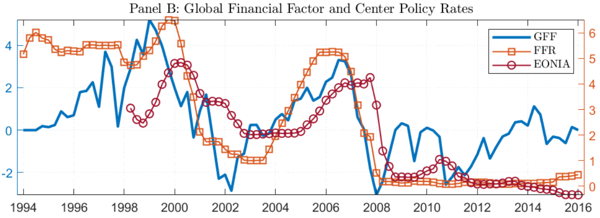
Estimated International Business Cycle ($\hat{\zeta}$) and Global Financial Cycle ($\hat{\xi}$) Shocks



NOTE. The global shocks are standardized, and the dotted lines are the one-standard deviation bands around the zero mean. Sample period: 1994:Q1-2016:Q4.

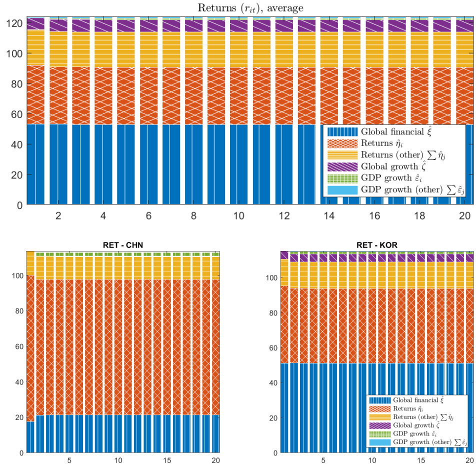
The Global Financial Factor





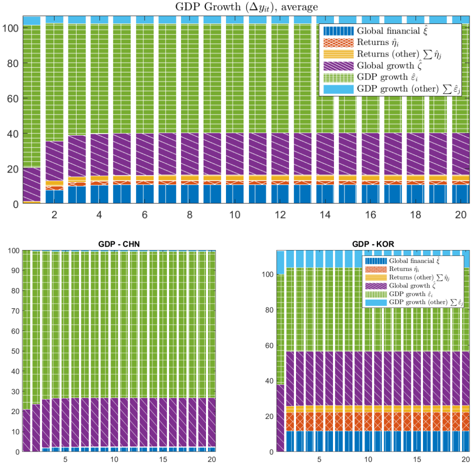
NOTE. Panel A plots the cumulative sum of our global financial shock $\sum_{s=0}^{t} \hat{\xi}_s$ together with a quarterly average of an updated estimate of the Global Factor from Miranda-Agrippino and Rey (2020). Panel B plots the cumulative sum of our global financial shock $\sum_{s=0}^{t} \hat{\xi}_s$ (left axis) together with a quarterly average of the U.S. Federal Funds rate and the ECB Eonia rate (right axis). Sample period: 1994:Q4-2016:Q4.

Sizing the Global Financial Cycle: Returns



- GFC shock ($\hat{\xi}_t$, blue area) explains more than 50% of the equity return variance in the average economy.
- Korea's exposure is similar to that of the average economy.
- China's exposure is much lower (20%), but non negligible.

Sizing the Global Financial Cycle: Output



- However, GFC shock, $\hat{\xi}_t$ explains only about 10% of the GDP growth variance in the average economy.
- GFC shocks explains a similar share of GDP growth variance in Korea, but virtually nothing in China.

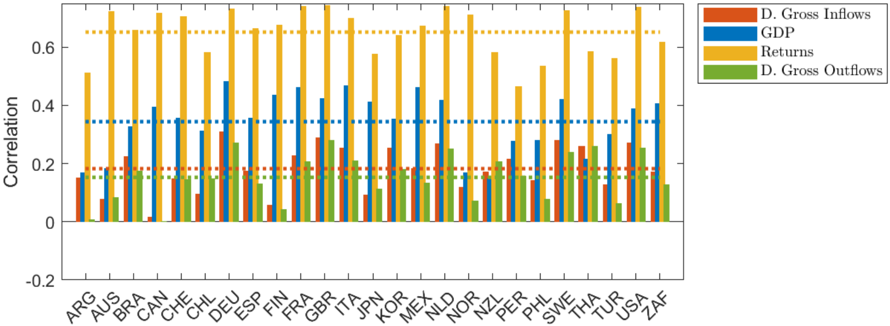
Conclusions

- We propose a new measure of the GFC obtained from world equity returns and identify GFC shocks exploiting returns' higher cross-country correlation relative to the output comovement generated by the international business cycle.
- We evaluate the relative importance of GFC shocks in a large sample of advanced and emerging countries, as well as in South Korea and China–two countries on opposite side the trilemma triangle.
- We find that GFC shocks in both China and South Korea explain a substantial share of equity return variability (20 and 50 percent of total variance, respectively), but a much smaller portion of real output fluctuations (less than 10 percent in Korea and negligible in the case of China).

Conclusions (Cont.)

- We also find that the combination of a closer capital account and a more rigid exchange rate regime, as in China, is associated with some costs in terms of diversification opportunities quantified by very large exposures to domestic financial and real shocks.
- More surprisingly, the combination of a relatively open capital account and a flexible exchange rate, as in South Korea, not only is associated with a higher exposure to the GFC than in China but also with a significant incidence of domestic financial shocks on output fluctuations.
- Two working hypotheses for further research:
  - The exchange rate not only fails to insulate open economies from external shocks but also amplifies transmission due to pricing and financial frictions (Cesa-Bianchi-Ferrero-Rebucci)
  - The GFC is a global cycle in asset prices rather than quantities consistent with a low elasticity view (Acalin-Rebucci: A Quantity View of the GFC)

Global Financial Cycle: Returns, Flows, and Growth



NOTE. Average pairwise correlation of quarterly Gross Inflows, GDP growth, Equity returns, and Gross Outflows. Gross Flows are normalized by GDP (First-Differences). Sample period: 1994:Q4-2016:Q4.

- Quantities much less correlated than returns, even less correlated than fundamental drivers, consistent with low elasticity view of Koijen and Gabaix (2020).

Thank you

Additional results

List of countries

Table List of Countries

Argentina	Finland	Malaysia	South Africa
Australia	France	Mexico	Spain
Austria	Germany	Netherlands	Sweden
Belgium	India	New Zealand	Switzerland
Brazil	Indonesia	Norway	Thailand
Canada	Italy	Peru	Turkey
Chile	Japan	Philippines	United Kingdom
China	Korea	Singapore	United States

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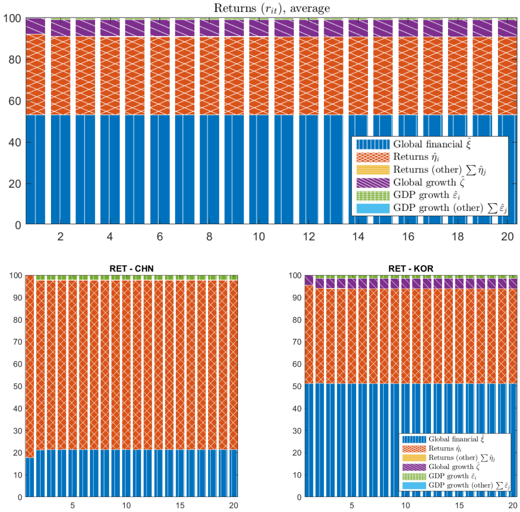
Average FEVD: Diagonal covariance matrix



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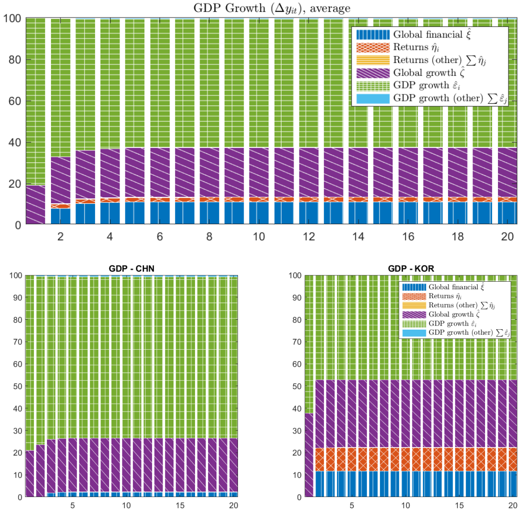
Average FEVD: Diagonal covariance matrix



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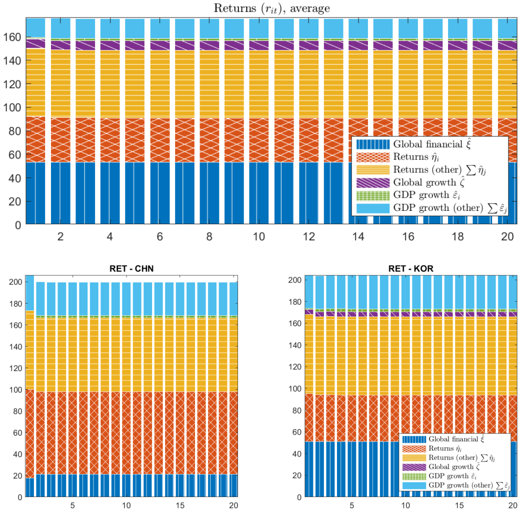
Average FEVD: Unrestricted covariance matrix



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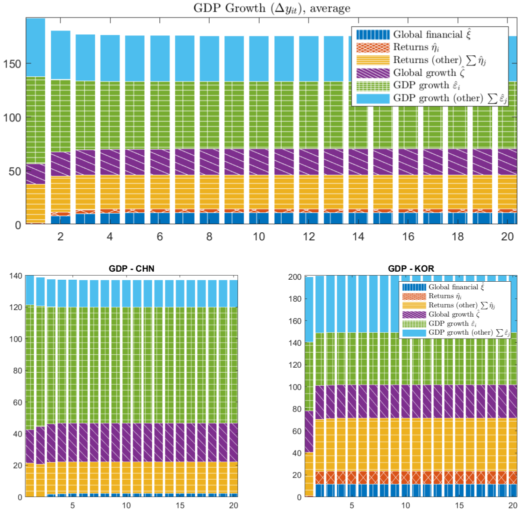
Average FEVD: Unrestricted covariance matrix



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Formal Assumptions

Assumptions

- **Assumption 1: Common factors and their loadings** The common unobservable factors, ζ_t and ξ_t, have zero means and unit variances, and are serially uncorrelated. The factor loadings, λ_i, γ_i, and θ_i, are distributed independently across i and from the common factors f_t and g_t for all i and t, with non-zero means λ, γ, and θ ($\lambda \neq 0$, $\gamma \neq 0$, and $\theta \neq 0$), and satisfy the following conditions, for a finite N and as $N \to \infty$:

$$N^{-1} \sum_{i=1}^{N} \lambda_i^2 = \mathcal{O}(1) \qquad \lambda = \sum_{i=1}^{N} \mathring{w}_i \lambda_i \neq 0$$

$$N^{-1} \sum_{i=1}^{N} \gamma_i^2 = \mathcal{O}(1) \qquad \gamma = \sum_{i=1}^{N} w_i \gamma_i \neq 0$$

$$N^{-1} \sum_{i=1}^{N} \theta_i^2 = \mathcal{O}(1) \qquad \theta = \sum_{i=1}^{N} w_i \theta_i \neq 0$$

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Assumptions (Cont.)

- **Assumption 2: Aggregation weights** Let $\mathbf{w} = (w_1, w_2, ..., w_N)'$ and $\mathring{\mathbf{w}} = (\mathring{w}_1, \mathring{w}_2, ..., \mathring{w}_N)'$ be the $N \times 1$ vectors of non-stochastic weights with $w_i, \mathring{w}_i > 0$, $\sum_{i=1}^N w_i = 1$ and $\sum_{i=1}^N \mathring{w}_i = 1$, such that the following "granularity" conditions are met:

$$||\mathbf{w}|| = O(N^{-1}), \; \frac{w_i}{||\mathbf{w}||} = O(N^{-1/2})$$

and

$$||\mathring{\mathbf{w}}|| = O(N^{-1}), \; \frac{\mathring{w}_i}{||\mathring{\mathbf{w}}||} = O(N^{-1/2})$$

for all i.

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Assumptions (Cont.)

- **Assumption 3: Cross-section correlations** The country-specific innovations, η_{it} and ε_{it}, have zero means and finite variances, and are serially uncorrelated, but can be correlated with each other both within and between countries. Furthermore, denoting the covariance matrices of the $N \times 1$ innovation vectors $\boldsymbol{\varepsilon}_t = (\varepsilon_{1t}, \varepsilon_{2t}, ..., \varepsilon_{Nt})'$ and $\boldsymbol{\eta}_t = (\eta_{1t}, \eta_{2t}, ..., \eta_{Nt})'$ by $\Sigma_{\varepsilon\varepsilon} = Var(\boldsymbol{\varepsilon}_t)$ and $\Sigma_{\eta\eta} = Var(\boldsymbol{\eta}_t)$, respectively, it is assumed that:

$$\varrho_{\max}(\Sigma_{\varepsilon\varepsilon}) = O(1)$$

$$\varrho_{\max}(\Sigma_{\eta\eta}) = O(1)$$

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Estimation

Estimating observable and orthogonal factors

- **Issue** Factors f_t and g_t are unobservable, and even if known, would be correlated with each other

- For ease of interpretation it is standard to work with the orthogonalized version of the factors
  * This task is simplified due to the triangular way the factors affect the global variables, $\Delta\bar{y}_{\omega,t}$ and $\bar{v}_{\omega,t}$

- Proceed recursively
  * Factor f_t can be identified up to a constant

$$f_t = \frac{\Delta\bar{y}_{\omega,t}}{\gamma} \quad \Rightarrow \quad \hat{\zeta}_t = \Delta\bar{y}_{\omega,t}$$

  * Factor g_t can then be approximated by the residuals of a regression of world equity return $\bar{r}_{\omega,t}$ on world growth

$$g_t = \frac{\bar{r}_{\omega,t}}{\theta} - \frac{\lambda}{\theta\gamma}\Delta\bar{y}_{\omega,t} \quad \Rightarrow \quad \bar{r}_{\omega,t} = \hat{\beta}\Delta\bar{y}_{\omega,t} + \hat{\xi}_t$$

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Consistent estimation of orthogonal factors

- **Proposition 3** Let $\hat{\zeta}_t$ and $\hat{\xi}_t$ be consistent, orthonormalized estimators of f_t and g_t, respectively. Then, $\hat{\zeta}_t$ can be obtained by re-scaling $\Delta\bar{y}_{\omega,t}$ so that its variance is 1, while $\hat{\xi}_t$ can be obtained as the standardized residual of a least squares regression of $\bar{r}_{\omega,t}$ on $\Delta\bar{y}_{\omega,t}$.

- **Proof** Set the coefficients $\boldsymbol{\alpha}_g = (\alpha_{1g}, \alpha_{2g})'$, such that $T^{-1}\sum_{t=1}^{T}\hat{\zeta}_t\hat{\xi}_t = 0$. This yields:

$$\frac{\hat{\alpha}_{2g}}{\hat{\alpha}_{1g}} = \frac{\sum_{t=1}^{T}\Delta\bar{y}_{\omega,t}\bar{r}_{\omega,t}}{\sum_{t=1}^{T}\Delta\bar{y}_{\omega,t}^2},$$

which is the OLS estimate of the coefficient on $\Delta\bar{y}_{\omega,t}$ in a regression of $\bar{r}_t$ on $\Delta\bar{y}_{\omega,t}$. Next, set α_f and α_{1g} so that ζ_t and ξ_t have unit in-sample standard deviations.

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