Foreign Portfolios and Domestic Business Cycles with Heterogeneous Agents

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Introduction

Research question:
US interest rates and the US dollar are on the rise again, what does this imply for emerging markets business cycles and inequality?

This paper provides a new perspective and quantification:
- New decomposition of foreign asset portfolios.
- Estimate a Small Open Economy - HANK model on macro/micro data.
- Allow for a broader set of foreign asset return shocks and heterogeneity in exposures.
Flow of Funds Data

Net Position of Korean Economy

(% of annual GDP)

-40 -30 -20 -10 0 10 20 30 40


- total

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**Key Question:** How important are foreign return/demand shocks for domestic outcomes in SMOEs? Does the composition of foreign portfolios matter?

**Additional Question:** Are HANK insights about policy transmission robust to SMOE setting?

- **Monetary Policy**
  - Importance of indirect effects
  - Importance of fiscal policy

- **Fiscal Policy**
  - Bond rate elasticity
This paper: Builds and estimates a SMOE-HANK model for South Korea.

- **South Korea** is a very open economy (export/GDP around 40 percent).
- **South Korea**’s net foreign asset position is approx. zero. However, sizable savings in liquid bonds, while the illiquid investment position is negative.

- **Flexible** nominal exchange rate.

- **Sensitive to** variations in foreign demand for South Korean goods.
- **Sensitive to** shocks in international capital markets (East Asian crisis):
  1) Liquid bond returns
  2) Illiquid capital return
Summary of key results: Transmission of Foreign Shocks

Liquid Bond Return
- Domestic economy little affected by foreign return shocks to liquid assets
- Foreign savings provide insurance via income effects

Illiquid Capital Return
- Domestic economy strongly affected by foreign return shocks to illiquid assets
- Foreign financing amplifies investment response

Foreign Demand
- Foreign demand shocks transmit via wages
Summary of key results: Policy Transmission in SMOE-HANK

**Monetary Transmission**
- Indirect effects are still key
- Transmission also goes through net exports

**Fiscal Transmission**
- Interest rate responds little to foreign asset position / government debt
- Smaller Laffer curve to exploit


Empirics

A New Perspective on Foreign Asset Portfolios
## Classification of Financial Instruments

### Liquid instruments
- Gold and SDRs, Cash and Deposits,
- Bonds (government, corporate, etc),
- Loans (short term, government), FX reserves

### Illiquid instruments
- Insurance and Pension,
- Long-term Bonds (ABS, external, derivatives-linked),
- Loans (long term), Equities and Investment Funds shares,
- Financial Derivatives, Trade Credits
- Foreign Direct Investment, etc
Flow of Funds Data: Net Positions by Liquidity

Net Liquid to GDP: 13.6%
Net Illiquid to GDP: -13.7%
Return rates

- Real return rate on liquid assets (LHS)
- Real return rate on illiquid assets (RHS)

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Notes on Return rates of assets

<table>
<thead>
<tr>
<th>Component</th>
<th>Liquid assets</th>
<th>Iliquid assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Housing Bond Rate (5-yr)</td>
<td></td>
<td>Equity Return Rate,</td>
</tr>
<tr>
<td>Government Loan Rate,</td>
<td></td>
<td>FDI Abroad Return Rate,</td>
</tr>
<tr>
<td>Corporation Bonds Rate (O.T.C, 3-yr, AA-)</td>
<td></td>
<td>Loan to Corporation Rate</td>
</tr>
</tbody>
</table>
Net Positions of Domestic Economy by Sector

(Liquid Net Positions)

Households & NPISH
Government
Financial corporations
Non Financial corporations
Domestic total (RHS)

(%) of GDP

Illiquid Net Positions

Households & NPISH
Financial corporations
Domestic total (RHS)

(%) of GDP

Source: Flow of Funds Data

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Model

A SMOE HANK Model with Foreign Asset Portfolios
SMOE HANK Model: Overall structure

- Domestic households
  - Liquid bonds, taxes
  - Illiquid Capital, Labor
  - Consumption
  - Liquid / Illiquid Savings
- Corporate sector
  - Government spending
  - Imports
  - Exports
- Domestic government
- World economy
- Liquid bonds, taxes
**Households**: Consumer, supply labor, manage portfolios of liquid and illiquid assets, subject to idiosyncratic productivity shocks.

**Labor unions**: Sell labor to firms, monopolistically competitive, nominal wages sticky.

**Retailers**: Competitive, produce final goods using input of domestic and imported goods.

**Domestic goods producers**: Monopolistically competitive, differentiate domestic intermediate goods, sell to domestic and foreign retailers, nominal prices sticky in domestic currency.

**Intermediate goods producers**: Competitive, produce using inputs of capital and labor.

**Capital producers**: Competitive, produce new capital subject to adjustment costs.

**Domestic Government**: In charge of monetary and fiscal policy, floating exchange rate.

**Foreign bond markets**: Provide bonds to domestic economy, interest rate is asset elastic.
Preferences:

$$u(c_i, l_i) = \left(\frac{c_i - G(h_i, n_i)}{1 - \xi}\right)^{1-\xi},$$

Skill Dynamics: Households have skill $h_i$ and are either:
- Workers (share $\iota / (\iota + \zeta) \approx 1$), or
- rentiers, receive all profits.

Law of motion of skills:

$$h_i = \begin{cases} 
\exp (\rho_h \log h_{i,-1} + \sigma_h \epsilon_{h,i}) & \text{with probability } 1 - \zeta \\
1 & \text{with probability } \iota \\
0 & \text{otherwise,}
\end{cases} \quad \text{if } h_{i,-1} \neq 0,$$

$$\epsilon_{h,i} \sim N(0, 1)$$
Households

Financial assets/liabilities:

\[ b'_i \geq B_{\text{min}} : \text{Liquid assets} \]
\[ k'_i \geq K_{\text{min}} : \text{Illiquid assets} \]

Net labor income:

\[ y_{i,t} = \left( 1 - \tau^L \right) \left( w_t h_{i,t} n_{i,t} \right)^{1 - \tau^P} \]

Budget constraint

\[ c_{i,t} + b_{i,t+1} + k_{i,t+1} = y_{i,t} + R^b_t(\cdot) b_{i,t} A_t + R^k_t(\cdot) k_{i,t} + \tau_t \left( 1_{h_{i,t} \neq 0} \Pi^U_t + 1_{h_{i,t} = 0} \Pi^f_t \right) \]
Households’ International Portfolios

Liquid asset portfolio
- Domestic bonds, share \( \Phi_B \in [0, 1] \), and foreign assets

\[
R^b_t(\cdot) = \Phi_B \frac{R^B_t}{\pi_t} + (1 - \Phi_B) \frac{R^B_F}{\pi_t} \frac{S_t}{S_{t-1}}
\]

Illiquid asset portfolio
- Domestic capital, share \( \Phi_K \in [0, 1] \), and foreign assets
- Adjustable with prob. \( \lambda > 0 \)

\[
R^k_t(\cdot) = \Phi_K \frac{q_t + r^K_t}{q_{t-1}} + (1 - \Phi_K) \frac{R^K_F}{\pi_t} \frac{S_t}{S_{t-1}}
\]


**Setting:** Continuum of monopolistically competitive labor unions, sell the differentiated labor

to labor packers. Calvo sticky wages set by unions.

**Technology**

\[
N_t = \left( \int n_{j,t}^{1-1/\zeta_t} \right)^{1/(1-1/\zeta_t)} \Rightarrow
\]

\[
n_{j,t} = \left( \frac{W_{j,t}}{W_t^F} \right)^{-\zeta_t} N_t
\]

**Wage Setting**

\[
W_{j,t} = \arg\max \ E_t \sum_{s=t}^{\infty} \beta^{s-t} \lambda_{s-t} \frac{W_s^F}{P_s} N_s \left[ \left( \frac{W_{j,t} \pi_{s-t}^t}{W_s^F} - \frac{W_s}{W_s^F} \right) \left( \frac{W_{j,t} \pi_{s-t}^t}{W_s^F} \right)^{-\zeta_s} \right]
\]

\[
\Rightarrow \log \left( \frac{\pi_t^w}{\pi_t^{w+1}} \right) = \beta E_t \log \left( \frac{\pi_t^w}{\pi_t^w} \right) + \kappa_w \left( m c_t^w - \frac{1}{\mu_t^w} \right)
\]
Retailers

**Setting:** Competitive, sell final good at price $P_t$, produce it using inputs of domestic and foreign goods.

**Technology**

\[
V_t = \left[ (1 - \alpha)^{1/\eta} \left( \int_0^1 V_{H,t}(j)(1-1/\epsilon_t) dj \right)^{(1-1/\eta)/(1-1/\epsilon_t)} + \alpha^{1/\eta} V_{F,t}^{1-1/\eta} \right]^{1/(1-1/\eta)}
\]

\[
V_t = C_t + I_t + G_t
\]

The demand functions and domestic CPI inflation are then given as:

\[
V_{H,t} = (1 - \alpha) p_{H,t}^{-\eta} V_t
\]

\[
V_{F,t} = \alpha p_{F,t}^{-\eta} V_t
\]

\[
\hat{\pi}_t = (1 - \alpha) p_H^{(1-\eta)} \hat{\pi}_{H,t} + \alpha p_F^{(1-\eta)} \hat{\pi}_{F,t}
\]
**Setting:** Monopolistically competitive, differentiate intermediate good, sell at home and export.

**Assumption:** Prices sticky in the producer currency and LOP, \( P_{H,t}(j) = S_t P^*_t(j) \).

**Price Setting** (exploiting LOP)

\[
P_{j,t} = \arg\max E_t \sum_{s=t}^{\infty} (\beta \lambda_p)^{s-t} \left(1 - \tau_s^L\right) D_{H,s}^{1-\tau_s^P} \left( \frac{P_{H,t}(j) \pi_{H,s}^{s-t}}{P_{H,s}} - MC_s \right) \left( \frac{P_{H,t}(j) \pi_{H,s}^{s-t}}{P^*_H} \right)^{-\epsilon_s} - \tau_s^P
\]

\[
\Rightarrow \log \left( \frac{\pi_{H,t}}{\pi_H} \right) = \beta E_t \log \left( \frac{\pi_{H,t+1}}{\pi_H} \right) + \kappa_w \left( m c_t - \frac{1}{\mu_Y} \right)
\]

where:

\[
D_{H,t}(j) = \left( \frac{P_{H,t}(j)}{P_{H,t}} \right)^{-\epsilon_t} \left(1 - \alpha \right) \left( \frac{P_{H,t}}{P_t} \right)^{-\eta} V_t + \alpha^* \left( \frac{P^*_H}{P_t^*} \right)^{-\eta} V_t^*
\]
**Setting:** Competitive, turn final goods into new capital goods subject to adjustment costs.

**Technology**

\[ K_{t+1} = (1 - \delta(u_t)) K_t + \Psi_t \left[ 1 - \frac{\phi}{2} \left( \log \frac{l_t}{l_{t-1}} \right)^2 \right] l_t \]

**Profit maximization and F.O.C.**

\[
V_{K,t} = \max_s \mathbb{E}_s \sum_{s=t}^{\infty} \beta^{s-t} l_s \left[ \Psi_s q_s \left( 1 - \frac{\phi}{2} \left( \log \frac{l_s}{l_{s-1}} \right)^2 \right) \right] - 1 \\
\Rightarrow \\
\Psi_t q_t \left[ 1 - \phi \log \left( \frac{l_t}{l_{t-1}} \right) \right] = 1 - \beta \mathbb{E}_t \Psi_{t+1} q_{t+1} \phi \log \left( \frac{l_t}{l_{t-1}} \right) \]
Intermediate Goods Producers

**Setting:** Competitive, rent labor from packers, capital from households

**Technology**

\[ Y_t = Z_t (u_t K_t)^{1-\vartheta} N_t^{\vartheta} \]

**Factor demands**

\[ w_t^F = p_{H,t} \theta mc_t Z_t \left( \frac{u_t K_t}{N_t} \right)^{1-\vartheta} \]

\[ r_t + q_t \delta(u_t) = p_{H,t} (1 - \vartheta) mc_t u_t Z_t \left( \frac{u_t K_t}{N_t} \right)^{-\vartheta} \]

\[ q_t \delta'(u_t) = p_{H,t} (1 - \vartheta) mc_t Z_t \left( \frac{u_t K_t}{N_t} \right)^{-\vartheta} \]
Government

**Setting:** In charge of monetary and fiscal policy.

**Fiscal policy**

\[
\frac{G_t}{G} = \left( \frac{G_{t-1}}{G} \right)^{\rho_G} \left( \frac{B_t}{B} \right)^{(1-\rho_G)\gamma_B^G} \left( \frac{V_t}{V_{t-1}} \right)^{(1-\rho_G)\gamma_V^G} \epsilon_t^G
\]

\[
\frac{\tau_t}{\tau} = \left( \frac{\tau_{t-1}}{\tau} \right)^{\rho_\tau} \left( \frac{B_t}{B} \right)^{(1-\rho_\tau)\gamma_B^\tau} \left( \frac{V_t}{V_{t-1}} \right)^{(1-\rho_\tau)\gamma_V^\tau}
\]

\[
T_t = \tau_t \left( w_t n_{it} h_{it} + \mathbb{1}_{h_{it} \neq 0} \Pi_t^U + \mathbb{1}_{h_{it} = 0} \Pi_t^F \right)
\]

\[
B_{t+1} = G_t - T_t + \frac{R^b_t B_t}{\pi_t}
\]

**Monetary policy**

\[
\frac{R^b_{t+1}}{R^b} = \left( \frac{R^b_t}{R^b} \right)^{\rho_R} \left( \frac{\pi_t}{\pi} \right)^{(1-\rho_R)\theta_\pi} \left( \frac{V_t}{V_{t-1}} \right)^{(1-\rho_R)\theta_V} \epsilon_t^R
\]
Import price

\[ P_{F,t} = S_t P_{F,t}^* \]

World demand

\[ \log \frac{V_t^*}{V^*} = \rho_{V*} \log \frac{V_{t-1}^*}{V^*} + e_t^V \]

International flows

\[ S_t B_{t+1}^F + S_t K_{t+1}^F = \left(1 + R_t^{BF}\right) S_t B_t^F + \left(1 + R_t^{KF}\right) S_t K_t^F + NX_t \]
International liquid asset market

\[
\mathbb{E}_t R_{t+1}^B = \mathbb{E}_t R_{t+1}^{B_F} \frac{S_{t+1}}{S_t}
\]

\[
Q^B \left( \frac{SB^F}{P} \right) + e^{B_F}_t = 1, \quad Q^{B'} < 0, \quad Q^{B''} < 0
\]

International illiquid asset market

\[
\mathbb{E}_t R_{t+1}^K = \mathbb{E}_t \frac{R_{t+1}^{K_F} \frac{S_{t+1}}{S_t}}{\pi_{t+1}}
\]

\[
Q^K \left( \frac{SK^F}{P} \right) + e^{K_F}_t = 1, \quad Q^{K'} < 0, \quad Q^{K''} < 0
\]
Model combines
- **Incomplete markets** through idiosyncratic risk, lack of insurance, illiquid assets.
- **New Keynesian features** through sticky prices and wages.
- **Open Economy features** through trade in goods and in liquid / illiquid assets.

**Fluctuations** driven by:
- **Shocks**: Idiosyncratic, domestic policy, domestic technology and markups, foreign demand and interest rates.
- **State variables**: Wealth distribution, portfolio composition including capital stock, government debt, foreign assets and debt.
Solution and Estimation Strategies

Model solution:
- The distribution $\Theta$ over $b, k, h$ is a state variable.
- First-order perturbation of the non-linear difference equation $EF(x_t, x_{t+1}, \epsilon_t) = 0$ around the stationary equilibrium.
- Approximate the policy functions as sparse polynomials around their stationary equilibrium values and approximate the distribution functions by histograms of their marginals and a **time-varying Copula** as in Bayer and Luetticke, 2018.
- Linear system depends only on a subset of model parameters.

Parameter estimation:
- Bayesian likelihood approach as in An and Schorfheide, 2007.
- Estimate those parameters that do not enter the non-linear part of the model solution.
- Employ Kalman filter to get state-space representation of the model, then use random walk Metropolis-Hastings algorithm to generate draws from the posterior likelihood.
Sources of Fluctuations

Domestic Aggregate Shocks
- total factor and investment-specific productivity
- price and wage markup
- risk premium
- monetary policy
- government spending

Foreign Aggregate Shocks
- foreign liquid return
- foreign illiquid return
- foreign demand
Estimation
What we estimate

HA Small Open Economy-HANK model

HA0 Small Open Economy-HANK model (zero foreign assets, liquid and illiquid return shocks)

RA0 Small Open Economy-RANK model (zero foreign assets, only one return shock)
Estimation: Two-step procedure

- First, we calibrate or fix all parameters that affect the steady state of the model.

- Second, we estimate by full-information methods all parameters that only matter for the dynamics of the model, i.e., the aggregate shocks, frictions, and policy rules.

- We set the priors for shocks, frictions, and policy rules to standard values from the representative agent literature.
## Calibration/Parameterization of Steady-State

### Table: Steady State Calibration Targets

<table>
<thead>
<tr>
<th>Target</th>
<th>Annual value</th>
<th>Source</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital to Output ($\frac{K}{Y}$)</td>
<td>307%</td>
<td>BOK</td>
<td>Discount factor</td>
</tr>
<tr>
<td>Gov Debt to Output ($\frac{D_G}{Y}$)</td>
<td>30%</td>
<td>Stat Korea</td>
<td>Portfolio liquidity</td>
</tr>
<tr>
<td>Gov spending over GDP ($\frac{G}{Y}$)</td>
<td>14%</td>
<td>BOK</td>
<td>Tax level</td>
</tr>
<tr>
<td>Top 10% Wealth Share</td>
<td>58%</td>
<td>WID</td>
<td>Fraction of entrepreneurs</td>
</tr>
<tr>
<td>Import share ($\frac{V^*_H}{V}$)</td>
<td>37%</td>
<td>Stat Korea</td>
<td>Share in V</td>
</tr>
<tr>
<td>Foreign Liquid Assets to Output ($\frac{B_F}{Y}$)</td>
<td>13.6%</td>
<td>Stat Korea</td>
<td>Share in liquid assets</td>
</tr>
<tr>
<td>Foreign Illiquid Assets to Output ($\frac{K_F}{Y}$)</td>
<td>-13.7%</td>
<td>Stat Korea</td>
<td>Share in illiquid assets</td>
</tr>
</tbody>
</table>

Time period: 1990-2019
Household side:

- Risk aversion: 2, Frisch elasticity: 0.5

- Income process: $\rho_h = 0.95$, $\sigma_h = 0.20$ from Chang et al. (2015)

- Average time as rentier: 6 years from Guvenen et al. (2014)

- Tax progressivity: $\tau^p = 0.13$ from Chang et al. (2015)
Calibration/Parameterization of Steady-State

Firm side:
- Labor income share of 62 percent
- Capital depreciation rate of 2% per quarter
- Price and wage markups of 10%
Estimation of Dynamics

Remaining parameters estimated using full-information approach:

- Real frictions: capital utilization and investment adjustment costs
- Nominal frictions: Price and wage adjustment costs
- Monetary policy rule
- Fiscal policy rules
- Elasticity of substitution with foreign goods
- Foreign interest rate schedule
- Aggregate shocks: Persistence and variance of domestic and foreign shocks
### Observables

**Table:** Aggregate time series data (quarterly)

<table>
<thead>
<tr>
<th>Time series (90Q1∼19Q4)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In first-differences:</strong></td>
<td></td>
</tr>
<tr>
<td>Output ($Y_t$), Consumption ($C_t$), Investment ($I_t$)</td>
<td>National Accounts (BOK)</td>
</tr>
<tr>
<td>Wage ($w_t$, hourly), Hours worked ($N_t$)</td>
<td>Stat Korea</td>
</tr>
<tr>
<td>(all seasonally adjusted, per capita, real)</td>
<td></td>
</tr>
<tr>
<td>Effective exchange rate ($S_t$)</td>
<td>Effective rate (BIS)</td>
</tr>
<tr>
<td>Exports ($X_t$), Imports ($I_t$)</td>
<td>National accounts (BOK)</td>
</tr>
<tr>
<td><strong>In log-levels:</strong></td>
<td></td>
</tr>
<tr>
<td>Inflation ($\pi_t$)</td>
<td>Consumption deflator (BOK)</td>
</tr>
<tr>
<td>Nominal interest rate ($R^B_t$)</td>
<td>Average of base rate (BOK)</td>
</tr>
<tr>
<td>Spread ($R^K_t - R^B_t$)</td>
<td>Own calculations</td>
</tr>
</tbody>
</table>

All demeaned and with measurement error on $w_t, I_t$. 

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<table>
<thead>
<tr>
<th>Parameter</th>
<th>Distribution</th>
<th>Prior</th>
<th>Posterior</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Dev.</td>
<td>HANK</td>
</tr>
<tr>
<td>Frictions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_s = \delta'' / \delta'$</td>
<td>Gamma</td>
<td>5.00</td>
<td>2.00</td>
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<tr>
<td>$\phi$</td>
<td>Gamma</td>
<td>4.00</td>
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<tr>
<td>$\kappa$</td>
<td>Gamma</td>
<td>0.10</td>
<td>0.01</td>
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<tr>
<td>$\kappa_w$</td>
<td>Gamma</td>
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<td>Monetary policy rule</td>
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<tr>
<td>$\rho_R$</td>
<td>Beta</td>
<td>0.50</td>
<td>0.20</td>
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<tr>
<td>$\sigma_R$</td>
<td>Inv.-Gamma</td>
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<tr>
<td>$\theta_\pi$</td>
<td>Normal</td>
<td>1.70</td>
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<td>$\theta_Y$</td>
<td>Normal</td>
<td>0.13</td>
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## Prior and Posterior

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Prior Distribution</th>
<th>Prior Mean</th>
<th>Prior Std. Dev.</th>
<th>Posterior HANK</th>
<th>Posterior HANK0</th>
<th>Posterior RANK0</th>
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<td>HANK</td>
<td>HANK0</td>
<td>RANK0</td>
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<td>Spending rule</td>
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<tr>
<td>$\gamma_B$</td>
<td>Normal</td>
<td>0.00</td>
<td>1.00</td>
<td>-0.18</td>
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<td>$\gamma_Y$</td>
<td>Normal</td>
<td>0.00</td>
<td>1.00</td>
<td>-0.11</td>
<td>-0.01</td>
<td>-0.02</td>
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<tr>
<td>$\rho_G$</td>
<td>Beta</td>
<td>0.50</td>
<td>0.20</td>
<td>0.98</td>
<td>0.96</td>
<td>0.99</td>
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<tr>
<td>$\sigma_G$</td>
<td>Inv.-Gamma</td>
<td>0.10</td>
<td>2.00</td>
<td>17.34</td>
<td>16.25</td>
<td>23.86</td>
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<tr>
<td>Distribution</td>
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<td>Std. Dev.</td>
<td>HANK</td>
<td>HANK0</td>
<td>RANK0</td>
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<tr>
<td><strong>Foreign Elasticities</strong></td>
<td></td>
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<tr>
<td>$\eta_{open}$</td>
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## Prior and Posterior

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<td>$\sigma_{\mu w}$</td>
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<td>0.10</td>
<td>2.00</td>
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</table>

Luetticke
Foreign Portfolios and Domestic Business Cycles
March 2023
Parameter estimates: SMOE-HANK is a mix of the RANK and SMOE-NK model:

- Prices sticky for around 6-8 months, wages close to a year.
- Smaller investment adjustment costs in HANK than RANK due to incomplete markets.
- Estimates of “foreign” parameters very similar in HANK and RANK.
- We find elasticity of substitution between foreign and domestic bundle below one.
Foreign Portfolios and the Transmission Mechanism of Shocks
Impulse Responses to Foreign Liquid Return in 3 Models (estimated)

World bond return
- HANK
- HANKLPC
- RANK0

Output

Investment

Consumption

Inflation

Ex. Rate

Luetticke
Foreign Portfolios and Domestic Business Cycles
March 2023
Impulse Responses to Foreign Liquid Return in 3 Models (counterfactual)

World bond return

Output

Investment

Consumption

Inflation

Ex. Rate

Luetticke

Foreign Portfolios and Domestic Business Cycles

March 2023
Impulse Responses to Foreign Illiquid Return in 3 Models (estimated)

World capital return

Output

Investment

Consumption

Inflation

Ex. Rate
Impulse Responses to Foreign Illiquid Return in 3 Models (counterfactual)

World capital return

Output

Investment

Consumption

Inflation

Ex. Rate
Foreign Illiquid Return Shock: Decomposition of Consumption
Impulse Responses to Foreign Demand in 3 Models (estimated)

World demand

- HANK
- HANKLP
- RANK0

Output

Consumption

Inflation

Investment

Ex. Rate
Impulse Responses to Foreign Demand in 3 Models (counterfactual)
Impulse Responses of Inequality to Foreign Return Shocks (estimated)
Foreign Portfolios and the Transmission Mechanism of Policy
Monetary Transmission: Decomposition of Consumption

![Graph showing monetary transmission decomposition](image-url)
International liquid and illiquid asset market

\[
R_{t+1}^{BF} = R^* + \phi_{BF} \log \left( \frac{B_t^F}{B^F} \right) + \epsilon_{R^{BF}}
\]

\[
R_{t+1}^{KF} = R^* + \phi_{KF} \log \left( \frac{K_t^F}{K^F} \right) + \epsilon_{R^{KF}}
\]

- **Parameter estimates:** \( \phi_{BF} = 0.000425 \) \( \phi_{KF} = 0.000467 \)

- In words, semi-elasticity of 0.04%. Foreign returns respond little to Korean investment.
Fiscal Transmission

Domestic bonds market

- Bayer et al (2022) find a semi-elasticity of 2.5% for US government debt (closed economy).
- Here: Substitution between domestic and foreign bonds.
- Semi-elasticity of 0.1% for South Korean government debt.
- Implication: Fiscal revenue maximizing level of government debt is close to zero for KOR, but fiscal costs are smaller too.
Historical and Variance Decompositions of Korean Business Cycle
Variance decomposition: Policy Rate and Liquidity Premium

Variance Decomposition for RB, Forecast Horizon:

Variance Decomposition for LP, Forecast Horizon:

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Foreign Portfolios and Domestic Business Cycles
March 2023
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Variance decomposition: Inequality

Variance Decomposition for TOP10Ishare, Forecast Horizon:

Variance Decomposition for TOP10Wshare, Forecast Horizon:
Historical decomposition: Growth of Consumption
Historical decomposition: Growth of Investment
Historical Decomposition: Return on Bonds
Summary

What we have done
- Formulated SMOE with heterogeneity in foreign portfolios.
- Estimated model on South Korean data.
- Used the model to
  - understand transmission mechanisms of foreign shocks.
  - understand the effect of foreign portfolios on monetary and fiscal policy.
  - understand drivers of the economy in KOR.

Still to be done
- Indirect net household foreign asset positions
- Decomposition of transmission to investment
- Correlated return shocks
Households’ Asset and Liability Classification

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liquid</th>
<th>Illiquid</th>
<th>Liabilities</th>
<th>Liquid</th>
<th>Illiquid</th>
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<tbody>
<tr>
<td>Real Estate</td>
<td>262.3</td>
<td></td>
<td>Mortgages</td>
<td></td>
<td>43.8</td>
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<tr>
<td>Consumer durables</td>
<td>3.2</td>
<td></td>
<td>Credit card loan &amp; etc</td>
<td></td>
<td>9.7</td>
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<tr>
<td>Deposits</td>
<td>92.6</td>
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<tr>
<td>Government bonds</td>
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<td>Corporate bonds</td>
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<tr>
<td>Corporate equity</td>
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<tr>
<td>Private equity</td>
<td>5.9</td>
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Reference date: 31 Dec 2019
### Households’ Domestic/Foreign Assets/Liabilities Structure

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liquid</th>
<th>Illiquid</th>
<th>Liabilities</th>
<th>Liquid</th>
<th>Illiquid</th>
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<tbody>
<tr>
<td><strong>Domestic Assets and Liabilities</strong></td>
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<tr>
<td>(A) Domestic liquid assets</td>
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<td>(C) Domestic illiquid assets</td>
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<td>(G) Domestic illiquid liabilities</td>
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<td><strong>Total Positions</strong></td>
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<td>(3) Deposits</td>
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### Foreign Assets and Liabilities

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