Risk Sharing Between Countries and Regions. Empirical Perspective

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Channels of Risk Sharing between Countries

Important for monetary union: monetary policy is unable to address "asymmetric" shocks

Theoretical Benchmark. Full Risk Sharing: Consumption grows at identical rates in all countries.

If markets are perfect

$$U'(C_0)/U'(C_1^s) = \pi_s/p_s$$

where C is (representative) agent's consumption of trade-able good, s is any state of the world, π is the probability, and p_s is the period 0 prices of an Arrow security that pays one unit of if state s occurs, otherwise 0.

Marginal Utility. One good, LOP,

- My work departs from benchmark, CRRA utility, representative agent model with one good, $\log U'(C) = -\rho \log(C)$ where ρ is risk preference. (I will present material from in-process computational multi-agent DSGE model later, but still one good.)
- Consumption growth rates equalized across countries. Implication: consumption growth rate of agent equal to average consumption growth rate
- Estimate deviation from benchmark. The results from these estimations are amazingly robust.

A DSGE literature attempts to interpret output, consumption, exchange rates

- If non-tradeables, only marginal utility of trade-able good can be equalized across countries and the marginal utility is with respect to the tradeable good.
- There is a quite large theoretical/quantitative DSGE literature that focus on tradeables/non-tradeables and exchange rates. (Backus and Smith 1993, Kollmann (1995)) with consumption being a CES index of tradeables/non-tradeables. Exogenous productivity shocks to tradeables/non-tradeables determine exchange rate. Consumption growth rates proportional to exchange rates.
  - ➢ This model does not fit the data.

Marginal Utility. L-O-P deviations

- My take is that exchange rates does not fit that pattern. My work does not attempt to model exchange rates.
- Some people have strong opinions about this.
- More ambitious quantitative DSGE models include deviation form the Law-of-one-Price (LOP) (Corsetti, Dedola, Leduc 2008). Included a distribution sector, persistent shocks and bond markets, Corsetti et al. can match many moments.
- Preference shocks usually ignored or assumed to go into residuals in empirical work. (Stockman and Tesar 1995 include taste shocks in quantitative model.)

How to estimate *degree* of risk sharing in regression framework.

- Empirical work on risk sharing starts around 1990. Townsend ECA (Indian villages)
  - ➢ Mace JPE 91. Panel of consumers. Does consumption growth of individual consumers deviate from average with income shocks? "Test for Perfect Risk Sharing"
  - ➢ Cochrane JPE 9, **how much** does consumption growth decline following (quantification)
  - ➢ My work encompass Mace panel regressions, but focus on quantification

How to estimate *degree* of risk sharing in regression setting?

- Measurement. Panel data regressions (country by year) "Full risk sharing" if coefficient in regression of consumption on GDP (with **time fixed effects**) returns coefficient of zero.
- The degree to which consumption (after removing aggregate/average component) comoves with income, I *define* as the "degree of risk sharing."

Channels of Risk Sharing. Asdrubali, Sorensen, Yosha (1996)

- My most robust regressions ever, most results still hold 20 years later
- National Income can vary less than one-to-one with GDP (income smoothing)
- Consumption can vary less than one-to-one with income (consumption smoothing)

National Accounts (simplified)

	GDP
+	Net Factor Income from abroad
=	GNI (Gross National Income, GNP)
–	Depreciation
=	NNI (Net National Income)
+	Net International Transfers (+ remittances)
=	NDI (Net Disposable National Income)
–	Saving
=	C+G (Consumption, Personal + Govt.)

Co-variance decomposition of GDP shocks, An level identity

- Sørensen, and Yosha (1998) following Asdrubali, Sørensen, and Yosha (1996), considered channels of risk sharing.
- Consider identity, holding for any period t,

$$\mathrm{GDP}^i = \frac{\mathrm{GDP}^i}{\mathrm{GNI}^i}\frac{\mathrm{GNI}^i}{\mathrm{NI}^i}\frac{\mathrm{NI}^i}{\mathrm{DNI}^i}\frac{\mathrm{DNI}^i}{\mathrm{C}^i+\mathrm{G}^i}(\mathrm{C}^i+\mathrm{G}^i), \qquad (1)$$

Co-variance decomposition of GDP shocks, A Delta log identity

Take logs and differences on both sides of (**??**), multiply both sides by $\Delta \log \mathrm{GDP}^i$ (minus its mean) and take the cross-sectional average, obtaining the variance decomposition

$$
\begin{aligned}
\mathrm{var}\{\Delta \log \mathrm{GDP}^i\} \quad = \quad & \mathrm{cov}\{\Delta \log \mathrm{GDP}^i - \Delta \log \mathrm{GNI}^i, \Delta \log \mathrm{GDP}^i\} \\
& + \mathrm{cov}\{\Delta \log \mathrm{GNI}^i - \Delta \log \mathrm{NI}^i, \Delta \log \mathrm{GDP}^i\} \\
& + \mathrm{cov}\{\Delta \log \mathrm{NI}^i - \Delta \log \mathrm{DNI}^i, \Delta \log \mathrm{GDP}^i\} \\
& + \mathrm{cov}\{\Delta \log \mathrm{DNI}^i - \Delta \log(\mathrm{C}^i + \mathrm{G}^i), \Delta \log \mathrm{GDP}^i\} \\
& + \mathrm{cov}\{\Delta \log(\mathrm{C}^i + \mathrm{G}^i), \Delta \log \mathrm{GDP}^i\} \ .
\end{aligned}
$$

A cross-sectional identity of regression coefficients

Dividing by $\text{var}\{\Delta \log \text{GDP}^i\}$ we get

$$1 = \beta_f + \beta_d + \beta_\tau + \beta_s + \beta_u, \tag{2}$$

where

$$\beta_u = \frac{\text{cov}\{\Delta \log(\text{C}^i + \text{G}^i), \Delta \log \text{GDP}^i\}}{\text{var}\{\Delta \log \text{GDP}^i\}}, \tag{3}$$

is OLS estimate of slope in cross-sectional regression $\Delta \log(\text{C}^i + \text{G}^i)$ on $\Delta \log \text{GDP}^i$.
β_u measures the amount not smoothed

Panel estimate is a weighted average of cross-sectional regressions

Federal Income Smoothing

$$\beta_f = \frac{\text{cov}\{\Delta \log \text{GDP}^i - \Delta \log \text{GNI}^i, \Delta \log \text{GDP}^i\}}{\text{var}\{\Delta \log \text{GDP}^i\}} \tag{4}$$

is slope in OLS regression of $\Delta \log \text{GDP}^i - \Delta \log \text{GNI}^i$ on $\Delta \log \text{GDP}^i$,

- β_f measures income smoothing from net factor income
- β_d similarly measures income smoothing from depreciation
- β_τ measures income smoothing from transfers
- β_s measures consumption smoothing from saving

Income Smoothing

- Total income smoothing: $\beta_f + \beta_d + \beta_\tau$
- Total risk "shared" : $\beta_f + \beta_d + \beta_\tau + \beta_s$
- Full risk sharing if this sum equals 1

Interpretation of long differences

- Results stable for income smoothing. Consistent with cross-ownership.
- Consumption consistent with PIH at longer horizons! Slow adjustment of growth.
- One could use time-series regressions, rather than longer intervals. Long intervals easier to communicate; esp. to policy makers.
  - ➢ But more complicated econometrics may get into better journals

Panel Data estimation

Simultaneous panel data estimation:

$$
\begin{aligned}
\Delta \log \mathrm{GDP}_t^i - \Delta \log \mathrm{GNI}_t^i &= \beta_f \ \Delta \log \mathrm{GDP}_t^i + \epsilon_{f,t}^i \ , \\
\Delta \log \mathrm{GNI}_t^i - \Delta \log \mathrm{NI}_t^i &= \beta_d \ \Delta \log \mathrm{GDP}_t^i + \epsilon_{d,t}^i \ , \\
\Delta \log \mathrm{NI}_t^i - \Delta \log \mathrm{DNI}_t^i &= \beta_\tau \ \Delta \log \mathrm{GDP}_t^i + \epsilon_{\tau,t}^i \ , \\
\Delta \log \mathrm{DNI}_t^i - \Delta \log(\mathrm{C}_t^i + \mathrm{G}_t^i) &= \beta_s \ \Delta \log \mathrm{GDP}_t^i + \epsilon_{s,t}^i \ , \\
\Delta \log(\mathrm{C}_t^i + \mathrm{G}_t^i) &= \beta_u \ \Delta \log \mathrm{GDP}_t^i + \epsilon_{u,t}^i \ ,
\end{aligned}
$$

including time fixed effects. Crucial! Absorbs the average. (The coefficients from panel regression with time fixed effects is a weighted average of cross-sectional regressions.)

Original Results for U.S. states (not much changed since)

	1964–1990
Capital markets (β_K)	39
	(3)
Federal government (β_F)	13
	(1)
Credit markets (β_C)	23
	(6)
Not smoothed (β_U)	25
	(6)

Econometric Issues

- We tried GLS/Generalized Linear Model with correlations between states and autocorrelation.
- OLS is pretty close, but allowing for heteroskedasticity had some effect

Interpretation of US results

- We interpreted β_K as a function of cross-state financial integration. If you assume that income smoothing reflect cross-ownership the results imply that about 40% of U.S. income has diversified ownership.
  - ➢ Kalemli-Ozcan, Reshef, Sorensen, and Oved Yosha REStat (2010) show that the U.S. data is roughly consistent with the full capital stock being owned by "joint fund" and labor income not diversified
- The federal government absorbs 13% of shocks (mainly because social security is not reacting to state-level shocks)
- Consumption growth is less correlated with GDP than income. Consumption models needed. U.S. state-level output and income near random walks. PIH: consumption should follow income one-to-one

Is risk sharing different over longer horizons?

	k=1	k=2	k=3	k=5
Capital markets (β_K)	39	39	44	36
	(3)	(4)	(2)	(3)
Federal government (β_F)	13	15	16	17
	(1)	(1)	(1)	(1)
Credit markets (β_C)	23	16	7	5
	(6)	(8)	(6)	(8)
Not smoothed (β_U)	25	30	34	42
	(6)	(8)	(7)	(8)

Some empirical points

- cross-ownership important in the US, dominates federal income smoothing
- risk-sharing through saving is short-term (matters little for welfare)
  - ➢ Becker and Hoffmann (2006) perform more systematic time-series analysis
- risk-sharing through saving is unstable
- "realistic" [life-cycle, housing, measurement errors, aggregation: time, agents] consumption models under imperfect markets that can explain state-level consumption are complicated Luengo-Prado, Sørensen, Yosha REStat (2008)
- realistic consumption models + endogenous risk sharing not done yet

What is risk?

- Basic model assumes trading/negotiation at period 0 (pre-sample)
- Takes variation in GDP as "shocks."
- Athanasoulis and van Wincoop (2001) decompose unexpected shocks to GDP for U.S. states, implicitly assuming one year insurance contracts to be re-traded each year.
  - ➢ Shocks are residuals from aggregate AR-model. I find it hard to imagine individuals condition on lagged GDP.
- The stylized model is no help: Predicts that only aggregate consumption should be significant, so testing if one type of shocks further predicts consumption is just as theory (un-) funded as the other.

Note on Prices I

Measuring risk sharing across countries raises the issue of prices.

- We measure GDP, consumption, etc. using CPI (not GDP deflator). If oil prices go up, an oil state can consumer more. (Sorensen and Yosha (2007)).
- We ignore exchange rate variation, German GDP and German consumption measured in dollars are very highly correlated.
- If we use fixed effects, the fixed effects captures average growth (unit free). If we normalize by aggregate variables, we basically use PPP values and aggregate.

Note on Prices II

- The role of real exchange rates in the Eurozone/U.S.'currency unions has not been systematically for risk sharing
- In my earlier papers I found the results not sensitive to using state-specific prices (imperfect data)
  - ➢ Using supermarket scanner data Beraja, Hurst, Ospina (WP) finds that prices and wages fall when unemployment increases in U.S. states in Great Recession.

Income and Consumption Smoothing (percent) by National Accounts Categories. Risk Sharing in the OECD/EU

	EU 71–99	OECD–EU 71–99	EU 99–07	OECD–EU 99–07
Factor Income (β_f)	0	−2	7	3
	(1)	(1)	(4)	(3)
Depreciation (β_d)	−7	−8	−4	−13
	(1)	(1)	(1)	(2)
Transfers (β_τ)	1	0	4	−2
	(1)	(0)	(1)	(1)
Saving (β_s)	54	46	34	90
	(3)	(4)	(9)	(8)
Not Smoothed (β_u)	52	63	59	22
	(3)	(4)	(6)	(6)

Risk *Sharing* or Self Insurance

Is risk actually *shared* between countries?

We can decompose β_s into contribution from pro-cyclical Current Account surplus ("shared risk") and pro-cyclical domestic physical net investment ("self-insurance")

$\mathrm{S} = \mathrm{I} + \mathrm{CA}$, where "I" denotes net domestic invest, "CA" is current account surplus

Risk Sharing or Self-insurance II

- We measure the fraction of shocks smoothed via domestic net investment by estimating the coefficient in the regression of $\Delta \log \mathrm{GDP}^i - \Delta \log(\mathrm{GDP}^i - \mathrm{I}^i)$ on $\Delta \log \mathrm{GDP}^i$.
- Similarly, the coefficient in the regression of $\Delta \log \mathrm{GDP}^i - \Delta \log(\mathrm{GDP}^i - (\mathrm{X}^i - \mathrm{M}^i))$ on $\Delta \log \mathrm{GDP}^i$ measures the fraction of shocks smoothed via net exports ("investment abroad")

Empirical Results. Investment vs. International Flows

	EU 1971–1999	OECD–EU 1971–1999	EU 1999–2007	OECD–EU 1999–2007
Net Investment	60	52	25	38
	(4)	(6)	(7)	(7)
Current Account	−13	−3	3	34
	(5)	(4)	(7)	(9)
Net Export	−11	−9	16	29
	(2)	(5)	(7)	(9)

Income and Consumption Smoothing (percent) by National Accounts Categories. Three-Year Frequency

	EU 1971–1999	OECD–EU 1971–1999	EU 1999–2007	OECD–EU 1999–2007
Factor Income (β_f)	−3	−3	16	−1
	(2)	(2)	(5)	(3)
Depreciation (β_d)	−7	−4	1	−13
	(2)	(2)	(3)	(3)
Transfers (β_τ)	2	0	5	−1
	(1)	(0)	(2)	(1)
Saving (β_s)	45	40	1	94
	(5)	(6)	(11)	(12)
Not Smoothed (β_u)	64	66	77	21
	(5)	(6)	(8)	(6)

Risk sharing through saving can be decomposed

Consider savings smoothing $\Delta \log(\textbf{NNDI}) - \Delta \log(\textbf{CONS})$ $= \Delta \log(1 + \frac{\textbf{S}_{it}}{\textbf{CONS}_{it}})$ ($\textbf{S} = \textbf{NNDI} - \textbf{CONS}$) so approximately we can estimate risk sharing from saving as

$$\frac{\textbf{S}_{it}}{\textbf{CONS}_{it}} = \alpha_s^t + \beta_s \Delta \text{GDP}_{it} + \epsilon_{its} \ ,$$

which highlights how consumption smoothing, if positive, is obtained through pro-cyclical total saving. Having a form linear in S allows us to decompose savings.

Risk sharing from Private or Government Saving

$$\Delta \frac{\mathbf{S}_{it}^{\text{Priv}}}{\mathbf{CONS}_{it}} = \alpha_{Priv}^{t} + \beta_{Priv} \Delta \text{GDP}_{it} + \epsilon_{itPriv} \ ,$$

$$\Delta \frac{\mathbf{S}_{it}^{\text{Gov}}}{\mathbf{CONS}_{it}} = \alpha_{Gov}^{t} + \beta_{Gov} \Delta \text{GDP}_{it} + \epsilon_{itGov} \ .$$

One can further interact with Dummies for year or crisis countries (GIIPS) (Kalemli-Ozcan, Luttini, Sorensen (2014))

Smoothing persistent shocks with savings has to come to an end

	Saving	
	Government(β_{Gov})	Private(β_{Priv})
GDP (1990–2007) (non-GIIPS)	46***	14**
	(7.85)	(2.46)
GDP (2008–2009) (non-GIIPS)	38***	19
	(2.73)	(1.36)
GDP (2010) (non-GIIPS)	17	44*
	(0.65)	(1.69)
GDP (1990–2007) (GIIPS)	15***	16***
	(2.71)	(2.89)
GDP (2008–2009) (GIIPS)	73***	–25**
	(6.67)	(–2.33)
GDP (2010) (GIIPS)	–38**	57***
	(–1.98)	(2.97)
Observations:	281	

International capital gains and risk sharing

International capital gains on foreign assets dwarfs factor income flows. (Balli, Kalemli-Ozcan, Sørensen (2012).

Consider magnitudes:

Descriptive Statistics for Capital Gain Variable

	1994-1999			1999-2007		
	Mean	S.Dev	Kurtosis	Mean	S.Dev	Kurtosis
Australia	6.89	19.88	2.49	6.04	52.98	1.41
Austria	1.10	8.59	0.48	-14.30	22.20	-0.60
Canada	10.58	13.04	2.60	5.13	40.34	0.23
Denmark	0.81	11.21	3.10	3.31	15.93	0.737
Finland	-20.16	45.59	6.31	1.67	58.65	1.25
France	0.40	80.97	-0.14	25.67	209.65	1.29
Germany	-9.53	58.13	1.23	-52.18	170.56	0.00
Italy	9.69	56.76	2.19	-14.30	101.29	0.44
Japan	-146.10	276.44	0.34	-1.19	253.78	0.01
Netherlands	-13.39	10.83	1.15	-22.67	49.79	1.46
Norway	-0.18	13.12	0.74	0.93	22.01	0.94
Spain	-5.40	39.12	-1.22	-11.63	117.96	0.74
Sweden	17.50	27.95	4.39	27.88	66.60	1.59
UK	17.44	65.64	1.76	46.46	97.60	0.52
US	90.82	144.21	0.13	250.02	618.77	3.84

The capital gain variable is measured in billion USD. We omit some countries due to the missing data.

How to measure the income smoothing from capital gains

- In our framework, an income source X provides risk sharing if in regression

$$\Delta log(GDP + X) = \mu_t + \beta \Delta log(GDP)\,,$$

  gives $\beta < 1$.
- Adding capital gains to GNP as in

$$GNP* = GNP + CapitalGains$$

  delivers wild fluctuations.
- However, capital gains are not persistent...“adding apples to oranges”

An complication: time series properties of GDP versus capital gains

AR(1) regressions for Capital Gain and GDP

	cap gain	GDP
AR(1)	0.16	0.99
	(0.04)	(0.01)

Panel Unit Root Tests for Capital Gain and GDP

	Test Statistic	Probability
cap gain	−6.62	0.000
GDP	47.21	1.000

How to combine persistent income shocks with transitory capital gains in regression

- A large part of capital gains are driven by exchange rates (close to random walks, the capital gain is the *change* in the interest rate, so transitory)
- For a near-unit root process with an interest rate about 5 percent, the permanent income value of an income shock is about 0.05 times shock (PIH-literature)—therefore, consider risk sharing regressions

$$\begin{aligned} & \Delta \log \mathrm{GDP}_t^i - \Delta \log(\mathrm{GNI}_t^i + 0.05 * \mathrm{CAPITALGAIN}_t^i) \\ = \; & \nu_t + \beta_k \, \Delta \log \mathrm{GDP}_t^i + \epsilon_{it} \;\; , \end{aligned}$$

and

$$\begin{aligned} & \Delta \log(\mathrm{DNI}_t^i + 0.05 * \mathrm{CAPITALGAIN}_t^i) - \Delta \log(\mathrm{C}_t^i + \mathrm{G}_t^i) \qquad (5) \\ & = \nu_{ks,t} + \beta_{ks} \;\; \Delta \log \mathrm{GDP}_t^i + \epsilon_{it} \;\; . \end{aligned}$$

In this regression, β_k measures incremental smoothing of GNI from adding capital gains, and β_{ks} is the measure of consumption smoothing relative to GNI cum cap. gain.

RS from Factor Income and Savings Including (perm income) Net Capital Gain from External Assets

	EU 1994–1999	OECD–EU 1994–1999	EU 1999–2007	OECD–EU 1999–2007
β_f	−14	16	1	5
	(5)	(12)	(5)	(3)
β_{kf}	−12	14	8	9
	(8)	(8)	(4)	(2)
β_{ks}	46	65	26	85
	(10)	(8)	(7)	(4)

Extension: Estimating economic determinants of risk sharing.

Consider, e.g, smoothing from factor income flows, β_f:
β_f can change with observable variable X:

$$\beta_f = \beta_{f0} + \beta_{f1}(t - \bar{t}) + \beta_{f2}(X_{it} - \overline{X}), \qquad (6)$$

First suggested by Mélitz and Zumer (1999)
Sorensen, Wu, Yosha, Zhu (2007) examined if risk sharing is correlated with international home bias

Asset structure matters: See Baxter-Crucini IER (1995) :
Bonds can smooth transitory shocks only. Equity permanent.
RBC—first RBC international RS: Backus, Kehoe, Kydland JPE (1992)—much cited "BKK"

Home bias and risk sharing

$$GNP \approx GDP + r_D A_D - r_F A_F \ ,$$

where A_D are domestically owned foreign assets, A_F is stock of domestic assets owned by foreigners, and r_D and r_F is return on these assets.

High A_D (low "home bias") will insulate GNP from GDP shocks if

- A_D is large (*)
- r_D is not perfectly correlated with GDP
- r_D is not perfectly correlated with r_F (assuming $A_D \approx A_F$)

(*) is our focus

Exact definitions of "home bias"

Two measures of "Home Bias" used:

1. Equity home bias $\text{EHB}_{it} = 1$ *minus* (share of foreign equity in country i's total equity portfolio / the share of foreign equity in the world portfolio).
   - ⋆ If German stock market capitalization is 3 percent of world and Germans hold only 3 percent German equity, $\text{EHB} = 0$.
   - ⋆ EHB is 1 is Germans hold 100 percent German equity,
   - ⋆ Debt security (bond) home bias BHB is similarly defined.

Ratio of Assets to GDP. No Benchmark, but Reflects "Importance."

2. the log of the share of foreign equity (and/or debt) holdings in GDP.
   Also: Foreign direct investment (FDI) relative to GDP.

⋆ Assets to GDP ratio not theory based but may show if the *expansion* of financial assets holdings is more important than the *composition* of holdings.

Data

- National Accounts data from the OECD
- Asset data are from Lane and Milesi-Ferretti (2006)
  - ⋆ Previous version used asset data from IMF Coordinated Portfolio Investment Surveys.

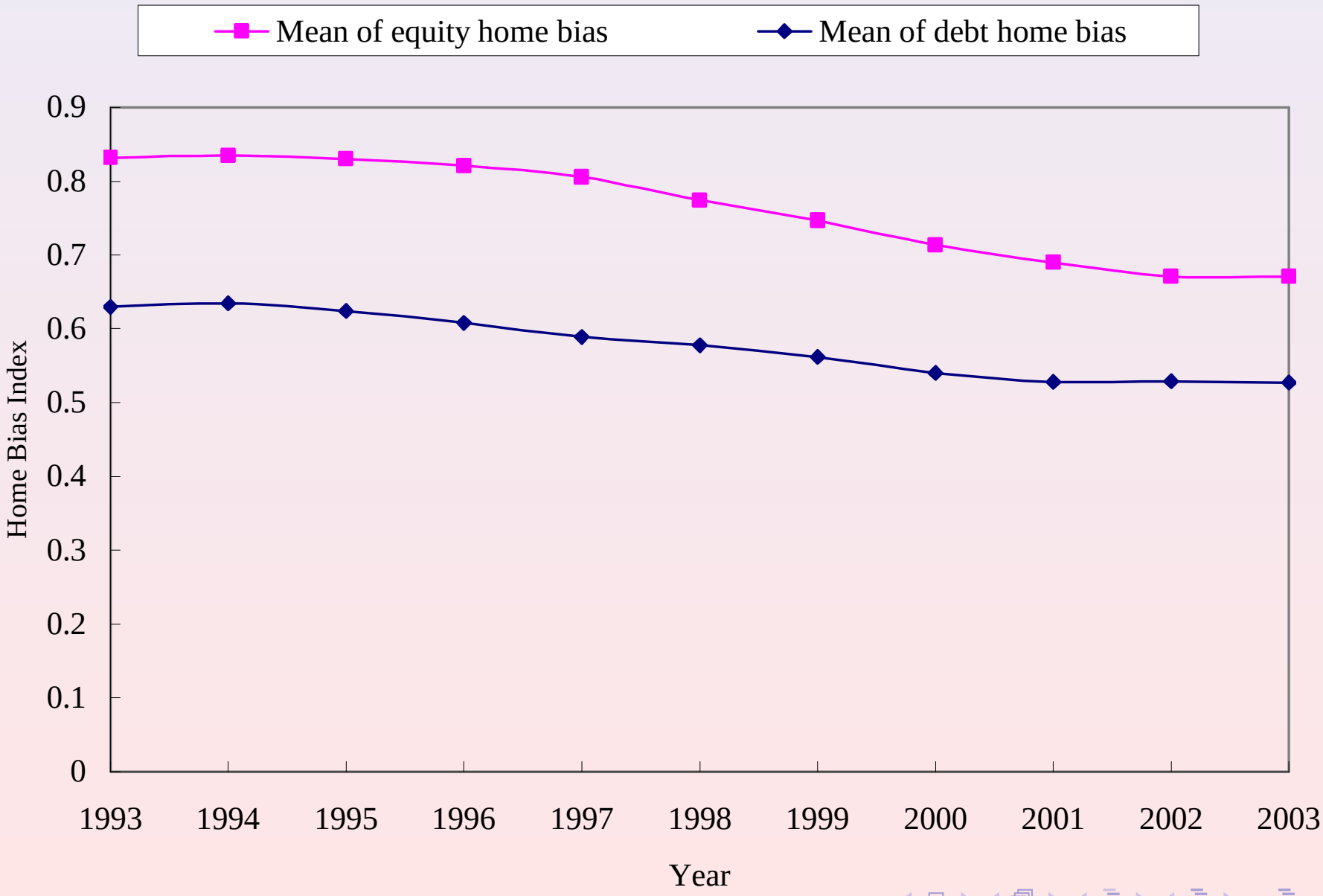
Large Increase in International Assets and Liabilities

Table: County-level Foreign Asset and Liability Holdings of Equity, Debt, and Foreign Direct Investment Relative to GDP

Table 1

Country		equity		debt		fdi	
Year:		1993	2003	1993	2003	1993	2003
Austria	assets	0.02	0.17	0.47	1.28	0.04	0.23
Austria	liabilities	0.02	0.10	0.63	1.55	0.06	0.22
Germany	assets	0.06	0.24	0.47	1.07	0.08	0.30
Germany	liabilities	0.05	0.15	0.46	1.15	0.04	0.27
Ireland	assets	0.26	1.42	0.80	6.64	0.10	0.47
Ireland	liabilities	0.32	3.07	0.97	4.33	0.40	1.42
Italy	assets	0.03	0.23	0.31	0.62	0.08	0.16
Italy	liabilities	0.03	0.11	0.47	0.96	0.05	0.12

Figure 1: Equity and Debt Security Home Bias Indices in the OECD



Notes. Mean of equity home bias and mean of debt home bias are the cross-sectional mean for 22 OECD countries

Table 3
Equity Home Bias 1993 and 2003

Country	(1) Foreign Equity in Portfolio (%)		(2) Equity Home Bias		
	1993	2003	1993	2003	Diff.
Austria	13.03	61.14	0.87	0.39	–0.48
Germany	23.75	44.70	0.75	0.54	–0.22
Italy	21.25	41.84	0.79	0.57	–0.21
Japan	3.59	9.97	0.95	0.89	–0.06
US	10.25	14.32	0.84	0.74	–0.10
Average	16.20	31.85	0.83	0.67	–0.16

Time pattern in risk sharing

The risk sharing regressions can be estimated year-by-year to show development over time.

Figure 2: Income Risk Sharing and Foreign Asset Holdings in the OECD

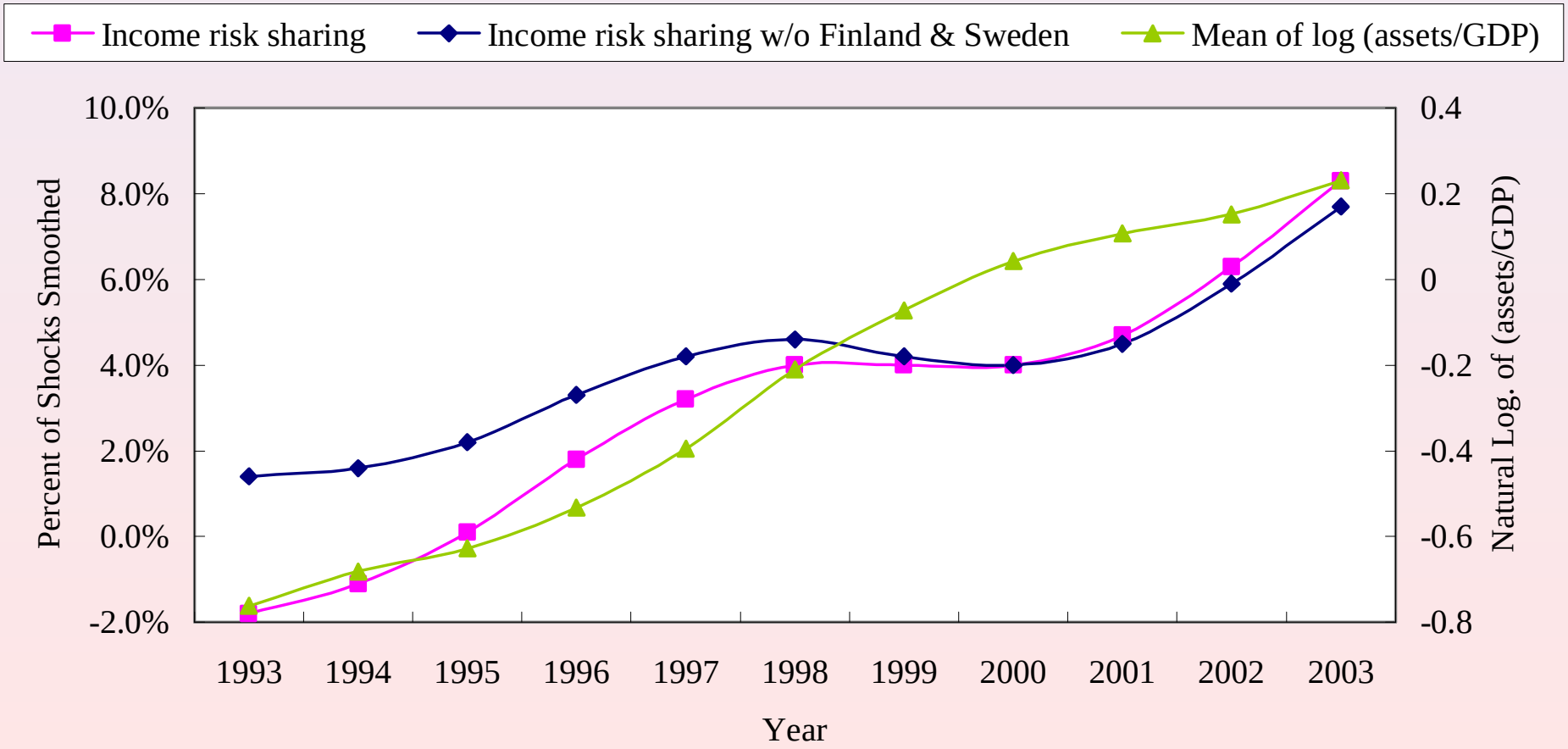
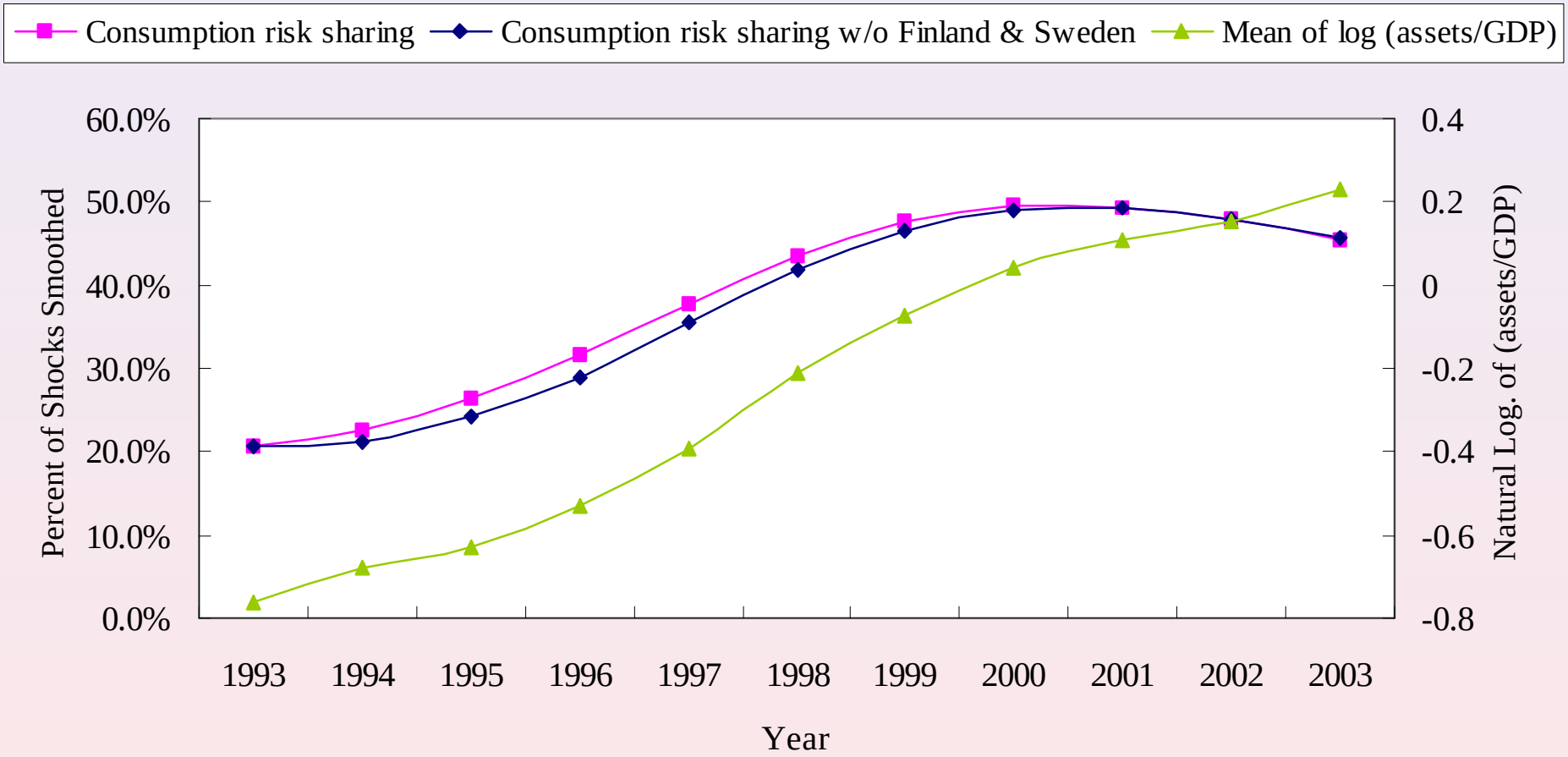


Figure 3: Consumption Risk Sharing and Foreign Asset Holdings in the OECD



Notes. Mean of log (assets/GDP) is the cross-sectional mean of foreign (equity+debt+FDI) holdings normalized by GDP for 24 OECD countries. The countries comprise the subset of OECD for which data are available (see text). Risk sharing is estimated cross-sectionally year-by-year and is smoothed by using a Normal kernel with bandwidth (standard deviation) equal to 2.

Risk sharing-panel data estimation

In a panel data regression we can let the estimated coefficient vary with measures of home bias:

$$\kappa = \kappa_0 + \kappa_1 * (t - \bar{t}) + \kappa_2 * (\text{home bias}_{it})$$

In tables show *increase* in risk sharing: $1 - \kappa_0$, $-\kappa_1$, and $-\kappa_2$. Interest is on $-\kappa_2$
We include country fixed effects

Table 5
Risk Sharing and Home Bias: OECD 1993–2003

with country fixed effects	average risk sharing	interaction terms with GDP: trend	equity home bias	debt sec. home bias
Income Smoothing	2	0	–39	
	(1.02)	(0.02)	(4.19)	
	–1	0		–24
	(0.81)	(0.30)		(2.27)

Table 5-part 2
Risk Sharing and Home Bias: OECD 1993–2003

with country fixed effects	average risk sharing	interaction terms with GDP: trend	equity home bias	debt sec. home bias
Consumption Smoothing	57	2	–136	
	(15.06)	(2.09)	(5.48)	
	43	1		–6
	(10.46)	(0.94)		(0.22)

Share of foreign assets and risk sharing

Change in home bias, using measures of portfolio composition, is clearly correlated with income risk sharing, less clearly with consumption risk sharing.

Now focus on simpler measure of home bias: foreign assets to GDP (also look at liabilities)

Table 8 Income Risk Sharing and Foreign Asset Holdings/GDP

average risk sharing	trend	equity	debt	fdi	(equity +debt)	all assets
6	0	5				
(2.74)	(0.77)	(4.50)				
5	0		9			
(2.53)	(0.34)		(4.46)			
3	0			3		
(1.70)	(0.47)			(2.70)		
6	0				9	
(2.85)	(0.37)				(4.65)	
6	0					8
(2.75)	(0.47)					(4.35)

Table 8 part2 Cons. Risk Sharing

average risk sharing	trend	equity	debt	fdi	(equity +debt)	all assets
51	1	11				
(13.34)	(0.83)	(4.02)				
45	0		7			
(11.56)	(0.25)		(1.64)			
51	0			9		
(13.39)	(0.09)			(3.79)		
47	0				9	
(11.95)	(0.33)				(2.26)	
48	0					11
(12.34)	(0.45)					(2.74)

Risk sharing is clearly correlated with foreign asset holdings.

Very robust result.
DSGE two-good literature (Heathcote and Perri JPE 2014) shows home bias can be optimal hedge in models of the Backus-Smith/Kollman type—does not seem to square well with results here

Next: an attempt to sort out the relative contribution of various assets, but high correlation between asset categories.

Table 12
Income Smoothing and Foreign Asset and Liability Holdings Relative to GDP: OECD 1993–2003

interaction terms with GDP					
assets			liabilities		
equity	debt	fdi	equity	debt	fdi
6	7	–5	0	–1	4
(2.71)	(1.69)	(2.75)	(0.01)	(0.22)	(1.61)