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Risk-Sharing and Monetary Policy Transmission

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European Economic Association - June 2022
Panel on Euro Area Monetary Policy

Motivation

▷ The classic OCA literature establishes a clear division of labor between

- Monetary policy, in response to symmetric shocks.
- Risk-sharing, to facilitate adjustment to asymmetric shocks.

(Mundell, 1961; McKinnon, R., 1963; Kenen, 1969; Farhi & Werning, 2017)

▷ The interaction between these macroeconomic stabilization tools has been, so far, under-explored.

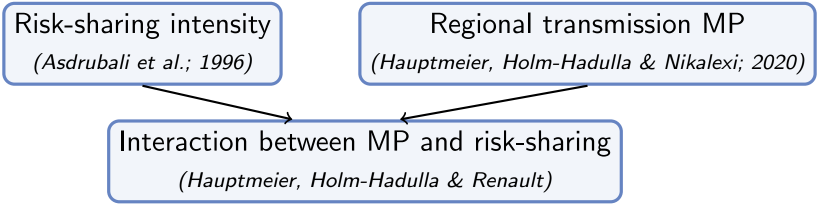
▷ If MP exerts a uniform impact, its role in limiting average economic fluctuations is unaffected by risk-sharing mechanisms.

▷ Increasing evidence that monetary policy transmits unevenly.
(Dedola and Lippi, 2005; Kaplan et al., 2018; Jordà et al., 2020)

▷ The overall impact of MP might be therefore dependent on the risk-sharing architecture.

▷ Does risk-sharing reinforce or dampen MP transmission?

This paper



Using regional-level data and LLPs (Jordà, 2005), we:

(1) Estimate the degree of risk-sharing in EA countries.
(Asdrubali et al.; 1996)

(2) Assess the effect of a MP shock on regional output, depending on:

- the level of risk-sharing in the country.
- and its breakdown into fiscal and market-based channels.

(3) Explore whether the interaction between MP and risk-sharing differs across poorer and richer regions.

Literature

This paper combines two strands of the literature:

▷ Estimation of risk-sharing intensity.

United States. Asdrubali et al. (1996), Athanasouslis & Van Wincoop (2001)

Euro-area. Sørensen & Yosha (1998), Hepp & Von Hagen (2013), Furceri & Zdzienicka (2015), Burriel et al. (2020), Cimadomo et al. (2020).

▷ Asymmetric effects of monetary policy.

Household level. Coibion et al. (2017), Ampudia et al. (2018), Lenza & Slacalek (2018).

Industry level. Peersman & Smets (2005), Dedola & Lippi (2005).

Regional level. Hauptmeier et al. (2020).

State of the economy. Tenreyro & Thwaites (2016), Jordà et al. (2020), Alpanda et al. (2021), Eichenbaum et al. (2022).

Risk-sharing in euro area countries

Risk-sharing estimation

Main idea: under complete markets, consumption growth should not vary with the region's business cycle.

(Mace, 1991; Cochrane, 1991, Townsend, 1994).

$$\Delta \log C_t^k = \alpha_t + \beta \Delta \log Y_t^k + \varepsilon_t^k$$

Incomplete smoothing if $\beta > 0$.

Asdrubali et al. (1996) propose a methodology that decomposes the risk-sharing equation into a system. ▸ Back

$$\underbrace{\text{GDP} \rightarrow \text{Primary income}}_{\text{Factor market channel}} \rightarrow \underbrace{\text{Disposable income} \rightarrow \text{Consumption}}_{\text{Credit market channel}}$$

$$\underbrace{\text{Primary income} \rightarrow \text{Disposable income}}_{\text{Fiscal channel}}$$

Regional data: Eurostat & Oxford Economics.

(10 EA countries, 155 regions, 2000-2018 ▸ Data sources ▸ NUTS)

Risk-sharing estimation ▸ Methodology

Estimate the below equations, country-by-country, by panel OLS:

Factor market channel

$$\Delta gdp_t^k - \Delta pi_t^k = \beta_K \times \Delta gdp_t^k + \alpha_{K,t} + \varepsilon_{K,t}^k$$

Fiscal channel

$$\Delta pi_t^k - \Delta di_t^k = \beta_F \times \Delta gdp_t^k + \alpha_{F,t} + \varepsilon_{F,t}^k$$

Credit market channel

$$\Delta di_t^k - \Delta c_t^k = \beta_C \times \Delta gdp_t^k + \alpha_{C,t} + \varepsilon_{C,t}^k$$

Unsmoothed

$$\Delta c_t^k = \beta_U \times \Delta gdp_t^k + \alpha_{U,t} + \varepsilon_{U,t}^k$$

$\beta_K + \beta_F + \beta_C \; (= \beta_S) = 1 - \beta_U$

β-coefficients are the amount of risk-sharing achieved by the regions in the country.

Risk-sharing estimation using differentiated data ▸ Regression table

The amount of risk-sharing may vary with the length of the shock. *(ASY, 1996).*

Following ASY (1996), we run the previous equations with differentiated data using intervals $j = 1, \ldots, 5$.

$$\Delta^j gdp_t^k - \Delta^j pi_t^k = \beta_{K,j}^c \times \Delta^j gdp_t^k + \alpha_{K,t} + \varepsilon_{K,t}^k$$

where $\Delta^j x_t^k = x_t^k - x_{t-j}^k$.

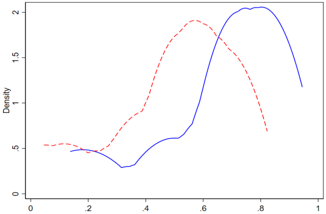
Hence, $\beta_{K,j}^c$ is the share of shocks smoothed by the factor market channel for regions in country c after j periods.

Risk-sharing estimation

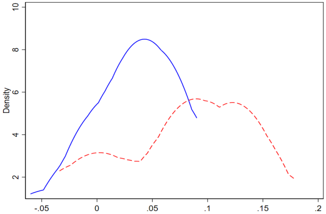
Densities of the country-specific β-coefficients for all EA countries.

Intervals $j = 1$ and $j = 5$

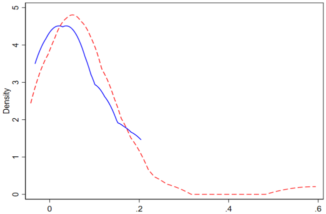
β_K^c Factor market channel



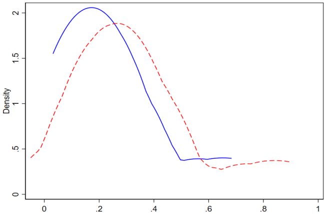
β_F^c Fiscal channel



β_C^c Credit market channel



β_U^c Unsmoothed



Risk-sharing & monetary policy

How does risk-sharing interact with monetary policy?

We augment Hauptmeier et al. (2020) LLP framework with risk-sharing :

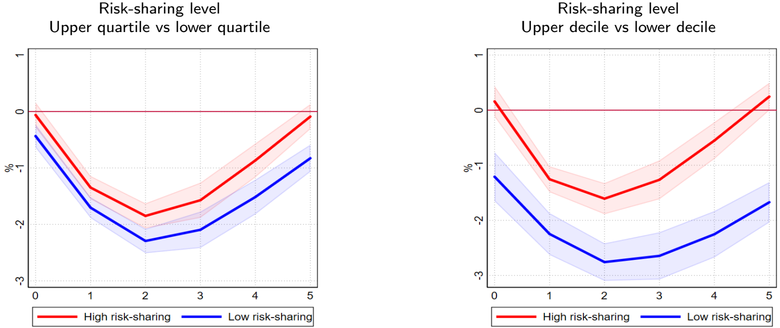
$$y_{k,t+h} = \alpha_{k,h} + \left(\kappa_{0,h} + \kappa_{S,h} \times \beta^{c}_{S,h}\right) i_t + \gamma_h \mathbf{X}_{k,t} + \delta_h \mathbf{X}_{c,t} + \theta_h \mathbf{X}_t + \varepsilon_{k,t+h}$$

- ▷ $y_{k,t+h}$: log GDP in region k in year $t+h$
  (Source: Eurostat Regional dataset; NUTS-2 level)
- ▷ i_t: euro area short-term interest rate (AWM database), extended from 2014 using the Lemke & Vladu (2017) shadow interest rate
- ▷ $\beta^{c}_{S,h}$: risk-sharing achieved in country c after h periods
- ▷ Controls: (i) region-specific: $\mathbf{X}_{k,t}$, (ii) country-specific: $\mathbf{X}_{c,t}$ and (iii) euro area-specific: $\mathbf{X}_t$ ▸ Control variables
- ▷ Sample consists of 155 regions over 18 years
- ▷ Bootstrapped Driscoll and Kraay standard errors

▸ Hauptemeier et al (2020) ▸ Identification ▸ Generated regressor

Results

$$\frac{\partial y_{k,t+h}}{\partial i_t} = \kappa_{0,h} + \kappa_{S,h} \times \beta^c_{S,h}$$



Note: Vertical axis refers to impact of 100 basis point rate hike on regional GDP (in %). Horizontal axis refers to horizon of IRF (in years). Solid lines denote point estimates and shaded areas denote 90% confidence bands. Red (blue) lines depict the estimates for the upper (lower) quartiles or deciles of $\hat{\beta}^c_{S,h}$. The Driscoll-Kraay standard errors are boostrapped using 1000 iterations.

▸ Table results

Interrelation of private and public risk-sharing

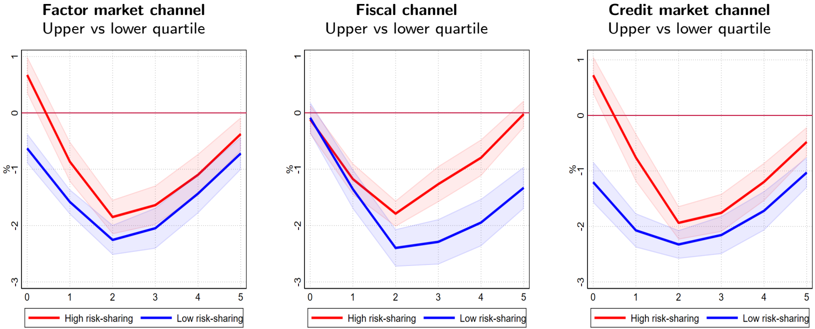
We break down aggregate risk-sharing by channels:

$$y_{k,t+h} = \alpha_{k,h} + \left(\kappa_{0,h} + \kappa_{K,h} \times \beta^{c}_{K,h} + \kappa_{F,h} \times \beta^{c}_{F,h} + \kappa_{C,h} \times \beta^{c}_{C,h}\right) i_t + \text{Controls} + \varepsilon_{k,t+h}$$

- $y_{k,t+h}$: log GDP in region k in year $t+h$
- i_t: euro area short-term interest rate (AWM database), extended from 2014 using the Lemke & Vladu (2017) shadow interest rate
- $\beta^{c}_{K,h}$, $\beta^{c}_{F,h}$, $\beta^{c}_{C,h}$: risk-sharing achieved in country c after h periods through fiscal and market-based channels
- Controls same as before

Generated regressor

Results



Note: Vertical axis refers to impact of 100 basis point rate hike on regional GDP (in %). Horizontal axis refers to horizon of IRF (in years). Solid lines denote point estimates and shaded areas denote 90% confidence bands. Red (blue) lines depict the estimates for the upper (lower) quartiles of $\beta^c_{K,h}$, $\beta^c_{F,h}$ or $\beta^c_{C,h}$. The Driscoll-Kraay standard errors are boostrapped using 1000 iterations.

▸ Table results ▸ Upper vs lower decile

Interpretations

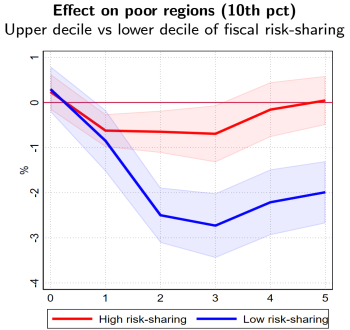
- The channels differ in their time profile:
  - Private risk-sharing dampens MP up to one year after the shock.
  - Fiscal risk-sharing mitigate the MP shock over longer horizons.
- As downturns become more persistent, banks gradually pare back their lending activity (Asdrubali et al. 1996).
- Similarly, HH may be forced to divest their international asset holdings as the downturn drags.
- Lagged fiscal response to changing economic circumstances consistent with:
  - Discretionary fiscal policies (Asdrubali et al. 1996 ; Buettner, 2002).
  - Sluggish automatic stabilizers (Bouadballah et al, 2020).
- The results point to complementarities between private and public risk-sharing channels over time.

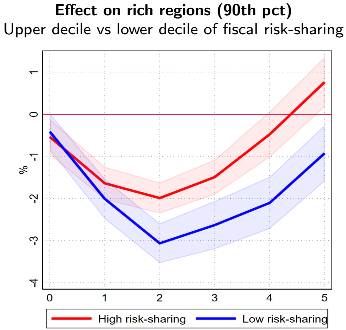
Heterogeneity across regions

- ▷ Explore whether the interaction of risk-sharing with the transmission of MP varies between poor and rich regions.
- ▷ Given its redistributive character, we focus on fiscal risk-sharing.
- ▷ Fiscal instruments may attenuate disposable income fluctuations and stabilize consumption and output (Brown, 1955).
- ▷ The stabilization role of fiscal policy may be reinforced if targeted towards agents with larger MPC (Blinder, 1975; Parker et al, 2011).
- ▷ As poorer geographical units tend to host a larger share of vulnerable agents, these mechanisms may also operate at the regional level (Hauptmeier et al., 2020).

Heterogeneity across regions

- ▷ Quantify the dynamic impact of exogenous changes in MP across the regional GDP distribution for different levels of risk-sharing.
- ▷ Combine Jordà (2005)'s LP method with quantile estimation techniques.





Note: Vertical axis refers to impact of 100 basis point rate hike on regional GDP (in %). Horizontal axis refers to horizon of IRF (in years). Solid lines denote point estimates and shaded areas denote 90% confidence bands. Red (blue) lines depict the estimates for the upper (lower) deciles of $\hat{\beta}^{c}_{F,h}$ in poor (10th percentile) and rich (90th percentile) regions. Standard errors are clustered at the time and regional-level and are boostrapped using 1000 iterations.

▸ Quantile regressions ▸ IRFs - Factor markets ▸ IRFs - Credit markets

Interpretation

- ▷ Pronounced differences in the degree to which fiscal risk-sharing shapes the transmission of MP to rich vs. poor regions.
- ▷ With weak fiscal risk-sharing, GDP in poor regions exhibit a strong and persistent contraction.
- ▷ Strong fiscal risk-sharing also dampens the MP shock for rich regions, but the persistence is much less accentuated than for poor regions.
- ▷ Risk-sharing is forceful in preempting long-lived hysteresis effects of MP in poor regions.

Conclusion

Our results show:

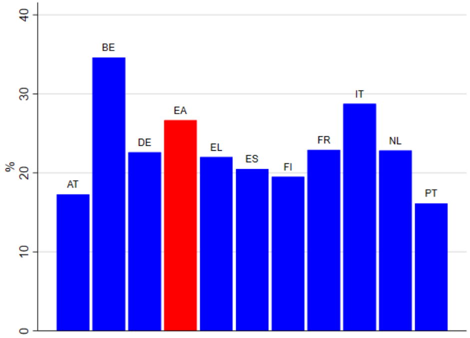
- ▷ Risk-sharing shapes the real effects of MP shocks
  - ▷ With high risk-sharing, regions experience a shallower output contraction...
  - ▷ and are less prone to hysteresis.
- ▷ Public risk-sharing benefits poor regions by shielding them against hysteresis.
- ▷ Fiscal and market-based risk-sharing emerge as complements.
- ▷ Provide support on the merits of deeper fiscal and financial integration in the EA (Bénassy-Quéré et al., 2018 ; Draghi, 2018 ; Lane, 2021).

Thank you!

Appendix

Regional disparities arise both within and between EA countries

Figure: Coefficient of variation of real GDP per capita (2018)



Note: The coefficient of variation (CV) is calculated as the ratio of the standard deviation to the mean of all NUTS-2 regions within each country in 2018. The red bar indicates the CV of all EA countries, using national real GDP per capita in 2018.

Channels of risk-sharing ▸ Back

Factor market channel: the wedge between **output** and **primary income** corresponds to the net income streams (capital and labour) receivable from and payable to other regions and countries.

Fiscal channel: the wedge between **primary** and **disposable income** stems from the difference between tax payments to and transfer payments from the government.

Credit market channel: the wedge between **disposable income** and **consumption** reflects economic agents' debt accumulation minus savings in each period.

Asdrubali et al. (1996) methodology ▸ Back

Starting the accounting identity,

$$GDP^k = \frac{GDP^k}{PI^k}\frac{PI^k}{DI^k}\frac{DI^k}{C^k}C^k$$

where k is an index of regions.

Taking logs and differences of the identity, multiply both sides by $\Delta \log GDP$, and take the cross-sectional average to obtain the variance decomposition

$$\begin{aligned}\text{var}\{\Delta gdp\} =& \text{cov}\{\Delta gdp, \Delta gdp - \Delta pi\} \\ &+ \text{cov}\{\Delta gdp, \Delta pi - \Delta di\} \\ &+ \text{cov}\{\Delta gdp, \Delta di - \Delta c\} \\ &+ \text{cov}\{\Delta gdp, \Delta c\}\end{aligned}$$

where gdp, pi, di and c are in log values and in real terms.

Asdrubali et al. (1996) methodology
Back

We obtain the following relation by dividing by var$\{\Delta gdp\}$ and rearranging:

$$\beta_K + \beta_F + \beta_C = 1 - \beta_U$$

where

$$\beta_K = \text{cov}\{\Delta gdp, \Delta gdp - \Delta pi\}/\text{var}\{\Delta gdp\}$$
$$\beta_F = \text{cov}\{\Delta gdp, \Delta pi - \Delta di\}/\text{var}\{\Delta gdp\}$$
$$\beta_C = \text{cov}\{\Delta gdp, \Delta di - \Delta c\}/\text{var}\{\Delta gdp\}$$
$$\beta_U = \text{cov}\{\Delta gdp, \Delta c\}/\text{var}\{\Delta gdp\}$$

β_K is the OLS estimate of the slope in the cross-sectional regression of $\Delta \log GDP$ on $\Delta \log GDP - \Delta \log PI$

List of variables and controls ▸ Back

Time sample: 2000 to 2018, annual frequency

Country sample: Austria, Belgium, Finland, France, Germany, Greece, Italy, Netherlands, Portugal, Spain.

	Variable	Level	Note	Source
Risk-sharing	GDP	Regional	ln	Eurostat
	Primary income	Regional	ln	Eurostat
	Disposable income	Regional	ln	Eurostat
	Consumption	Regional	ln	Oxford Economics
Monetary policy	Short-term interest rate	Euro area	percent per annum	AWM database
	Shadow interest rate	Euro area	percent per annum	Lemke & Vladu (2017)
Control variables	Population	Regional	ln	Eurostat
	HICP	National	ln	Eurostat
	Stock market index	National	ln	OECD
	Government debt	National	% of GDP	Eurostat
	10y gov bond yield	National		ECB
	Structural primary balance	National	First-diff	AMECO
	GDP	Euro area	ln	Eurostat
	HICP	Euro area	ln	Eurostat

NUTS classification ▸ Back

The NUTS classification breaks down the EU Member States into four levels.

- The highest level (NUTS-0) corresponds to the nation state.
- The lower levels (NUTS-1 to NUTS-3) subdivide national territories into ever more granular units based on population thresholds and existing administrative structures.

Our analysis uses NUTS-2 data, which offer the most granular regional breakdown with sufficient variable coverage to estimate the degree of risk-sharing within each country.

NUTS-2 regions are defined as hosting between 800,000 and 3,000,000 inhabitants and typically refer to Provinces, Regions and, in some cases, States.

Descriptive statistics

	GDP		Prim. income		Disp. income		Consumption	
	Mean	*CV*	*Mean*	*CV*	*Mean*	*CV*	*Mean*	*CV*
Austria	41,128	17	26,628	5	22,545	3	20,860	2
Belgium	36,521	35	24,708	14	19,918	9	19,255	6
Finland	40,929	20	24,237	16	21,205	9	21,590	11
France	29,859	23	21,145	12	19,047	6	17,568	4
Germany	37,345	23	26,398	16	21,174	9	19,508	7
Greece	14,494	22	9,988	17	9,774	12	11,127	8
Italy	28,190	29	18,612	26	17,088	20	17,272	20
Netherlands	39,254	23	25,209	10	18,866	5	18,324	4
Portugal	18,507	19	11,339	16	11,619	13	11,824	9
Spain	23,982	21	15,273	20	14,245	17	13,952	18
Euro area	29,664	27	20,888	30	17,727	24	17,225	20

Note: Figures refer to real per capita GDP, primary income, disposable income and consumption in 2018 at the NUTS-2 level, except for the euro area row, which is based on NUTS-0 (country-level) data. The coefficient of variation (CV) is computed as the ratio of the standard deviation to the mean of all NUTS-2 (NUTS-0) units within each country (the euro area) in 2018.

Estimation of the β_K^c-coefficients using differentiated data ‣ Back

	j = 0	j = 1	j = 2	j = 3	j = 4	j = 5
AT	0.568***	0.461***	0.350	0.320	0.327	0.301
	[0.105]	[0.165]	[0.223]	[0.251]	[0.286]	[0.291]
BE	0.736***	0.802***	0.730***	0.772***	0.725***	0.737***
	[0.121]	[0.179]	[0.191]	[0.229]	[0.221]	[0.254]
DE	0.785***	0.707***	0.679***	0.645***	0.643***	0.611***
	[0.0583]	[0.0540]	[0.0529]	[0.0485]	[0.0458]	[0.0464]
EL	0.756***	0.793***	0.717***	0.650***	0.549*	0.464
	[0.115]	[0.153]	[0.204]	[0.241]	[0.288]	[0.296]
ES	0.138**	0.0780	0.0653	0.0601	0.0523	0.0458
	[0.0541]	[0.0495]	[0.0458]	[0.0410]	[0.0394]	[0.0382]
FI	0.824***	0.638***	0.506***	0.499***	0.495***	0.469***
	[0.0456]	[0.0896]	[0.103]	[0.109]	[0.0991]	[0.142]
FR	0.811***	0.706***	0.706***	0.690***	0.637***	0.635***
	[0.0919]	[0.0871]	[0.0941]	[0.107]	[0.128]	[0.142]
IT	0.539***	0.443***	0.412***	0.397***	0.386***	0.423***
	[0.0317]	[0.0317]	[0.0374]	[0.0448]	[0.0522]	[0.0511]
NL	0.944***	0.977***	1.058***	0.997***	0.926***	0.823***
	[0.0699]	[0.0699]	[0.146]	[0.133]	[0.119]	[0.115]
PT	0.295*	0.157	0.0920	0.0433	0.0471	0.0666
	[0.179]	[0.136]	[0.110]	[0.115]	[0.117]	[0.148]
Observations	2790	2635	2480	2325	2170	2015

Note:This table reports the estimation of β_K using differentiated intervals, $j = 0 \ldots 5$. Standard errors are bootstrapped using 1000 iterations. * / ** / *** indicate 1% / 5% / 10% significance level.

Estimation of the β_F^c-coefficients using differentiated data ▸ Back

	j = 0	j = 1	j = 2	j = 3	j = 4	j = 5
AT	0.0587***	0.0664*	0.0533	0.0372	0.0350	0.0302
	[0.0193]	[0.0363]	[0.0546]	[0.0741]	[0.0866]	[0.0988]
BE	0.0340	-0.00729	-0.0346	-0.0321	-0.0324	-0.0338
	[0.0380]	[0.0696]	[0.0610]	[0.0743]	[0.0712]	[0.0809]
DE	0.0186	0.0486***	0.0737***	0.0862***	0.0895**	0.106**
	[0.0137]	[0.0172]	[0.0233]	[0.0333]	[0.0390]	[0.0469]
EL	-0.00928	0.00924	0.0574	0.0970	0.0906	0.0865
	[0.0868]	[0.0829]	[0.0806]	[0.0863]	[0.108]	[0.126]
ES	0.0383	0.0314	0.0275	0.0126	0.000426	-0.0115
	[0.0324]	[0.0392]	[0.0502]	[0.0589]	[0.0567]	[0.0607]
FI	0.0902	0.102***	0.0462	0.0197	-0.00499	-0.0139
	[0.0559]	[0.0288]	[0.0515]	[0.0625]	[0.0613]	[0.0615]
FR	0.0684**	0.0978***	0.101***	0.105***	0.154***	0.178***
	[0.0339]	[0.0295]	[0.0279]	[0.0340]	[0.0386]	[0.0435]
IT	0.0810***	0.112***	0.123***	0.122***	0.121***	0.113***
	[0.0295]	[0.0307]	[0.0309]	[0.0315]	[0.0375]	[0.0428]
NL	-0.0599	-0.0147	0.0427	0.0393	0.0383	0.0433
	[0.0889]	[0.111]	[0.110]	[0.111]	[0.114]	[0.120]
PT	0.0317	0.0562	0.0530	0.0800	0.0931	0.0943
	[0.0916]	[0.0872]	[0.0938]	[0.115]	[0.107]	[0.103]
Observations	2787	2631	2476	2321	2167	2013

Note: This table reports the estimation of β_F using differentiated intervals, $j = 0 \ldots 5$. Standard errors are bootstrapped using 1000 iterations. * / ** / *** indicate 1% / 5% / 10% significance level.

Estimation of the β_C^c-coefficients using differentiated data ▸ Back

	j = 0	j = 1	j = 2	j = 3	j = 4	j = 5
AT	0.0699	0.102	0.143*	0.173**	0.182*	0.204*
	[0.0575]	[0.0672]	[0.0855]	[0.0880]	[0.0972]	[0.104]
BE	0.0107	0.0196	0.0261*	0.0112	0.0240	0.0318
	[0.0234]	[0.0150]	[0.0159]	[0.0226]	[0.0258]	[0.0321]
DE	-0.0109	-0.0158	-0.00824	0.00240	0.00327	0.00475
	[0.0107]	[0.0155]	[0.0156]	[0.0155]	[0.0162]	[0.0170]
EL	0.0378	0.0307	0.0441	0.0572	0.0930	0.122
	[0.0422]	[0.0370]	[0.0441]	[0.0608]	[0.0726]	[0.0839]
ES	0.141	0.0956	0.0791	0.0631	0.0690	0.0691
	[0.0874]	[0.0971]	[0.115]	[0.123]	[0.131]	[0.137]
FI	0.0537	0.201***	0.468**	0.568**	0.582**	0.595**
	[0.0598]	[0.0710]	[0.215]	[0.287]	[0.292]	[0.279]
FR	0.0404*	0.0595**	0.0477*	0.0491	0.0542	0.0478
	[0.0240]	[0.0236]	[0.0282]	[0.0323]	[0.0393]	[0.0427]
IT	0.204***	0.182***	0.154**	0.140*	0.133	0.109
	[0.0452]	[0.0598]	[0.0744]	[0.0790]	[0.0914]	[0.103]
NL	-0.0328	-0.0532	-0.0739	-0.0666	-0.0529	-0.0424
	[0.0436]	[0.0430]	[0.0524]	[0.0586]	[0.0546]	[0.0501]
PT	0.104**	0.125***	0.131**	0.145**	0.141*	0.149*
	[0.0494]	[0.0480]	[0.0598]	[0.0666]	[0.0735]	[0.0843]
Observations	2787	2631	2476	2321	2167	2013

Note: This table reports the estimation of β_C using differentiated intervals, $j = 0 \ldots 5$. Standard errors are bootstrapped using 1000 iterations. * / ** / *** indicate 1% / 5% / 10% significance level.

Estimation of the β_U^c-coefficients using differentiated data ▸ Back

	j = 0	j = 1	j = 2	j = 3	j = 4	j = 5
AT	0.304***	0.371***	0.454***	0.469***	0.456***	0.464***
	[0.0706]	[0.0943]	[0.125]	[0.135]	[0.153]	[0.160]
BE	0.220	0.185	0.278	0.249	0.283	0.265
	[0.147]	[0.193]	[0.181]	[0.207]	[0.194]	[0.213]
DE	0.207***	0.260***	0.255***	0.267***	0.264***	0.278***
	[0.0555]	[0.0431]	[0.0371]	[0.0347]	[0.0331]	[0.0355]
EL	0.203**	0.155	0.182	0.188	0.245	0.296
	[0.0971]	[0.117]	[0.136]	[0.184]	[0.216]	[0.281]
ES	0.683***	0.795***	0.828***	0.864***	0.878***	0.897***
	[0.105]	[0.0957]	[0.106]	[0.113]	[0.124]	[0.145]
FI	0.0320	0.0589	-0.0198	-0.0874	-0.0721	-0.0497
	[0.0570]	[0.0889]	[0.138]	[0.202]	[0.204]	[0.253]
FR	0.0802	0.137***	0.146**	0.156*	0.155*	0.139
	[0.0623]	[0.0507]	[0.0651]	[0.0819]	[0.0929]	[0.105]
IT	0.176***	0.263***	0.311***	0.341***	0.360***	0.356***
	[0.0268]	[0.0534]	[0.0739]	[0.0834]	[0.107]	[0.112]
NL	0.148	0.0913	-0.0266	0.0307	0.0888	0.176
	[0.0939]	[0.0684]	[0.102]	[0.117]	[0.134]	[0.150]
PT	0.570***	0.662***	0.724***	0.732***	0.718***	0.690***
	[0.171]	[0.125]	[0.115]	[0.146]	[0.131]	[0.133]
Observations	2790	2635	2480	2325	2170	2015

Note: This table reports the estimation of β_U using differentiated intervals, $j = 0 \ldots 5$. Standard errors are bootstrapped using 1000 iterations. * / ** / *** indicate 1% / 5% / 10% significance level.

Generated regressor ▸ Back

When an estimated regressor is subject to sampling error, i.e. a generated regressor, the ordinary least squares (OLS) estimator is potentially biased (Pagan, 1984; Murphy & Topel, 1985). Consider a simple model:

$$y_i = \alpha_i \cdot \beta + \mathbf{X}_i \gamma + \varepsilon_i$$

Suppose that α_i is unknown and needs to be estimated by its sample counterpart $\hat{\alpha}_i$. Because $\hat{\alpha}_i$ differs from α_i as a result of sampling error, we write:

$$\hat{\alpha}_i = \alpha_i + u_i$$

where u_i is the sampling error. Therefore,

$$y_i = \hat{\alpha}_i \cdot \beta + \mathbf{X}_i \gamma + \tilde{\varepsilon}_i \quad \tilde{\varepsilon}_i = \varepsilon_i - u_i \cdot \beta$$

We follow the literature (Wooldridge, 2014) in bootstrapping both stages of the procedure

1. the estimation of risk-sharing
2. the LLPs

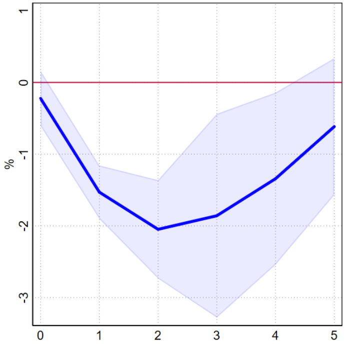
.

Baseline model and results ‣ Back

Hauptmeier et al (2020)

$$y_{k,t+h} = \alpha_{k,h} + \kappa_h i_t + \gamma_h \mathbf{X}_{k,t} + \delta_h \mathbf{X}_{c,t} + \theta_h \mathbf{X}_t + \varepsilon_{k,t+h}$$

Figure: Impact of monetary policy on regional output



Note: Vertical axis refers to impact of 100 basis point rate hike on regional GDP (in %). Horizontal axis refers to horizon of IRF (in years). Solid lines denote point estimates and shaded areas denote 90% confidence bands.

Identification ▸ Back

- Monetary policy is by construction endogenous to economic prospects
- Regionally disaggregated data offer a novel answer to this identification challenge
- Regional conditions do not enter the central bank objective function
- So, controlling for macro and financial factors factors, variation in policy is exogenous to regional GDP
- **Robustness check:** results hold when running the same regressions without the 20 largest regions.

> "*[The ECB's] single monetary policy will adopt a euro area-wide perspective; it will not react to specific regional or national developments*"

ECB Governing Council Press Release, 13 October 1998

Risk-sharing and monetary policy - results table Back

Table: Baseline estimates for coefficients on the short-term interest rate and the interaction with the fraction of shared risk .

	$h = 0$	$h = 1$	$h = 2$	$h = 3$	$h = 4$	$h = 5$
i_t	-0.331***	-1.593***	-2.092***	-1.853***	-1.279***	-0.556***
	(0.121)	(0.111)	(0.124)	(0.181)	(0.183)	(0.134)
$i_t \times \hat{\beta}^c_{S,h}$	0.486***	0.364***	0.387***	0.477***	0.582***	0.681***
	(0.136)	(0.115)	(0.108)	(0.109)	(0.108)	(0.101)
Observations	2945	2790	2635	2480	2325	2170
Within R2	0.705	0.698	0.663	0.595	0.529	0.514
Number of regions	155	155	155	155	155	155

Note: This table reports the estimation of the baseline model when risk is shared. We do not report the estimations of the control variables. $\beta^c_{S,h}$ are standardized. The Driscoll and Kraay (1998) standard errors are given in parenthesis. Standard errors are bootstrapped using 1000 interactions. * / ** / *** indicate 1% / 5% / 10% significance level.

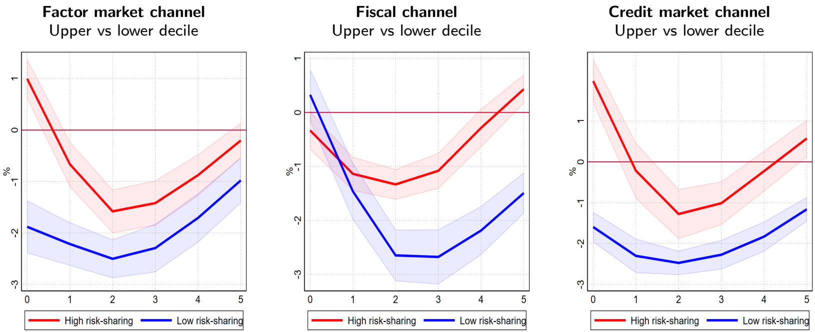
Risk-sharing and monetary policy - results table ▸ Back

Table: Baseline estimates for coefficients on the short-term interest rate and the interaction with the fraction of shared risk, through the different channels.

	$h=0$	$h=1$	$h=2$	$h=3$	$h=4$	$h=5$
i_t	-0.106	-1.290***	-2.051***	-1.842***	-1.272***	-0.562***
	(0.143)	(0.145)	(0.156)	(0.202)	(0.206)	(0.159)
$i_t \times \hat{\beta}^h_{K,h}$	1.177***	0.619***	0.348***	0.337***	0.297**	0.269**
	(0.192)	(0.164)	(0.131)	(0.124)	(0.132)	(0.124)
$i_t \times \hat{\beta}^h_{F,h}$	-0.0335	0.114	0.536***	0.648***	0.735***	0.759***
	(0.169)	(0.181)	(0.117)	(0.121)	(0.110)	(0.107)
$i_t \times \hat{\beta}^h_{C,h}$	1.293***	0.813***	0.396**	0.491***	0.659***	0.716***
	(0.216)	(0.234)	(0.177)	(0.137)	(0.135)	(0.135)
Observations	2945	2790	2635	2480	2325	2170
Within R2	0.735	0.716	0.680	0.613	0.550	0.533
Number of regions	155	155	155	155	155	155

Note: This table reports the estimation of equation **??**. We do not report the estimations of the control variables. $\hat{\beta}^c_{K,h}$, $\hat{\beta}^c_{F,h}$, $\hat{\beta}^c_{C,h}$ are standardized. Driscoll-Kraay standard errors are given in parenthesis. Standard errors are bootstrapped using 1000 interactions. * / ** / *** indicate 1% / 5% / 10% significance level.

IRFS for 10th vs 90th pct of risk-sharing ▸ Back



Note: Vertical axis refers to impact of 100 basis point rate hike on regional GDP (in %). Horizontal axis refers to horizon of IRF (in years). Solid lines denote point estimates and shaded areas denote 90% confidence bands. Red (blue) lines depict the estimates for the upper (lower) deciles of $\beta^c_{K,h}$ / $\beta^c_{F,h}$ / $\beta^c_{C,h}$. Driscoll-Kraay standard errors are boostrapped using 100 iterations.

Quantile regressions ▸ Back

- ▷ Quantile regression models characterize the entire conditional distribution of a dependent variable conditional on a set of regressors (Koenker & Basset , 1978).

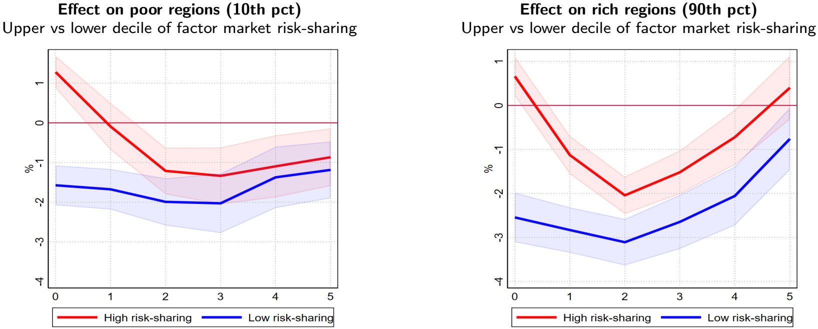
- ▷ Provide a flexible way to explore heterogeneity in the response of MP and its interaction with risk-sharing.

- ▷ In the presence of fixed effects, quantile estimation suffers from incidental parameter problems (Lancaster, 2000).

- ▷ To address this issue, we emplow the quantiles-via-moments estimator by Machado & Santos Silva (2019).

Risk-sharing, inequality and monetary policy ▸ Back

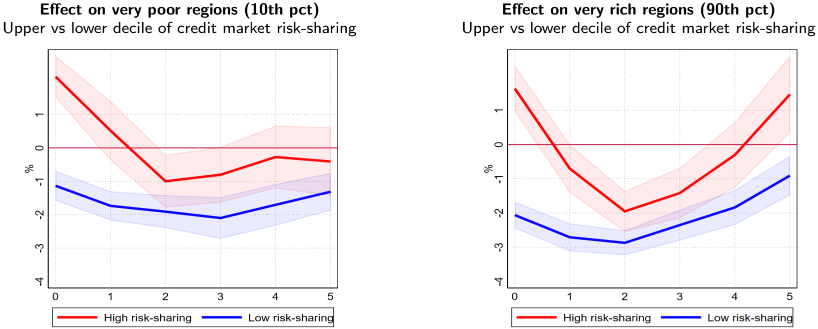
Study the effect of monetary policy on poor vs rich regions, depending on levels of risk-sharing through factor markets.



Note: Vertical axis refers to impact of 100 basis point rate hike on regional GDP (in %). Horizontal axis refers to horizon of IRF (in years). Solid lines denote point estimates and shaded areas denote 90% confidence bands. Red (blue) lines depict the estimates for the upper (lower) deciles of $\hat{\beta}^c_{K,h}$. Standard errors are clustered at the time and regional-level and are boostrapped using 1000 iterations.

Risk-sharing, inequality and monetary policy ‣ Back

Study the effect of monetary policy on poor vs rich regions, depending on levels of risk-sharing through credit markets.

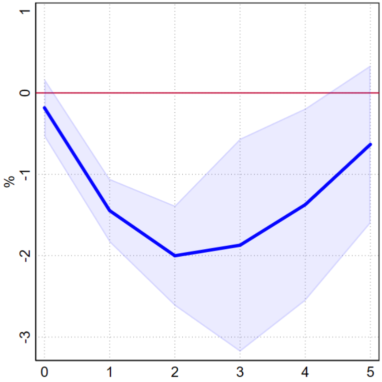


Note: Vertical axis refers to impact of 100 basis point rate hike on regional GDP (in %). Horizontal axis refers to horizon of IRF (in years). Solid lines denote point estimates and shaded areas denote 90% confidence bands. Red (blue) lines depict the estimates for the upper (lower) deciles of $\hat{\beta}^{c}_{C,h}$. Standard errors are clustered at the time and regional-level and are boostrapped using 1000 iterations.

Robustness checks

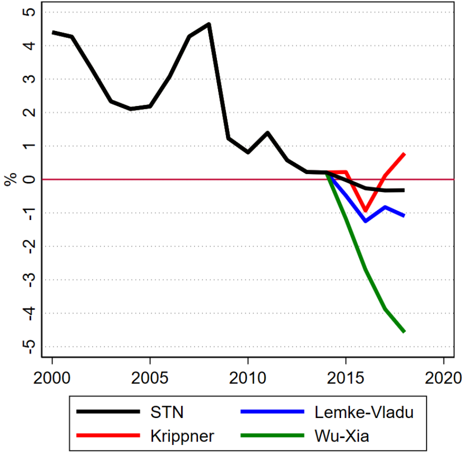
Excluding the largest regions

Impact of monetary policy on regional aggregates when excluding the largest regions



Note: Vertical axis refers to impact of 100 basis point rate hike on regional GDP (in %). Horizontal axis refers to horizon of IRF (in years). Solid lines denote point estimates and shaded areas denote 90% confidence bands. The 20 largest regions are excluded for each year.

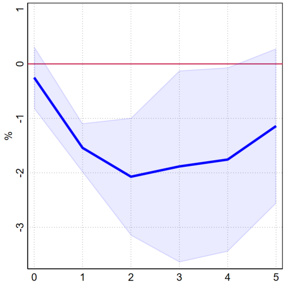
Shadow rates for the Euro area



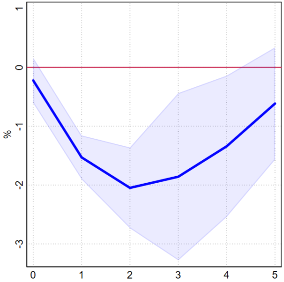
Note: The short-term interest rate (STN) is extended by adding the cumulative changes of the shadow rates developed by Lemke & Vladu (2017), Krippner (2015) and Wu-Xia (2017)

Shadow rates for the Euro area

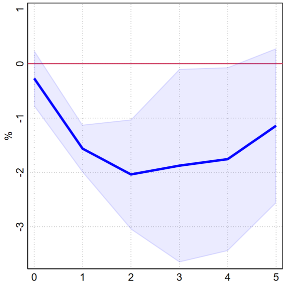
Short-term interest rate



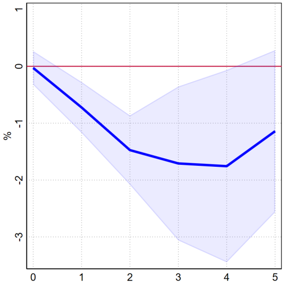
Lemke & Vladu (2017)



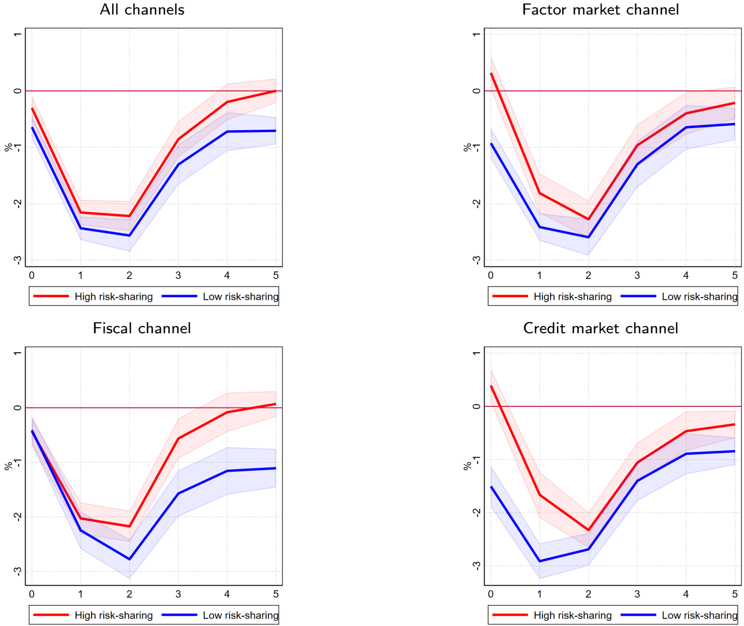
Krippner (2015)



Wu & Xia (2017)

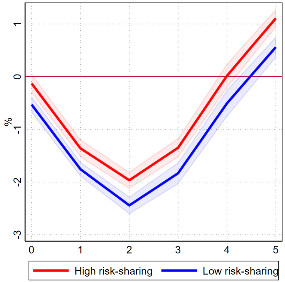


Adding oil prices and the real effective exchange rate

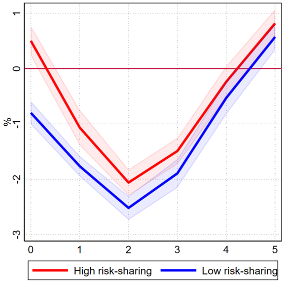


Alternative control variables

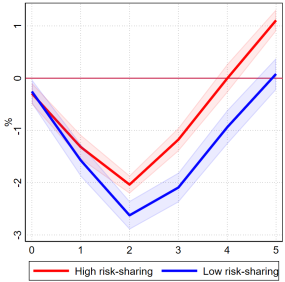
All channels



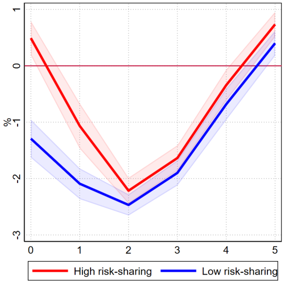
Factor market channel



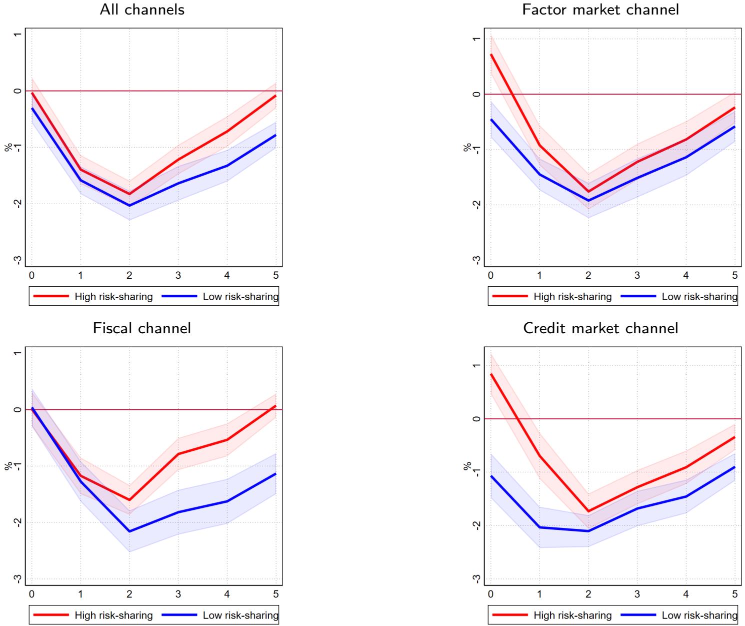
Fiscal channel



Credit market channel



Forward-looking variables



Does MP affects risk-sharing?

There is evidence that risk-sharing varies over the business cycle.
(Hoffmann & Stewen, 2011; Furceri & Zdzienicka, 2015)

Does the stance of MP influence risk-sharing?

We follow the approach of Hoffmann & Stewen (2011) and look at:

$$\Delta c_t^k = a_U \times \Delta gdp_t^k + b_U \Delta i_t \times \Delta gdp_t^k + \alpha_t + \varepsilon_{U,t}^k$$

so that $\beta_U(t) = a_U + b_U \times \Delta gdp_t^k$, the fraction of unshared risk that varies with Δi_t.

Does MP affects risk-sharing?

Table: Estimates for time-varying β_U-coefficients for EA countries

	AT	BE	DE	EL	ES	FI	FR	IT	NL	PT
Δgdp	0.280***	0.139	0.153***	0.212**	0.690***	-0.00175	0.0756	0.213***	0.202**	0.570***
	[0.0621]	[0.114]	[0.0479]	[0.0915]	[0.0995]	[0.0775]	[0.0587]	[0.0286]	[0.102]	[0.175]
$\Delta gdp \times \Delta\ i_t$	-0.0585	-0.0858	-0.0743***	0.0342	0.0718	-0.0290	-0.0172	0.0523	0.143*	0.182*
	[0.0567]	[0.121]	[0.0258]	[0.0443]	[0.0745]	[0.0473]	[0.0298]	[0.0421]	[0.0821]	[0.0939]
Observations	162	198	684	234	342	90	396	378	216	126

Note: This table reports the estimation of the standard risk-sharing equation, depending on the stance of monetary policy. Standard errors are reported in parenthesis and are bootstrapped using 100 iterations. * / ** / *** indicate 1% / 5% / 10% significance level.

$\Rightarrow$ No clear evidence that MP affects risk-sharing.