The Impact of the Russo-Ukrainian War and National Energy Subsidy on the EMU's Convergence

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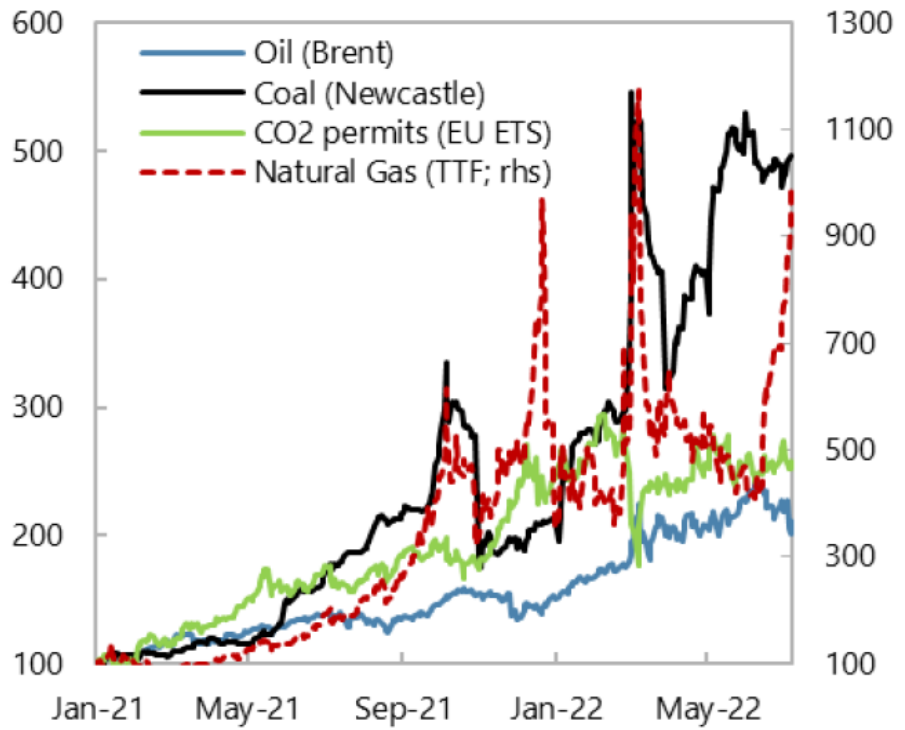
Introduction

- Global fossil fuel prices soared in early 2022 upon Russia's invasion of Ukraine.
- The natural gas prices are still higher than the pre-war period.
- Unstable prices will be a threat if the EU face a long-term war.
- BASF and steel have said to move out.

1-a. Primary Energy Commodity Prices
(Index 01/01/2021=100)



Sources: Bloomberg Finance L.P., and IMF staff calculations. Data as of July 7, 2022.

Introduction

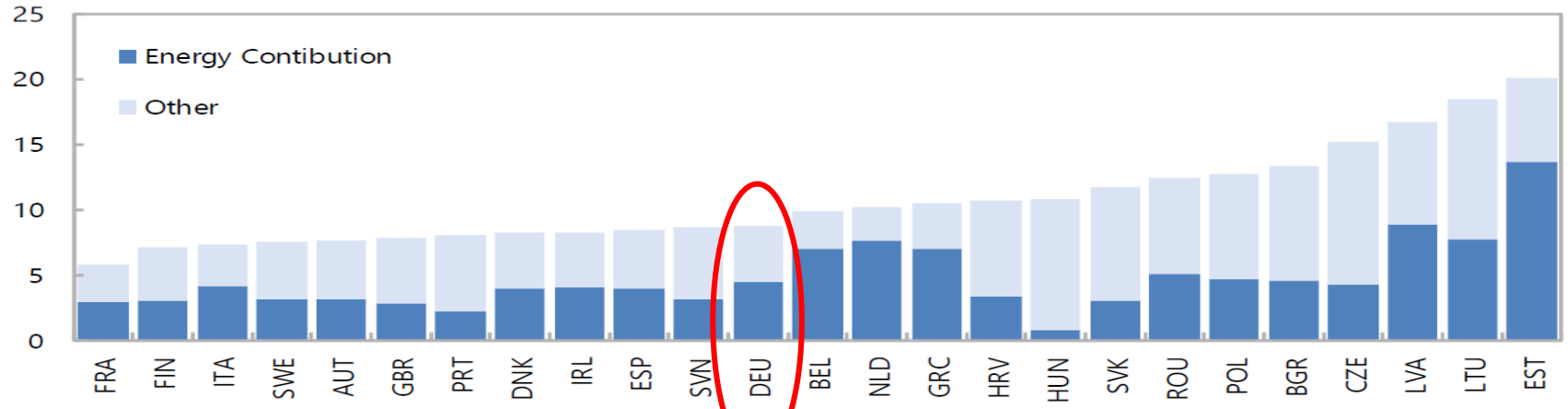
- EU imports of LNG from Russia increased by 40 percent between January and July this year compared with the same period in 2021, before Russia's full-scale invasion of Ukraine.
- The top three import Russian LNG: China, Belgium, Spain (spurious decoupling!).
- Due to energy supply worries, 32 percent of Germany's companies surveyed favored investment abroad.

Introduction

- The rise in energy prices substantially results in inflation in Europe.
- Differences in wholesale markets, regulations, policy measures, and contracting practices can help explain the cross-country variation in retail energy price inflation.

Figure 2. Contribution of Energy Prices to Consumer Price Inflation, May 2022

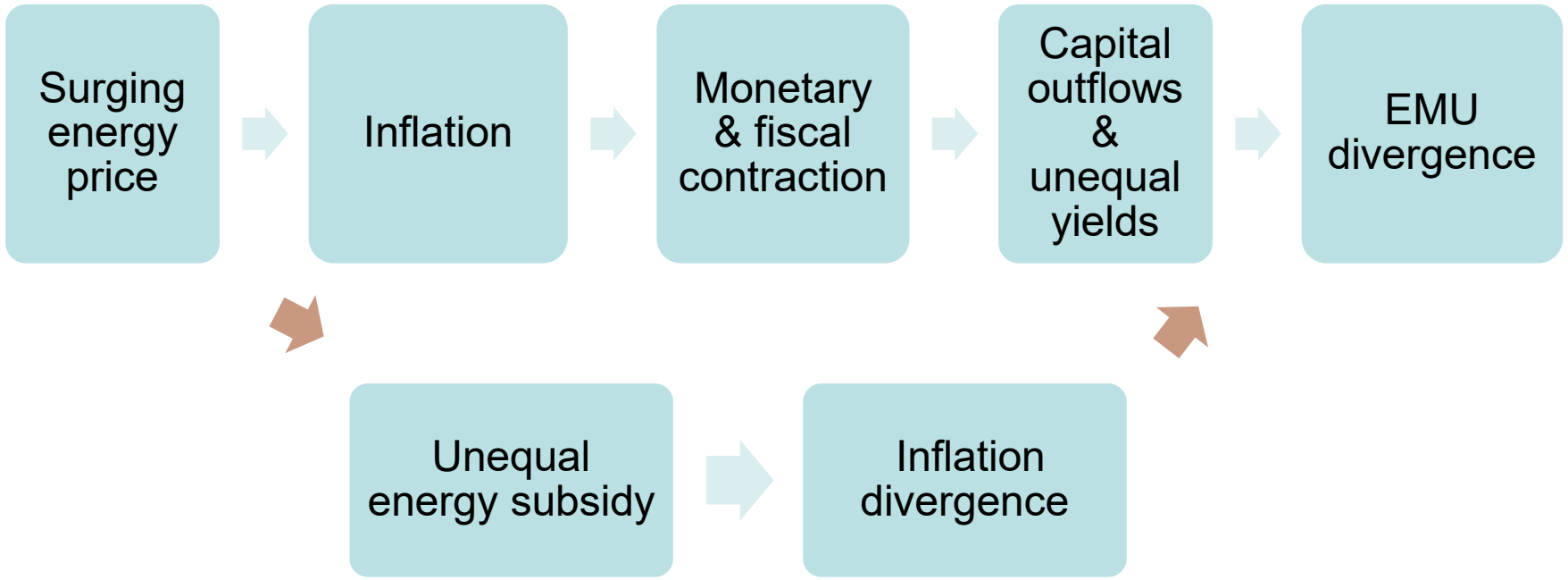
(YOY, in percent)



Sources: Haver Analytics, and IMF staff calculations

Introduction

Mechanism: The surging energy prices may result in instability in euro countries.



Debt crisis again ?

EU vor neuer Schuldenkrise?

Bernd Riegert aus Brüssel
07.11.2023

Die Schulden in den Mitgliedsstaaten der EU sind zu hoch. Noch haben die Finanzminister kein Rezept, wie man sie senken kann. Wie hoch sind die Risiken?

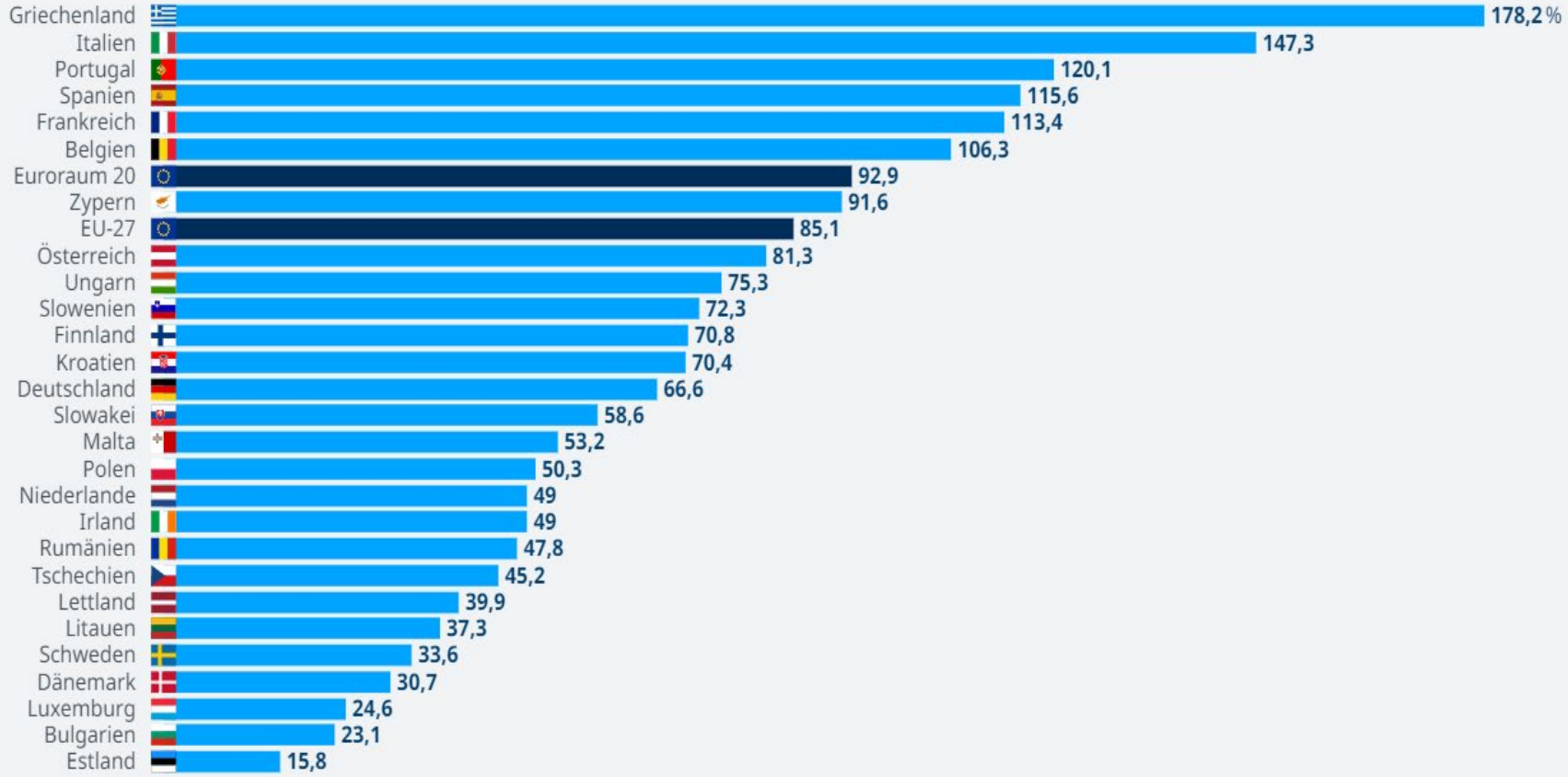
Bild: DesignIt/Zoonar/picture alliance

Die **Verschuldung der Staaten in der Eurozone** stand 2022 laut der Statistikbehörde Eurostat bei einer Quote von 91,4 Prozent der Wirtschaftsleistung. Gegenüber 2021 war das ein Rückgang der Verschuldung um vier Prozentpunkte. Das ist sehr viel, aber laut Analyse der **Europäischen Zentralbank (EZB)** auf einen einmaligen Effekt wegen der Erholung der Wirtschaft nach der Corona-Pandemie zurückzuführen.

Die EZB erwartet in ihrer jüngsten Prognose für dieses Jahr einen Schuldenstand von 89 Prozent. Im nächsten Jahr dürfte er noch leicht auf 88,6 Prozent sinken.

Schuldenstand EU

in % des Bruttoinlandsprodukts (BIP)



DW Quelle: Eurostat | Stand: 3. Quartal 2022

Introduction

Research Question:

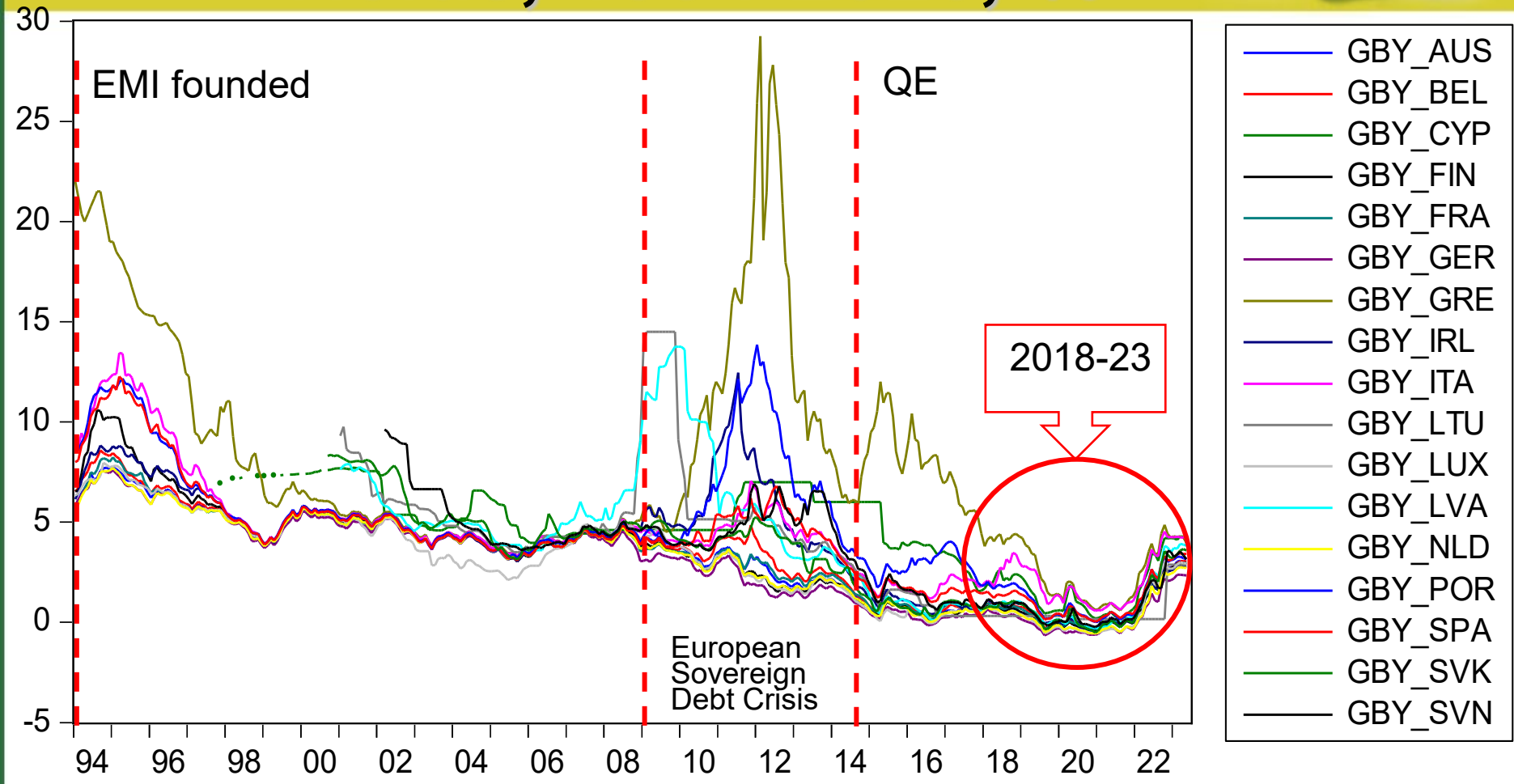
- Would the surging energy prices followed by the EMU policies threat EMU's convergence?
- Would unilateral policies (e.g., energy subsidy by rich member states. Germany? France?) become a threat too?

Introduction

Methodology to answer them

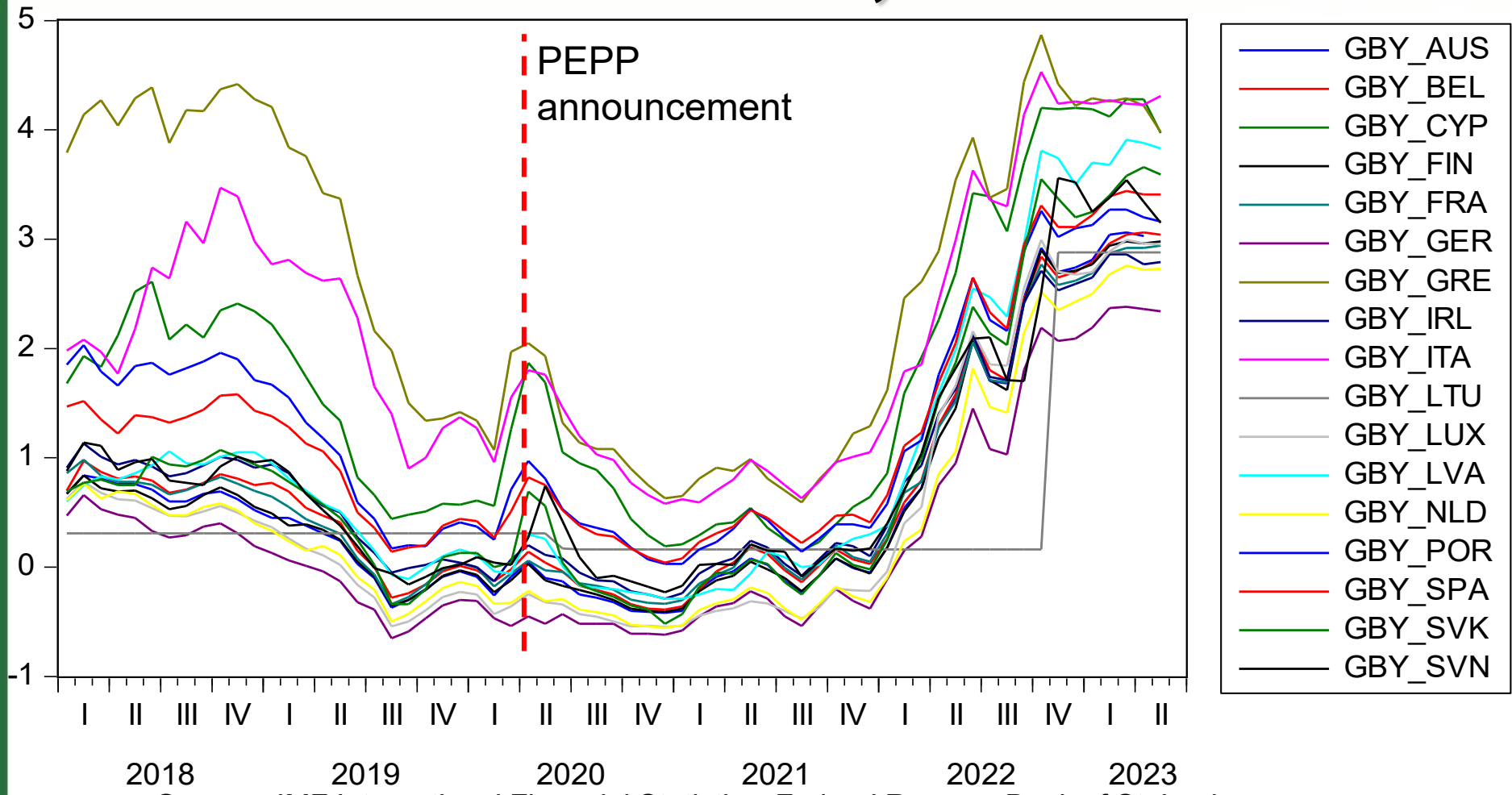
- A sigma-convergence test for the 1994-2023 government bond yields of the EMU countries to see whether they have been divergent since the war.
- A panel regression model in 2015-23 to see which determinants widen (or narrow) the EMU countries' yield spreads (e.g., EMU policy? unilateral energy subsidy? risk sharing including fiscal transfer?)

10 Year Government Bond Yields, 1994-2023, %



Source: IMF International Financial Statistics; Federal Reserve Bank of St. Louis, Economic Data; Author's Computation. EMI: European Monetary Institute.

10 Year Government Bond Yields, 2018-2023, %



Source: IMF International Financial Statistics; Federal Reserve Bank of St. Louis, Economic Data; Author's Computation. PEPP: Pandemic emergency purchase programme.

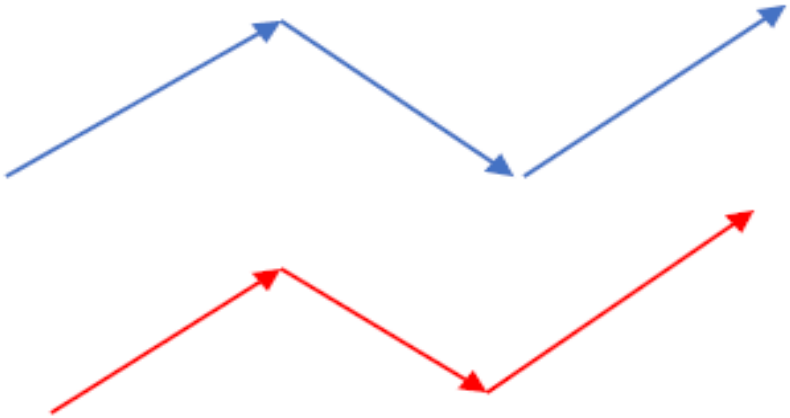
How to measure “convergence”

1994-2002

2002-2010

2019-2021 (?)

The real situations?



2. The log *t* Test

- This paper applies the sigma-convergence test of Phillips and Sul (2007) to examine the convergence of government bond yields.
- Assume that the interest rate is composed of systematic risk and idiosyncrat $r_{jt} = a_{jt} + \lambda_{jt}\mu_t$,
- To separate the common component from idiosyncratic components, the return is re-written as:

$$r_{jt} = \left(\frac{a_{jt}}{\mu_t} + \lambda_{jt} \right) \mu_t = b_{jt}\mu_t,$$

- To examine the joint hypothesis of return convergence,

$$H_0 : b_{j,t} \to b \quad \text{for all } j$$
$$H_A : b_{j,t} \not\to b \quad \text{for some } j$$

2. The log *t* Test

- The common factor could be removed by dividing the cross-section mean of returns.

$$h_{it} = \frac{r_{it}}{N^{-1}\sum_{i=1}^{N} r_{it}} = \frac{b_{it}}{N^{-1}\sum_{i=1}^{N} b_{it}}$$

- The cross-sectional variance is derived by $\mathrm{H_t} = \mathrm{N^{-1}}\sum_{\mathrm{i=1}}^{\mathrm{N}} \left(\mathrm{h_{it}} - 1\right)^2$
- The convergence test provided by Phillips and Sul (2007) is also called the sigma-convergence test.

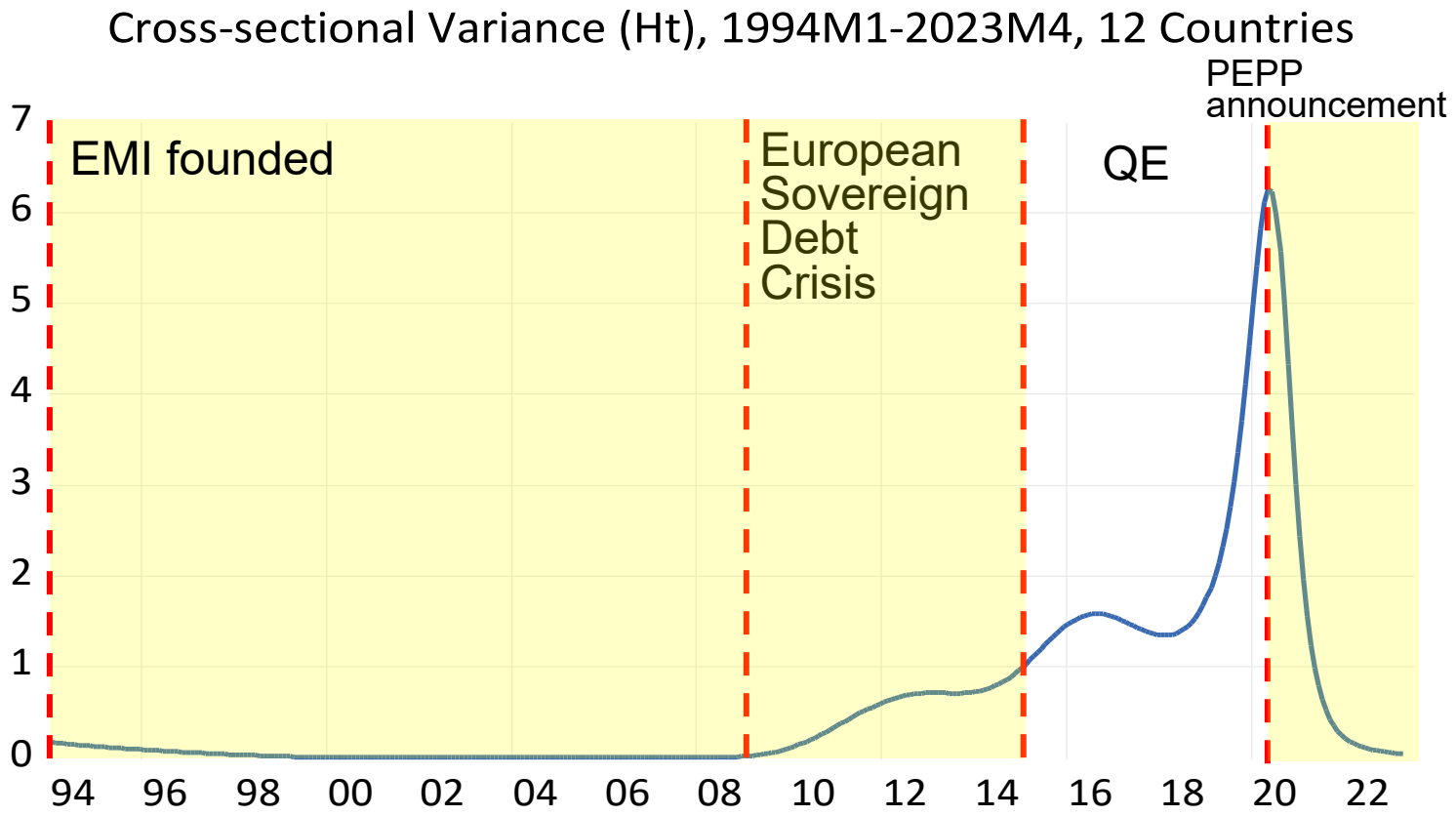
$$\log\frac{H_1}{H_t} - 2\log\left(\log t\right) = \xi_0 + \xi_1 \log t + u_t \ ,$$

$$t = T_0, \ldots, T$$

$$T_0 = [cT] \quad \text{for some} \quad c > 0$$

If ξ_1 <0, the long-run convergence of returns is rejected.

2. The log *t* Test



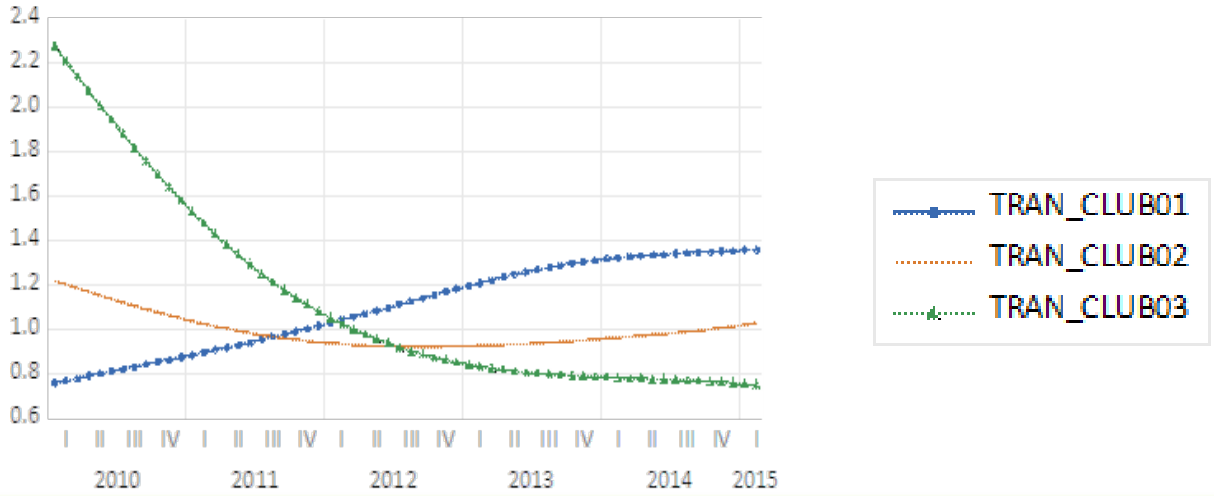
Author's Computation. PEPP: Pandemic emergency purchase programme.

2. The log *t* test:
Covergent→Divergent→Convergent now

	1994/01/01-2009/11/01; 12 countries		2010/01/01-2015/02/01; 17 countries		2020/03/01-2023/04/01; 17 countries	
c	log t	t-stat	log t	t-stat	log t	t-stat
0.20	0.83	(6.95)	-0.87	(-15.37)	4.58	(8.03)
0.21	0.74	(7.35)	-0.84	(-15.34)	4.58	(8.03)
0.22	0.63	(7.73)	-0.84	(-15.34)	4.64	(6.95)
0.23	0.57	(7.86)	-0.82	(-15.69)	4.64	(6.95)
0.24	0.45	(7.68)	-0.82	(-15.69)	3.54	(9.30)
0.25	0.31	(6.02)	-0.79	(-16.55)	3.54	(9.30)
0.26	0.17	(2.71)	-0.76	(-18.17)	3.54	(9.30)
0.27	0.01	(0.09)	-0.76	(-18.17)	3.19	(10.71)
0.28	-0.16	(-1.71)	-0.73	(-21.02)	3.19	(10.71)
0.29	-0.34	(-3.02)	-0.73	(-21.02)	2.97	(12.51)
0.30	-0.53	(-4.10)	-0.71	(-25.84)	2.97	(12.51)

Results of club convergence, 2010M1~2015M2

	log t	t-stat.	EMU Member States
Club 1	0.03	(1.19)	Italy, Portugal, Greece, Cyprus, Slovenia
Club 2	0.25	(0.49)	Ireland, Spain, Lithuania
Club 3	0.39	(6.72)	Austria, Belgium, France, Germany, Luxembourg, Netherlands, Finland, Slovakia, Latvia



3. Panel Regression in 2015-23

$$mr_{i,t} = \beta_{0,i} + \beta_1 y_{i,t} + \beta_2 r_t + \beta_3 \pi_{i,t}^{Gas} + \beta_4 Debt_{i,t} + \beta_5 G_{i,t} + \beta_6 ES_{i,t} + \beta_7 FA_{i,t} + \varepsilon_{i,t}$$

where $mr_{i,t}$: EMU convergence (Maastricht) criterion bond yields

$y_{i,t}$: log of the real GDP per capita

r_t : Euro Interbank Offered Rate (EONIA)

$\pi_{i,t}^{Gas}$: the unexpected change of gas price growth rate

$Debt_{i,t}$: government consolidated gross debt in percentage of GDP

$G_{i,t}$: the ratio of total government expenditure relative to GDP

$ES_{i,t}$: the ratio of total energy subsidy relative to GDP,

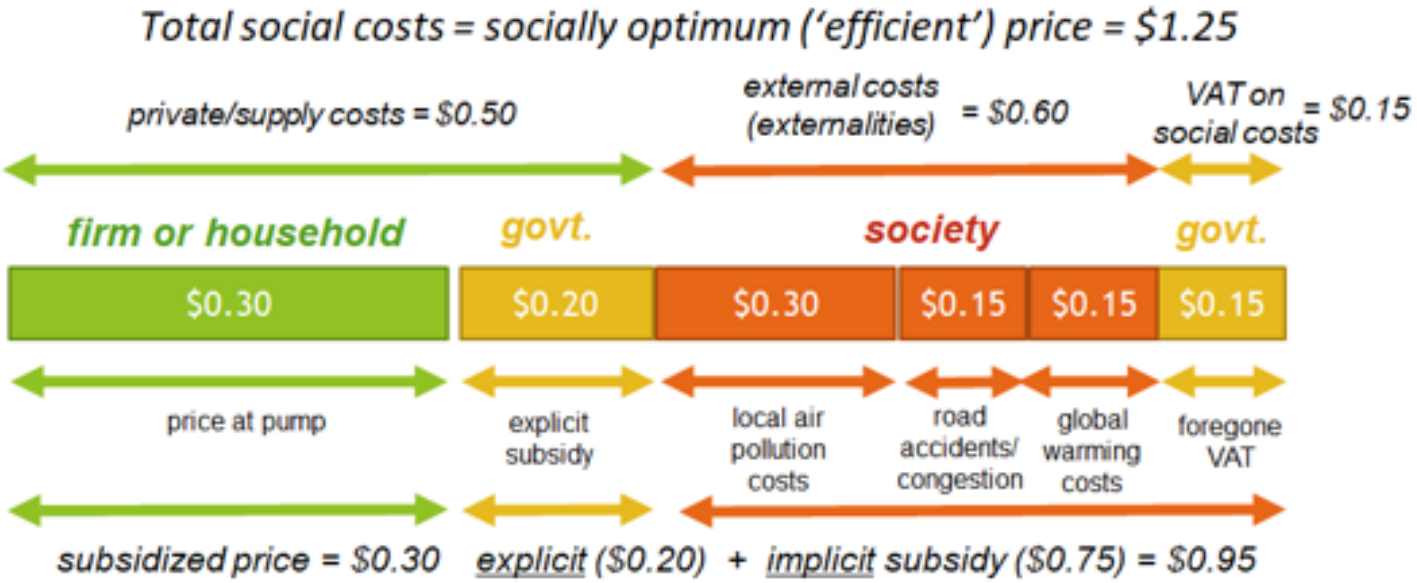
$FA_{i,t}$: the ratio of financial assistance relative to GDP

3. Panel Regression in 2015-23

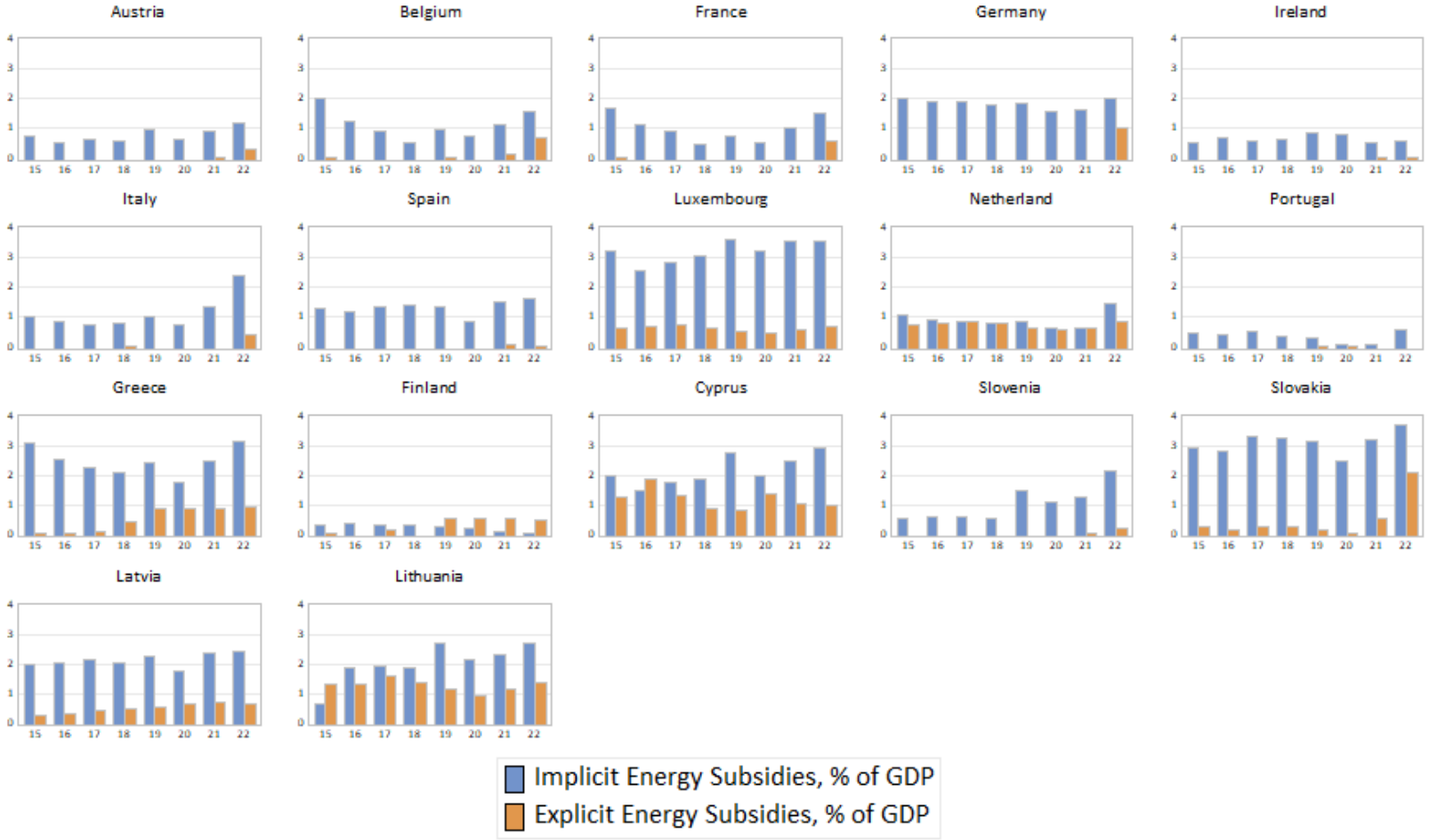
$$mr_{i,t} = \beta_{0,i} + \beta_1 y_{i,t} + \beta_2 r_t + \beta_3 \pi_{i,t}^{Gas} + \beta_4 Debt_{i,t} + \beta_5 G_{i,t} + \beta_6 XES_{i,t} + \beta_7 MES_{i,t} + \beta_8 FA_{i,t} + \varepsilon_{i,t}$$

where $XES_{i,t}$: the explicit energy subsidies in percentage of GDP

$MES_{i,t}$: the implicit energy subsidies in percentage of GDP

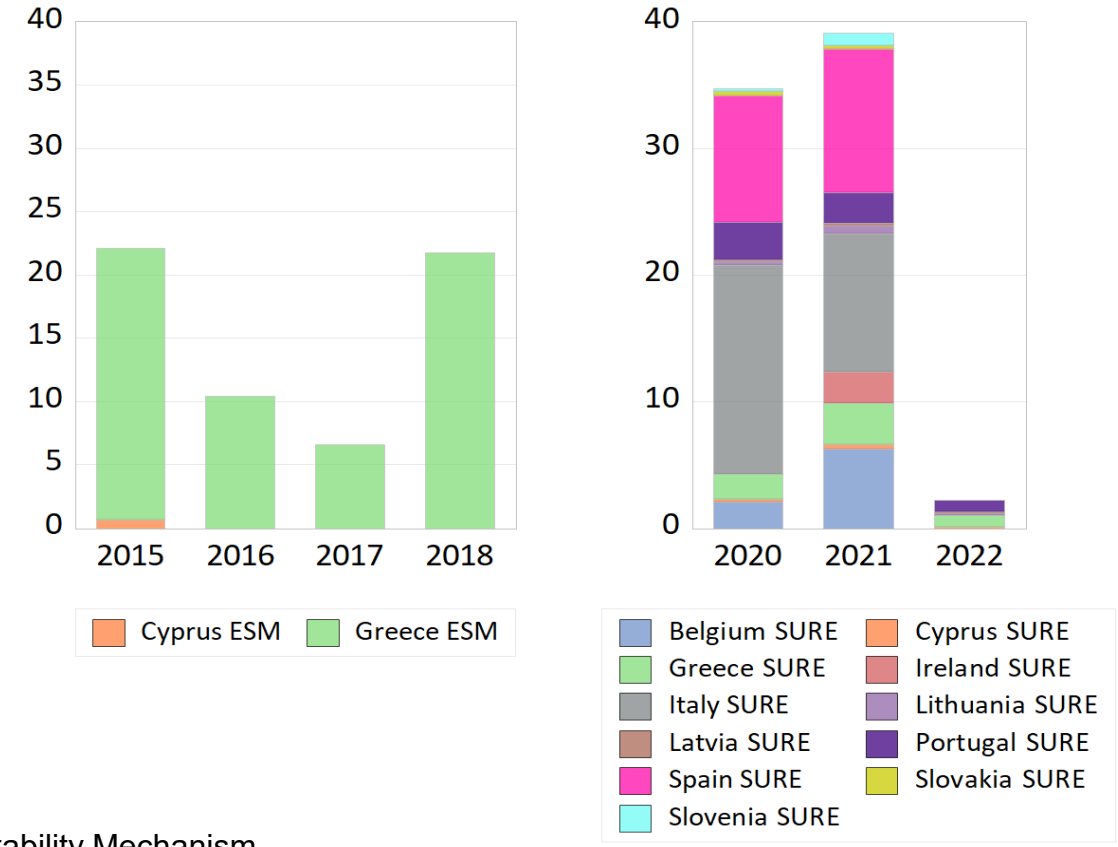


Tendency of the energy subsidies from 2015–2022, % of GDP



Source: IMF Fossil Fuel Subsidies Data; Authors' computation.

Tendency of the financial assistance from 2015–2022, billion EUR



ESM: European Stability Mechanism
SURE: Temporary Support to mitigate Unemployment Risks in an Emergency

Source: European Stability Mechanism Programme Database; EU financial assistance, European Commission; Authors' computation.

Data Source

- Sample period: 2015-2022
- Country: Austria, Belgium, France, Germany, Ireland, Italy, Spain, Luxembourg, Netherlands, Portugal, Greece, Finland, Cyprus, Slovenia, Slovakia, Latvia, Lithuania (20 EMU countries excluding ES, HR, MT)

Data Source	Data
Eurostat	Maastricht criterion bond yields, Euro Interbank Offered Rate (EONIA), the real GDP per capita, the government consolidated gross debt in percentage of GDP, the government expenditure relative to GDP ratio, the government expenditure relative to GDP
IMF Fossil Fuel Subsidies Data	energy subsidy, including explicit and implicit subsidies
European Stability Mechanism Programme Database	European Stability Mechanism (ESM)
EU financial assistance, European Commission	Temporary Support to mitigate Unemployment Risks in an Emergency (SURE)

$$mr_{i,t} = \beta_{0,i} + \beta_1 y_{i,t} + \beta_2 r_t + \beta_3 \pi_{i,t}^{Gas} + \beta_4 Debt_{i,t} + \beta_5 G_{i,t} + \beta_6 ES_{i,t} + \beta_7 FA_{i,t} + \varepsilon_{i,t}$$

OLS Results

	(1)	(2)	(3)	(4)	(5)
c	25.412***	28.044***	27.418***	16.301**	19.267***
	(7.658)	(8.445)	(6.698)	(7.750)	(6.279)
$y_{i,t}$	-1.948***	-2.190***	-2.111***	-1.176*	-1.422**
	(0.713)	(0.789)	(0.577)	(0.665)	(0.573)
r_t	2.811***	2.736***	2.821***	2.535***	2.540***
	(0.221)	(0.256)	(0.362)	(0.392)	(0.189)
$\pi_{i,t}^{Gas}$	0.004***	0.003	0.003***	0.004***	0.003***
	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)
$\pi_{i,t}^{Gas} \times D_t(T = 2021, 2022)$		0.001			
		(0.004)			
$Debt_{i,t}$	0.004	0.003	0.002	0.008	0.006
	(0.008)	(0.008)	(0.007)	(0.006)	(0.006)
$G_{i,t}$	-0.085***	-0.089***	-0.088***	-0.070***	-0.075***
	(0.015)	(0.015)	(0.020)	(0.020)	(0.011)
$ES_{i,t}$	-0.072	-0.034	-0.120*	-0.021	-0.080
	(0.073)	(0.074)	(0.067)	(0.053)	(0.061)
$ES_{i,t} \times D_t(T = 2021, 2022)$			0.056		0.066*
			(0.048)		(0.038)
$FA_{i,t}$	0.164*	0.189**	0.158*	0.431***	0.432***
	(0.083)	(0.082)	(0.092)	(0.132)	(0.128)
$FA_{i,t} \times D_t\ (T = 2020, 2021, 2022)$				-0.653***	-0.663***
				(0.222)	(0.155)
N	136	136	136	136	136
R-squared	0.868	0.866	0.869	0.880	0.882
Redundant Fixed Effects Tests					
F statistics	7.068***	6.560***	6.878***	6.231***	6.302***

Details for TSLS

- The instrumental variables include GDP growth rate, the seasonal component of gas price inflation, energy subsidy to GDP ratio, the change of energy subsidy to GDP ratio, the growth rate of debt to GDP ratio, current account to GDP ratio, budget deficit to GDP ratio and trend.
- Tests for IVs have been applied.

$$mr_{i,t} = \beta_{0,i} + \beta_1 y_{i,t} + \beta_2 r_t + \beta_3 \pi_{i,t}^{Gas} + \beta_4 Debt_{i,t} + \beta_5 G_{i,t} + \beta_6 ES_{i,t} + \beta_7 FA_{i,t} + \varepsilon_{i,t}$$

TSLS Results

	(1)	(2)	(3)	(4)	(5)
c	14.658	6.163	15.088	-9.407	-9.993
	(11.834)	(11.658)	(11.523)	(20.128)	(20.473)
$y_{i,t}$	-0.985	-0.256	-0.997	1.091	1.143
	(1.108)	(1.075)	(1.048)	(1.863)	(1.887)
r_t	2.945***	3.204***	3.167***	1.678*	1.667*
	(0.385)	(0.430)	(0.352)	(0.929)	(0.936)
$\pi_{i,t}^{Gas}$	0.002**	0.009*	0.001	0.004*	0.005*
	(0.001)	(0.005)	(0.001)	(0.003)	(0.003)
$\pi_{i,t}^{Gas} \times D_t(T = 2021, 2022)$		-0.009			
		(0.005)			
$Debt_{i,t}$	0.033**	0.049***	0.023	0.072***	0.073***
	(0.015)	(0.015)	(0.016)	(0.022)	(0.022)
$G_{i,t}$	-0.119***	-0.120***	-0.100***	-0.134***	-0.134***
	(0.024)	(0.021)	(0.021)	(0.037)	(0.037)
$ES_{i,t}$	0.014	-0.018	-0.170*	-0.050	-0.029
	(0.057)	(0.066)	(0.099)	(0.121)	(0.180)
$ES_{i,t} \times D_t(T = 2021, 2022)$			0.104		-0.017
			(0.070)		(0.112)
$FA_{i,t}$	-0.128	-0.249	-0.203	0.126	0.130
	(0.164)	(0.218)	(0.224)	(0.177)	(0.180)
$FA_{i,t} \times D_t\ (T = 2020, 2021, 2022)$				-1.189***	-1.176***
				(0.358)	(0.370)
N	118	118	118	118	118
R-squared	0.902	0.893	0.887	0.813	0.812

$$mr_{i,t} = \beta_{0,i} + \beta_1 y_{i,t} + \beta_2 r_t + \beta_3 \pi_{i,t}^{Gas} + \beta_4 Debt_{i,t} + \beta_5 G_{i,t} + \beta_6 XES_{i,t} + \beta_7 MES_{i,t} + \beta_8 FA_{i,t} + \varepsilon_{i,t}$$

OLS Results

	(1)	(2)	(3)	(4)	(5)
c	27.145***	28.550***	29.247***	18.663***	21.225***
	(7.853)	(8.540)	(7.191)	(6.084)	(7.447)
$y_{i,t}$	-2.091***	-2.217***	-2.274***	-1.368**	-1.583**
	(0.713)	(0.798)	(0.634)	(0.552)	(0.672)
r_t	2.844***	2.833***	2.851***	2.562***	2.587***
	(0.203)	(0.258)	(0.349)	(0.176)	(0.188)
$\pi_{i,t}^{Gas}$	0.003***	0.004	0.003**	0.004***	0.003***
	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)
$\pi_{i,t}^{Gas} \times D_t(T = 2021, 2022)$		0.000			
		(0.004)			
$Debt_{i,t}$	-0.002	-0.002	-0.005	0.003	0.001
	(0.007)	(0.009)	(0.009)	(0.006)	(0.007)
$G_{i,t}$	-0.077***	-0.081***	-0.078***	-0.066***	-0.070***
	(0.013)	(0.016)	(0.014)	(0.010)	(0.012)
$XES_{i,t}$	0.229**	0.237*	0.300*	0.232**	0.287*
	(0.099)	(0.135)	(0.136)	(0.090)	(0.170)
$XES_{i,t} \times D_t(T = 2021, 2022)$			-0.164*		-0.160
			(0.075)		(0.182)
$MES_{i,t}$	-0.214***	-0.195*	-0.245**	-0.184***	-0.225***
	(0.074)	(0.099)	(0.069)	(0.063)	(0.074)
$MES_{i,t} \times D_t(T = 2021, 2022)$			0.069*		0.090*
			(0.034)		(0.050)
$FA_{i,t}$	0.188*	0.217***	0.185	0.437***	0.437***
	(0.110)	(0.080)	(0.100)	(0.131)	(0.148)
$FA_{i,t} \times D_t\ (T = 2020, 2021, 2022)$				-0.630***	-0.630***
				(0.157)	(0.175)
N	136	136	136	136	136
R-squared	0.872	0.870	0.874	0.886	0.888
Redundant Fixed Effects Tests					
F statistics	7.519***	6.857***	7.178***	6.514***	6.303***

$$mr_{i,t} = \beta_{0,i} + \beta_1 y_{i,t} + \beta_2 r_t + \beta_3 \pi_{i,t}^{Gas} + \beta_4 Debt_{i,t} + \beta_5 G_{i,t} + \beta_6 XES_{i,t} + \beta_7 MES_{i,t} + \beta_8 FA_{i,t} + \varepsilon_{i,t}$$

TSLS Results

	(1)	(2)	(3)	(4)	(5)
c	13.743	8.832	14.832	-9.847	-3.027
	(9.618)	(12.380)	(28.707)	(18.555)	(13.492)
$y_{i,t}$	-0.861	-0.444	-0.914	1.158	0.620
	(0.891)	(1.142)	(2.714)	(1.742)	(1.216)
r_t	2.937***	3.208***	2.819*	1.529*	2.547***
	(0.388)	(0.517)	(1.166)	(0.892)	(0.386)
$\pi_{i,t}^{Gas}$	0.002*	0.008*	0.004	0.005**	0.004**
	(0.001)	(0.004)	(0.004)	(0.002)	(0.002)
$\pi_{i,t}^{Gas} \times D_t(T = 2021, 2022)$		-0.007			
		(0.005)			
$Debt_{i,t}$	0.031**	0.042**	0.046	0.071***	0.048**
	(0.014)	(0.018)	(0.049)	(0.024)	(0.019)
$G_{i,t}$	-0.122***	-0.123***	-0.167**	-0.135***	-0.112***
	(0.020)	(0.025)	(0.068)	(0.040)	(0.019)
$XES_{i,t}$	0.123	0.095	0.616*	0.149	0.335
	(0.091)	(0.116)	(0.292)	(0.349)	(0.199)
$XES_{i,t} \times D_t(T = 2021, 2022)$			-0.458*		-0.440**
			(0.216)		(0.175)
$MES_{i,t}$	-0.096	-0.114	-0.050	-0.158	-0.339**
	(0.101)	(0.112)	(0.298)	(0.222)	(0.134)
$MES_{i,t} \times D_t(T = 2021, 2022)$			-0.072		0.141
			(0.309)		(0.108)
$FA_{i,t}$	-0.092	-0.151	0.226**	0.136	0.157
	(0.163)	(0.203)	(0.056)	(0.121)	(0.762)
$FA_{i,t} \times D_t\ (T = 2020, 2021, 2022)$				-1.184***	-0.857
				(0.282)	(0.725)
N	118	118	118	118	118
R-squared	0.909	0.907	0.775	0.808	0.891

Conclusion

- EMU kept converge from EMI to the sovereign crisis. It has been stable since the pandemic and the Russo-Ukrainian War.
- However, ECB monitor it and think of the so-called “anti-fragmentation tools.” The way to apply the tools is still vague to the investors.
- The EMU overnight rate and governments’ expenditure can effectively narrow the yield spreads, which indicates the power of QE and national fiscal policies.

- Higher debt ratios and energy prices are still a threat for the spread widening. The debt crisis risks still exist.

- The explicit energy subsidies and financial assistance decreased the spreads during the crisis period. In contrast, the implicit energy subsidies had no a significant effect.

- However, some richer member states (e.g., Germany and France) intend to make an industry-wide energy subsidy without the EU's permission. The unilateral action in the EMU would worsen the convergence that needs to be explored.