What are the likely macroeconomic effects of the EU Recovery plan?

Fabio Canova (Norwegian Business School, CAMP and CEPR)
Evi Pappa (Universidad Carlos III and CEPR)

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Outline

Introduction

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- Will jobs be created? Will the EU economy permanently go back to the trend after the unprecedented fall of 2020Q2? Will the conversion to a greener economy be smooth? Will the programs jump start EU economies to a virtuous growth cycle?

The contribution of the paper

- Study the regional macro dynamics produced by the European regional development fund (ERDF), launched to foster innovation and research, to favor the digital agenda, and to support small and medium-sized enterprises; and the European Social Fund (ESF), launched to support investments in education and health; and to fight poverty.

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- Question: Given that NGEU combines features of ERDF and ESF, what is the likelihood of success in terms of jobs, output and inequalities?

Empirical results I

- ERDF has, on average, positive short term impact on all regional variables.

- Gains dissipate almost entirely within three years.

- Potentially usable for countercyclical purposes.

- ESF has a negative, often insignificant, impact consequences.

- Average effects on all regional variables after 3 years is positive; much larger than with ERDF.

- Potentially good instrument for economic transformation.

Empirical results II

- Important regional spillovers within a country.
- Little evidence of anticipatory effects.

- Considerable regional heterogeneity in the transmission.
- Location, national borders, membership and tenure with EU matter.
- Programs benefit more middle income regions. The poor stay poor
- Potential increase in inequality and income polarization.

Model insights

- Labor productivity is endogenous and depends on R&D and human capital accumulation.

- Federal spending generates an externality on the aggregate level of these services.

- Temporary spending shocks have demand and supply effects: government absorption increases; the productivity of production factors increases.

- Changes in the timing of these two effects following government R&D shocks account for ERDF stylized facts across different groups of regions.

- High human capital depreciation, variable human capital utilization, and low physical capital adjustment costs in response to government HK shocks needed to match ESF evidence.

- Size of the region matters. Spillovers larger, the larger is the region (the demand effect is larger).

Relationship with the literature

- Effects of EU transfers on income inequality or long-term growth, see Canova and Boldrin, 2001, Canova, 2004, Mohlhagen, 2009, Becker, et al., 2013.

- Endogenous growth models, see Jones et al., 2008.

- The dynamic effects of fiscal expansions in monetary unions, see Canova and Pappa, 2007, Nakamura and Stainsson, 2014, Dupour, 2017, Auerbach and Gorodnichenko, 2020.

- Federal transfers during special events, e.g. 2008 financial crisis or natural disasters, see Chodorow, 2019; Deryugina, 2017; Canova and Pappa, 2021.

- EU transfers on production and employement, see Coelho, 2019.

Policy implications

- Structural funds have important macroeconomic effects on the regional economies of the EU.

- Could support regional income, induce transformation, and ignite a virtuous investment cycle.

- Given that in Spain, France, and Italy medium term output and employment multipliers are positive for both funds, outlook moderately optimistic.

- EU funds may lead to polarization and larger regional inequalities.

- Macroeconomic reaction in different countries different (reason for the tense negotiations in the European Council when NGEU funds were created?)

- Need structural economic (and public administration) reforms to make sure funds produce generalized Pareto improving allocations and dynamics.
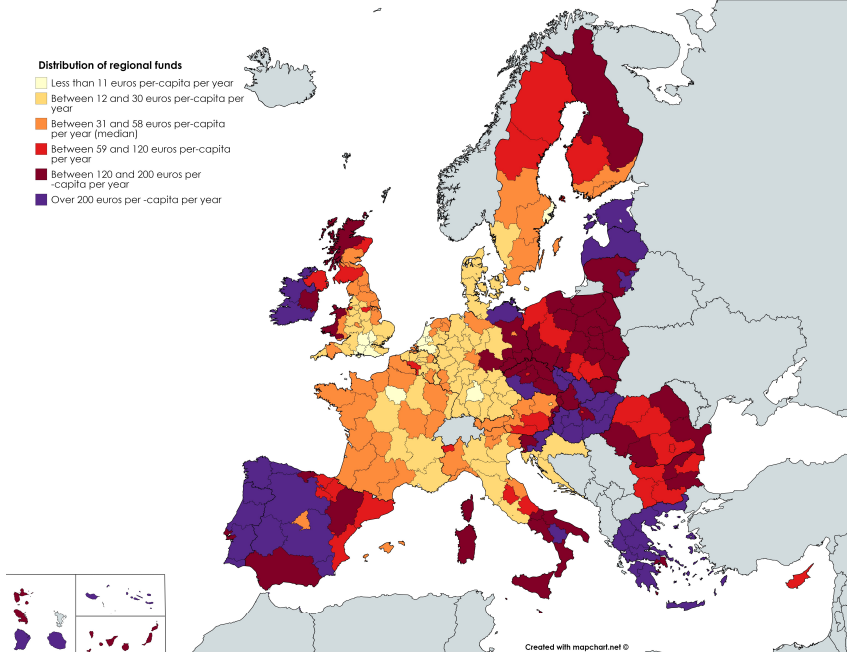
Outline

The data

- Regional macroeconomic data: ARDECO online available at
  https://ec.europa.eu/knowledge4policy/territorial/ardeco-online_en

- Restrict attention to 279 (of 314) or 240 NUTS2 EU units.

- Annual data on real gross value added (GVA), employment, real compensation,
  population, real gross fixed capital formation. Construct labor productivity.

- European structural funds: Historical data available at
  https://ec.europa.eu/regional_policy/EN/policy/evaluations/data-for-research/.

- Programs: Cohesion fund (CF), Agricultural fund (EARDF), Regional development
  fund (ERDF), Social Fund (ESF) (added Fishery fund (EMFF)).

- ERDF concerned with investments in innovation and research, and in the digital
  agenda, and with the support for small and medium-sized enterprises; ESF directed
  to support investments in education, health, and in projects fighting poverty.

- Data reporting problems: (i) time gap between the expenditure in EU books and
  the expenditure of regional government; (ii) mistakes in the data coding; (iii)
  nominal values; (iv) follow EU budget cycle. Usable data constructed in Canova,
  Canova, Pappa (2020b).

Top and Bottom recipients, EU funds		
Region	Acronym	Average yearly per-capita real funds
Azores	PT20	851,29
Ceuta	ES63	714,31
Madeira	PT30	569,69
Melilla	ES64	526,75
Alentejo	PT18	525,11
Anatoliki Makadonia-Traki	EL51	487,45
Dytiki Makadonia	EL53	444,62
Sostines	LT01	429,43
Ipeiros	EL54	428,67
Voreio Aigeio	EL41	426,76
Algarve	PT15	422,86
Hampshire-Isle of Wright	UKJ3	10,68
Outer London 1	UKI7	10,68
Zuid-Holland	NL33	10,48
Noord-Holland	NL32	10,46
Stuttgart	DE11	9,95
Inner London 2	UKJ2	9,72
Bruxelles	Be10	9,34
Inner London 1	UKJ1	9,29
Paris	FR10	8,25
Stockholm	SE11	7,99

Distribution of regional funds

- Less than 11 euros per-capita per year
- Between 12 and 30 euros per-capita per year
- Between 31 and 58 euros per-capita per year (median)
- Between 59 and 120 euros per-capita per year
- Between 120 and 200 euros per-capita per year
- Over 200 euros per -capita per year

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Outline

The econometric procedure I

- Use Bayesian IV local projections.

- IV regression ($x_{i,t}$ = ERDF or ESF expenditures)

$$x_{i,t,h} = \alpha_{i,h} + \beta_{i,h}v_{i,t} + u_{i,t,h} \qquad (1)$$

$v_{i,t}$ residual of regression of structural funds on own lags, Euro area GDP, employment, GDP deflator, nominal rate, and NEER (to control for endogeneity of funds to economic conditions).

- Estimated equation:

$$y_{i,t,h} = a_{i,h} + b_{i,h}y_{i,t-1,h} + c_{i,h}\hat{x}_{i,t,h} + e_{i,t,h} \qquad (2)$$

where i is region, t is time, h the horizon; $y_{i,t,h} = \sum_{j=1}^{h} \frac{Y_{i,t+j-1} - hY_{i,t-1}}{Y_{i,t-1}}$
$x_{i,t,h} = \sum_{j=1}^{h} \frac{G_{i,t+j-1} - hG_{i,t-1}}{GVA_{i,t-1}}$ see e.g. Dupour (2017) or Ramey (2018),
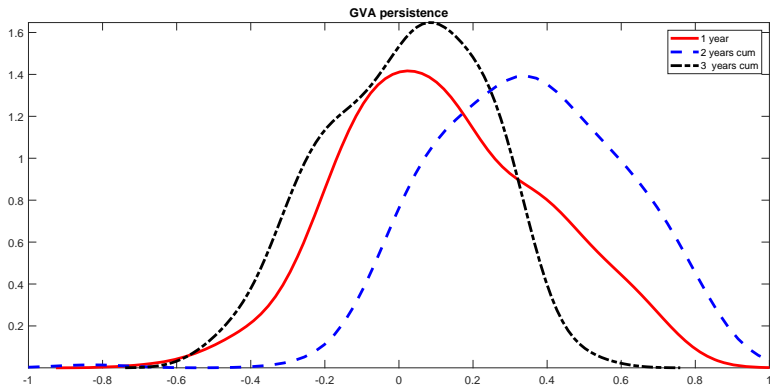
- $c_{i,h}$ is the cumulative multiplier at horizon h of an unexpected increase in a structural fund (Euro change in private income per Euro of grants).

The econometric procedure II

- Anticipation estimated equation $(m = 1, 2)$

$$y_{i,t,h} = a_{i,h} + b_{i,h} y_{i,t-1,h} + c_{i,h} \hat{x}_{i,t+m,h} + e_{i,t,h} \qquad (3)$$

- Because of short sample, set h=1,2,3 and use only $y_{i,t-1,h}$ as control.

- Normal prior for $(a_{i,h}, b_{i,h}, c_{i,h})$ with zero mean and fixed variance. (IV ridge estimator). The non-informative prior on the coefficients and the covariance matrix of the error term of (1)-(2) and auxiliary equation.

- Construct the cross sectional distribution of multipliers. Report (trimmed) average and cluster according to location, tenure in the EU, national border, and quartiles of income distribution (measured by the average GDP per-capita in the sample).

- Dynamic heterogeneity present. Pooling is inconsistent. Need different estimator for average effect, see Canova, 2020a.

Figure: Distribution of the b_h, GVA equation, different h

Outline

Results I

Table: Average cumulative multipliers, all EU regions

	ERDF funds			**ESF funds**		
Horizon	1 year	2 years	3 years	1 year	2 years	3 years
GVA	1.83	1.58	1.08	-0.51	2.57	5.09
	(0.19)	(0.32)	(0.32)	(0.64)	(0.80)	(0.83)
Employment	0.85	0.37	0.88	-0.31	1.23	1.61
	(0.16)	(0.28)	(0.29)	(0.23)	(0.37)	(0.27)
Compensation	2.19	0.70	0.98	2.10	2.79	3.54
	(0.36)	(0.68)	(0.80)	(0.39)	(0.58)	(0.69)
Investments	5.89	3.46	1.28	0.30	5.60	4.25
	(1.70)	(2.92)	(2.28)	(1.60)	(1.33)	(2.17)
Labor productivity	2.41	0.42	-1.02	2.81	1.77	3.59
	(0.37)	(0.77)	(0.75)	(0.70)	(0.90)	(0.91)
Participation	0.99	1.57	1.61	2.67	4.32	4.03
	(0.17)	(0.20)	(0.19)	(0.30)	(0.77)	(0.36)

Standard deviations of the estimates in parenthesis.

Results II

Table: Average cumulative multipliers, without UK

	ERDF funds			ESF funds		
Horizon	1 year	2 years	3 years	1 year	2 years	3 years
GVA	1.83	1.55	1.23	-0.17	4.09	6.44
	(0.23)	(0.36)	(0.36)	(0.75)	(0.94)	(0.97)
Employment	0.77	0.11	0.66	0.00	1.61	1.87
	(0.19)	(0.23)	(0.30)	(0.27)	(0.44)	(0.32)
Compensation	1.28	0.26	2.33	-0.39	2.95	4.90
	(0.37)	(0.67)	(0.55)	(0.46)	(0.66)	(0.62)
Investments	6.37	2.68	2.40	1.46	9.40	8.42
	(1.99)	(3.42)	(2.67)	(1.88)	(1.56)	(1.65)
Labor productivity	1.91	1.32	1.08	1.07	3.49	6.17
	(0.35)	(0.55)	(0.51)	(0.82)	(1.06)	(1.06)
Participation	0.95	1.40	1.40	2.72	4.01	3.85
	(0.19)	(0.24)	(0.23)	(0.35)	(0.31)	(0.25)

Standard deviations of the estimates in parenthesis.

Results III

Table: Average cumulative multipliers, only Euro

	ERDF funds			**ESF funds**		
Horizon	1 year	2 years	3 years	1 year	2 years	3 years
GVA	1.49	1.45	2.33	-0.69	4.78	8.02
	(0.30)	(0.48)	(0.47)	(0.97)	(1.22)	(1.27)
Employment	0.59	0.29	1.21	-0.33	1.89	2.42
	(0.17)	(0.30)	(0.39)	(0.35)	(0.57)	(0.42)
Compensation	-0.19	0.61	3.63	-0.90	4.08	6.98
	(0.35)	(0.69)	(0.72)	(0.56)	(0.85)	(0.81)
Investments	3.18	1.87	2.78	-1.95	8.92	10.57
	(2.61)	(4.48)	(3.50)	(2.44)	(2.04)	(2.14)
Labor productivity	0.92	0.48	1.72	0.04	3.63	7.03
	(0.34)	(0.58)	(0.61)	(1.07)	(1.38)	(1.38)
Participation	1.01	1.73	1.58	2.98	4.44	4.35
	(0.17)	(0.28)	(0.30)	(0.46)	(0.41)	(0.32)

Standard deviations of the estimates in parenthesis.

Results IV

Table: Average cumulative multipliers, all regions, after 2000

	ERDF funds			ESF funds		
Horizon	1 year	2 years	3 years	1 year	2 years	3 years
GVA	1.44	2.43	2.01			
	(0.37)	(0.41)	(0.34)			
Employment	0.22	1.32	1.23			
	(0.15)	(0.29)	(0.29)			
Compensation	3.58	4.89	1.80			
	(0.31)	(0.60)	(0.63)			
Investments	2.44	5.35	3.89			
	(2.01)	(3.41)	(2.99)			
Labor productivity	3.50	2.56	3.24			
	(0.41)	(0.64)	(0.62)			
Participation	1.60	3.34	3.08			
	(0.14)	(0.33)	(0.28)			

Standard deviations of the estimates are in parenthesis.

Results V

Table: Average cumulative multipliers with national spillovers, all EU regions

	ERDF funds			ESF funds		
Horizon	1 year	2 years	3 years	1 year	2 years	3 years
GVA	2.07	2.15	0.60	-0.64	2.22	3.73
	(0.11)	(0.23)	(0.25)	(0.25)	(0.45)	(0.55)
Employment	1.24	0.63	-0.10	0.09	0.90	1.12
	(0.06)	(0.11)	(0.22)	(0.09)	(0.22)	(0.29)
Compensation	1.80	0.40	0.62	2.05	2.05	2.82
	(0.32)	(0.64)	(0.67)	(0.37)	(0.55)	(0.61)
Investments	6.72	3.47	1.52	-0.34	-0.02	-1.47
	(0.28)	(0.57)	(0.74)	(0.47)	(1.13)	(1.39)
Labor productivity	3.46	1.92	1.17	2.24	1.15	1.93
	(0.28)	(0.57)	(0.58)	(0.34)	(0.53)	(0.63)
Participation	0.89	0.99	0.98	2.03	2.98	3.33
	(0.05)	(0.09)	(0.09)	(0.07)	(0.15)	(0.14)

Standard deviations of the estimates in parenthesis.

Results VI

Table: Average cumulative multipliers, one year anticipation, all EU regions

	ERDF funds			**ESF funds**		
Horizon	0 year	1 years	2 years	0 year	1 years	2 years
GVA	0.78	1.10	1.37	2.14	6.16	4.13
	(0.26)	(0.53)	(0.42)	(0.63)	(0.84)	(1.07)
Employment	0.25	-0.26	-0.46	0.36	0.68	-0.39
	(0.14)	(0.30)	(0.31)	(0.22)	(0.41)	(0.55)
Compensation	-0.62	-1.20	-2.58	-0.56	2.82	0.96
	(0.36)	(0.77)	(0.84)	(0.46)	(0.74)	(2.01)
Investments	1.19	1.73	3.00	1.73	3.54	1.77
	(1.87)	(3.88)	(3.47)	(1.50)	(3.08)	(2.01)
Labor productivity	0.00	1.46	-1.65	0.23	8.06	7.93
	(0.37)	(0.76)	(0.80)	(0.69)	(0.95)	(1.22)
Participation	0.89	0.82	1.20	0.91	2.49	1.48
	(0.27)	(0.29)	(0.30)	(0.37)	(0.82)	(1.13)

Standard deviations of the estimates in parenthesis.

Outline

Heterogeneities: Location

Table: Average cumulative multipliers: North vs. South

		ERDF funds			ESF funds		
		1 year	2 years	3 years	1 year	2 years	3 years
GVA	North	2.33	1.27	-0.02	-1.45	0.89	3.82
	South	2.63	2.21	1.86	2.96	6.90	7.85
Employment	North	0.66	-0.01	-0.64	-1.03	-0.04	0.61
	South	2.15	2.10	1.66	2.34	4.69	6.06
Compensation	North	6.15	1.56	-4.80	4.92	2.73	3.31
	South	0.45	-0.50	6.04	0.38	2.37	3.44
Investments	North	3.40	0.62	-1.28	-1.98	-2.41	0.69
	South	16.50	5.75	2.20	8.09	9.89	8.73
Labor productivity	North	5.79	-0.58	-7.61	4.72	-0.19	0.93
	South	2.21	1.62	4.86	3.31	6.18	4.32
Participation	North	1.03	3.19	3.39	2.33	5.19	3.85
	South	1.71	1.49	1.31	3.95	3.07	4.43

Heterogeneities: Tenure

Table: Average cumulative multipliers: Older vs Younger tenure

		ERDF funds			ESF funds		
		1 year	2 years	3 years	1 year	2 years	3 years
GVA	Old	2.58	2.10	1.63	-0.82	2.78	6.02
	Young	1.86	-0.37	-3.32	2.78	2.75	1.53
Employment	Old	0.97	0.37	1.39	-0.64	1.68	3.76
	Young	1.68	1.62	-2.82	2.56	0.92	-3.14
Compensation	Old	2.97	1.60	0.34	2.84	4.11	5.84
	Young	9.50	-1.89	-7.88	5.99	-3.04	-6.07
Investments	Old	2.34	0.98	-0.27	-1.27	6.60	8.50
	Young	26.25	6.75	0.07	10.45	-2.27	-16.86
Labor productivity	Old	3.13	0.05	-3.90	3.96	-0.18	1.49
	Young	10.17	0.28	-3.06	9.29	9.30	3.89
Participation	Old	1.38	3.13	3.48	3.09	5.61	5.02
	Young	0.71	0.94	0.05	1.87	0.41	0.26

ERDF Heterogeneities: Income
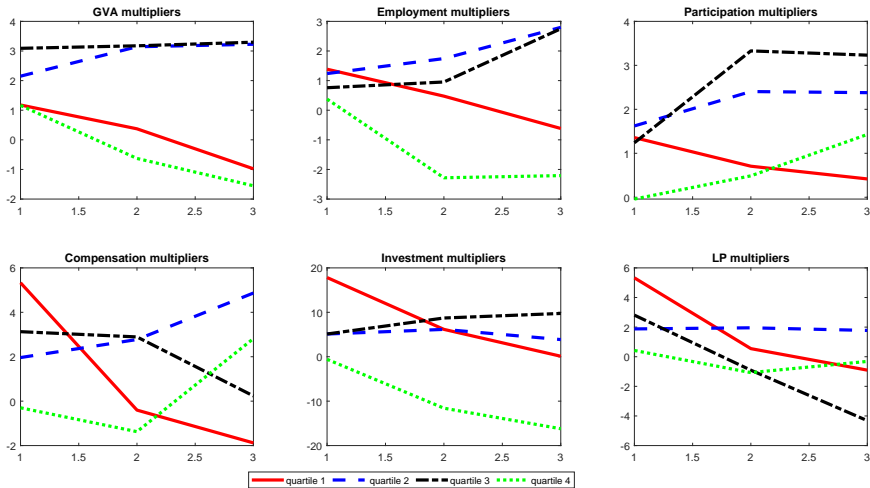
ESF Heterogeneities: Income
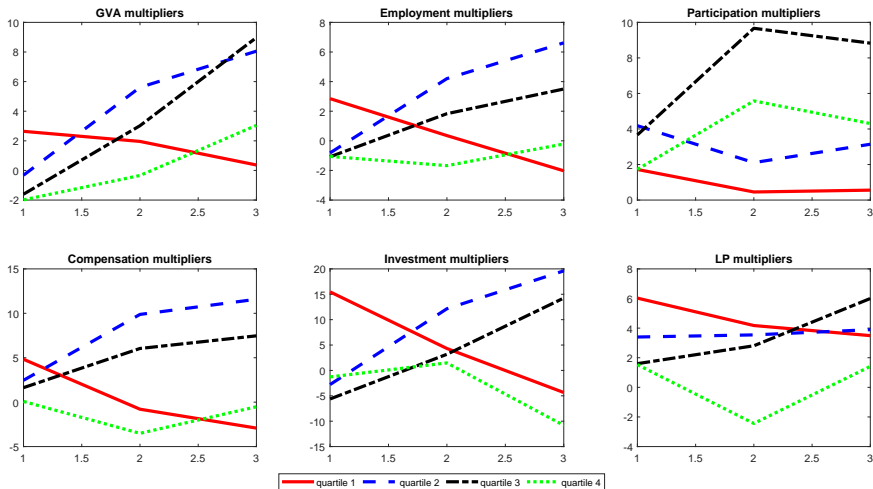
ERDF Heterogeneities: Borders
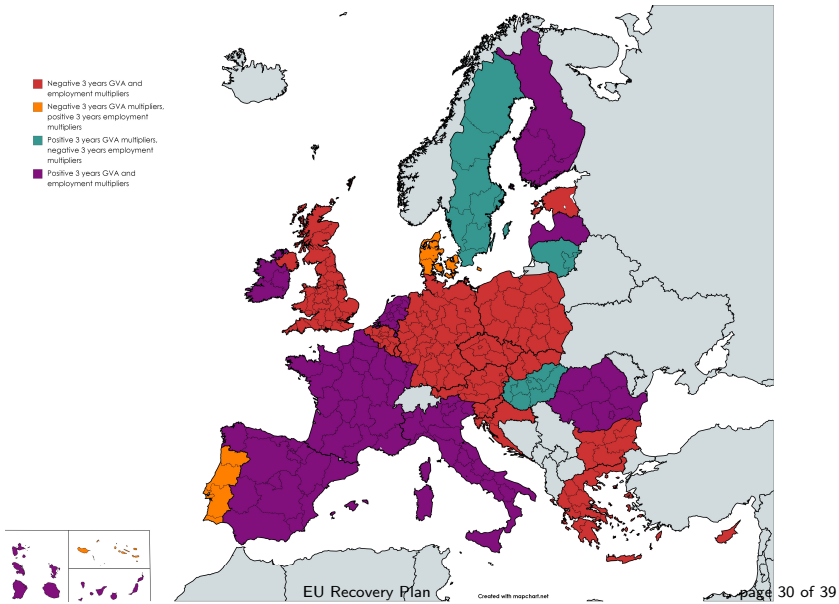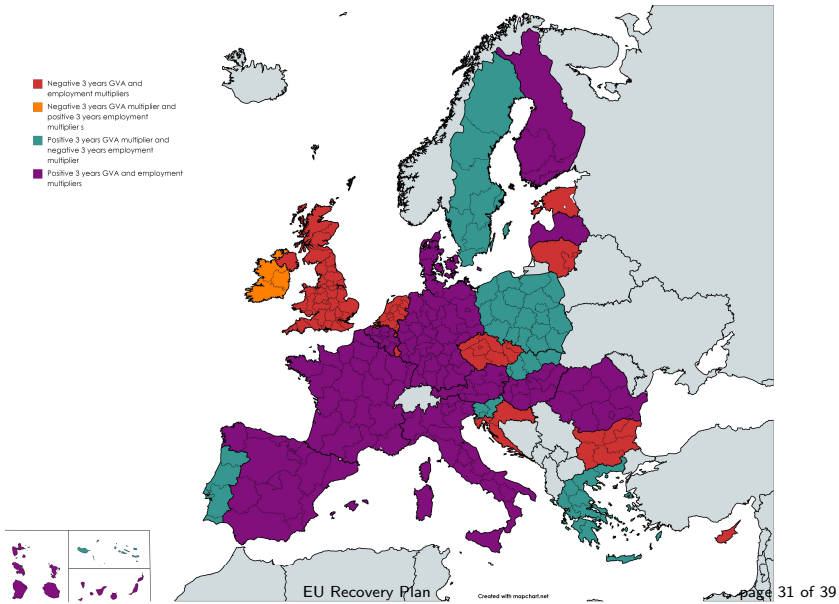
Negative 3 years GVA and
employment multipliers

Negative 3 years GVA multipliers,
positive 3 years employment
multipliers

Positive 3 years GVA multipliers,
negative 3 years employment
multipliers

Positive 3 years GVA and
employment multipliers

EU Recovery Plan

ESF Heterogeneities: Borders

Negative 3 years GVA and employment multipliers

Negative 3 years GVA multiplier and positive 3 years employment multiplier

Positive 3 years GVA multiplier and negative 3 years employment multiplier

Positive 3 years GVA and employment multipliers

EU Recovery Plan

Outline

Basic model features

- Two country model of a monetary union. Home country small.

- Standard NK bells and whistles.

- Key: R&D and HK accumulation affect labor productivity.

- Federal expenditure on R&D and HK generate an externality (local government taxes and transfers proceeds to federal government who spends it)

$$K_{t+1} = (1 - \delta_{K,t}(u_{K,t}))K_t + \Phi_K\left(\frac{I_t}{K_t}\right)K_t \tag{4}$$

$$D_{t+1} = (1 - \delta_{D,t}(u_{D,t}))D_t + \Phi_D\left(\frac{S_t}{D_t}\right)D_t \tag{5}$$

$$H_{t+1} = (1 - \delta_{H,t}(u_{H,t}))H_t + \Theta(H_t M_t)^\vartheta(\bar{H}_t \gamma_t^{HK})^{(1-\vartheta)} \tag{6}$$

Model: Production and Productivity

R&D: Productivity shock

$$Y_t(j) = (u_{K,t}(j)K_t(j))^{\alpha} (Z_t(j)L_t(j))^{1-\alpha} \tag{7}$$

$$Z_t(j) = (\gamma_t^{HD})^{\mu_{RD}}(u_{D,t}(j)D_t(j))^{\zeta}(\bar{u}_{D,t}\bar{D}_t)^{1-\zeta} \tag{8}$$
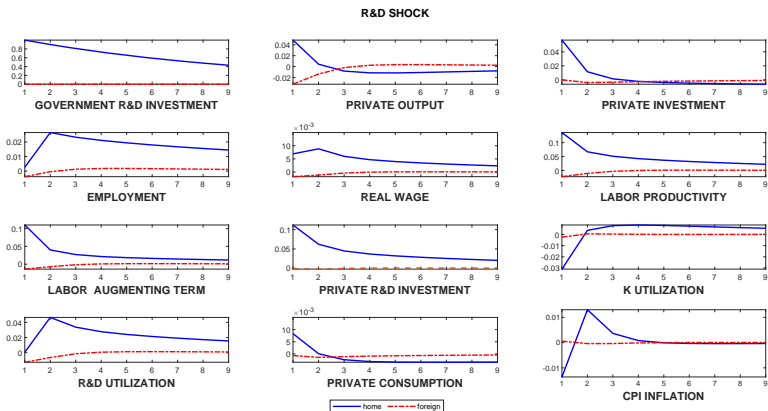
α is the capital share, $\gamma_t^{HD} = \frac{\tilde{G}_t^{HD}}{\tilde{G}_{t-1}^{HD}}$, μ_{RD} is a productivity parameter and ζ is an externality parameter.
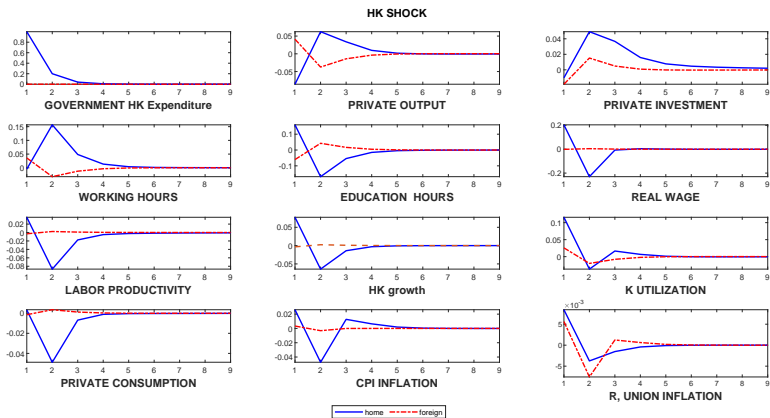
HK: Investment shock

$$Y_t(j) = (u_{K,t}(j)K_t(j))^{\alpha} (u_{H,t}H_t(j)L_t(j))^{1-a} \tag{9}$$

$(u_{K,t}(j)K_t(j))$ effective capital services and $(u_{H,t}H_t(j)L_t(j))$ effective labor services.

Responses to Government R&D shocks

R&D SHOCK

Responses to Government HK shocks

Multipliers

	R&D Shocks								
	Baseline		Lagged spending			Alternative		Large size	
Horizon	1 year	3 years	1 years	2 years	3 year	1 year	3 years	1 year	3 years
GVA	1.59	0.82	0.57	1.21	0.96	0.28	0.90	3.12	1.66
Employment	0.91	0.91	0.86	0.91	0.92	0.73	0.73	1.57	1.27
Compensation	0.50	0.34	0.36	0.45	0.39	0.43	0.59	0.75	0.47
Investments	3.56	1.93	1.45	2.75	2.20	0.94	2.40	4.29	2.34
Labor productivity	1.35	0.74	0.60	1.06	0.84	0.52	0.99	1.92	1.0.5

	Human Capital Shocks								
	Baseline		Higher depreciation			Higher adj.costs		Lower G productivity	
Horizon	1 year	3 years	1 year	2 years	3 years	1 years	3 years	1 year	3 years
GVA	-0.15	0.59	-0.23		0.78	-0.16	0.44	-0.53	0.54
Employment	-0.10	2.33	-0.47		2.92	-0.07	2.33	-0.94	2.14
Compensation	0.12	-1.81	0.24		-2.42	0.08	-1.88	0.64	-1.74
Investments	-0.16	0.95	-0.08		1.21	0.20	-1.64	-1.93	0.78
Labor productivity	0.98	-0.81	1.28		-1.30	0.94	-0.97	1.51	-0.70

For R&D shocks, in the ''lagged spending'' case, the growth rate of government R&D enters the production function with a lag; in the ''alternative case'' the lagged level of government R&D spending enters the production function; in the ''large size'' case $n = 0.3$. For human capital shocks, in the ''higher depreciation'' case, $\delta_H = 0.10$; in the ''higher adjustment costs'' case, $\psi_k = 7.5$; in the ''lower G productivity'', $\vartheta = 0.25$.

Outline

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2. The data

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Conclusions

- EDRF and ESF served different purposes: countercyclical vs. medium term.

- Large heterogeneities across regions and countries.

- Increased inequality and polarization.

- Optimistic outlook for NGEU funds, but need to be combined with other measures not to leave poor, peripheral, younger tenure regions behind.

- Model rationalizes the averages and account for some heterogeneities.

- Crucial for the results: timing of demand and supply effects; high depreciation and variable HK utilization, low adjustment costs of physical capital.