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Shocks and income inequality

Oleg Gurshev and Lucas van der Velde

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Oleg Gurshev
FAME|GRAPE

Lucas van der Velde
FAME|GRAPE and Warsaw School of Economics

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Keywords:
Inequality; Macroeconomic shocks; Administrative data

JEL Classification:
J30, J31, E24, E32

Corresponding author: :
Oleg Gurshev, o.gurshev@grape.org.pl.

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Oleg Gurshev
FAME|GRAPE

Lucas van der Velde
FAME|GRAPE
Warsaw School of Economics

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[†]Corresponding author: Oleg Gurshev. Email: o.gurshev@grape.org.pl.
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1 Introduction

It is now well recognized that the rise in economic inequality across advanced economies over the past decades has many drivers[1]. However, despite growing attention to the determinants of inequality, there is no systematic empirical evidence on how global shocks to supply and demand contribute to income inequality.

At the same time, understanding the origins of international fluctuations continues to be a key area of research. Given the sheer scale and global influence of the United States, its domestic changes to output and labor market are bound to have substantial implications for the global economy and its close economic partners (Carrillo et al., 2020; Fink & Schüler, 2015; Kose et al., 2003, 2012, 2017; Levchenko & Pandalai-Nayar, 2020; Miranda-Agrippino & Rey, 2022; Ramey, 2016).

This paper studies how income distributions react to supply and demand shocks originating in the US and within national economies. To this end, we draw on a rich cross-country database: the Global Repository of Income Dynamics (GRID) by Guvenen et al. (2022). This database contains comparable moments of income distributions of unparalleled quality. Our study analyzes data from countries that participated in the first phase of GRID: Canada, Denmark, France, Germany, Italy, Mexico, Norway, Spain, and Sweden.

Our analysis proceeds in two steps. First, we estimate supply and demand shocks using long-run restrictions[2] as proposed by Blanchard and Quah (1989)[3]. This method imposes restrictions based on economic theory, where supply shocks are assumed to have permanent effects on output, while demand shocks have only temporary effects. The second step involves recovering the reaction of income dispersion to US and country-specific (domestic) shocks using impulse response functions (IRFs) estimated directly from local projections (Jordà, 2005; Jordà & Taylor, 2024). Finally, we study the three potential transmission channels that are frequently identified in the literature: trade linkages (Corsetti & Müller, 2011), financial markets integration (Faccini et al., 2016), and expectations (Klein & Linnemann, 2021),

Our findings indicate that supply and demand shocks originating in the United States tend to raise income dispersion abroad. These shocks have persistent effects on inequality abroad. The comparison between domestic and international shocks reveals fundamental differences. First, domestic shocks generate weaker, and often not-statistically significant, responses. Second, domestic supply shocks are associated with a decline in inequality.

[1]Including, *inter alia*, technological progress (Acemoglu, 2002; Bound & Johnson, 1995), demographics (Karahan & Ozkan, 2013), globalization (Feenstra & Hanson, 2003), labor market structure (Jaumotte & Osorio, 2015), and monetary policy (Amberg et al., 2022; Andersen et al., 2023; Coibion et al., 2017; Furceri et al., 2018).

[2]See characterization of identification strategies in Ramey (2016).

[3]This seminal paper has been lately revisited by Binet and Pentecôte (2015), Herwartz (2018), and Keating (2013).

When considering transmission channels, the distinction between demand and supply shocks is relevant. Demand shocks increase inequality regardless of the level of exposure. By contrast, supply shocks produce more heterogeneous responses.

This paper contributes to the literature by showing how shocks to supply and demand affect income inequality and provides novel evidence on the transmission of US shocks. Our findings are complementary to the recent body of studies that investigate the dynamic causal link between shocks and the Gini: Coibion et al. (2017), Davtyan (2017), and Furceri et al. (2018). Specifically, we report novel results related to the impact of US and domestic shocks on inequality and find evidence related to the transmission of US shocks abroad via trade, financial, and expectations channels.

The paper is structured as follows. Section 2 describes data and methodology. Section 3 reports the results. Section 4 concludes.

2 Method and Data

2.1 Data

The Global Repository of Income Dynamics (GRID) provides measures of inequality from administrative records across several countries. This source has several advantages. First and foremost, income is less subject to reporting errors, and there is an adequate representation of earners at the top of the income distribution, neither of which is not guaranteed in other databases. Second, estimates are based on larger samples, quite often the entire working population. Finally, GRID also provides better coverage than similar open source databases (OECD, Luxembourg Income Study), as time series are uninterrupted. However, the database has some limitations: i) income refers to labor income at the individual level, ii) since it is based on tax records, envelope payments are not included. As our sample contains mostly developed countries, the bias introduced might not be significant.

All income inequality measures are computed only among individuals between ages 25-55, who are expected to be active in the labor market. To ensure that individuals are attached to the labor markets, the sample used in GRID is further restricted to those perceiving yearly earnings above a minimum threshold (one fourth of the minimum wage). All measures are based on gross earnings[4] deflated to 2018 price levels. Table A5 in Appendix presents descriptive statistics for Gini measures as collected from GRID.

We recover supply and demand shocks using the long-run restrictions approach pi-

[4]Each country has it's own specific approach to measuring gross earnings. However, the resulting measures are comparable as they include all forms of compensation subject to taxation and social security contributions (i.e., base salary, overtime compensation, performance and seasonal bonuses, paid vacations, paid sick leaves, and severance payments).

oneered by Blanchard and Quah (1989). Concretely, we estimate a bivariate VAR using quarterly rates of unemployment and real output growth[5]. We collect the necessary data from the Federal Bank of St. Louis (FRED) and the OECD databases.[6]. All series are demeaned, detailed description of the data used for the estimation of the bivariate models is available in Table A1 (Appendix). Tables A2 and A3 in Appendix display correlation of quarterly supply and demand shocks across countries. Shocks generally feature low degree of correlation across countries except two pairs (DEU-ESP, DEU-FRA). Finally, given that GRID data are available at the yearly level, we annualize and standardize (mean-center and scale to unit variance) the obtained shocks before using them in panel estimation.

2.2 Method

To study the impact of supply and demand shocks on (the level of) inequality, we compute cumulative IRFs directly from local projections. Specifically, we estimate the following regression at the country level:

$$y_{c,t+h} - y_{c,t-1} = \beta^h z_{c,t} + \gamma_c^h + \gamma_t^h + \pi^h X_{c,t} + e_{c,t+h}^h \tag{1}$$

where $y_{c,t+h}$ is the log of Gini for country c measured at time $t+h$, $z_{c,t}$ is the exogenous shock, and β^h are the estimated responses for $h = 0,..,3$ periods after the shock. The remaining elements identify country fixed effects (γ_c^h). The next term (γ_t^h) addresses potential period differences. When analyzing domestic shocks, γ_t^h represent time fixed effects. When shocks originate in the US (and are common to all countries), γ_t^h represents US recessions (level and two lag values).

Our baseline set of controls ($X_{c,t}$) includes two lags of: changes in inequality ($\Delta y_{c,t-i}$, for $i = 1,2$) and exogenous shock used ($z_{c,t-i}$, for $i = 1,2$), i.e. supply or demand. As a robustness check, we expand the set of control variables to include two lags of: i) share of exports to the US to total exports (trade exposure), ii) share of US bank claims to GDP (financial exposure), iii) changes in *de facto* economic openness (proxied by the *de facto* component of the KOF index), iv) expectations (proxied by the OECD's business confidence index), and v) changes in domestic labor market policies (proxied by the Economic Freedom of the World's indicator of labor market regulation), see Table A4 for details

[5]Lag length is selected using AIC separately for each country: one lag (Canada, Italy, Mexico, Norway), two lags (Denmark, France, Germany, Spain Sweden, USA). Impulse response functions for each country (demand and supply shocks) are available in Figures B4 and B5 (Appendix). While demand shocks are temporary, they decay at a slow rate. In some countries, the responses are different from zero even 20 quarters after the initial shock (see Figure B4 in Appendix).

[6]Even if data requirements are minimal, they are not satisfied by every country. Argentina and Brazil lack data on unemployment rates for the early years of the sample. Therefore, we excluded these countries from further analysis.

(Appendix).

To examine the three potential transmission channels of supply and demand shocks originating in the US using the state-dependency from Auerbach and Gorodnichenko (2013). Namely, we estimate the regression:

$$y_{c,t+h} - y_{c,t-1} = \beta^h z_t^{US} + \gamma^h (z_t^{US} \times s_{c,t-1}) + \pi^h X_{c,t} + \gamma_c^h + e_{c,t+h}^h \tag{2}$$

where $s_{c,t-1}$ represents the state variable: i) percentage of exports to US in all exports of country c (trade channel), ii) bilateral US bank claims as a proportion of GDP in country c (financial channel), and iii) business confidence in country c (expectations channel). $X_{c,t}$ includes two lags of: changes in inequality, exogenous shock being used, interaction term, and NBER recessions. The state-dependent cumulative impulse response is the linear combination $\beta^h + \gamma^h \times s_{c,t-1}$.

Finally, all estimations use Driscoll-Kraay standard errors in reporting confidence bands. These standard errors accommodate different forms of autocorrelation and heteroskedasticity.

3 Results

We report our results as follows. First, we estimate the baseline responses of the Gini coefficient computed for the entire working-age population to unanticipated, one-standard-deviation change in US and domestic shocks. Next, we study the three transmission channels. We specifically model the dependency through a direct linear interaction term using the three measures representing trade, financial, and expectations channels. We then check robustness of our baseline estimates by including additional controls related to alternative drivers of inequality.

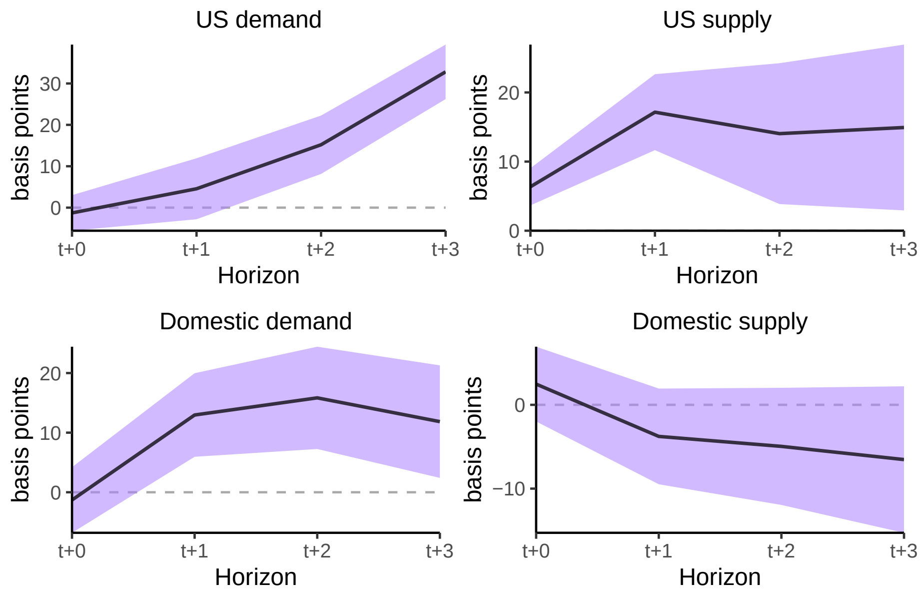
The upper row of Figure 1 displays the responses of the log of Gini to demand and supply shocks originating in the US. US demand shock leads to a significant and long-lasting increase (up to 40 basis points) in income inequality. US supply shocks produce much smaller increases in income inequality (up to 25 basis points). Domestic shocks, whether demand or supply, produce IRF in the vicinity of 5 basis points, as shown in the bottom row of Figure 1. The direction is less clear than in the case of US shocks. Domestic demand shocks produce an initial hike that quickly vanishes, whereas domestic supply shocks tend to decrease inequality at longer horizons.

Figure 2, we study the three potential transmission channels: trade linkages (Corsetti & Müller, 2011), financial markets integration (Faccini et al., 2016), and expectations (Klein & Linnemann, 2021). None of these channels explains variation in responses to demand shocks. By contrast, supply shocks produce heterogeneous responses based on exposure.

When countries have strong export links a US supply shock leads to a large and persistent increase in inequality. Second, countries with strong financial links observe a short-lived increase in inequality during the first period after the shock, whereas countries with weaker links observe a gradual increase in inequality during the entire estimation horizon. Lastly, lower business confidence in home country is associated with a more pronounced inequality response. As an extension, we perform a data-driven subsample split using country-level median values of channel measure and estimate our baseline specification (see Figure B3 in Appendix). When splitting the countries, demand shocks appear more differentiated by trade level, countries above the median in the initial year have a stronger reaction.

Further, we check whether the inclusion of additional drivers of the Gini coefficient affect the estimated responses. The new variables include labor market regulations, and the *de facto* component of the KOF globalization index. The resulting IRFs are portrayed in Figure B1. The patterns described for US demand shocks are robust to the inclusion of new variables. The trajectory of responses to supply shocks is also identical, but shifted downwards. Table B2 presents the estimated coefficients. Since the additional controls are not available each year, we also include an intermediate specification, which restricts the sample, but does not include any of the additional control variables.

Figure 1: Cumulative impulse responses to demand and supply shocks: Gini, baseline.

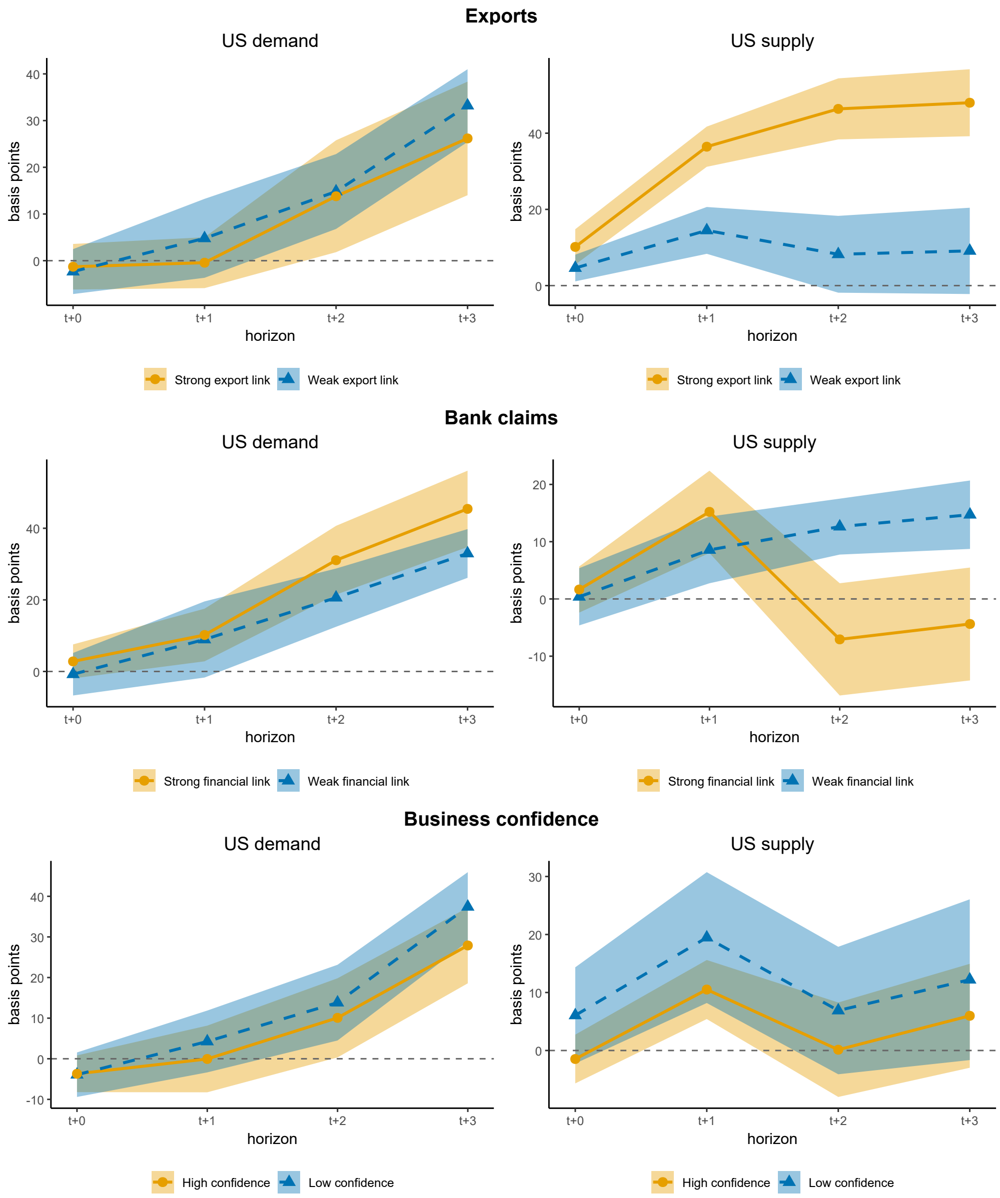


Note: shaded areas represent 68% Driscoll-Kraay confidence bands. Detailed output of our baseline result is available in Table B1 (Appendix).

Domestic demand shocks generate an increase in inequality, though responses remain lower than those to US shocks. Moreover, estimates from the intermediate specification suggest that responses are driven (partly) by sample composition.

A second extension evaluates the evolution beyond the initial estimation horizon of three years, see Figure B2, given that the panels are short, estimates from these longer horizon are less reliable, which is reflected in the broader confidence bands. To the extent that conclusions are possible, the response to foreign demand shocks decreases over time, whereas foreign supply shocks produce more persistent responses.

Figure 2: Cumulative state-dependent impulse responses to US demand and supply shocks: Gini.



Note: levels are data-driven, i) exports (weak: up to 50th percentile; strong: 90th percentile), ii) bank claims (weak: 25th percentile, strong: 75th percentile), iii) business confidence (low: 25th percentile, high: 75th percentile). Shaded areas represent 68% Driscoll-Kraay confidence bands.

4 Concluding remarks

In summary, we show that US supply and demand shocks increase income dispersion abroad. While demand shocks have widespread impacts, supply shocks appear more selective, with larger effects concentrated in trade-linked economies. The financial channel does not appear particularly relevant on our estimations. Domestic demand shocks tend to be weaker and more transient. Unlike US supply shocks, domestic shocks reduce inequality.

A more countries join the GRID project, it would become feasible to study the external validity of these findings. Another extension is to consider alternative measures of unanticipated shocks, which can be derived for all countries.

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Appendix

Part A: Data

Table A1: Real output and unemployment series used for estimation of domestic supply and demand shocks using long-run restrictions.

Country	Scope	Source
Canada (CAN)	1990:Q2-2019:Q3	OECD
Denmark (DKK)	1990:Q2-2019:Q3	OECD
France (FRA)	1990:Q2-2019:Q3	OECD
Germany (DEU)	1991:Q1-2019:Q3	OECD
Italy (ITA)	1990:Q2-2019:Q3	OECD
Mexico (MEX)	1990:Q2-2019:Q3	OECD
Norway (NOR)	1990:Q2-2019:Q3	OECD
Spain (ESP)	1990:Q2-2019:Q3	OECD
Sweden (SWE)	1990:Q2-2019:Q3	OECD
United States (USA)	1990:Q2-2019:Q3	FRED

Note: own summary, all data are quarterly. For the USA, we used GDPC1 and UNRATE series. For OECD countries, we used quarterly real GDP (expenditure approach, in USD) and the quarterly unemployment rate (seasonally adjusted, working-age population).

Table A2: Pairwise correlations: supply shock.

	CAN	DKK	DEU	ESP	FRA	ITA	MEX	NOR	SWE	USA
CAN	1									
DKK	-0.08	1								
DEU	-0.24	0.14	1							
ESP	-0.16	0.05	0.38	1						
FRA	0.07	0.08	-0.25	-0.22	1					
ITA	-0.14	0.01	0.1	-0.06	0.17	1				
MEX	-0.19	-0.13	0.4	0.2	-0.08	0.15	1			
NOR	0.14	0.12	-0.04	0	-0.02	0.05	0.02	1		
SWE	-0.04	0.14	0.31	0.25	-0.01	0.1	0.02	0.13	1	
USA	0.02	0.17	0.09	0.22	-0.08	0.07	0.18	0.03	0.12	1

Note: own summary, shocks are obtained using long-run restrictions. The period under analysis is 1990:Q2-2019:Q3 for all countries except Germany (1991:Q2-2019:Q3).

Table A3: Pairwise correlations: demand shock.

	CAN	DKK	DEU	ESP	FRA	ITA	MEX	NOR	SWE	USA
CAN	1									
DKK	0.2	1								
DEU	0.19	0.05	1							
ESP	0.12	-0.03	0.1	1						
FRA	0.24	0.17	0.36	-0.01	1					
ITA	0.14	0.2	0.14	-0.07	0.28	1				
MEX	0.22	0.17	0.12	0.15	0.12	0.17	1			
NOR	0.13	0.23	-0.11	-0.02	0.13	0.14	0.1	1		
SWE	0.23	0.15	0.15	-0.03	0.2	0.17	0.07	0.11	1	
USA	0.16	0.23	0.16	-0.07	0.12	0.25	0.16	0.16	0.05	1

Note: own summary, shocks are obtained using long-run restrictions. The period under analysis is 1990:Q2-2019:Q3 for all countries except Germany (1991:Q2-2019:Q3).

Table A4: Control variables used in the estimation of local projections.

Variable	**Source**	**Availability**
NBER identified economic recessions in the US	NBER	1990-2019
De facto component of the KOF Economic Globalization index	Gygli et al. (2019)	1990-2017
Labor market regulations score (Area 5)	Fraser Institute	1990,1995,2000-2019
Share of exports to the US	Own estimation based on UNCTAD	1990-2019, with gaps
Bilateral US bank claims to GDP	Own estimation based on BIS	1990-2019, with gaps
Business confidence index	OECD	1990-2019, with gaps

Note: own summary.

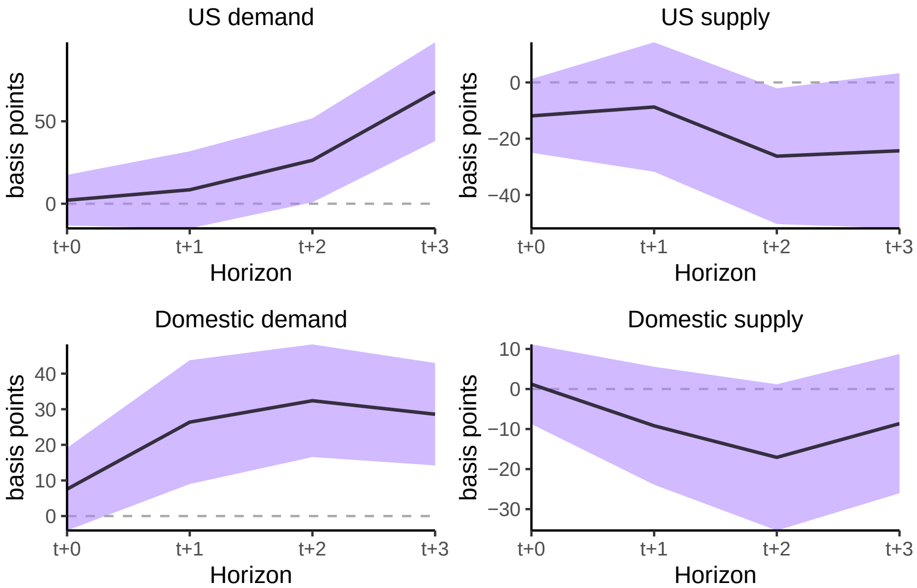
Table A5: Availability of GRID data (baseline sample).

Country	Scope	Mean Gini
Canada	1990–2019	0.41 (0.01)
Denmark	1990–2016	0.28 (0.01)
France	1991–2016	0.34 (0.00)
Germany	2001–2016	0.40 (0.01)
Italy	1990–2016	0.36 (0.02)
Mexico	2005–2019	0.56 (0.00)
Norway	1993–2017	0.33 (0.01)
Spain	2005–2018	0.40 (0.01)
Sweden	1990–2016	0.30 (0.01)
N	217	

Note: own summary, standard deviations in parentheses. All data are annual.

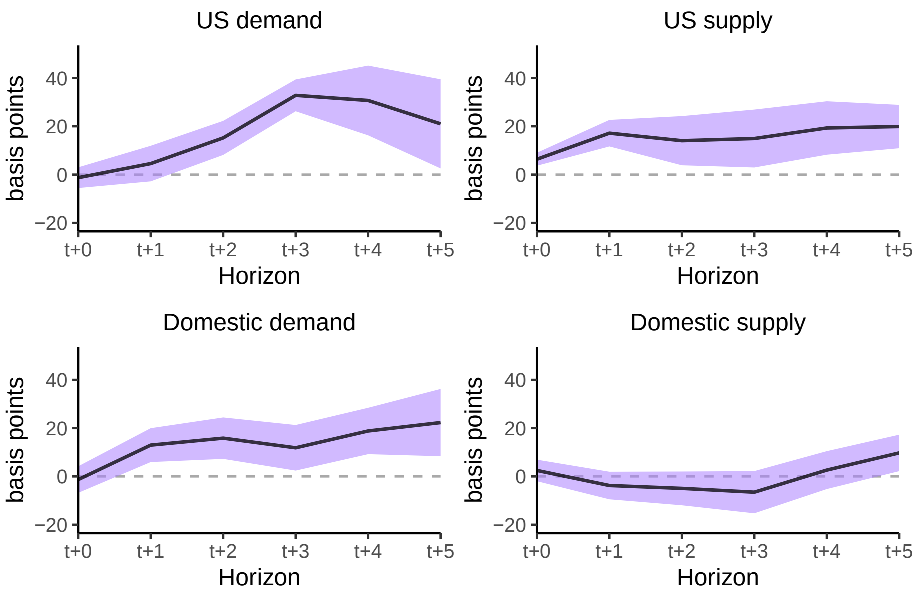
Part B: Local projections and additional results

Figure B1: Cumulative impulse responses to demand and supply shocks: Gini, robustness.



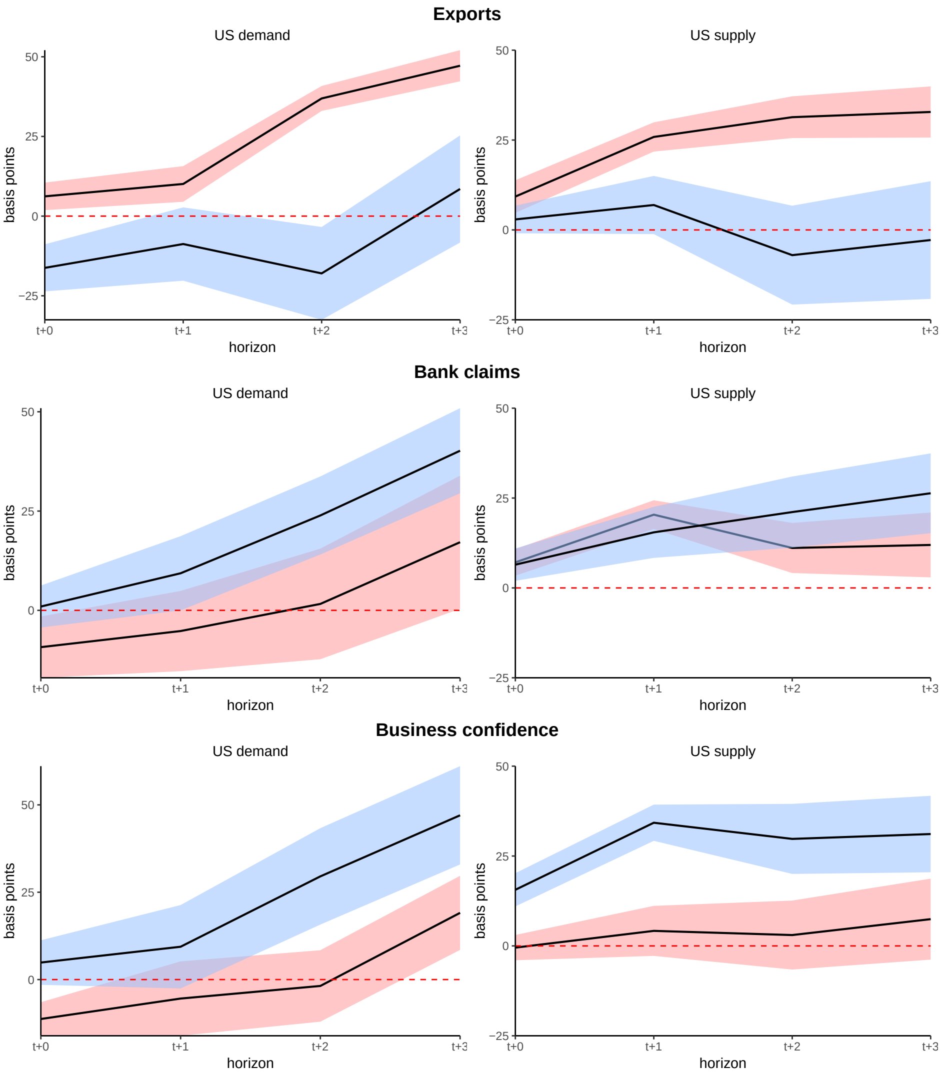
Note: shaded areas represent 68% Driscoll-Kraay confidence bands.

Figure B2: Cumulative responses over longer time horizons.



Note: shaded areas represent 68% Driscoll-Kraay confidence bands.

Figure B3: Cumulative impulse responses to demand and supply shocks: transmission channels of US shocks across subsamples.



Note: red response represents “high” subsample, blue response represents “low” subsample. Sample splitting is done using pooled country-level medians of each measure. Sample composition: i) exports (high exposure: Canada, Germany, Italy, Mexico, Sweden; low exposure: Denmark, France, Norway, Spain), ii) bank claims (high exposure: Canada, Denmark, France, Germany, Mexico; low exposure: Italy, Norway, Spain, Sweden), iii) business confidence (high confidence: France, Italy, Mexico, Norway, Spain; low confidence: Canada, Denmark, Germany, Sweden). Shaded areas represent 68% Driscoll-Kraay confidence bands.

Table B1: Baseline estimation results from local projections, 1990-2019.

	Dependent variable: log (Gini)							
	Demand				Supply			
	(0)	(1)	(2)	(3)	(0)	(1)	(2)	(3)
Model 1: US shocks								
Shock	−0.001	0.0001	0.001	0.003***	0.001**	0.002***	0.001*	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0003)	(0.0005)	(0.001)	(0.001)
Shock_{t-1}	0.001***	0.002***	0.003***	0.002	0.001***	0.001	0.002	0.002**
	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Shock_{t-2}	0.001*	0.001	0.001	0.001**	0.0005	0.001	0.001	0.0005
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$\Delta\ \text{Gini}_{t-1}$	−0.001	−0.0001	−0.001	−0.001	−0.001	0.00000	−0.002	−0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
$\Delta\ \text{Gini}_{t-2}$	0.001	0.0004	0.001	−0.001	0.001	0.0004	0.001	−0.0002
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)
Model 2: Domestic shocks								
Shock	−0.0001	0.001*	0.002*	0.001	0.0002	−0.0002	−0.0002	−0.0002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)	(0.001)	(0.001)	(0.001)
Shock_{t-1}	0.002**	0.002**	0.001*	0.002**	−0.0003	−0.001	−0.001	−0.0001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)	(0.0004)	(0.001)	(0.001)
Shock_{t-2}	0.0005	0.0003	0.0004	0.001	−0.0001	−0.0001	0.0003	0.001
	(0.0004)	(0.0004)	(0.0005)	(0.001)	(0.0003)	(0.001)	(0.001)	(0.001)
$\Delta\ \text{Gini}_{t-1}$	−0.001	0.00000	−0.001	−0.001	−0.001	0.0001	−0.0003	−0.0002
	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
$\Delta\ \text{Gini}_{t-2}$	0.001	0.0001	0.001	0.0004	0.001	0.0004	0.001	0.001
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)
N	177	168	159	150	177	168	159	150

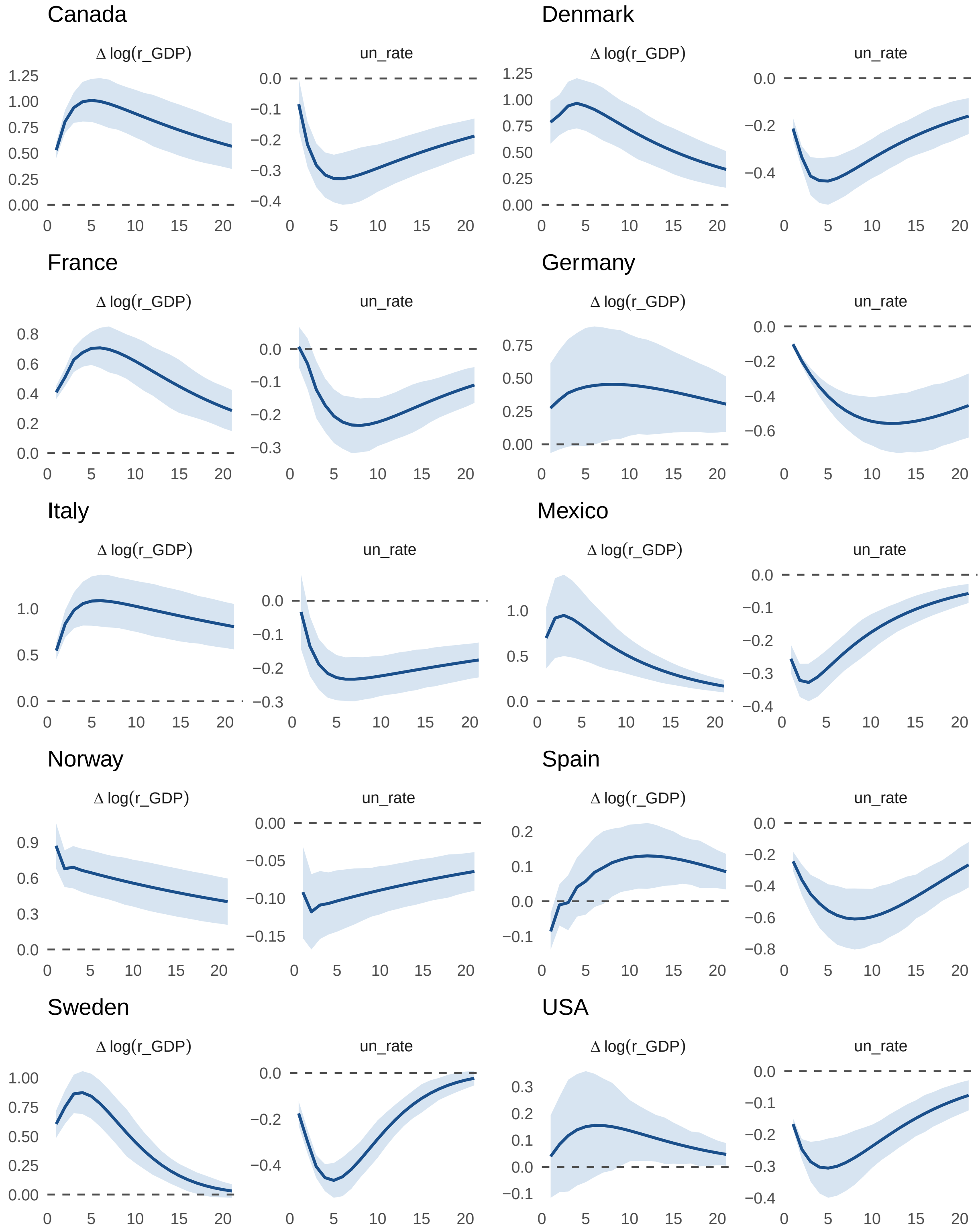
Note: Driscoll-Kraay errors in parenthesis, column headers represent estimation horizons. Model 1 includes country fixed effects and NBER recession dummy. Model 2 includes country and year fixed effects. Significance levels: *p<0.1, **p<0.05, ***p<0.01.

Table B2: The effect of supply and demand shocks on income inequality, 1990-2019.

	Dependent variable: log (Gini)							
	Demand				Supply			
	β_t	β_{t+1}	β_{t+2}	β_{t+3}	β_t	β_{t+1}	β_{t+2}	β_{t+3}
Panel 1: US shocks								
(a) Baseline	−0.001	0.0001	0.001	0.003***	0.001**	0.002***	0.001*	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0003)	(0.0005)	(0.001)	(0.001)
N	177	168	159	150	177	168	159	150
(b) Restricted sample	0.001	0.001	0.002	0.006***	0.001	0.002	−0.0001	−0.001
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
N	118	109	100	91	118	109	100	91
(c) All controls	0.0002	0.001	0.003	0.007**	−0.001	−0.001	−0.003	−0.002
	(0.002)	(0.002)	(0.003)	(0.003)	(0.001)	(0.002)	(0.002)	(0.003)
N	118	109	100	91	118	109	100	91
Panel 2: Domestic shocks								
(a) Baseline	−0.0001	0.001*	0.002*	0.0002	0.0002	−0.0002	−0.0002	−0.0002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)	(0.001)	(0.001)	(0.001)
N	177	168	159	150	177	168	159	150
(b) Restricted sample	0.001	0.003**	0.005***	0.004**	0.001	−0.0004	−0.001	−0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)
N	118	109	100	91	118	109	100	91
(c) All controls	0.001	0.003	0.003**	0.003*	0.0001	−0.001	−0.002	−0.001
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
N	118	109	100	91	118	109	100	91

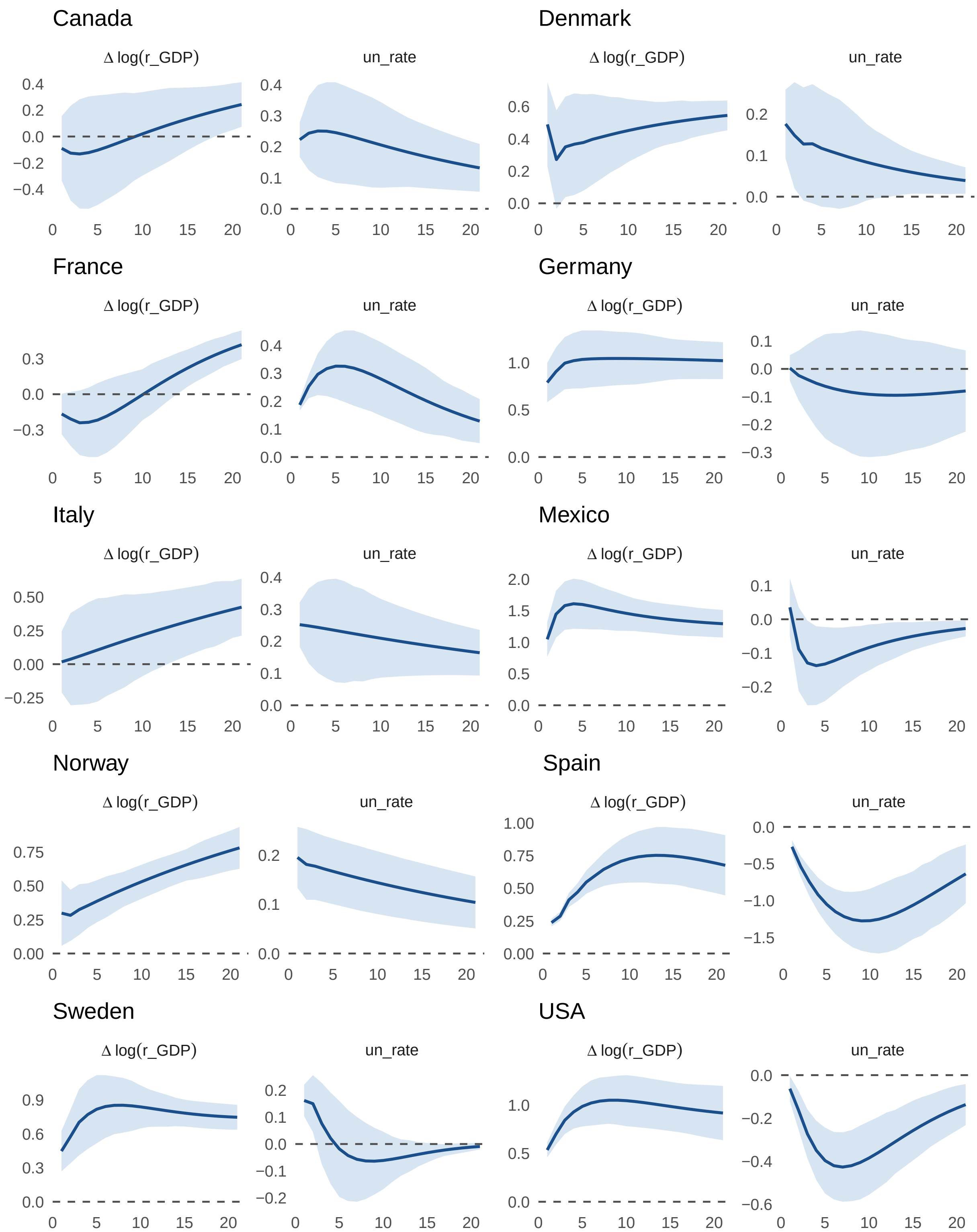
Note: Driscoll-Kraay errors in parenthesis, columns headers represent estimation horizons. Baseline regressions include additional controls for: growth of Gini (2 lags), shock (2 lags). Restricted sample is computed using baseline regressions, but only including entries, for which we have complete observations for all controls used in the estimation. For all controls, we introduce (2 lags): changes in the KOF index, changes in the labor market regulations, the share of exports to the US, bilateral US bank claims to GDP, and business confidence index. Significance levels: *p<0.1, **p<0.05, ***p<0.01.

Figure B4: Estimated impulse response functions to demand shock.



Note: 20 quarters, shaded areas represent 68% confidence bands. r_GDP and un_rate stand for real output growth and unemployment rate.

Figure B5: Estimated impulse response functions to supply shock.



Note: 20 quarters, shaded areas represent 68% confidence bands. r_GDP and un_rate stand for real output growth and unemployment rate.