LABOUR MARKET ADJUSTMENTS TO POPULATION DECLINE

A Historical Macroeconomic Perspective, 1875-2016

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DATA

- Information on population (total and by age), births, real GDP, real wages, investment share, total employment, unemployment rate, and the labour force participation rate from more than 90 individual sources

- Period covered: 1875 to 2016

- Countries covered on an annual basis without gaps: AUS, DEU, DNK, FRA, GBR, NLD, NOR, SWE, USA

ECONOMETRIC STRATEGY I

- We use our panel dataset and the corresponding cross-country variation to identify the effects of population decline in a panel VAR of the form:

$$Y_{it} = \mu_i + \delta_t + AY_{i,t-1} + EX_{i,t} + u_{it} \qquad (1)$$

- Y_{it} is a vector of six endogenous variables:
  - working-age population, real GDP, real wages, real investment, total employment, total unemployment

- μ_i are individual fixed-effects, δ_t are time fixed-effects, X_{it} is a vector of dummy variables

ECONOMETRIC STRATEGY II

- Non-symmetric effects in times of population growth and decline

- (Panel) Smooth-Transition VAR (Auerbach/Gorodnichenko 2012 and others)

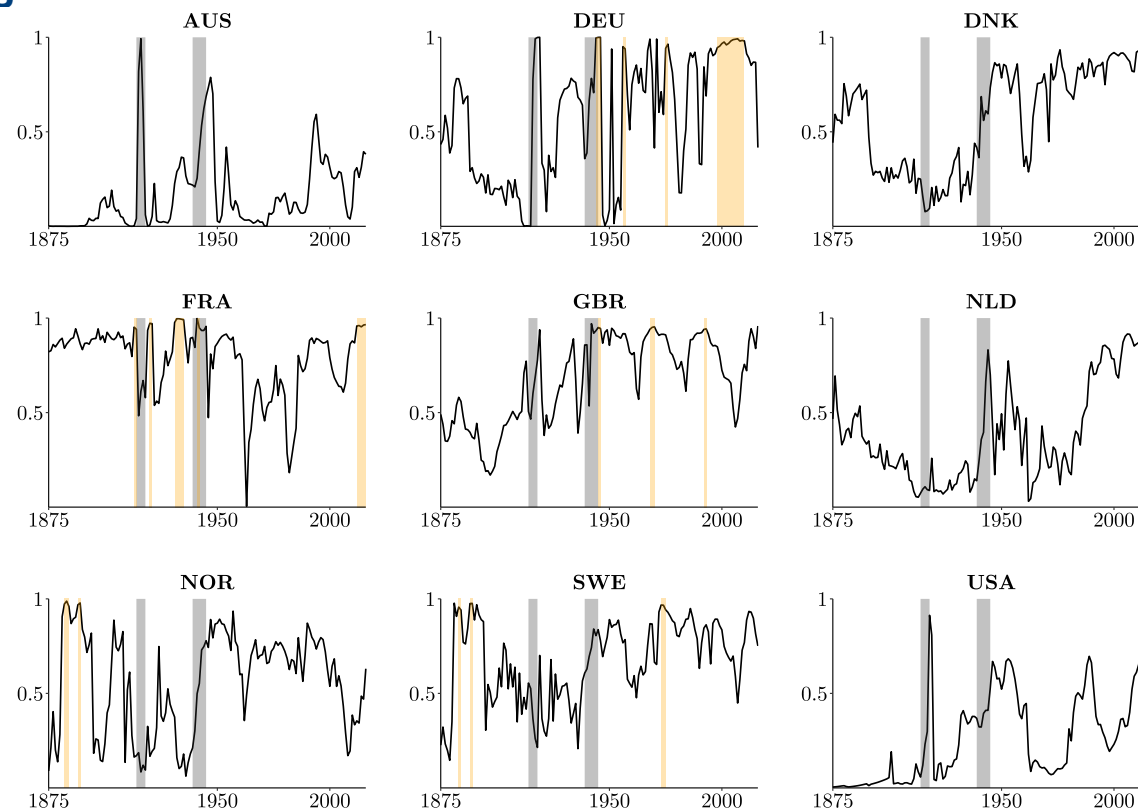$$Y_{it} = \mu_i + \delta_t + [1 - P(q_{i,t-1})]GY_{i,t-1} + [P(q_{i,t-1})]DY_{i,t-1} + u_{it} \tag{2}$$

$$P(q_{it}) = \frac{exp[-\gamma(q_{it} - c)]}{1 + exp[-\gamma(q_{it} - c)]} \tag{3}$$

$$\Omega_t = [1 - P(q_{i,t-1})]\Omega_G + [P(q_{i,t-1})]\Omega_D \tag{4}$$

- The transition variable q_{it} is the annual population growth rate; we define $c = 0$.
- We calibrate to match $\Pr[P(q_{it}) \geq 0.9374] \approx 0.0626$ and yield $\gamma = 2.27$

ECONOMETRIC STRATEGY III

Weights on the decline regime across countries

Source: own illustration

Legend: World War I & II | Years of population decline (15-64 years)

ECONOMETRIC STRATEGY IV

- As it is well known, the reduced form innovations of a SVAR can be understood as linear combinations of structural shocks:

$$u_{it} = S\varepsilon_{it} \tag{5}$$

- Increasingly, empirical approaches refrain from identifying the entire matrix S but rather focus on identifying only the shock of interest using external instruments (Stock/Watson 2012, 2018; Mertens/Ravn 2013; Gertler/Karadi 2015).

- That is, we identify only the first column s of matrix S and leave all other columns respectively shocks unidentified

ECONOMETRIC STRATEGY V

- The elements of s are estimated using two-stage least squares (2SLS) with a suitable instrument Z that satisfies

$$E(\varepsilon_{1,it}Z_{it}) \neq 0 \ (relevance)$$
$$E(\varepsilon_{2:n,it}Z_{it}) = 0 \ (exogeneity)$$

$$\hat{u}_{1,itR} = EZ_{it} + \psi_{it} \tag{6}$$

$$\hat{u}_{1:6,itR} = s_{1:6,R}\hat{\hat{u}}_{1,itR} + \xi_{it} \tag{7}$$

- Using two external instruments, allowing for different roles in growth and decline periods:

$$z_{1,it} = births_{i,t-15} \qquad\qquad z_{2,it} = births_{i,t-65}$$

- We observe F values of sufficient sizes (>30) in both regimes

ECONOMETRIC STRATEGY VI

- We find the appropriate lag length (= 3) for our model using the BIC and checking for serial correlation

- We derive regime-dependent orthogonal impulse response functions by applying a residual bootstrap with 2,000 draws

- Using these results, we additonally derive the impulse response of the labour force participation (included implicitly)

RESULTS I

Effects of a population shock in the growth regime
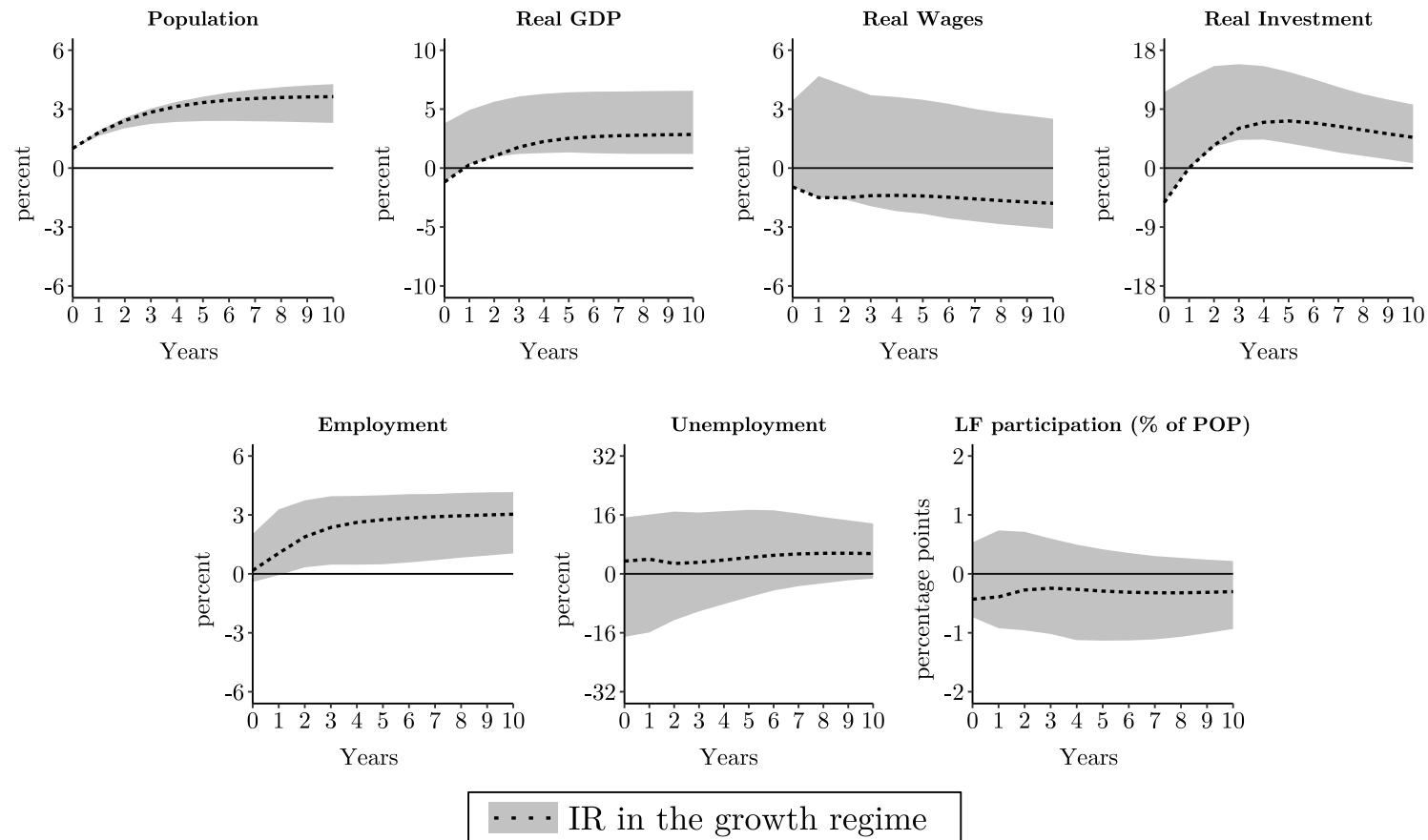
IR in the growth regime

RESULTS II

Asymmetric effects of population shocks in growth and decline regimes
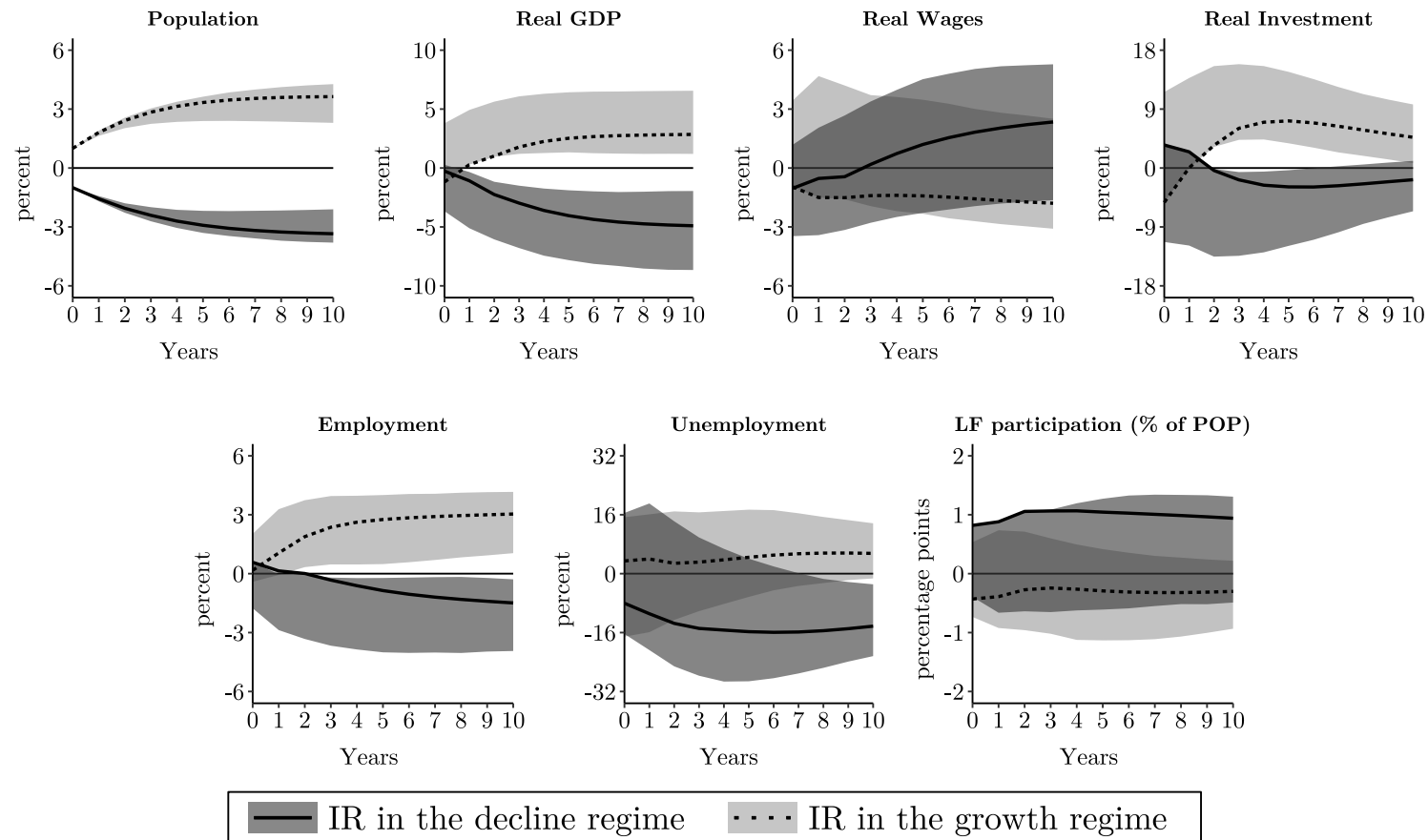
SUMMARY, CONCLUSION, LIMITATIONS

- Imminent or occuring working-age population decline among advanced economies, calling for a close investigation of labour market adjustments

- Collected a novel dataset containing demographic and economic variables for nine advanced economies over the period 1875 to 2016 from more than 90 individual sources

- Using a PSTVAR-IV, our preliminary results suggest that the labour market adjusts to population decline, in particular in terms of (1) **labour supply** through both **higher participation** and a **reduction in unemployment** in order to **maintain** the **employment level**, (2) a disproportionally **less distinct decline** in **investment**, but (3) only weak evidence of increasing wages

- Limitations and tasks ahead: (1) model specification and (historical) data availability, (2) ensuring non-linear parameter constancy in view of a strongly limited number of observations, (3) (historical) data quality

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