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:

\[ Y_{it} = \mu_i + \delta_t + AY_{i,t-1} + EX_{i,t} + u_{it} \]  

(1)

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

• \( \mu_i \) are individual fixed-effects, \( \delta_t \) 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)

\[ Y_{it} = \mu_i + \delta_t + [1 - P(q_{i,t-1})]G_{Y,t-1} + [P(q_{i,t-1})]D_{Y,t-1} + u_{it} \]  

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

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

- 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 \( \gamma = 2.27 \)
Weights on the decline regime across countries

Source: own illustration
ECONOMETRIC STRATEGY IV

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

\[ u_{it} = S \varepsilon_{it} \]  

(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)

$\hat{u}_{1,itR} = EZ_{it} + \psi_{it}$  \hspace{1cm} (6)

$\hat{u}_{1:6,itR} = s_{1:6,R}\hat{u}_{1,itR} + \xi_{it}$  \hspace{1cm} (7)

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

$z_{1,it} = births_{i,t-15}$

$z_{2,it} = births_{i,t-65}$

• 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 additionally derive the impulse response of the labour force participation (included implicitly)
RESULTS I

Effects of a population shock in the growth regime

Source: own illustration

NOTE: preliminary results - do not cite.
For recent results, contact the author.
Asymmetric effects of population shocks in growth and decline regimes

Source: own illustration
SUMMARY, CONCLUSION, LIMITATIONS

• Imminent or occurring 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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LITERATURE


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