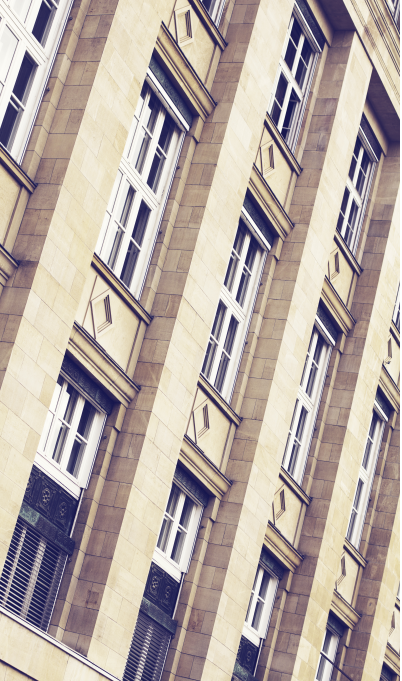

PAPER DISCUSSION

Macroeconomic implications of demographic changes in Bulgaria

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Summary

- Assessment of the **macroeconomic implications of demographic change** in Bulgaria, in particular on
  - potential output
  - inflation
  - fiscal sustainabililty
- Human capital-augmented production function, Bayesian VAR model
- **Results:** Bulgaria's declining working age population (WAP) will
  - constrain potential growth (via $L \downarrow$ & $H \downarrow$)
  - lower inflation in the longer run (*demand* $\downarrow$ outweighs $w \uparrow$)
  - increase government debt compared to no-ageing scenario
- **Policy implications:** need for policies that increase LFP and productivity and ensure fiscal sustainability

General comments

- **Highly relevant and timely topic with significance for policy**
  - Bulgaria's population expected to decline from ∼9m (1980) to ∼5m by 2070 (IIASA)
  - Old-age DR expected to increase from 19% in 1980 to 57% in 2070 (IIASA)
- **Comprehensive approach**
  - adopts extensive, broad perspective on the topic
  - comprehensive literature survey
  - clearly structured and very well written draft
- **Innovative methods**
  - ML-techniques to forecast education and LFP
- $\longrightarrow$ little to add, only few suggestions

Human capital index: non-employed and margins?

- Growth effect of demographic changes depends on
  - working age population (WAP) decline
  - ageing and associated less productive labor force (LF)

- **Human capital accumulation index:** relative wages by age/sex/education in 2018
  - **Human capital zero for non-employed**
    - Implicit assumption of independence of workers' productivity and proportion of workers in population (unpaid care work, social infrastructure, complementarities of roles, with productivity depending on support)
    - Emigration: it may make a difference if people emigrate vs. become non-employed (but stay)
    - Self-employed included?
  - **Intensive margin:** ageing might affect hours worked. Additional weight to reflect this?
  - **Extensive margin:** ageing might change LFP; only most productive remain in LF
  - Long projection horizon: health improvements, nature of jobs might change?

Comparison of human capital forecasts

- The (ML-based) forecasts for educational attainment could be compared to IIASA-VID projections of the population by age, gender, education (different scenarios)

Population projections for Bulgaria for 2040 (left) and 2070 (right), by age, gender, and education (medium scenario).
Source: Wittgenstein Centre for Demography and Global Human Capital `https://dataexplorer.wittgensteincentre.org/wcde-v3/`

Emphasizing the role of migration

- Besides ageing, emigration relevant for slow down in **human capital accumulation**
  - Currently, >1.2 million emigrants from BG (UN, 2024)
  - most productive could have emigrated/will emigrate?
  - distinction between ageing and emigration effects possible?
- Similarly for **WAP declines:** people are "ageing out" of WAP, but also emigrating out
  - worth the attempt to distinguish between the two?

- **Why distinguishing?** $\longrightarrow$ Policy-angle for emigration, not for ageing

- In the future, potentially interesting:
  - hypothetical human capital index development w/o (e)migration
  - hypothetical WAP development w/o (e)migration

Impact of wages on inflation: moderate effects?

- Unclear effect ex-ante: elderly consume less (*demand* ↓, *infl* ↓) but also *w* ↑, *infl* ↑
- Paper investigates which effect dominates under 1/ no ageing and 2/ ageing and finds
  - decline in wage growth in both scenarios, only minor differences between 1/ and 2/

- **BVAR results:**
  - wages have limited impact on inflation (no direct effect on prices, production costs…)
    - in particular, prices in services sector should respond
  - impulse response functions show effect of a 1 std.dev. wage shock (I assume). Variation in the wage variable (2020/Q1 - 2023/Q4)? IRF for an, e.g., 10%-wage-shock?
  - core inflation permanently lower in ageing scenario
- Sensitivity of results if difference in wage growth between the two scenarios was more pronounced?
- BVAR-part could benefit from more detailed discussion of results, and details on the estimation (predicted vs. actual data, robustness…)

Fiscal implications

- Paper assesses for 1/ ageing and 2/ no ageing scenario the development of public debt
- Estimated debt gap between the two scenarios: 35% (pp of GDP?)

- Are interest payments on existing debt included?
- Lower potential output (part 1) included in analysis?
- $\longrightarrow$ **Lower bound estimate?**

- **Interesting tool to assess different emigration scenarios, benefits of immigration, pension age adjustments…**

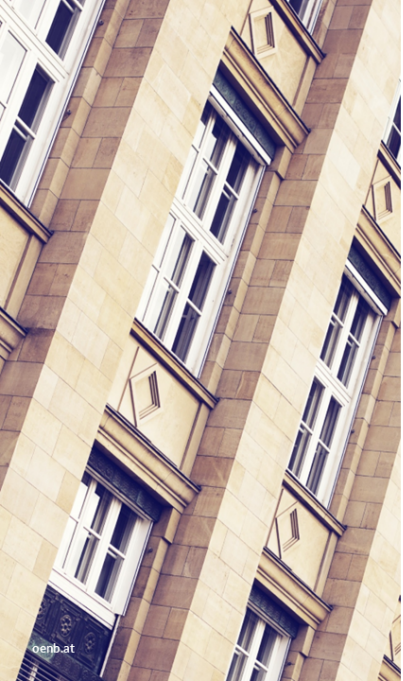
Minor comments

- BVAR section could benefit from more in-depth discussion of IRFs to better assess economic magnitude: size of shocks, variance of wage and consumption that feeds into estimation
- Figure 10: measurement of axis (percentage points, %-deviations from baseline?)
- Figure 14: why is the debt gap between the two scenarios flattening out towards 2027?

Conclusions

- Highly topical and policy relevant material
- Broad range of topics and
- Human capital index/productivity measure: analysis could benefit from robustness checks, discussion of (inherent) caveats
- Role of (e)migration could be highlighted (in a future study)
- BVAR section could be discussed in more detail (estimation, robustness…)

- **Overall, congratulations to the authors to well-written and comprehensive assessment of the macro implications of aging**



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