Discussion of Demographic Structure and Macroeconomic Trends *by Aksoy, Basso, Grasl, and Smith*

Henry Siu

UBC & NBER

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Summary

- Henrique's paper is an ambitious one, a pleasure to read:
  - documents the role of demographics – age composition – as determinant for a suite of macroeconomic variables
    - via a novel, panel VAR approach
  - studies a quantitative life-cycle model that aims to capture these relationships
- paper addresses interesting and important issues in macroeconomics

Why Consider Demographic Variation?

- **key feature**: relative to macroeconomic outcomes at time t, y_t, an economy's age composition, w_t, is largely **predetermined** by fertility choices from the past

$\Rightarrow$ plausible **identification** of causal relationships

  - *Feyrer (2007)*: how much of cross-country output/productivity differences due to demographics?
  - *Jaimovich-Siu (2009)*: how much of time-series variation in business cycle volatility due to demographics (vs policy vs "good luck")?

Why Consider Demographic Variation?

⇒ relevance for **forecasting** . . . e.g., implications of predictable population aging for

- *monetary policy*: trends in real rates and policy rates over the next 10-15 years
- *fiscal policy*: trends in national income and saving, and hence public pension financing and current account dynamics (Higgins, 1998)

⇒ useful as model **diagnostic**

- testable implications of demographic change to help decipher between models

Typical Approach

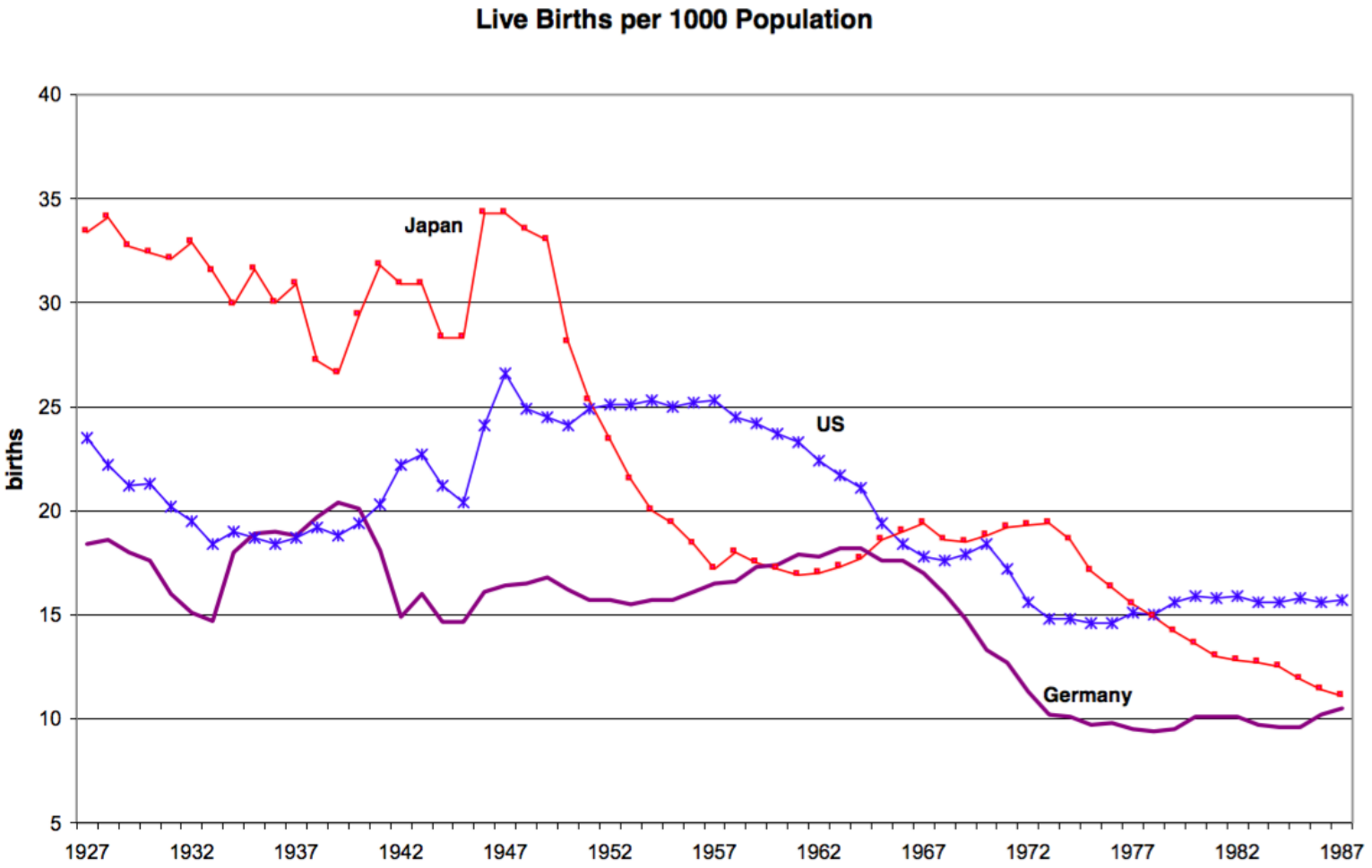
- e.g., Higgins (1998), Feyrer (2007):

$$y_{it} = \alpha_i + \beta X_{it} + DW_{it} + u_{it}$$

- idea: y_{it} (savings rate, productivity) – **in levels** – determined by demographics

- identification of D comes from variation in age composition, W_{it} ...
  - or – if X_{it} includes time dummies – that which is not common across countries over time

Variation in Age Composition Dynamics



source: Jaimovich-Siu (2009)

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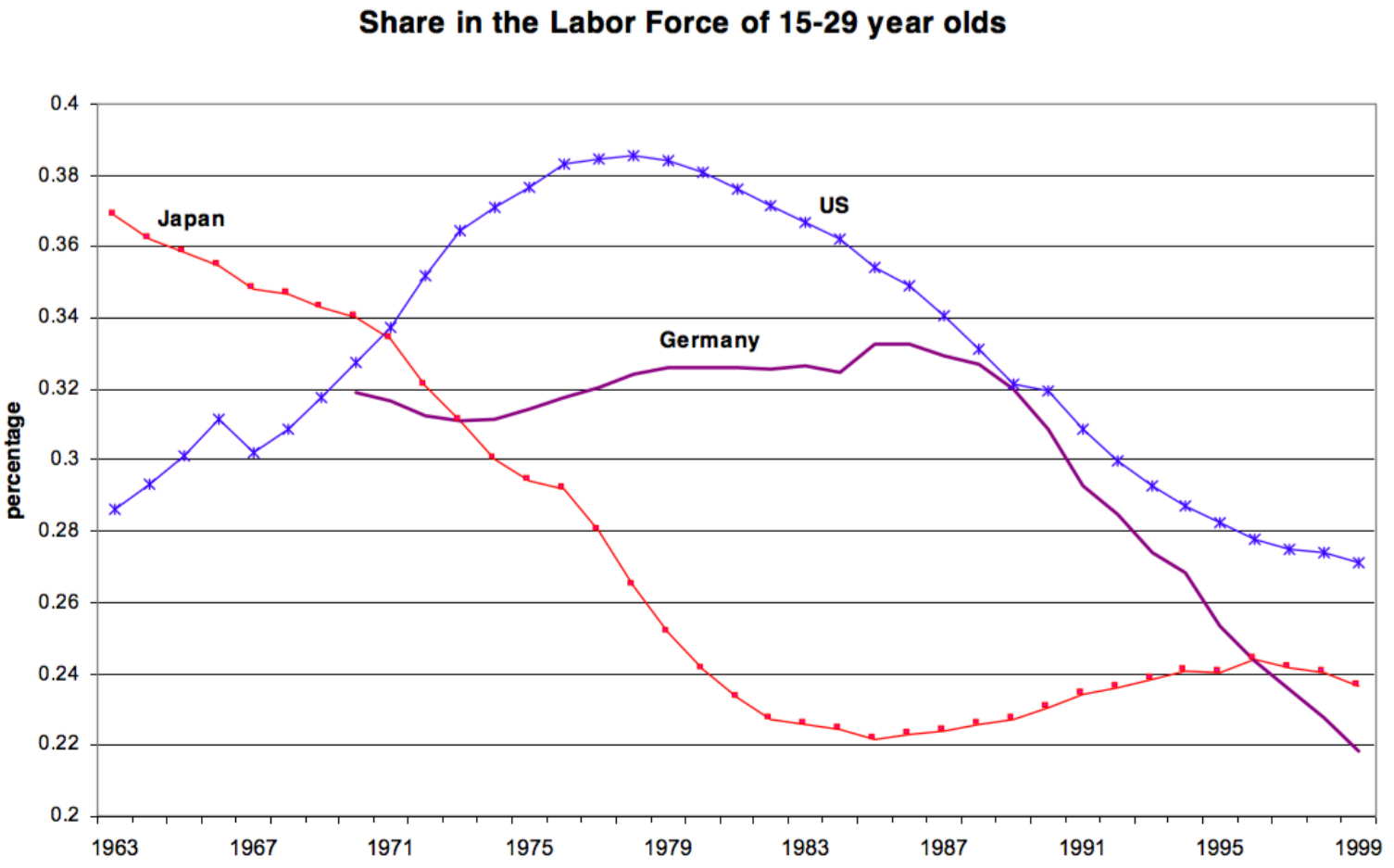

source: Jaimovich-Siu (2009)

ABGS Approach

- in this paper, regression model:

$$Y_{it} = \alpha_i + A_1 Y_{it-1} + A_2 Y_{it-2} + \beta X_{it} + DW_{it} + u_{it}$$

- key differences:
  - Y is now a ***vector*** of outcome variables (the "V" in VAR)
  - becomes a ***dynamic*** panel data model
- small technical issue: how to address "small T" bias

ABGS Approach

- in this paper, regression model:

$$Y_{it} = \alpha_i + A_1 Y_{it-1} + A_2 Y_{it-2} + \beta X_{it} + DW_{it} + u_{it}$$

- larger issue: how to interpret results?
  - "effect of the demographic variables is then the marginal effect after having controlled for lagged Y_{it} ..."
- nature of results very different from previous literature

ABGS Approach: Simple Illustrative Example

- re-consider **scalar** case of y_{it}, with only **1 lag** . . .

$$y_{it} = \alpha_i + A_1 y_{it-1} + \beta X_{it} + DW_{it} + u_{it}$$

- further suppose: $A_1 = 1$ (either by constraint or estimation):

$$\Delta y_{it} = \alpha_i + \beta X_{it} + DW_{it} + u_{it}$$

- now: how does the ***change in*** y_{it} (savings rate, productivity) depend on demographics, W_{it}?

ABGS Approach: Illustrative Example

- more generally, regression model takes the form:

$$(1 - A_1(L))y_{it} = \alpha_i + \beta X_{it} + DW_{it} + u_{it}$$

- why is it preferable to ask how "***partially time differenced***" outcomes y depends on W, as opposed to y ***in levels***?
  - is this specification better supported by the data?
  - is there economic/theoretical rationale for focusing on such a relationship?

Empirical Results

	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
g_{t-1}	0.25	0.05 *	0.13	0.03 *	-0.07	0.07
I_{t-1}	-0.27	0.12 *	0.92	0.06 *	0.06	0.09
S_{t-1}	0.09	0.06	0.06	0.03	0.99	0.05 *
H_{t-1}	0.07	0.06	-0.00	0.03	0.03	0.04
rr_{t-1}	-0.22	0.07 *	-0.09	0.02 *	-0.06	0.04
π_{t-1}	-0.28	0.07 *	-0.08	0.02 *	-0.05	0.03
g_{t-2}	-0.01	0.04	0.04	0.02	-0.05	0.04
I_{t-2}	0.09	0.11	-0.16	0.05 *	-0.16	0.08 *
S_{t-2}	-0.07	0.06	-0.05	0.03	-0.21	0.06 *
H_{t-2}	-0.08	0.07	0.02	0.03	-0.04	0.04
rr_{t-2}	-0.04	0.06	-0.01	0.02	-0.04	0.04
π_{t-2}	-0.00	0.04	-0.02	0.01	-0.03	0.03
$POIL_{t-1}$	-0.02	0.00 *	0.00	0.00	-0.01	0.00 *
$POIL_{t-2}$	0.02	0.00 *	0.00	0.00	0.00	0.00
popGrowth	2.74	1.06 *	0.51	0.50	1.58	0.74 *
popGrowth$_{t-1}$	2.22	0.99 *	0.29	0.50	1.17	0.79
δ_1	-0.06	0.08	-0.03	0.06	-0.10	0.06
δ_2	0.25	0.11 *	0.04	0.05	0.17	0.05 *
δ_3	0.18	0.06 *	0.08	0.03 *	0.02	0.06
δ_4	-0.03	0.07	-0.03	0.05	0.11	0.07
δ_5	-0.03	0.09	-0.06	0.05	0.08	0.07
δ_6	0.02	0.06	0.03	0.04	0.19	0.10
δ_7	-0.07	0.13	0.18	0.09 *	0.01	0.10
R^2	0.29		0.88		0.82	
$\Pr(\delta_j = 0)$	0.00		0.01		0.00	
obs	665		665		665	

Empirical Results

- lack of clear statistically significant evidence of demographics on vector of outcome variables ... why?
  - specification in auto-regressive form vs levels?
  - sample of countries studied (20 OECD vs $\approx$ 90 in Higgins, Feyrer)?
  - large number of age groups considered?
    - would like to see more analysis with 3 or 4 (children, young, prime-aged, retirees) age groups

Empirical Results

- in VAR framework, derive long-run impact of demographics as:

$$Y_{it}^{D} = (I - A_1 - A_2)^{-1} DW_{it}$$

	δ_1	δ_2	δ_3	δ_4	δ_5	δ_6	δ_7	δ_8
g_{t-1}	-0.14	0.16	0.11	0.10	0.11	-0.04	-0.32	0.01
I_{t-1}	-0.58	0.13	0.41	0.36	0.06	0.07	0.26	-0.70
S_{t-1}	-0.16	0.53	-0.26	0.36	0.39	0.72	-0.05	-1.53
H_{t-1}	-1.86	-0.13	0.66	2.44	0.47	0.59	-1.11	-1.05
rr_{t-1}	-0.43	-0.30	0.35	0.39	0.17	0.44	0.28	-0.91
π_{t-1}	0.96	0.65	-0.28	-1.01	-0.59	-0.26	0.22	0.32

Table 3: Long-Run Demographic Impact

- really need to see standard errors to gauge importance!

Model Analysis

- would like more discussion on parameter specification of medium-scale model . . .
  - elasticity of substitution between intermediate consumption goods
  - *elasticity* of this elasticity to the number of firms
  - elasticity of innovation productivity to demographic composition
- would prefer closer link between empirical specification and model . . .
  - **VAR**: includes both saving and investment; **model**: closed economy ($S = I$)
  - **VAR**: includes nominal inflation rate; **model**: real, no nominal variables