Labour Market Adjustments to Population Decline: A Historical Macroeconomic Perspective, 1875-2016

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Extended Abstract

Background

A hitherto stylized fact, the perpetual growth of the population, is questioned in the short and medium term by a range of demographic forecasts (e.g. UN 2019). In the years and decades to come, depending on the scenario under consideration, advanced economies will face a stagnation and, sooner or later, a decline of their populations – overall and even more distinct among working-age. Undoubtedly, given the importance of demography for economic growth in general and the labour market in particular, these impending transformations challenge other stylized facts as well, such as the ever-accelerating growth of GDP (per capita) (Jones/Romer 2010) but also the supposedly constant labour share in national income (Kaldor 1961). However, yet, there is a substantial lack of theoretical and empirical research on economic implications of declining populations.

This undercoverage may be due to the fact that there have been comparatively few periods of population decline among advanced economies in the recent past, reducing the need for explicit modelling and consequently also hampering the reliable identification of its effects. Thus, the demography-economy-nexus, which has already been subject to numerous debates and approaches, mostly draws on a variety of related but different issues: a multitude of empirical studies analyse the effects of population growth (see Heady/Hodge 2009 for a comprehensive meta-study), population ageing (e.g. Acemoğlu/ Restrepo 2017; Börsch-Supan 2008) or changing mortality, fertility, and human capital patterns (for many: Barro 1991, 1997; Barro/Lee 1994; Bloom/Williamson 1998; Hall/Jones 1999) on economic growth. From a more conceptual perspective, both the secular stagnation debate (e.g. Eggertson et al. 2019) and the

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unified growth theory (e.g. Cervellati et al. 2017), among others, have addressed the role of demography for long-term economic development.

Given the apparent gap in previous research, we investigate the labour market adjustments to population decline in the present paper.

State of Research

In formal economic modelling many approaches assume a growing or at least stagnant population (Jones 2020). On the contrary, population decline, and the accompanying implications have hardly been discussed yet. Sasaki (2019) analyses the consequences of negative population growth on the long-run growth rate of per capita output using a Solow-type growth model and demonstrates that if in such a setting the elasticity of substitution is less than unity, economic growth exclusively depends on the rate of technological progress. Similarly, Christiaans (2011) and Sasaki/Hoshida (2017) use semi-endogenous growth models to investigate the effect of population decline on economic growth. The results suggest varying effects of negative population growth on economic growth, depending on the assumed depreciation rate of capital. Jones (2020) demonstrates that in the case of population decline endogenous and semi-endogenous growth models lead to an "Empty Planet", that is stagnating living standards and knowledge. By taking one step further and endogenizing fertility, Jones (2020) shows that economic growth can be resumed even under conditions of population decline if the economy switches to an optimal allocation soon enough. These results suggest that the effects of growth and decline in the population do not need to follow symmetrical paths. Put differently, adjustments and mitigation to shrinkage may have profoundly different implications for the labour market compared to adjustments to population growth as well. However, the economic literature has yet been remarkably scarce in modelling these labour market effects, theoretically and empirically.

Data

The occurrence of periods of actual population decline and the availability of labour market data do not necessarily coincide. As noted above, for most advanced economies population shrinkage appears to be a phenomenon of the near future. If we take a more historical perspective back to the second half of the 19th century, we are able to identify several periods of decline and low population growth, particularly right before the *fin de siècle*, distributed across several countries. On the one hand, this suggests to empirically investigate population decline and its macroeconomic implications in a historical cross-country framework. On the other hand, the exploration of historical economic dynamics across countries is a notoriously

difficult task, particularly when focused on labour market issues. Well-known data collections such as the International Historical Statistics (Mitchell 2013) or Maddisons Historical Statistics (Bolt/van Zanden 2020) and their respective predecessors, among others, have settled the path for comparative historical economic research for decades. In these key sources, however, the annual availability in the very long run remains limited to selected variables. We have seen substantial improvements in recent years by compilations such as the Macrohistory Database (Jordà et al. 2017) or the Long-Term Productivity Database (Bergeaud et al. 2016), both starting in the second half of the nineteenth century, covering a variety of advanced economies, and broadening the range of available macroeconomic variables. Nevertheless, the availability of annual labour market data, such as unemployment and labour force participation, remains limited, hampering corresponding analyses of the labour market in the very-long run. Based upon this finding, we compiled a new historical annual labour market dataset, drawing both on existing macroeconomic and demographic databases and, particularly, on a vast number of national sources. Overall, the data collection combines more than 90 individual sources. The dataset contains information on population (both total and age groups), real GDP, real wages, investment, unemployment, and labour force participation. Our compilation covers nine countries (AUS, DEU, DNK, FRA, GBR, NLD, NOR, SWE, USA) and 141 years (1875-2016). The dataset is balanced and has no gaps. Population, real GDP, real wages, and employment are are prepared as an index using overlapping information, which allows us to cope with a multitude of large-scale boundary changes. Investment is given as share of GDP, unemployment is given as rate, and labour force participation measures the rate of those active in the labour force among the population 15-64 years.

Empirical Strategy

Periods of population shrinkage have occurred comparatively rarely in the recent past, and, even if one takes a more historical perspective, barely in the same country. To account for this, we draw on the cross-country variation in our panel dataset to identify the differing effects of population growth and decline. In general, we use a panel VAR (PVAR), and in doing so, we contribute to a growing body of literature making use of panel VARs in macroeconomics (e.g. Aksoy et al. 2019). Applying a vector autoregressive structure allows to flexibly analyse macroeconomic interdependencies without *a priori* imposing assumptions on the directions of effects. The growing popularity of panel VARs in macroeconomics can be traced back to further appealing features: including both dynamic and static interdependencies while simultaneously allowing for cross-sectional heterogeneity (Canova/Ciccarelli 2013). However, the econometric

strategy must also adequately address non-linear responses to population decline, such as distinct labour market adjustments. To account for this, we specify a panel smooth transition VAR (PSTVAR) and derive regime-dependent – times of population growth and times of population decline – coefficient and covariance matrices. Here, we contribute to growing bodies of literature which use regime-dependent methods (e.g. Auerbach/Gorodnichenko 2012) to analyse (non-linear) macroeconomic interdependencies.

Using our non-linear framework and seeking to derive regime-depdent impulse response functions, the identification of population shocks in the respective regimes is of key importance. Following a series of previous applications in the literature, we draw on identification of population shocks using instrumental variables (see e.g. Stock/Watson 2012, 2018; Mertens/Ravn 2013; Gertler/Karadi 2015). We compare our findings to a linear version of the panel VAR as well as to several robustness checks.

Contribution and Preliminary Results

Although population decline is projected to affect most advanced economies in the years and decades to come, possible labour market implications have not been analysed yet. By collecting a novel historical dataset over more than 140 years and analysing labour market adjustments to periods of actual population decline in the past using non-linear macroeconometric methods, we contribute to a hitherto scarcely studied field of research.

Our findings suggest that labour markets in fact adjust differently to negative population shocks in times of decline compared to positive population shocks in times of growth. While the impulse responses in the growth regime closely mirror those in the linear model, the impulse responses in the decline regime indicate distinct adjustments to population decline.

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