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Article

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Population age structure – An underlying driver of national, regional and urban economic development

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Abstract: This paper argues that population age structure plays a significant role alongside institutional, technological, political, and cultural factors when it comes to explaining shifts in urban, regional and national economic development. The paper demonstrates how demographic transitions lead to changes in population age structure which in turn correlate with global shifts in economic development from 1950 onwards. It then analyzes the role of population age structure at the sub-national level by reviewing some prominent cases of regional and urban shifts in Western Europe and North America. Population size, population density and migration have always been an integrated part of economic geography, and the consequences of ageing in national and regional economies are increasingly being studied. The specific role of population age structure as a driver of economic development has, however, so far largely been ignored in the field.

Keywords: working age ratio, age structure, economic growth, regional shifts, demography, aging

1 Introduction

In recent years, macro-economic analysis has increasingly started to investigate how demographic shifts impact economic trends (e. g. Eggertsson *et al.* 2019). In a way this is old news for economic geographers. From Smith (1776) through Weber (1909) to Krugman (1991), population volume and density have been seen as a determinants of market size, in turn allowing increased division of labor, attracting economic activity and forming the basis of agglomeration economies.

Article Note: Order of authors is alphabetical, all three authors contributed equally to this work.

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While many demographic aspects are generally well-studied and understood by economic geographers, including aging or migration and gender, one aspect has been strikingly absent: the economic impact of changing population age structures¹. Here – and this is the core argument to be advanced in the paper – geographers have a lot to learn from recent research in economics and demography showing how shifts in the age structure during a *demographic transition*, from high to low death and birth rates, correlate with economic performance on different geographic levels.

This growing body of literature², has demonstrated that age structure was a major factor behind increasing GDP per capita in the historical making of today's economically advanced countries, and it is a crucial component when contemporary emerging economies experience strong economic growth.

Age structure refers to the relative distribution of a given population across age cohorts or age groups (such as youngsters, young or older adults and seniors). While most studies of economic effects of population change have focused on national economies, only few have considered

¹ Clark's 1987 Roepke lecture was an early harbinger of these insights (Clark 1987), which hark back to Thompson (1929) and Myrdal (1957). Yet, two major readers in economic geography (Clark *et al.* 2018, Shepard & Barnes, 2000), with a total of around 70 chapters covering a quite comprehensive range subthemes in the field, contain no considerations regarding population age structure as a factor that might influence economic development at national or regional levels. A bibliometric search of the three journals Economic Geography, Journal of Economic Geography and Regional Studies 2000–2022, with a total corpus of 6000 papers, returns no papers using the terms demography, demographic transition or dividend. The term population can be found in the title, abstract or keywords of 260 papers, while age or aging appears in 90 papers. Of these, only a handful deal with aspects of the topic in focus in this paper. For recent examples of such contributions, see Andersson (2001); O'Leary (2001); Gregory & Patuelli (2015); Polèse & Shearmur (2006); Bönnte *et al.* (2009); Kurek (2011); Baerlocher *et al.* (2019); Prenzel & Iammarino (2021); Vendemmia *et al.* (2021). A couple of recent papers include age diversity as a control factor when modeling spillovers and productivity effects of immigration (Kemeny and Cooke 2028, Buchholz 2021).

² Early contributions upon which much of this literature in economics and demography builds, include Brander & Dowrick (1994); Kelley & Schmidt (1995); Crenshaw *et al.* (1997); Bloom & Williamson (1998); Lindh & Malmberg (1999); Bloom *et al.* (2003).

subnational regional and urban economies, even though intra-national spatial differences in age structure can be substantial (see Cruz & Ahmed, 2018 for examples).

In this paper we will argue that economic geography would benefit from explicitly considering the role of changes in population age structure in the analysis of shifts in local and regional economic development. Thus, the overall aim of this paper is to explore the impact of population age structure on regional and urban economic development. We do this by introducing and discussing the literature and by presenting population data that displays the close relationship between demographic transition and economic development. The remainder of the paper is divided into four main sections.

Section 2 presents the theoretical argument of why we should assume that population age structure impacts economic development, and describes the data and methodology of the paper.

In section 3 we present a generalized model of demographic transition in four stages and argue that this transition must now be understood as a *driver* of economic development, departing from entrenched views of demographic changes as a pure *reflection* of economic change. We consider how the broad global shifts in economic-geographic development since 1950, as described e. g. by Dicken (1998, 2015), correlate with the stages of demographic transition that have taken place, at uneven pace, in different countries around the world. The theoretical discussion of the demographic transition is supplemented with descriptive data on how population age structure has changed over time in different countries at different stages of economic development. We present a regression model that shows a statistical connection between age structure and growth. This model is not aiming to formally test causality – this will remain the task of future research – but merely to state that there is a correlation.

Having asserted that there is a connection, at the national level, between the historic undergoing of the demographic transition and its resulting effects on the population age structure on the one hand, and global economic growth patterns during the last 50–60 years on the other, we raise the question of whether a similar connection could be assumed to play a role when it comes to uneven growth patterns within countries.

Section 4 thus focuses on sub-national regions in Western Europe and North America. In this section, we revisit some of the most prominent cases of regional and urban shifts that have been studied by leading economic geographers in the last 30–40 years, and investigate if and how incorporating data on population age structure might add to their explanation. Even though all the cases in point

concern regions where the grand demographic transition was completed many decades ago, we show that differences in age structure can still be large enough to play an important role. In this context we also discuss the effect of migration on population age structure.

In section 5, we consider the main findings in the setting of economic geography and raise some general points for future research.

2 Theoretical considerations and methods

The impact of a population's age structure on macro-economic outcomes can be linked to the economic life-cycle of individuals at the micro level. Young children rely on the care and assistance of guardians or other caregivers. As they grow, their need for immediate care decreases, but they still require support to engage in education before joining the workforce. Upon transitioning into adulthood and the labor market, typically between 20–25 years of age, individuals often establish partnerships and have children. Under favorable circumstances this results in a relatively extended period where they are responsible for supporting themselves and their children, usually with limited opportunities to save. Around the age of 45–59, parental obligations typically decline, allowing for more savings and increased working hours (among all genders). Individuals approaching 65 often start retiring from the workforce and begin to rely more on their savings, including pension-system transfers. In the event of a long life, the final years may again necessitate dependency on care and support from others.

An age structure model of economic development can, in its most simple form, be seen and the mere aggregation of such individual life cycles. In any society, at any point in time, the population is distributed over ages in a specific way. This aggregate age composition has both direct and indirect effects on economic outcomes at the macro level (for an overview see Lee & Mason, 2010). First, there are consequences for aggregate savings and aggregate investment (upper middle-aged people on aggregate save more than younger or older people). As an extensive literature in economics has clarified, changes in the absolute and relative size of age groups will affect capital flows, currency exchange rates, real interest rates, and inflation. Other important channels consist of demographic effects on capital accumulation, labor supply, skills and capabilities, innovation, and entrepreneurship.

Recently, it has been suggested that shifts in age structure will have consequences for the balance between the

production of tradable and non-tradable goods (Papetti, 2021). Dependent age groups, i. e. children or elderly, induce a higher demand for non-tradables like personal services. In contrast, an increase in the proportion of working age adults will enable a shift towards the production of tradables which might produce export incomes. This, in turn, could generate national and regional growth processes along the lines suggested by Kaldor (1966, 1970), where increasing output in the export sector generates higher productivity through a mechanism of increasing returns³.

Throughout the paper we will use the *working age ratio*, i. e. the proportion of working age adults in the population, as our main empirical indicator of population age structure, where working age adults are defined to be in the 20–64 age span. We have chosen 20 years instead of 15 years as the lower cut-off value based on the increased proportion of young adults that are in upper secondary and tertiary education. The working age ratio will be used to explore both global and regional differences in age structure, as well as to explore global shifts in age structure over time, and regional shifts in age structure for a selection of countries. What we attempt to show is that this simple measure is closely related to cross-sectional differences in economic development and also to historical shifts in development patterns. This will be done both formally, using regression estimates, and informally, by relating differences in age structure and changes in age structure to well-documented patterns in economic development that have previously been analyzed in the economic geography literature.

Since the main aim of our paper is to argue that age structure effects should be given more consideration in economic geography research, the empirical results presented in this paper should be regarded as illustrations rather than original contributions to the empirical literature on age structure effects. The regression estimates used should be seen as descriptive, and as providing an indication of the type of statistical correlations that exists between demographic variables and income growth trajectories. A formal examination of possible causal relationships requires more advanced econometric modelling than the estimations we present in this paper. Our data sources are presented in the Data appendix.

3 Demographic transition – a driver of global change

The idea that most countries at some point experience a demographic transition from high death rates and high birth rates to low death rates and low birth rates was developed by demographers at Princeton University in the 1940s (Dyson, 2010). Back then it was assumed that the transition was driven by economic development. Later research has demonstrated that the transition process cannot be explained in this way. In most countries, the decline in (child) mortality predates any increase in per capita income, and the same is the case also for the subsequent reduction in fertility. This is a significant finding for economic geography, since it implies that demographic change cannot be seen as mere reflection of economic change. It opens up for considering a different direction of causality, namely viewing demographic change as a driver of economic change.

What, then, are the mechanism through which the demographic transition brings about economic development? This is explained by the now renowned stage model, showing how the proportion of dependents relate to people in the working ages throughout the transition process (Bloom and Freeman, 1988). The presence of clearly distinguishable stages of age structure change is due to the strong uniformity of the demographic transitions process, non-withstanding differences in the details: “when dealing with the demographic transition we are focusing on a phenomenon that, in very long term perspective, is fundamentally uniform” (Dyson, 2010: 79). The model has by now been extensively tested to explain divergent patterns of global economic development, and as such it deserves to be included alongside more familiar accounts of international trends in economic geography and related fields.⁴

In Figure 1, we use UN data to present how the working age ratio has changed from 1960 to 2020 and how it is expected to change until 2050. The heatmap, used several times in the paper, shows gradually warmer colors for higher working age ratios: shades of blue up to 40 per cent, green/yellow up to 50 per cent, yellow/orange/light red up to 60 per cent and dark red above that.

In this figure, the countries have been grouped according to their current stage in the transition model. It shows how the four stages in the demographic transition can be

³ See Antenucci *et al.* (2020) and Deleidi *et al.* (2021) on how shifting demographic structures through the Kaldor mechanism can have more pronounced effect on per capita income growth than suggested by mainstream growth models.

⁴ For example, capital mobility (Sassen, 1991), information technology (Castells, 1996), a search for new spatial fixes (Jessop, 2000), rescaling (Brenner, 2004), re-allocation of surplus capital (Harvey, 2010), or generalized, regional agglomerative processes (Scott & Storper, 2003). A summary of this literature is provided in Perrons (2004).

translated into changes in the working age ratio, which will typically rise gradually all the way up to the final stage where an ageing population will eventually lead to a decreasing ratio.

In *stage one* of the demographic transition model, diminished child mortality results in swelling numbers of surviving newborns, leading to a rapidly increasing population size while lowering the working age ratio. Families are typically struggling to provide for their many children and per capita income remain modest. Countries in stage 1 today are mainly found in Sub-Saharan Africa.

When this is followed – often after several decades – by a decline in fertility⁵ in *stage two*, a “generational bulge” is created that will affect society over the coming decades. The generational bulge consists of all the large cohorts of surviving children and youngsters that were born after the decline in child mortality but before the decline in fertility. In stage two, smaller cohorts of new born children ease the dependency burden on older generations and provide more room for capital accumulation. Many women, previously homeworking, might enter the labor market for the first time (Becker & Lewis, 1973). At the same time the early cohorts of the “bulge” are entering adulthood. In contrast to dependent children these young, mobile adults are positioned to support themselves with their labor, although still with limited capacity to generate savings. It is even likely that a large increase in the share of young, less experienced labor will temporarily push down the relative wages of this age group, while the growing need for investments, not least in housing and infrastructure, will drive up the price of capital. Income inequality and inflationary pressures may follow. Faced with limited options, restless unemployed youngsters may also take to the streets causing civil unrest (Urdal, 2006, Canning *et al.*, 2015) or attempt to migrate to places where the perceived prospects for building a future are greater (Malmberg & Sommestad, 2000). Stage 2 countries are today predominantly found in northern Africa, the Middle-East, southern Asia and Latin America.

In *stage three*, as time passes, the “bulge” continues upward into the middle-ages and things tend to change. With growing age follows increased experience and self-reliance. Competitiveness intensifies, incomes rise, savings grow, and personal networks expand as individuals in the bulge reach middle age (Mason & Lee, 2004). Idea generation, creativity, new firm formation, and productivity are stimulated. This is where a society benefits from the

so-called *demographic dividend*, and often experiences an extended period of exceptionally strong economic growth. Ireland and the Asian Tiger Economies of South Korea, Taiwan and Singapore reached this stage in the early 1980s while China followed somewhat later.

This growth-stimulating demographic environment is typically maintained for several decades, but inexorably “gold turns to silver” as the now aging “bulge” reach retirement age in *stage four*. Firms are deprived of access to the former employees’ personal networks and experience. The retirees will start spending their savings and demand more services that can drive up wages when competing with other sectors of the urban, regional, or national economy. The cohorts making their way into adulthood are much smaller, born as they are after the decline in fertility. With fewer to carry the growing burden of aging dependents, further economic progress can become increasingly difficult. Countries that have since long reached stage 4 include most European countries as well as the US, Canada, Japan, Argentine and Uruguay. From this point on, changes in the working age ratio will mainly be determined by baby booms and baby busts, i. e. cyclical variations in fertility levels, alongside migration (Crenshaw *et al.*, 1997; Feyrer, 2011).

The almost 40 “mature economies” classified as having reached stage 4 have passed their peak working age ratio, but it is notable that they have all maintained ratios well over 50 per cent for the last 70 years (see Figure 1), as the growing number of aging and substantially healthier citizens is balanced out, so to speak, by declining numbers of newborn (Kurek, 2011; Van der Gaag & Beer, 2014; Pool, 2016). Still, rapidly ageing countries, such as Italy, Spain and Greece display modest growth during the last few decades, and the United Nation’s (2019) forecasts indicate that several of these will see a further decrease in working age ratios, to levels substantially under 50 per cent, in the decades to come. In Asia, Japan has become the current showcase of demographic contraction, displaying the world’s largest proportion of centenarians – almost double in size of its closest followers (France, Italy, US).

China has perhaps benefitted more than any other country from a demographic dividend, with a working age population almost twice as large as the rest of the population altogether stemming from its one-child-only domestic policy 1980–2015, supported by rapid skilling and attraction of foreign investments (Wei & Hao, 2010). But now the consequences of this harsh child policy are being felt and by 2030 China’s population will on average be older than Europe’s and much older than that of the US. This foreseeable country-wide aging will in all likelihood take place before China has closed the economic gap to the richest economies. Future attempts to close this gap depends on

⁵ Evidence now suggests that lower infant mortality triggers lower fertility and that both are results of simple knowledge dissemination (World Bank, 1984; Kalemlı-Ozcan, 2002; Galor, 2010; Cervellati & Sunde, 2011).

	Working age ratio 1960 - 2050 (i.e. proportion of population in workforce between 20 and 65 years of age)															Mean age (in years, 2020)	Life expectancy (in years, 2020)	Annual growth rate in GDP per capita				
	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020	2030	2040			2050	1960-1990	1990-2015		
	Estimates																					
Stage 1: Pre-transitional countries with persistent high dependency rates and working age ratios consistently below fifty per cent (25 countries out of 111 share these properties)																						
Benin	46%	45%	44%	43%	41%	40%	39%	39%	39%	41%	41%	42%	44%	43%	44%	46%	48%	51%	17	62	-0.7%	3.2%
Burkina Faso	46%	45%	44%	42%	41%	39%	39%	39%	39%	40%	40%	41%	42%	44%	46%	50%	53%	18	62	0.4%	1.8%	
Burundi	44%	43%	41%	40%	41%	41%	40%	37%	36%	38%	41%	42%	42%	45%	50%	52%	52%	18	62	0.8%	-0.6%	
Cameroon	47%	46%	44%	43%	42%	41%	40%	40%	41%	41%	43%	44%	47%	50%	53%	53%	53%	19	60	1.5%	0.9%	
Central African Rep.	48%	47%	46%	44%	43%	43%	42%	42%	42%	42%	42%	42%	40%	41%	40%	43%	49%	20	54	-0.6%	-1.5%	
Chad	46%	45%	43%	43%	42%	40%	39%	38%	38%	38%	39%	40%	41%	44%	48%	48%	48%	16	55	-0.6%	1.9%	
Congo	45%	44%	42%	41%	40%	41%	41%	43%	44%	45%	46%	45%	46%	48%	51%	53%	53%	20	65	2.8%	2.3%	
Côte d'Ivoire	45%	45%	43%	43%	43%	43%	42%	43%	43%	43%	43%	43%	45%	48%	50%	52%	52%	19	60	1.0%	2.4%	
Dem. Rep. Congo	43%	43%	43%	43%	42%	42%	42%	41%	41%	41%	41%	40%	41%	41%	41%	44%	47%	17	61	-2.1%	-1.9%	
Ethiopia	43%	44%	43%	42%	42%	41%	40%	40%	40%	40%	41%	43%	45%	49%	52%	56%	56%	20	67	1.2%	2.9%	
Guinea	47%	46%	45%	45%	43%	42%	41%	40%	39%	39%	39%	40%	42%	47%	52%	55%	55%	19	62	0.1%	-2.0%	
Kenya	42%	38%	37%	37%	36%	37%	37%	39%	41%	42%	44%	45%	48%	52%	54%	57%	57%	20	67	0.5%	1.7%	
Madagascar	45%	43%	41%	40%	40%	40%	41%	41%	41%	42%	43%	44%	46%	49%	52%	54%	54%	17	65	-0.8%	0.7%	
Malawi	43%	43%	43%	42%	41%	41%	42%	41%	40%	40%	40%	41%	43%	47%	51%	54%	54%	17	65	0.5%	0.1%	
Mali	47%	46%	45%	44%	43%	41%	39%	39%	39%	40%	39%	39%	39%	41%	45%	48%	48%	16	60	0.7%	4.1%	
Mozambique	45%	44%	43%	43%	43%	42%	39%	42%	42%	41%	41%	41%	42%	45%	49%	53%	53%	17	61	0.1%	2.7%	
Niger	39%	40%	39%	39%	40%	39%	40%	39%	39%	39%	37%	37%	39%	41%	44%	44%	44%	15	63	-1.9%	-0.2%	
Nigeria	45%	45%	45%	44%	43%	42%	42%	42%	43%	43%	43%	43%	43%	45%	49%	52%	52%	19	55	-2.7%	7.6%	
Rwanda	40%	37%	38%	39%	39%	38%	38%	43%	40%	43%	45%	46%	47%	50%	54%	56%	56%	20	69	0.2%	2.1%	
Senegal	44%	43%	43%	43%	41%	40%	39%	40%	40%	42%	42%	43%	44%	47%	50%	52%	52%	19	68	-0.3%	0.3%	
Tanzania	42%	41%	41%	41%	41%	41%	41%	41%	42%	42%	42%	42%	43%	45%	48%	51%	51%	18	66	-0.5%	3.2%	
Togo	44%	43%	42%	41%	41%	40%	40%	40%	42%	44%	44%	45%	46%	49%	51%	53%	53%	16	64	1.5%	0.1%	
Uganda	42%	41%	40%	40%	40%	39%	39%	38%	37%	37%	38%	39%	41%	45%	50%	55%	55%	16	64	-1.1%	3.1%	
Zambia	41%	40%	39%	38%	38%	39%	39%	39%	40%	40%	40%	41%	42%	47%	51%	53%	53%	17	64	-2.5%	3.3%	
Zimbabwe	41%	40%	38%	37%	37%	38%	40%	41%	42%	43%	44%	44%	44%	49%	53%	55%	55%	21	62	2.5%	-2.4%	
Stage 2: Early transitional countries with declining dependency rates and working age ratios moving into the fifties after 1990 (31 countries out of 111 share these properties)																						
Algeria	43%	40%	39%	39%	39%	40%	42%	45%	49%	54%	57%	58%	56%	56%	58%	56%	56%	29	77	1.5%	0.9%	
Bangladesh	45%	44%	43%	43%	41%	42%	44%	46%	48%	51%	53%	56%	59%	61%	61%	60%	60%	28	73	-0.5%	3.6%	
Bolivia	44%	44%	45%	45%	45%	45%	45%	46%	47%	48%	49%	51%	53%	57%	59%	60%	60%	25	72	1.5%	4.5%	
Dominican Republic	40%	39%	39%	40%	43%	45%	47%	48%	50%	51%	53%	55%	56%	57%	58%	58%	58%	29	77	2.2%	4.4%	
Ecuador	42%	41%	41%	42%	43%	45%	47%	49%	50%	51%	53%	55%	56%	59%	60%	59%	59%	29	77	1.3%	2.4%	
Egypt	46%	44%	44%	44%	44%	44%	45%	45%	47%	50%	53%	52%	52%	55%	57%	57%	57%	24	72	3.6%	6.6%	
El Salvador	42%	41%	41%	41%	42%	43%	45%	47%	48%	49%	50%	53%	56%	59%	61%	61%	61%	21	64	1.4%	7.5%	
Ghana	43%	43%	41%	40%	39%	40%	42%	43%	44%	45%	47%	48%	50%	52%	55%	55%	55%	21	64	-1.5%	2.4%	
Guatemala	42%	41%	40%	41%	40%	40%	40%	40%	41%	43%	45%	48%	51%	57%	60%	61%	61%	24	64	1.3%	2.8%	
Haiti	46%	46%	45%	45%	44%	44%	43%	43%	44%	46%	48%	51%	52%	56%	58%	60%	60%	24	64	1.0%	1.2%	
Honduras	41%	39%	38%	38%	39%	39%	40%	41%	42%	45%	47%	51%	54%	59%	61%	61%	61%	29	70	1.2%	1.9%	
India	47%	46%	45%	46%	47%	47%	48%	49%	51%	52%	54%	57%	58%	61%	62%	61%	61%	29	70	0.7%	5.4%	
Indonesia	47%	46%	44%	43%	44%	46%	49%	51%	54%	56%	57%	58%	59%	60%	60%	59%	59%	31	72	3.8%	4.4%	
Iran	45%	43%	42%	43%	43%	41%	41%	43%	48%	56%	61%	63%	62%	62%	63%	62%	62%	32	77	0.7%	5.6%	
Jamaica	45%	42%	39%	38%	42%	44%	47%	49%	50%	52%	55%	57%	59%	66%	65%	62%	62%	29	76	-0.1%	1.9%	
Jordan	41%	41%	41%	40%	37%	38%	39%	45%	46%	48%	49%	50%	53%	57%	58%	58%	58%	29	76	0.4%	4.2%	
Malaysia	42%	41%	41%	43%	45%	47%	49%	51%	53%	55%	57%	60%	61%	62%	62%	60%	60%	29	76	3.6%	4.2%	
Mexico	41%	40%	39%	39%	40%	43%	45%	48%	50%	53%	55%	57%	58%	60%	60%	59%	59%	29	75	2.1%	1.8%	
Morocco	44%	41%	39%	39%	41%	44%	46%	47%	50%	53%	56%	57%	58%	58%	59%	58%	58%	29	77	3.5%	2.1%	
Nepal	47%	46%	45%	46%	45%	45%	44%	44%	45%	46%	48%	49%	54%	58%	61%	62%	62%	25	71	1.1%	3.5%	
Nicaragua	40%	39%	38%	39%	39%	39%	40%	42%	45%	48%	51%	54%	56%	58%	60%	60%	60%	22	67	-1.2%	1.8%	
Pakistan	46%	46%	45%	43%	43%	43%	43%	43%	44%	45%	47%	49%	51%	51%	55%	57%	57%	22	67	2.5%	2.1%	
Panama	42%	42%	42%	42%	44%	46%	48%	51%	53%	54%	55%	56%	57%	57%	57%	56%	56%	29	76	2.6%	5.3%	
Paraguay	39%	39%	39%	41%	43%	44%	45%	45%	46%	49%	51%	53%	55%	57%	58%	59%	59%	29	76	2.9%	3.5%	
Peru	43%	42%	42%	42%	43%	45%	46%	48%	50%	52%	54%	56%	59%	58%	59%	58%	58%	29	76	0.9%	4.6%	
Philippines	40%	40%	39%	41%	42%	44%	45%	47%	48%	49%	51%	53%	55%	56%	57%	58%	58%	24	72	2.0%	2.5%	
South Africa	46%	45%	44%	45%	45%	45%	46%	48%	50%	53%	56%	57%	57%	58%	60%	60%	60%	28	65	1.2%	1.3%	
Syria	41%	39%	37%	38%	37%	38%	38%	41%	44%	46%	49%	53%	55%	60%	58%	59%	59%	28	65	-1.6%	5.1%	
Tunisia	43%	42%	40%	41%	43%	45%	48%	50%	53%	57%	60%	61%	60%	58%	59%	56%	56%	32	78	4.1%	2.4%	
Turkey	46%	45%	44%	45%	45%	47%	49%	51%	53%	55%	57%	58%	59%	60%	60%	57%	57%	32	78	2.7%	3.2%	
Venezuela	42%	41%	41%	42%	44%	46%	48%	50%	51%	53%	55%	56%	56%	58%	58%	58%	58%	30	72	0.7%	-2.5%	
Stage 3: Transitional countries with declining dependency rates and working age ratios exceeding fifty per cent since 1990 (11 countries out of 111 share these properties)																						
Brazil	44%	43%	44%	45%	47%	49%	51%	52%	55%	57%	60%	61%	62%	62%	61%	58%	58%	33	76	3.2%	3.5%	
Chile	47%	47%	47%	49%	51%	53%	55%	55%	57%	58%	60%	61%	62%	60%	59%	56%	56%	36	80	1.4%	4.2%	
China	48%	46%	45%	46%	49%	52%	55%	59%	60%	62%	66%	68%	65%	62%	59%	55%	55%	38	77	3.1%	6.5%	
Colombia	40%	39%	40%	42%	44%	47%	50%	51%	52%	54%	57%	59%	60%	61%	60%	58%	58%	31	78	2.4%	2.3%	
Costa Rica	42%	41%	42%	44%	47%	50%	51%	52%	53%	56%	59%	61%	62%	62%	61%	57%	57%	33	81	1.5%	3.1%	
Ireland	49%	48%	49%	49%	49%	50%	52%	55%	59%	62%	62%	65%	68%	59%	57%	53%	53%	38	82	3.4%	5.4%	
South Korea	44%	43%	44%	46%	50%	55%	59%	62%	64%	66%	66%	67%	67%	61%	55%	49%	43	84	4.0%	4.2%		
Singapore	46%	44%	46%	50%	56%	61%	65%	67%	68%	68%	71%	72%	70%	62%	57%	53%	36	84	6.8%	5.3%		
Sri Lanka	44%	44%	46%	47%	49%	50%	53%	54%	57%	59%	59%	58%	57%	58%	57%	55%	55%	34	77	0.2%	5.2%	
Taiwan	43%	43%	45%	48%	52%	55%	57%	59%	61%	64%	66%	67%	66%	61%	56%	50%	50%	36	84	7.1%	3.3%	
Thailand	44%	43%	43%	43%	46%	50%	54%	57%	61%	63%	65%	64%	64%	60%	56%	53%	53%	39	78	5.0%	4.3%	
Stage 4: Post-transitional countries with working age ratios continuously exceeding fifty per cent since 1960 (25 countries out of 111 share these properties)																						
Argentina	55%	55%	55%	54%	53%	52%	52%	52%	53%	54%	55%	56%	56%	59%	60%	58%	58%	32	77	2.0%	5.0%	
Australia	54%	53%	54%	55%	56%	58%	59%	60%	60%	61%	60%	60%	60%	59%	58%	57%	56%	38	83	2.0%	2.0%	
Austria	58%	57%	55%	54%	56%	60%	61%	61%	62%	62%	61%	62%	61%	62%	61%	53%	53%	45	81	3.3%	2.6%	
Belgium	59%	58%	56%	56%	57%	60%	60%	60%	60%	60%	60%	60%	60%	58%	56%	53%	53%	42	81	2.9%	2.2%	
Canada	51%	50%	52%	55%																		

its ability to reduce the current high value placed on male children and to reverse its by now institutionalized 4–2–1 model, with one child supporting two parents and four grandparents (Fang, 2016).

Some countries in stage 1, mainly in Sub-Saharan Africa, experience a prolonged interval before completing stage two, resulting in a quite extended “bulge” (Canning *et al.*, 2015). So even when the demographic transition may induce gains in terms of improved health and human development (Eloundou-Enyegue & Giroux, 2013), today’s around 30 pre-transitional countries mainly in Sub-Saharan Africa (Ahmet *et al.*, 2016; Bloom *et al.*, 2017) might face tougher prospect of converting reduced fertility to economic growth than countries already well underway such as the countries that are today in stage two or three (Bleakly, 2006; Eastwood & Lipton, 2011). In Figure 1, Nigeria stands out as an exception with strong economic growth in the 2000s, with a still low national working age ratio.

Despite these qualifications, important as they are, broad and strong empirical evidence suggests that the demographic transition constitutes an important component in a country’s economic development (Galor, 2012; Ranganathan *et al.*, 2015). Industrialization and increased economic growth are typically associated in time with the demographic stimulus accompanying the third stage of the transition, and a slow-down of economic growth is typically associated with the ageing process that takes place in stage four.

The statistical correlation between the working age ratio and log GDP per capita is very strong. An OLS regression including 111 countries with GDP data from 1960 to 2015 using the working age ratio as the only explanatory variable beside fixed time effect gives an adjusted R-square of 0.679. The parameter for the working age ratio is 12.58 implying that that a one percentage point (0.01) increase in the working age ratio between two periods corresponds to an 12.58 % ($0.01 \cdot 12.58 = 0.1258$) increase in GDP per capita between the two periods. This corresponds to a 2.5 % annual growth rate over a five-year period. See Table 1, below.

To visualize this correlation, the two rightmost columns in Figure 1 show the annual growth rate in GDP per capita for countries in the different stages for two periods, 1960 to 1990 and 1990 to 2015. During the first period, income growth was very slow in stage 1 countries and in most stage 2 countries. Growth 1960–1990 was stronger in stage 3 countries, especially in those countries where the working age ratio increased early. Also most stage 4 countries had stable income growth during this period.

Through the years 1990 to 2015 the growth rate in GDP per capita intensified, especially in stage 2 countries that went from low to high working age ratios, while almost all stage 3 countries now experienced fast growth. In contrast,

the countries in stage 4 proceeded on a downward slope in income growth as their populations got older and working age ratios consequentially declined. The pattern for stage 1 countries is more mixed with some displaying higher growth rates whereas others continued along a low growth track.

The data suggest a link between demographic development and trends in global between-country income inequality. During the period up until 1990, developed countries increased their relative income as they experience an increasing working age ratio. During the second period, countries in stage 2 and stage 3 further reduced the global income gap as their working age ratio reached or even surpassed the now aging countries in stage 4. At the same time, the growth patterns show that the fit between age structure change and per capita income growth is far from perfect. Clearly there are other factors at play (including institutional, technological, political, and cultural), which can modify or restrain the ways by which changes in working age ratios influence economic development.

What we would maintain, though, is that the general correspondence between shifts in the working age ratio across countries and shifts in global income structure is of such extent and magnitude that it seems important to consider the demographic transition as a driver of economic development in its own right.

Table 1: Effects of age structure (population in working ages, 20–64 years, as proportion of total population) on GDP per capita, cross-country 5-year panel data. Models with only fixed time effects, and with both fixed time and fixed country effects.

	Response In GDP per capita (time effects) 1960–2015	Response In GDP per capita (time effects and country effects 1960–2015
Estimate for Prop in work age	12.58***	5.19***
t-value	49.55	18.7
Adj R sqr	0.679	0.924
Effect Prop work age (SSQ)	1143.3	38.5
Effect Year (SSQ)	27.6	53.5
Effect Country (SSQ)	–	481.2
N of observations	1332	1332
N of countries	111	111

Note: Shifts in world technology levels over time have been controlled for by using period fixed effects in column 1. By additionally controlling for country level factors that are constant over time, the parameter estimates in column 2 measure the extent to which shifts in the proportion of working ages for a country that already is in a specific stage of the transition will affect GDP per capita (5.19 over five years gives a 1.04 % annual growth rate in GDP per capita). SSQ is Sum of squares. See the Data Appendix for sources.

Existing frameworks in economic geography are quite successful in explaining how economic development tends to be spatially polarized and also to demonstrate the dynamic character of capitalist development. But these frameworks are not equally good at explaining why and when broad *shifts* appear in the relative economic fortune of nations, regions or cities, and it is here that the demographic dividend framework can be of help. That is, by exploring the role of changing age structure, economic geography could become better at explaining – and even predicting – shifts in regional and urban economic development. Moreover, changes occurring in working age ratios provide an account of global income trends that differs markedly from a more neoliberal interpretation suggesting that post-1990 shifts in income growth largely reflects the success of market-oriented reforms.

4 Age structure and regional shifts in developed countries – Reexamining four “paradigmatic” cases

We have seen that age structure changes can contribute to explain global shifts in economic development. Can it also explain regional trend shifts within industrialized countries? Having so far looked at population age structure and economic development globally and at the national level, we will now focus on spatially uneven economic development within countries, previously much studied by economic geographers.

In order to investigate the impact of population age structure on regional economic development, we will review four classical historical cases where economic geographers have paid a lot of attention to document and explain major regional shifts in industrial and economic growth patterns within industrialized countries.

The cases have thus been selected based on the established fact that during a given historical period one previously successful region has been “outcompeted” by another. The cases selected are not random. They do belong to the most well-studied, in their time “paradigmatic”, cases that economic geographers have investigated during the past 50 years (cf Scott 2000), and some of the classical analyses of these cases still belong to the most highly cited in the economic geography literature.

The cases selected are:

- The industrial growth of the so called Third Italy during the 1970s and 1980s *as compared to* the relative stagnation of the so called First Italy.
- The economic downturn of the traditional industrial core regions of West Midlands and the Northwest in the United Kingdom during the 1970s *as compared to* the growth in Southeast England and The London-Bristol axis.
- The industrial and economic crisis of the American Manufacturing Belt during the 1970s, *as compared to* the industrial and economic rise of the “Sunbelt” in the US.
- The relatively weaker economic growth of Southern California (Los Angeles) *as compared to* the strong economic growth of The Bay Area (San Francisco) 1970–2010.

In each of these cases, earlier research has documented how one region (or group of regions) displayed superior economic performance compared to the other. This difference in economic performance was typically explained with reference to changes in the ways economic activity were organized (technological development, industrial restructuring, rise of new production regimes) and by how well such changes conformed with varying social, cultural and institutional traits of the regions in question. Even though the selected cases are historic, and the initial key studies were published quite some time ago, they still form an important background to contemporary economic geography, characterized as it is by more focus on contextuality, path dependency and contingency. Despite differences in time frame, scope, theoretical approach, and methods applied, the studies selected all share two common features; they have had great impact on the field of economic geography and they do not include or even refer to population age structure in the array of explanatory factors considered.

In the following we will examine whether there can also be demographic explanations to those shifts, i. e. whether it can be that, in each of these cases, the regional shift coincided with a change to a more unfavorable population age structure in the “losing region”, and a more favorable age structure in the “winning region”. We do this by calculating the working age ratio for each pair of regions in point, and illustrating with heatmaps how it changes over time during the periods in focus.

NUTS Level 2		1955	1960	1965	1970	1975	1980	1985	1990	1995	2000
Liguria	"First Italy"	64.3%	64.2%	62.9%	61.3%	59.3%	58.3%	60.9%	61.7%	62.2%	61.0%
Piemonte	"First Italy"	63.3%	63.3%	61.9%	60.5%	58.7%	58.4%	61.4%	62.9%	64.0%	63.1%
Lombardia	"First Italy"	61.4%	62.0%	61.3%	60.2%	58.8%	58.6%	61.9%	63.9%	65.4%	64.7%
Valle d'Aosta / Vallée d'Aoste	"First Italy"	60.9%	62.4%	62.0%	61.5%	60.1%	59.7%	62.4%	63.9%	65.2%	64.3%
Emilia-Romagna	"Third Italy"	61.6%	62.5%	62.3%	61.6%	60.0%	59.3%	61.8%	62.4%	63.2%	62.6%
Toscana	"Third Italy"	61.3%	61.9%	61.5%	60.9%	59.0%	58.1%	60.8%	61.4%	62.4%	62.1%
Friuli-Venezia Giulia	"Third Italy"	60.9%	61.8%	61.9%	60.7%	58.5%	57.5%	60.7%	61.7%	63.5%	63.6%
Umbria	"Third Italy"	59.3%	60.7%	61.0%	61.1%	60.2%	59.2%	60.9%	60.6%	61.0%	60.6%
Marche	"Third Italy"	59.0%	60.3%	60.0%	59.6%	58.8%	58.1%	60.3%	60.6%	61.1%	60.8%
Veneto	"Third Italy"	56.8%	58.0%	58.0%	57.4%	56.6%	56.8%	60.5%	62.6%	64.3%	64.1%
Trentino Alto Adige / Südtirol	"Third Italy"	56.3%	57.6%	57.4%	56.1%	55.1%	55.3%	59.5%	61.3%	62.5%	62.1%
Lazio	"Second Italy"	58.3%	59.1%	58.7%	58.6%	57.7%	57.8%	60.9%	62.4%	64.0%	63.5%
Abruzzo Molise	"Second Italy"	56.1%	57.4%	57.1%	56.5%	56.0%	55.8%	58.1%	58.9%	60.0%	59.9%
Sicilia	"Second Italy"	54.0%	54.2%	53.6%	53.6%	53.4%	53.5%	56.0%	57.2%	58.9%	59.3%
Basilicata	"Second Italy"	53.3%	54.3%	53.2%	52.8%	52.8%	53.3%	56.3%	57.9%	59.4%	59.5%
Campania	"Second Italy"	53.0%	53.1%	52.5%	52.3%	52.2%	52.6%	55.5%	57.4%	59.6%	60.1%
Puglia	"Second Italy"	51.6%	52.1%	52.1%	52.5%	52.4%	52.5%	55.5%	57.6%	59.8%	60.8%
Calabria	"Second Italy"	51.3%	51.7%	51.1%	51.2%	51.7%	52.3%	55.1%	56.8%	58.7%	59.3%
Sardegna	"Second Italy"	50.6%	50.9%	51.5%	51.3%	51.7%	52.9%	56.3%	59.3%	62.4%	63.8%

Figure 2: Proportion of population in working ages (20–65 year) 1955–2000 (per cent) in Italian provinces divided into First, Second and Third Italy. Source: ISTAT (2022). Regional division based on Boschma (1998). The Lazio region, dominated by Rome, occupies an intermediate position until the 1990s when it starts to display the very high share of working age population typical of capital regions.

4.1 The economic rise of the Third Italy

The industrial districts of the Third Italy,⁶ rose to global fame in the late 1980s and early 1990s not least through Piore and Sabel's (1984) extremely well-cited analysis.⁷

The relevance of the case is derived from the claim that the industrial growth in Third Italy signified the rise of a new form of industrial organization, often referred to as flexible specialization, that was proving to be more competitive than the rigid Fordist production regime then dominating the traditional industrial core of the so called First Italy. Even critics of this claim had to admit that the idea of the Third Italy had “achieved an iconic status in geography” and that “perhaps the major theoretical thrust of Anglo-American economic geography in the 1980s and 1990s concerned the previously hidden potential of industrial districts for stimulating regional economic development” (Agnew *et al.*, 2005:83; see also Boschma, 2008).

⁶ The term “the Third Italy” was first described in a book by Bagnasco (1977). It alludes to the regions left out from the traditional division between the First Italy (the industrialized core in the Northwest) and the Second Italy (the less developed South).

⁷ Piore and Sabel's (1984) book on the second industrial divide, where the emergence of new industrial districts in the Third Italy plays a prominent role, has almost 20 000 citations in Google Scholar (captured autumn 2023).

In order to check for a possible “hidden” demographic impact behind the shift from the First to the Third Italy during the 1970s and 1980s, we have calculated the working age ratio for Italian regions from 1950 onwards. Figure 2 shows that the regions making up the First Italy had a clear demographic advantage over the rest of the country in the 1950s and 1960s, a period when they displayed superior economic performance, while that gap had largely closed by the 1970s and 1980s. In particular it is worth noting how Emilia Romagna, arguably the most archetypical Third Italy region, had a higher working age ratio than all the core regions of the First Italy: Liguria, Piemonte and Lombardia, in 1970, 1975 and 1980.

The figure also reveals how the longer-term problem of lacking economic development in Southern Italy was underpinned by a population age structure persistently unfavorable right up to the end of the 20th century.

Together the data clearly support the claim that explanatory gains could be harvested by including information about the regions' working age proportion – in this case when explaining the relative economic success of the Third Italy in the 1970s and 1980s.

4.2 Industrial restructuring and new spatial division of labor in the UK

The industrial crisis of the industrial core regions in the UK in the 1970s was the starting point for new types of analyses in economic geography. The most influential studies of the process of regional industrial restructuring were made by Massey (Massey 1979, 1984, Massey & Meegan 1982), who saw this process as part of a wider shift from one form of spatial division of labor (horizontal, sectoral) to another (vertical, hierarchical).⁸ Massey pointed out how the very generality of manufacturing decay in United Kingdom from the late 1960s allowed few areas to escape the industrial downturn entirely, though inevitably the traditional manufacturing core regions in North-West England and West Midlands were hit hardest, while new investment sought out the attractions of less urban areas or favored sectors mainly located in London and the southeast⁹.

Here we ask whether the industrial downturn in the UK in general and its traditional industrial core in particular could at least in part have been triggered by changes in the population age structure. Data availability restrict us to apply three data points only, but even so the industrial crisis in the UK from the 1960s and throughout the 1970s clearly coincided with a general and substantial deterioration of the working age ratio up to 1981, followed by a recovery (Figure 3). West Midlands and the North-West, the two regions that were hardest hit by the 1970s crisis, were (together with Wales and Yorkshire) the regions where working age ratios dropped sharpest in the period up to 1981 (over two percentage points)¹⁰.

These data support the general proposition that including age structure as an explanatory variable could have added value to the analysis of why some regions were hit so hard by industrial restructuring in the UK in the 1970s onwards.

⁸ Massey's (1984) book on new spatial divisions of labour has more than 6000 citations in Google Scholar (captured autumn 2023), making it one of the most cited contributions ever written by an economic geographer.

⁹ Neither Massey's work, nor the also influential concurrent work by Keeble (1976, 1980) on the same topic, conveyed any fixed definition of winning and losing regions to be easily reproduced and multiple changes in the delimitation of UK subdivisions used to report census data make any such attempt a challenge. The NUTS 1 regions of West Midlands and the North-West vs. London and the South-East should however work reasonably well as an approximation to capture the regional divide in focus.

¹⁰ London experienced an even more dramatic fall of three percentage points (though from a higher level), coinciding with strong de-industrialization, but as the city simultaneously benefited from a growing service sector its loss of manufacturing jobs attracted limited interest.

NUTS Level 1	1961	1981	2001
London	61.4%	58.4%	62.7%
West Midlands	58.7%	56.5%	58.1%
Wales	57.6%	55.6%	57.3%
North West	57.7%	55.4%	58.2%
Yorkshire	58.0%	55.7%	58.3%
East Midlands	57.9%	56.3%	58.9%
East of England	57.3%	56.4%	58.8%
North East	57.1%	56.7%	58.5%
South East	56.5%	55.7%	58.9%
South West	56.6%	54.8%	57.6%

Figure 3: Proportion of population in working ages (20–65 year) 1961–2001 (per cent) in NUTS-1 regions in England and Wales
Source: See Data appendix.

4.3 Industrial decentralization in the US

Around the same time the US experienced an equally dramatic shift, with strong industrial and economic decline in the core manufacturing regions in the north-east (The Manufacturing Belt, often also referred to as the “Rustbelt” or the “Snowbelt”), in parallel with industrial growth in the southern “Sunbelt” and in California. A seminal paper by Norton & Rees (1979) showed how the search for lower costs and more flexible labor made firms turn their back to the strongly unionized strongholds in the north-east in favor of greenfield locations, while Bluestone & Harrison (1984) added the advantages of offshore outsourcing to low cost-countries. For a recent literature review of the case, see Klein (2023).

Checking for the possible impact of population age structure, Figure 4 shows a huge demographic advantage of the Manufacturing Belt over the rest of the country in 1950, but also that this advantage evaporated during the 1960s and 1970s. The downturn is most clearly illustrated by comparing the East North Central Division (comprising the states of Indiana, Illinois, Michigan, Ohio and Wisconsin), with the East South Central Division where a 6.4 percentage point advantage in 1950 for the former is reduced to one percentage point by 1970, and then stays at that level. Similarly, the South Atlantic Division had a 3.4 percentage point advantage that was reversed to a 0.9 disadvantage by 1970 and this disadvantage remained in place all the way up to 2019.

All in all, this case provides a sterling argument for the potential value of incorporating changes in age structure as a supplementary factor to be considered in analyses of regional shifts. It seems obvious that the strong Snowbelt to Sunbelt shift in the US economy from the 1970s onwards coincided with equally dramatic changes in regional population age structure. For some supporting econometric evidence see (Persson & Malmberg, 1996).

Region		1950	1960	1970	1980	1990	2000	2010	2019
"Manufacturing Belt"	States								
Middle Atlantic Division	NJ, NY, PA	61.9%	55.2%	53.3%	57.1%	59.7%	59.1%	60.6%	59.2%
New England Division	CT, ME, MA, NH, RI, VT	59.5%	53.1%	52.0%	57.0%	60.3%	59.7%	61.1%	59.7%
East North Central Div.	IN, IL, MI, OH, WI	59.1%	52.3%	51.4%	56.3%	58.2%	58.7%	59.7%	58.3%
"Periphery"									
South Atlantic Division	DE, DC, FL, GE, MD, NC, SC, VA, WV	55.7%	51.7%	52.3%	56.8%	59.5%	59.7%	60.1%	58.3%
East South Central Div.	AL, KY, MS, TE	52.7%	49.5%	50.2%	54.8%	57.7%	59.3%	59.7%	57.9%
Mountain Division	AZ, CO, ID, NM, MT, UT, NV, WY	54.8%	49.8%	50.4%	56.1%	57.5%	58.7%	59.1%	57.9%
West South Central Div.	AR, LA, OK TX	55.3%	50.6%	50.8%	55.3%	57.6%	58.5%	59.3%	58.3%
West North Central Div.	IA, KS, MN, MO, NE, ND, SD	56.6%	50.5%	49.7%	54.9%	56.7%	57.7%	59.1%	57.3%
Pacific Division	CA, OR, WA	60.5%	53.4%	53.6%	58.6%	60.2%	59.5%	60.8%	59.9%

Figure 4: Proportion of population in working ages (20–65 year) 1950–2019 (per cent) in US states, broad regional groupings.

Source: Ruggles *et al.* (2022). Regional Division based on Norton and Rees (1979).

Area	1970	1980	1990	2000	2010
San Francisco Bay Area	55.7%	61.1%	63.2%	62.8%	63.0%
Greater Los Angeles Area	54.3%	58.8%	60.5%	58.7%	60.4%

Figure 5: Proportion of population in working ages (20–65 year) 1970–2000 (per cent) in two Californian city regions.

Source: Haines (2018) and Bureau of the Census (2021). Regional definitions following Storper *et al.* (2015).

4.4 Los Angeles vs San Fransisco 1970–2010

The final case we look into – based on the book by Storper *et al.* (2015) on the rise and fall of urban economies – does not relate a regional shift to a specific historic transformation, but is instead an ambitious attempt of making a fully grounded historical analysis of why two initially quite similar city regions – Los Angeles and San Francisco – display radically different economic growth rates over a 40-year period.

In 1970, the two regions both ranked among the country's most prosperous with comparable per capita income. In 2010, however, there was almost a one third difference in per capita income to the advantage of San Francisco, and Los Angeles had slipped to 25th place in the US regional income ranking.

In the public discourse the shift was often attributed to developments in specific sectors (such as the loss of aerospace industry in Los Angeles in contrast the growth of the ICT industry in the Bay Area) or to differences in migration patterns (Los Angeles receiving lots of low-skilled immigrants from Latin America, while the Bay Area became the recipient of highly skilled immigrants). But the authors maintain that the divergent paths were “principally due to the different ways the two economies reshaped their social and economic networks, the practices of their firms, and the overall ecology of organizations in their economies” (Storper *et al.*, 2015: 3).

Yet, while both regions display a gradual increase in the working age ratios (except for a small dip in 2000), Figure 5 reveals that the San Francisco Bay Area has had a clear age structure advantage over the Los Angeles area throughout the period. The difference in working age ratios even accelerated over time, from 1.4 percentage points in 1970 to 4.1 percentage points in year 2000.

Again, demographic data suggest that it would add explanatory power to include age structure effects in the analysis of this regional shift. Incorporating such insight, in this case, would have added positively to an already compelling story.

4.5 Summing up the four cases

The simple stories told by the four cases and their heatmaps do suggest that population age structure should not be ignored as it seems to impact – presumably even substantially – on regional economic development. Population age structure thus appears to have an effect on economic outcome at the level of cities and regions within countries, just as it has on uneven development patterns between countries.

Moreover, the regional cases reviewed indicate the existence of age structure effects even in mature industrial economies where the grand demographic transition took place very long ago and where changes in the working age ratio over time is mainly the aggregate effect of temporary variations in fertility patterns (baby booms and busts) and

inter-regional migration. In many of these countries, the general pattern is that rural areas and peripheral towns are progressively dominated by senior citizens, while internal as well as international migration often helps uphold a more age-balanced structure in larger urban areas (Bini *et al.*, 2010).

One major concern that should be addressed here is that inter-regional migration within a country is typically higher than migration between countries. This could imply that a favorable or improved working age ratio might not necessarily be the driver of a region's economic growth and development in the same way as seen between countries, but could rather occur as a result of an inflow of working age adults attracted by the improved opportunities that follow from economic growth.

This alternative viewpoint cannot be dismissed, but there are some arguments against it. We know that the age groups that are most strongly associated with economic growth are those in the middle and upper middle-ages (45+) but that people who migrate are mainly much younger (<35). Such young mobile adults are typically without much savings and in the childbearing ages, which means some of them might conceive or already have children which in turn will lower the working age ratio, while increasing the demand for housing, infrastructure, and services in the receiving regions. Migration of elderly citizens – though much smaller than youth migration – adds to such demands, but will in addition bring with them savings to invest locally, perhaps most important in parts of the US. All in all, inter-regional migration certainly impacts the working age ratio as well as the age distribution within the working ages, but it seems less likely to alter the main conclusion in this section, i. e. that population age structure, as measured with the working age ratio, contributes to the explanation of major regional shifts within mature industrial economies.

5 Conclusion and discussion

The arguments forwarded and data presented in this paper can be summarized in six main points:

- The demographic transition that most countries have undergone or are about to undergo, from high fertility and mortality to low fertility and mortality, is a driver rather than an effect of economic development.
- The demographic transition is associated with a period of strong economic growth that can last for several decades when large cohorts/generations born after the decline in mortality, but before the decline in fertility, reaches middle-age.
- The sequence in which this transition process has occurred across countries coincides with major global shifts in economic development, not least with the rise of a number of newly industrializing economies during the last 50 years.
- In mature countries, where the transition was concluded a long time ago, population ageing is a trait that generally slows down economic growth. Even in such countries, however, population age structure may vary substantially over time due to baby booms and baby busts, as well as variations in migration flows.
- There are reasons to believe that changes in population age structure will have an effect on shifts in regional and urban economic development within countries in much the same way as it has on national economies.
- A review of four “paradigmatic” cases of historical regional shifts in industrialized countries, much studied by influential economic geographers, shows that in each of the cases, the shift in economic fortune from one region to another coincide with corresponding changes in population age structure that can contribute to explaining such shift.

The overall conclusion is that when analyzing shifts in the economic development of nations, regions, and cities, explanatory gains can be reaped by economic geographers if including demographic dynamics, and especially changes over time in population age structure.

We are not arguing that age structure effects reduce or remove any of the valuable explanations offered by existing institutional (Gertler, 2010; Rodríguez-Pose, 2013), relational (Bathelt & Glückler, 2017; Buchholz & Bathelt, 2021) or evolutionary (Boschma & Frenken, 2006; MacKinnon *et al.*, 2009; Martin & Sunley, 2022) approaches to such shifts, but rather that the inclusion of changes in population age structure provides a foundation upon which the specific processes of spatial economic development unfolds.

Before asserting that the relative success of one region or country compared to another is the outcome of any kind of organizational, institutional, technological, cultural or geopolitical shift, a first step should be to consider whether the shift in question is actually bigger than what should be expected given existing trends of change in regional or national working age ratios. Regrettably, this insight seems to remain largely ignored in contemporary economic geography.

If the argument put forward in this paper should gain acceptance it would imply that population age structure and the existence of demographic dividends would inherently become a starting point in any account of broad national or regional shifts in economic activity. However, this is still

far from the case. A telling illustration is provided by the first chapter of the *New Handbook of Economic Geography* (Berry & Engels 2018). It explores the growth and transformation of the Asian region in the 21st century. Noting that “Asian industrialization came in waves”, it identifies trajectories of development and mentions in order of appearance on the economic world scene Japan and the four Asian tigers (Hong Kong, South Korea, Taiwan, and Singapore), followed by Malaysia, Thailand, the Philippines, and Indonesia, and eventually by China and then India. It goes on to discuss key challenges of the region (environmental degradation, inequality, financial instability, corruption) and future prospects for sustained growth (“China’s major concern is likely to be managing its relations with the USA”). It does so without any mentioning of the fact that all the countries in focus have been reaping the benefits of demographic dividends and that all of them in the years and decades to come will be affected by population ageing and a deteriorating working age ratio, of the sort already now hampering the Chinese economy. This, *nota bene*, is not to say that the rest of the analysis provided is flawed or that the key challenges identified in the chapter are less important, but merely to state that one imperative piece is missing.

Still, an understanding of economic-geographical processes as being embedded in a local context that goes beyond what is strictly considered economic activities is in line with a longstanding tradition of the field. Labor supply and cost have long played a strong role in economic geography when attempting to explain why certain places attract certain types of economic activity (e. g. Storper & Walker, 1983). Even though labor factors have rarely been directly associated with population age structure, such a link is certainly close at hand. Also, Florida’s work on the role of the creative class in the economic dynamism and competitiveness of cities (Florida, 2002) indirectly points in the same direction. Although not explicitly focusing on age structure, it clearly suggests that the composition of the urban population determines economic outcomes, rather than the other way around.

Finally, a fuller understanding of demographic dynamics can help resolve some of the conundrums of our discipline and add significantly to the tools available when attempting to explain why geographical *shifts* in economic development happen at a certain time, e. g. how formerly stagnant cities, regions or nations can enter phases of accelerated growth while others suddenly lose their golden touch and fall back.

Supplementing traditional institutional, technological, political, and cultural explanations with demographics in policy-directed research does in addition provide a novel and useful device for forecasting future trends and shifts where timely policy responses might be needed.

Fertility levels can change quite suddenly and vary substantially from one year to another (Grimm, 2021; Amuedo-Dorantes *et al.*, 2023), but changes in the population belonging to the working ages will – by definition – only arrive after a twenty-year lead period. Similarly will the distribution of people aged 50 in two decades from now largely be determined by the number of people aged 30 today while only marginally affected by migration since most migrants are younger adults. In this sense demography creates a slowly changing structure upon which societal responses to other unexpected events plays out, be they institutional, technological, political, or cultural. It is also this difference in velocity that makes it possible to extend the scope of economic geographical analyses into the future when demographic variables are included. This ancillary capability of prediction constitutes a powerful quality perhaps particularly relevant in research aimed at providing advice to managers or policy makers.

Not least in in the post-2020 period when an increasing number of mature economies will experience a decline in the working age population will there be a demand for economic-geographic research that clarifies how processes of regional and urban growth are affected by shifts in the age structure.

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Data appendix

Global data on age structure

Country level data on age structure is available from (United Nations, 2019). This dataset contains population estimates for every fifth year from 1950 to 2020 for a total of 201 countries. We compute the proportion of working age adults, aged 20–64 years, by dividing the number of individuals aged 20–64 with the total number of individuals in the population. The standard definition of the working age population is 15–64 years of age. However, we restrict the working age population to the 20–64 age group to account for the fact that an increasing proportion of the 15–19 years age group participate in upper secondary education or tertiary education (Lutz *et al.*, 2017).

Global data on real GDP 1950–2015

For data on GDP we use expenditure-side real GDP at chained PPPs from Penn World Table, version 10.0 (Feenstra *et al.*, 2015). The Penn data contains time series for real GDP for 172 of the countries for which UN provides demographic data. 55 countries of these countries have data on real GDP starting in 1950. In 1960, a total of 111 of the 172 countries has GDP data in Penn. In 1970, and additional 37 countries have data. And from 1990, all the 172 countries have GDP data in Penn World Tables have data for real GDP.

Per capita income is obtained by dividing real GDP with the total population as provided in (United Nations, 2019).

Data on regional age structure for England and Wales 1961–2001

In England and Wales, changes in the geographical subdivisions that are used to report census data make it difficult to obtain data for regions with the same definition over time. The approach used in this paper is to aggregate local data to NUTS2 areas (Nomenclature of Territorial Units for Statistics) using digital vector boundaries for NUTS2 areas in England and Wales and for local districts. Such data is available at the Office for National Statistics on their Open Geography Portal, (<https://geoportal.statistics.gov.uk>). We have used data from three censuses: 1961, 1981, and 2001.

For 1961 we have used the SH13 table: Age and marital condition by five year age groups [1961 Census] that reports aggregates for Local authority districts as defined in 1961. Available at https://www.nomisweb.co.uk/sources/census_1961_sh.

For 1981 we have used “1981 census – small area statistics”, Table 2, Age and Marital Status, Great Britain, with geography for “local authority: district / unitary (prior to April 2015)”. Available at: https://www.nomisweb.co.uk/sources/census_1981.

For 2001 we have used the 2001 census, Standard Table 2 (ST002), Age by sex and marital status, with geography for “local authority: district / unitary (prior to April 2015)”, available from https://www.nomisweb.co.uk/sources/census_2001_st.

Census data is available for 5-year age groups. These age classes have been aggregated to working age adults in the age span 20–64 year, and to non-working age adults, age span 0–19 and 65+.

Local authority districts as defined in 1961 and Local authority districts unitary, prior to 2015 have been assigned to NUTS2 areas using the “Join attributes to location” feature

in QGIS version 3.22.7-Białowieża. This feature allows districts to be assigned to NUTS areas on the basis of with which NUTS area the district has the largest overlap.

The aggregation to NUTS1 areas has been made using the map “UK: NUTS1 Levels 1 and 2, 2018”, available at <https://geoportal.statistics.gov.uk/documents/ons::nuts-levels-1-and-2-january-2018-map-in-united-kingdom/about>.

Data on regional age structure for Italy 1952–2001

For data on the age structure of Italian provinces we have used four data sets for inter-censuses populations: Estimated resident population – Years 1952–1971, Estimated resident population 1972–1981, Estimated resident population 1982–1991, and Estimated resident population 1991–2001. The data is provided for one-year age groups. We have aggregated the age data into working age population (20–64 years), and non-working age population (0–19 years and 65+). These data contain information on 20 provinces corresponding to the NUTS2 regions of Italy, as well as data on 5 broader regional groups corresponding to Italy’s NUTS1 regions. The Inter censuses population data is available from ISTAT, <https://www.istat.it/en/population-and-households?data-and-indicators>, submenu Population-Demographic indicators.

Data on state level age structure for the United States 1940–2019

Regional data on age structure has been obtained from IPUMS (<https://www.ipums.org>). IPUMS now holds microdata from a large set of national censuses and provides researcher access to this data. In the present study we have used 1% samples from the 1940 census, the 1950 census, and the census 1970, and 5% samples from the 1960 census, the 1980 census, the 1990 census, and the 2000 census. In addition we have used the 1% samples of the American community survey (ACS) for 2010 and 2019 (see Ruggles, S., Flood, S., Foster, S., Goeken, R., Schouweiler, M., & Sobek, M. (2022) *IPUMS USA: Version 12.0* [dataset]. Minneapolis, MN: IPUMS). All these datasets contain information about the state where the samples individual lives as well as information of exact age, and on sample weights. Age structure data for the US states have been obtained by aggregating this data, using a weight that reflect the above sampling scheme, by year, state of residence, and age. A further age

aggregation has then been made to obtain the size of the working age population (aged 20–64 years) and the size of the non-working age population (0–19 years, 65+), for each state and each year. Aggregation to Census Divisions has been done on the basis of the document “Census Bureau Regions and Divisions with State FIPS Codes”, (https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf).

Data on county level age structure for the United States 1970–2010

The microdata from IPUMS does not, in general, contain information on county of residence. Here we have instead used two different data sources. First, Haines, M. R. (2018) *U.S. County Populations by Single Years of Age, Sex, and Race, 1970, 1980, 1990*. Inter-university Consortium for Political and Social Research Available online at <https://www.icpsr.umich.edu/web/ICPSR/studies/37115>. Second, a table provided by the Bureau of the Census: Intercensal Estimates of the Resident Population for Counties and States: April 1, 2000 to July 1, 2010. Available online at <https://www.census.gov/data/datasets/time-series/demo/popest/intercensal-2000-2010-counties.html>. The Haines data provide numbers for one-year age groups. The intercensal data gives data for five-year age groups.

For the Greater Los Angeles area and the Bay Area we follow the definitions given in Storper *et al.* (2015): “Los Angeles, in this context, means the Greater Los Angeles metropolitan region (known officially as the Combined Statistical Area [CSA] encompassing five adjacent, continuously urbanized counties (Los Angeles, Orange and Ventura, and parts of San Bernardino and Riverside)” p. 3, although we include the whole of San Bernardino and Riverside. “The San Francisco metropolitan area, which is also known as the Bay Area, is a Combined Statistical Area that until 2010 comprised ten varied counties, from the Sonoma and Napa wine country in the north to Silicon Valley and the Santa Cruz Mountains and coast in the south, and from the wild Pacific coastline to the west inland to the mountains separating it from the Central Valley of interior California”, p. 5. According to the map presented on p. 6 (Map 1.2), these counties are: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma.

References for data appendix

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- United Nations. (2019). *World population prospects 2019, online edition. rev. 1*. File POP/7-1: Total population (both sexes combined) by five-year age group, region, subregion and country, 1950-2100 (thousands): United Nations, Department of Economic Social Affairs, Population Division. Available online at: <https://population.un.org/wpp/Download/Standard/Population/>