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New Avenues in Development Economics: Identifying the Determinants of Economic Shrinking

A critical examination of the dimensions underlying economic shrinking

by

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Abstract:

Recently there has been a revision of longstanding ideas in development economics. Studies have shown that it is not so much increases in growth rates which cause long-term economic development, but rather decreases in shrinking rates, alongside a reduced frequency of shrinking. This paper reviews two theories of economic shrinking, one based on 5 social capabilities and the other based on 4 dimensions which are theorized to affect economic shrinking. Of these proposed categories only 'state autonomy', 'demographic change' and possibly 'the inclusion of the population in the market' are significantly related to economic shrinking. Future research should not only improve the theoretical foundation and operationalization of variables which determine shrinking, but also leverage data-driven methods to identify the dimensions underlying economic shrinking.

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1 Introduction

One of the longstanding goals of development economics is to promote economic growth, as it is widely assumed to be able to have a favourable impact on poverty reduction (see e.g. Kuznets, 1955; Ravallion, 2004; Škare & Družeta, 2016) and sufficient economic growth can enable a transformation from developing countries into developed countries. However, recently a new strand of literature in the domain of economic history has nuanced this perspective. Broadberry and Wallis (2017) focus on the role of economic shrinking in the development process, rather than growing. Their observations were fuelled by new findings which suggest that countries do not only vary in how they grow, but more so how (and how often) they shrink (Pritchett, 2000; Cuberes & Jerzmanowski, 2009).

Shifting the focus from economic growth to shrinking might have the potential to radically transform our understanding of the development process. Broadberry and Wallis (2017) for instance argue that the primary driver of economic improvement over the long run is due to a decline in magnitude and frequency of shrinking, rather than an increase in the growing rate. Furthermore, they argue that the transition to modern economic growth regimes during the industrial revolution is less due to rapid increased economic growth and more due to a reduction in shrinking, which is at odds with many widespread contemporary accounts (see e.g. Jones, 2001).

1.1 Research Problem

The main research question of this paper is whether the dimensions or categories that affect economic shrinking have been identified. This paper attempts to contribute to the literature on economic shrinking by doing three different things. Firstly by offering a thorough review of the literature on economic shrinking, where primarily two models of economic shrinking are contrasted. The first is a social capability approach, developed in the work of Andersson, Julia and Palacio (2021), which builds on the work of Abramovitz (1986) and theorizes that economic shrinking is affected by 5 different social capabilities:

transformation of economic structures, inclusion of the population in the market, social stability, accountability of the state and autonomy of the state. Another theory of economic shrinking can be found in the work of Broadberry and Wallis (2017), who also theorize about 4 dimensions underlying economic shrinking: structural change, technological change, demographic change and changing incidence of warfare. Broadberry & Wallis (2017) do not empirically test whether these categories are indeed related to shrinking, an addition to the literature made by this paper is testing their theory. Secondly, the empirical part of this thesis operationalizes the categories underlying shrinking mentioned above and contrasts the models of Andersson, Julia and Palacio (2021) with that of Broadberry & Wallis (2017). In both models, only one or a few variables are significantly related to shrinking. Lastly, the discussion in this paper critically examines the concepts and theory used in shrinking literature and attempts to chart a course for future research by identifying additional dependent variables worthy of investigation, commenting on potential interaction effects and suggesting the use of factor analysis to gain a deeper understanding of the dimensions underlying shrinking.

2 Theory

2.1 A model of economic shrinking

A simple mathematical model can be used to elucidate what is meant by growing and shrinking and how those terms are related to long-run economic growth (Broadberry & Wallis, 2017). If *l* is long-term economic growth, then *l* can be expressed as the average of growing and shrinking. Growing is the frequency of growth episodes (*f*) times the growth rate when growing (*g*). While shrinking is the frequency of shrinking episodes (*v*) times the shrinking rate when shrinking (*s*). Thus long-term economic growth (*l*) can be expressed as:

$$l = (f * g) + (v * s) \quad (1)$$

And since the frequency of shrinking episodes is equal to 1 minus the growing episodes (i.e. both add up to the total 'growth' episodes, usually years), *v* can be expressed as *(1-f)*, reducing equation 1 to:

$$l = (f * g) + [(1 - f) * s) \quad (2)$$

Equation 2 gives workable variables which can be extracted from databases that contain information on economic growth, allowing for a fairly easily obtainable dependent variable when working with this model. Variables *g* and *s* will be called magnitude of growing and shrinking respectively throughout this paper, while the term *(1-f)* will be called the frequency of shrinking.

Empirically, Broadberry and Wallis (2017) start by highlighting that between 1950-2011 for a group of 141 countries using Penn World Tables (Feenstra, Inklaar & Timmer, 2015), low income countries exhibit higher growth when they are growing. This by itself is not a surprising finding as for instance in the Solow model diminishing returns to capital imply that countries early in the development process (with limited capital stock) will see higher returns than more advanced economies (Solow, 1956). Furthermore, Broadberry and

Wallis (2017) observe that when low income countries are shrinking, the shrinking rate is higher as well. Yet, the frequency of growing is higher for more affluent countries (84% of years), while poor countries shrink more often (38% of years). This results in poor economies not catching up to rich economies leading to unconditional divergence (Pritchett, 1997).

Broadberry and Wallis (2017) extend their analysis to include data from 1820, for a subset of 18 western economies, thereby attempting to capture the transition to modernity. The main implication is that the frequency of growing increases sharply after 1950 from around 66% to 88% (Broadberry & Wallis, 2017). Despite this, the growth rate during growing episodes actually diminished during the same period, yet due to the high frequency of growing, average growth rates are more than 1 percentage point higher after 1950 than the previous periods for these economies (Broadberry & Wallis, 2017).

The final empirical contribution of Broadberry and Wallis (2017) revolves around extending the time-span of the analysis even further to encompass the late 13th and early 14th century up to the late 19th century and contrasts the economies of Britain and the Netherlands – the earliest countries to transition to sustained economic growth – with those of Italy and Spain – who achieved this transition later. This exercise again highlights that high rates of growing are accompanied by high rates of shrinking and vice versa for low rates (Broadberry & Wallis, 2017). It is apparent that Britain experienced higher growth rates during 1800-1870 compared to 1700-1750 (respectively 0.23% and 0.79% annually), yet the cause of this increase in growth was not a higher growing rate (which fell from 4.76 % to 3%), but rather a steep decline in the shrinking rate (from -2.15% to -1.05%) , alongside an increased frequency of growing (from 50% to 61%). Thus, using the model outlined in equation (1) and (2), this decomposition analysis shows that all of the increase in economic performance between 1700-1750 and 1800-1870 can be explained using changes in shrinking as opposed to growing (Broadberry & Wallis, 2017).

As the above shows, Broadberry and Wallis (2017) present three stylized facts regarding the role of growing and shrinking on long-run economic growth. First, growing and shrinking rates are variable and substantial for most of history and remain variable and substantial for developing economies nowadays. Second, the frequency and magnitude of the shrinking rate have declined for developed countries nowadays, which is the main driver of long run economic performance, rather than increased growing rates. Third, growing rates tend to decline as long run economic performance improves, which again implies that the key

to economic long-run performance mostly lies in a reduced frequency and magnitude of shrinking.

2.2 Proximate causes of economic shrinking

The above outlines conflicting accounts as to the causes of long run economic performance and specifically the transition to sustained economic growth. Dominant theories regarding the industrial revolution tend to focus on economic growth resulting from innovations which enabled manufacturing processes to become more efficient and capital-intensive (Ashton, 1948: 48), such as coke smelting of iron and prior to that more mechanical-based innovations such as the spinning jenny (Allen, 2009). However, some of these dominant theories have received more scrutiny in recent years.

By synthesizing research on growth accounting over the past decade Crafts and Woltjer (2019), for instance, show that previous estimates of the contribution of total factor productivity (TFP) to growth during the industrial revolution are likely biased upwards due to measurement error in industrial output and real GDP. One early estimate of the contribution of TFP to U.S. labour-productivity growth by Solow was 87.5% (1957: 320). Yet, Crafts and Woltjer (2019) convincingly show that, first of all, TFP growth is not synonymous with technological change, rather TFP growth estimates tend to be biased up or downward compared to the actual contribution of technological change to productivity growth in labour. This is affected by for instance elasticity of substitution and the embodiment of technological change in capital goods (Crafts & Woltjer, 2019). If the elasticity of substitution is below zero then using standard Cobb-Douglas model assumptions will bias TFP growth estimates downwards and if technological change is embodied in capital goods, then TFP captures part of what is usually subsumed under capital-deepening (Crafts & Woltjer, 2019). Another aspect of TFP growth pertains to negative TFP growth as documented in for instance several African nations in the late 20th century (Bosworth and Collins, 2003). This should not be interpreted as "forgetting production methods" (Crafts and Woltjer, 2019: 682), but rather as an increase in inefficient allocation of capital and labour, a problem which tends to persist even in developing economies which show high growth rates such as China (Hsieh & Klenow, 2009). Hence inefficiency reduction in capital and labour allocation is a strong contributor to TFP growth. Therefore Crafts and Woltjer (2019) using updated growth

accounting methodology and new methods for capital estimates find that rather than Solow's estimate of 87.5%, TFP contribution to labour productivity growth in the U.S. is around 40%. Crafts and Harley (1992) provide similar caveats when it comes to the British industrial revolution. Although they do not deny that a fundamental transformation of the economy occurred during 1750-1850, particularly highlighting the end of Malthusian dynamics and the role of structural transformation, they argue that industry growth during this period has been overestimated (Crafts & Harley, 1992). This is mainly due to previous underestimation of the state of British industry prior to 1750 and more rapid increases in growth rates after 1850 (Crafts & Harley, 1992).

Gordon (2012) also criticizes the importance given to the role of technological change during the period he calls the first industrial revolution (1750-1830) and argues that the most important inventions actually stem from the second industrial revolution (1870-1900), which encompasses innovations such as electric light, indoor plumbing and telephones. Yet, the main effects stemming from these innovations took much longer to take hold. Gordon (2012) argues that the innovations from the second industrial revolution would continue to have transformative effects on societies for 100 years, exemplified by for instance highways, television networks and air conditioning. The impact of these technologies is apparent in estimates of growth rates of frontier economies (the U.S. and U.K.), which peaked during 1928-1950 at around 2.5% (Gordon, 2012). These technologies consist of electricity and associated products and services, the internal combustion engine, running water, plumbing and heating, new biochemical methods and products such as petroleum and plastics and communication devices (Gordon, 2012). According to Gordon (2012) it was the innovations implemented during the second industrial revolution which transformed life from "dark, dangerous and involv[ing] backbreaking work" (Gordon, 2012: 7) to a much more pleasant form of life. Furthermore, Gordon (2012) argues that many of these innovations and associated social transformations are a one-time-only benefit and will likely not re-occur. For instance transportation improvements from horses to cars to eventually airplanes are likely one-time events and equal improvements in transportation from horse-powered transport to airplanes is unlikely to occur again (Gordon, 2012). Similarly, the inclusion of women in the workforce is a one-time event because obviously the adoption of women in the workforce cannot occur again (Gordon, 2012). Thus Gordon (2012), Crafts and Woltjer (2019) and Crafts and Harley (1992) all present revisions of the role of innovation and technological change in the process of the industrial revolution and their interpretations conflict with earlier

models of this period. This implies that perhaps it is not total factor productivity growth or rapid capital accumulation which explains the move from pre-industrial societies to modern economies and new accounts of this transformation are needed.

Broadberry and Wallis (2017)'s account of the industrial revolution stresses that it is not an increase in growing rates, but a reduction in frequency and magnitude of shrinking which enabled long-run economic performance. According to Broadberry and Wallis (2017) our focus should not be on innovations during periods of positive growth, but on what causes a decline in economic shrinking. In order to achieve this, they take a meta-theoretical approach based on the work of Maddison (1991: 12), who distinguishes between proximate (e.g. increased capital accumulation) and ultimate causes of growth (e.g. better property rights protection). They argue that the underlying ultimate cause is institutional, specifically the transition from 'natural states to open access societies' (North, Wallis & Weingast, 2007). Broadberry and Wallis (2017) put forth four proximate factors they argue are linked to shrinking: structural change, technological change, demographic change and the incidence of warfare.

2.2.1 Structural Change

Structural change has been long-hailed as a feature of a transition to modernity (Lewis, 1954; Fei & Ranis, 1961). Structural change is the shifting away of resources (often with a focus on labour) from the agricultural sector (which is often characterized by subsistence farming in poor countries) towards sectors with higher productivity, typically manufacturing but sometimes also services is included. Shifting away of labour from agriculture is possible because early in the development process there tends to exists surplus labour in the agricultural sector (as a large share of people work in the agricultural sector) which adds no or very little value to agricultural output (Lewis, 1954). This surplus labour can thus be used in other more productive sectors such as manufacturing or services, enhancing the output of those sectors while not harming total agricultural output, resulting in increased aggregate economic output (Lewis, 1954). This combined with Engel's (1857) law – which states that as households grow richer a lesser proportion of income is spent on food products – implies that as economies grow, the agricultural sector represents a diminishing share of total output compared to other sectors.

For countries such as Britain it has been widely established that prior to and during the industrial revolution structural change played a large role in the transformation of labour (see e.g. Voigtländer & Voth, 2006; Wallis, Colson & Chilosi, 2018). There was a decline of agriculture from around 40% of the British economy in the early 14th century to 30% during the 17th century and 20% during the 19th century (Broadberry et al., 2015: 194). Yet, agricultural output is highly susceptible to weather-related shocks (Odening & Shen, 2014), which for Britain often meant that declines in agricultural output with a magnitude of 10-20% were not uncommon during this transition. However, as Broadberry and Wallis (2017) argue, because the share of agriculture in the economy declined, volatility in weather patterns will affect the aggregate economic output to a lesser extent.

Even though Broadberry and Wallis (2017) present structural change as a cause of shrinking, they add a caveat that structural change is likely not only a cause of shrinking, but rather a consequence. The declining share of agriculture is not what 'causes' economic growth, but it is a consequence of labourers and resources moving to more productive sectors, this shifting away to more productive sectors can be seen as a cause of economic growth. This is in line with Engel's law which states that as incomes increase a smaller portion of income is spent on food items (Engel, 1857), hence as societies become wealthy a similar pattern

emerges and the industrial and manufacturing sector start dominating the economy. I think this is an important observation and warrants some attention, especially since causality is hard to establish in panel data regressions without approaches such as instrumental variables. Thus structural change might have a strong correlation with economic outcomes, but this does not necessarily imply that the direction runs from structural change to economic outcomes, nonetheless structural change (specifically the fact that a relatively small share of the economy works in agriculture) - be it an determinant or outcome of economic growth - is a strong indicator or feature of a modern and developed economy.

2.2.2 Technological Change

The importance of technological change in the development process is a longstanding idea among growth theorists, for instance endogenous growth theory (Aghion et al., 1998: 1-2) as well as unified growth theory (Galor, 2005) both stress the importance of technological progress and knowledge (spillovers) in the transition from Malthusian stagnation to sustained economic growth. The main measure of technological change in modern growth models is usually TFP which is the share of output that cannot be explained by the amounts of inputs, i.e. the residual unexplained output, which is often thought to reflect how efficiently inputs are used in production (Comin, 2010).

In principle, TFP growth should shift the distribution of growing and shifting episodes towards growing, which would lead the frequency and magnitude of shrinking to decline and increases the frequency and magnitude of growing (Broadberry & Wallis, 2017). Yet this is inconsistent with the earlier empirical observation from Broadberry and Wallis (2017) that growing episodes also diminish in magnitude as countries develop. Broadberry and Wallis (2017) only briefly discuss quantitative evidence on the role of TFP, mainly because historical estimates are unreliable and hard to obtain, due to an absence of (human) capital data. For Britain they find that TFP growth is only able to explain around 16% of the increase in output growth during from 1760-1873, implying that the rest of the output growth is due to more rapid factor accumulation (Broadberry & Wallis, 2017), yet this is add-odds with the previously discussed findings of Solow (1957) and Crafts and Harley (1992), who find estimates in the range of 40% to 87.5%. Since there are such widely varying estimates for TFP contributions to output growth, this warrants a degree of cautiousness to ascribing the importance of TFP. For the Netherlands, although there was substantial TFP growth in the

Dutch Golden Age (1540-1620), this was followed by a reversal in TFP between 1620-1655, resulting in no trend increase in TFP across the entire period (Broadberry & Wallis, 2017). Thus, growth reversals are common in both TFP and GDP per capita. In order to transition from Malthusian stagnation to modern economic growth, this requires not only fewer GDP per capita growth reversals, but TFP growth reversals as well (Broadberry & Wallis, 2017).

However, the view that TFP is unrelated to human capital and can cleanly be expressed as a separate determinant of economic growth has received much scrutiny. Abramovitz (1986) for instance highlights the role of catch-up potential of technological adaptation, only when countries have developed enough social capabilities. This implies that TFP growth has a conditional dependency on for instance human capital development, which is intuitive as more advanced technologies require understanding of those technologies before they can effectively be implemented. Andersson and Palacio (2019) also highlight this exact same conditionality, they distinguish between the effects of a commodity boom on various sectors and show that technological adaptation in agriculture tends to be quicker than for the manufacturing and service sector. They then further develop these conditionalities by showing that it also matters what types of products the agricultural sector produces in terms of the types of technologies embedded within the sector, which leads to more or less labour flowing out of the agricultural sector during a commodity boom (Andersson & Palacio, 2019). Easterlin (1981) formalizes these ideas by explaining that in his view the diffusion of knowledge and the adaptation of a rationalistic, science-based world view in the vein of the Enlightenment is the key to understanding differential growth-rates, where countries that have embraced this world-view experience more rapid economic growth than those who have not. Easterlin (1981) relates this theory to data on growth during the industrial revolution, reiterating Weber's thesis that western (Protestant) nations were the first to leverage these ideas, because of their propensity for critical thinking. He also shows that formal education became much more widespread globally after the second world war and he argues that this was also the moment that modern economic growth became more widespread globally (Easterlin, 1981). Hence, TFP cannot always be disentangled from measures of human capital, TFP and education have interaction effects, especially conditionalities where TFP growth might be impossible, unless human capital reaches a certain level, as Abramovitz (1986) has argued as well.

2.2.3 Demographic Change

Malthus' (1826: 8) model of demographic change assumes that any increases in food production will be offset by increases in population, resulting in no long-term increases in per capita GDP and thus people's incomes. Yet he did acknowledge the power of certain checks to population growth; preventive checks reduce fertility (such as a higher marriage-age), while positive checks increase mortality (e.g. war, famine, disease) (Malthus, 1826: 12). As Broadberry and Wallis (2017) explain, short-run increases and decreases in per capita income can occur in a Malthusian model through increases and decreases in mortality and fertility. Yet any gains in per capita incomes are temporary, because these higher living standards induce more fertility (as there is more income available to raise an additional child) or mortality (e.g. due to crowding of cities) (Malthus, 1826: 2).

The black death, the bubonic plague episode in Afro-Eurasia which resulted in the death of approximately a third of Europe's population, is a well-known and widely studied incident of Malthusian positive checks on population (Voigtländer & Voth, 2013). Broadberry and Wallis (2017) review the effects of the black death on per capita incomes for Italy, Spain and Britain. While Italian population data seems to follow the Malthusian model – experiencing increased living standards after many died during the black death and a subsequent reversal to pre-black death population levels and living standards – both the Netherlands and Britain were able to break free from this stagnation (Broadberry and Wallis,, 2017). Yet for Britain, there is no evidence of a boom in population levels following the black death, only in the mid-18th century is there evidence of a population boom, when fertility rates start increasing and mortality declining (Broadberry and Wallis, 2017). Then when fertility rates start declining in the 1870s, the opposite of what is predicted by the Malthusian model occurs, living standards decline (Broadberry and Wallis, 2017). The case for Spain is somewhat special, as living standards never increased post-black death and even though Spain was hit less hard by the black death compared to other European nations, the effects on its economy were devastating according to Álvarez-Nogal and De la Escosura (2013). Spain was hit hard by the black death because it already had a high land-labour ratio initially and the black death reduced the presence of commercial networks and isolated the population even further, which resulted in a decreased specialization (Álvarez-Nogal & De la Escosura, 2013). Broadberry and Wallis (2017) argue that for Spain, the Smithian forces of coordination dominated the demographic forces of the Malthusian approach. This means that the relationship set out in Malthus model is not without conditionalities and some reductions in

population levels might pass a certain threshold where non-Malthusian forces exert a greater effect on per capita output (Galor & Weil, 2000).

2.2.4 Incidence of Warfare

As outlined above, war and its casualties serves as one of the positive checks on population growth in Malthus model. It furthermore carries direct (negative) effects such as disruptions to commerce and business (Broadberry and Wallis, 2017) and destruction of infrastructure and capital. The world wars of the 20th century serve as intuitive examples, these hampered international trade and trade blocks became a feature of the geopolitical landscape (power and plenty). Hoffman (2015) highlights that despite the negative effects of war, wars can also promote the development of new technology which can later be applied for civilian purposes thereby generating spillover effects and he argues this happened during the fragmentation of Europe in the world wars. Voigtländer and Voth (2013) instead focus on Malthusian dynamics and from this perspective also argue for the favourable effects of warfare on per capita incomes, because wars (alongside other disasters) reduce population and tends to stimulate per capita incomes (at least temporarily) through higher land-labour ratios and associated increases in bargaining power for labourers.

Broadberry and Wallis (2017) argue that both these accounts suffer from a lack of appreciation for both the growing and shrinking effects wars have. Shrinking, in both frequency and magnitude, tends to be higher during war, while post-war recoveries are marked by increases in the rate and frequency of growing. Some papers find that the net effect of war, even including the 20th century world wars, on long-run economic performance is minimal (Broadberry and Harrison, 2008). This means that if warfare has an effect on long-run growth, it is highly ambiguous which direction this effect has. Thus, in- or decreases in warfare incidence are difficult to relate to a reduction in shrinking, yet Broadberry and Wallis (2017) include this as an determinant of shrinking and its worth investigating whether an effect in any direction can be detected or whether there is no effect and/or the effects of warfare cancel each other out.

2.3 Empirical Research on Economic Shrinking

Several additions have been made to the economics of shrinking, one prominent example is work by Andersson, Julia and Palacio (2021) and Andersson and Palacio (2017) who emphasize the importance of social capabilities, based on the work of Abramovitz (1986). The work of Abramovitz (1986) is itself an expansion of the work of Gerschenkron (1962) who emphasized the 'advantage' of being economically backward. Gerschenkron (1962) argued that countries that are far away from the economic frontier, at least in theory, have a greater 'catch-up potential', because they could implement available technologies from more economically advanced countries instead of discovering or inventing similar technologies themselves which would be much more costly, yet this is almost always paired by "different, indigenously determined elements" (Gerschenkron, 1962: 75).

Abramovitz (1986) explored the hypothesis set-out by Gerschenkron in more detail and found that indeed productivity growth seems to be inversely related to productivity levels. This in itself is not such a surprising finding, as countries at the productivity frontier not only have to invent new technologies rather than adopt existing ones, but also likely have to face diminishing returns to productivity, similar to capital and human capital at high levels in the Solow model. But Abramovitz (1986) did nuance Gerschenkron's theory by exploring why during some periods and for some countries catch-up was more rapid than during other periods and for other countries. He found that differences in 'social capabilities' are a key determinant in to what extent countries are able to leverage their backwardness (Abramovitz, 1986).

What social capabilities exactly are and how one should go about measuring them is still somewhat up for debate, but Abramovitz (1986) mentions several important factors such as education, the organization of firms and openness to competition. So in essence a country that is similar in social capabilities to a frontier economy, but is economically backwards will be able to realize more rapid catch-up, while countries that are economically backwards, but also have undeveloped social capabilities might not realize any catch-up. Abramovitz (1986: 390) summarizes: "Countries that are technologically backward have a potentiality for generating growth more rapid than that of more advanced countries, provided their social capabilities are sufficiently developed to permit successful exploitation of technologies already employed by the technological leaders."

One aspect of social capabilities is the relationship between finance and development, this has been explored in the literature some years later. King and Levine (1993), based on Schumpeter's work on 'creative destruction' show that financial development is related to economic growth, capital accumulation and capital allocation. This means that having a relatively large financial sector which provides capable financial services tends to increase capital stocks and in turn economic growth (King and Levine, 1993). Arguably the development of the financial sector can be seen as one of the social capabilities required to leverage technological backwardness. This view has been expanded further by Rousseau and Sylla (2003) who argue that sophisticated domestic financial systems can increase connectivity to the rest of the world by enhancing trade and capital imports. Furthermore, they argue that a strong domestic financial system is a requirement for sustainable capital inflows and if it is absent, capital inflows tend to seize due to financial crises (Rousseau & Sylla, 2003). They also highlight the interconnectedness between central banks and public finance, since central banks tend to develop from the domestic public financial sector and argue that many foundational central bank functions (such as being the lender of last resort) are later developments in central banking (Rousseau & Sylla, 2003).

Andersson, Julia and Palacio (2021) use the social capability approach of Abramovitz to analyze economic shrinking in the framework of Broadberry and Wallis (2017). They show that poorer countries are consistently more susceptible to economic shrinking from 1964 to 2018 and while the magnitude of economic growth rates among developing countries is roughly the same when countries grow, there is volatility in shrinking rates, which suggests that it is resilience against economic shrinking that is the key difference that determines whether a country is able to realize catch-up (Andersson, Julia & Palacio, 2021). Comparing the development paths of on the one hand Asian and on the other hand Sub-Saharan African and Latin American economies from the 1960s is interesting as several (east) Asian economies (initially the Asian tigers, later other countries as well), have grown at staggering rates since then, while many countries in Sub-Saharan Africa and Latin America have stagnated.

For Asian economies Andersson, Julia and Palacio (2021) find that the frequency of shrinking was around 10-15% of years from 1964 to 2018, the magnitude of growing was between 4% and 6%, while the magnitude of shrinking was around 3 percent for the first three decades, this increased during the Asian financial crisis in the 1990s and then

dropped again. Sub-Saharan Africa on the other hand experienced a frequency of shrinking higher than 30% until 2000 when an international commodity boom boosted growth (Andersson, Julia and Palacio, 2021). The magnitudes of shrinking and growing of Sub-Saharan Africa was roughly the same across the period, but the 1980s were an exception where the frequency of shrinking was higher than 50% and the magnitude of shrinking was higher than the magnitude of growing (Andersson, Julia and Palacio, 2021), which means that GDP per capita declined during this decade. For Latin America they find similar data as for Sub-Saharan Africa, although with a lower volatility in growing and shrinking magnitudes, however again the 1980s show a growth reversal with a frequency of shrinking around 50% and higher shrinking than growing rates (Andersson, Julia and Palacio, 2021). This 'lost decade' of the 1980scoincides with debt crises in the region, yet in combination with the findings in Sub-Saharan Africa should cast serious doubt on the primary development approach at that time, which is known as the Washington Consensus (Williamson, 2009). Despite these regional numbers, it must be acknowledged that in all regions there is significant heterogeneity in frequency and magnitude of growing and shrinking; every region contains both economies that experienced a relatively lot of shrinking as well as economies that experienced a relatively lot of growing.

After setting out these stylized facts on shrinking, Andersson, Julia and Palacio (2021) then use Abramovitz' idea on social capabilities to relate these to resilience against economic shrinking. Since Abramovitz did not distinguish between shrinking and growing, instead focussing on long-term economic growth, the authors take elements from his work to relate them to economic shrinking (Andersson, Julia and Palacio, 2021). Abramovitz (1995) distinguishes between two major categories of social capabilities, the first is establishment of egalitarian incentives and effective political institutions, while the second pertains to the ability of a society to adopt new technologies. Andersson, Julia and Palacio (2021) give little justification for the use of these categories in relation to economic shrinking rather than economic growing. This is important because many of their proposed categories, which are discussed in the next section, can arguably be linked to both shrinking as well as growing. An example are health outcomes, which Andersson, Julia and Palacio (2021) relate to their category of accountability. Health outcomes can affect both economic growing as well as economic shrinking (and their frequencies). For instance better healthcare provision might reduce unemployment and absenteeism due to illness, since recovery and prevention of disease and accidents is improved due to better healthcare thereby reducing economic

shrinking as people have to take less sick leave or leave the workplace altogether. Yet better healthcare provision might also increase economic growing as life expectancy grows, which allows people to retire at later ages, meaning they are part of the labour force for longer, effectively raising the total available labour in the economy, which would lead to economic growth. If the determinants of growing and shrinking are not that different after all, this minimizes the potential impact and importance of the economic shrinking literature. Because the same determinants as for long-run average growth rates will be found to be linked to magnitude and frequency of shrinking which subsequently limits the impact economic shrinking findings might have on policy recommendations (because they will be the same as previously found when looking at average growth rates).

They develop 5 categories – earlier publications hypothesized 4 categories; see Anderson and Palacio (2017) – based on the 2 by Abramovitz (1995). The first category in their model is transformation of economic structures, which corresponds to Abramovitz' category of 'the ability of a society to adopt new technologies' (Andersson, Julia and Palacio, 2021). Abramovitz' other category, the establishment of egalitarian incentives and effective political institutions, is split up into four different capabilities: "[2] broad-based inclusion of the population in the market, [3] social stability, [4] accountability and [5] the autonomy of the state" (Andersson et al., 2021: 10). Below I briefly explain these categories in more detail, as well as their origins in development literature.

2.3.1 Transformation of Economic Structures

What is meant by transformation of economic structures in the work of Andersson, Julia and Palacio (2021) roughly coincides with ideas regarding structural transformation, as explained earlier. As the agricultural sector is able to provide cheap food, urbanization can take place as labourers move towards cities where the manufacturing and services sector tends to be concentrated. Another transformation in economic structures relates to economic complexity (Hausmann et al., 2013), specifically countries which are reliant on natural resources tend to be exposed to international price volatility, which can cause big shocks to occur in those economies. Thus economies which produce diversified and knowledge-intensive products, i.e. 'economically complex products', are more insulated against (international) economic shocks and thereby more resilient against economic shrinking (Andersson, Julia and Palacio, 2021).

2.3.2 Inclusion of the Population in the Market

Broad participation of the population in the market is essential for a thriving and competitive market and limits price fluctuations and supply-side bottlenecks (Andersson, Julia and Palacio, 2021). This furthermore enables limits to the degree of inequality in a society. High inequality has been show to hamper long term economic growth (Persson & Tabellini, 1994), human capacities are not used to its full extent and high inequality opens the potential for increased social conflict. Thus, pro-poor growth strategies, which target income growth of the poorest households (Ravallion, 2004), can help to limit shrinking by raising the availability of human resources and foster dynamic markets (Andersson et al, 2021).

2.3.3 Autonomy of the State

The development of government is a central theme to institutional economics (see e.g. North, 1991) and underpins much of the theory pertaining to this category and the following two, therefore it is worthwhile to comment briefly on a more meta-theoretical explanation underpinning the choice of these categories. North, Wallis and Weingast (2009) have attempt to capture an overarching political and economic theory that can explain "the central problem of violence in human societies" (p. 55). Violence is contained, limited and regulated through the establishment of institutions, at the largest level this form of social organization is called 'social orders' by North, Wallis and Weingast (2009). According to them, there are only three types of social orders in human history. The first they call the foraging order, which reflects the tribal organisation of hunter-gatherer societies, most closely associated with pre-history (North, Wallis and Weingast, 2009). The second is called the limited-access order or natural state and arose some 5 or 10 millennia ago, it is characterized by scaling up of human societies or communities, usually through the establishment of a hierarchical order among elites (North, Wallis and Weingast, 2009). It is relationships among these elites and associated bargaining over power which allows a political organization to develop, yet people outside the dominant coalition only have limited access to resources, privileges and organizations held by the coalition (North, Wallis and Weingast, 2009). The third form of social orders are open access orders and have only been around since the 1800s (North, Wallis and Weingast, 2009). It is this order which is associated with the rapid increase in welfare after the industrial revolution and the beginning of modern sustainable economic development. Open access orders are characterized by 'impersonal interaction', where citizens can establish

organizations with limited criteria, hence the access to those organizations is relatively open (North, Wallis and Weingast, 2009), the most intuitive example of an open access order is the rule of law, where in the eyes of the law everyone is equal, no matter whether you are part of the elite or not. Yet according to North, Wallis and Weingast (2009) it is not sufficient for only the rule of law or constitutions to exist to be characterized as open access societies, they require supporting organizations as well. As an example they give that democracy requires more than just elections, free press, the ability to establish yourself in the political domain as an outsider and an accessible economy are also important to support democratic functioning (North, Wallis & Weingast, 2009).

The theory presented by North, Wallis and Weingast (2009) is certainly ambitious as it attempts to capture the entirety of the development of human social organization. Yet a primary issue remains is that most of their theory is hardly empirically verifiable. Firstly, collecting data on the transition from natural states to limited-access orders is difficult as few natural states remain and this would be more in the realm of anthropology, rather than economics. Secondly, the theory is broad, this has benefits since it allows for many different versions of limited-access and open access, thereby it is not so constrained that it only captures a western form of organization, but can also explain forms of organization which have seen much economic success over the past decades, such as state capitalism. However, since it is a meta-theory, operationalization of a 'limited-access order' and an 'open access order' is by itself not possible. There is no set of indicators that captures these terms completely. Therefore, authors such as Broadberry and Wallis (2017) and Andersson et al., 2021) who base their theory underlying economic shrinking in large parts on North, Wallis and Weingast (2009), tend to view the transition to open-access orders as underlying proximate causes of economic shrinking. So whereas, the ultimate causes of shrinking might be found in the narrative from North, Wallis and Weingast (2009), the proximate causes should be institutional parameters which can be measured. In Broadberry and Wallis (2017)' model demographic, technological and structural change together capture the degree to which the economic and the political arena is open to citizens, if this is not the case then there will be less evidence of development among these dimensions, whereas warfare incidence is of course a much more direct measurement of the containment of violence, which is the central theme of the evolution of social orders. In Andersson, Julia and Palacio (2021) 's model, in addition to structural change and the inclusion of the population in the market (which is a form of economic openness), the role of the state receives a more explicit focus. Hence the

use of state autonomy and state accountability as measures for how responsive and trustworthy states are to society's needs, while social stability is again a more direct measure for how well states are able to contain violence and create a functional legal system

State autonomy implies that states are able to withstand vested interests (Andersson et al, 2021). Thus states should be able to enforce progressive taxation systems, but are also tasked with balancing the interests of powerful actors, such that there is a shared basis for development policies (Andersson, Julia and Palacio, 2021). This is closely related to recent work by Acemoglu and Robinson (2019) where they emphasize the role states play in balancing one the one hand cooperation with powerful actors (such as entrepreneurs, unions and politicians) as well as disciplining these actors. State autonomy should lead to credible commitments to special interest groups and facilitating representative government.

One aspect of state autonomy pertains to monetary policy, specifically the targeting of inflation rates, usually through central banks (Andersson, Julia and Palacio, 2021). In terms of pro-poor growth, inflation tends to act as a regressive taxation on the poor (Barro, 1995), thus ensuring a degree of control over inflation rates is vital for equitable growth. Because the implementation of central banks requires a degree of independence and constitutes a gradual reform process, the establishment of these institutions can have wider effects on bureaucracy and the role of technocrats within that. Thus the building up of state autonomy should enable higher long-term growth rates due to "smoothing the downsides of the economic cycle" (Andersson et al., 2021: 12), through improved tax administration and public provision.

2.3.4 Accountability of the State

The concept of state accountability supplements that of state autonomy, because state autonomy in itself is not enough to guarantee freedom from corruption and other abuses of power (Andersson, Julia and Palacio, 2021). This is often operationalized through the ratio of social spending to GDP or total government spending, which in developing countries is often measured via investments in education and health (Besley & Persson, 2014). Yet Andersson, Julia and Palacio (2021) argue for a more 'real' measurement of these factors; even though spending on health might be high, that does not mean that health outcomes are equally high.

Thus they promote the use of for instance life expectancy as this can be seen as more 'real' measurement of health outcomes, rather than spending (Andersson, Julia and Palacio, 2021). There are some caveats with this operationalization as other factors besides the healthcare system such as climates can affect health outcomes (Epstein, 1999), meaning that some countries might be more predisposed to disease outbreaks, purely because of their climate. Thus a more appropriate measurement might examine the effectiveness of healthcare systems, given a certain climate.

2.3.5 Social Stability

The role of enforceable contracts, ensuring rule of law and supporting competitive markets in fostering economic growth has been a longstanding idea among (institutional) economists (World Bank, 1997; Levine, 1998). Social stability attempts to capture these stabilizing effect as a measure of successful conflict resolution (Andersson, Julia and Palacio, 2021). Firstly, social unrest takes away from the government's efforts to support social and economic policies, because its attention has to be put into conflict resolution, thereby increasing the chance of economic shrinking (Andersson, Julia and Palacio, 2021). Secondly, social unrest such as civil wars have a negative influence on the likelihood of attracting (foreign) investments (Jones & Olken, 2008). Thirdly, social unrest can lead to more volatile food prices, an effect that is especially pronounced for developing countries (Dawe & Timmer, 2012). Thus ensuring social stability is a pivotal goal for states and a failure to contain social unrest can have devastating effects through multiple channels.

2.4 Conflicting Accounts of Economic Shrinking

As the above has outlined, research on economic shrinking is a relatively new phenomenon. However, given the empirical facts shown above, escaping from frequent and intense economic shrinking might be *the* key to understanding how countries go from long-term stagnation to long-term sustained growth. Furthermore, for developing countries today, their inability to catch-up seems to be driven more by their frequency and magnitude of shrinking, rather than their growing episodes. Thus, understanding the determinants of the

magnitude and frequency of economic shrinking is vital if one wants to be able to give policy recommendations based on resilience against shrinking.

Yet empirically the matter on determinants of shrinking has not been settled yet. Some of the causes of resilience against shrinking set forth by Broadberry and Wallis (2017) align with those of Andersson, Julia and Palacio (2021) ; they both acknowledge the importance of technological change (and its wider adoption in society) as well as the role structural transformation plays in the development process. But on other dimensions, such as the incidence of warfare and the role of the state, their accounts diverge. This paper explores whether these proposed determinants show a link with resilience against economic shrinking and if it useful to combine Broadberry and Wallis' (2017) categories with those from Andersson, Julia and Palacio (2021) , or whether some categories are superfluous. Furthermore, what is essential to know about these categories is whether they are truly related with resilience against economic shrinking or if they also exert a large influence on growing, because if they are as much determinants of economic shrinking as they are of economic growing then the focus on economic shrinking might not be as useful as some authors argue. Thus, ideally one would find that some categories act as insulators against economic shrinking, while not being (sizeable) determinants of economic growing. If those categories can be isolated, then this could potentially enhance not only our understanding of the development process of countries, but also serve as a new avenue for development policies. Identifying whether some of the categories as set forth by Broadberry and Wallis (2017) and Andersson, Julia and Palacio (2021) are determinants of the magnitude and frequency of shrinking and not determinants of growing is the primary objective of this study.

3 Data & Methodology

The model used in this analysis follows in the footsteps of Andersson, Julia and Palacio (2021) and is based on the 5 social capabilities explained above. They attempt to answer how developing economies can limit the frequency and magnitude of economic shrinking by constructing a social capability index, based on the 5 categories and examine across 6 decades (1960s-2010s). However there are some crucial differences between this analysis and the one of Andersson, Julia and Palacio (2021).

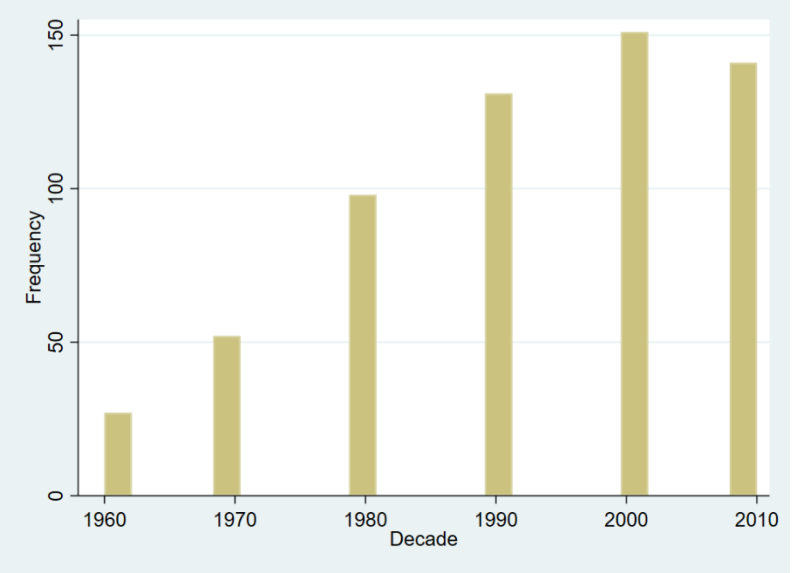
The first and foremost difference is that instead of using a single social capability index, the 5 social capabilities will be operationalized as separate independent variables in order to better distinguish between the effect of each separate social capability. Andersson, Julia and Palacio (2021) find significant effects of their social capability index on both the magnitude and frequency of shrinking, i.e. higher social capability indexes leads countries to shrink a lesser extent and less frequently. Yet, since they use a single social capability index in their main approach, it is impossible to say which social capability matters and to which degree. Therefore, my analysis attempts to uncover specifically which social capabilities are related to the frequency and magnitude of shrinking by disentangling the different categories and examining their particular relevance.

A second difference is that Andersson, Julia and Palacio (2021) use the ranking of the 26 countries in their analysis on the social capabilities (and then subsume these in a single index). Instead of using the ranking of countries, this analysis takes - wherever possible - the total values on the relevant capabilities. For some variables such as economic complexity this is not possible as the source data is already in rankings.

A third difference is that Andersson, Julia and Palacio (2021) limit their analysis to 26 developing countries, this is useful from a data availability standpoint since they are able to select countries which have a wide range of observations. However the theory on social capabilities does not pertain merely to developing countries and should hold across the entire ‘development ladder’. Therefore there is no reason to limit the analysis merely to developing countries, nor is there a need to have observations available throughout the entire period for

each country. Thus, this analysis contains all countries for which observations are available in the relevant datasets. The main analysis consists of 100 countries and 6 decades, but for some countries not all decades contain available observations (i.e. it is an unbalanced panel), since data collection for some variables has only started in recent decades for particular countries, hence time-wise there is a skew towards the present (see figure 1).

Figure 1: Observations per decade



The second part of the analysis models economic shrinking in a similar vein, but using the proximate determinants of economic shrinking as theorized by Broadberry and Wallis (2017). The four dimensions are, as discussed above: structural change, technological change, demographic change and warfare incidence. Structural change is modelled in the same way that Andersson, Julia and Palacio (2021) model transformation. Technological change is modelled through TFP, although TFP is not a pure indicator of technological progress, as it also measures to what extent labour and capital are allocated efficiently (Broadberry & Wallis, 2017). Yet TFP remains one of the most obvious ways to capture technological improvements, for which historical data is available (Broadberry & Wallis, 2017). Demographic change in the theory of Broadberry and Wallis (2017) coincides with the move away from Malthusian dynamics, which is apparent in developed economies through lowered fertility rates. Warfare incidence is the most straightforward to model and takes the number of battle-related deaths in a country.

3.1 Empirical Model

The analysis begins by replicating the social capabilities used by Andersson, Julia and Palacio (2021), which are drawn from various data sources. These social capabilities are then used to estimate their effect on shrinking behaviour of countries (both frequency and magnitude are taken as dependent variables), subsequently the effect of social capabilities on the magnitude of growing is estimated to see whether social capabilities tend to be related to shrinking exclusively, or whether they influence growing as well. The operationalizations of these variables are taken from the paper by Andersson, Julia and Palacio (2021).

The following (country and time) fixed effects model (A) is estimated, based on Andersson, Julia and Palacio (2021), *i* denotes countries and *t* denotes time (in decades):

$$S_{it} = \alpha_i + \delta_t + \beta_1 Tr_{it} + \beta_2 In_{it} + \beta_3 Au_{it} + \beta_4 Ac_{it} + \beta_5 St_{it} + u_{it} \quad \text{(A)}$$

Where S_{it} is the shrinking (or growing) variable, this is operationalized in 4 different manners, all based on data from the Penn World Tables (Feenstra, Inklaar & Timmer, 2015). The first are average growth rates during the decade, which features as the 'standard' dependent variable in most growth models. Subsequent dependent variables use mathematical nature of growing and shrinking set-out in equation 2, i.e. differentiating between frequency of growing and shrinking as well as magnitudes of growing and shrinking. Therefore the second dependent variable is the frequency of shrinking, which is operationalized as the number of times a country shrank in a decade. The third is the average magnitude of shrinking (using only years where countries are shrinking) per decade. Instead of assessing the effect of social capabilities on shrinking, the fourth operationalization takes the average magnitude of growing (using only years where countries are growing) per decade to assess whether these social capabilities have a stronger association with shrinking rather than growing.

α_i denotes country fixed effects, δ_t denotes decade fixed effects, while u_{it} represents the residual error term. The following explains the independent variables (the social capabilities) in the model, the operationalizations of which are all drawn from Andersson, Julia & Palacio (2021): Tr_{it} denotes the transformation of economic structures, which is operationalized using the Economic Complexity Index (OEC, 2021), In_{it} denotes the inclusion of the population in the market, which is operationalized using Solt's (2020)

disposable GINI coefficient (Solt, 2019), Au_{it} denotes state autonomy, which is operationalized using inflation rates (IMF, 2022), Ac_{it} denotes state accountability, which is operationalized using life expectancy (World Bank, 2019a) and St_{it} denotes social stability, which is operationalized using the Polity 5 Index (Centre for Systemic Peace, 2021).

For the second part of the analysis a contrast is drawn between the social capabilities from Andersson, Julia and Palacio (2021) and the proximate causes of shrinking as theorized by Broadberry and Wallis (2017) in order to see whether there is any difference in explained variance, as well as to see whether some proposed categories are superfluous, or whether proposed categories from Broadberry and Wallis (2017) and Andersson, Julia and Palacio (2021) should be combined. The model uses the same methodology as outlined above. Since Broadberry and Wallis (2017) do not explicitly operationalize all their categories in their publication, this can be seen as the most novel and experimental part of the analysis. The following (country and time) fixed effects model (B) is estimated, based on the categories underlying shrinking proposed by Broadberry & Wallis (2017), *i* denotes countries and *t* denotes time (in decades):

$$S_{it} = \alpha_i + \delta_t + \beta_1 Sc_{it} + \beta_2 Tc_{it} + \beta_3 Dc_{it} + \beta_4 Wi_{it} + u_{it} \qquad \text{(B)}$$

Where S_{it} remains the shrinking (or growing) variable and is operationalized in the same way as the first model. α_i denotes country fixed effects, δ_t denotes decade fixed effects, while u_{it} represents the residual error term. The following explains the independent variables in the model based on Broadberry & Wallis (2017)'s categories underlying shrinking: Sc_{it} denotes structural change, which is operationalized in the same manner as transformation of economic structures in model A, using the Economic Complexity Index (OEC, 2021). Tc_{it} denotes technological change, which is operationalized using data on Total Factor Productivity from the Penn World Tables, adjusted for purchasing power parity (Feenstra, Inklaar & Timmer, 2015). Dc_{it} denotes demographic change, which is operationalized using fertility rates from the World Bank (2019b), Wi_{it} denotes warfare incidence, which is operationalized using battle-related deaths from the Uppsala Conflict Database (Gleditsch et al. 2002; Davies, Petterson & Öberg, 2022).

For both model A and B, there are 4 different dependent variables of interest based on equation 2. The first is the decadal average growth rate, which represents a dependent variable as used in many standard growth accounting models. For this regression it

is hypothesized that most if not all 5 social capabilities are significant predictors, as they are expected to be determinants of either or both the frequency and magnitude of economic shrinking and as equation 1 shows, average growth rates are a product of growing and shrinking rates times their respective frequencies. However, since the social capabilities are theorized to be stronger predictors of economic shrinking than growing the other dependent variables should shed light on the relative contribution to growing and shrinking of the independent variables. Hence, the second dependent variable is the frequency of shrinking, while the third and fourth dependent variables are respectively the magnitude of shrinking (for shrinking years) and the magnitude of growing (for growing years). Ideally, the proposed determinants of economic shrinking in both model A and B are significant predictors of either or both the frequency and magnitude of shrinking, but are only weakly related (or not related at all) to the magnitude of growing.

Summary statistics for all dependent and independent variables discussed above can be found in Appendix A. Because of the construction of the independent variables and their mathematical properties (see equation 2) for some countries there are decades where they do not shrink or grow at all, therefore there is a slight discrepancy in the number of available observations for each country per regression. There is substantial variation in independent variables to allow for effects to be detected. The sample consists of a wide variety of different countries, due to data constraints not every country has observations throughout the dataset (i.e. it is unbalanced). Most observations in the dataset come from low income per capita countries (see figure 2), this is partially because Gross Domestic Capita is in purchasing power parity, chained to 2017 United States dollars. It is clear when examining incomes across decades that the distribution of countries course shifts towards higher incomes per capita towards the presents (figure 3). Yet, because some countries only have available observations towards the present (and these tend to be mostly developing countries), there are also low income countries in later decades (see figure 3).

Figure 2: Distribution of per capita incomes in the entire dataset

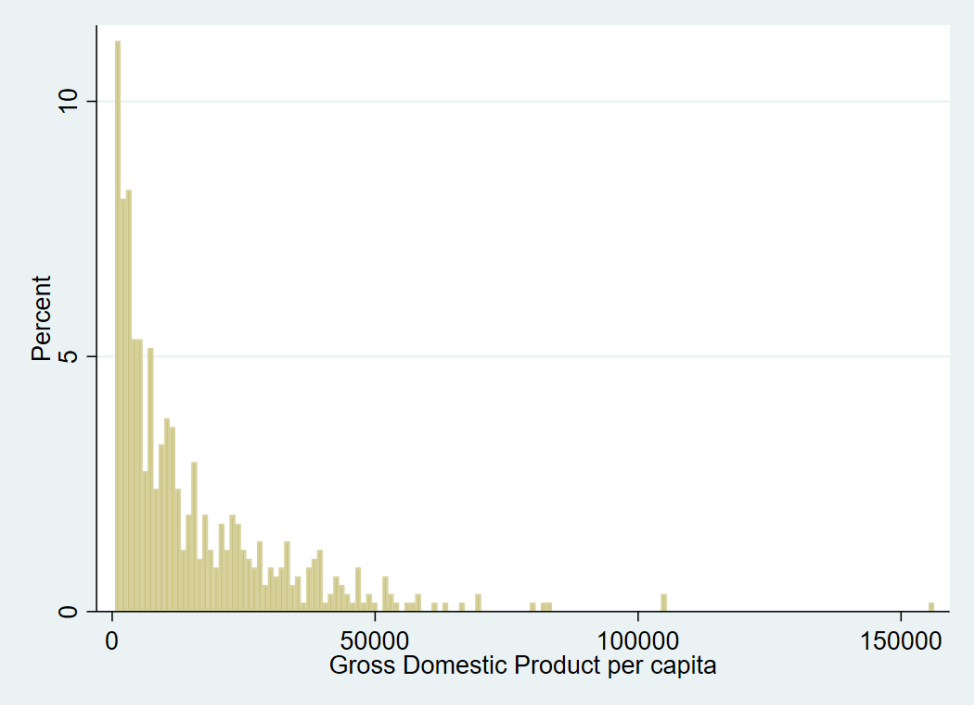
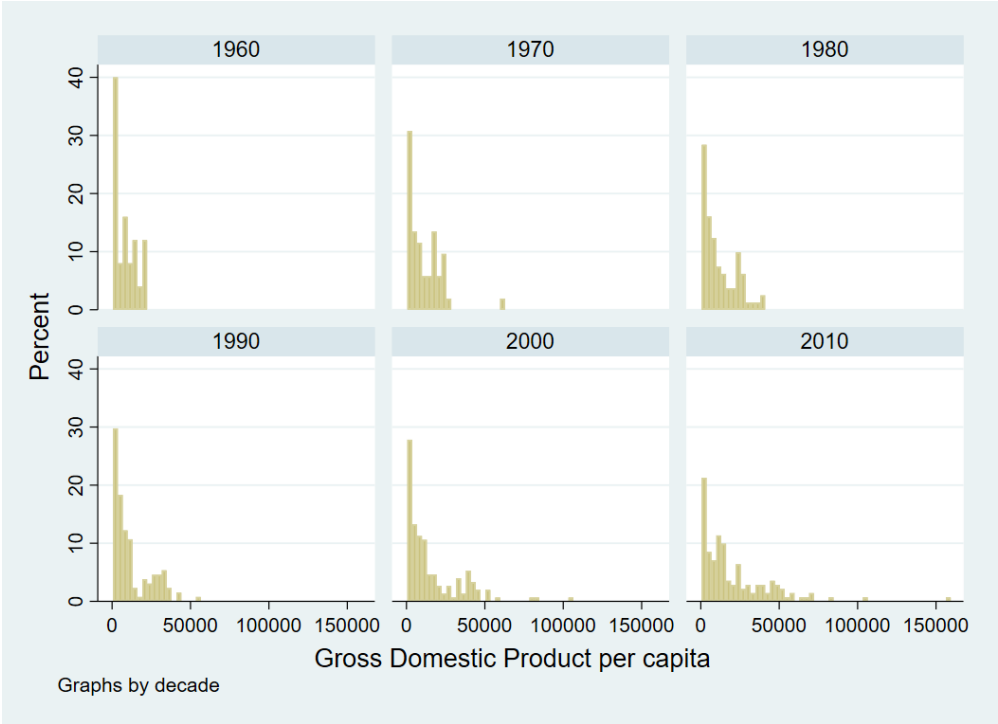


Figure 3: Distributions of per capita incomes across decades



4 Results

All of the following regression results use robust standard errors due to the presence of heteroskedasticity in the data, as indicated through the Breusch-Pagan / Cook-Weisberg test for heteroskedasticity (see Appendix B). Furthermore, all regressions use country fixed-effects to capture uncontrolled country-specific characteristics, as well as time-fixed effects to capture uncontrolled decade-specific characteristics affecting all countries. In order to see the appropriateness of this fixed effects specification versus a random effects model statistically, the Hausman test for model fit in panel data is used. Appendix C reports these results, even though the p-value of this test is slightly above the usual threshold of .05 (.0516), because of the theoretical reasoning outlined in the previous section, it is more appropriate to use a fixed-effects model, which will be the standard model throughout all specifications. The first analysis uses model A and examines the influence of the 5 social capabilities, based on the work of Andersson, Julia and Palacio (2021) , using their operationalizations of those dimensions. The second analyses is based on model B and uses the 4 proposed categories underlying economic shrinking, as proposed by Broadberry and Wallis (2017).

4.1 Model A

The results of this regression can be found in table 1. The first column represents a regression which takes average decadal growth rates (i.e. ‘standard’ growth rates) as the dependent variable. The results in this column suggests that the three dimensions transformation of economic structures (operationalized by the economic complexity index), inclusion of the population in the market (operationalized by the GINI coefficient) and state autonomy (operationalized by CPI-based inflation rates) are significant predictors of economic growth. Yet, state accountability (operationalized by life expectancy) and social stability (operationalized by the Polity5 index) do not have a significant effect on decadal average growth rates.

Table 1: Model A (Social Capabilities) Regression Results

Variables	1 DV: Mean Decadal Growth Rate	2 DV: Decadal Shrinking Frequency	3 DV: Decadal Magnitude of Shrinking	4 DV: Decadal Magnitude of Growing
Economic Complexity Index	-0.0030***	0.4159	-0.0011	-0.0016***
	(0.0011)	(0.4022)	(0.0012)	(0.0006)
Gini Coefficient	0.0211**	-13.6839**	-0.0056	0.0034
	(0.0100)	(5.3295)	(0.0099)	(0.0057)
Inflation Rate	-0.0016***	0.6538***	-0.0007**	-0.0002
	(0.0006)	(0.1656)	(0.0003)	(0.0003)
Life Expectancy	-0.0000	-0.0682	-0.0000	-0.0000
	(0.0001)	(0.0652)	(0.0001)	(0.0001)
Polity 5 Index	0.0001	-0.0296	0.0000	-0.0000
	(0.0001)	(0.0280)	(0.0000)	(0.0000)
Constant	-0.0126	-23.4948	-0.1372**	0.0450
	(0.0692)	(31.1083)	(0.0652)	(0.0349)
Country-fixed effects	Yes	Yes	Yes	Yes
Decade-fixed effects	Yes	Yes	Yes	Yes
Observations	387	388	305	384
R-squared	0.1456	0.1223	0.1607	0.0549
Number of countries	100	100	98	100

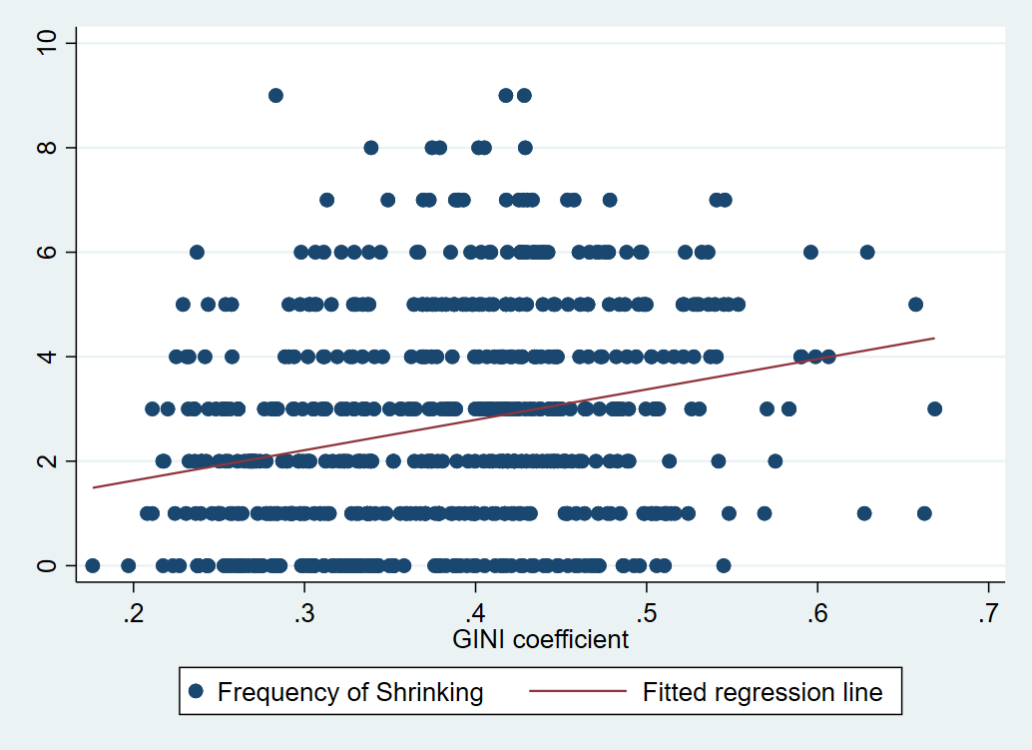
DV = Dependent Variable. Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The direction of the effect of economic complexity is surprising, as the only regressions where it is significant point towards a negative effect of the transformation of economic structures. Given the estimated coefficient in column 1 of table 1, an increase in economic complexity of 1 implies that average decadal growth rates are .03 percentage points lower, implying that more economic complexity is associated with reduced growth. However, given the empirical fact established by Broadberry and Wallis (2017) that as economies develop, the magnitude of their growing rates become lower, this result could actually fit that pattern. Similarly, the effect for the GINI coefficient in column 1 is surprising, as low GINI scores correspond to countries where the distribution of income is more equal. The coefficient in column 1 of table 1 implies that for a given country, an increase in GINI of 0.1 leads to an increase in average decadal economic growth rates of around 0.02 percentage point, a small but nonetheless significant increase in economic growth rates as countries become more unequal, which is not as hypothesized. The effect for inflation in column 1 is in-line with expectations. Using the estimates from column 1 of table 1 for a given country, an increase in

inflation of 10 percentage points implies that average decadal economic growth rates are .016 percentage points lower. The final 2 effects for life expectancy and polity 5 scores are not significant and close to zero throughout all regressions, suggesting that both of these variables are not related to both frequencies and magnitudes of economic growth or shrinking. As discussed above, since these 5 social capabilities are thought to be predictors of (the magnitude and frequency of) economic shrinking, it is not necessarily unsurprising that two of these social capabilities; state accountability and social stability as operationalized through life expectancy and Polity 5 scores respectively, do not significantly affect decadal average growth rates, yet it is surprising that they seem to be unrelated to all dependent variables.

Column 2 in table 1 takes the frequency of shrinking per decade as dependent variable. Both the inclusion of the population in the market (GINI coefficient) and state autonomy (inflation) have a significant effect on the frequency of shrinking, while the other social capabilities do not. Using these estimates, an increase in GINI coefficient of 0.1 leads to a reduction of economic shrinking of 1.368 years per decade, which is a very sizeable decrease in economic shrinking. This suggests that more unequal countries experience reduced shrinking frequency and the effect is large. This finding is completely at odds with the hypothesized effect of inclusion of the population in the market, as a high degree of market access implies a society which has moved towards an open access society, as competition is now driving opportunities instead of rent-seeking (North, Wallis & Weingast, 2009). Furthermore, a standard scatterplot of the frequency of shrinking and GINI coefficients shows the opposite trendline (see figure 4).

Figure 4: Scatterplot of GINI coefficient and Frequency of Shrinking

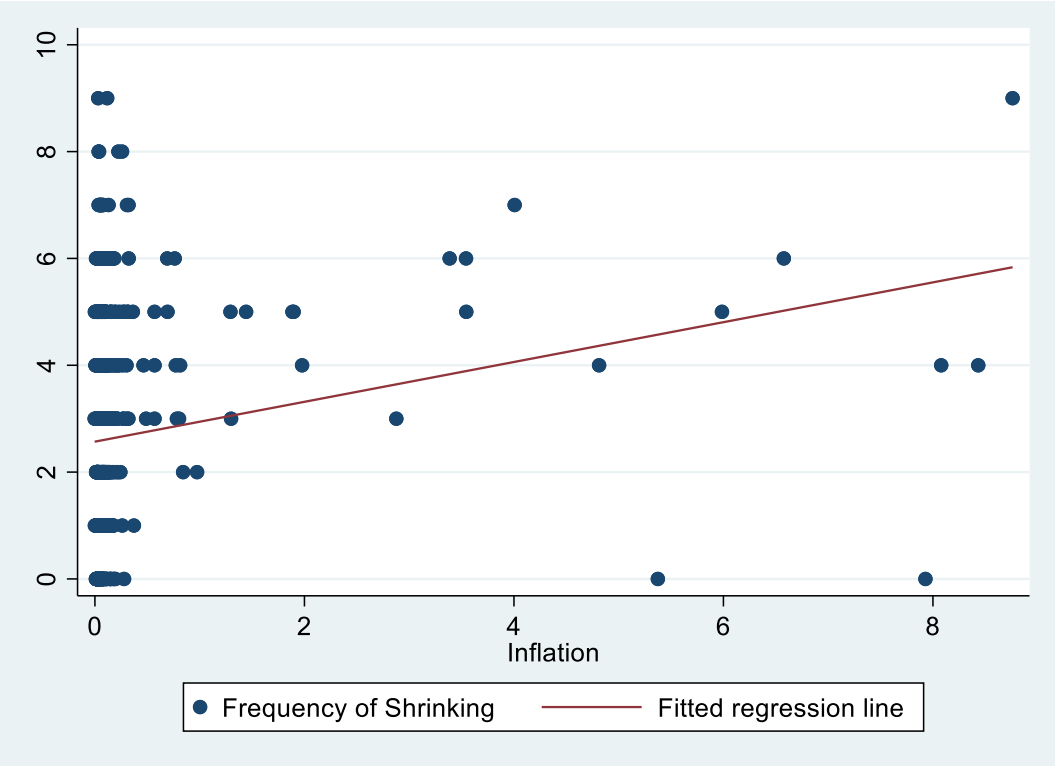


Further investigation of the dynamics of the model, reveals that only including the GINI variable in a regression model with country-fixed effects also produces a negative effect of the GINI coefficient (see Appendix D). However, when country-fixed effects are excluded, the effect flips and lower GINI coefficient are associated with a reduced frequency of shrinking (see Appendix D). This means that across countries, countries with lower GINI rates tend to experience a lower frequency of economic shrinking. However, within a country, lower GINI coefficients are associated with a higher frequency of economic shrinking. This finding warrants some caution, as this would imply it is beneficial for a country to initially have a low GINI coefficient, which if then increased should lead to a lower frequency of shrinking. Yet countries do not 'choose' their initial GINI coefficient. This finding could possibly be due to the existence of Kuznets curves in the development process (1955). The Kuznets curve implies that as countries develop, they experience increased inequality, which then peaks and starts declining again, leading to a parabolic or inverted U-shape relationship between development and inequality (Kuznets, 1955). Yet, the Kuznets curve has received scrutiny in the past decades, primarily due to a greater data availability and the use of panel data models. For instance Galbraith (2007) argues that recent growth spurs in east Asia do not conform to the Kuznets curve and highlights other determinants of inequality primarily related to global macroeconomics, rather than country specific determinants. Furthermore,

Piketty (2014) has argued that recent increases in inequality among the frontrunners of economic development invalidate the view of an inverted U-curve between inequality and development. Lastly, Palma (2011) has shown that around 80% of countries in the world have a GINI of around 0.4, including most low and middle income countries, suggesting no inverted U-shape relationship between inequality and development. Hence, what exactly is driving the relationship between GINI and frequency of shrinking within countries is unclear, but it is notable that the effect of the GINI coefficient on the frequency of shrinking shifts when excluding country-fixed effects.

The other significant effect in column 2 is inflation, the estimate suggests that an increase in inflation of 10 percent leads to an increase in decadal shrinking of 6.5 years, which is an immense effect on economic shrinking. This suggest that the primary determinant of economic shrinking is likely state autonomy (as operationalized through inflation rates). However, a caveat to this finding is that inflation rates tend to be relatively stable across countries, with some sizeable outliers (see figure 5). Thus, the effect of inflation might be driven in large parts by these outlying inflation scores. Yet, if inflation rates of larger than 5% are excluded, the effect of inflation is even stronger with a coefficient of larger than 1 and more statistically significant (see Appendix E), which reinforces the fact that the effect of inflation is not driven by outlying data.

Figure 5: Scatterplot of Inflation rates and Frequency of Shrinking



Columns 3 and 4 in table 1 elucidate whether variables are exclusively or primarily related to magnitudes of economic shrinking or growing as well. The dependent variables are magnitudes of shrinking and growing per decade respectively, but only for those years where a country is growing or shrinking (see equation 2). Column 3 shows that the only significant determinant of shrinking magnitude is inflation, where higher inflation rates reduce the magnitude of shrinking (since the dependent variable does not use absolute values and hence is below zero), however the size of the effect is minor, where a 10% increase in inflation leads to a lower magnitude of shrinking by .007 percentage points for years when a country is shrinking. Column 4 shows that the only variable which is related to the magnitude of growing is economic complexity, where an increase in economic complexity of 1 leads to a reduction in magnitude of growing of .016 percentage points, for years when a country is growing.

Thus, the regression results from model A highlight that some of the proposed categories (and their operationalizations) by Andersson, Julia and Palacio (2021) indeed seem to be related to shrinking, especially the frequency of shrinking, where sizeable effects are detected for GINI rates (inclusion of the population in the market) and for inflation (state autonomy). However, since the effect of GINI rates are in the opposite direction and heavily

affected by the inclusion of country-fixed effects, this warrants more empirical research on the role of inequality and its relationship to frequency of shrinking, before solid conclusions can be drawn regarding GINI rates. Yet, the data on inflation reveals a very sizeable effect, which is robust against outliers. This suggests that - if inflation is indeed a proper measure of state autonomy, as argued by Andersson, Julia and Palacio (2021) – state autonomy seems to be the primary determinant of frequency of shrinking in this model. The relationship between magnitudes of growing or shrinking and the 5 categories is more ambiguous, with only a minor effect for economic complexity (transformation of economic structures) on growing and a minor effect for inflation (state autonomy) on shrinking. However, an important takeaway is that these regressions do suggest that the determinants of economic shrinking and growing are indeed different and that there are especially important differences in regards to the frequency of shrinking, where inflation (state autonomy) and the GINI index (inclusion of the population in the market) are significant and sizeable predictors. Another important takeaway from these regressions is that life expectancy (state accountability) and Polity 5 (social stability) does not seem to be related to any of the dependent variables. Therefore, either life expectancy and Polity 5 scores are improper operationalizations of state accountability and social stability respectively, or state accountability and social stability are not significant determinants of both frequencies and magnitudes of economic shrinking and growing, or the dataset is biased in such a way that the real effect of these two social capabilities cannot be detected.

4.2 Model B

The results of this regression can be found in table 2. This regression is based on model B, which uses the categories underlying economic shrinking as proposed by Broadberry and Wallis (2017). Structural change is operationalized by the Economic Complexity Index, technological change is operationalized by purchasing-power adjusted Total Factor Productivity, demographic change is operationalized by Fertility rates as an indication of distance to Malthusian regimes, warfare incidence is operationalized using battle-related deaths. The dependent variables are the same as for model A. A major limitation to these regressions is data availability, since data had to be drawn from different sources than for model A, specifically data on battle-related deaths limits the sample size for model B. Some countries which have data in model A do not have observations in model B (model A

contains 100 or 98 countries, while model B only has 41 to 43 countries) and for other countries the set of available observations is more limited, leading to less decades per country.

Table 2: Model B (Broadberry & Wallis, 2017's dimensions of Shrinking) Regression Results

Variables	1 DV: Mean Decadal Growth Rate	2 DV: Decadal Shrinking Frequency	3 DV: Decadal Magnitude of Shrinking	4 DV: Decadal Magnitude of Growing
Economic Complexity Index	-0.0030**	0.6720	0.0026	-0.0016
	(0.0014)	(1.1719)	(0.0020)	(0.0015)
Total Factor Productivity	-0.0140*	2.5256	0.0095	-0.0184**
	(0.0081)	(2.8949)	(0.0100)	(0.0078)
Fertility rates	-0.0035***	2.0579***	-0.0025*	-0.0016
	(0.0011)	(0.5647)	(0.0013)	(0.0011)
Battle-related Deaths	-0.0000	-0.0005	-0.0000	-0.0000
	(0.0000)	(0.0004)	(0.0000)	(0.0000)
Constant	0.2401***	-37.9587	-0.1730	0.2725***
	(0.0785)	(44.6313)	(0.1119)	(0.0715)
Country-fixed effects	Yes	Yes	Yes	Yes
Decade-fixed effects	Yes	Yes	Yes	Yes
Observations	84	84	70	83
R-squared	0.3278	0.3008	0.4653	0.2729
Number of countries	43	43	41	42

DV = Dependent Variable. Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Column 1 shows that all indicators, except battle-related deaths are significantly related to economic growth. However, the direction of the effect of economic complexity and total factor productivity is negative, which suggests that structural and technological change do not increase growth rates. Similar to model A, this could be due to the fact that as countries become more developed, their economic growth rates tend to diminish (Broadberry and Wallis, 2017). The effect for fertility is in-line with expectations, as lower fertility rates (representing a move away from Malthusian regimes) are associated with higher economic growth.

Column 2 is the most interesting column, as this reveals that the only indicator that has a significant effect on the frequency of shrinking are fertility rates, however the size of that effect is large. Given that fertility rates in this dataset range between 1.1 and 7.75, a decrease in fertility rates of 1 implies that economic shrinking is reduced by 2.06 years per decade,

which is a substantial reduction in shrinking frequency. This finding implies that demographic change is significantly related to shrinking frequency. This primarily points towards the fact that moving away from Malthusian regimes, which happens through positive checks on the birth-rate (Malthus, 1826: 4), e.g. birth control and a later marriage age, is associated with a substantial reduction in shrinking frequency and this can primarily be seen in reduced fertility rates. Furthermore, not only does fertility affect shrinking frequency, it also has a significant effect on the magnitude of shrinking (column 3), implying that a reduction in fertility-rates of 1 leads to lower shrinking magnitudes of .0025. However, this relationship might not be unidirectional, i.e. it is certainly possible that shrinking frequency affects fertility rates, rather than vice versa.

However, all the other determinants of economic shrinking as proposed by Broadberry & Wallis (2017) are not significantly related to economic shrinking magnitude and frequency. It is only total factor productivity which has a significant effect on the magnitude of growing, yet this effect is negative, which is not in-line with expectations as total factor productivity is expected to enhance growth or reduce shrinking (Broadberry & Wallis, 2017). However, this again might be due to the fact that more developed countries tend to grow to lesser magnitudes than developing countries (Broadberry & Wallis, 2017).

5 Discussion

The results show that from the proposed social capabilities by Andersson, Julia and Palacio (2021), only the inclusion of the population in the market (as operationalized by GINI coefficients) and state autonomy (as operationalized through inflation) are significantly related to the frequency of shrinking and the direction of the effect of GINI coefficients runs opposite of the hypothesis that lower inequality leads to less shrinking. While among the proposed determinants of shrinking by Broadbery & Wallis (2017) only transformation of demographic structures (as operationalized through fertility rates) is significantly related to frequency of shrinking. Note that these results do not in any way provide insight to causality, i.e. whether the direction of the effect really runs from these variables to shrinking outcomes is unknowable with this approach. It might be tempting to conclude that a model which includes state autonomy, transformation of demographic structures and possibly inclusion of the population in the market (although the detected effect runs counter to theory) will provide the best model fit, based on these findings. However there can be other causes for these findings. First is that the operationalization of these categories might not be optimal. Second is that several of the proposed categories underlying shrinking might not be determinants of shrinking at all, some might be superfluous, others might not have been identified yet.

5.1 Operationalization of Categories

This section discusses the operationalization of the categories proposed by Andersson, Julia and Palacio (2021). The first is transformation of the economy in Andersson, Julia and Palacio (2021) which is more or less the same as structural change in the work of Broadberry & Wallis (2017). The idea behind these categories draws from economic literature on structural change (see e.g. Lewis, 1954). It is a well-established empirical fact that practically all economies start from a primarily agriculture based economy and if development takes place, economies transform towards being primarily manufacturing and/or service based. The use of the Economic Complexity Index seems appropriate, since this should capture the degree to which economies are diversified (Hausmann et al., 2013). Yet

two other measurements which require much less information and might be more widely available, could just be the share of labour in the agricultural sector or the share of the agricultural sector to total output. It is worthwhile to explore these alternative options as measures of transformation of the economy, as there is little evidence that the Economic Complexity index is related to shrinking.

The second category in Andersson, Julia and Palacio (2021: 11) is the inclusion of the population in the market and consists of "broad-based economic participation of the population in the market". This idea draws heavily on economic literature on pro-poor growth (Ravallion, 2004) and tends to reflect a growth process where more vulnerable and marginalized people, such as people living in rural areas, have access to economic opportunities. Although the GINI coefficient is a good measure of equality, this measure is based on economic outcomes, rather than economic opportunities. There is of course a link between existing economic inequality and economic opportunities, however it would be better to have a more direct measurement of those economic opportunities, particularly because economic inequality as measured through the GINI index might take a long time (up to decades) to adjust to improving economic opportunities. Two potential measurements which might be more immediately related to economic opportunity are contract enforcement and education. The importance of contracts for economic growth has received longstanding attention in institutional economics (North, Wallis & Weingast, 2009). The degree to which contracts are enforceable and the speed of that process can in large part determine the hold that powerful actors might have over market access, therefore this might be a better reflection of what kind of barriers exist for non-elite market participants. Education, perhaps more specifically educational attainment based on one's parents position in society, can be a good indicator of access to opportunities in a society and its establishment is key in the development process (Bakhtiari & Shajar, 2006). A person's educational attainment relative to their parents is furthermore a good indicator of how meritocratic a society is and inclusion of the population in the market is a meritocratic concept.

State accountability is the fourth category proposed by Andersson, Julia and Palacio (2021) for which no significant relationship with shrinking was found. State accountability is "the quality of governance and provision of public goods" (Andersson, Julia & Palacio, 2021: 13). Yet because it is not just the spending which matters, but also the eventual reach and outcomes of those government policies, Andersson, Julia and Palacio

(2021) argue that health outcomes are a proper indicator of government quality and how public goods are distributed, approximated by life expectancy as 'the ultimate economic test' (Sen, 1998). But by only focussing on health outcomes, other important aspects of state accountability are ignored. Andersson, Julia and Palacio (2021) admit that educational attainment or infrastructure outcomes might also (partially) capture the degree of state accountability. Therefore it would be better to either create an aggregate measure of health outcomes, education and infrastructure, or to revert to a measure of social spending to GDP or total government spending, which Andersson, Julia and Palacio (2021) also discuss, even though that might neglect how efficiently and equitable this social spending is distributed.

The final social capability is social stability, which reflects successfulness in conflict resolution (Andersson, Julia and Palacio, 2021). This social capability is theoretically weakly defendable, Andersson, Julia and Palacio (2021) spend two short paragraphs on discussing the importance of decreasing civil unrest, yet they fail to relate this to their measurement of democracy and autocracy, which is the Polity 5 index. The theoretical justification on whether democracy is able to reduce conflict is somewhat mixed. There are certainly aspects of democracies which provide stabilizing effects such as allowing citizens to express dissatisfaction through elections, smooth transitions of power, more responsiveness to citizen's needs (Tusalem, 2015). Yet autocracies also need to balance civil unrest to maintain power and some autocratic states such as China have recently leveraged new information and communication technologies to reduce civil conflict (Tusalem, 2015). Hence, there must be a broader review of existing empirical evidence of the role of democracies and autocracies on social stability, before this can be used as a measure. A much more direct measure, which is less dependent on the relationship between democracies and autocracies, would be to use a measurement of social stability such as the University of Illinois' Social, Political and Economic Event Database Project (Nardulli, Althaus & Hayes, 2015). This database uses technologically intensive methods to collect, analyse and categorize news reports, which could be used as a direct measure of social stability. Of course, in countries without free media, the reliability of this data must be questioned. Yet even among countries with free media, using this database to operationalize social stability could provide more insight into the effects of social capability.

Lastly, the operationalization of the determinants of economic shrinking as proposed by Broadberry & Wallis (2017) require more attention. The relationship between

Total Factor Productivity and shrinking is somewhat ambiguous. Broadberry and Wallis (2017) propose that TFP might act by shifting the distribution of growing and shrinking towards growing (and possibly reducing volatility), yet the empirical relationship between TFP and shrinking frequency is non-existent in this dataset. This might be because TFP does not only capture technology, it is also a measure of efficiency and captures resource allocations by for instance managers. Therefore alternative measures might focus on technology measures more explicitly, such as the number of patents (Popp, 2005), spending on research and design or returns on that spending.

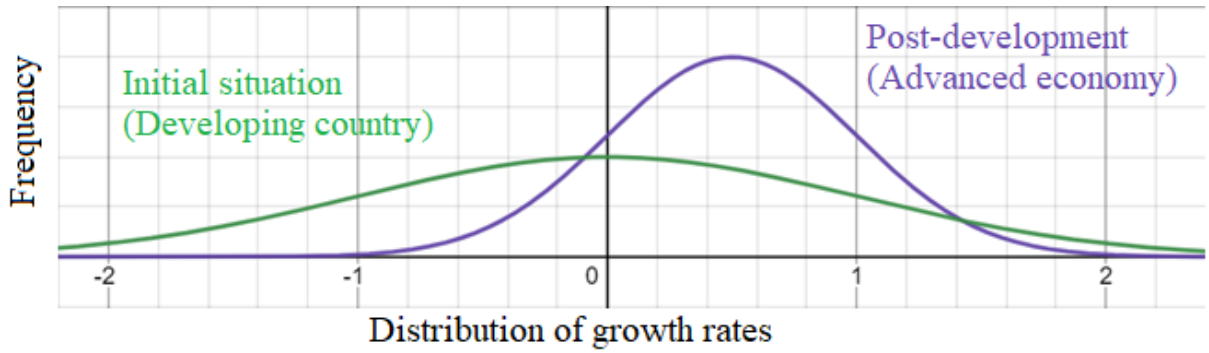
5.2 Identification of Categories

The theoretical foundations of the proposed categories by both Andersson, Julia and Palacio (2021) and Broadberry & Wallis (2017) is relatively underdeveloped. Although both papers string together theories and empirical findings of a wide variety of economic subdisciplines ranging from demography to structural change to political theory, the relationship between most of the proposed categories and shrinking is not strong. Both papers fail to establish concretely why their proposed categories would impact shrinking magnitude and frequency but not growing magnitude, since all of the proposed categories are already linked to economic growth in the literature. Most of the theoretical work in economic shrinking in upcoming research has to address this paucity of theory and has to convincingly show why there are some institutional categories that affect shrinking frequency and magnitude, but not growing per se.

Many of the proposed categories by both Broadberry and Wallis (2017) and Andersson, Julia and Palacio (2021) capture or relate to the concept of 'stability', be it economic stability or stability in terms of citizens' expectations of the polity. Structural change is a decreased reliance on a single sector (agriculture), demographic change reflects increased stability through lessening the need for many children, warfare incidence is a literal measurement of stability and government autonomy and accountability both provide citizens with stable and reliable expectations. Theoretically this makes sense, as the concept of stability aligns well with the empirical observations pertaining to shrinking set out by Broadberry and Wallis (2017). These are that first, among developing countries growing and shrinking rates are high and variable, second, long-run economic growth occurs because the

frequency and magnitude of shrinking have declined and thirdly, growth rates also decline as countries develop (Broadberry & Wallis, 2017). This suggests that as countries develop their distribution of growth rates has a higher mean, but lower variance, see figure 6 for a graphical illustration. If a country's growth rates during the development process indeed follow this pattern, then this embodies the idea of stability, not only in the outcome variable (since the variance in growth rates is reduced), but according to Broadberry & Wallis (2017) and Andersson, Julia and Palacio (2021) also in the underlying causes of this shift in growth rate distributions. Future research should explore this idea of stability more, in that there might be additional categories of variables that indicate or provide stability in a society. These can be outcome variables such as numbers of conflicts or life expectation, but they could also be evaluations of a country's system, for instance the time required to start a business in a standardized case, or evaluations of the political system.

Figure 6: Development of distributions of growth rates across development levels



In addition to more theoretical work on the independent variable site, figure 6 also highlights a potentially interesting additional dependent variable to explore, namely volatility in growth rates. There is surprisingly little literature on volatility in economic growth rates. Some authors have attempted to model volatility in economic growth and see whether developments such as deepening of the financial sector affect this volatility (Da Silva et al., 2017), which could be seen as a test of whether state autonomy (which was also modelled through state's control over inflation) affects volatility in growth rates. The topic of volatility in growth rates and which factors affect it is a topic worthy of study and very closely related to the literature on economic shrinking. Arguably the use of volatility in growth rates as dependent variable is superior to counting frequencies of shrinking since it contains more information. Whereas shrinking frequency across a decade is merely a sophisticated binary variable, volatility among growth rates in a decade will not only reflect if a country tends to be shrinking or growing (the mean), but also by how much they are shrinking or growing as

reflected in the standard deviation of growth rates for a certain period and hence how stable or volatile their growth is.

5.3 Factor Analysis as a Course for Future Research

The concerns remaining in shrinking research explained above are all forms of top-down or theoretical driven approaches to the topic. However, another interesting avenue for future research, which is bottom-up or data driven, is the use of factor analysis or principal component analysis to arrive at the dimensions underpinning shrinking. Here the approach would be to collect a large set of indicators which might or might not be related to economic shrinking, such as the World Development Indicators from the World Bank, but combining multiple datasets is possible as well. Then (exploratory) factor analysis or principal component analysis can be used to find common factors among those variables. The primary idea behind factor analysis is to reduce the number of variables or categories one is working with and identify 'factors' which are common to a set of variables (see e.g. Sul, 2019). A well-known example, outside of development economics, is the use of factor analysis by Hofstede (2011) to identify cultural dimensions. Hofstede did this by collecting data from IBM researchers on cultural preferences and was then able to reduce these preferences to initially 4 cultural dimensions, which were later expanded to 6 dimensions in subsequent research (Hofstede, 2011). A similar approached could be used to identify the factors which determine the shrinking frequencies and magnitudes of countries. As an example, if a common factor is found which explains much of the variance among health outcomes, educational outcomes and infrastructure of countries, then this would point to a factor that corresponds to the social capability of state autonomy in the work of Andersson, Julia and Palacio (2021). Moreover, additional factors might be found using this method which have not been theorized in the literature.

5.4 Interaction Effects

A final point for future research is that thus far no attention has been paid to interaction effects among the determinants of economic shrinking. The likelihood that these types of interaction effects exist is relatively high, since many interaction effects and conditionalities appear to exist among institutional variables. North, Wallis and Weingast (2009) for instance argue that a functioning democracy does not only consist of an electoral process, other requirements need to be met for well-functioning democracies. These are things such as having a free press and open access in both the political and economic sphere (North, Wallis & Weingast, 2009). Similar interaction effects most likely exist between the social capabilities proposed by Andersson, Julia and Palacio (2021), an obvious one might be between transformation of economic structures (or structural transformation) and state accountability. State accountability, as discussed earlier, is a measure of governance quality and public good provision, hence why it is operationalized through health outcomes. In order to improve the quality of healthcare, a great degree of knowledge of medicine is required, this in turn requires that people are able to follow education, if a large majority of the population instead is 'stuck' in subsistence farming, then health outcomes are unlikely to improve at a substantial rate. Hence, a sufficient degree of structural change can be seen as a prerequisite for improvements in the educational system, which then can be translated in improved health outcomes, which could lead to a decreased frequency of shrinking. This implies that there could be a conditional relation between the transformation of economic structures and state autonomy, where the effect of state autonomy might differ across various 'levels' of structural change, i.e. when a large percentage of the population works in agriculture the effect of state autonomy might be weaker than when a small percentage of the population works in agriculture.

Another type of interaction effect might exist between the determinants of economic shrinking and the level of development of a country, where some determinants of shrinking have more pronounced effects at early stages of development, e.g. structural change, which is often a first step in the development process (Fei & Ranis, 1961). While other determinants of shrinking might have more pronounced effects at later stages of development, e.g. autonomy of the state, as central bank development seems to be related to financial development in general (King & Levine, 1993).

6 Conclusion

6.1 Research aims

The objective of this study was three-fold. Firstly, to review and summarize the existing literature on economic shrinking. Secondly, to empirically investigate several of the proposed categories underlying economic shrinking by Andersson, Julia and Palacio (2021) and Broadberry and Wallis (2017). Thirdly, to provide theoretical and practical critiques to the current concepts used in the economic shrinking literature as well as discuss interesting avenues for further research in this topic.

In terms of the theoretical justification for the use of the 5 social capabilities presented by Andersson, Julia and Palacio (2021), as well as the four dimensions underlying economic shrinking from Broadberry & Wallis (2017), this remains an area where more work is needed. For none of these categories is it made clear why they would only affect frequencies and magnitudes of shrinking, rather than affect the magnitude of growing as well. Most of the categories seem to share that they can provide stability for people in a society in some way, which is in-line with the empirical observations Broadberry & Wallis (2017) make that as countries develop, they shrink less often, to a lesser extent, while growth rates also tend to drop off, i.e. the distribution of their growth rates becomes less volatile.

The empirical investigation of the social capabilities from Andersson, Julia and Palacio (2021) and the four dimensions of shrinking from Broadberry & Wallis (2017) showed that there is evidence that state autonomy (as operationalized through inflation) and demographic change (as operationalized through fertility rates) are significantly related to shrinking frequency. Plus there is evidence that inclusion of the population in the market (as operationalized through GINI coefficients) also significantly affects shrinking frequency, yet the direction of the effect runs counter to what is established in the literature (Palma, 2011), i.e. increased inequality reduces shrinking frequency. However given that random effects regression shows alternative outcomes, this finding might be due to model specification issues, specifically the use of country-fixed effects.

Lastly, several aspects pertaining to the operationalization of the proposed dimensions underlying economic shrinking, as well as identifying those dimensions are discussed. More theoretical justification is needed, where there is a clear delineation whether a variable (or dimension) affects shrinking primarily or exclusively, or whether some variables might be related to shrinking as much as they are to growing. Furthermore, the use of volatility in growth rates might be an additional dependent variable for further investigation, as this captures more information than frequencies of shrinking and growing. The use of factor analysis or principal component analysis to help identify the dimensions underpinning economic shrining is another interesting avenue for future research as well as a greater focus on the potential existence of interaction effects.

6.2 Practical implications

Since the topic of economic shrinking is relatively new and the empirical evidence on which dimensions underpin economic shrinking is mixed, it is unwise to jump to conclusions in terms of policy implications. Furthermore, this study nor other existing studies have shown that there is a causal relationship which runs from these dimensions to economic shrinking. Therefore, the practical implications of the field of economic shrinking are relatively minor, aside from country-specific studies which go deeper into the specific institutional context of a country, see e.g. Andersson, Palacio & Axelsson (2021). Based on this study, state autonomy and demographic change are significantly related to economic shrinking and could turn out to be determinants of economic shrinking.

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Appendix A

Table 3: Summary Statistics for all dependent and independent variables in Model A & B

Variable type	Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Dependent variables	Decadal average growth rates	581	.0026	.0042	-.0229	.0296
	Frequency of shrinking	600	2.6933	2.0872	0	9
	Magnitude of Growing	573	.0062	.0040	.0006	.0332
	Magnitude of Shrinking	457	-.0051	.0053	-.0445	-.0001
Independent variables	Economic Complexity Index	451	.1550	.9846	-2.2274	2.5001
	GINI coefficient	659	.3826	.0894	.1761	.6685
	Inflation rate	550	.2395	.9223	-.0045	8.7605
	Life expectancy	600	68.0533	9.9206	33.9842	87.7439
	Polity 5 index	545	3.5511	3.3415	-10	10

	Total Factor Productivity	450	.7036	.2602	.1563	2.2370
	Fertility rate	599	3.1948	1.7145	1.1	7.7463
	Battle-related deaths	153	614.5025	1306.369	0	10490

Appendix B

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity for model A, Dependent Variable is frequency of shrinking

H0: Constant variance

Variables: fitted values of frequency of shrinking

chi2(1) = 21.10

Prob > chi2 = 0.0000

Appendix C

Table 4: Hausman test for determining model fit (random versus fixed effects)

	Coefficients			
	(b) Fixed	(B) Random	(b-B) Difference	[(V_b-V_B)^(-1) Standard Error
Economic Complexity Index	.416	-.267	.673	.420
GINI	-13.684	-.115	-13.569	5.139
Inflation	.007	.005	.001	.001
Life Expectancy	.007	-.034	-.034	.059
Polity 5 index	-.068	-.037	.007	.014
Decade-fixed effects	.180	.021	.160	.160

b = consistent under H0 and Ha

B = inconsistent under Ha, efficient under H0

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 12.50
Prob>chi2 = 0.0516

Appendix D

Table 5: Comparison of random versus fixed effects models for Gini Coefficients

Variables	1 DV: Decadal Shrinking Frequency	2 DV: Decadal Shrinking Frequency
Gini Coefficient	-5.3001	5.6640***
	(4.381)	(1.0624)
Constant	19.1808	14.2722
	(12.304)	(11.3242)
Country-fixed effects	Yes	No
Decade-fixed effects	Yes	Yes
Observations	600	600
R-squared	.0581	0.0652
Number of countries	155	155

DV = Dependent Variable. Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix E

Table 6: Regression results for Model A with limited inflation rates (5% or lower), Shrinking Frequency as dependent variable

Variables	(1) DV: Decadal Shrinking Frequency
Economic Complexity Index	0.4305
	(0.3956)
Gini Coefficient	-12.7336**
	(5.2395)
Inflation Rate	1.0735***
	(0.2307)
Life Expectancy	-0.0539
	(0.0672)
Polity 5 Index	-0.0288
	(0.0285)
Constant	-23.5784
	(30.9246)
Country-fixed effects	Yes
Decade-fixed effects	Yes
Observations	384
Number of countries	100
R-squared	0.1161

DV = Dependent Variable. Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1