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Growth and Resilience Theory:

A new way of conceptualising convergence dynamics.

by

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Abstract: Recent studies have highlighted how building resilience to 'shrinking' episodes, as opposed to increasing growth rates, appears to be the missing piece of the puzzle when it comes to between-country income convergence. All economies seem to be able to grow, but few countries have been able to drastically improve their shrinking patterns, which has underpinned the divergence often argued in literature. However, whilst growth theory does not take into account the role of shrinking, shrinking has not yet clearly defined itself from growth processes, leaving shrinking research more generally indistinguishable from classic growth economics. This thesis proposes a new theoretical framework that solves these research gaps. Growth and resilience theory argues that building resilience to shrinking is movement through the aggregate production function, whilst growth is a shift of the function itself. Long-run convergence is an economy's ability to accomplish both of these feats simultaneously by balancing their growth- and resilience-based institutions. Thus, a 'Goldilocks Area' of long-term development patterns is proposed that would categorise a successful catch-up experience and highlight how growth and resilience to shrinking are two sides of the same coin.

Keywords: Economic Development, Growth, Shrinking, Resilience, Convergence, Divergence, Catch-up

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1 Introduction

Despite the vast studies focused on growth volatility and economic crisis, studies on the dynamics of shrinking[1] as a phenomenon are rare. The U.N. Sustainable Development Goals, for example, provide no mention or recognition of shrinking, yet how can we seriously discuss sustainability without it? After all, shrinking is, in one sense, the ability of an economy to maintain positive growth rates, though building resilience surely runs deeper than that alone (Andersson, 2018). This is not entirely surprising given that shrinking is a relatively novel topic, but the real problem lies in shrinking theory's inability to distinguish itself clearly from growth processes. Previous literature has persuasively argued for the phenomenon's existence and the need for a societal approach (Andersson, 2018; Andersson, Julia & Palacio, 2021; Axelsson & Martins, 2022; Broadberry & Wallis, 2017). Yet the old adage seems to still apply, have the poorer nations not grown enough and is a shrinking episode simply a lack of growth in that year (see for example Acemoglu & Robinson, 2012; Collier, 2007)? Is the way to combat shrinking to grow more or are there different dynamics at play? The lack of any clear separation from growth processes presents a major flaw in shrinking research which has not yet been convincingly addressed. This leaves subsequent shrinking studies open to the critique that they are indistinguishable from classic growth economics which must be addressed for the research field to truly advance.

Growth theory has failed to take into account the role of shrinking in global income divergence patterns, and shrinking has not yet clearly defined itself from growth processes. These are the salient problems facing conversations on developing country catch-up and income convergence dynamics. Growth theories have traditionally focused on factor accumulation, in particular labour and capital inputs, and productivity, often thought of as technological advancement, with their relative contributions to growth measured through accounting exercises. In this way, growth accounting literature tends to have two main focuses, either the

1 Shrinking is when GDP per capita growth rates turn negative from the preceding period, in essence, income per person 'shrinks' or contracts: $GDP\ per\ capita_t < GDP\ per\ capita_{t-1}$. This is the defining feature of shrinking that separates it from growth rate volatility, which is often defined as the standard deviation of GDP per capita growth rates (Campi & Duenas, 2017).

improvement of input measures and understanding resource misallocation, or understanding the dynamics of convergence and divergence (Gallardo Albarran, 2018). This thesis primarily contributes to the second strand of literature by proposing a new theoretical framework that unites and explains underlying growth and resilience to shrinking processes to explain how long-run convergence can be achieved.

Simon Kuznets (1973) famously characterised modern economic growth as rapid technological progress and high growth rates in productivity, with standard neoclassical growth theories suggesting that between country productivity growth rates should differ inversely with productivity levels. As such, developing economy GDP per capita tends to grow faster than their developed country counterparts with this in-built potential for catching-up said to give lower-income countries an 'advantage of backwardness' (Gerschenkron, 1962). However, there instead appears to be a 'disadvantage of backwardness' as the world at large has seen only sporadic instances of successful economic catch-up (Milanovic; 2016; Pritchett, 1997; Rodrik, 2011). Barring the East Asian Tigers, income convergence has been few and far between which continues to leave huge question marks for researchers to reconcile.

When it comes to economic growth, this has long been ascribed to be the ultimate driver of convergence. Exogenous growth theory began by suggesting that there is a systemic relation between growth and initial capital stocks, which would entail an unconditional convergence between country income levels (Solow, 1956; 1957). However, partly borne out of the lack of empirical evidence for convergence (Barro & Sala-i-Martin, 1992; Easterly & Levine, 2001; Hall & Jones, 1999; Temple, 1999) and the need to explain technological change within a growth model, endogenous growth theory would argue for conditional convergence instead. Steady states could be heterogeneous due to technological, institutional, and behavioural differences. Thus, convergence would be conditional on these factors being the same across countries (Hall & Jones, 1999; Pack, 1994; Sala-i-Martin, 1996). The addition of these factors has been welcome, but it is technological advancement and productivity that are still regarded as the key drivers of income divergences between countries (Caselli, 2005; Easterly & Levine, 2001; Feenstra, Inklaar & Timmer, 2015; Hall & Jones, 1999; Jones, 2016; Klenow & Rodriguez-Clare, 1997; Solow, 1988). The reasons for increased volatility of developing country growth rates are often painted as weak institutional environments and a lack of export diversification (Calderon & Yeyati, 2009). This has left volatility largely outside of productivity conversations. However, the conventional approach of focusing on average between-country

growth rates has missed key information on growth spells and collapses (Berg, Ostry & Zettelmeyer, 2012), which has sorely hindered growth theory's overall explanatory power.

This is where economic shrinking comes into play as all economies seem to be able to grow, but relatively few nations have managed to reduce both the magnitudes and frequencies of shrinking episodes. It seems to have been a prevalent phenomenon for how the industrialised Western countries began forging ahead centuries ago (Broadberry & Wallis, 2017) and poorer Global South regions that have shown more recent signs of income convergence (Andersson, 2018). Though success remains heavily concentrated in East Asia. In his study of shrinking patterns in Global South regions between 1951-2016, Andersson (2018) showed how a key driver of Asian economic performance was their lower frequencies of shrinking. On average, Asia did indeed have higher growth rates compared to Latin America and Sub-Saharan Africa, but by 'lending' Sub-Saharan Africa the same shrinking patterns as Asia, whilst keeping growth rates unchanged from reality, Andersson's (2018) counterfactual exercise resulted in Sub-Saharan Africa's GDP per capita increasing from $3,011 (constant 2015 USD) to $9,245 (constant 2015 USD). This more than three-fold increase in income illustrates the huge value in compound growth and the importance for understanding resilience to shrinking episodes in any successful catch-up process.

Due to the importance of compound growth, it is hypothesised that the frequency of shrinking episodes is of greater importance in the long run, as this is more suggestive of systemic vulnerabilities in a society, whilst shrinking magnitudes are more related to short-term shock responses (Andersson, 2018). It is through this lens that, based on Abramovitz's (1986; 1995) concept of 'social capability' and North, Wallis & Weingast's (2009) proposals for moving towards an 'open access' society, Andersson & Palacio (2017) and Andersson (2018) propose a *social capabilities* theoretical framework for building resilience to economic shrinking. They identify five broad inter-related institutional categories that govern the development process with subsequent shrinking research being mostly analysed through this framework (Andersson, Axelsson & Palacio, 2021; Andersson, Julia & Palacio, 2021; Andersson, Palacio & Von Borries, 2022; Axelsson & Martins, 2022; Smythe, 2021).

This thesis does not argue that previous theories are wrong, only that they are incomplete which is especially striking through their relative isolations from one another. Therefore, the main proposition here is that growth processes are those that shift the aggregate production function, and resilience to shrinking processes are those that allow for movement

through the aggregate production function. Growth accounting gives a viable method of distinguishing movement through the production function, i.e., growth in factor inputs, or a shift in the function itself, i.e., improved labour productivity. However, any explanatory model of building resilience to shrinking must go beyond mere factor accumulation and productivity considerations as, for example, negative total factor productivity cannot be disentangled from its key components (Andersson, 2018; Andersson, Palacio & Von Borries, 2022). Therefore, growth accounting literature is often considered in this thesis to distinguish movement through the production function from shifts of it. Though it is recognised that this does not necessarily capture the underlying processes in their entirety, as highlighted by the *social capabilities* approach.

To that end, this thesis takes a narrative approach to try and bridge the research gap between growth theory and resilience to shrinking theory into one unified framework that does not rely on growth accounting concepts alone. According to Bates, Greif, Levi, Rosenthal & Weingast (1998, p.10), the narrative approach "pays close attention to stories, accounts, and context" whilst also extracting "explicit and formal lines of reasoning, which facilitates both exposition and explanation". Historical growth difference studies do capture aspects of economic performance, but they do not accurately convey the long-term drivers of differences, as there is growing evidence that these do not remain constant over time (Crafts & O'Rourke, 2014). Thus, these methodological techniques hold the advantage of combining the economist and political scientist rational choice analytic tools with that of the historian narrative approach (Aboagye, 2020). In this way, the narrative approach allows for a deeper secondary analysis of previous literature which is especially important in proposing any potentially new theoretical framework or insights, as is the case here.

This thesis is divided into four sections. Section 1 is the present introduction. Section 2 discusses previous literature: first, growth theory is discussed and, second, shrinking theory to highlight where both strands of literature are at and their respective research gaps in greater depth. Section 3 then presents Growth and Resilience Theory: first, process distinctions are made for what it means to move through the aggregate production function and shift the function itself. Second, the theory's model is presented and discussed. Third, the implications of the model for income convergence are analysed by suggesting that there is an ideal path, i.e., a 'Goldilocks Area', in which growth and resilience institutions are balanced appropriately for successful catch-up to take place. Section 4 offers concluding remarks.

2 Convergence and Divergence: The Story so Far

Modern economic growth has helped to improve living standards and material well-being the world over, however, this has not been felt equally across time and space. Differences in economic performance have led to wide regional disparities and understanding the drivers of these processes remains of paramount importance. A common technique of previous literature has been growth accounting, in essence dividing proximate sources of economic growth into factor accumulates and how efficiently they are combined, i.e., the accounting residual commonly known as total factor productivity (TFP). Capital accumulation and labour force growth have traditionally been thought of as the key inputs whilst TFP is commonly thought of as a measure of technological change. In this way, growth essentially originates from three sources: the workforce, investment, and technological advancement. Cross-country studies have tended to find higher TFP levels for higher-income countries (Feenstra, Inklaar & Timmer, 2015) which have reinforced previous theoretical understandings on growth as the key source of economic performance. Historically, however, growth rates tended to be lower than commonly assumed with the fundamental change instead seeming to be the elimination of negative growth episodes (Broadberry, 2016). Furthermore, productivity, as measured by TFP seemed to only gain greater importance for economic performance post-1950 (Gallardo Albarran, 2018). This begs the question, what has growth theory missed and how could this missing piece be reconciled with our existing knowledge?

2.1 Economic Growth and the Catch-up Process

The Solow-Swan, or Solow model (Solow, 1956; 1957; Swan, 1956) is still perhaps the best-known model of economic growth and shaped the way the entire field of macroeconomics is approached (Acemoglu, 2009). Taking the classical theory of factors of production and marginal productivity theory, Solow (1956) assumed the substitutability of the factors of production. Capital intensity changed in response to relative price changes in capital and labour,

a key modification from earlier growth models, and increasing the physical capital stock would increase per capita production. Growth rates will ultimately not be sustained, however, due to the law of diminishing marginal returns. Thus, as the growth contributions from capital become increasingly smaller, a steady state of growth is reached whereby capital, labour, and output all grow at the same rate.

The Solow model proposed that aggregate supply be determined by a Cobb-Douglas production function, as this satisfies certain required technical conditions[2]. The technological possibilities can then be formally expressed as:

$$Y_t = f(K_t^{\alpha}(A_t L_t)^{1-\alpha}) \tag{1.1}$$

where subscript *t* represents a temporal dimension with total output, *Y*, being a function of capital inputs[3], *K*, labour inputs, *L*, and the productivity of labour[4], *A*. The capital-labour ratio, α, defines the constant elasticity of substitution owed to any changes in the marginal rate of technical substitution[5]. Technological progress is labour-augmenting in this specification, in that the quality and skills of the labour force are upgraded by technological advancement. The law of motion for the stock of capital is a defining feature of the Solow model as savings determine the level of capital intensity and net investment. Constant returns to scale and adding per-worker terms in the Solow model allow for simplification that deals with only one argument in the production function and measures quantities per worker:

$$\frac{Y}{L} = f\left(\frac{K}{L, 1}\right) \quad \text{or} \quad y = f(k) \tag{1.2}$$

thus,

$$y = Ak^{\alpha} \tag{1.3}$$

Here output per worker is a function dependent on capital per worker, i.e., capital deepening or the capital-labour ratio. Assuming technological progress, *A*, the savings rate, *sf(k)*, workforce

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2 These are: i) Each factor displays decreasing marginal returns; ii) constant returns to scale; and iii) increasing in both arguments.
3 May include human capital as well as physical capital (Todaro & Smith, 2011).
4 Often synonymous with technological progress though in neoclassical growth theory this refers to qualitative changes in production and used interchangeably with efficiency, or TFP (Sharipov, 2015).
5 In the range of $0 < \alpha < 1$.

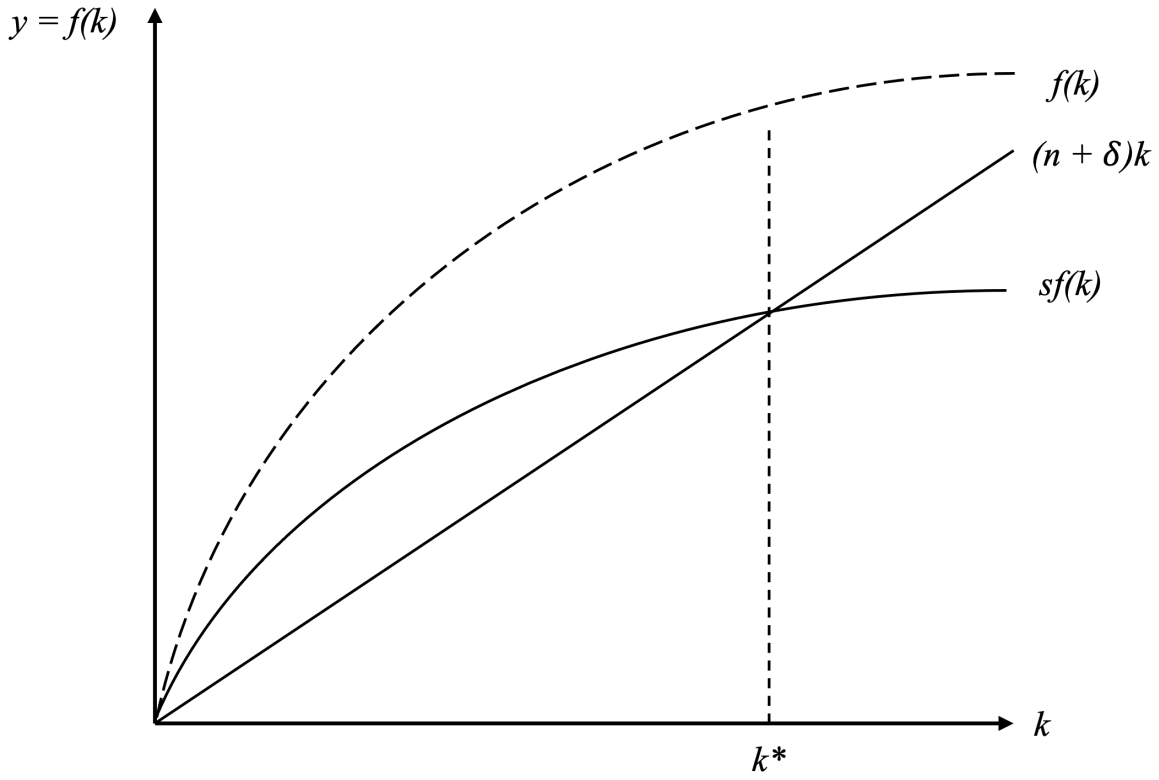

Figure 1: The Solow model and equilibrium. (Source: Author's editing)

growth, n, and capital stock depreciation, δ, are exogenous, then these variables can be thought of as constants in the Solow model. *Figure 1* shows how the equilibrium, or steady state, k^*, is determined by the savings rate's ability to service the attrition of the capital stock after accounting for any labour force changes. In this way, Solow (1956) showed that any increased savings proportion of income would not lead to permanent increase in growth rates. Increased proportions of savings, i.e., investment, only allow for movement through the production function. In the absence of technological change, i.e., a shift in the production function, growth rates would be entirely dependent on increasing the labour supply in a steady state situation. Should the labour supply increase without accompanying increased investment, i.e., capital widening, the result would be reduced capital deepening and income.

Thus, Solow (1956; 1957) proposed a neoclassical growth theory that the equality of aggregate supply and demand determines economic equilibrium. Equilibrated growth is compatible with different savings norms that maximise consumption as this is determined not by the largest possible capital stock, but by its marginal productivity, also known as the "golden rule" of accumulation (Sharipov, 2015, p.768). A key proposition of the model emerges that

factor accumulation does not yield long-term progress on its own and technological progress is the key difference between country growth rates (Solow, 1988).

In effect, the Solow model assumes that capital accumulation and how this capital is utilised is vital for economic growth and shows how the capital-labour relationship translates into increased output. Furthermore, the Solow model provided a method of differentiating movements through the production function with shifts in the function itself. However, critics often point to the model's assumption of exogenous technological progress as a major weakness, as the theory cannot explain technological advances, i.e., shifts in the production function. TFP has been ascribed to account for roughly 50% of industrialised nation growth so large variations in country incomes could not be accounted for within the model (Todaro & Smith, 2011). The Solow model also suggested that capital should be drawn to lower-income countries as the marginal return diminished in developed countries, thus postulating an unconditional convergence between growth rates. Instead, developing countries often failed to attract investment and curb domestic capital flight becoming a stylised fact commonly known as the Lucas Paradox (Lucas, 1990).

Such concerns gave rise to new growth, or endogenous growth theories in the 1990s, trying to account for such conundrums. Investment, research and development, capital and knowledge accumulation can all be thought of as contributing to long-term economic growth with growth a direct result of human capital levels, and as such must be accounted for in any growth model (Romer, 1990; 1994). Moreover, in the Solow model the state can only affect growth rates through policy that impacts savings rates whereas endogenous growth theories began to incorporate institutional environment considerations. For example, these can be government support to increase R&D and favourable business climate, particularly for promoting science and technology investments, investments to improve human capital, and property right protections, especially intellectual property in imperfect competition conditions (Sharipov, 2015). The Lucas Paradox also seems to have an institutional explanation with Alfaro, Kalemli-Ozcan, & Volosovych (2008) showing that the paradox seemed to "disappear" when accounting for institutional quality in cross-country regressions.

The first model of endogenous growth was the AK theory with an early version being proposed by Frankel (1962). His theory did not distinguish between technological progress and capital accumulation as it effectively lumped together human and physical capital. Frankel (1962) argued for increasing or constant marginal product of capital as capital accumulation

will in part be made up of intellectual capital, which in itself is a driver of technological progress. Since then, endogenous growth theory has mainly proceeded along two distinct paths with the first wave being generally characterised by its focus on human capital accumulation, following Frankel (1962), and the second focused on that of innovation.

Lucas (1988); Mankiw, Romer, & Weil (1992); and Romer (1989; 1990) all created separate models where levels of human capital defined output levels. For example, Mankiw, Romer, & Weil (1992) introduced an influential model that 'augmented' Solow's original model to include 'human capital' and, in the process, explain a higher variation of between-country per capita income level differences:

$$Y_t = F(K_t^{\alpha} H_t^{\beta} (A_t L_t)^{1-\alpha-\beta} \tag{2.0}$$

where human capital, *H*, is represented alongside its respective elasticity[6], β. In contrast to the Solow model, their results are concerned with explaining the difference in income levels and not growth rates. In this regard, Mankiw (1995) maintains that the strong correlation between savings and growth is plausibly explained by economies approaching their steady state through 'transitional dynamics'. Furthermore, countries converge towards different secular paths as production technique changes should be viewed as movement along the production function, rather than the shift of the function itself (Mankiw, 1995). Thus, the general premise of the human capital endogenous growth theories maintains that higher investment in human capital, especially to increase educational quality, could lead to long-lasting and sustained economic growth.

Endogenous growth theory's second wave of innovation-based growth theories are premised on technological advancement from many innovations that are the result of economic activity, such as new markets, processes, and products. These recognised that intellectual capital is different from both physical and human capital, and essentially accumulates through innovation. In this regard, Romer (1990) introduced a seminal contribution to endogenous growth theory by suggesting that the non-rivalry of ideas allows for increasing returns to drive economic growth. He outlines a model of economic growth that defines the mechanisms of how new ideas are formed with an idea essentially being a means of producing a new good (Schiliro, 2019). Successful innovating firms make profits through monopolistic positions of a new good,

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6 $\alpha + \beta < 1$

providing incentives for capital accumulation as R&D is paid as a fixed upfront cost. Technological change lies at the heart of economic growth which is made endogenous by accounting for the intentional actions of people in R&D and technological adoption. Romer's (1990) theory suggests that larger markets induce more research and grow faster, and larger human capital stocks will increase growth rates which can potentially be sped up through free international trade. Thus, an important policy aspect for growth rates is to incentivise and increase returns of the research and development sector, potentially through direct subsidies, or subsidise total human capital accumulation (Romer, 1990).

Both Solow (1956; 1957) and Romer (1990) have been recognised for their important contributions to economics in advancing neoclassical growth theories. On the one hand, exogenous neoclassical growth theory postulated unconditional convergence between country income levels, assuming a systemic relation between growth and initial capital stocks. On the other hand, endogenous growth theories argued for conditional convergence as steady states could be heterogeneous due to technological, institutional, and behavioural differences (Hall & Jones, 1999; Pack, 1994; Sala-i-Martin, 1996). Both standard neoclassical growth theories have suggested that between country productivity growth rates should differ inversely with productivity levels. As such, developing economy GDP per capita tends to grow faster than their developed country counterparts. The marginal gains for inputs are lower in higher-income economies, due to the law of diminishing returns, and developing countries are spared the additional costs associated with technological frontier innovation pressures, instead adopting rather than inventing. In this way, lower-income countries are said to exhibit an 'advantage of backwardness' as they have an in-built potential for catching-up (Gerschenkron, 1962). However, such catch-up advantages in action remain dubious as historic trends seemingly pour cold water on such theoretical musings.

The world at large has seen only sporadic instances of economic catch-up with previous research instead arguing that there has been divergence, not the convergences expected from growth theory (Milanovic; 2016; Pritchett, 1997; Rodrik, 2011). This lack of convergence has been a key area of critique with empirical evidence often being inconclusive in support of growth theories (e.g., Barro, 1991; Barro & Sala-i-Martin, 1992; Easterly & Levine, 2001; Hall & Jones, 1999; Sala-i-Martin, 2002; Temple, 1999; Young, 1991). There has been remarkable GDP per capita convergence with the higher-income countries in the East Asian region since the 1950s. However, even here this has only been limited to a small sub-set of economies,

namely Japan, Taiwan, South Korea, Singapore, and Hong Kong. The success of these East Asian Tigers is conventionally attributed to their export-orientated policies (World Bank, 1993), though Krugman (1994) would argue it was due to input accumulation, such as labour, human capital, and physical capital, and not any productivity or technological convergence.

These trends have led to a dominant historical pattern of technological divergence not only on a global scale, but within the developing world as well, something that growth narratives alone have failed to predict or explain. In light of such failure, Abramovitz's (1986; 1995) would propose a theory of 'social capability' which states that a society needs to be socially advanced but technologically backwards for modern technology to be successfully assimilated. Whilst the theory recognises the multidimensional process to development and is a useful analytical framework, the vagueness of social capability made it difficult to quantify and fit into growth models. As Abramovitz (1986, p.388) himself put it, "no one knows just what it means or how to measure it" though he surely underestimated his own contribution in this regard.

2.2 Economic Shrinking as an Alternative Concept for Catching-up

One problem with earlier growth theories was the focus on growth rates. It is not that developing economies do not grow, it is that growth is volatile with rates often "collapsing" or even "reversing" from economic shocks or conflict (Rodrik, 1999). Pritchett (1997; 2000) highlighted how negative growth rates are a salient feature of developing economies even going as far to describe a 'disadvantage of backwardness' that appears the norm, the East Asian Tigers proving the exception. Endogenous growth theory was a welcome addition for its alternative perspective on income levels though the neglect of short- and medium-term dynamics still limited the value of its contribution (Todaro & Smith, 2011). Thus, the volatility of growth rates, and how to sustain them, is "just about the most important policy issue in economics" (Hausmann, Pritchett & Rodrik, 2005, p.303) with poor institutional environments and lack of diverse exports often being the key reasons given for increased fragility (Calderon & Yeyati, 2009). Moreover, investment levels are more depressed in higher volatile output environments, including human capital investment, thus reinforcing the institutional vulnerabilities in more cyclical economies (Perry, 2009). Investment declines during growth slowdowns but does not

increase substantially with growth accelerations, suggesting that initiating growth and maintaining it are governed by separate processes (Jones & Olken, 2008).

Earlier research has thus focused exclusively on the growth imperative, essentially trying to establish the dynamics of increasing and maintaining growth rates. Therefore, the conventional approach of focusing on average between-country growth rates has missed key information on both the duration of growth spells and the magnitude of rate collapses (Berg, Ostry & Zettelmeyer, 2012). Broadberry & Wallis (2017) take this as their point of departure by introducing the alternative concept of *economic shrinking,* crystalising it as a separate phenomenon than simply growth volatility. Economic shrinking is defined as a year in which the GDP per capita growth rate is below zero, i.e., a period in which an economy contracts and income per person 'shrinks'. Therefore, economic shrinking relates to both the magnitude of output contractions and the frequency in which shrinking episodes occur. In their study of select industrialised Western economies, Broadberry & Wallis (2017) determine that long-run economic performance was historically improved not by higher growth rates but by lower frequencies and magnitudes of shrinking episodes. They argue that by moving towards 'impersonal rule' with institutional change, the Netherlands, UK, Spain, and Italy were able to reduce shrinking which was the key driver of diverging fortunes between developing and developed economies.

The historic nature of Broadberry & Wallis's (2017) study, however, leaves limited scope for both its modern-day applications and its ability to explain divergence within the developing world. For example, Andersson (2018) added his perspective by studying shrinking rates of developing countries between 1951-2016 and found that shrinking patterns are not homogenous across Global South regions. When compared to Latin American and Sub-Saharan African countries, growth rates were higher across Asian economies but crucially they also had reduced shrinking. Andersson (2018) simulated a counterfactual economic performance for Sub-Saharan Africa by 'lending' them Asia's shrinking frequency and magnitude rates, whilst not changing their historic growth rates. The result was Sub-Saharan Africa's GDP per capita increasing from $3,011 (constant 2015 USD) to $9,245 (constant 2015 USD), a more than three-fold increase in income than in reality (Andersson, 2018). Furthermore, as the magnitude of growth rates tend to be universally shared, the frequency of shrinking episodes appears to be more important in the long run for growth to ultimately compound (Andersson, 2018). The implication being that the magnitude of shrinking rates is more related to how an economy can

handle short-term shocks, whilst a higher frequency of shrinking episodes is suggestive of underlying systemic vulnerabilities (Andersson, 2018).

Recreated from Andersson, Palacio & Von Borries (2022), *Table 1* shows the growth rates, shrinking frequencies, and shrinking magnitude averages by decade across various global regions. Growth rate measures are averages of only positive growth rate years whilst shrinking magnitudes are averages of only shrinking years. Sub-Saharan Africa exhibits the highest shrinking frequencies globally between 1970-2000, followed closely by the MENA region. Growth rates are higher across both First and Second Tier Asian economies, yet shrinking magnitudes and frequencies are consistently lower than the other regions as well. Growth rates also appear to be declining across all regions though there was an understandable acceleration during the commodity boom period 2001-2010. Most regions' shrinking frequencies began to decline post-1990 and even more markedly since the turn of the millennium, except in the MENA region. The poorest countries experience much more frequent shrinking episodes than their richer counterparts and both the frequency and magnitudes of shrinking tend to decline as countries develop (Andersson, 2018; Broadberry & Wallis, 2017; North, Wallis & Weingast, 2009), which is seemingly played out in the data.

The importance of economic shrinking for understanding long-term development and catch-up dynamics is thus a vital, yet understudied area of research. In this relatively novel field, Andersson & Palacio (2017) and Andersson (2018) proposed a *social capabilities* theoretical framework for building resilience to economic shrinking. They propose five broad inter-related institutional categories, i.e., capabilities, that govern the development process: structural *transformation*, *inclusion*, state *autonomy*, state *accountability*, and *social stability* including conflict resolution. These capabilities are derived from Abramovitz's (1986; 1995) concept of 'social capability', and North, Wallis & Weingast's (2009) proposals for moving towards an 'open access' society. A country's convergence capacity is determined by how technologically backwards but socially advanced the society is (Abramovitz, 1995). In essence, and going beyond neoclassical growth accounting, certain institutional environments need to be in place for economies to effectively adopt and use new technologies, such as, but not limited to, appropriate levels of human capital. Moreover, societies must move towards institutional arrangements that enforce the rule of law equally, give the right of autonomous organisation creation, and negate the use of violence in negotiation or participation (Andersson, Palacio & Von Borries, 2022; North, Wallis & Weingast, 2009).

Table 1: Growth and shrinking patterns by decade in developing regions.

	1971-1980	1981-1990	1991-2000	2001-2010	2011-2018
Asia First Tier					
Growth Rate	7.0%	6.5%	4.8%	4.3%	2.2%
Shrinking Frequency	6%	6%	12%	20%	3%
Shrinking Magnitude	-2.5%	-1.3%	-4.8%	-2.0%	-0.1%
Asia Second Tier					
Growth Rate	4.8%	4.6%	4.3%	5.3%	4.2%
Shrinking Frequency	24%	14%	10%	9%	2%
Shrinking Magnitude	-2.9%	-3.2%	-4.8%	-2.4%	-0.4%
Latin America					
Growth Rate	4.0%	2.5%	3.1%	3.8%	2.8%
Shrinking Frequency	21%	48%	25%	18%	11%
Shrinking Magnitude	-3.3%	-4.5%	-2.6%	-3.0%	-3.3%
MENA					
Growth Rate	7.7%	6.2%	6.8%	3.6%	3.1%
Shrinking Frequency	35%	47%	28%	29%	39%
Shrinking Magnitude	-7.2%	-7.4%	-4.9%	-2.8%	-3.5%
Sub-Saharan Africa					
Growth Rate	5.0%	3.4%	4.6%	5.0%	3.2%
Shrinking Frequency	45%	52%	43%	24%	18%
Shrinking Magnitude	-4.5%	-4.0%	-4.3%	-3.4%	-4.2%
Eastern Europe					
Growth Rate	5.3%	3.5%	6.1%	6.4%	3.5%
Shrinking Frequency	4%	36%	24%	12%	11%
Shrinking Magnitude	-3.5%	-4.5%	-5.0%	-6.7%	-1.9%

(Source: Author's recreation from Andersson, Palacio & Von Borries, 2022)[7]

The *transformation* capability is concerned with an economy's diversification, shift away from agriculture towards industrialisation, and increased complexity in production. Structural change is recognised as a key feature of any economic modernisation as an economy increasingly moves from lower to higher productive activities (Rodrik, 2014). *Inclusion* refers to the ability of a society to broadly participate, and benefit from, economic activity. Berg & Ostry (2017) found that inequality is seemingly related to growth-break episodes which can turn into shrinking episodes, whilst Smythe (2021) specifically found that higher poverty levels are correlated with increased frequencies of shrinking episodes. *Autonomy* is concerned with the ability of the state to remain free of vested interest and elite group influence. Such insulation

7 Underlying data source is the Penn World Table 9.1. See *Appendix A* for list of countries per region.

is important to create a credible and exemplary government that can impartially enforce the rule of law (Andersson, 2018). The *accountability* capability relates to the central state's quality of governance and ability to provide public goods. In effect, this captures the legitimacy of the governing to the governed as it represents principles and policies applied to the use of public resources (Andersson, Axelsson & Palacio, 2021). Finally, *social stability* is the ability of the state to provide institutions for peaceful conflict resolution, such as those needed for the enforcement of law and order (Andersson, 2018)[8].

The advantage of the *social capabilities* approach is that it can better reflect the multi-dimensional nature of the development process. Building on work from Palacio (2018), Andersson, Julia & Palacio (2021) investigate a *social capabilities* Index, constructed by the average relative ranking of 26 developing economies across five capability indicators from 1964-2018. They find strong support for the notion that the more advanced the capabilities, the greater the resilience to shrinking, both in frequency and severity, making recovery and convergence more likely. Furthermore, stronger social capabilities become even more important for economies that are international trade and export dependent, particularly with weak internal markets, as they are better able to mitigate external price shocks (Andersson, Julia & Palacio, 2021). However, whilst a composite index can be a useful analytical tool, this does not mean that all capabilities are equally relevant across time and space. For example, Andersson & Andersson (2019) found that the lack of broad-based economic participation was a key detriment to sustainable growth patterns in Côte d'Ivoire and Senegal between 1930-1980. Strong agricultural growth, in Côte d'Ivoire especially, was not enough to drive long-term development as societal transformation sorely lagged behind (Andersson & Andersson, 2019).

On the other hand, Indonesia between 1950-2015 was able to generate strong pro-poor growth and substantially reduce poverty through farmer investment that increased production and food security (Andersson, Axelsson & Palacio, 2021). However, faced with capital and labour constraints, industrialisation led to the formation of powerful special interest groups which only changed after the emergence of democracy (Andersson, Axelsson & Palacio, 2021). Thus, the initial phases of industrialisation required a 'worsening' of *autonomy* in some sense before this became more detrimental later on, only effectively being addressed with the fall of

8 See *Appendix B* for greater discussion on how these capabilities are hypothesised to specifically build resilience to shrinking episodes.

the Suharto regime. Moreover, when comparing Indonesia with Brazil, Axelsson & Martins (2022) argue that the latter's capabilities are only more advanced due to Brazil starting its development journey earlier. Indonesia's higher resilience to shrinking is due to its *relatively* more advanced capabilities, helping to explain why Brazil is being caught up instead of catching up (Axelsson & Martins, 2022). This suggests that there is an ideal timing to advancing social capabilities in order for a virtuous cycle of development to emerge (Axelsson & Martins, 2022). The Latin American region more broadly has also managed to build an increased resilience to economic shrinking through democratic and liberal economic transitions, aided by favourable terms of trade since the 2000s (Andersson, Palacio & Von Borries, 2022). However, the productive complexity of the region has not improved, suggestive of a relative weakness in the region's *transformation* capability and its long-term catch-up capacity (Andersson, Palacio & Von Borries, 2022).

Whilst economic shrinking might be the neglected phenomenon for enabling long-term development and catch-up, the literature has not yet distinguished it clearly from growth processes. For example, Andersson, Julia & Palacio (2021, p.9) highlight how Abramovitz's (1995) "social capability-hypothesis applies to both growth and shrinking" but also discuss how "social capabilities and resilience to shrinking are both interactive cause and effect in the catching up process". Arguably, a critique could be easily levelled at the *social capabilities* theoretical framework that the difference between shrinking and growth is merely a semantic exercise. Is a country's ability to not shrink that year simply that they have not experienced enough growth? For example, should resilience be achieved then would growth and convergence effectively 'take care of itself'? Or are the processes and institutions that enable growth different than building resilience to shrinking? Whilst the *social capabilities* try to go beyond simple growth accounting, the answers to these questions have not entirely been addressed convincingly, which has been further reflected in subsequent shrinking research. Thus, previous literature persuasively argues for the shrinking phenomenon's existence and the need for a societal approach but fails to truly distinguish the underlying processes that differentiate it from economic growth. Such a predicament is not entirely surprising given the infancy of the shrinking topic, but it does represent a major gap in the *social capabilities* theoretical framework, with shrinking research more generally being indistinguishable from classic growth economics.

3 Growth and Resilience Theory

Growth theory does not take into account the role of shrinking in income divergence patterns, and shrinking has not yet clearly defined itself from growth processes. How then would one go about reconciling these research gaps? In reaching the *social capabilities* framework, Andersson (2018, p.2) argues against the inclusion of growth theory concepts, noting that "no production function can explain why economies shrink" and any explanatory model must go beyond mere factor accumulation and productivity considerations. For example, as negative TFP cannot disentangle its key components, neoclassical theories provide little explanatory power towards proneness to shrinking (Andersson, Palacio & Von Borries, 2022). Moreover, as labour and capital tend to be long lasting, shrinking cannot be explained through standard growth accounting decompositions (Pritchett, 2000). Whilst no production function can truly capture all the elements required to build resilience to shrinking, it is argued here that building resilience to shrinking does not lie outside of growth theory concepts. The wholesale disregard for growth theories has led previous research to miss a key insight to help conceptualise growth and resilience processes. That is, growth is the ability to shift the production function up whereas building resilience is the ability to move through the production function.

3.1 Growth, Resilience, and The Aggregate Production Function

Consider again a Cobb-Douglas production function from model (1.1). Even if we consider this production function as is, then one could easily see how a country further through the function has a higher resilience to shrinking episodes. Due to the law of diminishing returns, the amount that inputs would need to 'regress' would need to be higher if an economy is further along its function for the same drop in output to be felt. Essentially, a more sizeable shock would need to be induced for the same magnitude of shrinking to be experienced. If an economy's production function is relatively flat, or the economy is very far along the function, then even a sizeable shock could limit the contraction in output, which might be much easier

balanced out by technological advancement. In this way, a 'balanced-out' contraction through technological advancement would have an easier recovery through a suggested higher marginal product of inputs. Moreover, even though significant amounts of capital and labour might be lost, states would be in a better position to manage expectations and business confidence through the reduced impacts of aggregate output. States would also be able to easier supplement aggregate demand to smooth the business cycle as higher investments relative to GDP would be minimised.

Important to note is that such a simple scenario would be dependent on the capital-labour share to determine the functions shape. Neoclassical models often assume that this share remains constant, typically .3 capital to .7 labour split. However, Karabarbounis & Neiman (2014) investigated how the share has been shifting further towards capital since the 1980s. They propose that technological change is the key to understanding this trend with ICT lowering the relative price of investment goods, facilitating a global shift towards capital through efficiency gains. This has raised the corporate savings share by 20 percentage points, increasing investment as well as equity repurchases, but was only responsible for about half of the global capital-labour share shift with the remaining estimated to be due to increased markups (Karabarbounis & Neiman, 2012, 2014).

Interestingly, Karabarbounis & Neiman (2014) found that share shifts due to the decrease of the relative price of investment goods had a positive effect on welfare equivalent consumption, whilst share shifts due to markups had a negative effect on welfare equivalent consumption. Declining prices of investment goods can increase total investment to GDP as both corporate and household investments increase and do not offset each other one-to-one in order to stabilise total saving to GDP (Karabarbounis & Neiman, 2012). This would facilitate movement through the production function.

On the other hand, a share shift from markups implies increasing monopoly rents and power which would not facilitate movements through the function and thus be detrimental to welfare. Furthermore, increasing economic power can create vicious cycles by shifting political bargaining power further in favour of such monopolistic actors (Acemoglu & Robinson, 2012). As such, a society's steady state would be lower on its production function making them more susceptible to economic shocks and a reason why a weaker institutional environment can increase shrinking vulnerabilities.

This also has various implications within the *social capabilities* framework by touching on aspects such as *autonomy* and *inclusion*. The capital-labour share tends to show different characteristics over 30–50 year periods with increasing labour shares impacting growth rates negatively in the short run but positively in the long run, and higher labour shares are also associated with lower income inequality (Charpe, Bridji & McAdams, 2019). Thus, the capital-labour share highlights precisely why growth accounting exercises may fail to truly explain movements along the production function by missing key qualitative considerations. Not considering the underlying reasons why the global capital-labour share has changed since the 1980s misses key information as to production function movements, even though its shape would remain relatively consistent. In this regard, the *social capabilities* framework can play a crucial role in bridging this information gap to help build resilience to shrinking.

The *social capabilities* framework also offers new perspectives on prevailing wisdom. For example, one could consider the human capital focus a success of endogenous growth theories, however, one thing the theories fail to take into consideration is the *type* of human capital needed. In their historical study on Industrial Revolution France, Squicciarini & Voigtländer (2015) distinguish between average measures of human capital and 'upper-tail knowledge'. They define upper-tail knowledge broadly as the ability of innovators and entrepreneurs to adopt and improve new and modern technologies consistent with the notion of economically "useful knowledge" (Mokyr, 2005). Their results show that average worker skills raised the productivity of a given technology, which increased per capita incomes in the cross-section, but it was upper-tail knowledge that allowed entrepreneurs to adopt new productive techniques. In other words, general improvement in human capital allowed for shifts along the production function, helping to improve societal living standards through raised wages, but growth was fostered by a relatively small group of "knowledge elite", who shifted the production function through innovation and modern technological diffusion (Squicciarini & Voigtländer, 2015).

In their study, Squicciarini & Voigtländer (2015) have a heavy focus on growth, i.e., shifting the production function, like many researchers before them. For example, Schultz (1963, 2009) highlights how higher educational levels have significantly increased economic growth rates in both developed and developing countries. Whilst this is undoubtedly an essential element of long-term prosperity, it is not always balanced with considerations for moving through the aggregate production function. Higher education can help societies move to a higher

steady-state in productive capacity but also make income per capita more robust through people's increased employment opportunities and wealth accumulation. Increasing employment attractiveness allows a person to be more flexible and respond better to economic shocks with higher educated people tending to exhibit lower unemployment rates (Feng, Lagakos & Rauch, 2018). Increasing labour inputs through unemployment reductions allows an economy to gain more workers in productive activities. Furthermore, the ability of individuals to respond more effectively to short-run unemployment incidence also helps to reduce the long-run natural rate of unemployment itself (Arulampalam, Booth & Taylor, 2000).

Developing countries often have stronger informal sectors which can inefficiently allocate labour resources, generate lost tax capacity, and allow unregulated activity to thrive (Pratap & Quintin, 2006). For example, it is not unusual for low-income countries' informal sectors to account for over half of employment and output (Pratap & Quintin, 2006). Such environments can further limit movement through the production function as public investment opportunities are constrained through reduced fiscal capacity. In this regard, the *social capabilities* framework can again capture and govern a countries ability to move through its production function, for example, through the *accountability* and *autonomy* capabilities. Thus, the ability of the state to improve tax administration and public goods provisions builds resilience by helping to smooth the downsides of economic cycles (Andersson, Julia & Palacio, 2021), governing movements through the production function. Interestingly, low tax generating states often also fail to effectively enforce property rights (Besley & Persson, 2014). Property rights are a key institutional requirement in endogenous growth theory, especially intellectual property rights, which suggests that building resilience to shrinking, through the *social capabilities'* framework, is what is needed first for growth processes to build on top of a solid societal foundation.

Societal *inclusion* also helps build resilience and fosters growth through different but sometimes overlapping channels. Cingano (2014) studied income inequality in the OECD states and found that higher income inequality has depressed growth rates, particularly due to reduced opportunity investments. Concern should especially be directed at the bottom 40% of the income distribution and amongst the OECD countries anti-poverty policies would not be enough to drive higher growth rates (Cingano, 2014). Inequality of opportunity is greater outside of the top and middle part of the income distribution, is more sensitive to increases in inequality, and likely has systemic human capital underinvestment's (Cingano, 2014).

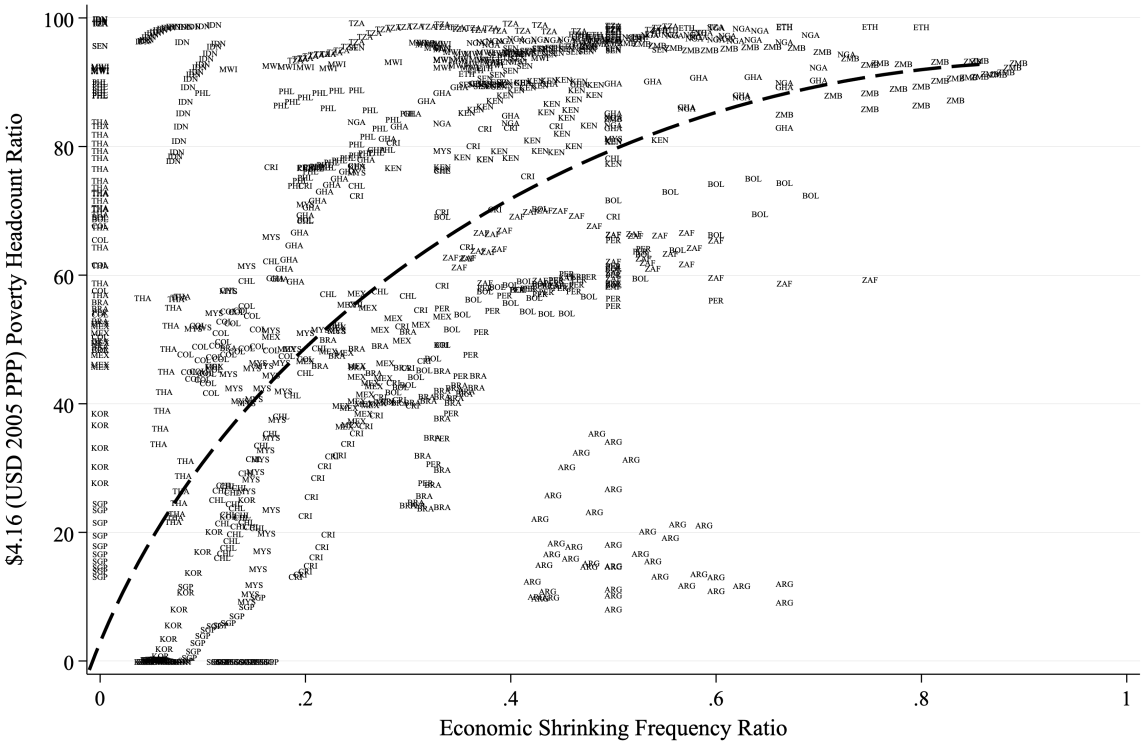

Figure 2: Economic Shrinking Frequency Ratio vs $4.16 (USD 2005 PPP) Poverty Headcount Ratio for developing countries, 1974-2006. (Source: Author's recreation based on Smythe, 2021)

On the other hand, in his study of developing countries Smythe (2021) found evidence that income inequality did not appear correlated with instances of shrinking frequency, whereas poverty is highly correlated with it. Recreated from Smythe (2021), *Figure 2* shows the relationship between the economic shrinking frequency and absolute poverty rates in developing countries between 1974-2006. Whilst certainly not definitive evidence, and barring Argentina's inclusion, *Figure 2* does suggest a nonlinear relationship in the aggregate. This harkens back to the shape of a Cobb-Douglas production function whilst no such discernible pattern is visible for income inequality trends (Smythe, 2021).

In this way, one might consider income inequality to be more concerned with growth dynamics whilst poverty alleviation could impact both growth and resilience. For example, poorer entrepreneurs might not have the financial capacity to take their ideas forward (Doering, 2016) whilst unemployment episodes for the poor can transfer poverty intergenerationally (Gavin & Hausmann, 1998). Poverty alleviation can also lead to increases in employment and higher incomes (Hawkes & Ugur, 2012) along with greater capacity for harnessing

technological advancement. Thus, 'poverty traps'[9] arising from capital market imperfections that restrict borrowing for the poor could lead to multiple equilibria in the Solow model and a theoretical reason why lower-income countries are unable to move further along their production functions. Developing country growth is often impeded by imperfect capital and goods markets, poor infrastructure, and poor incentive structures that limit savings and human capital accumulation (Todaro & Smith, 2011).

In their review of poverty trap literature, Kraay & McKenzie (2014) find no evidence for the phenomenon's existence outside of theoretical reasonings. However, one of their contentions supporting this claim is that poorer countries have managed growth rates similar to that of the United States over the past 200 years. The focus on growth rates again misses the volatility aspect that might be the main vehicle of resilience building. In this way, one can also see how higher poverty measures in developing countries can hinder both resilience and growth as it limits the capacity to both shift and move through the production function. Growth rates alone may hide relevant factors for poverty and at the technological frontier income inequality seems more relevant. Greater resilience has already been built by higher movement through the production function and as such innovation and productivity advancements take centre stage.

Kraay & McKenzie (2014) do recognise that even if poverty traps do not exist in practice, this does not mean that steady-state convergence is not significantly slowed by higher poverty. Slow steady-state convergence would also increase an economy's vulnerability as they might not build enough resilience in between shocks. In investigating the mechanisms behind start-stop growth patterns, Jones & Olken (2008) highlight how growth "miracles" and "failures" appear omnipresent at ten-to-fifteen-year scales, except in the most advanced of economies. In examining structural breaks in growth episodes, they note how capital accumulation explains 32% of growth decreases during down-breaks but only explains 7% of growth increases during up-breaks. Furthermore, Jones & Olken (2008) find it "surprising" how TFP is implied to play a relatively larger role in up-breaks but the asymmetry between down-breaks means that capital accumulation seems to play the dominant role. Investment collapses during down-breaks whilst increases in TFP reflect increases in trade and up-breaks (Jones & Olken, 2008). Technologic advancement can be diffused through trade which, as knowledge crosses borders, would increase TFP and spur innovation, suggesting that trade liberalisation

9 Poverty traps are commonly thought of as a series of self-reinforcing mechanisms in that poverty perpetuates poverty.

can help to increase productivity especially for developing countries (Grossman & Helpman, 1991). When one considers that growth is a shift in the production function whilst building resilience is movement through the function, Jones & Olken's (2008) results are no longer surprising.

In development accounting[10], however, the focus has overwhelmingly been on increasing TFP with many recent studies identifying this as the key driver of income divergences (Caselli, 2005; Easterly & Levine, 2001; Hall & Jones, 1999; Jones, 2016; Klenow & Rodriguez-Clare, 1997). Labour productivity is often the focal point for determining the proximate sources of economic growth as differences in output per worker are determined by taking stock of inputs per worker and compared for a given point in time. Development accounting typically takes all factor outputs and inputs, divides by a country's labour force, then expresses these relative to a base country, usually the United States (Crafts & Woltjer, 2021). The relative GDP per capita of country *i* could thus be expressed as:

$$\tilde{y}_i = \tilde{k}_i^{\alpha} \tilde{h}_i^{1-\alpha} A_i \tag{3.1}$$

where,

$$\tilde{y}_i = \frac{Y_i/L_i}{Y_{US}/L_{US}} \tag{3.2}$$

with capital intensity, *k*, relative to the United States and human capital per worker being defined by *h*[11]. Furthermore, Hall & Jones (1999) propose a specification based on the capital-to-output ratio, as a country's steady state is likely achieved when capital has already endogenously, and fully, responded to their respective level of technology.

Frontier analysis takes these ideas one step further by determining 'best-practice' activities in order to establish whether differences are due to TFP or the efficiency of input combinations. For example, Jerzmanowski (2007) determined that between 1960-1985 a large part of European catch-up was driven not by increases in TFP, but by using factor inputs in a more efficient way. Input efficiencies could thus characterise an economy moving towards realising its production possibilities curve more fully, whilst TFP would be the shift of the curve outwards. It is much more plausible that negative TFP growth be an indicator of worsening

10 Also commonly referred to as level accounting in literature.
11 Note that a temporal dimension is still applicable though it is not shown for simplicity.

efficiency or capacity utilization rather than a technological regress, which would be indicative of a 'forgetting' of production methods (Crafts & Woltjer, 2021). Nevertheless, both scenarios would entail an upward shift in the aggregate production function and not movement through it, which contrasts with previously discussed endogenous growth conjectures by Mankiw (1995). Furthermore, Crafts & Woltjer (2021) highlight how this improvement in input efficiency would at least in part be related to the absorptive capacity of Abramovitz's (1995) social capability theory which is underpinned by human capital and economic competences.

As Andersson, Julia & Palacio (2021) point out, it is clear from Abramovitz's (1995) argumentations that the capability approach was to understand long-run *economic performance* and not be simply focused on short term growth rates. Economic performance, as defined by Broadberry & Wallis (2017), considers both the magnitude and frequency of shrinking episodes alongside episodes of growth which implies that the capability-hypothesis applies to both growth and shrinking (Andersson, Julia & Palacio, 2021). It is in this moment that building resilience to shrinking through the *social capabilities'* framework (Andersson, 2018) fails to properly distinguish itself from growth processes. The *social capabilities* framework could arguably then be said to not be about building resilience to shrinking, but about maximising economic performance. Undoubtedly, this involves building resilience to shrinking but the theory fails to recognise that this is possible by movement through the production function. Growth processes likely still require an element of social capability, but the precise capabilities required are not necessarily the same, as growth involves shifting the production function up.

The Solow model offered the key insight that technological advancement was the reason for permanent long-run welfare increases. Endogenous growth theorists would later pick up the baton to try to explain technological change within growth models. This perspective on the importance of shifting the production function itself is perhaps a salient reason why discussions on resilience have been underrepresented in the literature. Even the institutional aspects that endogenous growth theories have advanced have all centred on how to increase technological progress. Encouraging R&D in technology and science, human capital investments, and property rights protection have all been proposed with the specific aim to induce a shift in the production function. Such a focus on technological progress is unsurprising when one considers that research is often focused on higher-income countries. Diminishing returns from movement through the production function have naturally shifted the focus towards more fertile fields for increasing growth rates, which at the technological frontier is through innovation dynamics.

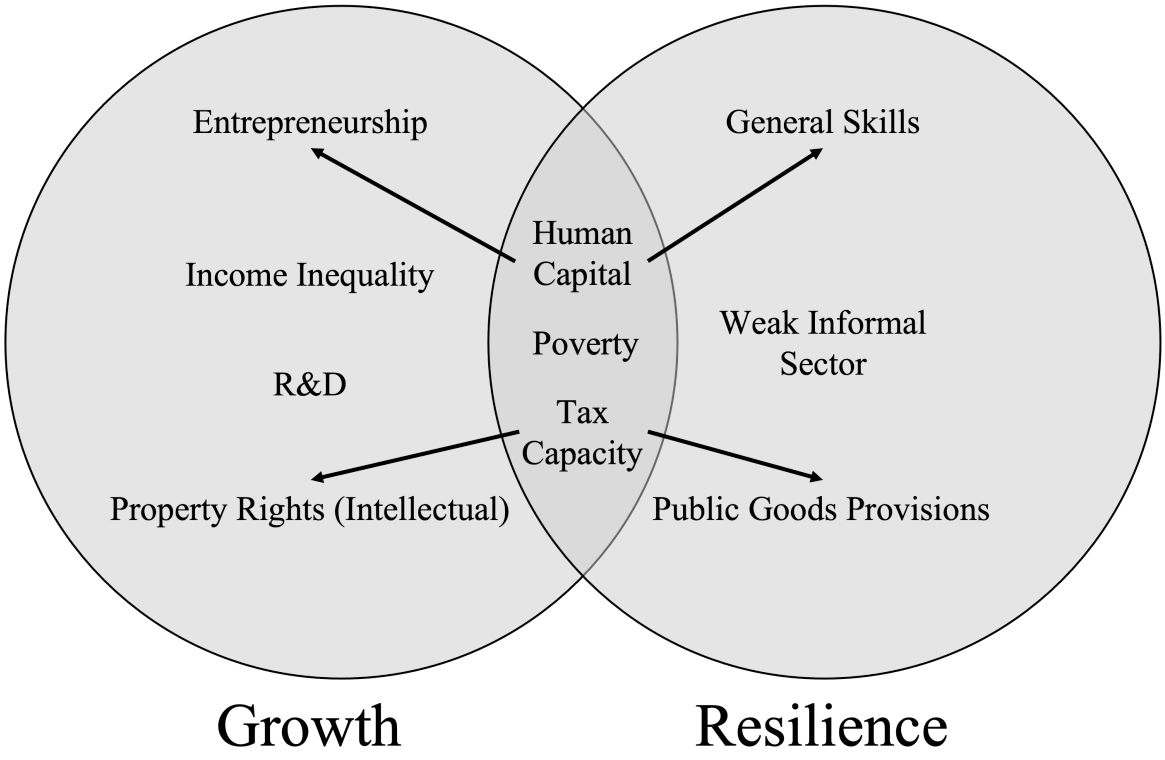

Figure 3: Contributing factors to Growth and Resilience processes. (Source: Author's editing)

Hypothetically, should an economy be far enough along its production function that no growth rate contribution comes from increasing inputs, or their combination efficiencies, then the only source of growth rates would be technological advancement. However, this focus on growth highlighted that a higher steady state can be achieved through production function shifts but failed to recognise equilibrium is not an automatic process and movements through the function help protect incomes from backsliding. Long-term growth rates might be limited by movement through the production function, but such a narrow view does not consider an economy's ability to build resilience to shrinking episodes. In this way, one could think of the shift of the production function as the *trigger* and the movement through the function as the *sustainer* of long-term development patterns. Therefore, the shift of the function can be thought of as *growth* and the movement through the function as building *resilience* to shrinking. In summary of the previously discussed literature, *Figure 3* conceptualises how topics might be characterised as potential growth and resilience process contributors. These phenomena are two sides of the same coin with potential spillover effects but also separate and distinct processes for governing growth and building resilience to shrinking.

3.2 Growth and Resilience Theory Model

The theoretical proposition in this thesis is that movement along the production function helps to build resilience to shrinking and shifting the production function up increases growth. Both frontier and development accounting literature increasingly focus on labour productivity as the determinant of country income differences. In essence, the differences in the efficiency of input combinations and technology is what determines the success or failure of catch-up capacity.

The problem with these strands of literature is that a labour productivity focus gives too much attention to dynamics involved with shifting the production function up. That is not to say that this literature is wrong, but that it is limited. This accounting technique more accurately separates TFP from capital deepening, otherwise a productivity increase from a technology improvement might be incorrectly attributed to capital accumulation (Gallardo Albarran, 2018). However, such narrow considerations for only labour and capital as key inputs potentially lack the means to truly capture movement through the production function, which is where the *social capabilities* framework can come in. As Crafts & Woltjer (2021) note, it is not easy to answer if there are more factor inputs that should be considered, and economic history literature rarely attempts to explore this avenue further. However, to simplify the relationship between growth and resilience processes, one could consider *all* 'inputs' as the total measure of movement through the production function, as opposed to separating them into individual factors. Though a simple Cobb-Douglas production function has considerable controversy (see for example Caselli, 2005) it is also likely to be the most appropriate function for long-run analysis as it remains consistent with microeconomic foundations (Jones, 2003):

$$y_{i,t} = \beta_1 f\left(Tech_{i,t}\right) + \beta_2 f\left(In_{i,t}\right)^{\frac{1}{\alpha}} + \varepsilon_{i,t} \tag{4.1}$$

where,

$$\alpha = 100\left(\frac{n_{i,t-1}}{N}\right) \tag{4.2}$$

Output in this formulation is represented as a country's income level per capita, *y*, which is a function of technological advancement, *Tech*, and inputs, *In*. α is a country specific factor which is equal to a country's global income distribution percentile from the proceeding period,

such that n is the ordinal rank of y, and N the total number of country observations. ε is the error term, subscript t is a temporal dimension, and subscript i index's countries.

With respect to α, as a country successfully develops and becomes richer, it naturally has both become closer to the technological frontier and built a high resilience to shrinking. This means that its production function becomes increasingly flatter approaching the frontier, α becomes increasingly larger, and income increases are primarily driven by technological advancement. On the other hand, a small α implies a relatively steeper effect from factor accumulation, suggesting that building resilience to shrinking has higher returns at lower income levels. α is in essence a crude measure of a country's technological frontier proximity and institutional quality which also adds an element of endogeneity into the model.

In this specification, technological advancement, *Tech*, can be thought of as a country's ability to move the production function up, including institutional arrangements that encourage technological advancement and efficiency gains from combining inputs differently. For example, protections for intellectual property rights or incentives to encourage entrepreneurship and innovation. Inputs, *In*, in this instance go beyond just physical and human capital and labour inputs and can be thought of as including institutions that facilitate not only movement through the function but the ability to remain further along the function as well. For example, a state with a high *accountability* through its public goods provision provides a more solid societal foundation for responding to shocks.

There undoubtedly remain empirical challenges, especially regarding inputs proxied by *social capabilities*, as inputs have traditionally been thought of as labour and capital. In considering all inputs, model (4.1) avoids the problem of technological advancement being neutral-, labour-, or capital-augmenting. However, this would certainly need to be addressed in any future empirical exercise. The two main paths of growth accounting literature focus on improving measures of inputs and understanding resource misallocation, and understanding the dynamics of divergence and convergence (Gallardo Albarran, 2018). The primary purpose of this thesis is to contribute to the second strand of literature by proposing a new theoretical framework to help conceptualise the underlying growth and resilience building processes[12].

12 See *Appendix C* for a more detailed discussion on TFP and input measurement improvements.

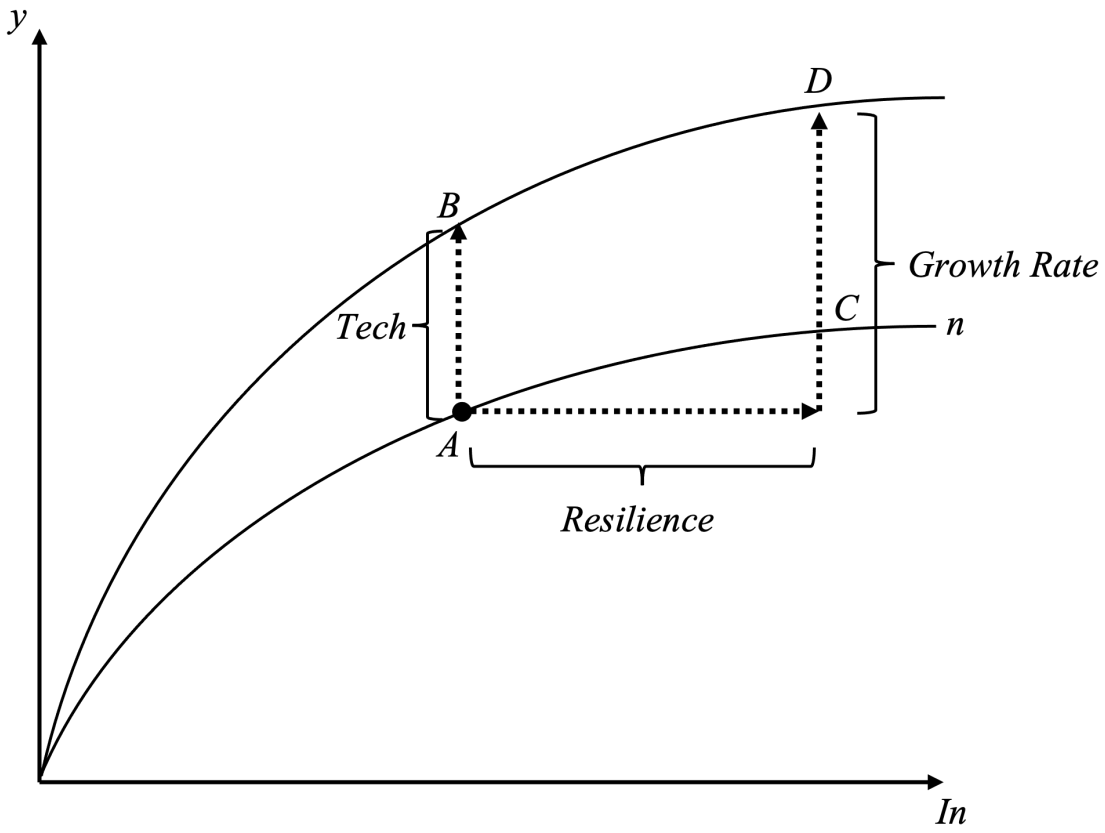

Figure 4: Growth and Resilience production function. (Source: Author's editing)

This can be seen in *Figure 4* which describes these processes in action. *Figure 4* shows an aggregate production function for country *n* and its initial starting position of point *A* at a static point in time. At time point *A*, one could describe country *n* as being 'backwards' in the sense that they have lower levels of technological advancement and little accumulation of inputs. As there is little accumulation of inputs, country *n* is vulnerable to economic shrinking and as such presents volatile growth patterns. Growth rates appear high, likely in part due to growth as technological advancement, but primarily due to recovery as rates frequently turn negative. This part growth process could be conceptualised as movement towards point *B* through a technological shock. However, at this point growth is volatile and movement frequently regresses back to *A*. This would likely take place in lost efficiency gains for countries far below the technological frontier as developing countries often have the opportunity to markedly improve resource allocation (Hsieh & Klenow, 2009).

A movement from point *A* to point *C* would entail an economy building resilience to shrinking as it moves through its production function, which in this scenario might be described

as an ‘inputs shock’, though in reality this can be a slow process. Point *C* would not exhibit high growth rates, due to diminishing returns, but shrinking patterns would decrease as resilience is built. Neither movement towards point *B* nor *C* would entail convergence for lower income countries. The goal would be movement towards point *D*, which would characterise high and resilient growth patterns. Important to note here is the difference between growth processes and growth rates. Movement through the production function might *appear* as growth *rates* but the underlying process that truly represents growth is technological advancement, as movement through the function is really concerned with building resilience to economic shrinking.

There is nothing to say that country *n* could not move towards point *B* first before moving to point *D*, and indeed neoclassical growth theories postulate that it must be this way around. However, one must consider the speed of technological advancement in such a scenario. If the growth is too high without an accompanying movement through the function, then country *n* would remain volatile and technological gains would not be successfully assimilated. For example, a society with high poverty might drastically slow the speed of movement towards its steady-state (Kraay & McKenzie, 2014) making it more vulnerable to regressive shocks. Perhaps this constitutes another missed point from growth theories, the order in which movement through and the shift of the production function should happen. It is also in this way that Abramovitz’s (1995) social capability theory can cover both growth and resilience building processes in its conceptualisation.

An interesting consequence of building resilience to shrinking being the movement along the production function is that resilience grows asymptotically. In other words, building resilience grows at decreasing rates. Mathematically this makes sense as building resilience to shrinking has reached its inherent limitation when shrinking frequency equals zero. This also makes sense intuitively as human capital displays diminishing returns in both education and health measures. For example, Trostel (2004) found that human capital displays diminishing returns to scale at higher levels of education. This goes against the assumption of constant returns to scale assumed in endogenous growth theories, though in the long run human capital might still present constant returns to scale if it is focused on ideas and the ability to shift the production function. Again, this depends on how we are defining our human capital measures.

Public goods provisions also produce diminishing returns on investments. Roads that open new regions of the country, for example, would have significantly more impact than roads

that are added to a basic existing network. Even politics is not immune from diminishing returns. In their study of Western European social democracy between 1975-2014, Loxbo, Hinnfors, Hagevi, Blombäck & Demker (2019) discuss how social democratic parties primarily benefitted electorally at lower levels of welfare state generosity with their expansive reforms. The diminishing returns at higher levels helps to predict electoral turns towards the political right though the structure of welfare state institutions explains the pace and extent that social democratic parties influence declined (Loxbo, et al., 2019). The suggestion here being that unless a virtuous process of resilience building is in place, then it can likely be assumed that the process might become arrested as, for example, the diminishing returns on resilience become increasingly unattractive investment propositions. Such an observation also falls in line with findings from Axelsson & Martins (2022) in that there could be an ideal timing for advancing *social capabilities* for building resilience to shrinking.

Returning to model (4.1), in order to derive the effects of moving through the function from a shift in the function itself, a key assumption must first be made. One must assume that the error term equals zero as ε will capture any interaction between *Tech* and *In*. Without this assumption the function could thus be expressed as:

$$y_{i,t} = \beta_1 f(Tech_{i,t}) + \beta_2 f\left(In_{i,t}\right)^{\frac{1}{\alpha}} + \beta_3 f(Tech_{i,t}) f(In_{i,t})^{\frac{1}{\gamma}} \tag{4.3}$$

This interaction, β_3, must be assumed to be zero so that the effects of β_1 and β_2 can be accurately parcelled out. The interaction term is likely extremely difficult to measure, potentially capturing intangibles such as culture with societies having different attitudes towards institutional arrangements. For example, it is often considered that Anglo-Saxon countries have higher tolerance to increased inequality measures, reflective of institutional differences and technological change (Piketty, 2014). Furthermore, γ would also be related to α so this assumption negates any multi equilibria in the model though the possibility of coordination failures would still be theoretically possible should the assumption be violated. This assumption can be formally expressed as:

$$\beta_1 + \beta_2 + \beta_3 = 1 \tag{4.4}$$

$$\beta_1 + \beta_2 = 1 - \beta_3$$

$$\beta_1 + \beta_2 \leq 1 - \beta_3$$

where,

$$\alpha + \gamma = 1 \tag{4.5}$$

$$\alpha \leq 1 - \gamma$$

Though it is recognised that it is highly unlikely that this assumption holds in reality, the assumption is used to generate ideal experiment conditions. When the assumption holds, we can derive the effects of shifting the production function and moving through the production function:

$$\frac{\delta y}{\delta Tech} = \beta_1 \tag{4.6}$$

and,

$$\frac{\delta y}{\delta In} = \frac{\beta_2}{\alpha} In^{(\frac{1-\alpha}{\alpha})} \tag{4.7}$$

It should also be remembered that the above equations describe a static point in time. By incorporating these functions across time, *t*, one could map the development journey of how a country can effectively move both through the production function and move the production function higher. Therefore, one could think of a development trajectory that needs to move in a general direction, but still leaves sufficient room for multiple country experiences. Thus, even though a 'steady state' needs to move towards a generally higher point, the long-term development journey can be described as the area under the production function over a given period. This would amount to a descriptive journey and process rather than the simple measure of income level, *y*, often used in economic growth literature:

$$\int_{t=T}^{\infty} y = Development \tag{5.0}$$

3.3 The Goldilocks Area of Long-term Development

In this way, the theory presented here is more in line with that of conditional convergence. An interesting implication emerges that conditional convergence is not only

predicated on technological, or productivity differences as previous growth theory has suggested. This is undoubtedly a part of the story but building resilience is the other side of the coin and is needed for long-run convergence to take place. An overreliance on growth institutions places too much focus on dynamics that shift the production function up, rather than dynamics that also allow movement through the function as well. Therefore, one could consider that long-term economic development is the journey towards the top right-hand corner of *Figure 4*, in essence the movement towards point *D*.

To simplify this point even further, *Figure 5* presents three alternative development trajectories for countries: *n1*, *n2*, and *n3*, over time periods: *t1*, *t2*, and *t3*. Time period *t0* is the beginning in which all countries would be at the same income level. Whilst an aggregate production function is concave, these development trajectories are presented as linear to simplify the illustration process. In this context, these trajectories should not be thought of as production functions themselves, but instead as very general 'steady state' direction movements. The steady-state in essence being defined by an economy's blend of appropriate institutions that allow for movement through and a shift of the production function. Whilst a direct linear progression seems unlikely, it is not impossible. Output and input measures are average measures over a temporal dimension, usually years, and as such a country's 'steady state' could move in any direction between periods.

One could imagine that country *n1* has the 'perfect' balance of institutions that allow it to effectively move both along its production function and shift the function at its maximum possible pace. Country *n2* has successfully nurtured institutions that help growth, i.e., a shift in the function itself, but this growth is volatile and vulnerable to shocks. Country *n3* is successful at moving along its production function which has helped it to build resilience to shrinking, but it has been unable to harness the institutions needed to help shift its function up, i.e., low growth rates due to diminishing returns.

Furthermore, one could consider a 'Goldilocks Area' in that growth is sufficiently harnessed without its volatility outweighing the effects of building resilience to shrinking. Country *n1* is presented with error-bars to illustrate such a concept. In essence, countries in area's *i* will have different growth- and resilience-based institutions that perfectly counter-balance one-another. However, once a country enters area's *j* then convergence still happens but at a slower rate. Growth rates would be able to counter-balance resilience to some extent, and vice-versa, but a minimum requirement would be needed from both to dictate the speed of

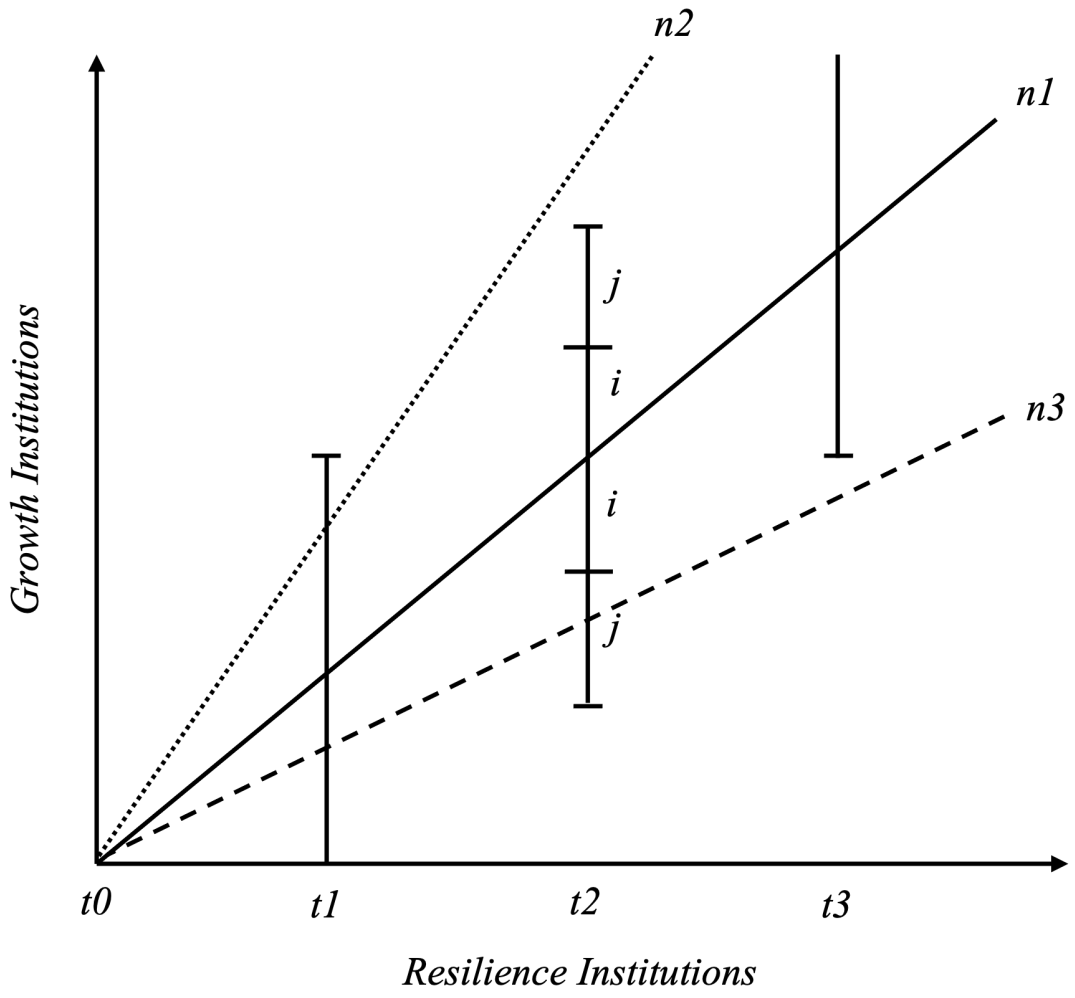

Figure 5: The Goldilocks Area of long-term economic convergence. (Source: Author's editing)

economic convergence, or if it is even happening in the first place. Country *n2* would show signs of income convergence at time point *t1*, however, at time point *t2* growth would become too volatile and convergence would cease to happen. Country *n3* on the other hand would show signs of income convergence as well, which would be especially strong at *t1*. Convergence would continue at time point *t2*, due to *n3*'s lower volatility, but higher growth rates would eventually run out of steam, due to the diminishing marginal returns, so convergence would slow down. By time point *t3* both country *n2* and *n3* are no longer exhibiting signs of economic convergence. Essentially, over the very long run countries within area's *i* would be at their peak development potential by maximising the space under their respective production functions.

What should be noted here is that growth institutions 'outweighing' resilience building institutions, or vice versa, is not inherently present in model (4.1) as potential trade-offs would

take place in political arenas. One potential model that could be thought of here is that of Acemoglu, Johnson & Robinson (2004), who outline an endogenous model of how political institutions impact economic institutions[13]. Any potential model outlining this mechanism however lies outside the scope of this thesis and should be thought of as complementary to the growth and resilience theory.

Returning to growth and resilience theory, one important implication is that the technological frontier is likely pushed the strongest in the long run by countries that lie in the upper-bound of area *i*, i.e., above country *n1*'s trajectory line, with these economies playing an important role for the global economy by acting as the technological leaders. The role of the remaining countries in area *i* but below *n1*'s trajectory would be more predicated on their ability to absorb and use advances from the technological leaders. For example, only a relatively small number of countries invent new technologies with 90% of most countries technological advancement being reliant on foreign sources (Keller, 2004). In essence, societies can develop their institutions within their respective cultural contexts and the global economy likely benefits from diverse institutional arrangements. However, there exists fundamental growth- and resilience-based institutions that are needed for long-run development and the goal should be to maximise the space under the production function, rather than simply maximising growth rates. Even at the technological frontier, any focus on growth institutional promotion should be balanced alongside this space maximisation, as development would back-slide if growth comes at the expense of resilience.

The 'Goldilocks Area' concept then can have different institutional setups yet still have highly developed economies and societies. If one considers *n1* as having the 'perfect' balance of required institutions, then 'rapid' economic development is characterised by an economy's ability to move within area's *i* and stay there over the long run. Countries in area's *j* would likely have imbalances in either growth promoting or resilience promoting institutions that hinder convergence without wholly arresting the process. A country outside of area's *i* and *j*, however, would diverge from the technological frontier. Put another way, if an economy is above the Goldilocks Area, then there has been too much focus on supply-side economics, if it is below then there has been too much focus on demand-side economics.

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13 See *Appendix D* for the Acemoglu, Johnson & Robinson (2004) model.

An example here could be the Latin American region, whose countries have seen particular success for building resilience to shrinking over the last 40 years or so. The 1980s saw their economies on average shrink on average 48% of the time, in essence every other year growth rates were negative. This fell markedly over the proceeding decades to be 11% between 2011-2018. However, average growth rates were also consistently some of the lowest for developing regions, hindering catch-up dynamics, see *Table 1*. Fernandez-Arias (2017) shows that between 1960-2014, Latin American economies were not impeded by factor accumulation or investment, and it was low productivity increases that largely drove gaps in growth rates. A widespread trend for Latin American countries is that productivity is not converging with the frontier, as opposed to East Asian economies that are (Fernandez-Arias, 2017). Moreover, by measuring relative GDP per capita and TFP levels, Fernandez-Arias (2017) posits that TFP levels are only about half of their potential with the typical Latin American economy having the potential to improve productivity by around 81%. Factor accumulation is in line with global levels and policies to help ease this can somewhat help improve productivity, though specific policies will also be needed, without impacting aggregate investment levels (Fernandez-Arias, 2017).

In essence, there is an imbalance that requires a greater shift towards supply-side economics, though institutional reform and continuing to strengthen *social capabilities* must still be a vital part of the development process. The *inclusion* aspect, for example, has seen some success by reducing relative regional poverty levels in Latin America, but income inequality still remains high as the second most unequal region in the world (Gasparini & Cruces, 2013). Whilst a trade-off in demand- and supply-side might be needed, income inequality and poverty must still be brought down so that both growth and resilience can be achieved for catch-up to be successful. Such a prospect of trade-offs offers potentially interesting propositions for a number of fields. For example, a cultural mechanism of entrepreneurial promotion could be around intergenerational transmissions for traits such as risk propensity and patience (Doepke & Zilibotti, 2014). On one level such a prospect would be growth institution encouraging and undoubtedly required for innovation, but too much focus on channelling the ‘entrepreneurial spirit’ could introduce too much risk into an economic system. It must also be noted that there is nothing to say that the Goldilocks Area remains constant over time and space. For example, a country’s factor endowments might naturally give a society more flexibility to respond to shocks whilst their contextual effectiveness might change over time, though such a study is beyond the scope of this thesis.

Table 2: Income variance accounting across countries (%).

	1900	1929	1950	1973	1990	2008
Due to TFP	41	41	63	61	72	70
Due to factor inputs	59	59	37	39	28	30

(Source: Author's recreation from Gallardo Albarran, 2018)[14]

The conversation thus far has been mainly focused on that of convergence, but what implications does this then have when a country does not need to converge? A high-income country at the technological frontier would already be along its production function enough to have built resilience and thus would not have growth rates increase dramatically through factor accumulation. For example, Gallardo Albarran (2018) found that contrary to popular belief, the relative importance of TFP as the primary source of between country income inequality only began to become more important post-1950. *Table 2* shows the relative importance between factor inputs and TFP in explaining the variance of cross-country income inequality during the 20th and 21st centuries. Factor inputs remain relatively large and consistent contributor to growth from 1900 to 1929 at 59%. This changes from 1950 to 1973 by contributing to less than 40% and again slightly less than 30% from 1990 onwards.

This makes perfect sense when one considers the very general historical context. For example, demand-side economics becoming increasingly popular in the 1930s, with Keynes (1936) especially. Western economies in particular would increasingly build resilience to shrinking by moving through their production functions during this period. Inputs percentage of growth contribution would naturally decline as economies approached the technological frontier with an unparalleled European factor accumulation growth between 1955-1973 and productivity growth driven higher by advances in electricity and internal combustion-engines between 1940 and 1955 (Bergeaud, Cette & Lecat, 2016; Gallardo Albarran, 2018; Gordon, 2016). The 1970s saw a general trend towards neoclassical and supply-side economics in Western economies as growth stalled, and economic crises loomed with stagflation[15]. Unsurprisingly, TFP's contribution to growth rates increased even further after this decade and

14 Estimates are based on growth accounting method from Hall & Jones (1999).
15 An economic situation in which rising inflation is coupled with stagnant growth and high unemployment.

Latin American economies would also contribute to such trends through diminished returns on inputs (Fernandez-Arias, 2017).

One thing to note with Gallardo Albarran's (2018) study, however, is that the countries included are mostly today's higher income countries and Latin American economies, with only a few East Asian states included. Returning to Krugman's (1994), he noted how technological convergence did not characterise the East Asian Miracle and it was primarily driven by factor accumulation. The suggestion being that long-term convergence would eventually run out of steam as growth rates decline. However, this has not appeared to be the case, especially for Asia First Tier countries. For example, Bosworth & Collins (2003) would go on to question Krugman's findings, particularly his underlying methodology, in their study of Taiwan, Singapore, and South Korea. These authors would highlight how capital deepening was formidable and much more significant than TFP, but these countries still had very respectable TFP growth between 1960-1990. Furthermore, the East Asian Miracle involved major structural changes, including firm size and sector specialisations, which allowed capital to be successfully assimilated (Nelson & Pack, 1999). The East Asian economies did not only move through their respective production functions as Krugman (1994) would seem to argue, but they were also effectively shifting their production functions as well. These economies were able to harness both growth and resilience institutions to remain in the Goldilocks Area over a long period of time and successfully converge with the developed nations.

The key driver of growth rates at the higher income stage of development is thus seen to come from technological advancement. However, this hides the fact that growth is resilient precisely because a country is further along its production function. Growth rates will naturally turn lower for countries further along their production functions, but they will also experience fewer instances of shrinking. However, if policy is overly focused on increasing growth rates, rather than long-run development, then having more 'advanced' growth institutions could leave resilience institutions weaker, thus economies would be more vulnerable to shocks and shrinking episodes. In short, both growth and building resilience to shrinking are necessary for long-run development to be successful and finding the right institutional balance between the two is the key for convergence to be realised.

4 Concluding Remarks

Growth theory does not take into account the role of shrinking in income divergence patterns, and shrinking has not yet clearly defined itself from growth processes. These research gaps can be rectified by considering growth processes as those that shift the aggregate production function, and resilience to shrinking processes are those that allow for movement through the aggregate production function.

A shift of the production function entails productivity growth through either technological advancement or greater efficiency of input combinations. Potential processes that contribute to such a feat could be encouraging increased investment in R&D, effective property rights, especially intellectual, enforcement, or encouragement for entrepreneurship and innovation (Romer, 1990). More egalitarian resource distributions by lowering income inequality and poverty are also likely to aid growth processes through greater equalities of opportunity and by addressing systemic human capital underinvestment (Cingano, 2014). Such human capital considerations also highlight the importance of clearly identifying the *types* of human capital being considered. Entrepreneurship and innovation are best encouraged by "upper-tail knowledge" with adopting new production techniques requiring an element of technological diffusion (Squicciarini & Voigtländer, 2015). Simply improving general skills and knowledge amongst a population can improve incomes by movement through the production function but this involves separate processes.

A movement through the production function suggests an increase in the growth of inputs, primarily thought of as capital and labour. However, this view is too limited and greater consideration must be given to what is missing or the qualitative implications of such a process. For example, potential processes might entail a weakening of the informal sector of an economy, strengthening the tax administration capacity, and increasing public goods provisions (Andersson, Julia & Palacio, 2021). Poverty can also limit movement through the production function by lowering employment and reducing intergenerational poverty transfers from capital market imperfections that restrict borrowing (Gavin & Hausmann, 1998; Todaro & Smith, 2011). Furthermore, encouraging corporate investment from capital windfall efficiency gains, as opposed to capital-labour share shifts due to increased markups (Karabarbounis & Neiman,

2012; 2014), would also entail greater movement through the production function. This is suggestive for the need of a regulatory environment that can help build resilience to shrinking as well as encourage innovation and growth. What is clear is that generating growth, and maintaining it involves different processes. In this way, growth can be thought of as the *trigger* for long-term development yet building resilience to shrinking can be thought of as the *sustainer* of long-run development patterns.

The combination of these processes implies that an institutional balance is needed as both growth and resilience are required for catch-up to occur. If the focus is too much on growth, then growth rates will be volatile as the production function shifts up too quickly for resilience to be built. If the focus is too much on resilience, then growth rates will be too low, due to diminishing returns to inputs and investment. Over time, one can therefore imagine a 'Goldilocks Area', in which growth and resilience institutions are balanced to the point that income convergence can take place. In essence, this requires a country to both move through its respective production function *and* shift the function itself at an appropriate pace, with implications around balancing both demand- and supply-side economics. The qualitative aspect enters the fray by considering how such institutions are set up so that virtuous processes that encourage both growth and resilience can take place. In a sense, how does development beget more development by allowing society to stay within the Goldilocks Area over long periods.

This thesis does not disagree with the idea that more 'advanced' *social capabilities* are needed to build resilience to shrinking episodes. In fact, social capabilities for both growth and resilience are clearly needed, at least to some extent. The purpose here, however, is to identify the distinct underlying processes to help shrinking differentiate itself clearly from growth so that the field can move forward. Furthermore, it should be remembered that any potential trade-offs in policy that facilitate either growth institutional or resilience institutional developments lie outside of the growth and resilience theory model. However, the great value of the theory lies in its ability to reconceptualise the development process that brings together growth- and resilience-based theories. A fruitful avenue for future research could be to try identifying the limits of the Goldilocks Area and the economies that might be within it. It can also seek to identify the institutional structures that might encourage virtuous cycles of development and the points at which more 'advanced' capabilities are required. In this regard, future research should avoid the trap of focusing alone on labour and capital inputs as the key to building

resilience, and instead seek to recognise the underlying qualitative aspects that govern such processes.

In the meantime, growth and resilience theory specifically outlines how growth and resilience to shrinking processes are two sides of the same coin, and for long-run convergence to happen we should not be focused on flipping the coin, but instead turning it over and inspecting each side carefully.

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Appendix A – List of countries in *Table 1: Growth and shrinking patterns by decade in developing regions*.

Asia First Tier: Hong Kong, Japan, Korea, Singapore, Taiwan.

Asia Second Tier: Bangladesh, Cambodia, China, India, Indonesia, Laos, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam.

Latin America: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela.

Middle East and North Africa (MENA): Algeria, Iran, Iraq, Kuwait, Saudi Arabia, United Arab Emirates, Bahrain, Djibouti, Egypt, Israel, Jordan, Lebanon, Malta, Morocco, Oman, Qatar, Syrian Arab Republic, Tunisia, Yemen.

Sub-Saharan Africa: Angola, Congo, Equatorial Guinea, Gabon, Nigeria, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo, Cote d'Ivoire, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe.

Eastern Europe: Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Latvia, Lithuania, Macedonia, Moldova, Poland, Romania, Russian Federation, Slovak Republic, Slovenia, and Ukraine.

Appendix B – Note on how the social capabilities framework help build resilience to shrinking episodes.

Transformation: This capability is often thought of in terms of transformation away from the agriculture sector to higher productive activities (Timmer, 2009). Structural transformation has long been recognised as a vital component of any development journey. The movement away from agriculture in particular can build resilience by having less of a population reliant on a sector that is prone to exogenous shocks, i.e., weather (Andersson, 2018). Increasing economic complexity can also reflect the level of productive knowledge a society has which might increase their exports goods diversity to be less vulnerable to global market conditions (Hausmann, Hidalgo, Bustos, Coscia, Simoes & Yildirim, 2013). For example, economies that are dependent on single resources, such as non-renewable natural resources, are vulnerable to demand or price slumps.

Inclusion: This capability refers to the broad-based economic participation of a population through access to opportunities and the distribution of productive capabilities (Andersson, 2018). These market characteristics tend to be reflective of dynamic and diversified societies as competitive domestic markets are usually subject to less price fluctuations through greater capacity to resolve supply-side bottlenecks (Andersson, 2018). Growth that is pro-poor is more likely to be sustained (Pritchett & Werker, 2012) and involves dynamics that make it less likely people will fall back into poverty once they have escaped it (Dercon & Shapiro, 2007). In this way, high measures of inequality and poverty tend to limit resilience to shrinking because productive and human capacities are not being fully utilised which might even further exacerbate potential social conflicts (Andersson, 2018).

Autonomy: This capability refers to how well a state can keep vested interests at bay. This can be reflective in a state's capacity to impose direct and progressive tax structures, whilst also keeping mutually beneficial commitments from actors for successful development policies and goals to be achieved (Andersson, 2018). This implies the formation of a consensual and representative government whilst ensuring credible investment commitments can be honoured (Brautigam, Fjeldstad & Moore, 2008). Thus, autonomy helps build resilience to shrinking by

promoting a general development policy in governments that has not been captured by any special interest agenda.

Accountability: This capability is designed to capture the quality of governance and public goods provisions (Besley & Persson, 2013; 2014). The fundamental aspect here is the legitimacy of the government to the governed as tax evasion and under taxing are typical features of lower-income societies (Andersson, 2018). This is particularly worrisome as the reduced tax capacity limits fiscal space for investment and development policy so that virtuous cycles of development are restrained. This is important as "best practice" policies in governance are usually an outcome, rather than a precondition, of resilient development patterns (Levy, 2014). As such, greater resilience to shrinking can be gained by a state's increased ability to provide public goods and smooth potential business cycles.

Social stability: This capability is perhaps the most obvious for resilience to shrinking. However, besides the obvious negative impacts of civil war and strife, a state that needs to commit relatively more resources to conflict resolution has further limited capacity to devote resources to successful development policies (Andersson, 2018). Conflict negatively impacts investment willingness and general business environments as states provide important law and order institutions for contract enforcement and market support (North, Wallis & Weingast, 2009; Rodrik, 1999).

Appendix C – Note on improvements in measuring factor inputs and TFP.

Labour inputs are most often considered as the total number of employees or workers who are employed in production. Long-run productivity studies often benefit by also including average working hours as these are well below historical levels and often show considerable differences between countries (Crafts & Woljter, 2021; Huberman & Minns, 2007). Furthermore, it is also recognised that there are many different types of labour inputs and, as such, quality adjustments can be made by weighting averages earnings and wages. For example, distinctions are usually made between low- and high-skilled workers and average earnings is essentially used to reflect the differences between the marginal productivity of these labour input types. Accounting for this labour quality is often referred to as *labour services*, and output growth from labour can be better accounted for in the sense of better educated or trained workers, as opposed to productivity or technological change (Jorgenson, Ho & Stiroh, 2008).

Capital inputs often take the form of the (real) value of the physical capital stock, such as the book or market value of all assets used in production, or investment flows alongside imputed attrition rates (Crafts & Woljter, 2021). This second method usually rely on asset lifetime assumptions for standardisation which may not be accurate, for example asset lifetime might be necessarily extended if there is an investment collapse (Gordon, 2016). Another method is that capital inputs can be measured as *capital services*, which weights the growth of capital assets by their rental prices, as opposed to the capital stocks weighting by asset price rates (Jorgenson, Ho & Stiroh, 2008). Capital services thus captures 'flows' derived from the capital assets, rather just a measure of all capital structures and equipment (Crafts & Woljter, 2021). Ideally, capital services should be used in studies, especially historic, though critics remain as capital flows invariably deteriorate at a much slower rate than market value depreciation. Furthermore, the problem of needing rental prices of capital by asset remains the primary stumbling block. Capital services, however, account for the relative prices changes between structures and machinery and, because the price of buildings has increased more than machinery, using constant relative prices of more recent years would overestimate capital stocks (Gallardo Albarran, 2018). Moreover, it would also be preferable to distinguish between non-residential and residential structures, and machinery and transport equipment, though this

is non-exhaustive, as well. This approach gives relatively more importance to machinery, and other equipment, in the capital stock which is important as these tend to be more abundant capital assets for higher-income economies. Not accounting for this difference would therefore make it harder to compare developed and developing countries over time and a larger share of income differences would be ascribed to factor accumulation, and not TFP (Crafts & Woljter, 2021).

Studies that use these techniques for correcting labour and capital flows yield cleaner TFP measurements by extension, as TFP is the residual of growth accounting exercises. TFP is, however, is still subject to potentially missing inputs. For example, natural resource discoveries or new land inputs could boost output whilst leaving labour and capital services unchanged, which would appear as higher TFP and suggest, erroneously, that there had been technological advancement. Endogenous growth theory's focus on idea creation also suggests an element of intangible capital that is vital for growth processes, however, as these are extremely difficult to measure are often left to be captured by TFP, though this is not necessarily accurate (Crafts & Woljter, 2021). Furthermore, there also remains considerable controversy around the neutrality of technological change as there is no reason to think that technological advancements could affect factor arguments equally, i.e., Hicks neutrality. It is relatively easy to account for non-neutrality in a production function, but does technological change affect labour productivity, i.e., Harrod neutral, or is it capital-augmenting, i.e., Solow neutral? The answer to this question is still unclear (Crafts & Woljter, 2021). Even accounting for better factor inputs and assuming neutral technological change, however, leaves TFP often still hard to interpret. It is common to ascribe technological advancement to TFP though this still likely captures factor misallocation, policy changes that improve market quality and integration, specialisations or even just omitted variable bias or measurement error (Hulten, 2001). TFP as a measure of technological progress could still largely said to be little further along than when Abramovitz (1956, p.11) first described it as a "measure of our ignorance", yet right now it still remains the best we have got.

Appendix D – Potential model for political and economic institution balancing mechanism.

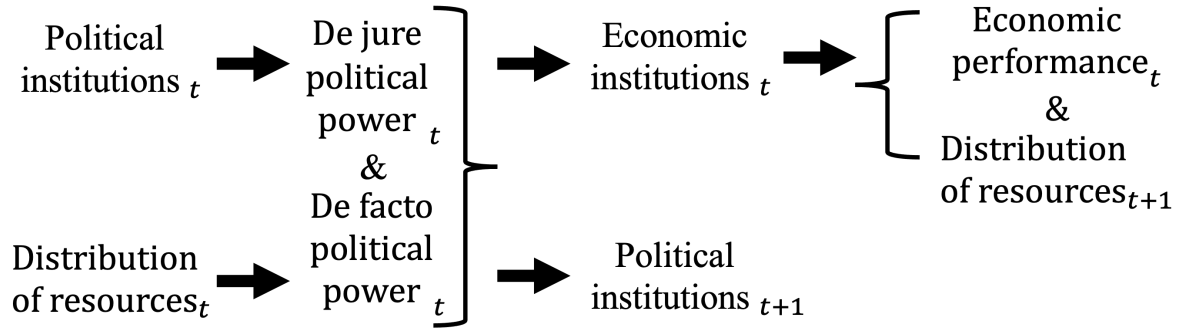

Figure D1: Political and economic institutional theoretical framework. (Source: Author's recreation from Acemoglu, Johnson & Robinson, 2004)