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JEL Classification: D30, O10, O31, O40

Keywords: Economic Growth, Inequality, redistribution

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July 6, 2022

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1 Introduction

Is inequality good or bad for growth? Is there a fundamental trade-off for policymakers between achieving an equal society or a thriving economy? How does inequality evolve at different stages of a capitalist market economy? In particular, will inequality eventually simply fade away with technological progress and economic development or continue to intensify? Although such and related questions have fascinated and preoccupied economic thinkers since the beginning of the discipline's modern history, few clear answers and little consensus have emerged. According to Banerjee and Duflo (2003), this is because the most fundamental questions in economics typically prove to be the most difficult to answer, and the question of the effect of inequality on growth is no exception. However, this by no means implies that no progress on these issues has been made in the last decades—quite the contrary. Consequently, the main objective of this chapter is to provide a critical overview of the theoretical and empirical state of knowledge on the complex interplay between inequality and economic growth. A major complication with respect to this issue is that causality can run both ways. That is, inequality can affect growth, and conversely, growth can affect inequality. This review centers on the first of the two causal relationships: namely, the conditions under which (human) capital accumulation, innovation and economic growth are influenced by the distribution of economic resources. Fundamentally, the objective is to identify a set of mechanisms driving the effect of a more equal distribution of (labor) income and wealth on economic growth—whether beneficial or detrimental. As mentioned, however, there may exist complicated feedback loops from growth to inequality that need to be kept in mind. Nonetheless, due to space constraints, the reverse causal relationship is not discussed. The literature focusing on the dynamics of the distribution of income and wealth over the course of economic development, in particular the famous Kuznets curve hypothesis postulating an inverse U-shaped relationship between growth and inequality, and other "trickle-down" mechanisms are mentioned only in passing.

For the classical economists of the 19th century, above all David Ricardo and Karl Marx, the distribution of production among different classes within society was the central object of study in political economy. In contrast to their central importance and prominence in the 19th century, distributional issues receded considerably from attention in the field of economics over the course of the 20th century. Two reasons, among others, may be given as explanations. First, the very influential theory of Kuznets (1955) suggested that inequality will eventually decline as the economy develops. This extremely positive outlook of naturally diminishing inequality within maturing market economies was a major factor in the decline of interest in inequality within the field of economics (a more detailed discussion along these lines is provided in Piketty, 2014). Second, the triumph of neoclassical growth theory (see particularly Solow, 1956), which relies on representative agent modeling strategies, relegated distributional issues to the margins of mainstream macroeconomics for decades. Indeed, as Atkinson and Bourguignon (2000) noted, many

economists in the second half of the century believed that differences in distributional outcomes were of secondary importance relative to improvements in overall economic performance. This was largely due to the prevailing narrative at the time that there is a fundamental trade-off between growth and equality (Okun, 1975)—specifically, that redistributing economic resources from rich to poor may hamper growth, as higher taxes and subsidies distort economic incentives, eventually leaving everyone worse off. Perhaps the most lucid articulation of this view was provided by Nobel laureate Robert E. Lucas (2004): "Of the tendencies that are harmful to sound economics, the most seductive, and in my opinion the most poisonous, is to focus on questions of distribution." To put the prevailing thinking of the time more succinctly (and rakishly): Economics and economic policy should not be concerned with how to divide up the economic "pie", but how to make it bigger. However, does a trade-off between growth and equality truly exist? Intuitively, at least, it is not hard to think of policies that both reduce inequality and strengthen growth prospects—think, perhaps, of public education. Clearly, public expenditures must be financed, and since lump-sum redistributive instruments are not available in reality, (progressive) taxes and transfers indeed alter incentives and rewards in market interactions. Whether such distortions outweigh the welfare gains from public investment, however, is an empirical question that requires a thorough investigation, a matter covered in Section 5.2.

In the wake of the profound shifts in the distribution of income and wealth both within and across countries in the latter half of the 20th century (see Alvaredo et al., 2017), the relevance of inequality as an object of study has surged since the 1990s and is now back at the heart of macroeconomic analysis. This is clearly reflected in the recent growth literature, which has produced a variety of theoretical models and an enormous body (and range) of empirical results on the relationship between inequality and growth. However, a clear consensus has not yet been reached: existing empirical evidence finds both significant positive and negative effects of inequality on growth. This is perhaps hardly surprising insofar as the various theoretical channels and, in particular, their interplay are considerably more complex than the commonly estimated empirical relationships. Indeed, attempting to estimate a (linear) reduced-form relationship and identify a single parameter that captures the complex inequality-growth effect for all countries at each stage of development seems a rather futile endeavor from the outset. Consequently, theoretical work identifying the multitude of distinct channels through which inequality can promote or hamper growth remains key. A careful examination of these theoretical channels (see Section 3 and 5) is both necessary and promising for two main reasons. First, it permits the existing empirical evidence to be both better understood and reconciled. Thus, it helps bridge the empirical and theoretical literature. Second, an in-depth theoretical understanding of the channels through which inequality affects growth is likely to be key for fruitful future empirical work in this field.

This chapter reviews various interactions between inequality and growth from both a theoretical and empirical perspective, but given the limited scope, it is only possible to highlight the

main issues from this extensive literature. Thus, the review by no means claims to be exhaustive. Furthermore, this chapter relates to, complements, and updates previous surveys of the inequality-growth relationship (Bénabou, 1996; Aghion et al., 1999; Bertola, 2000; Zweimüller, 2000a; Galor, 2009; Voitchovsky, 2011; Neves and Silva, 2014). For a more in-depth formal discussion and treatment of the theoretical models used in the literature, see Bertola et al. (2014). Meta-analyses of the empirical results regarding the effect of inequality on growth can be found in Dominicis et al. (2008) and Neves et al. (2016). The purpose of this chapter, however, is to provide a general and nontechnical overview of current research in the inequality-growth literature while providing the reader with key references for a more in-depth study of the variety of topics touched upon.

The rest of this review is organized as follows. Section 2 introduces and defines some key concepts and terms. In Section 3, the main theoretical channels proposed in the literature are discussed, with different models revealing both positive and negative effects of inequality on economic activity. Section 4 presents and discusses the main reduced-form estimates of the effect of inequality on growth. Therefore, the focus is on methodological aspects and, in particular, on the manifold applied empirical specifications, the variety of which has thus far impeded conclusions from being drawn on the reduced-form relationship. To move a step forward, Section 5 investigates the evidence on the various theoretical channels. In doing so, however, the focus is on a theoretical rather than a strongly empirical-methodological perspective, emphasizing substantive evaluation and interpretation of the results. The final Section 6 concludes and highlights some salient aspects for promising future empirical and theoretical work in this field.

2 Defining Inequality and Growth and its Relationship

The relationship between inequality and growth can be analyzed from three angles: (i) Growth and inequality can be joint outcomes of market interactions and economic policies (see, e.g., Lundberg and Squire, 2003). The neoclassical theory of distribution argues that with perfect markets, technology, and factor endowments, the level of output and its distribution among the factors of capital and labor are determined simultaneously. Thus, technological change likely affects inequality and growth simultaneously. Another relevant example is trade openness. If a country opens to trade, growth and inequality are likely to rise at the same time (Melitz, 2003; Foellmi and Oechslin, 2020). Additionally, government interventions—especially taxation (e.g., Rebelo, 1991) and the provision of public goods, such as education (e.g., Goldin and Katz, 2010)—are arguably the most important forces affecting inequality and growth simultaneously. (ii) Growth may alter inequality. The Kuznets curve hypothesis is the famous articulation of this connection. Kuznets (1955) argued that inequality increases at early stages of economic development as workers move from the traditional to the modern sector and eventually decreases through a trickle-down process

as the modern sector becomes prevalent in the entire economy. Many major theoretical contributions (see, e.g., Greenwood and Jovanovic, 1990; Galor and Tsiddon, 1997; Aghion and Bolton, 1997; Acemoglu and Robinson, 2000) feature a mechanism capable of generating a Kuznets curve. More recent empirical evidence based on long-run inequality series, however, questions the general validity of such a relationship and suggests that historical and political events are more decisive (Piketty, 2014). (iii) Inequality can affect growth. This is the causal link at the heart of this review. In particular, the question of whether there exists a general trade-off between inequality and growth is investigated here. To make the concepts more precise, the aspects of inequality and growth to be examined are defined below.

Inequality. Economic inequality can be measured along several dimensions: (top) incomes, wages, consumption, wealth, land, effort, or opportunity. The empirical literature has largely employed the concepts for which the largest and highest-quality data sets were available—predominantly income (see Table 1). A priori, there is no single correct concept of inequality that should be utilized. Rather, the choice of concept depends on the specific question and, in particular, the relevant theoretical mechanism (see Section 3). In most theoretical channels, as discussed below, the distribution of wealth is the inequality measure of primary interest. Wealth should be broadly defined. In particular, it should include financial and nonfinancial assets—housing wealth and land—net of debt. The primary theoretical channel whereby distribution affects aggregate output and growth is through the impact of individual savings and investment decisions on human or physical capital, and hence, it is the distribution of wealth that matters—regardless of whether that wealth is the result of the accumulation of labor or capital income (Aghion et al., 1999). Note that some factors used in the production of output can be accumulated, while others cannot. In theoretical models, the accumulable factor is sometimes referred to as capital and the nonaccumulable factor as labor. This crude distinction between capital and labor can, however, be misleading, as an individual's human capital, which determines the efficiency of his or her labor, is clearly determined by investment decisions. Hence, accumulable factors (e.g., physical capital, human capital, knowledge), which by definition are determined by (individual) saving behavior, evolve dynamically and, on the other hand, nonaccumulabe factors (e.g., land, natural resources, physical and intellectual abilities) are exogenously determined (see Bertola et al., 2014 for a detailed discussion).

How and with what data inequality can be measured best is a challenging task in itself. The empirical inequality–growth literature, which attempts to estimate a relationship in reduced form, has mostly used a single inequality statistic, the Gini coefficient (see Table 1). However, as shown by Voitchovsky (2005), the use of this sole statistic may be problematic, as it measures only the average effect of inequality on growth and thereby obscures underlying complexity in the relationship. Hence, the appropriate choice of inequality statistic should again be guided by theory, since different channels (see Section 3) refer to inequality at different parts of the

distribution.

Growth. In the analysis of growth, the fundamental object of interest is how people's standard of living and welfare evolve over time. The standard measure used for this purpose is the (annual percentage) change in real per capita GDP. Although the limitations of GDP as a measure of economic welfare are well established (see, e.g., Stiglitz et al., 2009; Jones and Klenow, 2016), it remains the standard metric employed in virtually all of the empirical studies discussed in this review. Growth performance measured by GDP can in turn be captured in several ways: average growth rates, variability of growth, the length of growth spells or the potential of growth to "take off" from stagnation to positive growth rates. Most empirical work typically focuses on per capita growth rates over a somewhat arbitrary period of time, say, five or ten years. Accordingly, these growth measures are the focus of this review. However, there are other interesting studies that examine, for instance, the impact of inequality on the duration of growth spells (see Berg et al., 2012). With respect to real per capita GDP as a measure of growth, two important points should be noted. First, the choice of time period seems to be of great significance with respect to the estimated effect (Halter et al., 2014). Second, the GDP per capita growth rate is an average measure. This implies that positive per capita growth improves income and living standards on average but not necessarily for everyone within a society, perhaps not even for the majority. Consequently, the topic of "inequality of growth" rates is discussed at the end of Section 4.2.

3 Theoretical Channels from Inequality to Growth

The prevailing neoclassical paradigm removed distributional considerations from mainstream macroeconomic analysis for a long period. By building on representative-agent modeling strategies and thus discarding heterogeneity among agents, the neoclassical approach allows investigation of efficiency without having to consider distributional issues. Consequently, it abstracts from the causal link connecting inequality to economic growth, which was prominent in classical economics. By focusing on averages, neoclassical growth theory has undoubtedly made an extremely meaningful and significant contribution to the understanding of long-run growth, and its clarity and tractability continue to make it an appropriate starting point for understanding growth today. This is particularly evident from the fact that virtually any discussion of growth in contemporary macroeconomics textbooks starts with the Solow and Ramsey models. However, since neoclassical growth theory was first proposed, the theoretical literature has come a long way in reintroducing heterogeneity into the field of macroeconomics. In particular, since the 1990s, a variety of distinct rationales for both positive and negative channels linking inequality to growth have been put forward. In the following subsections, the main theoretical channels identified in the literature, under both the classical and modern approaches, are discussed from a basic perspective. Some more recent theoretical contributions are discussed along with the empirical evidence on the specific

channels in Section 5.

3.1 Unequal Propensity to Save

Early on, Fisher (1930) and Keynes (1936) and later the post-Keynesians (see, e.g., Kaldor, 1955; Kaldor, 1957; Pasinetti, 1962) argued that the marginal propensity to save is an increasing function of wealth—that the rich save relatively more than the poor. If the saving function is convex, inequality **positively** affects capital accumulation and hence growth accordingly. As a polar case, Stiglitz (1969) demonstrates that under neoclassical assumptions and with a linear savings function, wealth and income inequality have no effect on the long-run behavior of the economy. When the savings function is convex, however, as subsequently shown by Bourguignon (1981), unequal societies have higher aggregate savings and investment, leading to faster growth. Moreover, and perhaps surprisingly, an unequal society (steady state) is Pareto superior to an egalitarian society: the income and capital of both the poor and the rich are higher in the inegalitarian steady state.

3.2 The Equity–Efficiency Trade-off

A second argument for why inequality might be **pro**-growth builds on incentives. When there are no or small income differences, incentives to engage in time-consuming or risky investment activities are limited. Hence, inequality serves as a motivator to invest in education or physical capital. This rationale was first formally presented in a seminal contribution by Mirrlees (1971). The core premise, established in the context of optimal labor income taxation by Mirrlees (1971), is that tax authorities—or, to be more precise, a utilitarian social planner within the model—seek a tax system that maximizes social welfare. The problem that tax authorities face, however, is that the innate ability of the agents whom they wish to tax is unobservable to them and, hence, they resort to labor income as the best available proxy for ability, which ultimately gives rise to a conspicuous moral hazard problem. By taxing income rather than ability, tax authorities distort economic incentives: Higher taxes translate into lower returns from work, which discourages individuals from exerting effort (or investing in education), which in turn reduces output and growth. Although this Mirrleesian reasoning is mostly employed within the context of taxation, it is not contingent upon it. When effort is difficult or costly to monitor and consequently moral hazard may arise, an unequal distribution of income may create positive economic incentives for effort and investment (Lazear and Rosen, 1981), eventually leading to greater output.

The Mirrlees approach outlined above provides the foundation for the famous classic **trade-off between equality and efficiency**. Equality and growth may not be achieved simultaneously because redistribution, while it might create more equality, comes at some efficiency cost. This view is most famously articulated in Okun's (1975) leaky bucket metaphor: "The money must be carried from the rich to the poor in a leaky bucket. Some of it will simply disappear in

transit, so the poor will not receive all the money that is taken from the rich." This basic logic of this trade-off is also present in the growth literature. Rebelo (1991) has demonstrated, using endogenous growth models where output is proportional to physical capital, that higher tax rates lower the rate of return on private investment. This downward distortion of savings incentives leads to a permanent decline in the rate of capital accumulation and economic growth. This is the central message of the equity–efficiency trade-off. Whenever the return to investment is decreased, through redistribution or changed economic circumstances, savings or education incentives are reduced, which lowers growth. As Rebelo (1991) shows, this argument is not restricted to perfect markets but also holds in an environment with increasing returns to scale. However, Aghion and Howitt (1992) argue that excessively high levels of inequality could lead to less investment: A new entrant might be deterred from investing in R&D if the income/technology gap relative to the incumbent is too large. Moreover, greater equality through (tax-financed) redistribution may well trigger higher investment in infrastructure, education and healthcare, thus dampening or even reversing the negative growth effects of taxation (see Section 5.2).

3.3 The Classical Political Economy Approach: Endogenous Fiscal Policy

The finding above raises a another issue. Apparently, the negative effects of taxation may be substantial and have potentially significant negative effects on long-term growth. Why, then, are taxes introduced at all? This is where the classical political economy growth approach steps in. Combining endogenous growth with the political economy mechanisms of majority voting (e.g., Meltzer and Richard, 1981), which endogenizes the tax rate decision, a number of highly influential studies (in particular, Bertola, 1993; Persson and Tabellini, 1994; and Alesina and Rodrik, 1994) established a **negative** link from inequality to growth. Although the models in this literature differ—see Bénabou (1996) for a comprehensive discussion which provides an excellent overview of this literature along with several interesting extensions of the models cited—the basic reasoning and theoretical account of causation are broadly similar: In a democracy, or more generally in a system with majority voting, the median voter is decisive and thus sets the tax rate. Because the median voter is poorer than the average individual in society (wealth distributions are right-skewed), he or she votes for increased redistribution. Insofar as the distribution of income and wealth becomes more right-skewed, the tax rate rises. Consequently, more unequal societies end up with higher taxes, more distorted economic incentives, and thus lower long-term growth.

3.4 The Sociopolitical Instability Approach: Instability, Conflict and Institutions

The sociopolitical instability approach (see, e.g., Alesina et al., 1996; Benhabib and Rustichini, 1996; Bénabou, 1996) is yet another channel by which inequality has a **negative** effect on economic growth. The general rationale of the approach is fairly straightforward: more (wealth)

inequality causes people to pursue social activities outside regular markets, such as crime (see, e.g., Fajnzylber et al., 2002), sociopolitical unrest, violent protests, revolutions and civil wars (see Blattman and Miguel, 2010). Such sociopolitical instabilities and conflicts fuel insecurity, mistrust and negative economic prospects. This in turn discourages investment and capital accumulation and thus depresses long-run growth. The argument that greater inequality leads to more conflict is, of course, a rather stark oversimplification. In fact, the effect of distribution on conflict might be highly nonlinear and surprisingly complex (see Esteban and Ray, 1999).

A much-emphasized and closely intertwined issue is that economic inequality and social polarization may impede the securing of property rights, resulting in a decline in investment and growth. For example, in unequal societies, governments may underinvest in their legal infrastructure (Svensson, 1998) or make more unstable (volatile) decisions (Keefer and Knack, 2002), or the rich may abuse political and legal institutions for their own benefit (Glaeser et al., 2003). Moreover, Rodrik (1999) has argued that the economic consequences of a negative exogenous shock are exacerbated by the distributional conflicts that these shocks trigger when social cleavages in a society are profound and conflict management institutions are weak. The importance of economic institutions—such as the structure of property rights and the functioning of markets—for economic development has long been recognized and documented (see, e.g., Hall and Jones, 1999; Acemoglu et al., 2001; Acemoglu et al., 2002). However, institutions are themselves endogenous and are thus determined by a variety of factors, including inequality (Sokoloff and Engerman, 2000). The question of how growth-enhancing economic institutions emerge, however, is beyond the scope of this survey (for literature (reviews) on this issue, see Acemoglu et al. (2005), Acemoglu and Robinson (2012), Acemoglu et al. (2014), and references therein).

3.5 The Credit Market Imperfection Approach: Barriers to Accumulation

Many barriers to the accumulation of (human) capital, such as lack of access to education and health services or, more generally, socio-economic background, exist and are economically relevant because individuals cannot fully participate in the credit market. The credit market imperfection approach therefore typically points to a **negative** effect of inequality on growth. The seminal article by Galor and Zeira (1993) rested on two central assumptions that have generally been maintained in the subsequent literature. First, borrowing is limited (or, in extreme cases, impossible). Second, there are fixed costs involved in investments. Galor and Zeira (1993) argue that the poor cannot adequately invest in their human capital, as they do not have sufficient wealth and have no access to credit. The wealthy, on the other hand, do not need to borrow and can therefore afford to invest in human capital. Inefficiency occurs if the wealth distribution does not coincide with the distribution of innate abilities. Since it is unlikely that there exists a perfect correlation between ability (and thus returns to investment) and wealth, wealth inequality leads the poor to underinvest in human capital, which negatively affects the overall level of human

capital and thus economic growth in both the short and long run. This argument is true for investment in physical capital, as well. When access to borrowing is limited, promising business ideas might not be realized (Foellmi and Oechslin, 2010), or firms may not adopt more productive technologies, thereby reducing long-term growth (Foellmi and Oechslin, 2020).

In the seminal Galor and Zeira (1993) model, inequality and credit constraints lead to investment decisions in education that effectively segment the labor force into skilled and unskilled workers, thus determining long-run output. Similarly, Banerjee and Newman (1993) analyze the effect of wealth inequality on the decision to become a worker or an entrepreneur. Again, with imperfect credit markets and fixed costs associated with entrepreneurial activities, wealth inequality can lead to underinvestment in entrepreneurial activities and thus be detrimental to economic growth. The subsequent literature has modified and advanced the capital market imperfection approach along many dimensions. For instance, even when limited borrowing is possible, poor people in need of borrowing have to pay back a share of the returns when they become successful. This, however, limits the efforts of the poor in first place, as argued by Aghion and Bolton (1997) and Piketty (1997). In addition, the limited opportunity to invest in human capital may result in a changed quality–quantity trade-off in fertility decisions. Credit-constrained poor households may have more children and invest little in education (see, e.g., Kremer and Chen, 2002 and De La Croix and Doepke, 2003). This mechanism explains why inequality is perpetuated, since the high number of children and the low level of human capital hinder poor households from building capital.

Under some circumstances, however, inequality might promote growth even with capital market imperfections, as the fixed costs of investment present a nonconvexity. Without inequality, there might be no households with sufficient funds to surpass the investment threshold, creating a positive link between inequality, investment, and subsequent growth. When a household's wealth level is close enough to the investment threshold, high savings or hard work might allow poor people to reach the minimum level of investment needed in a future period (see, e.g., Ghatak et al., 2001). Even with convex technology, as Foellmi and Oechslin (2008) argue, higher inequality decreases capital demand and the interest rate. The lowered interest might ease access to credit for poor people where the marginal product of investing in human capital is large.

Galor and Moav (2004) unify the savings argument (see Section 3.1) with the credit market imperfection approach. In particular, they argue that the impact of inequality on growth reverses over the course of development. At early stages, when countries switch from stagnation to a process of sustained growth, physical investment is the main driver of growth, but it is replaced by education at later stages of development. Inequality may thus be beneficial to growth at earlier stages of development but detrimental in later phases due to potential credit constraints. Beyond this, Galor et al. (2009) argue that high land inequality negatively affects human capital accumulation, as land-owning elites retard economy-wide investment in human capital, such as

public schooling, that would allow capital market imperfections to be overcome. The arguments for why inequality promotes growth, at least temporarily, bear a commonality: they typically postulate a trickle-down process. Higher savings and investment lower interest rates or increase wages; through this mechanism, the wealth of the rich eventually raises the incomes of the poor.

Returning to the initial argument in this subsection: What kind of inequality underlies these barriers to accumulation? Marrero and Rodríguez (2013) emphasize that income inequality can be understood as inequality of effort (IE) and inequality of opportunity (IO). In theory, however, IE and IO have opposite effects on economic growth: The arguments in Section 3.2 suggest that IE has a positive effect while IO has a negative effect, as discussed in this section. The negative effect of IO arises because not the most talented individuals—i.e., those with the highest returns on investment—but rather those with a more privileged social background are able to accumulate more (human) capital. The influential work by Chetty et al. (2020) documents that racial disparities in the United States are rooted in differences in intergenerational mobility, a strong sign for inequality of opportunity. With regard to this debate, Roemer and Trannoy (2016) give a detailed overview of the philosophical foundation on whether inequality is morally (un)acceptable. The theories discussed there distinguish between processes and outcomes, thus (in)equality of opportunity becomes a central issue.

3.6 The Demand-Driven Innovation Approach: Prize and Market Size Effects

The channels above do not consider demand effects resulting from Engel's law, i.e., that consumption becomes more diverse as income rises. However, under nonhomothetic preferences, (income) inequality and the corresponding distribution of purchasing power across individuals alter the incentives for entrepreneurs to undertake R&D and thus affect innovation and growth. Due to Engel's law, rising incomes are predominantly spent on new products. Consequently, income-dependent demand implies that the income distribution influences the market size for innovations. Note that this effect is not limited to a closed economy setup. Based on a trade model with increasing returns to scale, Matsuyama (2019) argues that domestic demand composition can affect domestic supply more than proportionally when a country opens to trade. Therefore, domestic demand continues to play a distinct role for innovation as long as there are some trade barriers.

For an innovator to develop a new or better product or process technology, he or she must pay a fixed R&D cost ex ante. Because the initial R&D outlays constitute fixed costs, the economic mechanism bears similarities to the opportunity-creation effect of investment discussed in the models with financial market imperfections above. The demand for innovation depends on market size, that is, how many consumers can afford the new product, which typically leads to an ambiguous relationship between inequality and growth (see the static model of Murphy et al.,

1989 and the subsequent dynamic models of Zweimüller, 2000b and Matsuyama, 2002). These papers, however, abstract from the possibility of innovators trying to extract the purchasing power of the rich by setting higher prices. Foellmi and Zweimüller (2006) develop an endogenous growth model that studies monopolistic price setting. They show that when price effects dominate market-size effects, higher inequality is favorable for growth. Whenever process innovations—for which the market size is of greater importance—are relevant for growth, as in Foellmi et al. (2014), excessively high inequality could be detrimental to growth, while an intermediate level of inequality renders a maximal growth rate. Foellmi and Zweimüller (2017) summarize the interplay of price and market-size effects in a parsimonious framework of horizontal innovations. They conclude that innovations are fostered if there are rich consumers willing to pay high prices for new products. On the other hand, profitable innovations require sufficiently large markets, which may be lacking when incomes are concentrated among a small number of rich households. Hence, an intermediate level of inequality would lead to a maximal growth rate.

3.7 Two Remarks on the Difference between Positive and Negative Channels

This section has discussed theoretical channels that point to both negative and positive links from inequality to growth. The extent to which the various theoretical channels examined are empirically supported by the data is addressed in Section 5. At this juncture, however, it is worth noting two important insights from the literature regarding the different mechanisms of action between the positive and negative channels. First, as argued by Voitchovsky (2005), most positive channels can be associated with inequality at the top end of the distribution, while many negative channels are attributed to inequality at the bottom end. Second, as explained in more depth in Halter et al. (2014), most of the positive channels are based on mechanisms focusing on incentives or market distortions. Insofar as the latter are limited and can be improved significantly through reforms, the mentioned economic mechanisms are more short-term in nature. The negative channels, on the other hand, operate through changes in political and economic institutions and social norms or highlight economic forces affecting changes in educational attainment, making the negative effects more likely to be experienced in the long run.

4 Reduced-Form Evidence on the Effect of Inequality on Growth

The stream of empirical literature attempting to estimate the effect of inequality on economic growth in reduced form sprang up in the mid-1990s and continues to grow to this day. After nearly 30 years of extensive research on this issue, no empirical consensus has yet been reached, but some insights have emerged. In this section, a review of this voluminous empirical literature—with a focus on more recent research—is presented, and some key lessons are highlighted. The differences in the results are due to several factors: the quality and comparability of the data, the

data structure and estimation techniques, the country sample selection, the inequality concept and statistics applied, and the length of growth periods considered. Table 1 provides a systematic overview of the empirical literature reviewed in this section.

4.1 A (Too) Early Consensus from Cross-Country Regressions

In the mid-1990s, a number of influential papers (Persson and Tabellini, 1994; Alesina and Rodrik, 1994; Clarke, 1995; Perotti, 1996) ran standard reduced-form OLS regressions on cross-sectional data from a sample of developed and developing countries to estimate the effect of inequality on growth. Essentially, these studies linearly regressed the average real GDP growth rate per capita over a long period (approximately 20 years) on initial inequality (mostly measured by the income Gini) and some standard growth controls, as identified by Barro (1991). While there were some methodological differences in this first wave of empirical inequality–growth research, the overall finding and conclusion was that more inequality generally hinders future growth (see Bénabou, 1996 for a comprehensive review of this early literature).

4.2 New Data, New Inequality Concepts, New Estimation Techniques and New Results

With the introduction of Deininger and Squire's (1996) more comprehensive and higher-quality dataset (henceforth the DS dataset), the early consensus of the mid-1990s that there exists a negative effect of inequality on growth was soon challenged by a new wave of research. The subsequent literature has raised a number of criticisms, which are discussed in turn below.

Quality and Comparability of the Data. A major concern regarding the first wave of research was the dubious quality of the data on which the results were based (see, e.g., Deininger and Squire, 1996; Deininger and Squire, 1998). The introduction of the DS dataset doubtless represented a significant advancement over previous compilations, in terms of both quality and coverage, although it raised concerns as well (see, e.g., Atkinson and Brandolini, 2001). This is reflected by the fact that since then, most research has used the DS dataset or its successor, the World Income Inequality Database (WIID). Most intriguingly, however, the introduction of the DS dataset has not fundamentally altered the main conclusions of earlier studies. Deininger and Squire (1998) conclude that the main results of previous studies are not affected by the use of their higher-quality data set: initial income inequality has a negative effect on subsequent growth.

Although the quality of the WIID remains a subject of lively debate (see, e.g., Atkinson and Brandolini, 2009; Jenkins, 2015; Solt, 2015), it is undeniable that this database has improved significantly over the past two decades. In its current version, the WIID covers 200 countries with over 3,700 unique country-year observations (UNU-WIDER). Continuous improvement in the quality and coverage of income inequality data is, of course, valuable in itself, but this by no means implies that this is sufficient to overcome the difficulties encountered in the empirical literature

reviewed in this section. The failure to reach a consensus on the inequality-growth relationship, despite significant improvements in data quality, suggests that there are more fundamental issues to be addressed.

Data Structure and Estimation Techniques. Another main concern with the first wave of empirical work based on cross-sectional data was potential bias due to omitted variables (see Forbes, 2000 for a detailed discussion). The apprehension was that time-invariant (unobservable) country characteristics (e.g., geography, institutional and governmental quality, labor market institutions, production technologies) might be correlated with inequality and growth, causing a bias in the reduced-form estimates. Two main approaches have been adopted in the literature to avoid possible omitted variable bias resulting from time-invariant country-specific effects. First, panel data techniques such as fixed effect (FE) and first-difference generalized method of moments (D-GMM) models have become newly applicable with the introduction of the DS panel data set. Second, panel estimation techniques have also been applied at the US cross-state level (Partridge, 1997; Panizza, 2002). Early results from panel data studies tend to find a positive relationship from inequality to subsequent growth (Partridge, 1997; Li and Zou, 1998; Forbes, 2000) or no robust and significant relationship between the two (Panizza, 2002; Barro, 2000). The general conclusion has been that cross-sectional OLS estimates for long-run growth rates yield a negative effect of inequality on growth while panel estimates for shorter growth periods find a positive effect (Voitchovsky, 2011).

In contrast, Banerjee and Duflo (2003) apply nonparametric methods to show that changes in inequality (both positive and negative) are associated with lower growth in the future. Their main argument is that applying a linear model (OLS, FE, GMM) to a nonlinear relationship—for which they provide evidence—may result in very misleading conclusions. Furthermore, Herzer and Vollmer (2012) have argued that the standard panel estimators used in the literature discussed above may suffer from slope heterogeneity and endogenous regressors, problems that might be addressed by using heterogeneous panel cointegration estimators. In particular, they apply the between-dimension group-mean panel dynamic OLS (DOLS) estimator proposed by Pedroni (2001). It should be noted, however, that this approach has not been widely adopted in the empirical inequality–growth literature and that most studies still rely on the popular system GMM (S-GMM) estimator proposed by Blundell and Bond (1998). The S-GMM estimator has several advantages over estimators previously utilized in the literature and is hence suitable (in principle) for examining the inequality–growth relationship and for performing growth empirics in general. However, a word of caution is warranted. There is growing concern that weak instruments in S-GMM models may produce spurious results, both in general growth empirics (see Bazzi and Clemens, 2013) and in the empirical inequality–growth literature (see Kraay, 2015). To alleviate such concerns and to provide evidence of consistency, a number of different diagnostic tests regarding weak instruments, as proposed by Bazzi and Clemens (2013) and Kraay (2015), should

be performed. Recent studies also rely on quasi-experimental policy changes. Bartels et al. (2022) exploit the variation in historical land inheritance rules in Germany using a graphical regression discontinuity design—to show that a more equal distribution of land resulted in higher average incomes.

Country Sample Selection. Selection of the country sample is likely to be a critical factor in determining which reduced-form results are obtained. For instance, Galor and Moav (2004) have argued that the positive effects of inequality on growth are reversed as an economy moves from the early to more advanced stages of development. Another theoretical prediction is that the endogenous fiscal policy channel via the median voter theorem applies only to democracies and not to nondemocracies. While Persson and Tabellini (1994) find support for this premise, others do not (Alesina and Rodrik, 1994). At issue is that democracies are predominantly rich countries, making it empirically difficult to distinguish an income effect from a democracy effect in the relationship between inequality and growth (Perotti, 1996). Nevertheless, many scholars have divided their samples into poor and rich countries to test whether there is a heterogeneous effect of inequality on growth. What do these subsampling exercises reveal about the reduced-form estimates? A number of studies find no significant difference between developing and developed countries regarding the impact of inequality on growth (Deininger and Squire, 1998; Forbes, 2000; Castelló and Doménech, 2002; Herzer and Vollmer, 2012). Many other papers that find a negative (or no) effect in the full sample generally conclude that inequality has a negative effect on subsequent growth in poor countries and no clear or a positive effect in rich countries (Barro, 2000; Castelló-Climent, 2010; Chambers and Krause, 2010; Gründler and Scheuermeyer, 2018). Facing the potential complications arising from the vast heterogeneity across countries and consequently for sample selection, several studies have opted for an alternative empirical strategy and investigated the inequality-growth nexus by examining subnational variations at, for example, the U.S. state level. Yet this has not resulted, at least for the U.S., in a clear consensus as well on the actual nature of the relationship (see Table 1).

The review of country samples provides two important insights. First and foremost, there is ample evidence that country sampling plays a crucial role in many empirical applications and should therefore be critically evaluated and justified. Second, there is at least some evidence that the negative effect of inequality on growth works through poor countries rather than the other way around, which may be viewed as suggestive evidence for the credit market imperfection channel (see Sections 3.5 and 5.3).

Measuring Inequality. The precise measurement of inequality is a salient issue to the reduced-form estimation. In particular, what is the right (i) inequality concept: inequality of income; wages; wealth; land; or opportunity and (ii) inequality statistic: the Gini coefficient; the Theil index; quintile shares, to cite only some examples, that should be used in empirical work?

And how does the choice of these different inequality concepts and inequality statistics affect the empirical estimates?

(i) Inequality Concept. Generally, wealth is a theoretically superior concept to income inequality for measuring the impact of inequality on growth (Aghion et al., 1999). For most of the theoretical channels discussed in Section 3, different wealth levels are decisive. However, due to data availability, the empirical literature has relied almost exclusively on income measures (see Table 1). But even when studying income as a concept of inequality, ambiguities in results may arise. For instance, Knowles (2005) has shown that whether the data correspond to gross income, net income or expenditures, as well as to individuals or households, is pertinent to determining the effects of inequality on growth. In a limited number of cases, the distribution of wealth has been approximated by the distribution of land (Alesina and Rodrik, 1994; Birdsall and Londoño, 1997; Deininger and Squire, 1998). Indeed, this work has established that land inequality has a stronger negative impact on growth than income inequality—the coefficient on the income Gini is often no longer significant when both inequality measures are included. Castelló and Doménech (2002) and Castelló-Climent (2010) have instead emphasized the role of human capital inequality as the critical concept for measuring the impact of inequality on growth. Although the concepts of human capital inequality and land inequality differ markedly, a general pattern emerges. Again, wealth inequality, as measured by human capital inequality, seems to yield more robust results, with the identified effects borne particularly by less developed countries. However, both human capital and land are arguably rather imprecise measures of net wealth at market values. Braggion et al. (2021) are the first to use an improved measure of financial and housing wealth inequality to examine the impact of wealth inequality on business formation and economic development at the US metropolitan statistical area (MSA) level. They find that wealth inequality economically and statistically significantly reduces business creation and leads to lower per capita income growth rates, in line with the theoretical predictions of Foellmi and Oechslin (2020) on wealth inequality and entrepreneurship. Surprisingly, however, they find that when they include both the financial wealth and income Ginis, the former remains roughly unchanged (a statistically negative effect), while the coefficient on the latter is statistically positive. From this, they conclude that (financial) wealth inequality slows entrepreneurship while income inequality promotes it through supply-side effects. However, it may be noted that Aghion et al. (2019) have shown that the causal link between income inequality and innovation may run well in the other direction as well: Their IV results indicate that a 1 percent increase in innovation (as measured by the number of patents) raises the income share of the top 1 percent by 0.2 percent. In general, the empirical evidence discussed above has yet to be confirmed by properly measured wealth inequality. In particular, the interplay of income and wealth inequality statistics in growth regressions does not yet seem to be thoroughly explored. This might, however, be feasible in the near future, at least for a shorter period of time and for developed economies. The World Inequality Database (WID.world), for

instance, is currently aiming to compile new and comparable data on wealth inequality. The relationship between inequality of opportunity and growth is discussed in more detail in Section 5.4.

(ii) Inequality Statistic. The second issue raised involves which statistic is most suitable for measuring inequality in the growth context. Most (early) empirical work utilized the most popular inequality measure, the Gini coefficient. In an important contribution, Voitchovsky (2005) demonstrated that the use of a single inequality statistic—like the Gini—may obscure the complexity of the inequality–growth relationship and lead to nonsignificant results. However, she finds that if a measure of inequality at the top and bottom end of the distribution is included in a regression simultaneously, inequality at the top tends to be positively associated with growth but inequality at the bottom negatively related to growth. Likewise, Cingano (2014) supports the finding of a negative effect of income inequality at the bottom of the distribution, while the effect on future growth of inequality at the top appears not to be robust or significant. However, a recent study by Litschig and Lombardi (2019) arrives at the opposite result. They exploit differences among 3,659 Brazilian municipalities over the period 1970-2010 and find that inequality at the bottom of the distribution has a positive effect on economic growth, while inequality at the top has no effect. These new results contrast sharply with Voitchovsky's (2005) earlier findings that inequality at the bottom of the distribution is negatively associated and inequality at the top positively associated with growth. Litschig and Lombardi (2019) suggest that these differences are due to a conceptual difficulty in Voitchovsky's (2005) work. Voitchovsky's (2005) regression specifications generally include percentile ratios along with the Gini coefficient in the same equation. However, as Litschig and Lombardi (2019) point out, if the Gini coefficient remains constant, a higher 90/75 income percentile ratio necessarily implies that inequality in other parts of the distribution must be lower. This, they argue, is troublesome because it is therefore not clear what the coefficient on the 90/75 income percentile ratio is truly picking up. Thus, whether inequality at the bottom end of the distribution favors or hinders subsequent growth remains a contentious issue. However, it seems apparent that a single inequality statistic is unlikely to be sufficient to capture the full complexity of the relationship from inequality to growth.

Measuring Growth. The standard metric for assessing a country's growth performance is the growth rate of GDP per capita. Hence, this is what has been used (almost exclusively) in the empirical inequality-growth literature. However, two points are worth noting. (i) Which growth periods have been considered and how has this affected the estimation results? And (ii) is an average measure of growth a meaningful metric in the context of inequality?

(i) Length of Growth Period. Recall that cross-country regressions (e.g., Alesina and Rodrik, 1994) find a negative effect, while panel studies (e.g., Forbes, 2000) find a beneficial effect of inequality on growth. This difference is partly explained by the fact that cross-sectional studies use much longer growth periods than panel studies (see Table 1). Indeed, Forbes herself

emphasizes that her estimates of a short-term positive effect (based on 5-year growth periods) are not necessarily inconsistent with the long-term negative relationship previously reported. In line with this, Halter et al. (2014) argue that the positive channels are based on purely economic mechanisms related to market incentives and therefore materialize in the short or medium run. The negative channels, on the other hand, operate through political, institutional, and educational systems, the effects of which are much longer run in nature. Consistent with this argument, the authors present empirical evidence on the differential lag structure of the effects of inequality on growth. Their baseline result is that a rise in inequality has a positive effect on growth in the subsequent five-year period, while it reduces growth in the five-year period after the initial one. The overall long-term impact of higher inequality (over a 10-year growth period) tends to be negative.

(ii) Inequality of Growth. An important limitation of the existing literature has recently been highlighted by Van der Weide and Milanovic (2018). Namely, all previous papers discussed in this review have exclusively examined how inequality affects average income growth rates. As Van der Weide and Milanovic (2018) note, this seems somewhat paradoxical. After all, one might suppose that we should be particularly interested in how inequality affects the income trajectories of individuals located at very different points in the income distribution. Using US state-level data for the period 1960 to 2010, Van der Weide and Milanovic (2018) examine whether and how inequality affects income growth differently across various percentiles of the income distribution. In essence, they find that in the US, initial inequality is negatively associated with subsequent growth rates among poorer income percentiles and positively related among higher percentiles. Recent evidence by Marrero et al. (2021) documents that at least part of this effect may be due to racial and gender inequalities. These findings suggest that more research along these lines is warranted. First, an obvious next step in order to generalize these results is to extend this type of analysis to other countries and/or in a cross-country framework. Second, a more thorough exploration of the mechanisms that cause inequality to affect growth unevenly along the income distribution is needed. Moreover, the finding that inequality in different parts of the distribution affects subsequent average growth unequally may be taken into account. To wit: Is inequality at the bottom or at the top of the distribution causing different rates of income growth along the distribution?

4.3 Still No Consensus from Reduced-Form Cross-Country Estimates

This subsection presents the latest wave of empirical inequality–growth research in reduced form at the cross-country level, which has experienced a strong resurgence since 2018. However, the results remain divergent. Therefore, this survey is reluctant to draw a firm conclusion, as the debate continues and more research is needed.

Even just since 2018, a large body of empirical work has found positive, negative, or no effects

of inequality on growth. In these works, in comparison to previous cross-country research, the data quality and sample selection appear to be less determinant. An exception is Scholl and Klasen (2019), who caution that the positive growth effect of inequality they identify is driven exclusively by transition countries (post-Soviet states).

Much more critical are the differences in estimation techniques. While studies using the popular S-GMM estimator on large country samples consistently find a negative effect of income inequality on economic growth (see, e.g., Berg et al., 2018; Gründler and Scheuermeyer, 2018; Breunig and Majeed, 2020), alternative estimation techniques yield more diverse results. In particular, El-Shagi and Shao (2019) have argued that other estimators—such as the least squares dummy variable (LSDV) estimator—may provide more reliable results in the inequality-growth context. Using LSDV estimates, they indeed reach a different conclusion, namely, that inequality has a positive growth effect in the medium run. Similarly, Brueckner and Lederman's (2018) IV regression results suggest a positive relationship in the full sample. In particular, they find a positive growth effect of inequality for poor countries and a negative effect for developed economies. These results are diametrically opposed to the results of Gründler and Scheuermeyer (2018), who rely on the S-GMM estimation method. To proceed and to better understand these contradictory findings, it appears crucial to better understand how the various estimation procedures drive the reduced-form results. Accordingly, further methodological research on the various estimators used in the growth literature will be key.

5 Evidence on Specific Theoretical Channels

The debate over the reduced-form evidence on the link from inequality to economic growth remains open. To make progress, it makes sense to scrutinize the underlying economic mechanisms to better understand the different influence channels. Therefore, this section provides empirical evidence on the specific channels presented in Section 3.

5.1 Do the Rich Save More than the Poor?

While the empirical underpinning of the convexity of the saving function (see Section 3.1 for theoretical arguments) was rather controversial in early empirical work, the seminal contribution by Dynan et al. (2004) documents this relationship using household survey data. More recent research based on micro data (see, e.g., Parker et al., 2013 and Gandelman, 2017) supports the empirical findings of Dynan et al. (2004), showing that there is a positive relationship between (lifetime) income and the marginal propensity to save. In addition, Fagereng et al. (2020) find large differences in returns across the wealth distribution that are not merely due to differences in wealth allocation between safe and risky assets. Hence, the positive impact of inequality on growth through the savings channel might even be amplified by heterogeneous asset returns, as

wealthier individuals not only have a higher propensity to save but also earn higher returns on their savings.

5.2 How Does Redistribution Affect Economic Growth?

The theoretical arguments on incentives, taxation and political economy discussed in Sections 3.2 and 3.3 raise the key empirical question of how taxation affects long-run growth. Recall that the endogenous fiscal policy channel posits a link between inequality and growth operating through two mechanisms: (i) Democratic countries with a more unequal income and/or wealth distribution adopt higher taxes (in accordance with the median voter theorem), and (ii) these higher taxes reduce economic growth (via the general equity–efficiency trade-off rationale). These two principal propositions are discussed in turn.

Do More Unequal (Democratic) Countries Redistribute More? Answering this question empirically is challenging for several reasons. First, note that the redistribution hypothesis and the median voter hypothesis are not the same (Milanovic, 2010). The former states that more redistribution occurs when market inequality increases, while the latter provides one particular theoretical explanation for why this might be the case. Indeed, the link from inequality to redistribution is theoretically ambiguous. More market inequality, i.e., before redistribution, may cause more redistribution through the median voter channel. However, greater inequality also implies that the wealthy have more resources to advocate for lower taxes in the political process (Glaeser, 2008). Second, causality may run well in the other direction: Less progressive taxes could cause more inequality (Piketty et al., 2014). Third, there is some question over how should redistribution best be measured: (i) as government transfers to GDP (e.g., Bassett et al., 1999), (ii) as the change in the income share (of the bottom half or bottom quintile) with the move from factor to disposable income (e.g., Milanovic, 2000), or (iii) as top marginal tax rates (e.g., Piketty et al., 2014).

Most empirical work suggests a negative correlation between inequality and redistribution (see, e.g., Perotti, 1996; Bassett et al., 1999; Alesina and Glaeser, 2004; Iversen and Soskice, 2006; Piketty et al., 2014). For instance, a look at simple cross-country correlations between inequality (measured by top 1 percent income shares) and top marginal tax rates (see Figs. 2 and 3 in Piketty et al., 2014) casts doubt on a positive relationship between inequality and redistribution. From such correlations, if any, one would conclude that there is a negative relationship. Some studies, however, find a positive relationship (Milanovic, 2000; Milanovic, 2010; Scervini, 2012). However, even those studies that conclude that more unequal countries redistribute more suggest that this is not driven by the median voter mechanism. Overall, there is little evidence that the median voter is decisive for the extent of redistribution. First, households with lower income tend to exhibit lower political participation. Mueller and Stratmann (2003) indeed find greater income disparities in countries where this is relevant in particular. Second, as argued in Mulligan et al. (2004), there

is no significant difference between economically comparable democracies and nondemocracies with regard to the economic or social policies that they pursue. Third, the middle class (home of the median voter) does not appear to be a net beneficiary of redistribution (Milanovic, 2000; Scervini, 2012). Fourth, Piketty et al. (2014) presents evidence that increases in inequality (at the top) tend to follow tax cuts rather than vice versa. Fifth, experimental evidence by Kuziemko et al. (2015) suggests that their information treatment has large effects on views about inequality (the share of those who think inequality is a "very serious problem" rises by over 35 percent) but results in only a small and statistically nonsignificant increase in support for redistribution.

Do Higher Taxes Cause Lower Economic Growth? Standard growth models generally predict that taxes are detrimental to growth (see Section 3.2). At the cross-country level, however, there is hardly any empirical evidence that higher taxes lead to lower economic growth (see, e.g., Easterly and Rebelo, 1993; Piketty et al., 2014; Cingano, 2014; Jaimovich and Rebelo, 2017; Berg et al., 2018; Gründler and Scheuermeyer, 2018). There are several reasons for this finding.

First, and possibly most importantly, the efficiency loss resulting from redistribution may be offset if taxes are used to promote public (Saint-Paul and Verdier, 1993) and private (Lee and Roemer, 1998) investment, most notably in the presence of binding credit constraints (see Section 3.5). If public investments, such as in infrastructure and education, are indeed complementary to a more prosperous economy, the taxes needed to finance these public investments might at least partially be positively correlated with growth, too. Econometrically, the causal link from taxes to growth is therefore at least questionable. Consistent with this, there is empirical evidence suggesting that the positive growth effect of lower inequality might (more than) offset the negative incentive effect of taxation (Berg et al., 2018; Gründler and Scheuermeyer, 2018). In fact, Gründler and Scheuermeyer (2018) suggest that redistribution may even be growth-enhancing in developing countries. However, they caution that the most growth-friendly environment is characterized by a low level of net inequality resulting from an equal distribution of market incomes and not from redistribution. Second, the negative impact of taxation on incentives, and hence on long-run growth, is likely not as strong as predicted by traditional growth models. Jaimovich and Rebelo (2017) demonstrate in their model that taxation may have strongly nonlinear effects on growth: Low to medium tax rates impose only a very modest drag on long-term growth. However, if tax rates rise to extremely high levels (such as above 80 percent), their negative impact on growth becomes very strong. Considering these results together, higher taxes do not appear to have a noticeable negative impact on long-run growth unless tax rates reach very extreme levels.

Work on the political economy channel has been highly influential and continues to reverberate today. However, due to the aforementioned problems, which have not been satisfactorily addressed thus far, there is little empirical evidence to support either of the theoretically critical linkages posited under the political economy channel.

5.3 Does Sociopolitical Instability Hamper Growth?

The sociopolitical instability approach (see Section 3.4) hypothesizes that inequality causes sociopolitical instability, which in turn leads to more economic insecurity and thus less investment and growth. The vast majority of empirical studies yield evidence consistent with the general rationale of this theoretical approach (see, e.g., Alesina and Perotti, 1996; Alesina et al., 1996; Svensson, 1998; Keefer and Knack, 2002; Jong-A-Pin, 2009; Aisen and Veiga, 2013). An exception to the general consensus is the study by Campos and Nugent (2002), who find no evidence of a negative long-run relationship between political instability and growth.

Different papers focus on different transmission channels through which sociopolitical instability has a negative impact on economic growth: (i) Alesina and Perotti (1996) and Perotti (1996) investigate the occurrence of violent political unrest; (ii) Alesina et al. (1996) and Aisen and Veiga (2013) focus on government instability (measured by government turnover and cabinet changes, respectively); and (iii) Svensson (1998), Keefer and Knack (2002) and Jong-A-Pin (2009) suggest that political instability affects growth through the quality of property rights.

5.4 Do Imperfect Credit Markets and Lack of Opportunities Limit (Human) Capital Accumulation and Growth?

The capital market imperfection approach and its theoretical extensions (see Section 3.5) have spawned a vast body of empirical contributions that generally support the validity of this rationale. The main theoretical prediction of the capital market imperfection approach is that with greater inequality, the poor tend to underinvest in their human capital because they do not have sufficient wealth and/or access to credit to undertake these investments. Early empirical studies (see, e.g., Perotti, 1996 and Deininger and Squire, 1998) offered suggestive evidence that inequality could negatively affect growth through the credit constraint channel. However, according to Neves and Silva (2014), these early results should be treated with great caution, as they do not test this theoretical mechanism directly and/or appropriately. On this note, Cingano (2014) argues that while it is well established that income inequality across countries is negatively related to educational attainment (see, e.g., Figure 4 in Cingano, 2014), this simple correlation is not sufficient to confirm the theory, as it is likely to suffer from omitted variable bias. According to Cingano (2014), a more appropriate empirical test is to examine how rising inequality within a country affects human capital accumulation of individuals from different socioeconomic backgrounds. After all, if rising inequality has a stronger negative impact on the educational attainment of the poor, this would support the idea of the credit market imperfection channel. Employing individual-level survey data from OECD countries, Cingano (2014) presents evidence consistent with this proposition, finding that greater income inequality reduces educational outcomes for individuals from lower-class socioeconomic backgrounds but does not impact the outcomes of individuals from middle- and high-class socioeconomic backgrounds. In a different vein, the seminal contribution of Beck

et al. (2007) provides direct support for the credit market imperfection channel by looking at the income growth of the poor. Beck et al. (2007) examine the theoretical prediction that improved financial development—by easing credit constraints, which are likely to be particularly binding for the poor—should disproportionately benefit the poor. They find consistent empirical evidence supporting this rationale: Increased financial development drives bottom quintile incomes to grow faster than average GDP per capita.

Moreover, two recent empirical studies provide supporting evidence for two theoretical extensions of the credit market imperfection approach proposed by Galor and Moav (2004) and Galor et al. (2009). First, based on the theoretical arguments of Galor and Moav (2004), Erman and te Kaat (2019) postulates that inequality has a positive effect on the growth rates of physical capital–intensive industries and a negative effect on human capital–intensive industries. Their article is innovative in the empirical inequality–growth literature in that it provides evidence at the industry level. Using data for 22 industries in 86 countries for the period 1980-2012, Erman and te Kaat (2019) provide evidence consistent with the theoretical hypothesis outlined above. In particular, they find that the difference in annual value-added growth between an industry at the 75th versus the 25th percentile of physical capital intensity is 0.8 to 1.1 percentage points higher in a country with a Gini coefficient at the 75th percentile than one with a Gini at the 25th percentile. In contrast, but in line with theory, human capital–intensive industries grow less in countries with a more unequal income distribution. In light of these results, the authors suggest that the empirical difficulty in establishing a clear relationship between inequality and growth may be because different countries have distinct production structures. If the relative importance of human and physical capital intensity in a country's production is not taken into account, this may obscure the overall relationship between inequality and growth. Second, Galor et al. (2009) hypothesize that greater land inequality negatively affects human capital accumulation because landowning elites have incentives to delay economy-wide investment in human capital, such as public schooling, thereby slowing the pace of transition from an agrarian to an industrial economy and thus moderating economic growth. Instrumental variable (IV) estimates for Brazil in Wigton-Jones (2020) provide evidence consistent with this theoretical prediction: Greater land inequality in 1920 is associated with a substantial reduction in local public welfare spending and, to a lesser extent, education spending per child over the 1995-2005 period. Moreover, the results suggest that higher land inequality is related to lower long-run human development, attributable to lower income and life expectancy.

A related issue raised in the literature is unequal access to education. Due to a lack of opportunities available to those from poor social origins, it is often not the most talented individuals who invest in human capital but those with a more favorable social background. Indeed, there is ample evidence that a person's socio-economic background strongly affects the chances of pursuing a career in science or entrepreneurship (see e.g., Bell et al., 2019; Agarwal and Gaule, 2020). Blundell

et al. (2022) discuss the empirical evidence on how inequality affects access to entrepreneurship—and, more generally, the relationship between innovation and inequality—in more detail. Hence, inefficiencies and thus lower growth might occur because it is not the individuals with the highest returns who invest but those who enjoy social privileges. Marrero and Rodríguez (2013) provide empirical evidence for the hypothesis that inequality of effort has a positive effect (see Section 3.2) and inequality of opportunity a negative effect on subsequent growth. From this observation, they conclude that income inequality, as a composite concept of IE and IO, may be partly responsible for the ambiguity of the empirical results in the inequality-growth literature. While the initial results of Marrero and Rodríguez (2013) are based on data for 26 US states, more recent research has examined the same question using cross-country panel data. First, Ferreira et al. (2018) find no robust relationship between either inequality component (IO or IE) and later growth in either of the two datasets that they exploit. Consequently, they were not able to confirm the theoretical hypothesis that IO is bad for growth in a cross-country setting—which, according to the authors themselves, may suffer from noisy data. Second, and in a different vein, Aiyar and Ebeke (2020) analyze the interaction between IO (measured by intergenerational mobility) and income inequality. They hypothesize that in countries with high IO (i.e., where parents' economic circumstances limit their children's opportunities), income inequality has a stronger negative effect on subsequent growth. Consistent with this, their empirical results suggest that the lower intergenerational mobility is, the larger the negative impact of income inequality on growth. Moreover, they argue that not accounting for the interaction between IO and income inequality may result in omitted variable bias, which may explain the inconclusiveness in the empirical inequality–growth literature. A closer examination of this proposition could be an interesting task for further research.

Misallocation of talent in an economy due to barriers to human capital accumulation is expected to have significant negative consequences for long-run growth. In this context, Hsieh et al. (2019) find (through the lens of a general equilibrium model) that declining barriers to human capital accumulation explain 36 percent of US GDP per capita growth between 1960 and 2010 while declining labor market discrimination explains only 8 percent. Moreover, it is quite conceivable that such impediments to human capital formation might have all the more negative effects on growth in developing countries—this has yet to be confirmed empirically, however.

5.5 Does the Demand-Side Drive Innovation and Growth?

The common key ingredient of demand-driven innovation approach models (see Section 3.6) in comparison to more standard growth models is the adoption of nonhomothetic preferences. Empirical evidence supports this theoretical choice, as it suggests that the diversity of consumption, that is, the number of product varieties consumed by individuals, strongly varies with their income level (Jackson, 1984; Falkinger and Zweimüller, 1996; Clements et al., 2006). Engel's law and the increasing diversification of consumer spending as incomes rise certainly capture a styl-

ized fact (see, e.g., Chai et al., 2015) and are central to understanding patterns of trade between rich and poor countries (Caron et al., 2014). Jaravel (2019) documents that inequality positively affects the demand for income-elastic products, increasing that incentives to pursue innovation in these sectors. In future research, it would be interesting to test the theoretical predictions of the demand-based innovation approach further. To the best of our knowledge, no empirical investigation has directly tested the theoretical predictions of this approach. Such work could answer the question of whether inequality influences growth through price or market-size effects.

6 Conclusion

The relationship between inequality and growth is an essential question in economic science. This complex question is far from settled, but important progress has been made. This chapter critically reviewed the theoretical and empirical literature on the causal effect of inequality on economic growth. Theories and evidence that—building on the Kuznets curve hypothesis—investigate causality running in the reverse direction from economic growth to inequality have not been surveyed.

Empirical estimates on the overall impact of inequality on economic growth in reduced form remain inconclusive. Depending on the specification, significant positive and negative effects have been found, and a clear consensus has not yet been established, although, in particular among developing countries, there is more evidence for a negative link than for a positive one. Given the general ambiguity of the reduced-form results, empirical evidence that tests specific theoretical channels of how inequality affects growth is thoroughly examined. The underlying logic of the savings channel (the rising marginal propensity to save) and of the demand-driven innovation approach (Engel's law) is well documented and acknowledged. However, whether and, in particular, to what extent inequality affects growth through these two channels is not yet clearly established. Meanwhile, both sociopolitical instability and, in particular, the credit market imperfection channel have received empirical support that largely validates their respective reasoning. In contrast, the endogenous fiscal policy channel, while highly influential, is generally not supported by the data. In particular, there is no evidence that the tax rates applied in most countries are statistically significantly related to their long-run growth performance. While several of the aforementioned channels are backed empirically, as discussed in this survey, it is uncertain how quantitatively relevant any particular channel is. A pending and ambitious task is therefore to more accurately quantify the relative contribution of the various transmission mechanisms that determine the overall effect of inequality on growth.

Without making a statement on welfare, the theoretical arguments can be synthesized to suggest that some intermediate level of inequality is likely growth maximizing. This is because when inequality is extremely low, there are few incentives to save, invest in (human) capital or

innovate, while as inequality rises, the negative channels—such as credit market imperfections or sociopolitical instability—gain importance and exert a more adverse impact on growth. Taken together, it seems fair to say that a society that has lower inequality of opportunities and fewer barriers to human capital accumulation has a better shot at achieving prosperity and stability. Economic and political institutions leading to an equal primary income and wealth distribution are crucial in this regard. After all, when the ex ante distribution is relatively equal, there is less need for potentially costly redistribution ex post. Instrumental to achieving such a state is an education system and a free economic environment allowing all people to realize their potential. With equal market distribution and low IO, social mobility is high, and a broad part of the population is able to stand on its own. Therefore, such a country is likely to enjoy active engagement of broad segments of the population in its economic and public spheres.

The preliminary insights from this survey point to several open questions and could provide guidance for interesting avenues in future research. First, there are several theoretical channels, e.g., the demand-driven innovation approach, whose proposed mechanisms deserve to be scrutinized more carefully in empirical studies. Second, wealth plays a prominent role in the theoretical discussion. However, the debate on how best to incorporate wealth inequality into the empirical literature on inequality and growth has just begun. This, however, has become even more important as the ratio of wealth to income has risen dramatically in recent years (see, e.g., Piketty and Zucman, 2014; Blanco et al., 2021; Baselgia and Martínez, 2021). Future empirical work should therefore study how wealth, properly measured, and income inequality interact to affect growth. Third, on a methodological level, research on the most relevant estimation techniques in the growth literature will be key: A better understanding of how to exploit cross-sectional versus time-series variation could lead to more flexible functional assumptions on the inequality–growth relationship. This would help clarify the potentially heterogeneous impact of inequality at different levels of economic development. Fourth, investigations providing a better theoretical and empirical understanding of the interplay of the different channels in this relationship, such as social mobility and the level of (wealth) inequality, offer a further fruitful research direction. In a similar vein, such works could also serve to clarify whether inequality at the bottom or at the top of the distribution causes differential rates of income growth along the distribution. Finally, undertaking the ambitious task of structurally estimating different channels would deepen our understanding of causality and the quantitative relevance of the influencing factors. All these tentative directions point to open and interesting issues to be addressed in the years ahead.

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Appendix

Table 1: Main reduced-form estimates on the inequality–growth relationship

Study	Countries	Number of obs.	Time period	Structure of data	Length of growth period	Inequality concept and measurement	Estimation technique	Main results	Remarks
Alesina and Rodrik (1994)	70 LD/HD	70	1960–1985	CS	25 yr.	Income: Gini	OLS (2SLS)	(−)	Inequality in land appears to be
Alesina and Rodrik (1994)	49 LD/HD	49	1960–1985	CS	25 yr.	Land: Gini	OLS	(−)	quantitatively more important than in income.
Persson and Tabellini (1994)	49 LD/HD	49	1960–1985	CS	25 yr.	Income: Share of Q3	OLS (2SLS)	(−)	The negative effect in the full sample is driven by democratic countries.
Clarke (1995)	74 LD/HD	74	1970–1988	CS	18 yr.	Income: Gini, Theil and others	OLS (WLS, 2SLS)	(−)	Negative effect approx. doubles with use of 2SLS instead of OLS.
Perotti (1996)	67 LD/HD	67	1960–1985	CS	25 yr.	Income: Share of Q3–4	OLS (WLS)	(−)	Negative effect weaker and statistically non-significant for poor countries.
Partridge (1997)	48 US	144	1960–1990	Panel	10 yr.	Income: Gini	FE	(+)	When both measures are included, results
Partridge (1997)	48 US	144	1960–1990	Panel	10 yr.	Income: Share of Q3	FE (2SLS)	(−)	imply higher inequality is positively related to growth: overall distribution matters.
Deininger and Squire (1998)	87 LD/HD	87	1960–1992	CS	32 yr.	Income: Gini	OLS	[−]	Income inequality estimates generally
Deininger and Squire (1998)	64 LD/HD	64	1960–1992	CS	32 yr.	Land: Gini	OLS	(−)	non-significant. Land inequality negatively impacts growth, but not for the rich (top 20 per cent).
Li and Zou (1998)	46 LD/HD	217	1947–1994	Panel	5 yr.	Income: Gini	FE (RE)	(+)	
Barro (2000)	84 LD/HD	146	1965–1995	Panel	10 yr.	Income: Gini	3SLS	[0]	No effect for the full sample, but (+) for rich and [−] for poor countries.
Forbes (2000)	45 LD/HD	135	1970–1995	Panel	5 yr.	Income: Gini	D-GMM	(+)	
Castelló and Doménech (2002)	67 LD/HD	67	1960–1990	CS	30 yr.	Human Capital: Gini	OLS	(−)	When both concepts are included simultaneously
Castelló and Doménech (2002)	83 LD/HD	83	1960–1990	CS	30 yr.	Income: Gini	OLS	(−)	results show: human capital inequality (−) and income inequality (+).
Panizza (2002)	48 US	239	1940–1990	Panel	10 yr.	Income: Gini, share of Q3	FE, D-GMM	[−]	No evidence of a positive link and some evidence of a negative link. Central statement: results are not robust across time and econometric specifications.
Banerjee and Duflo (2003)	45 LD/HD	98 128	1965–1995	Panel	5 yr.	Income: Gini	*Kernel regression	(Δ)	Changes in inequality (positive and negative) are associated with reduced growth.
De La Croix and Doepke (2003)	68 LD/HD	83	1960–1992	Panel	16 yr.	Income: Gini	GMM	[+]	With fertility (differentials) controlled for, the coefficient on the Gini turns non-significant.
Knowles (2005)	27 LD/HD	27	1960–1990	CS	30 yr.	Income: Gini	OLS	[−]	It matters how inequality is measured:
Knowles (2005)	30 LD	30	1960–1990	CS	30 yr.	Income: Gini	OLS	(−)	(i) through net income, gross income, or expenditures; (ii) at the household or individual level.
Voitchovsky (2005)	21 HD	81	1975–2000	Panel	5 yr.	Income: *90/75P*, (50/10P, Gini)	S-GMM	(+)	Inequality at the top is positively related to growth, while inequality at the bottom is negatively
Voitchovsky (2005)	21 HD	81	1975–2000	Panel	5 yr.	Income: *50/10P*, (90/75P, Gini)	S-GMM	(−)	related to growth. Key finding: using a single inequality statistic may be insufficient.

Study	Countries	Number of obs.	Time period	Structure of data	Length of growth period	Inequality concept and measurement	Estimation technique	Main results	Remarks
Castelló-Climent (2010)	102 LD/HD	744	1965–2005	Panel	5 yr.	Human Capital: Gini	S-GMM	(−)	The negative effect is driven by LD countries. For HD countries, no clear effect.
Castelló-Climent (2010)	56 LD/HD	244	1970–2000	Panel	5 yr.	Income: Gini	S-GMM	(−) (+)	Again, the negative effect is driven by LD countries. For HD countries the effect is positive.
Chambers and Krause (2010)	54 LD/HD	240	1965–2000	Panel	5 yr.	Income: Gini	*semi-parametric	(−)	The negative effect originates primarily from LD countries.
Herzer and Vollmer (2012)	46 LD/HD	1,196	1970–1995	Panel	level	Income: Gini	*DOLS	(−)	The negative effect is robust across different subsamples (e.g., LD vs. HD countries).
Marrero and Rodríguez (2013) Marrero and Rodríguez (2013) Marrero and Rodríguez (2013)	26 US	78	1970–2000	Panel	10 yr.	Income: *Theil (Total)* *between component (IO)* *within component (IE)*	S-GMM	(+) (−) (+)	Total income inequality can be decomposed into inequality of opportunity (IO) and effort (IE). IO is (−) and IE (+) associated with growth. Total effect depends on strength of the two channels.
Cingano (2014)	31 OECD	127	1970–2010	Panel	5 yr.	Income: Gini	S-GMM	(−)	The effect is driven by inequality in the lower part of the distribution.
Halter et al. (2014)	70 LD/HD	227	1965–2005	Panel	*5 yr.*	Income: Gini	S-GMM	(+)	Including both current and 5-year lagged Gini jointly in the estimation yields the result: inequality
Halter et al. (2014)	70 LD/HD	227	1965–2005	Panel	*10 yr.*	Income: Gini	S-GMM	(−)	increases growth in the short run (5 yrs.) and reduces it in the long run (10 yrs.). The latter effect is quantitatively more important.
Berg et al. (2018)	130 LD/HD	828	1960–2010	Panel	5 yr.	Income: Gini	S-GMM (others)	(−)	Higher inequality is also linked to shorter growth spells.
Brueckner and Lederman (2018)	112 LD/HD	768	1960–2005	Panel	5 yr.	Income: Gini	2SLS	(+)	Positive effect for the full sample, but (−) for high-income and (+) for low-income countries.
Ferreira et al. (2018)	42 LD/HD	117	1981–2005	Panel	5 yr.	Income: MLD	S-GMM (others)	[−]	No robust link between total inequality and growth.
Ferreira et al. (2018)	42 LD/HD	134	1986–2006	Panel	5 yr.	Wealth: variance	S-GMM (others)	[0]	A decomposition into IO and IE analogous to that in Marrero and Rodríguez (2013) find no supporting evidence for IO (−) and IE (+).
Gründler and Scheuermeyer (2018)	164 LD/HD	969	1960–2014	Panel	5 yr.	Income: Gini	S-GMM	(−)	Negative effect for the full sample, but (+) for high-income and (−) for low-/middle-income countries.
Van der Weide and Milanovic (2018)	48 US	240	1960–2010	Panel	10 yr.	Income: Gini	S-GMM	(−)	The average negative effect is driven mainly by lower subsequent growth among poorer income percentiles, and not present (or turns positive) among the higher percentiles.
El-Shagi and Shao (2019)	123 LD/HD	694	1960–2010	Panel	5 yr.	Income: Gini	*LSDV	(+)	Redistribution may have a positive effect when the average level of education is low.
Erman and te Kaat (2019)	22 industries in 86 LD/HD	1,613	1980–2012	CS	22 yr.	Income: Gini	FE	[−]	Key result: inequality has a (+) effect in physical- and a (−) effect in human-capital-intensive industries. The main results are robust to the panel specification.
Litschig and Lombardi (2019)	3,659 BRA municipalities	3'659	1970–2010	CS	30 yr.	Income: share of Q1, Q2, Q4, Q5	OLS	(+)	The (+) effect, is driven by inequality at the bottom of the distribution. No effect of higher right-tail inequality. Main results robust to the panel specification.
Scholl and Klasen (2019)	116 LD/HD	590	1960–2012	Panel	5 yr.	Income: Gini	D-GMM (2SLS)	[0]	After introduction of separate time effects for 15 post-Soviet countries, no robust, systematic relationship between inequality and growth remains.

Study	Countries	Number of obs.	Time period	Structure of data	Length of growth period	Inequality concept and measurement	Estimation technique	Main results	Remarks
Aiyar and Ebeke (2020)	55 LD/HD	270	1960–2015	Panel	5 yr.	Income: Gini	S-GMM	[−]	Key finding: inequality has a (−) effect when interacted with intergenerational mobility (IGM). The lower the IGM, the greater is the (−) impact of inequality on growth.
Aiyar and Ebeke (2020)	89 LD/HD	412	1960–2015	Panel	5 yr.	Income: Gini	S-GMM	[−]	
Breunig and Majeed (2020)	102 LD/HD	410	1956–2011	Panel	5 yr.	Income: Gini	S-GMM	[−]	Key result: inequality has a (−) effect when interacted with poverty. The higher the poverty level, the greater is the (−) impact of inequality on growth.
Braggion et al. (2021)	384 US MSAs	3,370	2005–2014	Panel	1 yr.	Financial wealth: Gini	2SLS	(−)	Wealth inequality hampers entrepreneurial dynamism and is associated with lower short-term income growth.

Note: this table summarizes the main results of relevant empirical work estimating a reduced-form relationship between inequality and growth, with more emphasis on cutting-edge research. The results are presented schematically and are reduced to their core statements. The interpretation is always that more inequality has a positive (+) or a negative (−) impact on growth. The studies, of course, contain much more nuanced and detailed results than those listed here. The reader is therefore strongly encouraged to refer to the original papers for a more detailed and nuanced interpretation of the results. **Abbreviations and symbols:** *Countries*: LD indicates developing and HD developed countries. MSAs indicates metropolitan statistical areas. *Structure of data:* CS is short for cross-sectional data. *Inequality concept and measurement:* Q3 is short for the share of the third quintile. 90/75P refers to the 90/75th percentile ratio. MLD is short for the mean log deviation. *Estimation technique:* OLS refers to ordinary least squares, 2SLS to two-stage least squares, WLS to weighted least squares, FE to the fixed effects model, RE to the random effects model, D-GMM to the (first-)difference generalized method of moments, and S-GMM to system GMM. * The estimation methods marked with an asterisk are not standard methods in the literature. For details on these methods, refer to the original papers. *Main results:* round parentheses indicate a statistically significant and square brackets a statistically non-significant effect.