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LABOR INEQUALITY AND ECONOMIC GROWTH: THE KUZNETS HYPOTHESIS IS A PATH OF CREATIVE DESTRUCTION

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Abstract

In this paper, we re-examine the Kuznets hypothesis on the relationship between economic growth and income inequality by integrating the theoretical framework of Schumpeterian creative destruction. Our analysis posits that the critical condition for the emergence of the inverted "U" curve is the gradual dominance of a more productive labor class over a less productive one. The study develops a novel model for this dynamic relationship, constructing a labor inequality index and a measure of the "critical dominance" of the more productive class. Our empirical findings, based on a panel data econometric analysis, confirm the existence of the Kuznets curve, supporting both its ascending and, importantly, its descending trajectories. This relationship is empirically linked to the demographic and economic dominance of skilled workers. The results suggest that the process of creative destruction provides a robust theoretical and empirical mechanism for interpreting the Kuznets hypothesis, while also offering significant policy implications for managing inequality and growth within an economy.

JEL Codes: J38, J23, J31, J08, O15, D30, D63

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1. Introduction

The relationship between economic growth and income inequality is one of the most debated and critical issues in economic theory and policy. The relationship between economic growth and income inequality is one of the most debated and critical issues in economic theory and policy. Simon Kuznets was among the first to argue that economic inequality is intrinsically linked to economic growth in his seminal work, "Economic Growth and Income Inequality" (Kuznets, 1955).

Historically, economic growth has been linked to significant social and structural changes, which often affect income distribution. Understanding this dynamic is crucial for formulating policies that promote both growth and social cohesion.

This paper substantiates the Kuznets hypothesis through an examination of the intricate relationship between labor income inequality and economic growth. The analytical framework integrates two foundational theoretical perspectives: Kuznets's hypothesis and Schumpeter's theory of creative destruction. Kuznets posited a non-linear, inverted "U"-shaped relationship between inequality and the level of development. Schumpeter, in contrast, underscored innovation as a primary driver of growth, which inherently entails the structural reconfigurations he termed creative destruction. This study aims to elucidate the emergence of an inverted "U"-shaped relationship for inequality from this integrated process.

Novel and more efficient production structure changes, while obviously increasing productivity and wealth accumulation, may parallel exacerbate inequalities, particularly during their initial stages of deployment. This study seeks to investigate the mechanisms

by which alterations in production structures influence the labor market. Particular emphasis will be placed on phenomena such as skill-biased technological change and the displacement of less productive labor by more efficient counterparts. Subsequently, the implications of these mechanisms for employment, wages, and, ultimately, labor income inequality will be rigorously analyzed.

2. The Kuznets curve meets the Schumpeterian creative destruction

The potential relationship between inequality and economic growth was first highlighted by Simon Kuznets in his seminal 1955 paper, "Economic Growth and Income Inequality" (Kuznets, 1955). Kuznets posited that inequality levels could be linked to output levels as an economy grows over time. The Kuznets hypothesis suggests a positive, non-linear relationship between inequality and total output during the early stages of growth, which then shifts to a negative correlation as the economy matures. Consequently, Kuznets proposed that income inequality initially rises during early growth, stabilizes during the transition from rural or pre-industrial to industrial economies, and eventually declines in later growth stages. This implies that the graphical representation of the relationship between economic growth and income inequality would resemble an inverted "U" shape.

Kuznets based his suggestions on historical data from three developed countries (USA, UK, and Germany) spanning the period from 1919 to 1945. According to Kuznets, income inequality appears to oscillate between a positive and negative relationship with GDP per capita as an economy shifts from a poor rural to a prosperous industrialized state.

This phenomenon was particularly evident during the Industrial Revolution, when rural economies transformed into industrial ones.

This transition led to the expansion of sectors yielding higher returns, prompting the population to migrate from rural to urban regions in pursuit of higher-paying jobs and improved living conditions. As this demographic shift gained momentum, inequality, which initially increased, began stabilizing and then decreasing, thus forming the characteristic inverted U-shape of the Kuznets hypothesis. Consequently, the economy featured a larger proportion of high-paid industrial workers and fewer low-paid agricultural laborers.

Many interpret Kuznets's hypothesis to suggest that the inequality observed in less developed countries may represent a temporary phase in their development trajectory, with inequality expected to decline as these nations continue to grow (Boushey & Price, 2014). This perspective often arises because, during the initial stages of production development, growth tends to exacerbate income inequality. This is due to certain segments of the population having greater opportunities to accrue profits than others, which widens the inequality. Conversely, in later stages, production growth is accompanied by a more equitable distribution of human capital and income. Once a certain threshold is surpassed, this trend reverses, leading to stabilized inequality that subsequently decreases until it reaches its lowest level (Wahiba & Dina, 2023).

While Kuznets's hypothesis provides a foundational perspective, its validity has sparked considerable debate regarding the intertemporal relationship between inequality and economic growth. Several key criticisms cast doubt on its universal applicability. Firstly, Kuznets's assumptions were based on the rural-to-urban and agricultural-to-

industrial transition during periods of rising income. This specific historical context might not universally apply. For example, the decrease in inequality observed in the USA—one of the countries in Kuznets's original study—during his sample period could be attributed more to the profound impacts of World Wars and the Great Depression than to a sustained developmental relationship (Piketty, 2014).

Furthermore, modern economies, especially over the decades of 80s, 90 and 00s, have experienced significant structural changes and crises that influence both inequality and growth. These shifts, including credit market imperfections and skill-biased technical changes, may not align with the original Kuznets hypothesis (García-Peñalosa, 2010).

Kuznets himself honestly acknowledged the limitations of his hypothesis, noting it was constructed with limited empirical data, simple mathematical extrapolation, and theoretical speculation (Boushey & Price, 2014). He even humorously remarked that his work comprised "perhaps 5 percent empirical information and 95 percent speculation) (Kuznets, 1955).

Despite ongoing debates surrounding its validity, the Kuznets hypothesis offers two crucial insights into the relationship between income inequality and capitalism. First, it highlights the pivotal role of economic growth in shaping inequality, especially through transitions between older and newer modes of production. These transitions dynamically reveal their effects on income distribution. Second, the hypothesis emphasizes that the features of income distribution in any given society are influenced by institutions and collective social forces impacting power arrangements. In essence, the interplay of economic and social factors, including institutions and societal forces, shapes how income is distributed. (Galbraith, 2012)

Hence, In Kuznets' framework, income differences arise from distinct economic sectors, with industrial workers typically earning higher incomes than agricultural workers. Kuznets (1955) argued that income inequality follows an inverted U-shaped pattern: it initially rises with technological change and industrialization but eventually decreases as the majority of workers transition into newer, more productive sectors (Deskoska & Vlčková, 2018).

Kuznets's work remains crucial for highlighting the dynamic interplay between economic growth, institutional structures, and income distribution. Complementing Kuznets, Joseph Schumpeter's (1942) theory of "creative destruction" provides a powerful framework where economic growth is driven by continuous innovation that fundamentally disrupts existing industries and economic structures. Entrepreneurs, as central figures, introduce new technologies and business models, leading to temporary monopolies and efficiency gains. This process, while essential for long-term productivity and wealth creation, inherently generates periods of significant economic and social upheaval, as older methods and jobs become obsolete, making way for new ones. Schumpeter argued that capitalism thrives on this continuous cycle of innovation and disruption, which drives productivity and efficiency (Schumpeter, 1942)..

The intersection of these two theoretical approaches becomes evident when examining the profound impact of technological change on labor markets and income inequality. Innovations, as described by Schumpeter, act as catalysts for economic growth, initially benefiting innovators and highly skilled labor disproportionately. The introduction of innovative technologies can initially lead to temporary increases in inequality during the transition phases, as certain sectors and workers benefit from new technologies (e.g.,

skilled workers or entrepreneurs) while others may be displaced. (Kharlamova, et al., 2018; Permana, et al., 2018; Risso & Carrera, 2019; Wahiba & Dina, 2023)

Authors argue that skill-biased technological change can be the primary cause of inequality (OECD, 2012; Herr, 2018; Asteriou, et al., 2014; Dew-Becker & Gordon, 2008; Dew-Becker & Gordon, 2008; Deskoska & Vlčková, 2018). This initial phase aligns with the rising arm of Kuznets's inverted "U" curve, where the introduction of new technologies, often complementary to skilled labor, increases the demand for such workers, leading to higher wages and a widening wage gap (Autor, et al., 1998; Goldin & Katz, 2008; Kwon, 2016). Hence, this phenomenon, known as skill-biased technological change (SBTCT), is a primary driver of inequality, as it creates new jobs requiring advanced skills while automating or displacing lower-skilled, routine tasks. Technological change can impact both labor and overall inequality through wage premium and shifts in the relative demand for skilled labor (Stockhammer, 2012). For instance, studies estimate that exposure to robots has a robust negative effect on both employment and wages for workers with less than a college degree (Acemoglu & Restrepo, 2020). Empirical evidence, such as the impact of workplace computerization in the 1970s, consistently points to technology's role in exacerbating income disparities by favoring high-skilled over basic-skilled labor (Berman, et al., 1994; Autor, et al., 1998; Kwon, 2016). Firms adopt these technologies due to their potential for enhanced efficiency, increased productivity, and reduced production costs, further incentivizing the shift towards a more skilled labor force and leading to increased profitability (Qureshi, 2021; Risso & Carrera, 2019). This can result in job displacement for unskilled workers, particularly in sectors susceptible to automation,

contributing to higher unemployment rates and stagnant wages for this group (Qureshi, 2021; Wahiba & Dina, 2023).

However, the Schumpeterian legacy also offers insights into the latter part of the Kuznets curve. As technology becomes more widely diffused and the supply of skilled labor increases—driven by incentives for individuals to invest in education and adapt to new production standards—the wage premium for skilled workers can decline, leading to a reduction in labor inequality (Antonelli & Gehringer, 2017; Antonelli & Gehringer, 2013). This suggests that while creative destruction initially creates disparities, the subsequent adaptation of labor and institutions, coupled with the widespread adoption of innovations, can lead to a more equitable distribution of benefits across income strata. The rising skill premium incentivizes individuals to invest in education, leading to an overall increase in the supply of skilled labor, which can mitigate some inequality. Thus, the Kuznets hypothesis finds new support when integrated with the Schumpeterian legacy, particularly in understanding how economies adapt to technological changes and how policies can mitigate rising inequality over time (Antonelli & Gehringer, 2017; Acemoglu & Restrepo, 2020). Beyond wage disparities between less and more productive labor classes, a potentially more significant factor, as will be demonstrated in the subsequent analysis, is the proportional size of these labor classes. Both frameworks underscore that technological change, while crucial for progress and enhancing productivity, can exacerbate inequalities in its early phases, but as industries mature and economies adjust, the resulting policies and social structures can help mitigate these disparities, aligning with the latter part of the Kuznets curve (Wahiba & Dina, 2023).

3. A model

3.1. The Labor Income Distribution and how inequality among workers grows.

Initially, it is assumed that two distinct labor types exist, each characterized by differing productivity levels. These are categorized into a class comprising workers with basic education and another class consisting of higher-skilled and educated workers. Analogous to the agricultural workers in Kuznets's hypothesis, the class of workers with basic education is considered less productive than the skilled labor class and typically operates in sectors of lower technological development.

The population of basic labor is denoted as L_b and its labor productivity as A_b[1]. Respectively, the population and labor productivity of skilled labor are denoted as L_s and A_s[2]. As it is already assumed the productivity of skilled labor class is greater than that of the basic labor class, implying $A_s > A_b$. Differences in labor productivity among workers may depend on factors such as their education, experience, or the sector in which they work.

Consequently, it is assumed that these two types of labor receive different wages (w_b, w_s), resulting in the average income of basic labor being lower than that of skilled labor $(w_b < w_s)$. Thus, the relationship between the average wage of the skilled class and

[1] $A_b = \frac{Y}{L_b}$, Y is the total product of the economy

[2] $A_s = \frac{Y}{L_s}$, Y is the total product of the economy

the basic class is defined as the wage premium, denoted as q_L, as presented in Equation (1):

Equation 1

$$q_L = \frac{w_s}{w_b}$$

The variable q represents one of the three fundamental components of the income distribution model and its underlying theoretical framework. Specifically, q quantifies the relative income of each skilled worker compared to each basic worker. It is assumed that q is always greater than unity ($q_L > 1$), signifying that a more productive worker consistently receives a higher income than a less productive worker. We assume that the forces determining the size of q_L are the same to those influencing wages generally, with institutions, bargaining power and market forces being potential examples.

The next fundamental component is labor composition which is represented as Λ_L and is the ratio of the basic labor population to the skilled labor population as it is presented in relationship (2).

Equation 2

$$\Lambda_L = \frac{L_b}{L_s}$$

The labor composition, Λ_L is arguably the most significant fundamental component, as it indicates the demographic dominance of each labor class within the labor market. A lower value of Λ_L signifies a greater demographic dominance of the skilled labor class, and vice versa.

The variable Λ_L is a highly crucial factor because, on one hand, it reveals the type of labor, and consequently the mode of production, an economy relies on and invests in

over time. Labor composition directly influences the total productivity of the economy as it reflects the varying productivity levels of different labor types. Consequently, given that skilled labor is more productive than basic labor, $A_s > A_b$, a lower labor employment composition Λ_L, corresponds to higher overall productivity. Hence, a lower value of Λ_L, when accompanied by robust economic growth, suggests that the economy is increasingly dependent on newer, more productive sectors and production methods that require more skilled labor.

The factors influencing $\Lambda_L$are primarily the forces of supply and demand. The relative supply of skilled versus basic labor can depend on the prevailing conditions and the ease of skill acquisition within a given economy. Correspondingly, the demand for more or less skilled labor may be driven by the product or sector in which an economy chooses to invest. This implies that the demand for more or less skilled labor is influenced by whether the economy relies on sectors that primarily require skilled labor relative to unskilled labor, or vice versa.

The last fundamental component is the ratio of the total income of higher-paid labor to that of lower-paid labor, denoted as m_L. Assuming that total basic labor, L_b, receives a total wage income denoted as W_b, while total skilled labor workers L_s, receive a total wage income denoted as W_s, then m_L can is defined by the relationship (3).

Equation 3

$$m_L = \frac{W_s}{W_b} = \frac{q_L}{\Lambda_L}$$

The variable m_L expresses the economic dominance of each labor class within the labor market, indicating which of the two labor classes accrues the larger share of wage

income. Consequently, a higher value of m_L signifies greater economic dominance by the skilled labor class, and vice versa.

By expressing economic dominance (m_L) as a relationship involving the wage premium (q_L) and labor composition (Λ_L), we can readily demonstrate that m_L expands with an increase in either wage premium $(\dot{q_L} > 0)$, skilled population $\left(\dot{\Lambda_L} < 0\right)$, or their combined effect, as described in Equation (4).

Equation 4

$$\dot{m_L} = \dot{q_L} - \dot{\Lambda_L}$$

Furthermore, given that each labor type possesses distinct productivity levels and receives varying wages, their unit costs also differ, as presented in Equations (5) and (6). The significance of unit costs lies in the logical premise that the labor type with the lower unit cost will be preferred, thereby boosting demand for that specific labor class. As previously discussed, this will, in turn, influence the level of labor composition (Λ_L).

Equation 5

$$\frac{W_s}{Y} = \frac{w_s L_s}{Y} = \frac{w_s}{A_s}$$

Equation 6

$$\frac{W_b}{Y} = \frac{w_b L_b}{Y} = \frac{w_b}{A_b}$$

The determination of labor composition is based on the relative cost. The relative cost of workers in the two labor classes depends on their productivity and nominal wages. Additionally, as firms seek to optimize the composition of basic and skilled labor based on

considerations of relative cost, they strive to minimize production costs to enhance competitiveness determining the labor employment composition Λ_L.

Subsequently, to facilitate further analysis, the income shares, ω, and proportions of population, γ, for each labor class are expressed in terms of q_L and Λ_L, as represented in equations 7, 8, 9,10.

Equation 7

$$\omega_s = \frac{W_s}{W} = \frac{1}{1 + \frac{1}{\frac{q_L}{\Lambda_L}}}$$

Equation 8

$$\omega_b = \frac{W_b}{W} = \frac{1}{\frac{q_L}{\Lambda_L} + 1}$$

Equation 9

$$\gamma_s = \frac{L_s}{L} = \frac{1}{\Lambda_L + 1}$$

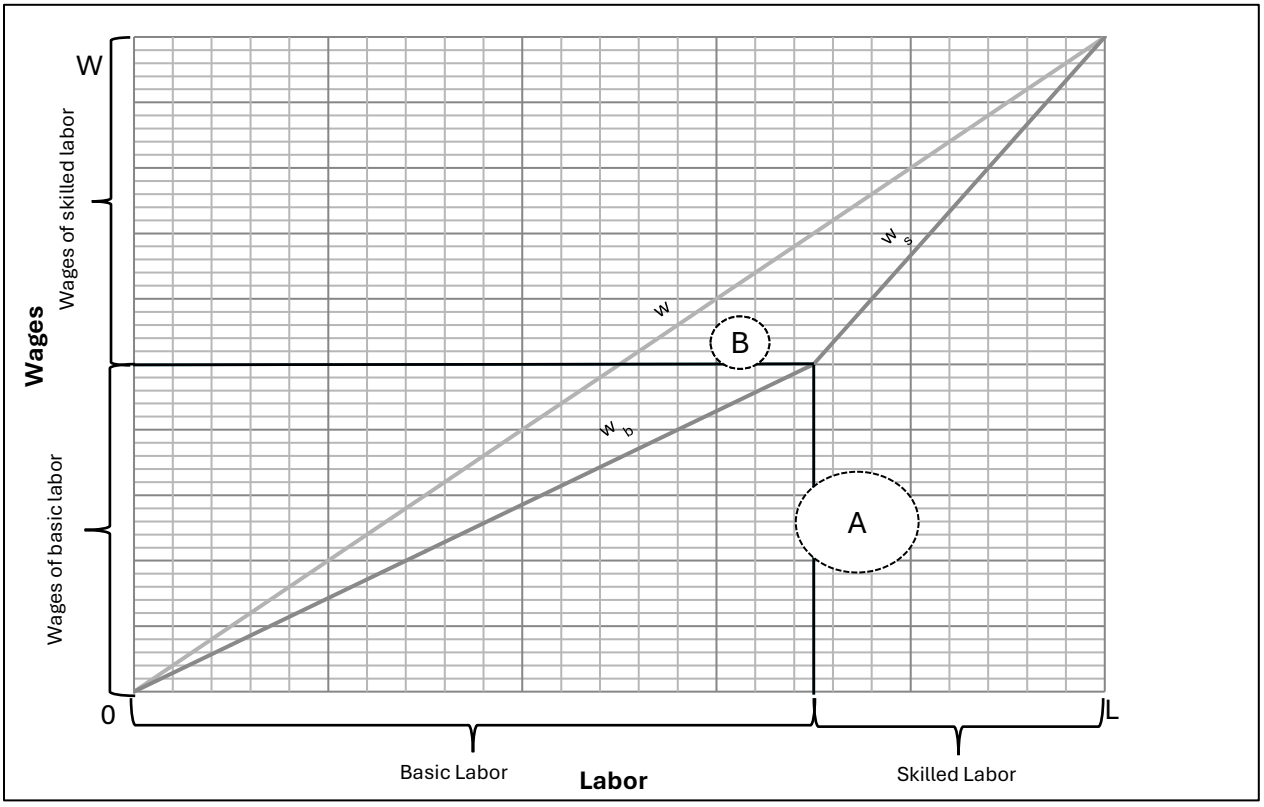
Equation 10

$$\gamma_b = \frac{L_b}{L} = \frac{1}{\frac{1}{\Lambda_L} + 1}$$

Subsequently, the wage distribution across the two classes of skilled and basic workers is presented using a Lorenz curve. On the x-axis, the cumulative population is displayed, starting with the entire population of the lower-income class (i.e., basic workers), followed by the population of the higher-income class (skilled workers) to its right. Correspondingly, on the y-axis, the cumulative income share is presented, beginning with the income of the lower-income class (i.e., basic workers), followed by the income of

the higher-income class (skilled workers) higher up. The Lorenz curve for these two classes is presented in Figure 1 below.

Figure I Lorenz curve



The w line is the slope of average wage income, w, while w_b is the slope of average wage income of the class of the basic labor and respectively w_s is the slope of average wage income of the class of the skilled labor.

The overall average wage income is represented by the slope of the reference line (or 'w-line'), denoted as w. As previously mentioned, w_b denotes the average wage income of the basic labor class, and w_s denotes the average wage income of the skilled labor class. These class-specific average wage incomes (w_b and w_s) correspond to the slopes of their

respective segments in the Lorenz curve representation. The area B between the w line and the $w_b w_s$ line denotes labor inequality.

The Gini index, derived from the Lorenz curve presented in Figure 1, quantifies the inequality between skilled and basic labor workers. This is expressed by the following relations 11, 12 and 13:

Equation 11

$$Inequality_L = \frac{area\ B}{area\ B + \text{area}\ A}$$

Equation 12

$$Inequality_L = \omega_s - \gamma_s$$

Equation 13

$$Inequality_L = \gamma_b - \omega_b$$

Furthermore, by combining equations (12) and (13) with equations (7), (8), (9), and (10), wage inequality can be expressed in terms of the wage premium, q_L, and labor composition Λ_L as demonstrated in equation (14).

Equation 14

$$Inequality_L = \frac{q_L - 1}{(m_L + 1)(1 + \Lambda_L)}$$

Equation (14) indicates that labor inequality is determined by the wage premium, q_L, labor composition, Λ_L and economic dominance m_L.

Further, using Equation (14) and Equation (4), labor inequality in growth terms can be expressed as a function of the wage premium (q_L) and labor composition (Λ_L), as demonstrated in Equation (15). (see in Appendix)

Equation 15

$$\dot{Inequality}_L = \frac{1}{m_L + 1}\left(\frac{q_L + m_L}{q_L - 1}\dot{q}_L + \frac{m_L - \Lambda_L}{\Lambda_L + 1}\dot{\Lambda}_L\right)$$

As observed in equation (15), labor inequality is influenced by two terms, each representing changes resulting from the growth of the wage premium and labor composition, respectively. Consequently, two key implications emerge from the growth dynamics of these terms. Firstly, the first term of the equation indicates that the impact of the growth in wage premium on labor inequality will consistently be positive, given that the wage premium always exceeds unity ($q_L - 1 > 0$).

Secondly, labor composition has an ambiguous effect on wage inequality contingent upon whether the economic dominance**,** m_L, is higher or lower than labor employment composition, Λ_L.

Given that a higher value of m_L indicates greater economic dominance for the skilled worker class, and a lower value of Λ_L signifies a larger demographic dominance of the skilled worker class, we can refer to this combined relationship, $m_L - \Lambda_L$, as the critical dominance of the skilled worker class.

To elaborate, the second term suggests that the effect of labor composition growth on labor inequality is positive when the critical dominance of the skilled worker class is positive,($m_L - \Lambda_L > 0$); otherwise, it is negative. Additionally, the impact of a change on labor composition, Λ_L, depends on the level the critical dominance.

Therefore, wage premium will always be positively related to labor income inequality, while the sign of the impact of the labor composition will depend on the sign of the critical dominance of the skilled worker class. This last point indicates a dynamic, non-

linear relationship between inequality and the population of skilled workers, which is depending upon which class dominates the labor market.

Having first examined the formation of worker inequality, we now turn to its evolution as the economy grows.

3.2. labor inequality, economic growth and the creative destruction

This subsection will describe the dynamics of economic inequality among workers in an economy experiencing growth driven by an increase in productive labor.

As discussed in the previous subsection, economic inequality is influenced by q_L and Λ_L. While q_L is always positively correlated with economic inequality, the impact of Λ_L (labor composition) can be either positive or negative, depending on the sign of the critical dominance of the skilled and more productive worker class.

To fully explain the relationship between inequality and economic growth, we first need to clarify the significance of m_L as a fundamental analytical link. As established in Relation (3), m_L serves as an index of economic dominance of one labor class over the other. From Relations (3) and (4), we observe that the skilled worker class can achieve economic dominance over the basic worker class through two primary mechanisms. This can occur either by an increase in their wage premium ($\dot{q_L} > 0$), meaning their average wage grows relative to the basic labor class, or by an increase in their population share ($\dot{\Lambda_L} < 0$), or through a combination of both these tools.

Now, let's address what happens to economic inequality and economic growth when one class exerts dominance over the other.

Using the first mechanism, economic inequality will increase in every scenario, as shown in Equation (17). Thus, if the skilled worker class can, for any reason, impose higher incomes relative to the other class, this will result in an increase in their economic dominance ($\dot{m}_L > 0$), while simultaneously raising labor inequality $\left(\dot{Inequality}_L > 0\right)$. Crucially, while their demographic dominance may remain constant $\left(\dot{\Lambda}_L = 0\right)$, the overall productivity of the class may also be unaffected. Therefore, given that economic growth does not directly depend on q_L (wage premium); we do not anticipate a significant change in economic growth due to the skilled worker class's economic dominance achieved through this mechanism.

Furthermore, considering the second mechanism, an increase of economic dominance, m_L, driven by an expansion of their population ($\dot{\Lambda}_L < 0$), will initially increase economic inequality as long as the critical dominance of the skilled worker class remains negative, ($m_L - \Lambda_L < 0$), as shown in Equation (17). However, when the economic and demographic dominance of the skilled worker class increases sufficiently to reverse this relationship $(m_L - \Lambda_L > 0)$, economic inequality will then begin a decreasing path $\left(\dot{Inequality}_L < 0\right)$. This occurs as the skilled worker class dynamically achieves comprehensive dominance, both economically and demographically, $\left(\dot{m}_L > 0, \dot{\Lambda}_L < 0\right)$. Consequently, economic growth is expected to accelerate as the demographic dominance of the more productive class expands as shown in Figure2.

Figure II relation between Demographic Dominance and Economic Growth

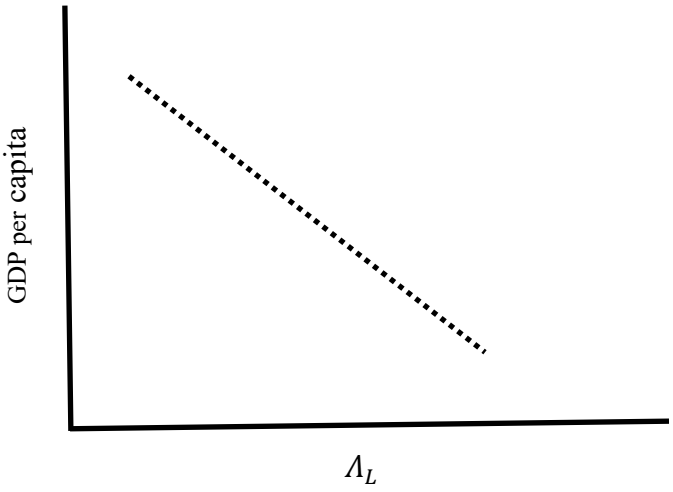


Figure III relation between Demographic Dominance and Labor Income Inequality

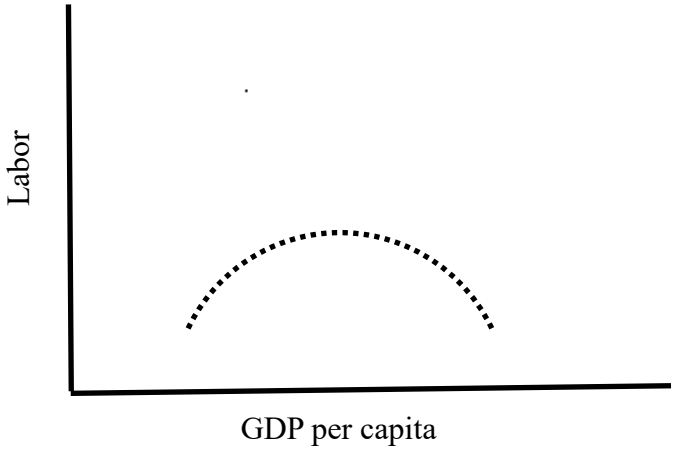
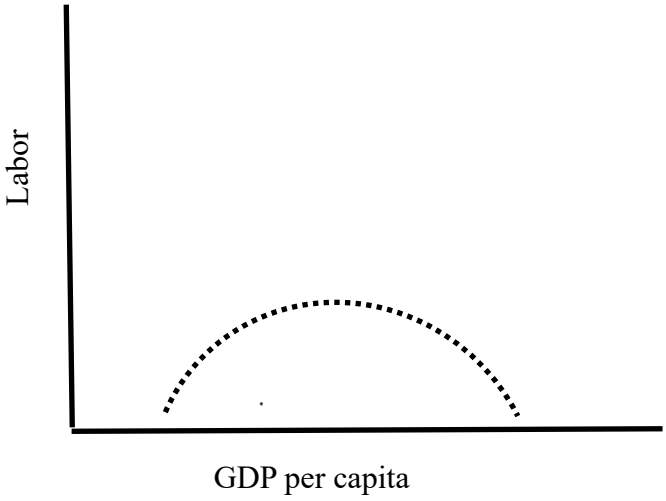


Figure IV Kuznets Curve



Thus, continuous economic dominance by a more productive working class, such as skilled workers, achieved through their persistent demographic dominance, will initially increase labor inequality up to a critical point $(m_L - \Lambda_L > 0)$. Beyond this threshold, inequality will begin to decrease, while economic growth simultaneously accelerates as shown in figure 3.

A continuous economic dominance by a more productive class, such as skilled workers, achieved through their persistent demographic dominance, will consequently increase economic growth. Initially, this growth will be accompanied by a parallel rise in labor inequality. This parallel increase in inequality will continue until the critical dominance of the skilled worker class reaches zero $\left((m_L - \Lambda_L) = 0\right)$. Beyond this point, as the economy continues to grow in parallel with the increasing dominance of the skilled worker class, labor inequality will begin to decline. This dynamic describes a long-term trajectory consistent with Kuznets's hypothesis as shown in figure 4.

Table I. The relation between Labor Inequality and Economic Growth

Labor Inequality and Economic Growth Dynamics	Negative Critical Dominance $m_L - \Lambda_L < 0$		Positive Critical Dominance $m_L - \Lambda_L > 0$	
	Wage Premium, q_L	Labor Composition, Λ_L	Wage Premium, q_L	Labor Composition, Λ_L
Economic dominance, m_L	+	-	+	-
Labor Inequality	+	-	+	+
Economic Growth	?	-	?	-

Therefore, when an increase in economic dominance is observed due to the wage premium of the more productive class, we anticipate a rise in economic inequality that will not be directly related to the economy's economic growth.

On the other hand, an increase in economic dominance driven by the demographic dominance of the more productive class suggests a non-linear relationship between economic inequality and economic growth. This relationship is consistent with Kuznets's hypothesis, where inequality initially increases up to a turning point, after which it begins a declining trend.

It's clear that this process signifies the gradual demographic replacement of a less productive labor class by a more productive one. This process unfolds in the same manner and for the same reason as creative destruction, as described by Schumpeter. Schumpeter argued that economic growth is fueled by "creative destruction," where new technologies and innovations disrupt existing industries and economic structures, leading to economic growth.

Joseph Schumpeter, in describing the idea of creative destruction, wrote:

> "The opening up of new markets, foreign or domestic, and the organizational development from the craft shop and factory to such concerns as U.S. Steel illustrate the same process of industrial mutation—if I may use that biological term—that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism. It is what capitalism consists in and what every capitalist concern has got to live in." (Schumpeter, 1942)

In Kuznets's "story," his observations on inequality and economic growth originate from precisely such a process, wherein the productive topography shifted from the "old" (i.e., the agricultural sector) to the "new" (the industrial sector).

Hence, through this process of Creative Destruction, labor inequality will initially increase as the "old" begins to be dismantled. It will continue to rise as the "new one" gradually replaces the "old one." This will persist until the "new one" dominates. From that

point forward, inequality among workers will begin to decrease, creating a relationship with economic growth that resembles an inverted "U," precisely as described by Kuznets.

Hence, a Schumpeterian creative destruction, characterized by the demographic replacement of traditional workers by more productive, new-type workers commanding higher wages, when combined with economic growth, will generate a non-linear, dynamic relationship between labor inequality and economic growth, forming an inverted "U" shape, precisely as described by Kuznets.

4. Empirical Evidence

4.1. The data

Having theoretically demonstrated in Section 3 that Kuznets's hypothesis holds true under the premise of a gradual dominance by a more productive and better-compensated labor class, this section will present statistical evidence supporting our assumptions.

This study employs panel data analysis, utilizing data from 13 OECD countries spanning the period 2004 to 2023. The list of these countries is presented in Table 2 below.

Table II Data countries

Countries				
USA	Canada	Australia	Denmark	
Germany	France	Netherlands	Belgium	Finland
Italy	Spain	Ireland	Greece	

The selection criteria for countries were based on data accessibility and each country's engagement with technological advancements, whether as an innovator or an adopter. The latter criterion safeguards our assumption, made in Section 3, that for

Kuznets's hypothesis to hold, economic growth must occur concurrently with the dominance of the more productive labor class. This is further supported by Figures 3 and 4.

Initially, for our analysis, data were sourced from the International Labour Organization (ILO) and the World Bank. To examine Kuznets's hypothesis, a Gini inequality index was constructed, specifically focusing on skilled and basic employees. The construction of this Gini index adhered to the methodology presented in Equation (16) of Section 3.

The variables q_L (wage premium) and Λ_L (labor composition) were calculated from income and population data, respectively, obtained from the ILO, in accordance with Relations (1) and (2). More specifically, for the calculation of the wage premium (q_L), average incomes of "advanced educated employees" were utilized for the numerator, while the average income of "Less than basic," "Basic," and "Intermediate" educational attainment levels were summed and averaged for the denominator[3]. For the calculation of labor composition Λ_L, population data for "advanced employees" were used for the denominator, and the sum of the populations of "Less than basic," "Basic," and "Intermediate" educational attainment levels constituted the numerator[4].

[3] (Average income of Less than basic + Average income of Basic + Average income of Intermediate)/3

[4] (Less than basic + Basic + Intermediate)/3

Table III Data

DATA	source			symbol
Skilled Workers	LFS - EU Labour Force Survey	ILO	Education (Aggregate levels): Advanced	Ls
Basic Educated Workers	LFS - EU Labour Force Survey	calculated	Education (Aggregate levels): Less than basic + Basic + Intermediate	Lb
labor composition	LFS - EU Labour Force Survey	calculated	Lb/Ls	LaborComp
Average Income for skilled Labor	HIES - EU Statistics on Income and Living Conditions	ILO	Education (Aggregate levels): Advanced	ws
Average Income for basic Labor	HIES - EU Statistics on Income and Living Conditions	calculated	Education (Aggregate levels): Less than basic + Basic + Intermediate	wb
wage premium	HIES - EU Statistics on Income and Living Conditions	calculated	ws/wb	qL
Economic Dominance	LFS - EU Labour Force Survey and HIES - EU Statistics on Income and Living Conditions	calculated	qL/LaborComp	m
Wage Inequality	LFS - EU Labour Force Survey and HIES - EU Statistics on Income and Living Conditions	calculated	(qL-1)/((m+1)+(LoaborComp+1))	InequalityL
GDP per capita	Gross domestic product is the total income earned through the production of goods and services in an economic territory during an accounting period. It can be measured in three different ways: using either the expenditure approach, the income approach, or the production approach. The core indicator has been divided by the general population to achieve a per capita estimate.This indicator is expressed in current prices, meaning no adjustment has been made to account for price changes over time. This indicator is expressed in United States dollars.	World Bank	GDP per capita (current US$)	GDPpcapita

Unemployment rate	Unemployment refers to the share of the labor force that is without work but available for and seeking employment.	World Bank	Unemployment, total (% of total labor force) (modeled ILO estimate)	UnmRT
Openness	Trade is the sum of exports and imports of goods and services. This indicator is expressed as a percentage of Gross Domestic Product (GDP) which is the total income earned through the production of goods and services in an economic territory during an accounting period.	World Bank	Trade (% of GDP)	open
Foreign Direct Investment	Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP.	World Bank	Foreign direct investment, net inflows (% of GDP)	FDI
Share of RnD	Gross domestic expenditures on research and development (R&D), expressed as a percent of GDP. They include both capital and current expenditures in the four main sectors: Business enterprise, Government, Higher education and Private non-profit. R&D covers basic research, applied research, and experimental development.	World Bank	Research and development expenditure (% of GDP)	RnD
Wage Share of GDP	ILO - Modelled Estimates	ILO	Labour income share as a percent of GDP -- ILO modelled estimates, May 2025 (%)	WS

Additionally, several control variables, consistent with established literature on inequality, were incorporated into the model. Specifically, these variables include wage share, the unemployment rate, Research and Development (R&D), trade openness, and Foreign Direct Investment (FDI). All variables used in this study, along with their sources, are presented below in Table 3.

Figures 5, 6, and 7 depict the long-term trends of labor composition (Λ_L), wage premium (q_L), and economic dominance (m_L), respectively. A consistent trend is observed across all countries: labor composition (Λ_L) decreases over time while economic dominance (m_L) increases. This pattern suggests that the more productive skilled worker class is steadily gaining both demographic and economic dominance in the labor market.

Furthermore, in certain countries, there are periods where m line in figures 5, 6 and 7 is higher than line Λ_L(LaborComp) indicating that the skilled worker class achieves such a degree of dominance that the critical dominance is positive (m_L-Λ_L>0). This provides evidence that certain periods in these economies correspond to the descending segment of the Kuznets curve, consistent with the analysis presented in Section 3.

Figure V labor composition (Λ_L), wage premium (q_L), and economic dominance (m_L)

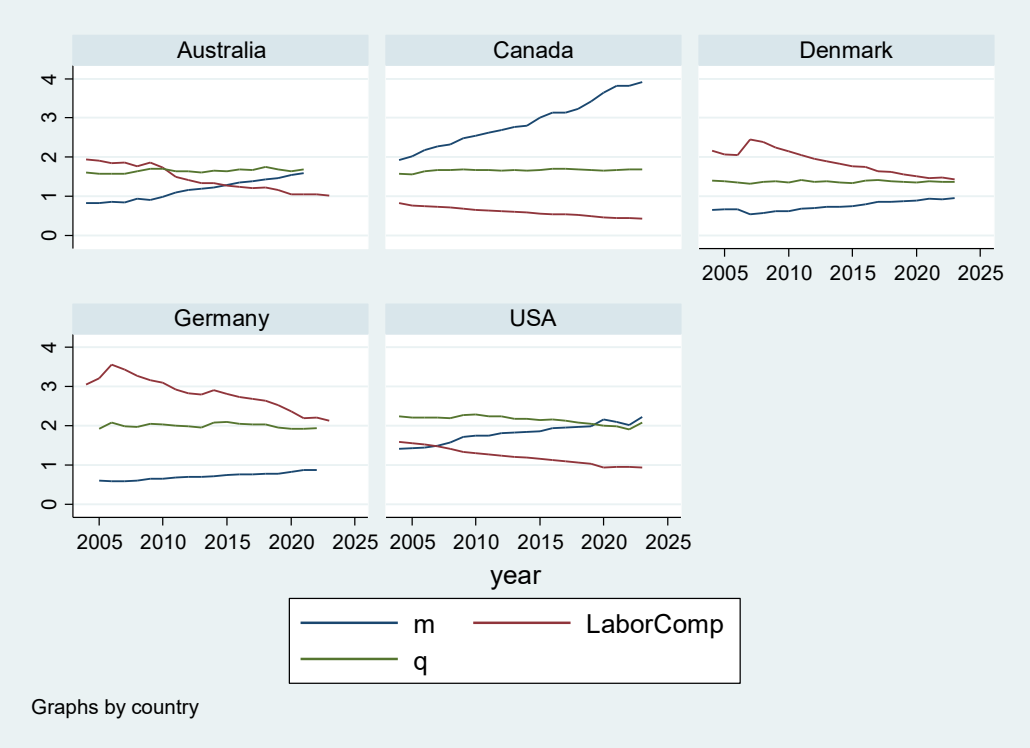


Figure VI labor composition (Λ_L), wage premium (q_L), and economic dominance (m_L)

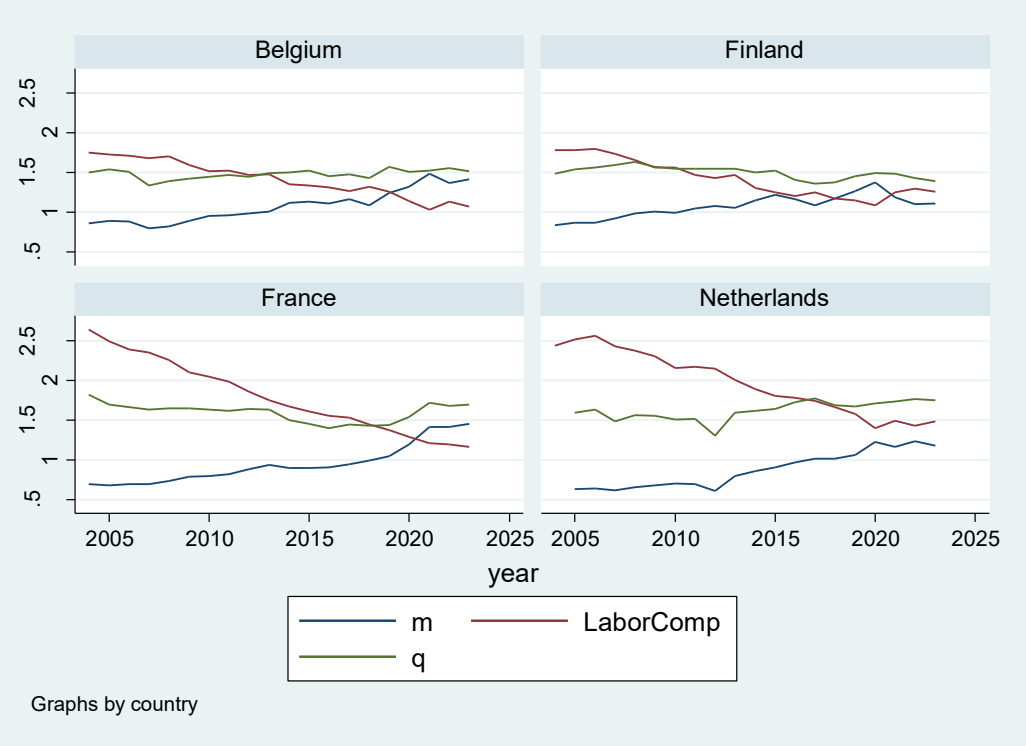
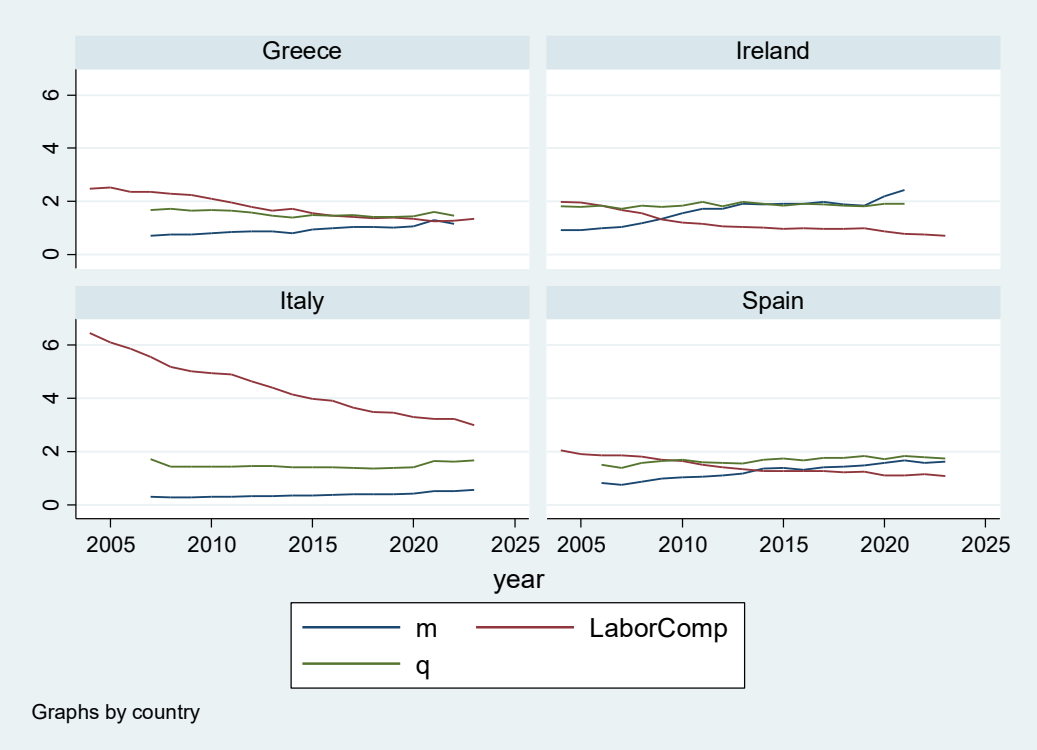


Figure VII labor composition (Λ_L), wage premium (q_L), and economic dominance (m_L)



Regarding the wage premium (q_L), no single, discernible trend is observed across the data. Instead, different countries exhibit varying fluctuations throughout the examination period.

Finally, Figures 5, 6, and 7 suggest that the contribution of demographic dominance— the decrease in labor composition (Λ_L)—is a significant factor in the rise of economic dominance (m_L). Consequently, we anticipate that economic growth will be linked to inequality, with this relationship being driven by the relative increase in the population of skilled workers. This corresponds to the second case described in Subsection 3.2.

Additionally, as demonstrated in Section 3, the condition for the existence of the Kuznets curve is a simultaneous economic growth and a demographic, and by extension an economic, dominance of the more productive economic class. Below, Figures 8 and 9 present scatter diagrams illustrating the relationship between economic dominance (m_L) and GDP per capita (Figure 8), and demographic dominance (Λ_L) and GDP per capita (Figure 9).

Figure VIII economic dominance (m_L) and GDP per capita

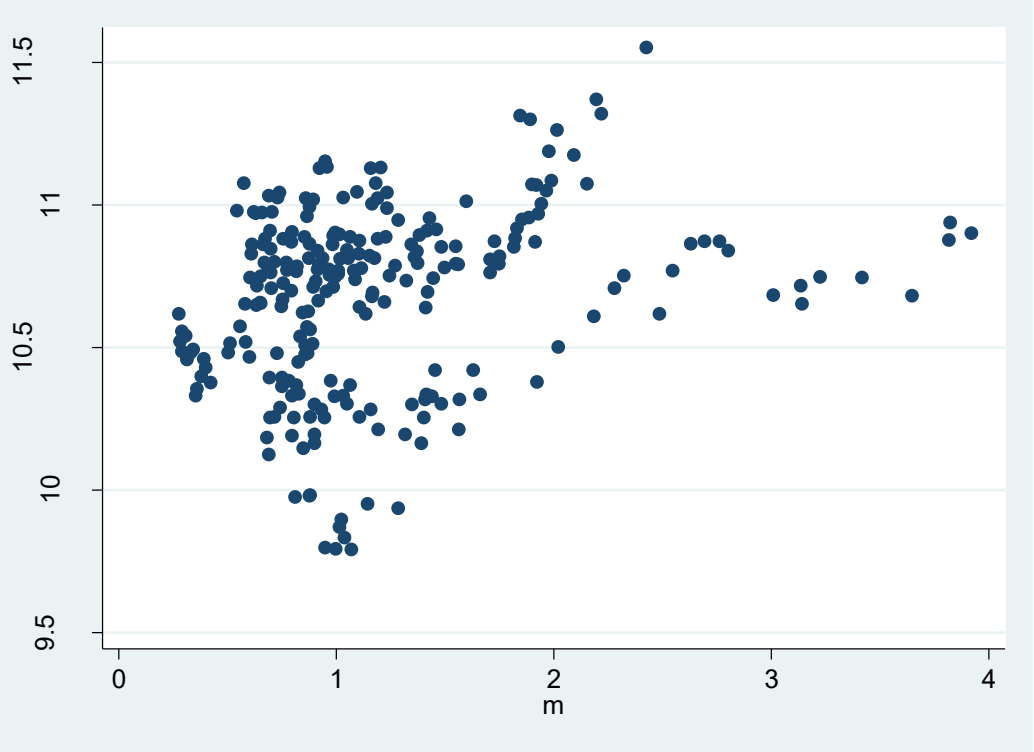
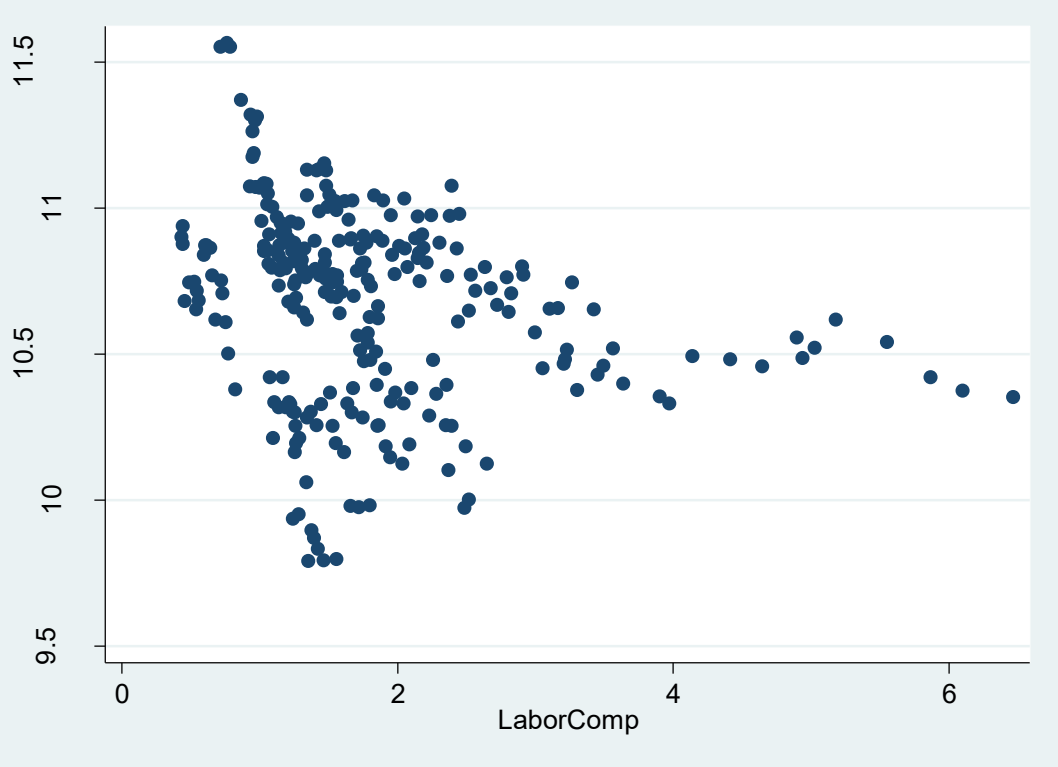


Figure IX demographic dominance (Λ_L) and GDP per capita



The diagrams appear to satisfy these prerequisites, as higher values of GDP per capita seem to correlate with greater economic dominance (m_L) and demographic dominance (Λ_L) by the skilled worker class. This provides further reason to assume that the sample economies indeed possess the characteristics of the second case described in Subsection 3.2, and that their economic growth will be linked to the evolution of labor economic inequality, according to the Kuznets hypothesis as analyzed in Chapter 3.

4.2. The test

Subsequently, with the prerequisite conditions being satisfied, we will proceed to empirically validate Kuznets's hypothesis. For this purpose, a panel data analysis was conducted, employing Fixed Effects, Random Effects, and GMM methodologies. For the empirical tests, Stata 13 software was utilized.

Panel data analysis is favored by researchers for its ability to provide more efficient evidence compared to cross-sectional analysis. This approach offers increased variability, reduced collinearity, and more degrees of freedom, making it ideal for investigating relationships such as inequality and growth (Deaton, 1995; Baltagi, 2005; Schmidheiny & Basel, 2011). Furthermore, panel datasets are advantageous for minimizing measurement errors and facilitating cross-country and cross-time comparisons, which is particularly beneficial in studies exploring the link between inequality and growth (Iradian, 2005). To address potential heterogeneity arising from unobservable social and institutional variables, both Fixed Effects and Random Effects methods for panel data were applied. To account for endogeneity and potential dynamic effects, the Generalized Method of Moments (GMM) method, proposed by Arellano & Bond in 1991, was employed. GMM is advantageous as it leverages both cross-sectional and time dimensions, increases the

number of observations, controls for country-fixed effects, and addresses the endogeneity of regressors (Steger, 2010). The significance of the results has been corrected for heteroskedasticity and autocorrelation using a robust variance-covariance estimator (VCE) model. Additionally, the suitability of the Fixed, Random effects methods was assessed using the Hausman test.

The analytical framework utilized two stochastic models, the general forms of which are delineated in Relations (16) and (17In this context, the subscript "i" corresponds to individual countries, and "t" pertains to time periods. The term b_i represents the unknown intercept for each country, and u_{it} signifies the error term.

Equation 16

$$Inequality_{it} = \beta_{0_{it}} + \beta_1 ln\text{GDP} + \beta_2 ln\text{GDP}^2 + \beta_3 X'_{it} + b_i + u_{it}$$

Equation 17

$$Inequality_{it} = \beta_{0_{it}} + \beta_1 ln\text{GDP} + \beta_2 ln\text{GDP}^2 + \beta_3 mLdumm + \beta_4 Kuzdum * ln\text{GDP} + \beta_5 X'_{it} + b_i + u_{it}$$

The dependent variable $Inequality_{it}$ is the Gini index which was constructed as described in the previous subsection. The explanatory variables include GDP per capita and its squared term, which follows the standard model found in the literature concerning the empirical evidence for the Kuznets hypothesis.

More specifically, according to Equation (16) and the relevant literature, it is anticipated that the coefficient of GDP per capita (β_2) will be positive, signifying a positive relationship between inequality and economic growth.

Conversely, the coefficient of the squared GDP per capita (β_3) is expected to be negative, indicating a decreasing rate of change that will lead to the characteristic inverted U-shaped (concave) trajectory of the relationship. However, a limitation of this empirical test is its inability to integrate the descending trajectory of the curve, where GDP per capita growth is negatively correlated with inequality.

Equation (17) represents a variant of the previous equation, distinguished by its explicit incorporation of the descending segment of the Kuznets curve. This is facilitated by the ability of derivation of the critical dominance of the skilled worker class ($m_L - \Lambda_L$), as presented in Section 3. To operationalize this distinction, a binary dummy variable (kuzdum) was constructed. This variable is assigned a value of 1 when the critical dominance of the skilled worker class ($m_L - \Lambda_L$) is positive, and 0 when it is negative. Consequently, observations for which kuzdum equals 1 correspond to instances where the skilled worker class has attained dominance, and these observations are posited to reside on the descending portion of the Kuznets hypothesis curve. Conversely, a value of 0 for kuzdum signifies observations where the basic worker class retains dominance, and these are anticipated to occupy the ascending portion of the curve.

Thus, based on our econometric analysis, the coefficient for GDP per capita (β_1) is anticipated to be positive for observations where kuzdum equals 0, corresponding to the ascending segment of the Kuznets curve. On the contrary, the coefficient for GDP per capita (β_4) is expected to be negative expressing observations where kuzdum equals 1, representing the descending segment of the curve. With respect to the GDP per capita squared term (β_2), it is projected to consistently exhibit a negative effect, thereby affirming the negative rate of change characteristic of the curve's inverted U-shape.

Additionally, X'_{it} denotes the set of control explanatory variables which were incorporated, consistent with established literature. These variables include the unemployment rate, total Research and Development (R&D) as a GDP share, wage share, trade openness, and foreign direct investment, as detailed in Table 3.

The findings of the econometric analysis are subsequently presented in Table 4.

The results of the Hausman Test indicated that the Random Effects method is more appropriate than the Fixed Effects method. The p-value of 0.9646, which is greater than the conventional significance level of 0.05, suggests that the unobserved heterogeneity is not correlated with the independent variables. This finding validates the choice of the more efficient Random Effects model. Accordingly, it is assumed that the unobserved, time-invariant heterogeneity is uncorrelated with the independent variables. This heterogeneity is subsequently modeled as a random component of the error term.

The Sargan / Hansen Test yielded a p-value of 0.2202, which, by exceeding the conventional 0.05 significance level, substantiated the validity of the GMM model.

Additionally, the Arellano-Bond test for autocorrelation detected the presence of first-order autocorrelation (AR(1)) but found no evidence of second-order autocorrelation (AR(2)). This is corroborated by the p-values for the AR(1) test (0.0099) and the AR(2) test (0.1223), respectively, which satisfy the necessary conditions for a correctly specified GMM model. These findings collectively indicate that the GMM model utilized in this study is correctly specified. All of the tests are presented in the Appendix.

Table IV empirical results

	Labor Income Inequality (InequalityL)					
	fixed effects		random effects		GMM	
	16	17	16	17	16	17
GDP per capita	1.2974*** (0.2636)	1.0373** (0.2521)	1.2873*** (0.2689)	1.0261*** (.2514)	.36643** (0.1301)	0.27319 (.1689)
GDP per capita2	-.06119*** (0.0126)	-.04815** (0.0119)	-.0607*** (0.0129)	-.04764*** (0.0119)	-.01743** (0.0062)	-0.01223 (.0079)
kuzsum		.3962** (0.1074)		.39121*** (0.1050)		.34200*** (.0587)
kuzsum*GDP per capita		-.03666** (0.0101)		-.03613*** (0.0099)		-.03170*** (.0056)
WS	-0.0008 (0.0004)	-.0010** (0.0003)	-.0010** (0.0004)	-.00115*** (0.0002)	-0.00012 (0.0003)	-0.00034 (.0003)
Unemployment rate	0.00002 (0.0003)	0.0002 (0.0003)	0.00003 (0.0003)	0.0002 (0.0003)	-0.00016 (0.0002)	0.00008 (.0003)
RnD	0.0063 (0.0059)	0.0046 (0.0062)	0.0071 (0.0049)	0.0052 (0.0055)	0.0042 (0.0042)	0.00458 (.0047)
Openness	0.0002 (0.0001)	0.0002 (0.0001)	0.00018 (0.0001)	0.0001 (0.0001)	0.00005 (0.0001)	0.000003 (.0001)
FDI	-.0003*** (0.00005)	-.0003*** (0.00005)	-.0003*** (0.00005)	-.0003*** (0.00005)	-0.00008 (0.0000)	-.00011* (.00005)
L. InequalityL					.5906*** (0.0633)	.50111*** (.0536)
constant	-6.7380*** (1.3715)	-5.4291** (1.3318)	-6.6718*** (1.3842)	-5.3588*** (1.3167)	-1.8802** (0.6779)	-1.4537 (.9055)
N	228	228	228	228	195	195
R2	0.2230	0.3266				
adjR2	0.1983	0.2988				

* p<0.05; ** p<0.01; *** p<0.001

Sources: ILO, World Bank

Sample: 13 OECD, period 2004 to 2023

Notes: Codes 16 and 17 on the columns refer to the corresponding models.

The results of our analysis confirm the Kuznets hypothesis and are consistent across all three estimation methods (Fixed Effects, Random Effects, and GMM). More specifically, the hypothesis is substantiated by the findings of both models.

In Model (24), the coefficient for GDP per capita (β_2) and the coefficient of its squared term (β_3) exhibit the anticipated signs ($\beta_2>0$ and $\beta_3<0$). This finding indicates a non-linear relationship between economic growth and economic inequality, consistent with an inverted "U" shape according to the bibliography.

Model (25) provides further corroboration of the analysis presented in Section 3. It validates the ascending segment of the Kuznets curve, similar to Model (24), while additionally confirming the descending segment. The derivation of the critical dominance of the skilled worker class ($m_L - \Lambda_L$) facilitates this specific empirical test, as outlined in Section 3.

Consistent with our a priori expectations, the coefficient for GDP per capita is positive when the critical dominance of the skilled worker class is negative (kuzdum = 0) and negative when it is positive (kuzdum = 1). Furthermore, the squared term of GDP per capita consistently exhibits a negative correlation with inequality, reinforcing the non-linear, inverted U-shaped trajectory of the relationship.

Regarding the control variables, the wage share exhibits the expected negative sign, although it is only statistically significant in half of the cases. This is consistent with the analysis in Section 3, which posits that the production choices of a more productive class lead to lower unit costs per worker. Therefore, it is logical that greater dominance by the skilled worker class would be associated with a lower wage share.

The coefficients for unemployment, Research and Development (R&D), and openness all have the correct signs according to the literature, but they are not statistically significant. In contrast, Foreign Direct Investment (FDI) is statistically significant and negatively correlated with economic inequality in five out of the six models. A plausible explanation for this is the impact of FDI on the wage premium (q) through an increase in the demand for skilled workers.

The empirical findings of this study confirm the analysis and hypotheses put forth in Section 3. The Kuznets hypothesis is substantiated in both models, and importantly, the confirmation of the descending side of the curve within the same model strengthens our analysis. The contribution of the critical dominance of the skilled worker class proved to be quite significant in this regard.

This confirms our hypothesis that the Kuznets curve accurately expresses the relationship between economic growth and economic inequality when both evolve over time due to the demographic dominance of the more productive labor class. Ultimately, an evolutionary process of creative destruction, where a more productive group of workers gradually replaces an older, less productive class, will be accompanied by a relationship between inequality and economic growth that resembles the inverted "U" shape originally described by Kuznets.

5. Conclusion

According to the findings of this study, the Kuznets hypothesis is confirmed both theoretically and empirically.

Adopting the approach that the relationship between economic inequality and economic growth is linked to the conditions that lead to the prevalence of a more productive class in the market (such as industrial workers over rural workers during the period Kuznets examined), the analysis demonstrates that inequality initially increases when the economy grows through more productive labor. Subsequently, as the more productive class gains dominance in the market—both economically and, more importantly, demographically—inequality reaches a pivotal point, from which a downward trajectory begins as the economy continues to grow.

This process gives rise to a relationship between economic inequality and economic growth that is characterized by the inverted "U" of the Kuznets hypothesis. This relationship occurs for the same reasons and in the same manner as the process of creative destruction described by Schumpeter, where the "new" and more productive replaces the "old" and less productive.

The present study offers a unique methodological contribution by constructing a dedicated index for labor inequality and calculating the critical dominance of the skilled worker class. This approach, which relates directly to the stage of an economy according to the Kuznets hypothesis, allowed for a more targeted examination of the hypothesis.

Specifically, the empirical confirmation of the Kuznets hypothesis, particularly for the long-term observations on the descending segment of the curve, strengthens our

theoretical framework and its assumptions about the relationship between economic inequality and economic growth.

A key contribution of this paper is its focus on labor composition as a crucial link between economic inequality and economic growth. By analyzing the demographic relationship between different classes with varying productive capacities, this paper provides a valuable tool for understanding how an economy's growth, driven by innovation, dynamically shapes labor inequality to form the Kuznets curve.

The findings have significant policy implications, offering a framework for policymakers to map where an economy is located on the Kuznets curve. This can inform decisions related to innovation and industrial policy, helping leaders anticipate the effects of their choices on both inequality and growth, whether the economy acts as an innovator or a follower.

In conclusion, this work demonstrates that the Kuznets hypothesis holds both theoretically and empirically, particularly within contexts similar to those Kuznets observed. Furthermore, these contexts appear to be a direct result of Schumpeterian creative destruction, where older, less productive methods of production are replaced by new ones that demand a more specialized and productive workforce.

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Appendix

Equations' explanations

12 and 13

From the Lorenz curve

$$Inequality_L = \frac{area\ B}{area\ B + \text{area}\ A}$$

$$Inequality_L = \frac{\frac{1}{2}\text{Labor} * \text{Wages} - \left(\frac{1}{2}L_b * W_b + \frac{1}{2}L_s * W_s + L_s * W_b\right)}{\frac{1}{2}\text{Labor} * \text{Wages}} \rightarrow$$

$$Inequality_L = \frac{\frac{1}{2}\text{Labor} * \text{Wages} - \frac{1}{2}(L_b * W_b + L_s * W_s + 2 * L_s * W_b)}{\frac{1}{2}\text{Labor} * \text{Wages}} \rightarrow$$

$$Inequality_L = \frac{\text{Labor} * \text{Wages} - \left((L_b + L_s) * W_b + L_s * (W_s + W_b)\right)}{\text{Labor} * \text{Wages}} \rightarrow$$

$$Inequality_L = \frac{\text{Labor} * \text{Wages} - (L * W_b + L_s * W)}{\text{Labor} * \text{Wages}} \rightarrow$$

$$Inequality_L = \frac{\text{Labor} * \text{Wages} - L * W\left(\frac{W_b}{W} + \frac{L_s}{L}\right)}{\text{Labor} * \text{Wages}} \rightarrow$$

$$Inequality_L = \frac{\text{Labor} * \text{Wages}\left(1 - \left(\frac{W_b}{W} + \frac{L_s}{L}\right)\right)}{\text{Labor} * \text{Wages}} \rightarrow$$

$$Inequality_L = 1 - \left(\frac{W_b}{W} + \frac{L_s}{L}\right) \rightarrow$$

$$Inequality_L = 1 - \frac{W_b}{W} - \frac{L_s}{L} \rightarrow$$

$$Inequality_L = \frac{W_s}{W} - \frac{L_s}{L} \quad (12)$$

$$or$$

$$Inequality_L = \frac{L_b}{L} - \frac{W_b}{W} \quad (13)$$

14

$$Inequality_L = \omega_s - \gamma_s$$

From equations 7 and 9

$$\omega_s = \frac{W_s}{W} = \frac{1}{1 + \frac{1}{\frac{q_L}{\Lambda_L}}}$$

$$\gamma_s = \frac{L_s}{L} = \frac{1}{\Lambda_L + 1}$$

$$Inequality_L = \frac{1}{1 + \frac{1}{\frac{q_L}{\Lambda_L}}} - \frac{1}{\Lambda_L + 1} \rightarrow$$

$$Inequality_L = \frac{(\Lambda_L + 1) - \left(1 + \frac{1}{\frac{q_L}{\Lambda_L}}\right)}{\left(1 + \frac{1}{\frac{q_L}{\Lambda_L}}\right)(\Lambda_L + 1)} \rightarrow$$

$$Inequality_L = \frac{(\Lambda_L + 1) - \left(1 + \frac{1}{\frac{q_L}{\Lambda_L}}\right)}{\frac{1}{\frac{q_L}{\Lambda_L}}(m_L + 1)(\Lambda_L + 1)} \rightarrow$$

$$Inequality_L = \frac{\frac{q_L}{\Lambda_L}(\Lambda_L + 1) - \frac{q_L}{\Lambda_L}\left(1 + \frac{1}{\frac{q_L}{\Lambda_L}}\right)}{(m_L + 1)(\Lambda_L + 1)} \rightarrow$$

$$Inequality_L = \frac{q_L + \frac{q_L}{\Lambda_L} - \frac{q_L}{\Lambda_L} - 1}{(m_L + 1)(\Lambda_L + 1)} \rightarrow$$

$$Inequality_L = \frac{q_L - 1}{(m_L + 1)(\Lambda_L + 1)} \qquad (14)$$

15

$$Inequality_L = \frac{q_L - 1}{(m_L + 1)(1 + \Lambda_L)}$$

$$\frac{\partial Inequality_L}{\partial q_L} = \frac{1}{(m_L + 1)(1 + \Lambda_L)}$$

$$\frac{\partial Inequality_L}{\partial \Lambda_L} = \frac{-(q_L - 1)(m_L + 1)}{\left((m_L + 1)(\Lambda_L + 1)\right)^2}$$

$$\frac{\partial Inequality_L}{\partial m_L} = \frac{-(q_L - 1)(\Lambda_L + 1)}{\left((m_L + 1)(\Lambda_L + 1)\right)^2}$$

$$\dot{Inequality}_L = \frac{q_L}{q_L - 1}\dot{q}_L + \frac{\Lambda_L}{\Lambda_L + 1}\dot{\Lambda}_L + \frac{m_L}{m_L + 1}\dot{m}_L \rightarrow$$

Using equation 4

$$\dot{m}_L = \dot{q}_L - \dot{\Lambda}_L$$

$$\rightarrow \dot{Inequality}_L = \frac{q_L}{q_L - 1}\dot{q}_L - \frac{\Lambda_L}{\Lambda_L + 1}\dot{\Lambda}_L - \frac{m_L}{m_L + 1}\left(\dot{q}_L - \dot{\Lambda}_L\right) \rightarrow$$

$$\dot{Inequality}_L = \left(\frac{q_L}{q_L - 1} - \frac{m_L}{m_L + 1}\right)\dot{q}_L + \left(\frac{m_L}{m_L + 1} - \frac{\Lambda_L}{\Lambda_L + 1}\right)\dot{\Lambda}_L \rightarrow$$

$$\dot{Inequality}_L = \left(\frac{q_L + m_L}{(q_L - 1)(m_L + 1)}\right)\dot{q}_L + \left(\frac{m_L - \Lambda_L}{(m_L + 1)(\Lambda_L + 1)}\right)\dot{\Lambda}_L \rightarrow$$

$$\dot{Inequality}_L = \frac{1}{m_L + 1}\left(\frac{q_L + m_L}{q_L - 1}\dot{q}_L + \frac{m_L - \Lambda_L}{\Lambda_L + 1}\dot{\Lambda}_L\right) \qquad (15)$$

Statistic tests

```
. hausman fixed random
```

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lnGDPpc	1.037254	1.026101	.0111537	.0306397
lnGDPpc2	-.0481492	-.0476442	-.000505	.0014125
Kuzdum	.3962719	.3912156	.0050562	.0083871
lnGDPpcD	-.0366617	-.0361389	-.0005228	.0007975
WS	-.0010451	-.0011514	.0001063	.0001236
UnmRT	.0001969	.000191	5.94e-06	.0000319
RnD	.0046457	.0052378	-.0005921	.0009499
open	.0001697	.0001284	.0000413	.0000385
FDI	-.0002732	-.0002758	2.60e-06	8.97e-06

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(9) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 2.99
Prob>chi2 = 0.9646

Arellano-Bond test for zero autocorrelation in first-differenced errors

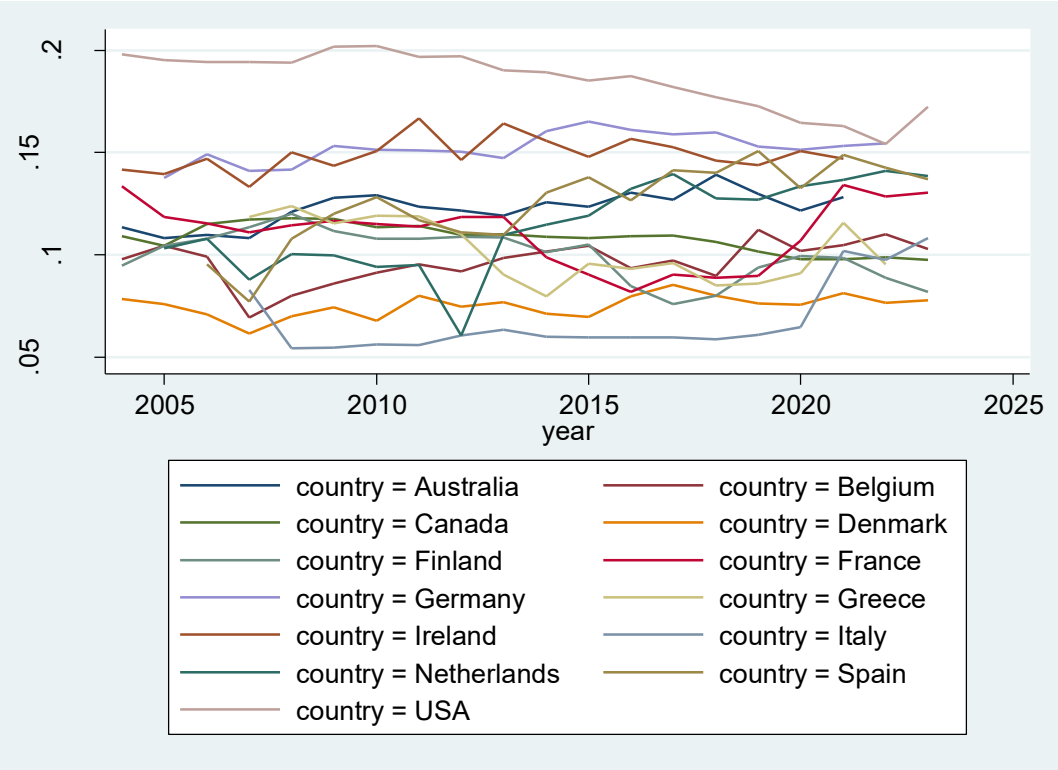
Order	z	Prob > z
1	-2.5777	0.0099
2	1.5453	0.1223

H0: no autocorrelation

```
. estat sargan
Sargan test of overidentifying restrictions
        H0: overidentifying restrictions are valid

        chi2(137)     =  149.4665
        Prob > chi2   =    0.2202
```

Inequality levels



Equations

Equation 1

$$q_L = \frac{w_s}{w_b}$$

Equation 2

$$\Lambda_L = \frac{L_b}{L_s}$$

Equation 3

$$m_L = \frac{W_s}{W_b} = \frac{q_L}{\Lambda_L}$$

Equation 4

$$\dot{m}_L = \dot{q}_L - \dot{\Lambda}_L$$

Equation 5

$$\frac{W_s}{Y} = \frac{w_s L_s}{Y} = \frac{w_s}{A_s}$$

Equation 6

$$\frac{W_b}{Y} = \frac{w_b L_b}{Y} = \frac{w_b}{A_b}$$

Equation 7

$$\omega_s = \frac{W_s}{W} = \frac{1}{1 + \frac{1}{\frac{q_L}{\Lambda_L}}}$$

Equation 8

$$\omega_b = \frac{W_b}{W} = \frac{1}{\frac{q_L}{\Lambda_L} + 1}$$

Equation 9

$$\gamma_s = \frac{L_s}{L} = \frac{1}{\Lambda_L + 1}$$

Equation 10

$$\gamma_b = \frac{L_b}{L} = \frac{1}{\frac{1}{\Lambda_L} + 1}$$

Equation 11

$$Inequality_L = \frac{area\ B}{area\ B + \text{area}\ A}$$

Equation 12

$$Inequality_L = \omega_s - \gamma_s$$

Equation 13

$$Inequality_L = \gamma_b - \omega_b$$

Equation 14

$$Inequality_L = \frac{q_L - 1}{(m_L + 1)(1 + \Lambda_L)}$$

Equation 15

$$\dot{Inequality}_L = \frac{1}{m_L + 1}\left(\frac{q_L + m_L}{q_L - 1}\dot{q_L} + \frac{m_L - \Lambda_L}{\Lambda_L + 1}\dot{\Lambda_L}\right)$$

Equation 16

$$Inequality_{it} = \beta_{0_{it}} + \beta_1 ln\text{GDP} + \beta_2 ln\text{GDP}^2 + \beta_3 X'_{it} + b_i + u_{it}$$

Equation 17

$$Inequality_{it} = \beta_{0_{it}} + \beta_1 ln\text{GDP} + \beta_2 ln\text{GDP}^2 + \beta_3 mLdumm + \beta_4 Kuzdum * ln\text{GDP} + \beta_5 X'_{it} + b_i + u_{it}$$