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The finance-growth nexus over the long-run*

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Abstract

This paper studies the finance-growth nexus in historical perspective. We employ a panel data model with interactive fixed effects and time-varying coefficients for a sample of advanced economies since the late 19th century. The model considers flexible specifications of heterogeneity and accounts for global common shocks that have likely shaped the finance-growth nexus over time. We present three main sets of results. First, our empirical analysis shows that the relationship between finance and growth is time-varying. Using our benchmark model, we estimate the time-varying slope coefficient of financial development and show that the finance-growth nexus has secularly evolved, thus challenging the mainstream assumption of a uniform association over time. Second, by accounting for global common shocks and their heterogeneous impact, we challenge the dominant narrative suggesting a consistently positive contemporaneous relationship between financial development and economic growth. Third, differences emerge when we distinguish between Schumpeterian finance (bank credit growth) and a more speculative type of finance (stock market growth). While both exhibit time-varying behaviors, the empirical evidence points to a substantially stronger and positive association between bank credit growth and economic growth, as opposed to stock markets, which tend to display a weaker or even negative relationship. Our results remain robust when we account for a range of alternative specifications and potential sources of variation.

Keywords: Finance-growth nexus, Financial development, Economic growth, Semiparametric methods, Time-varying estimates, Long-panel
JEL classification: C14, E44, N20, O16

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1 Introduction

> *"It is not trivial for the endogenous evolutionary dynamics of capitalist economies to change the relations between financial and real economic variables which, in turn, changes the dynamic patterns of the economy."*
>
> – (Minsky, 1990, p. 66)

Since Smith (1776), economists and economic historians have discussed the potential role of finance in shaping long-run economic growth.[1] For Schumpeter (1911), the financial sector is the *ephor of capitalism* whose ability to create purchasing power and "to force the economic system into new channels" allows entrepreneurs to drive structural change. Gerschenkron (1962) and Minsky (1990) argue that industrial development has always relied on well-developed financial systems. Studies by Boyd and Prescott (1986), Allen (1990) and Merton (1995) claim that financial institutions and markets reduce the burdens of market frictions, while Diamond (1984) argue that financial intermediaries can reduce monitoring costs and improve corporate governance, ultimately contributing to economic growth. For Greenwood and Smith (1997), finance enables greater specialization and division of labor, which are key drivers of productivity improvements and long-run economic growth. Furthermore, key contributions by Magdoff and Sweezy (1983), Magdoff and Sweezy (1987) and Sweezy (1994) advance the view that financial expansions are key forces to counteract stagnation tendencies in the real side of the economy.[2] What may at first glance appear as a broad consensus that finance plays a fundamental role in fostering long-run economic development can be summarized using the words by Miller (1998), "financial markets contribute to economic growth is a proposition almost too obvious for serious discussion".

Yet, alongside this apparent consensus, a long-standing tradition has questioned the *love affair* between finance and growth. For instance, Kindleberger and Aliber (1978) demonstrate the inherently cyclical and destabilizing nature of financial systems, highlighting their tendency to generate speculative manias, panics, and crashes. In this view, finance is not necessarily productive or growth-enhancing, but can rather lead to recurrent crises and systemic fragility. Similarly, Minsky (1992) introduces the financial instability hypothesis, showing that financial institutions and markets endogenously evolve toward fragility and they are inherently prone to detach from productive investment in order to fulfill their function of making money (Minsky, 1993). This critical view of the finance and growth nexus has increasingly extended even to those orthodox strands of the literature that had long assumed a positive relationship between finance and growth. For instance, in his 2015 American Finance Association (AFA) Presidential Address, Luigi Zingales writes that "we have to acknowledge that our view of the benefits of finance is inflated" (Zingales, 2015).

An extensive body of empirical research has emerged to test the finance and growth nexus and the bulk of historical evidence remains mixed. On the one hand, King and Levine (1993) find a robust association between

[1] Smith (1776) highlights the role of "banking debt" in shaping capital accumulation and productive investment.

[2] This is particularly noteworthy given that finance is entirely absent from Baran and Sweezy's *Magnum Opus* (Baran and Sweezy, 1966), which laid the foundations of the monopoly capital tradition. In Baran and Sweezy (1966), the financial sector is cited only once in the last paragraph of chapter 5 about sales effort. The authors suggest that "the entire apparatus of 'finance, insurance, and real estate' is essential to the normal functioning of the corporate system and another no less indispensable prop to the level of income and employment. The prodigious volume of resources absorbed in all these activities does in fact constitute necessary costs of capitalist production" (Baran and Sweezy, 1966, p. 141).

financial development and economic growth, suggesting that financial growth could predict future per capita GDP growth rates. Levine (1997), Beck et al. (2000) and Levine et al. (2000) use legal origins as instruments, claiming that the exogenous component of financial development positively impacts economic growth. On the other hand, among many contributions, Deidda and Fattouh (2002) and Arcand et al. (2015) highlight a non-linear relationship between finance and growth, while Bofinger et al. (2024) provide mixed evidence on the effect of financial growth on GDP growth.

There are three reasons that motivate this paper. Firstly, while there is abundant evidence on the finance and growth nexus, much of the existing research is concentrated on the post-war period (especially the Great Moderation), leaving us with limited knowledge of how this relationship has evolved historically. Secondly, the finance and growth relationship is often assumed to be constant over time, i.e. the slope coefficient is time-invariant. However, policy environments and macroeconomic conditions have changed significantly across different historical periods, shaping the way finance interacts with economic growth. Using the words of Minsky (1990, p. 66), "it is not trivial for the endogenous evolutionary dynamics of capitalist economies to change the relations between financial and real economic variables which, in turn, changes the dynamic patterns of the economy". To properly account for these variations, a more flexible approach is needed − one that captures the dynamic and time-varying nature of the finance and growth nexus, particularly when studying it over the very long run. Thirdly, a significant portion of the existing literature suffers from critical econometric issues, particularly cross-sectional dependence and time-varying unobservable heterogeneity, both of which pose challenges for inference. On the one hand, cross-sectional dependence arises when countries are affected by common but unobserved global shocks, which, if not properly accounted for, can lead to biased and inconsistent estimates. To address this, interactive fixed effects (IFE) models à la Pesaran (2006) and Bai (2009) provide a flexible framework for capturing heterogeneous responses to common shocks by introducing latent group structures with unit-specific loadings. This allows the model to account for numerous structural breaks that affect multiple countries differently, rather than assuming a uniform effect across the entire panel. On the other hand, time-varying unobservable heterogeneity implies that country-specific effects evolve over time in ways that standard fixed-effects or random-effects models cannot capture. Moreover, the impact of the same common shock (such as a financial crisis or a war) is also not constant over time, as economies and their growth trajectories adapt to changing policy environments and macroeconomic conditions. To account for this, time-varying interactive fixed effects models (TVIFE) à la Sun et al. (2009) extend the standard IFE approach by allowing factor loadings to change over time. Addressing these econometric challenges may uncover a more complex or even opposing relationship between finance and growth.

This article studies the long-run relationship between finance and economic growth employing a historical dataset for the OECD area from 1882 to 2020. We employ a semiparametric panel data model with interactive fixed effects and time-varying coefficients, applying the kernel-based method used by Casas et al. (2021). The model considers flexible specifications of heterogeneity and accounts for global common shocks that have likely shaped the finance and growth nexus over the last century and a half. We present three main sets of results. First, we conduct the constancy test introduced by Casas et al. (2021) to assess the time-varying nature of the finance and growth nexus. This test examines the null hypothesis that all coefficients remain constant against the alternative hypothesis that at least one exhibits statistically significant time variation. The results confirm the time-varying behavior of the relationship between financial development and economic growth. Then, we estimate the time-varying slope coefficient of financial development and show that the finance-growth nexus has evolved significantly in the last 139 years. Second, after accounting for global structural breaks and their heterogeneous impact, the contemporaneous relationship between financial development (measured by the growth of liquid liabilities over GDP) and economic growth has historically been far from positive. Third, differences emerge when we distinguish between Schumpeterian finance (bank credit growth) and a more speculative type of finance (stock market growth). While both exhibit time-varying behaviors, the empirical evidence points to a substantially stronger and positive association between bank credit growth and economic growth, as opposed to stock markets, which tend to display a weaker or even negative relationship. Our results remain robust when using labor productivity growth as an alternative proxy for economic development. We also check the robustness of our results by considering different country samples (e.g., excluding the United States and all the Anglo-Saxon countries) and various model specifications, including alternative lag structures and different length of growth rates.

Related literature. This research contributes primarily to the finance and growth literature. In the 1960s, Goldsmith (1969) documents a positive correlation between financial growth and economic activity using data from 35 countries spanning the period 1860-1963. King and Levine (1993) analyze data from 80 countries (1960–1989), using various financial development proxies, including liquid liabilities to GDP, bank deposits to total deposits, and private sector credit to total domestic credit. Their findings reveal a positive correlation between financial development and economic growth, thus suggesting that financial growth can predict future per capita GDP growth rates. Levine and Zervos (1998) extend this analysis by introducing the stock market. The authors find that both banking development and stock market liquidity promotes long-run economic growth. Levine (1997), Beck et al. (2000) and Levine et al. (2000) use legal origins as instruments, asserting that the exogenous component of financial development positively impacts economic growth. In a dynamic panel setting, Benhabib and Spiegel (2000) find that financial development positively influences investment rates.

Nonetheless, while some scholars have provided evidence of a positive and monotonic effect of finance on economic growth, recent studies have challenged these findings, offering a more critical assessment of the finance and growth relationship. On the one hand, Deidda and Fattouh (2002) and Arcand et al. (2015) highlight a non-linear relationship between finance and growth. Their evidence suggests an inverted U−shaped relationship, and so that, at intermediate stages of financial development, a larger financial sector is associated with higher economic growth. However, excessive financial development appears to be linked to lower growth rates. Moreover, studies such as Aizenman et al. (2013), Jordà et al. (2015), and Krishnamurthy and Muir (2017), provide evidence that rapid credit growth is a strong predictor of macroeconomic instability and financial crises. In this regard, Cecchetti and Kharroubi (2012) integrate these perspectives, providing evidence of tipping points where financial expansions become a drug on growth and showing that a rapidly expanding financial sector (measured by credit growth and by employment growth in the financial sector) can hinder aggregate productivity growth. On the other hand, some authors provide evidence that financial activity can have detrimental effects on economic growth in times of financialization. Bofinger et al. (2024) provide mixed evidence on the effect of credit growth on GDP growth, suggesting that the unproductive use of credit − a cornerstone of financialization − may explain the negative effects of credit on growth or the absence of a clear relationship between them. Loayza and Ranciere (2006) employ a dynamic panel pooled mean group estimator, revealing that while financial activity has a positive long-term effect on growth, it can also lead to financial crises and slower growth in the short run. Instead, using time series data on business investment from the USA, UK, France, and Germany, Stockhammer (2004) shows that rising financial investment of non-financial businesses has had a negative long-term effect on capital accumulation, contributing to the post-1970s economic slowdown. Lastly, Tori and Onaran (2020) provide further evidence of the negative impact of financialization on investment and growth, emphasizing that in countries with more developed financial sectors (usually, high-income countries), firms are even more inclined to shift resources toward financial activities rather than physical capital accumulation. Despite increasing recognition of potential non-linearities or negative effects, most studies still implicitly assume that the finance and growth nexus is time-invariant. The possibility that this relationship evolves over time − potentially exhibiting periods of positive, weaker and negative effects − remains largely unexplored. Our findings suggest that the finance and growth nexus should be analyzed within a time-varying framework. Accounting for this time-varying behaviors, the contemporaneous correlation between finance and growth turns out to be historically weak or even negative.

This paper also relates to the work of economic historians on international finance in historical perspective. This body of research serves as the historical counterpart to the work of contemporary economists on the relationship between measures of financial development and GDP per capita growth. Rousseau and Sylla (2003) analyze the evolution of liquid liabilities and total bank credit for 17 advanced economies from 1850 to 1997. The authors find that financial activity predominantly affects growth during the early stages of development, and this result holds particularly true before 1914. Van Nieuwerburgh et al. (2006) assess the role of finance for growth in Belgium post 1830 suggesting that stock market development significantly influenced economic growth, particularly between 1873 and 1935. Rousseau and Wachtel (1998) provide a comparative five country study for the period 1870-1929. The results highlight the crucial role of financial intermediation in driving the rapid development of the real economy in the United States, the United Kingdom, Canada, Norway, and Sweden. However, this body of research primarily relies on cross-country studies or time-series evidence. To the best of our knowledge, no study in this literature has employed time-varying panel data models to systematically assess the evolution of the finance-growth nexus in historical perspective.[3]

Finally, this article contributes to the literature that applies time-varying panel models with interactive fixed effects and unobserved individual and time heterogeneities to address key policy questions. In energy demand

[3] Schularick and Steger (2010) employ dynamic panel estimations to examine the relationship between financial integration and economic growth for the periods 1880-1913 and 1980-2002. However, the focus is more on the degree of openness to global capital markets rather than domestic financial development. Moreover, the GMM estimation primarily assumes a time-invariant slope coefficient, as is standard in the literature.

studies, works such as Gao et al. (2021) and Liddle and Parker (2022) use this methodology to obtain reliable estimates of the income and price elasticity of energy demand. In the health economics literature, studies such as Baltagi and Moscone (2010) and Casas et al. (2021) apply time-varying panel data frameworks to study the long-run economic relationship between health care expenditure and income. Wang et al. (2025) contribute to the policy debate on the shape and evolution of the Phillips curve using a time-varying interactive fixed effects framework with U.S. state-level unemployment and nominal wages data, while Wang et al. (2024) propose a panel data model with interactive fixed effects and two-way slope heterogeneity to study the relationship between house prices and real income in the United States. Our work extends this methodological approach to a different strand of the literature by applying it to the finance-growth nexus.

This paper proceeds as follows. In Section 2, we provide a historical background on the evolution of financial systems in the OECD area starting from the late 19th century. Through an institutionalist perspective, we trace the evolution of financial institutions and markets across three distinct institutional-policy arrangements, whose characteristics may have likely shaped the finance-growth nexus over time. In Section 3, we present the data and we provide some descriptive statistics. Section 4 discusses the empirical strategy, while Section 5 presents the results and discusses them in relation to the historical background. Section 6 presents our battery of robustness checks, while Section 7 concludes. In the extensive Data Appendix at the end of the paper, we present for each country the sources, the data used and additional robustness checks.

2 Historical background

In the literature of historical institutionalism, scholars such as Capoccia and Kelemen (2007) and Capoccia (2015) describe institutional development as a dual process, alternating between long periods of stability and institutional reproduction and shorter phases of flux and transformation. During stable periods, economies undergo incremental adaptation within a well-established and self-organized institutional arrangement. Institutional arrangements are path-dependent and incremental (David, 1994); partly unintentional, far from any form of rational process (Dosi et al., 2020); and based on self-reinforcing mechanisms such as economic complementarities and increasing returns. Once rules, norms, and practices are in place, they affect the incentives and resources of key actors, shaping the set of possible trajectories and making alternative paths increasingly costly and unlikely (Arthur, 1994). However, these stable configurations are periodically disrupted by moments of *institutional flux*, which create windows of opportunity for the emergence of a new institutional-policy mix. These moments of institutional reshuffling are typically the result of endogenous structural change.

In modern financial history, economic instability, financial crises, and geopolitical transformations have often necessitated institutional adaptation. Over the past 150 years, three distinct institutional-policy regimes have characterized and shaped global finance (and, likely, its relationship with economic growth), each defined by *(i)* the prevailing monetary regime, *(ii)* the role of the state in financial regulation, and *(iii)* the distribution of corporate equity ownership. In particular, the monetary regime has played a fundamental role in shaping confidence and trust in domestic financial institutions while also fostering patterns of international financial integration. The government's role in financial regulation has, in turn, determined "the legal rights and boundaries of powers that define financial institutions" (Calomiris and Neal, 2013), thereby influencing both market stability and the occurrence of manias, panics and crashes (Kindleberger and Aliber, 1978). Lastly, the distribution of corporate equity ownership has conditioned corporate governance mechanisms, and affected both the allocation of capital and the broader operation of financial markets.

Traditionally, economic and financial historians have sought to periodize the history of financial globalization. For instance, in their historical analysis of international capital mobility, Obstfeld and Taylor (2004) identify four distinct phases of capital market integration: the first spanning from 1870 to the outbreak of World War I; the second encompassing the off-gold interwar period; the third running from the end of World War II to the collapse of the Bretton Woods system; and the fourth beginning in the post-1970 era. Notably, their framework focuses exclusively on the prevailing monetary regime, looking at the transitions between phases only through the lens of the so-called macroeconomic policy trilemma. Fasianos et al. (2018) explore varieties of financialization in the United States starting from the late 19th century and propose a four-phase periodization (1900–1933, 1934–1940, 1945–1973, and 1974–2010) based primarily on two key dimensions: the prevailing monetary regime and the financial regulatory framework. Additional significant periodizations can be found in works such as Quinn (2003), Calomiris and Neal (2013), and Bordo (2017), among many others.

In this paper, we distinguish three long phases, which we shall describe later, spanning time periods of different lengths. As discussed before, in defining each phase, we focus on three key aspects: the prevailing monetary regime, the degree of financial regulation, and the distribution of equity ownership within the non-financial corporate sector. The first phase (1870-1920s) was characterized by minimal state intervention and free-market ideology, the Classical Gold Standard, and a concentrated corporate ownership structure dominated by few financial conglomerates. This institutional-policy mix faced its first major setback with the outbreak of World War I. During the 1920s, there were attempts to revive it through efforts to restore the Gold Standard, but it ultimately collapsed with the onset of the Great Depression. The second phase (1929-1971) emerged in response to the Great Depression, leading to strong financial regulation, broader corporate ownership dispersion, and the establishment of the Bretton Woods system, which provided a more flexible monetary framework compared to the pre-World War 1 Gold Standard. Finally, the third phase (post-1974) began with the collapse of Bretton Woods in 1971, marking a transition toward the so-called Washington Consensus system (Skidelsky, 2010). Table 1 provides a summary of the key institutional characteristics across these three historical phases.

Table 1: **Institutional characteristics across historical periods**

	1870–1920s	**1929–1971**	**1974–Today**
Monetary regime	Highly rigid	Flexible	Absent
Financial regulation	Absent	Pervasive	Minimal
Corporate ownership	Highly concentrated	Highly dispersed	Highly concentrated

2.1 The making of modern finance: 1870-1920s

Before 1870, global finance was fragmented and loosely structured. Financial markets lacked strong institutional frameworks and were primarily concentrated in a few regions, including parts of Europe and the United States. The absence of advanced financial infrastructure and limited international capital mobility meant that investments were largely localized, with minimal global integration. Modern banking networks were still in their early stages of development, and cross-border transactions were constrained by regulatory barriers, rudimentary communication networks, and a lack of stable monetary arrangements. Instead, the period from 1870 to 1913 was characterized by a deep wave of domestic financial deepening and international financial integration.[4] Specific institutional characteristics and political factors related to that historical period deeply marked the making of modern finance.

Monetary orthodoxy. The institutionalization of the classical gold standard played a role in fueling domestic financial development and driving global financial integration.

From an international point of view, by reducing unpredictable fluctuations and depreciation, the system provided a more reliable and predictable financial environment, fostering investor confidence and facilitating cross-border capital flows. The system encouraged high income countries to invest a significant share of their national savings abroad, particularly in middle- and low-income countries such as Argentina, Australia, Brazil and New Zealand, among others (Obstfeld and Taylor, 2004). The system's mechanics further reinforced these capital movements. Countries with persistent current account surpluses accumulated gold reserves, which expanded their domestic money supply and lowered interest rates. This, in turn, led investors to seek higher returns abroad, leading to large-scale financing of infrastructure projects in emerging economies. These recipient countries benefited from capital deepening, enhancing their productive capacity and trade specialization within the global economy. Domestically, the monetary stability provided by the gold standard enhanced public and investor trust in domestic financial institutions, reducing uncertainty and promoting higher savings rates. As governments adhered to the rules of the gold standard, financial markets grew more liquid, enabling banks to expand lending and investment activities, thereby deepening domestic credit markets. This environment encouraged the establishment of stock exchanges and securities markets, further integrating national economies into global capital markets.

Of course, it is important to emphasize it would be highly misleading to suggest that adherence to the gold standard alone accounts entirely for the observed patterns of domestic financial development and global financial integration. For instance, Ferguson and Schularick (2006) advance the view that also geopolitical factors - in particular membership in the British Empire - was an important determinant of capital market deepening in the 1880-1913 era. Indeed, the adherence to the gold standard system was a result of an asymmetric hegemonic system and political stability, largely ensured by the Pax Britannica (Brown Jr et al., 2006). The United Kingdom's dominance in political, economic, military, technological, and financial spheres was a central force

[4] Of course, heterogeneity matters. For example, Italy's financial sector remained relatively underdeveloped until at least 1914, consisting mainly of a few public credit institutions and private bankers. It was predominantly bank-oriented, had low international integration, and featured small, relatively insignificant local stock exchanges (Gigliobianco et al., 2009).

that significantly enhanced global commercial and financial integration (Eichengreen, 2019). As the world's leading economic power, Britain maintained a vast colonial empire, controlling crucial trade routes and fostering a global economic environment conducive to investment and commerce. Its naval supremacy guaranteed the security of international shipping lanes, reducing trade risks and facilitating the smooth flow of goods and capital. Furthermore, British financial institutions, particularly those in London, played a crucial role in global capital markets, serving as the primary hub for international lending and investment.[5]

However, despite its benefits, the classical gold standard was not without significant drawbacks and exposed countries to considerable economic rigidities and vulnerabilities. Indeed, the classical gold standard imposed rigid monetary constraints that often led to numerous sovereign defaults. Because money supply was directly tied to gold reserves, governments lacked the ability to engage in active demand management or countercyclical policies to respond to recessions or financial crises. Countries experiencing capital outflows were forced into painful deflationary adjustments, requiring reductions in wages and public expenditure to restore balance, often at the cost of rising unemployment and social unrest. These structural weaknesses ultimately contributed to the system's instability and eventual collapse. Moreover, the onset of World War I led most countries to abandon the system in order to finance military expenditure through deficit spending. After the World War I, efforts among major economies to restore the pre-war monetary order failed. On the one hand, the war had left economic structures fundamentally altered: public debts had skyrocketed, trade imbalances were more pronounced, and labor markets had changed significantly. On the other hand, the Treaty of Versailles (or, as defined by Keynes in *The Economic Consequences of the Peace* (Keynes, 1919), the "Carthaginian Peace") resulted in an imbalanced distribution of gold reserves, with the United States and France claiming the lion's share. This imbalance forced deficit countries to undergo severe deflationary adjustments.

Limited financial regulation. The 1870-1920s era was also characterized by minimal state intervention in financial markets, a trend observed in both the United States and Europe.[6] The prevailing laissez-faire economic philosophy promoted limited regulation, both within and across borders. Governments largely refrained from intervening in domestic financial markets, allowing private banks and investors to operate with a high degree of autonomy. This environment fostered the expansion of capital markets, banking networks, and cross-border investment, further integrating financial systems on both sides of the Atlantic. However, it is important to emphasize that the combination of minimal financial regulation and the absence of central banks actively managing financial stability created an environment prone to excessive risk-taking and speculative bubbles. As a result, banking panics became a recurring phenomenon worldwide, particularly in economies with highly unregulated financial systems. In the United States, for instance, between the 1860s and 1913, the country

[5]For more, see Michie et al. (2007) and their historical documentation of the rise of the City of London as the financial center of the world pre-1914.

[6]For instance, although marked by some regulatory attempts during the "Giolittian era", the period going from 1890 to the 1920s is defined by italian financial historians as the "free banking" era, characterized by no specific legal controls over private financial institutions (De Bonis et al., 2015). Between 1850 and the early 1930s, Belgium experienced a general "climate of financial freedom", which played a crucial role in the development of its domestic banking system (Houtman-De Smedt, 1994). In the United States, the decades between 1870 and 1913 (the so called "Gilded Age") were marked by a generally weak regulatory environment coupled with significant fragmentation in domestic capital markets (Snowden, 1987). In Germany, despite longstanding concerns over financial stability dating back to before World War I, the first banking legislation came up only in 1934 with the Reich Banking Law (Yee, 2023).

experienced eight major banking panics, three of which – 1873, 1893, and 1907 – were particularly severe, spreading beyond the country borders to affect financial markets in Austria, Canada, Germany, Italy, and the United Kingdom. These crises were often triggered by sharp declines in asset prices, speculative overexpansion of credit, and sudden bank runs, as confidence in financial institutions quickly deteriorated in the absence of a lender of last resort. The Panic of 1907, in particular, underscored the fragility of the financial system, as a liquidity crisis in the city of New York spread rapidly, leading to the collapse of multiple banks and trust companies, with ripple effects felt across global financial centers. This persistent instability ultimately led to growing recognition of the need for stronger financial oversight, culminating in the creation of the Federal Reserve in 1913 as the first major attempt to institutionalize central banking in the United States.

Corporate equity concentration. By the late 19th century, corporate equity in major industrialized economies was largely concentrated in the hands of powerful financial conglomerates, family-owned conglomerates and banking dynasties. This era was marked by an oligarchic structure in which ownership and control were tightly held by large banks (France and Germany) or investment banks (the United Kingdom and the United States). As such, individual or retail investors were largely absent. Financial conglomerates exercised significant influence over corporate decision-making, either directly through managers or indirectly by controlling capital allocation through the underwriting and distribution of financial securities.

2.2 The rise of Big Government and financial regulation: 1929-1971

Before World War I, the international financial system operated with minimal domestic regulation and oversight, relying primarily on the stability and credibility of the classical gold standard as the foundation for both domestic financial development and global financial integration. The system functioned under the assumption that self-regulating markets, coupled with the discipline imposed by gold convertibility, would ensure financial stability. However, this reliance on market-driven finance and rigid monetary rules left economies vulnerable to financial crises and endogenous booms and busts. Instead, the 1930s, and particularly the economic devastation of the Great Depression, marked a profound transformation in the global financial infrastructure. In the 1930s, a new institutional framework was established, based on stringent financial regulation, increased state intervention, and a shift toward a more flexible monetary regime. Governments enacted strict capital controls, strengthened banking oversight, and imposed restrictions on speculative financial activities to contain systemic risk. Meanwhile, monetary policy evolved away from the rigid gold-based system toward a more managed monetary framework, culminating in the establishment of the Bretton Woods system in 1944. This new regime combined fixed but adjustable exchange rates, capital controls, and active central banking, allowing governments to pursue monetary and fiscal policies aimed at stabilizing their domestic economies while still maintaining a degree of international monetary order. This shift represented a decisive break from the laissez-faire finance of the pre-WW1, setting the stage for a period of macroeconomic stability and state-led financial governance.

A flexible monetary regime. The Great Depression highlighted the deep flaws of a monetary system that required painful deflation rather than allowing for countercyclical macroeconomic policies. By the early 1930s, country after country abandoned the Gold Standard, with Britain suspending it in 1931 and the United Sates following in 1933 under Roosevelt's administration.

The collapse of the gold standard left governments without an established international monetary framework, forcing them to experiment with new economic policies. This marked the beginning of a period characterized by active government intervention, demand management, and monetary policies aimed at stabilizing financial markets. The devastation of the Great Depression demonstrated that unregulated finance and rigid monetary systems were inadequate to handle severe economic downturns. Governments increasingly embraced policies focused on counteracting asset price deflation and financial instability, two factors that had exacerbated the severity of the Depression. Central banks moved toward more active monetary policies, using interest rates adjustments to prevent asset price collapses and stabilize financial institutions. Additionally, fiscal policy became a crucial tool, as governments recognized the need to stimulate demand through public spending.

This transition laid the foundation for the Keynesian economic era, where state intervention became central to economic management. The lessons of the interwar period profoundly shaped post-World War II economic governance, culminating in the Bretton Woods system, which sought to balance international monetary stability with the flexibility needed for domestic economic growth. Unlike the gold standard, which required fixed exchange rates with gold convertibility, the Bretton Woods system established a system of adjustable pegs in which countries were allowed to adjust their exchange rates if they faced prolonged domestic economic distress. Most importantly, the system permitted capital controls to insulate domestic financial markets from destabilizing international capital flows.

Strict financial regulation. Following the economic depression, the financial system became more strictly regulated across many countries. This era of widespread financial regulation involved multiple interventions. In the United States, Regulation Q introduced interest rate controls to reduce competition among banks. Similarly, Italy's 1926 Banking Law limited the opening of new banks and branches by requiring government approval (Molteni, 2024). Across Europe, extensive capital controls and capital requirements were introduced — the former to protect domestic markets from volatile international flows, and the latter to strengthen the stability of national banking systems. Furthermore, many governments – especially in the United States (Elliott et al., 2013) – leveraged credit controls to steer macroeconomic policy and ensure that credit growth was at the service of industrial growth. Even more, the United Sates and many European countries mandated the separation of commercial and investment banking to segment financial markets and reduce systemic risk. Notable examples include the Glass-Steagall Act of 1933 in the United States and Italy's 1936 banking regulation. At the same time, a combination of tax policies on equity investments and increasing degree of state ownership within the banking sector diminished the role of stock exchanges as sources capital. These regulatory measures remained in place well into the post-World War II period as a way to guarantee an international financial architecture designed to promote economic stability and rising living standards.

Corporate equity dispersion. In the immediate postwar period, the introduction of new antitrust laws, coupled with stricter financial regulation that reduced stock market activity, contributed to the progressive decentralization of share ownership. These regulatory changes reduced the power of financial conglomerates, paving the way for a broader distribution of corporate equity.[7] As a result, corporate control gradually shifted away from a small financial elite toward a more diverse base of shareholders, particularly individual investors and households, who began to hold a growing share of corporate equity in both the United States and Europe.

The distribution of equity ownership marked a significant transformation in financial markets. The broader allocation of corporate equity ownership enhanced profit sharing, allowing a larger segment of the population − particularly households − to participate in the process of wealth accumulation thus broaden the overall distribution of income and wealth. This diffusion of ownership helped reduce the concentration of economic power that had previously been controlled by a small financial elite, making corporate governance more transparent. Additionally, with individual investors and households playing a more significant role, companies had to improve disclosure standards, fostering a more accountable and competitive business environment.

2.3 The era of financialization (Mark I and Mark II): 1974-Today

The collapse of the Bretton Woods system in the early 1970s inaugurated a new institutional configuration, marking the transition to a new institutional regime, commonly known as the era of financialization (Epstein, 2005; Orhangazi, 2008).[8] This process has unfolded in two analytically distinct yet historically connected phases. The first phase, that we refer as financialization *Mark I*, was characterized by a deregulatory shift and the dismantling of capital controls. The gradual dismissal of the post-war regulatory framework created the institutional conditions for the expansion of market-based finance, the growing centrality of institutional investors such as pension and mutual funds, and a significant rise of the volume of financial relative to total profits, particularly in the United States (Lapavitsas and Mendieta-Muñoz, 2022). The second phase, or financialization *Mark II*, took shape in the aftermath of the global financial crisis of 2007–09 and reflects a profound transformation in the global financial infrastructure and in the role of the State. As traditional financial institutions − most notably commercial banks − retrenched under new regulatory constraints and declining profitability (Lapavitsas and Mendieta-Muñoz, 2022), large portfolio managers have emerged as central nodes in the global financial value chain. Furthermore, this period has marked the rise of a state-led financialization, in which public authorities no longer act merely as guardians of monetary stability, but increasingly take on an active role in fostering and preserving financial sector profitability through sustained liquidity provision (Lapavitsas, 2023).

Deregulation and the retreat of Big Government. The Bretton Woods system, which had initially provided a stable framework for capital controls, started to weaken in the 1960s due to persistent international imbalances and mounting speculative pressures, ultimately collapsing in the early 1970s. The shift to floating exchange rates and the gradual liberalization of capital movements undermined governments' ability to maintain strict financial regulations. From the late 1970s onwards, policymakers, particularly in the United States and the United Kingdom, embraced free-market policies. At the same time, the expansion of derivatives, securitization,

[7] Looking at the United States, according to Federal Reserve Flow of Funds data, in the aftermath of World War II around 95% of the ownership of US listed firms were held directly by individuals, especially households (Gibadullina, 2024).

[8] According to Epstein (2005), the concept of financialization refers to the "increasing importance of financial markets, financial motives, financial institutions, and financial elites in the operation of the economy and its governing institutions, both at the national and international levels".

and shadow banking reshaped financial intermediation and introduced new systemic risks. The proliferation of complex financial instruments, such as collateralized debt obligations (CDOs) and credit default swaps (CDS), increased financial market interconnectivity and amplified risk-taking behavior. While these innovations enhanced liquidity and credit availability, they also contributed to speculative excesses and growing levels of household indebtdness, culminating in major financial crises, most notably the 2008 crash.

Fiat currency and central bank activism. With the end of Bretton Woods, exchange rates became fully flexible, and monetary policy emerged as the primary tool for managing economic cycles. Central banks increasingly adopted inflation targeting as their primary mandate, seeking to maintain price stability while also playing an active role in financial market stabilization. The shift to fiat currency regimes allowed governments greater flexibility in responding to economic shocks, but it also introduced new challenges.

Over time, central banks expanded their mandates, particularly in response to financial crises. The Federal Reserve and ECB's aggressive interventions during the 2008 financial crisis and the COVID-19 pandemic in 2020 exemplified this new role, as central banks deployed large-scale asset purchases (quantitative easing) and emergency liquidity programs to stabilize markets. This marked a new phase of state-driven financialization, where financial markets came to depend on the active monetary support of public authorities. While formally designed to stabilize markets through the purchase of government bonds and financial assets on secondary markets and to support aggregate demand, the direct and massive creation of fiat money by central banks ultimately inflated the profitability of the financial sector. Shadow banking institutions, operating outside the regulatory perimeter of traditional banks, absorbed much of the liquidity injected by central banks, using it to expand speculative operations, inflate asset prices, and deepen their role in the global financial infrastructure (Lapavitsas, 2023).

The financialization of corporate ownership. In the 1980s, as financial markets grew in size, institutional investors – such as pension funds, hedge funds, mutual funds, and sovereign wealth funds – gradually replaced households as the primary holders of corporate equity in the Western world. These large money managers gained unprecedented influence over corporate governance, reshaping decision-making processes within publicly traded firms. This shift led to the prioritization of shareholder value maximization, reinforcing short-term profit-seeking behavior at the expense of long-term investment strategies (Lazonick and O'sullivan, 2000). At the same time, cross-border investment practices facilitated by institutional investors deepened financial globalization, making it even more difficult for national governments to insulate their economies from external financial shocks. As a result, the ability of governments to implement autonomous financial policies weakened, reinforcing the dominance of financial markets in shaping global economic outcomes.

This dynamic became even more pronounced in the aftermath of the 2008 global financial crisis, when new actors – most notably large asset management firms – emerged as central nodes in the global financial value chain. What we are witnessing is a renewed process of centralization of corporate ownership – albeit one that differs significantly from the pre-1920s *Finanzkapital* of Hilferdinian memory (Hilferding, 1910), when large commercial banks dominated the financial landscape. Unlike commercial banks, portfolio managers represent a distinct category of financial institution. They do not engage in maturity transformation or traditional credit intermediation. Far from being money lenders, their business model relies on fee-based income generated through the management of pooled capital on behalf of both retail and institutional clients across globally diversified portfolios. As a consequence, while traditional banks profit from the spread between lending and deposit rates, asset managers increase their profits primarily by expanding both the volume and the market value of the assets under management.[9] Their focus tends to be more macro-sectoral than firm-specific, emphasizing broad portfolio performance rather than direct firm-level intervention (Braun et al., 2021). Far from being mere shareholder-value maximizers à la Lazonick and O'sullivan (2000), the precise implications of their growing presence in corporate governance remain a fertile area for future research.

3 Data

We construct a long-run dataset collecting historical macroeconomic and financial data for the OECD area. The countries included are Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The time span and country coverage of our analysis vary based on data availability, ranging from a maximum period of 1882–2020 to a minimum of 1899–2016, and from 16 to 12 countries. The data are reported at an annual frequency.

Our proxy of economic growth is GDP growth measured in terms of the 5-year growth rate of real GDP per capita. Instead of using data averaged over non-overlapping n-periods, the growth rate is computed as a moving average using the difference between t and t-5 of the natural logarithm of real GDP per capita. This approach is intended to mitigate the influence of idiosyncratic factors affecting individual sub-periods, as the moving average smooths out such irregularities. Moreover, we use the 5-year growth rates instead of annual growth to smooth out business cycle fluctuations and emphasize medium and long-term trend dynamics.[10] Data are taken from Bolt and Van Zanden (2020) for the full sample (16 countries) for the period 1882-2020. We also collect an alternative proxy for economic development, i.e. we consider labor productivity growth computed as the growth rate of GDP over total hours worked. We take labor productivity data from the Long-Term Productivity database (Bergeaud et al., 2016) covering the full sample (16 countries) for the time span 1890-2020.

We define all financial measures used in the analysis in terms of their rates of change, rather than using level variables. Similarly to GDP growth, we compute growth rates using a 5-year moving average approach. The choice of growth rates, rather than levels, allows to focus on structural change. Recently, Bofinger et al. (2024) discussed how using financial variables in growth rates rather than in levels leads to different results when analyzing the correlation between financial development and GDP growth. This distinction is also crucial to avoid erroneous theoretical interpretations in the distinction between real and monetary analysis (Bofinger et al., 2023).

[9] It is important to emphasize that portfolio managers are multi-asset holders. In terms of equity (private or listed), while they hold stakes in companies, they are not the ultimate beneficial owners of the capital. Their own equity holdings are, in turn, owned by corporations, wealthy individuals, and other shadow banking entities. This means that while the economic interests belong to their clients, asset managers act as legal fiduciaries of the capital, thus holding the associated voting rights and exercising control over the assets they manage.

[10] However, we also check the robustness of our results using different lenght of growth rates (in particular, 3-year growth rates). These results are provided in Section 6.

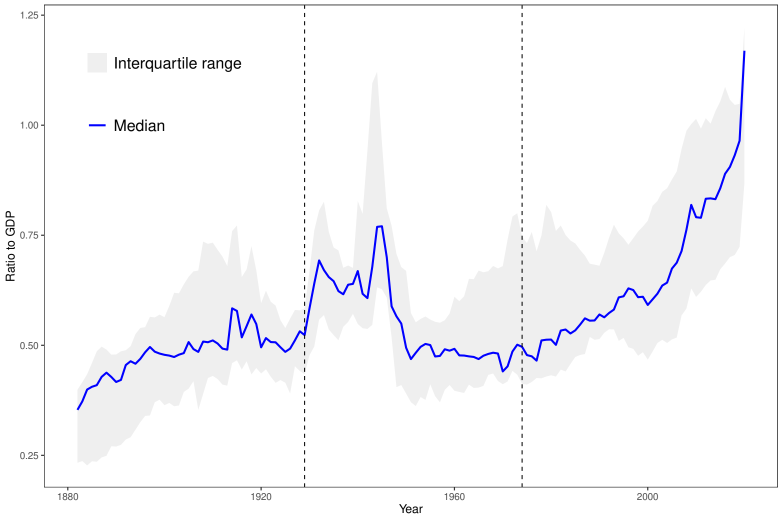
Size of finance. In line with the literature that looks at the relationship between finance and economic growth, we quantify financial development by using the growth rate of liquid liabilities of the financial system over GDP (King and Levine, 1993; Levine and Zervos, 1998; Levine et al., 2000; Beck et al., 2000; Arcand et al., 2015). The growth of liquid liabilities is a defining feature of finance. Hedge funds actively manage liquidity, institutional investors rely on it for portfolio adjustments, and historically, banks have used liquid liabilities as a tool for managing short-term obligations. This fact underscores liquidity's critical role in shaping the size and functionality of financial systems, making it a reliable and meaningful proxy for financial growth. Furthermore, while the use of liquid liabilities has been criticized in the literature for being a rather imperfect proxy of financial development, it remains the only indicator available that can consistently capture financial development over a secular time horizon such as the one considered in this study.

In our analysis, liquid liabilities equal "M2" or "M3" and they consist of currency held outside the banking system plus demand and interest-bearing liabilities of banks and non-bank financial intermediaries. We take liquid liabilities data from the Jordà-Schularick-Taylor Macrohistory Database (Jordà et al., 2017), Global Macro Database (Müller et al., 2025) and other minor sources such as Ritschl (2014) for interwar Germany and Martín-Aceña (2018) for Spain during the Civil war. Our liquid liabilities data cover the period 1882-2020 for 16 countries.

Functions of finance. This study incorporates data on bank credit and stock market capitalization, allowing for a distinction between two key dimensions of financial development. Bank credit serves as a proxy for the traditional banking sector, reflecting the role of financial institutions in channeling funds to businesses and households for productive uses. This perspective aligns with a more Schumpeterian view of financial institutions. In contrast, stock market data capture the dynamics of capital markets. By including both measures, the analysis differentiates between the different functions that the financial system can exert: from the one hand, a financial system fueling economic growth by the provision of intermediated lending, from the other hand, a financial system that allows for the concentration of capital ownership and market capitalization of shares. In the econometric exercise, both variables are considered in terms of their growth rates. Data for bank credit growth are taken from the Jordà-Schularick-Taylor Macrohistory Database (Jordà et al., 2017), while stock market data come from Kuvshinov and Zimmermann (2022). In addition, we collect data from other minor sources to deal with some missing values. Due to data availability, bank credit data cover the period 1882–2020, but only for a restricted sample of 12 countries, excluding Spain, France, the Netherlands, and Portugal. Instead, stock market data are available for a sample of 12 countries, excluding Finland, Italy, Japan and the Netherlands, but for a shorter time span that goes from 1899 to 2016.

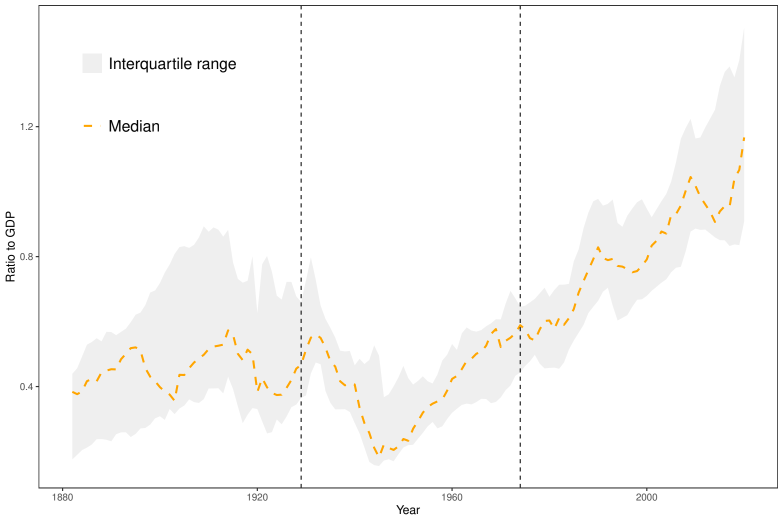
Figures 1, 2 and 3 illustrate the historical evolution of the three main financial variables used in this study. Vertical black lines (at 1929 and 1974) separate between the three institutional-policy regimes previously discussed in Section 2. Notably, liquid liabilities, as a size proxy, quite strictly follow the proposed periodization, with an increasing share over GDP until 1929, a bubble-burst dynamics between the Great Depression and the Bretton Woods system, followed by a phase of semi-regulated regime in the immediate post-war era, and a post-1974 phase with an uprising trend, with a distinct pre- and post-2008 growth rate (i.e., financialization Mark I and Mark II). With reference to the function of finance, the share of bank loans increases, with ample fluctuations in the Gold Standard phase, in line with the consolidation of an unregulated banking system, backlash in correspondence of WWII, and reach shares well beyond the peak in the Gold Standard after 1974. Finally, stock market capitalization presents a similar hump-shaped pattern in the first period, a generalized decrease in the second, and a non-linearly growing dynamics is the last period, especially from the 1990s onwards. In all cases, large inter-quartile ranges signal country-specific patterns, that, however, tend to wear thin in periods of common crises.

Figure 1: *Share of liquid liabilities over nominal GDP, historical evolution*



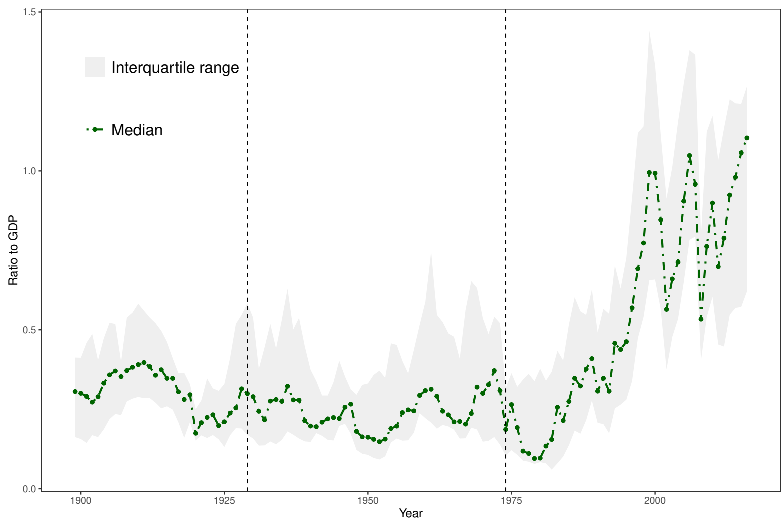
Notes: median and interquartile range of the country-level data. The time span runs from 1882 to 2020, while the sample composition includes 16 countries.

Figure 2: *Share of bank loans over nominal GDP, historical evolution*



Notes: median and interquartile range of the country-level data. The time span runs from 1882 to 2020, while the sample composition includes 12 countries.

Figure 3: *Share of stock market capitalization over nominal GDP, historical evolution*



Notes: median and interquartile range of country-level data. The time span runs from 1899 to 2016, while the sample composition includes 12 countries.

Following the finance and growth literature, we assume that openness to trade and inflation are key factors that, along with financial development, influence economic growth. In the battery of robustness checks, we show that our results remain unaffected by the specific set of controls. We collect data on CPI from the Jordà-Schularick-Taylor Macrohistory Database (Jordà et al., 2017). Instead, for trade openness, we collect total imports and total exports combining data from the Jordà-Schularick-Taylor Macrohistory Database (Jordà et al., 2017), Global Macro Database (Müller et al., 2025) and the Federico-Tena World Trade Historical Database (Federico and Tena-Junguito, 2016).

While these controls are widely used, we acknowledge that the empirical growth literature has traditionally considered a broader set of variables in both cross-sectional growth regressions and panel frameworks. Among the most prominent are human capital accumulation and government expenditure. Unfortunately, we do not include these controls in our main analysis due to data limitations. For human capital, the most widely used source is Barro and Lee (2011), which provides, in its historical extension, secondary enrollment rates from 1870 onward. However, these estimates are only available at five- or ten-year intervals, while our dataset is constructed on an annual basis, making consistent integration problematic. As for government expenditure, annual data are available from the World Development Indicators (WDI) and, more relevantly for our purposes, from Jordà et al. (2017). Although the JST database offers the appropriate frequency and time span, the variable on public expenditure presents substantial data gaps for countries such as Australia, Germany and Spain. Since we prefer to define our sample based on the availability of financial variables, rather than on the data coverage of control variables, we do not include government spending in our specifications.

In Table 2, we provide some descriptive statistics for the main real and financial variables used in this paper. A more detailed description of our data, including all the sources, other descriptive statistics and additional results related to the batteries of robustness checks can be found in the Data Appendix at the end of the paper.

Table 2: **Descriptive statistics, main variables of interest**

	N	Mean	Std Dev	Min	Q1	Median	Q3	Max
Real GDP pc	2224	16116.50	14496.70	1581.00	4997.25	9841	24807.51	85115.32
Money/GDP	2224	0.60	0.25	0.09	0.43	0.55	0.71	2.03
Credit/GDP	1668	0.63	0.36	0.05	0.34	0.55	0.84	2.04
Market cap/GDP	1416	0.44	0.38	0.00	0.17	0.33	0.58	2.80
Openness to trade	2224	0.39	0.22	0.01	0.25	0.37	0.50	1.90
CPI (1990=100)	2224	44.48	57.85	0.00	2.67	11.92	85.54	226.83

Notes: From the left to the right, Table 2 provides information about the number of observations, the mean value, the standard deviation, the minimum, the 25th percentile, the median, the 75th percentile and the maximum value. CPI (1990=100) means that the Consumer Price Index is expressed relative to the price level in 1990, which is set as the base year with a value of 100.

4 Empirical strategy

To begin with, we estimate a standard fixed effects (FE) panel data model to control for time-invariant unobserved heterogeneity across countries. Similar to Barro (1989), King and Levine (1993) and Bofinger et al. (2024), the model takes the following form

$$GROWTH_{it} = \alpha \ln(GROWTH)_{it-h} + \beta FINANCE_{it} + \gamma X_{it} + \delta_i + \mu_{it} \tag{1}$$

where i denotes the country and t refers to the time period. By including δ_i, we control for country fixed effects and μ_{it} is an idiosyncratic error term. In each specification, the model includes one economic growth variable and one financial indicator, while the two control variables remain fixed across all estimations. Accordingly, $FINANCE_{it}$ represents proxies for size and functions of finance, while $GROWTH_{it}$ indicates the growth rate of real per capita GDP. X_{it} is an $P \times 1$ vector that includes two control variables (i.e., $P = 2$).

About the control variables, we consider a logarithmic transformation for trade (given as the sum of exports and imports relative to GDP) and consumer price inflation. The specification is estimated using 5-year growth rates (computed as log differences), with financial indicators and inflation measured accordingly. An alternative specification with 3-year growth rates is presented in Section 6. Finally, we include the natural logarithm of lagged real GDP per capita (lagged by five years) to account for convergence effects, as standard in the neoclassical growth literature (Barro and Sala-i Martin, 1992).[11]

Some econometric issues arise. First of all, standard fixed-effects do not adequately address concerns related to cross-sectional dependence. Factors such as international financial shocks, policy spillovers, and synchronized

[11] As highlighted by Dosi and Roventini (2024), there is no empirical evidence supporting the so-called β-convergence hypothesis, which suggests that countries with initially low per capita income tend to grow faster. Instead, a series of studies has demonstrated a persistent shift over time towards polarization, with low mobility across income groups. However, empirical evidence does indicate a degree of convergence within specific subsets of countries (for instance, high-income countries) which share similar initial conditions and common structural characteristics (i.e., club convergence).

Table 3: **ADF tests and cross-sectional augmented IPS tests**

	Drift	Drift + trend
Real GDP pc 5-year growth	93.75%	93.75%
PSI.p.value	0.01	0.01
Real GDP pc LAG 5	0.00%	0.00%
PSI.p.value	0.01	0.01
Liabilities over GDP 5-year growth	100.00%	100.00%
PSI.p.value.2	0.01	0.01
LN openness to trade	31.25%	31.25%
PSI.p.value	0.01	0.01
Inflation 5-year growth	93.75%	93.75%
PSI.p.value	0.01	0.01

financial cycles can create strong interdependencies across countries, violating the assumption of independent error terms and potentially biasing the estimates.

Second, while the fixed effects specification accounts for unobserved heterogeneity, it relies on the assumption of stationarity, which might be problematic in our case given the temporal dimension of the dataset. Table 3 shows the percentage of countries in our sample for which the unit-root hypothesis is not accepted via augmented Dickey–Fuller (ADF) tests, at a 5% significance level. Table 3 focuses on the main variables used in our benchmark specification, with liquid liabilities and 5-year growth rates. All other variables and specifications are tested in the Data Appendix. As we can see, the null hypothesis is rejected for most countries. The lowest rate of rejections is for trade openness, while the highest rate of rejection is for liquid liabilities. In addition, Table 3 reports results for the cross-sectionally augmented test (IPS) for unit-roots proposed by Pesaran (2007). p-values for this test are lower than 0.1 for all variables, with the test rejecting the hypothesis of nonstationary variables. The evidence of panel-level non-stationarity (IPS test results) suggests that many of our macroeconomic variables share common trends and global influences. This fact reinforces the validity of using panel econometric techniques that account for cross-sectional dependence in the analysis.

Finally, model (1) assumes time-invariant slope coefficients (α, β and γ). Given the heterogeneous institutional and structural transformations experienced by OECD countries over the last century, this assumption appears highly unrealistic. In fact, as institutions change or economic transition occurs, the relationship between macroeconomic and financial variables may change over time. If our historical investigation fails to account for such time-varying behavior, it can lead to incorrect conclusions (Wang et al., 2025).

To address the limitations of the standard fixed effects (FE) model, we follow the estimation procedure proposed by Casas et al. (2021). We first extend the analysis by employing an interactive fixed effects (IFE) framework. The IFE model allows for the presence of unobserved common factors influencing all cross-sectional units, capturing global shocks that standard FE models fail to account for. The model specification is given by

$$GROWTH_{it} = \alpha \ln(GROWTH)_{it-h} + \beta FINANCE_{it} + \gamma X_{it} + \delta_i + \lambda_i f_t + \mu_{it}, \tag{2}$$

where f_t is an $R \times 1$ vector of unobserved common factors that capture global economic shocks (e.g., financial crises, wars, institutional shifts), λ_i is an $R \times 1$ vector of heterogeneous factor loadings which measure country-specific exposure to these common shocks, and μ_{it} is the idiosyncratic error term. Unlike the standard FE model, which assumes that errors are independently distributed across cross-sections, the IFE model explicitly controls for cross-sectional dependence by decomposing the error term into a component driven by latent common factors and an idiosyncratic component. Since the unobserved common factors f_t are not directly observable, we extract them from the residuals of the fixed-effects regression using Functional Principal Component Analysis (FPCA). This procedure decomposes the residual term into

$$\mu_{it} = \lambda_i f_t + u_{it}, \tag{3}$$

where u_{it} is the remaining idiosyncratic component. The number of unobserved common factors, R, is unknown and must be determined empirically. To do so, we apply the criterion proposed by Bai and Ng (2002), which selects the number of factors based on an eigenvalue decomposition of the covariance matrix of residuals. The function iteratively examines the ratio of successive eigenvalues to detect the point at which the marginal contribution of an additional factor becomes negligible. The threshold function used to determine the optimal number of factors is given by

$$\epsilon = \frac{1}{\log(\max(\eta_0, N))} \tag{4}$$

where η_0 is the variance of the idiosyncratic error and N is the cross-sectional dimension. The optimal number of factors, R, is chosen as the largest rank where the ratio criterion remains above this threshold, ensuring that the model captures significant common components while avoiding overfitting. A detailed description of the iterative refinement process used to ensure numerical convergence and accurate identification of the common components is provided in the Data Appendix at the end of the paper.

The IFE formulation effectively mitigates omitted variable bias by incorporating unobserved common factors that influence all cross-sectional units, capturing latent global shocks and systemic forces that traditional fixed-effects models fail to account for. By allowing for cross-sectional dependence, the IFE model provides a more robust representation of financial-growth interactions, as it explicitly accommodates interdependencies arising from global financial shocks, policy spillovers, and synchronized financial cycles. Moreover, the model partially addresses cross-sectional heterogeneity by allowing factor loadings to vary across countries, meaning that different economies can respond differently to the same underlying common factors.

Despite its advantages, the IFE model assumes that the coefficients and factor loadings are time-invariant, a restrictive assumption when analyzing long-run macroeconomic relationships. To test the validity of this assumption, we perform the constancy test proposed by Casas et al. (2021), which provides evidence that the finance and growth nexus exhibits significant time variation. We provide and discuss the results of this test in the next Section. Our findings underscore the necessity of transitioning to a time-varying version of the IFE model. In particular, the time-varying interactive fixed effects (TVIFE) model extends the IFE approach by allowing the coefficients and factor loadings to vary over time

$$GROWTH_{it} = \alpha_t \ln(GROWTH)_{it-h} + \beta_t FINANCE_{it} + \gamma_t X_{it} + \lambda_{it} f_t + \mu_{it} \tag{5}$$

where β_t is the time-varying coefficient associated with the financial variable included in the specification, γ_t is a 2 $\times$ 1 vector of unknown time-varying coefficients of other growth determinants and λ_{it} is a $R \times 1$ vector of time-varying factor loadings. This specification not only captures time variation in the finance-growth nexus, but it also allows the latent factors to be heterogeneous over time.[12] This implies that the same global shock (for instance, a financial crisis) can exhibit differentiated effects both across countries at the same point in time and within the same country at different time periods. The estimation is conducted in relation to Sun et al. (2009). We follow a non-parametric local smoothing approach, ensuring that the time-varying coefficients and factor structures are estimated flexibly from the data without imposing strong distributional assumptions. A more detailed discussion of the TVIFE estimation procedure is provided in the Data Appendix.

5 Results

In this Section, we present our empirical findings. We begin by reporting results from the standard fixed effects (FE) model, which serves as a benchmark for comparison. We then extend the analysis to the interactive fixed effects (IFE) model to account for unobserved global factors and cross-sectional dependence. Finally, we implement a time-varying interactive fixed effects (TVIFE) framework, in which both the coefficients and the factor loadings are allowed to change over time.

5.1 Fixed-effects (FE) estimation

To begin with, we present standard fixed effects (FE) results for the 5-year growth rate of our financial variables of interest with real GDP per capita as dependent variable. As robustness checks, we consider also 3-year growth rates. The results of these robustness checks are presented in Section 6 and they are widely in line with the findings we present here.

Regarding the other growth determinants, the results are fully in line with the empirical growth literature and with expectations. In each specification, the initial level of GDP negatively correlate with per capita GDP growth, which is consistent with the convergence hypothesis of Barro and Sala-i Martin (1992) − suggesting that poorer economies tend to grow faster than richer ones, all else being equal. At the same time, inflation negatively or weakly correlate with per capita GDP growth, in line with the conventional view that macroeconomic instability can act as a drag on long-term growth. Instead, openness to trade consistently suggests − as largely expected − positive correlation with GDP growth. These results are presented in Figure 4.

[12] Cross-sectional heterogeneity in the factor loadings (or heterogeneous country-exposure to common shocks) is different from cross-sectional heterogeneity in the coefficients α_t, β_t and γ_t. One limitation of our TVIFE approach, as with all panel data models, is the assumption of homogeneous slope coefficients across units. For instance, one can extend the slope coefficient of equation (5) from β_t to β_{it}. However, no econometric approach currently exists to support the assumption of homogeneous slope coefficients in a TVIFE framework (Wang et al., 2024).

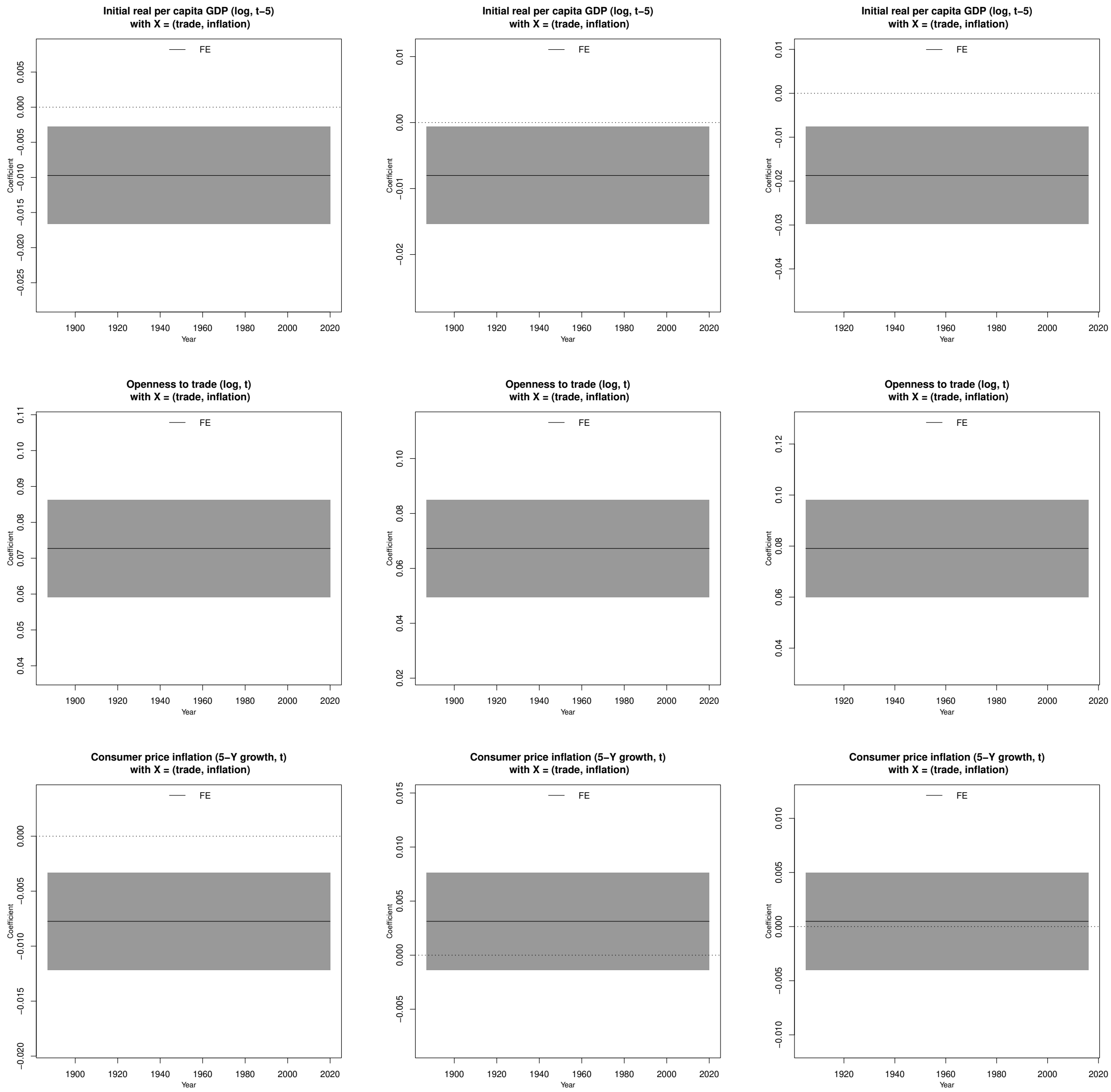


Figure 4: Coefficient estimates for lagged real GDP (top panel), openness to trade (middle panel) and consumer price inflation (bottom panel) using liquid liabilities growth (left column), bank loans growth (middle column) and stock market capitalization growth (right column). The graphs show the estimated values of the coefficients at each year and their 95% confidence interval (bands).

Figure 5 shows the coefficient estimates for liquid liabilities growth, credit growth, and stock market capitalization growth. Using the 5-year growth rate of liquid liabilities, which serves as our proxy for financial development, reveals a negative relationship between finance and economic growth. This finding contrasts with the prevailing literature, where the coefficient is typically positive. A plausible explanation for this discrepancy lies in the time period under consideration. Much of the existing research focuses on the post-war era or the period of the Great Moderation. In contrast, our analysis spans a much broader time span, from 1882 to 2020. However, differences emerge when we distinguish between bank credit growth and stock market growth. Using the same set of control variables, for bank loans we find a positive contemporaneous correlation with GDP per capita growth, while for the stock market the relationship seems to be weak and close to zero. The results remain quite stable using interchangeably only consumer price inflation or openness to trade.

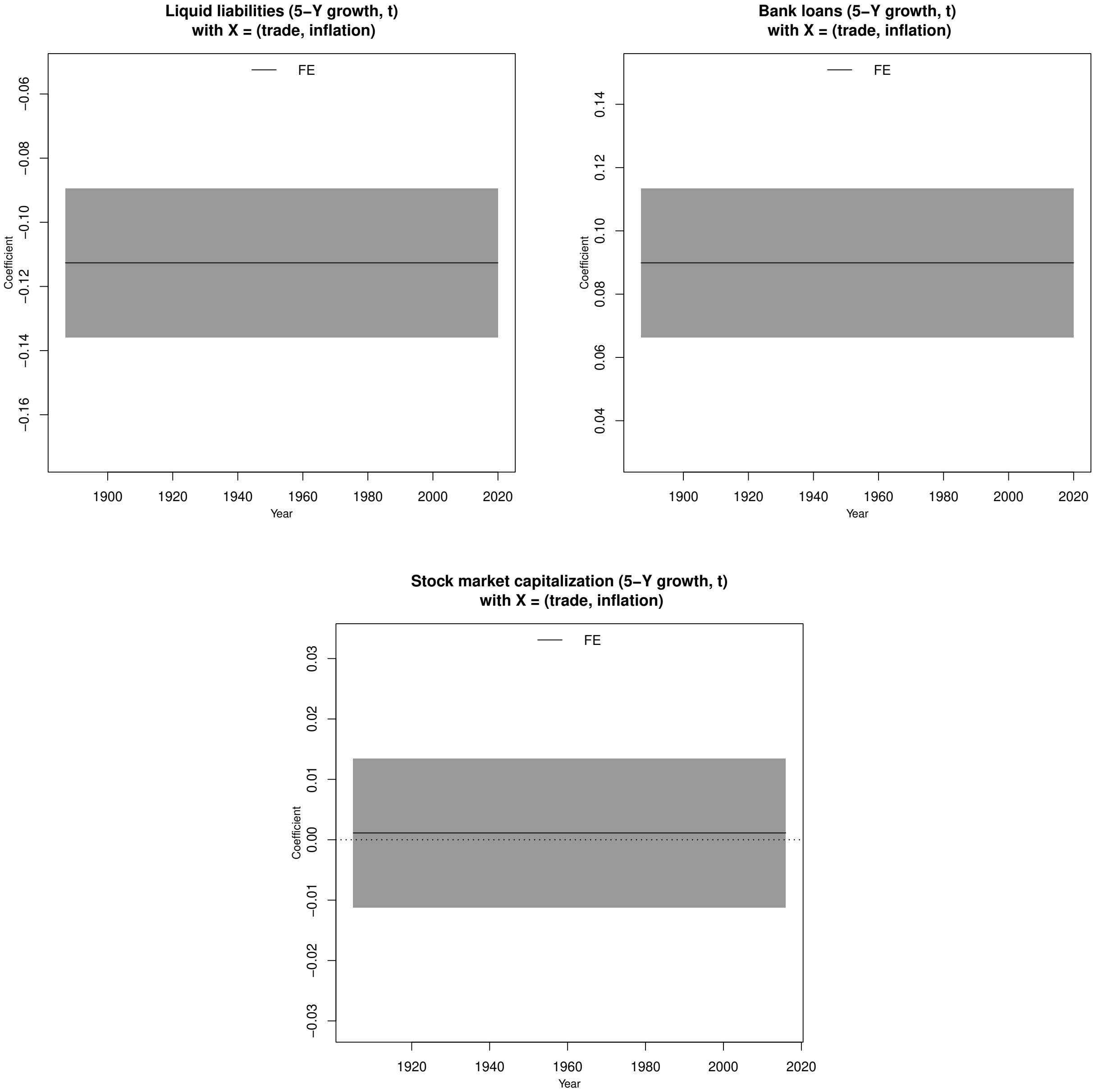


Figure 5: Coefficient estimates for liquid liabilities growth, bank loans growth and stock market capitalization growth. The graphs show the estimated values of the coefficients at each year and their 95% confidence interval (bands). Time span and sample size differ across estimations. For more details, see the Data Appendix.

5.2 Interactive fixed-effects (IFE) estimation

While the Fixed Effects (FE) model accounts for time-invariant unobserved heterogeneity, it fails to capture latent common factors that influence cross-sectionally our economic growth variable. To address this limitation, we adopt the Interactive Fixed Effects (IFE) framework. In Figure 6, we present the estimates for other determinants of economic growth. In line with the FE estimates, the initial level of GDP negatively correlates with per capita GDP growth, and openness to trade consistently suggests positive correlation with GDP growth. Inflation, on the other hand, shows a very small coefficient, close to zero, indicating a negligible effect on growth. Compared to the FE estimates, the IFE estimates exhibit smaller coefficients and narrower confidence bars, suggesting improved precision in the estimates after controlling for unobserved common shocks.

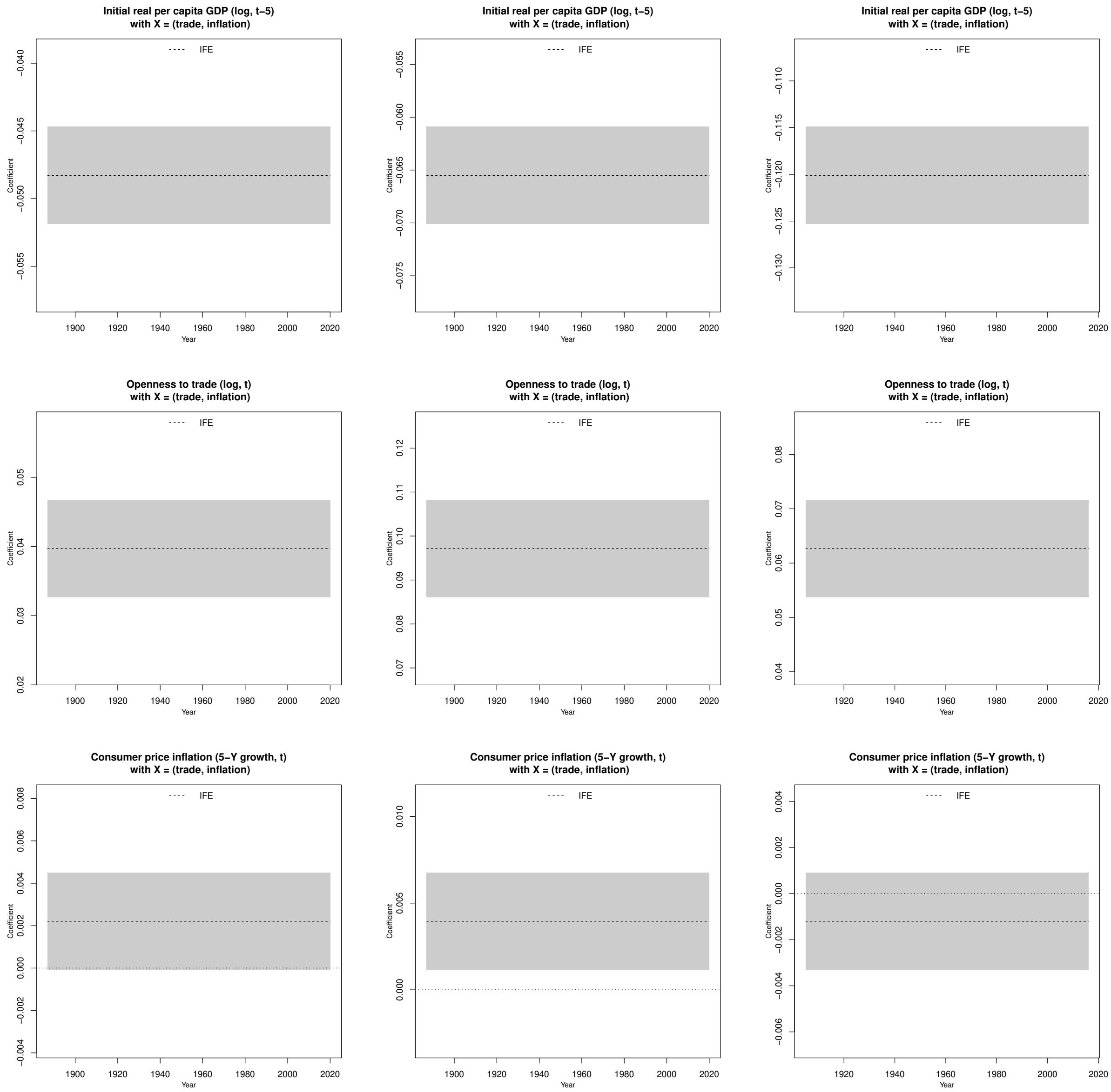


Figure 6: Coefficient estimates for lagged real GDP per capita (top panel), openness to trade (middle panel) and consumer price inflation (bottom panel) using liquid liabilities growth (left column), credit growth (middle column) and stock market capitalization growth (right column). The graphs show the estimated values of the coefficients at each year and their 95% confidence interval (bands).

Figure 7 presents the coefficient estimates for liquid liabilities growth, credit growth, and stock market capitalization growth. Comparing the financial variables under the IFE model to those in the FE specification, we find that the overall sign relationships hold: our proxy of financial development (measured by liquid liabilities growth) remains negatively correlated with economic growth, bank credit maintains a positive correlation, and stock market growth remains only weakly correlated with GDP growth, with the estimated coefficient close to zero. However, the magnitude of the effects changes slightly. When accounting for common latent factors, the negative relationship for financial development becomes less pronounced, while the contemporaneous relationship with stock market growth becomes slightly more positive. Additionally, compared to the baseline FE model, the IFE model produces narrower confidence intervals, suggesting improved precision in the coefficient estimates.

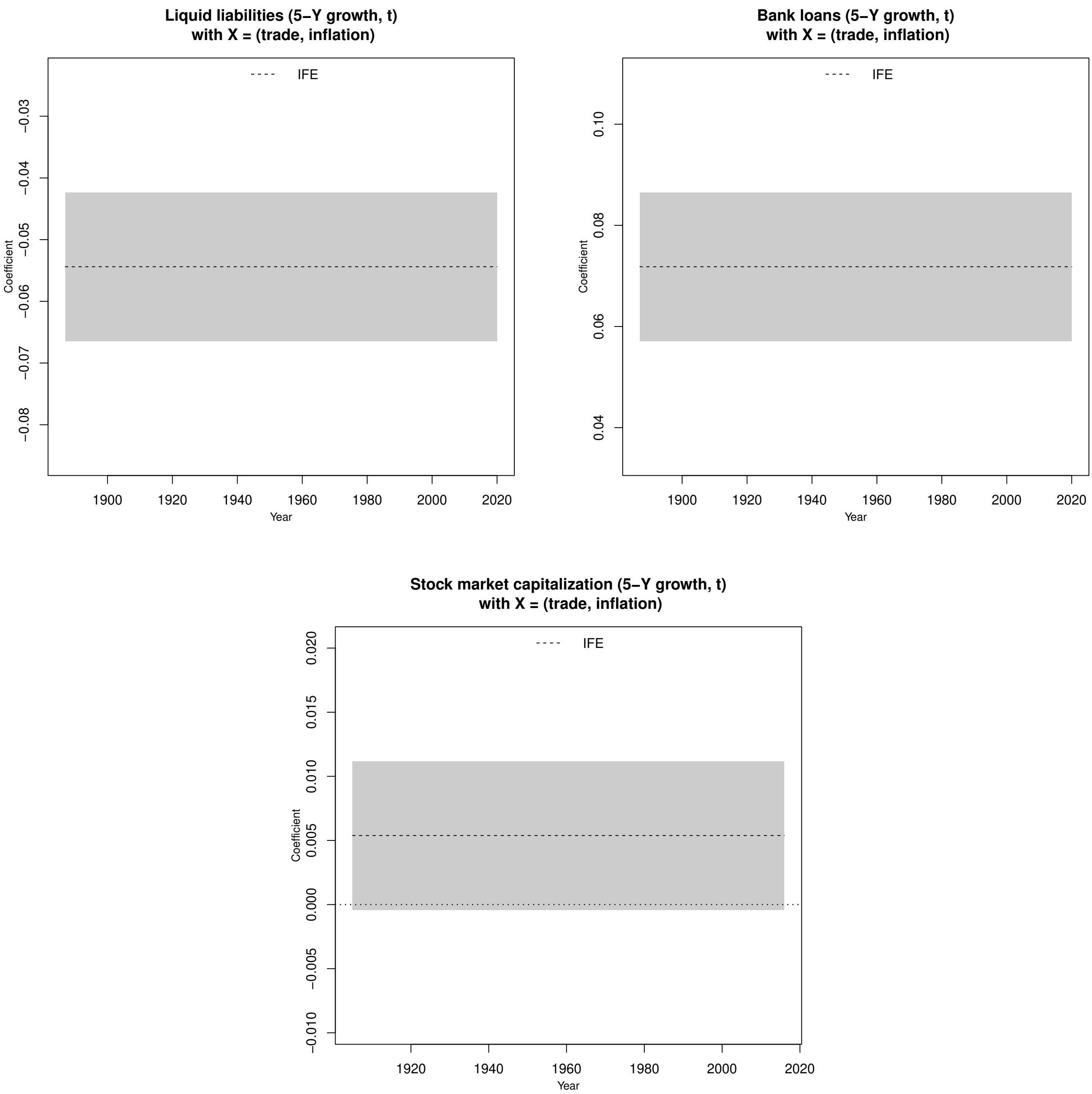


Figure 7: Coefficient estimates for liquid liabilities growth, bank loans growth and stock market capitalization growth. The graphs show the estimated values of the coefficients at each year and their 95% confidence interval (bands). Time span and sample size differ. For more details, see the Data Appendix.

Table 4 compares the root mean square error (RMSE) of the FE and IFE estimations, respectively. The comparison involves the two methodologies with the same set of control variables. The smallest RMSE occurs for the IFE model, and therefore, it is selected as the best model in the sense of the one with the smallest estimation error. This result demonstrate the necessity of accounting for global common shocks in our historical investigation of the finance and growth nexus.

Furthermore, the test proposed by Casas et al. (2021) allows us to show the limitations of parametric models and the need to adopt more flexible approaches. This test evaluates whether coefficient estimates remain constant over time. Specifically, this test examines the null hypothesis that all coefficients are time-invariant against the alternative hypothesis that at least one is statistically time-varying. A rejection of the null suggests the presence of time variation in at least one coefficient. The test proceeds in three main steps.

Table 4: **RMSE of the FE and IFE estimations with different financial variables**

Model	RMSE FE	RMSE IFE
With liquid liabilities growth	0.124	0.065
With bank loans growth	0.120	0.075
With stock market growth	0.125	0.059

To begin with, it estimates a baseline model under the null hypothesis of constant coefficients by minimizing a loss function that accounts for unobserved common factors. Then, it determines the number of relevant factors by analyzing the eigenvalues of the residual covariance matrix. This step includes the data-driven selection rule in equation (4). Finally, using the updated estimates, the test constructs a kernel-based statistic that captures potential time variation in the residuals.

As pointed out by Casas et al. (2021), a key limitation of this test is that it does not allow us to isolate which coefficients are driving the rejection. Our primary interest lies in determining whether our financial proxies exhibit time variation, rather than assessing time variability in control variables such as trade openness or inflation. Since the test does not explicitly target a subset of coefficients, we address this limitation by conducting a series of robustness checks across different model specifications. We start with a baseline model that includes only GDP convergence and the financial proxy. We then progressively introduce additional control variables, first adding trade openness and subsequently inflation. The underlying idea is that if the null hypothesis is consistently rejected across all model specifications (with or without control variables), we can be reasonably confident that the financial proxy is time-varying.

The corresponding test p-values are displayed in Table 5, with financial variables and GDP in terms of their 5-year growth rates. As we can see, all p-values are less than 5%; therefore, the null hypothesis of time-invariant coefficients is rejected, supporting the idea that the finance and growth nexus is time-varying. Consequently, in the next Section we turn to a time-varying version of the Interactive Fixed Effects (IFE) model, which allows us to account for potential structural changes in the finance-growth nexus over time.

Table 5: **Constancy test p-values using different models. *H0*: all coefficients are constant**

	Liquid liabilities growth	Bank loans growth	Stock market growth
Without X	0.008	0.018	0.051
With X = (trade)	0.008	0.018	0.050
With X = (trade, inflation)	0.008	0.018	0.050

5.3 Time-varying interactive fixed effects (TVIFE) estimation

In this Section, we present our main results. As explained before, the IFE model assumes that the slope coefficients (α, β and γ) and factor loadings (λ_i) are time-invariant, which appears very restrictive given the long time span of our historical dataset. In fact, as economic transitions occur, the relationship between real and financial variables may change over time (Minsky, 1990). If a panel data model fails to account for such a time-varying behavior, statistical inference can be highly misleading. The underlying idea is that, even accounting for global common interdependencies, IFE estimates provide an average effect, reflecting compensations that occur over time.

In Table 6, we compare the root mean square error (RMSE) of the IFE model and its time-varying version, respectively. Again, the comparison involves the two methodologies with the same set of control variables, i.e. GDP lagged, openness to trade and consumer price inflation, and the same dependent variable, i.e. the 5-year growth rate of real GDP per capita. As we can see, the smallest RMSE occurs for the time-varying model, suggesting improved precision in the estimates.

Table 6: **RMSE of the IFE and TVIFE estimations with different financial variables**

Model	IFE	TVIFE
With liquid liabilities growth	0.065	0.035
With bank loans growth	0.075	0.029
With stock market growth	0.059	0.028

Next, Figure 8 presents the time-varying slope coefficients of liquid liabilities growth, credit growth and stock market capitalization growth, while time-varying estimates for GDP convergence and other growth determinants (openness to trade and consumer price inflation) are presented in Figure 9. It is important to emphasize that our main interest in this Section relates to the sign, direction, and temporal evolution of the estimated relationships, rather than in their precise point estimates. Our goal is to understand how the finance and growth relationship has changed over time and to identify consistent patterns.

In the upper-left of Figure 8, we show that the finance and growth nexus has evolved significantly in the last 139 years. In terms of sign, accounting for global common shocks and their heterogeneous impact over time, the contemporaneous association between financial development and economic growth turns out to be far from positive. In terms of dynamics, from 1880s until 1980s, the relationship is clearly negative. This holds true both for our time-varying estimates and their 95% confidence intervals (bands). The negative relationship emerges as early as the late 19th century and declines further at the beginning of the 20th century, remaining consistently negative until the early 1960s. In the post-war era, a period in which financial regulation tightened and corporate ownership became more diffused, we observe a clear upward trend where the negative relationship gradually weakens. From that point, the correlation between liquid liabilities growth and real GDP growth stabilizes close to zero in the era of massive financialization. Our results highlight the importance of allowing for time variation in the coefficients, as time-invariant models would fail to capture these dynamics.

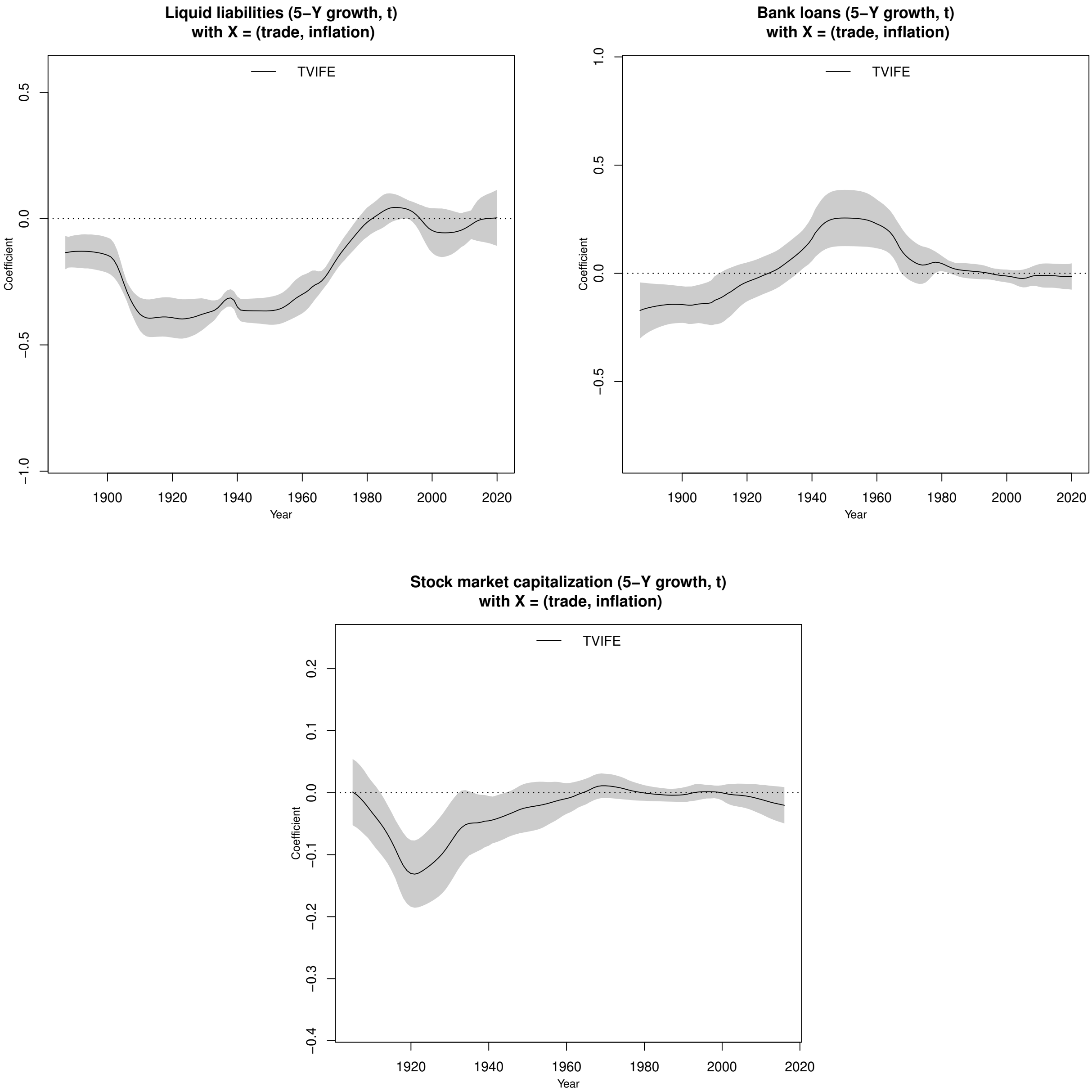


Figure 8: Time-varying coefficient estimates of liquid liabilities, bank loans and stock market capitalization growth. The graphs show the estimated values of the coefficients at each year and their 95% confidence interval (bands). Number of bootstraps used for each estimation: 100.

A different picture emerges when we distinguish between Schumpeterian finance (bank credit growth) and a more speculative type of finance (stock market growth). While both exhibit time-varying behaviors, we find a historically more positive relationship with economic growth for the former (in particular, from the 1930s until 1980s the correlation is consistently above zero), while for stock market the correlation with GDP growth has been either zero or negative across our entire time span. It is noted that, in the era of financialization, the correlation between credit growth and economic growth has steadily weakened, eventually approaching zero, indicating a growing disconnect between credit expansion and productive economic activity. This lack of association can be attributed to two well-documented trends in the post 1970s: a decline in business lending and a corresponding shift toward household lending, reflecting a reallocation of credit away from growth-enhancing activities toward unproductive consumption-based borrowing (Lapavitsas and Mendieta-Muñoz, 2022).

While it is not part of this study to discuss the time-varying relationship between other growth determinants and GDP per capita growth, Figure 9 presents the time-varying slope coefficients for our set of control variables and the GDP convergence term. For openness to trade and inflation, the results align broadly with expectations from the empirical literature and remain consistent across different financial proxies used in the specification. Openness to trade consistently shows a historically positive correlation with economic growth, while inflation tends to exhibit a weak or negative correlation with per capita GDP growth. In contrast, the initial level of real GDP per capita displays a positive association with future per capita GDP growth rates, contradicting the β-convergence hypothesis tipically associated with neoclassical growth theory (Barro and Sala-i Martin, 1992).

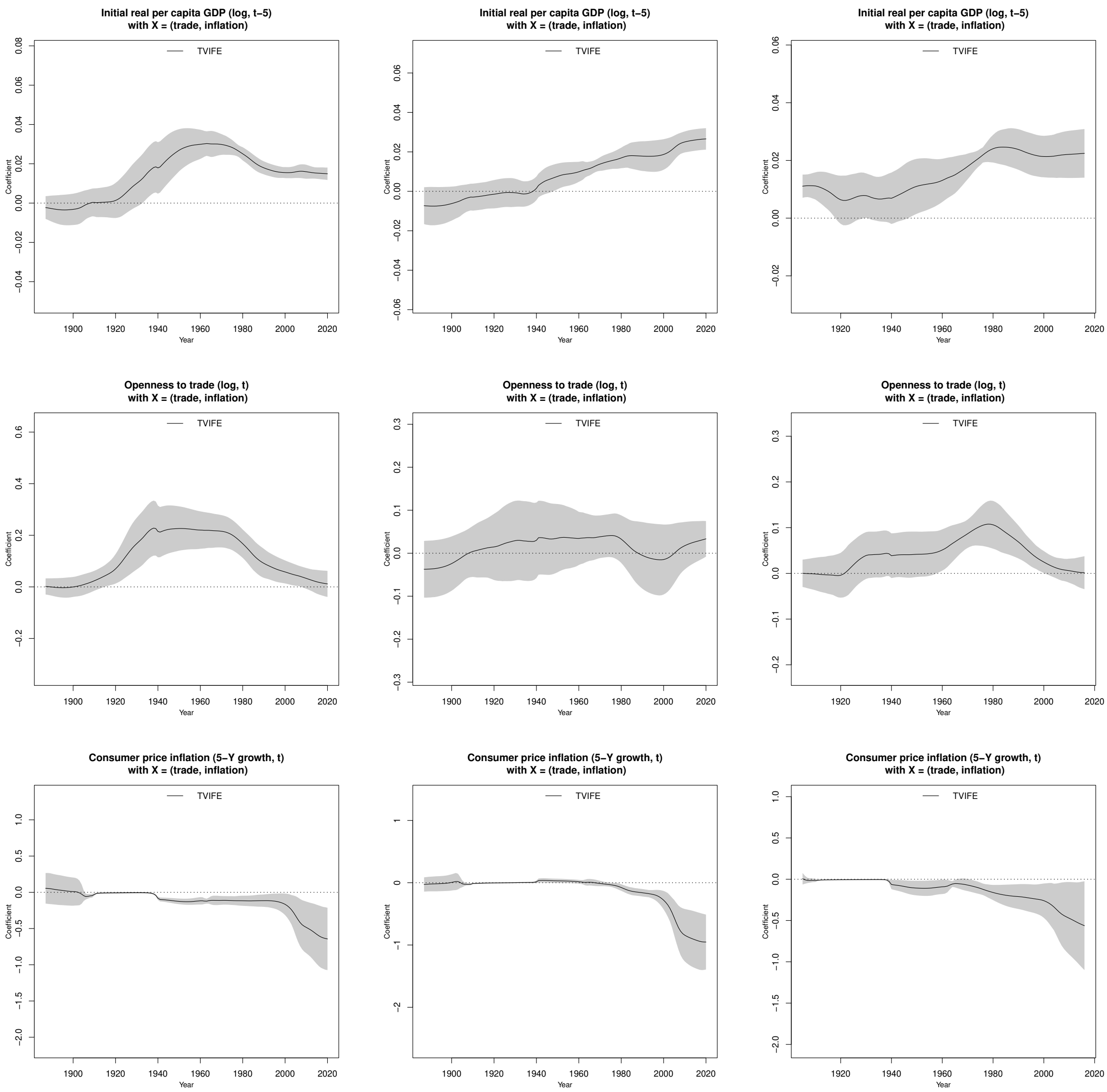


Figure 9: Time-varying coefficient estimates of lagged real GDP per capita (top panel), openness to trade (middle panel) and consumer price inflation (bottom panel) using liquid liabilities growth (left column), bank loans growth (middle column) and stock market capitalization growth (right column). The graphs show the estimated values of the coefficients at each year and their 95% confidence interval (bands). Number of bootstraps used for each estimation: 100.

5.4 Common unobservable factors

One way to mitigate cross-sectional dependence is to include interactive effects that reflect common correlated determinants through a set of unobservable factors f_t, with their impact on GDP growth in each country represented by λ_i. By incorporating these unobservable common factors, our approach accounts for structural breaks and non-stationary cross-sectional correlations that standard fixed-effects models would otherwise overlook. This allows us to move beyond linear interpretations and recognize that the finance-growth nexus operates within a changing global environment, one that requires models capable of adapting to time-varying interdependencies and structural heterogeneity.

A key limitation of factor-based models lies in their inherent abstraction. While these models effectively capture the presence of common unobservable influences, they do not allow for a straightforward identification of the specific economic or institutional determinants that the extracted factors represent. This lack of direct interpretability poses challenges. Nonetheless, this limitation is offset by a significant methodological strength: the ability to capture the influence of unobservable determinants otherwise difficult to observe and measure, thereby enhancing the robustness of our estimates of the relationship between finance and economic growth.

The algorithm described in Section 3 identifies eight unobservable factors when using the growth of liquid liabilities, while it selects seven factors each for credit growth and stock market growth, respectively. All factors are shown in the Data Appendix at the end of the paper. In this Section in Figure 10, we present the most significant factors in terms of variance explained.

Given that it would be difficult and of limited relevance to interpret what latent factors represent, we focus only on describing their main characteristics. As we see from Figure 10, the three main latent factors of this paper exhibit substantial temporal variation. Their non-constant behavior suggests that they are absorbing complex patterns of common shocks and time-varying co-movements across countries. These factors likely reflect deeper common-correlated structural changes that have influenced global growth patterns in the last 139 years. Two out of three present a U-shaped pattern, clearly aligned with the historical periodization proposed above. The most relevant latent factor in the case of bank credit shows, instead, a positive growing trend.

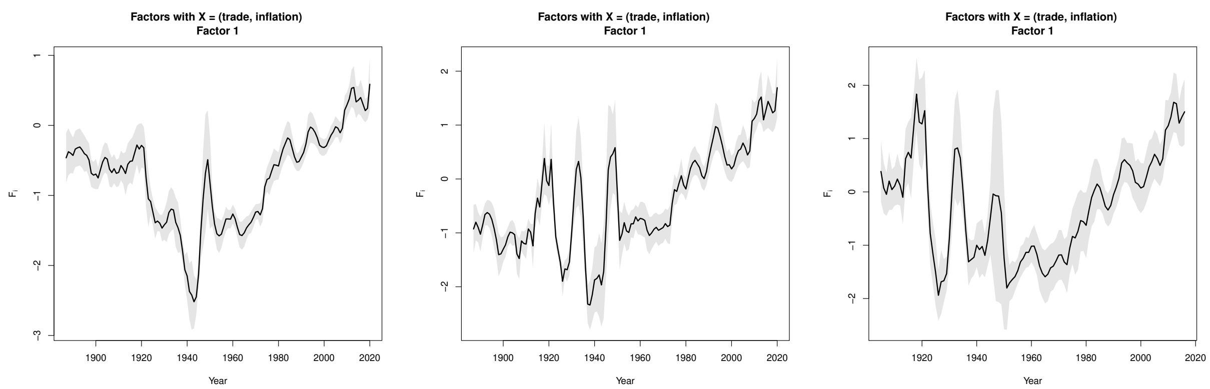


Figure 10: Main factors with liquid liabilities growth, bank credit growth and stock market growth, respectively. The graphs show the estimated values of the factors at each year and their 95% confidence interval (bands). Factors explain the following proportion of variance relative to the total variance captured by the factor structure: 61.29%, 57.14% and 48.03%, respectively.

6 Robustness checks

We now demonstrate that our main findings remain robust even when we account for a range of alternative specifications and potential sources of variation. In particular, we proceed in three steps. First, we verify the stability of our results by using an alternative proxy for economic growth, namely labor productivity growth. Second, we test changes in the sample composition by excluding the United States and then all Anglo-Saxon countries. Finally, we introduce modifications to the model specification, including alternative lag structures and different length of growth rates.

6.1 Alternative proxy for economic growth

In our baseline analysis, we use real GDP per capita growth as the dependent variable, which represents the standard proxy for economic growth. However, to ensure the robustness of our results, we explore an alternative measure of economic performance. Specifically, we consider labor productivity growth, sourced from the Long Term Productivity Database by Bergeaud et al. (2016).

Table 7 reports the p-values from the constancy test using the 5-year growth rate of labor productivity as the dependent variable. The results show that for liquid liabilities growth and credit growth, the p-values remain consistently below 5% (around $0.01-0.03$) across specifications, suggesting some degree of time variation in the estimated coefficients. However, for stock market capitalization growth, the p-values are higher than 10% (ranging from 0.203 to 0.271), providing no evidence against coefficient constancy.[13] As a result, in this Section we do not proceed with any further time-varying analysis for this variable.

Table 7: **Constancy test p-values using different models**

	Liquid liabilities growth	Credit growth	Stock market growth
Without X	0.030	0.01	0.271
With X = (trade)	0.027	0.01	0.208
With X = (trade, inflation)	0.025	0.01	0.203

In Figure 11, we present the time-varying coefficients for our proxy of financial development (liquid liabilities growth) and credit growth, using labor productivity growth as the dependent variable. The specification follows the same structure as equation (5), with the only modification being the replacement of lagged GDP per capita with the lagged level of labor productivity. The set of control variables remains unchanged and includes the natural logarithm of openness to trade and the five-year CPI growth rate. As usual, time-varying estimates for these control variables are reported in the Data Appendix. As shown in Figure 11 and in line with expectations, the historical dynamics observed with GDP per capita growth remain largely unchanged when using labor productivity growth as an alternative proxy for economic development.

[13] This result also holds true when looking at the 3-year growth rate of our variable of interest.

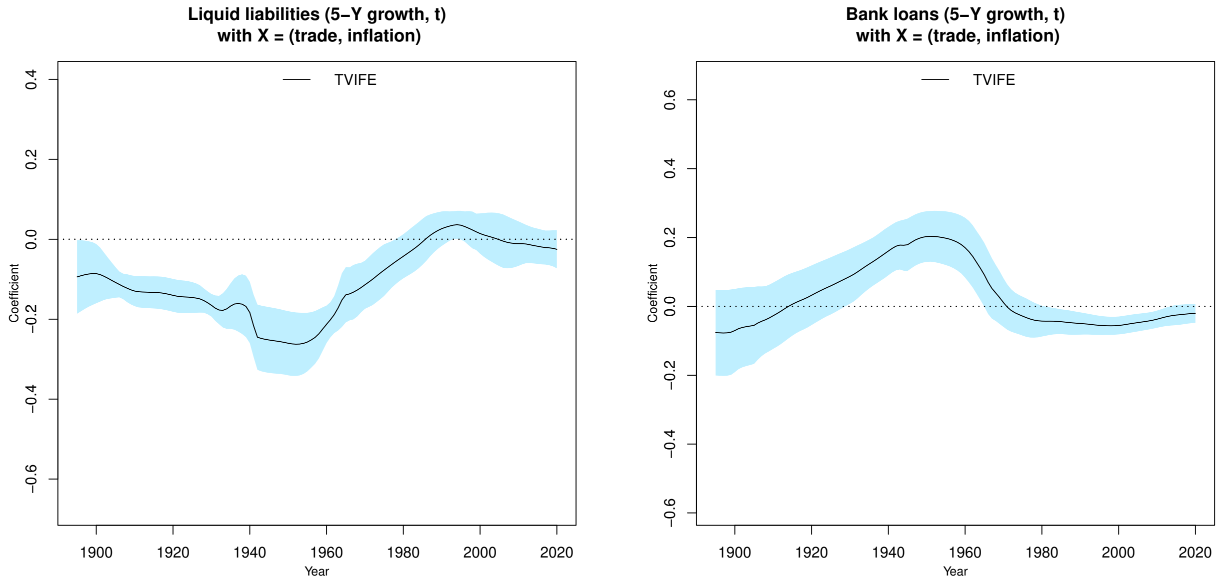


Figure 11: Time-varying coefficient estimates of liquid liabilities growth and bank loans growth with labor productivity growth as dependent variable. The graphs show the estimated values of the coefficients at each year and their 95% confidence interval (bands). Number of bootstraps used for each estimation: 100.

6.2 Different country samples

We check the robustness of our results by changing the sample. Specifically, we look at two additional cases: one without the United States and one without all Anglo-Saxon countries (Australia, Canada, the United Kingdom, and the United States). Our goal is to understand whether certain countries or groups of countries are driving our main results. In the Data Appendix (Figure 17), we provide the historical evolution of the global composition of liquid liabilities, bank loans, and stock market capitalization based on our dataset.

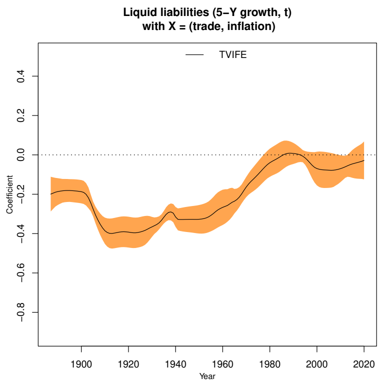
Figure 12 shows the time-varying estimates for different country-samples. The first row (plots (a), (b) and (c), respectively) presents time-varying estimates for liquid liabilities growth, bank loans growth, and stock market capitalization growth excluding the United States, while the second row (plots (d), (e) and (f), respectively) shows the same estimates using a sample that includes only Europe and Japan.[14] The dependent variable is the 5-year growth rate of real GDP per capita.

Looking at the contemporaneous relationship between financial development and economic growth (plots (a) and (d), respectively), it is interesting to observe that historical patterns remain broadly similar to those in the full sample. What changes slightly is the sign of the correlation in certain historical periods. For instance, when comparing Figure 4 with the case that excludes all Anglo-Saxon countries (plot (d)), the correlation between financial development and real GDP per capita growth is less negative in the late 19th century, but more negative post-1980s. Instead, when we distinguish between a more Schumpeterian type of finance (bank loans) and stock market growth, we show that excluding Anglo-Saxon countries makes the relationship between bank credit and economic growth much more positive over time. In contrast, for stock markets, both the pattern

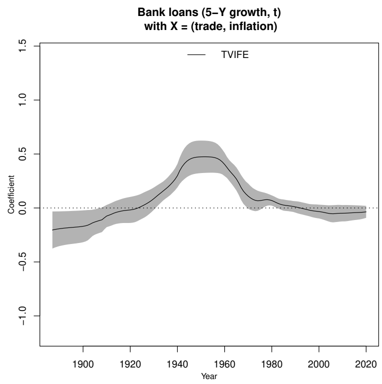
[14] For bank loans, the European sample includes Denmark, Finland, Germany, Italy, Norway, Sweden, and Switzerland. For stock market capitalization, it includes Denmark, France, Germany, Norway, Portugal, Spain, Sweden, and Switzerland. For more details, see Section 3.

and magnitude are largely unaffected by changes in sample composition, except for a slightly weaker negative correlation before the 1920s when Anglo-Saxon countries are excluded (plot (f)).

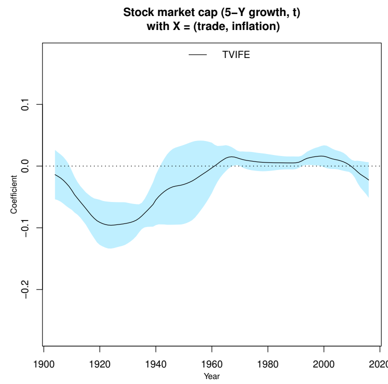
Overall, these findings suggest that the historical relationship between finance and economic growth is broadly robust across different country samples. Compared to the full sample, the underlying dynamics remain remarkably consistent, indicating that no single country or group of countries drives the overall pattern. This is particularly evident when we exclude the United States (plots (a), (b), and (c)), where the results closely mirror those of the full sample. While some variations emerge, they mainly concern the sign of the relationship in certain periods and likely reflect underlying institutional and structural differences across countries. In particular, the more positive correlation observed when excluding Anglo-Saxon economies in plot (e) highlights the contrast between bank-based financial systems, common in continental and Nordic Europe, and market-based systems, typical of Anglo-Saxon economies.



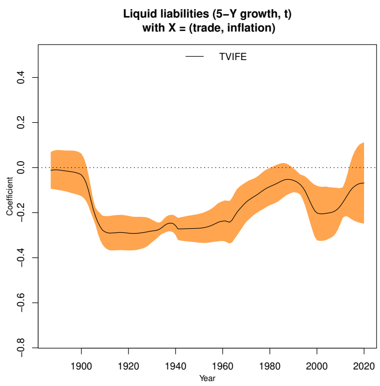
(a) Liquid liabilities



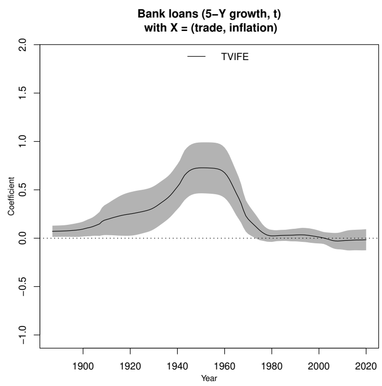
(b) Bank loans



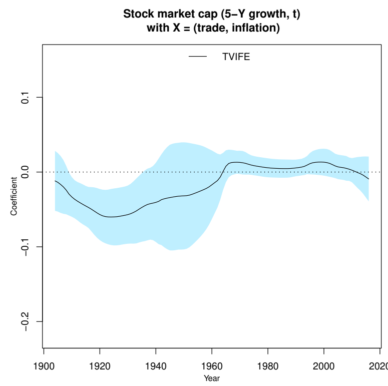
(c) Stock market



(d) Liquid liabilities



(e) Bank loans



(f) Stock market

Figure 12: Time-varying coefficient estimates of liquid liabilities, bank loans and stock market capitalization growth for different samples. The graphs show the estimated values of the coefficients at each year and their 95% confidence interval (bands). Number of bootstraps used for each estimation: 100. First row (plots a, b and c) refers to the full sample without the United States, while the second row (plots d, e and f) considers only European countries and Japan.

6.3 Model specification

6.3.1 3-year growth rates estimates

Since the literature that uses panel data models to study the finance and growth nexus has traditionally focused on 5-year growth rates, it is interesting to check whether our findings are robust to using different growth spells. In this Section, we first present fixed effects and interactive fixed effects estimates for liquid liabilities growth, bank loans growth and stock market capitalization growth using 3-year growth rates of our variables of interest and real GDP per capita as dependent variable. The top panel of Figure 13 shows the FE estimates, while at the bottom the IFE coefficients are presented. Comparing these results with those in Figures 2 and 3, we find that the sign of the relationship remains unchanged, with only minor variations in the magnitude of the estimated coefficients.

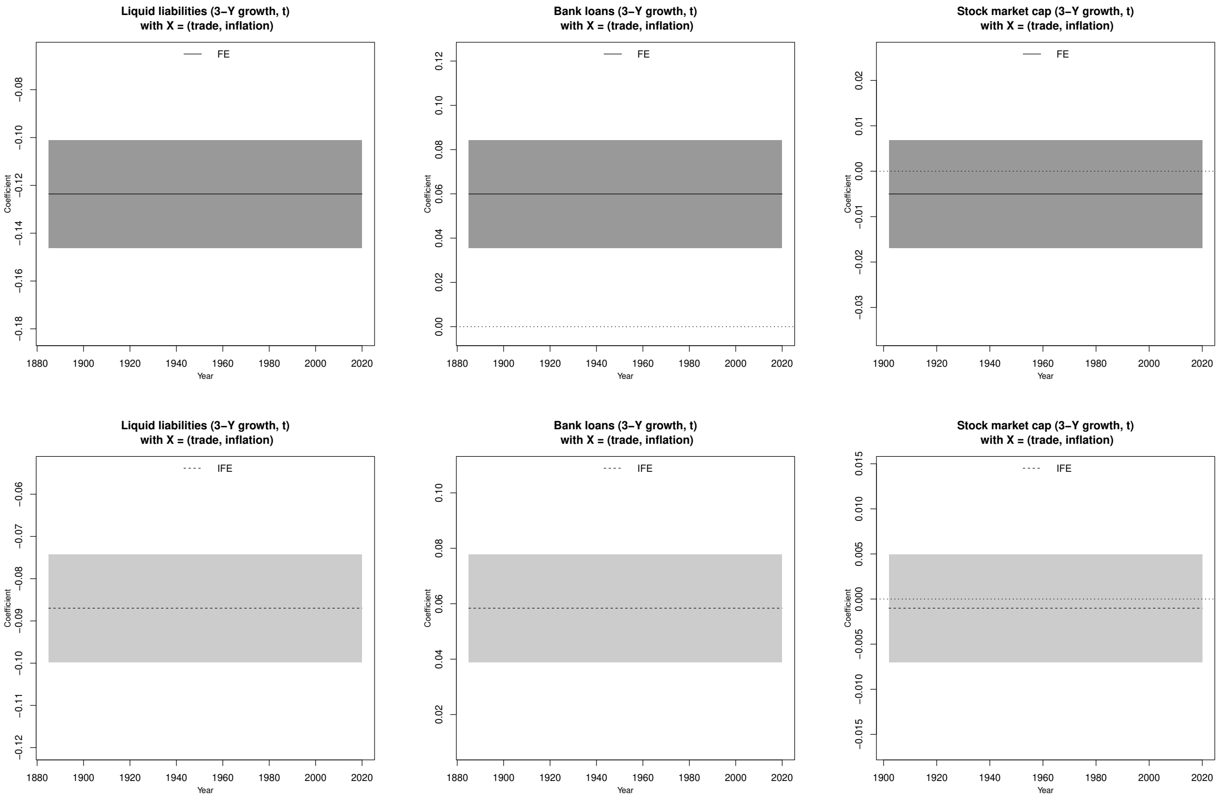


Figure 13: Coefficient estimates for liquid liabilities, bank loans and stock market capitalization growth. The graphs show the estimated values of the coefficients at each year and their 95% confidence interval (bands).

Table 8 compares the root mean square error (RMSE) of the FE and IFE estimations, respectively. The comparison involves the two methodologies with the same set of control variables. The smallest RMSE occurs for the IFE model.

Table 8: **RMSE of the FE and IFE estimations with different financial variables**

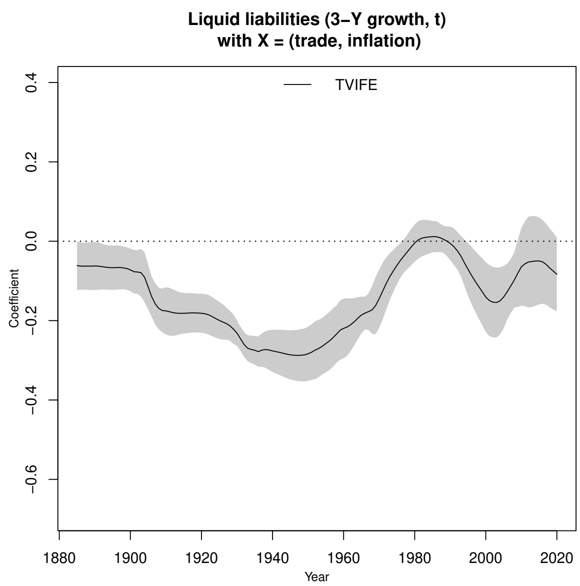
Model	FE	IFE
With liquid liabilities growth	0.093	0.053
With bank loans growth	0.091	0.074
With stock market growth	0.096	0.048

The constancy test p-values based on 3-year growth rates are reported in Table 9. As shown, the p-values for liquid liabilities growth and stock market growth are consistently below the 10% threshold across different specifications, indicating also in this case a rejection of the null hypothesis of time-invariant coefficients. In contrast, and differently from the 5-year growth rate case, the p-values for credit growth are slightly above 10%, preventing rejection of the null hypothesis. A potential explanation lies in how we compute the growth rates. The 5-year moving average likely captures more persistent structural changes in the relationship between growth and financial variables − changes that may be obscured by the higher short-term volatility present in the 3-year window. In other words, the longer averaging period provides a clearer signal, enhancing the test's ability to detect time variation in the coefficients, whereas shorter moving averages may still contain a considerable amount of high-frequency noise.

Table 9: **Constancy test p-values using different models**

	Liquid liabilities growth	Credit growth	Stock market growth
Without X	0.031	0.112	0.080
With X = (trade)	0.031	0.112	0.080
With X = (trade, inflation)	0.031	0.113	0.079

Figure 14 and Table 10 present the time-varying coefficient estimates for liquid liabilities and stock market capitalization growth, along with the corresponding RMSEs, compared to the IFE benchmark. As with the fixed effects (FE) and interactive fixed effects (IFE) analyses, the overall picture remains robust to the specific time window used to compute growth rates.



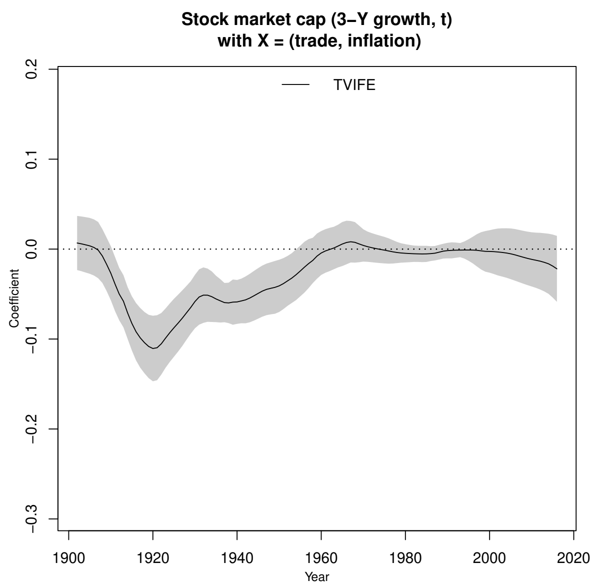


Figure 14: Time-varying coefficient estimates of liquid liabilities growth and stock market capitalization growth. The graphs show the estimated values of the coefficients at each year and their 95% confidence interval (bands). Number of bootstraps used for each estimation: 100.

Table 10: **RMSE of the IFE and TVIFE estimations with different financial variables**

Model	IFE	TVIFE
With liquid liabilities growth	0.053	0.026
With stock market growth	0.048	0.022

6.3.2 Different lag structures

As an additional robustness check, we examine the effect of our financial variables in lags on economic growth. Specifically, we use the lagged five-year growth rates of our financial variables − liquid liabilities, bank loans, and stock market capitalization − as the main regressors, alternatively. This specification allows us to test the robustness of our findings to the introduction of a lag structure.

To provide a clearer understanding of our lagged structure, consider the following example. If the dependent variable is the five-year growth rate of real GDP per capita in 1893 − measured as the log difference between 1888 and 1893 − then the corresponding lagged financial variable refers to the five-year growth rate in the preceding non-overlapping period, namely from 1882 to 1887. This structure is deliberately designed to avoid any overlap between the periods used for the dependent and independent variables. We present results only for the five-year growth rate specifications, as those based on three-year windows yield essentially identical conclusions. The time span of the analysis runs from 1893 to 2020 for liquid liabilities and bank loans, and from 1910 to 2016 for stock market capitalization growth, reflecting the availability of data for each variable.

Table 11 reports the p-values from the constancy test using the 5-year growth rate of real GDP per capita as the dependent variable and lagged values of the the financial variables as regressors, alternatively. The results show that for liquid liabilities growth and credit growth, the p-values remain consistently below 5% across specifications, while for stock market capitalization growth the p-values remain consistently below 10%. These results suggest some degree of time variation in the estimated coefficients.

Table 11: **Constancy test p-values using different models**

	Lag liquid liabilities growth	Lag credit growth	Lag stock market growth
Without X	0.010	0.024	0.084
With X = (trade)	0.010	0.024	0.099
With X = (trade, inflation)	0.009	0.017	0.079

In Figure 15, we present the time-varying coefficients for the lagged values of liquid liabilities growth, credit growth and stock market capitalization growth. The specification follows the same structure as equation (5), with the only modification being the replacement of the contemporaneous financial growth rates with their lagged values. The set of control variables remains unchanged and includes the natural logarithm of openness to trade and the (contemporaneous) five-year CPI growth rate. As usual, time-varying estimates for these control variables are reported in the Data Appendix. The corresponding root mean square errors (RMSEs) of the specifications in Figure 15 range from 0.031 (lagged liquid liabilities) to 0.034 (lagged credit and stock market capitalization growth).

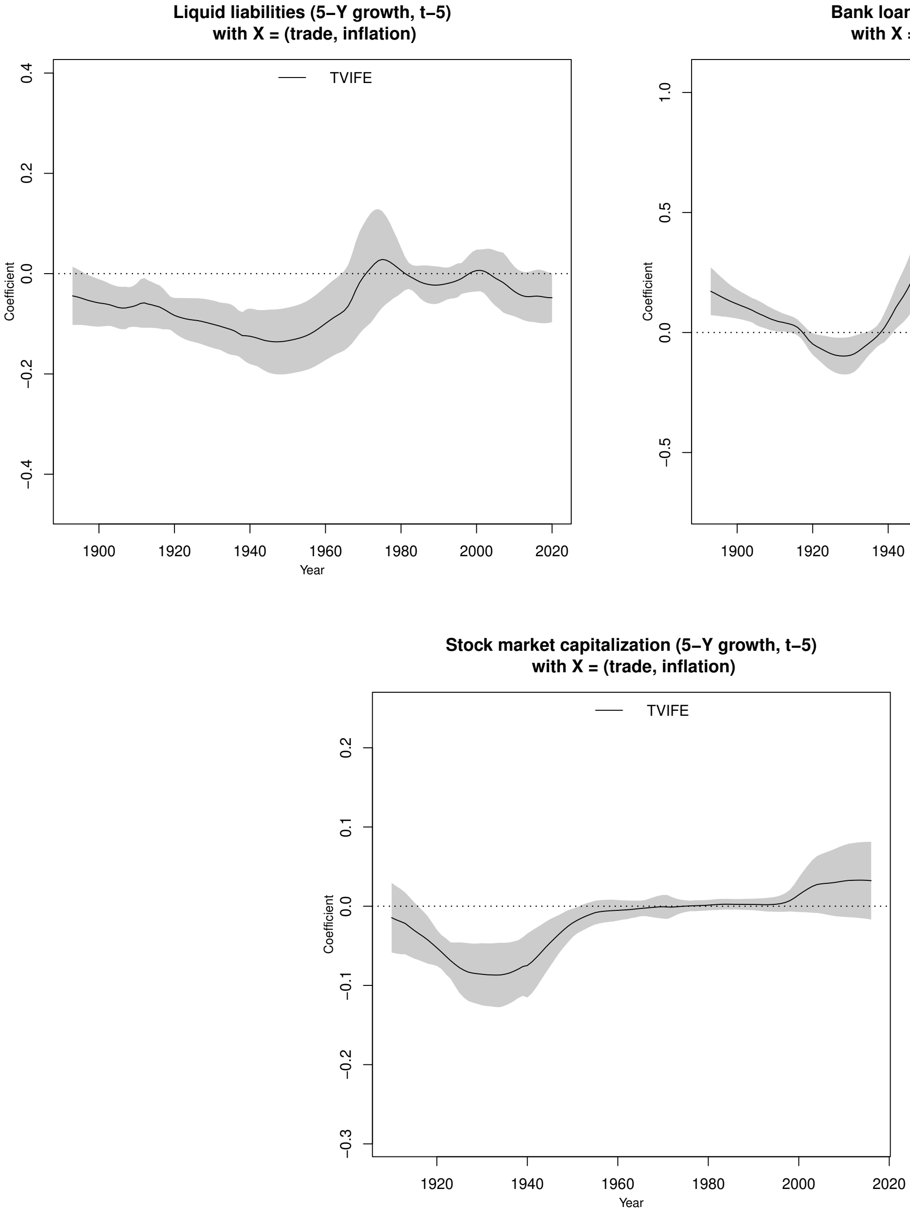


Figure 15: Time-varying coefficient estimates of lagged liquid liabilities, bank loans and stock market capitalization growth. The graphs show the estimated values of the coefficients at each year and their 95% confidence interval (bands). Number of bootstraps used for each estimation: 100.

For our proxy of financial development, the historical dynamic remains largely unchanged. In this specification, the relationship between financial development and economic growth remains far from positive, indicating that historically financial development is negatively associated with subsequent economic performance. Nonetheless, compared to the benchmark result in Figure 8, the magnitude of the effect is smaller. This fact likely reflects the time gap introduced by the five-year lag structure: as the time between the financial indicator and the growth outcome increases, the strength of the association naturally fades. Nonetheless, the persistence of a negative correlation − even under this more demanding lag specification − underscores the robustness of the negative historical relationship documented in this paper.

In terms of functions of finance, we confirm a historically more positive relationship between credit growth and economic growth compared to stock markets. In contrast, lagged stock market capitalization growth is either weak or even negative associated with subsequent economic performance. In the post-2000 period, the estimated time-varying coefficient remains very close to zero, often with confidence intervals overlapping zero and extending into negative territory, and the magnitude remains consistently low (below 0.1).

7 Concluding remarks

The interplay between finance and economic growth constitutes a fundamental concern for both economic theory and the formulation of economic policy. The theoretical literature reflects a persistent tension between two coexisting views: one sees finance as essential for long-run economic growth, while the other highlights its potential to create instability and crises. On one side, some scholars emphasize the capacity of financial systems to mobilize savings, allocate capital efficiently, and support innovation, which are key drivers of productivity improvements and structural transformation. On the other, some economists highlight the pro-cyclical nature of financial markets, their propensity to fuel speculative bubbles, frauds, and swindles, as well as the recurring disconnect between financial expansion and real economic investment, all factors that may ultimately undermine long-term growth. This theoretical ambiguity is mirrored in the empirical literature, where findings remain equally inconclusive: while some studies report a positive and robust link between financial development and growth, others reveal non-linearities, threshold effects, or even negative correlations.

This paper examines the finance-growth nexus by addressing two key aspects: first, the potential time-varying nature of the relationship; and second, its evolution in the very long-run. To do so, we employ a panel data model with interactive fixed effects and time-varying coefficients for a sample of advanced economies from 1882 to 2020. Our methodology considers flexible specifications of heterogeneity and accounts for global structural breaks that have likely shaped the finance and growth nexus along this secular time span. We embed our empirical analysis within a historical framework that traces the evolution of three distinct institutional-policy regimes, arguing that any assessment of finance's role in economic growth must account for the broader institutional context in which finance operates. Notably, the theoretical periodization articulates a non-linear accounting of the finance-growth nexus, context and institutional dependent.

By drawing on historical macroeconomic and financial data for the OECD area, we provide empirical support for the time-varying nature of the finance and growth relationship. First, we account for three different proxies for the role of the financial system. One relates to the size or degree of financial development, liquidity. The second to the role of finance as ephor of growth, via banking credit. The third to the role of finance as accumulation of gains from capital ownership, via stock market capitalization. Through a constancy test and flexible estimation methods, we demonstrate that the effect of finance on growth has varied secularly. Periods often assumed to exhibit a positive finance-growth link in fact reveal much weaker or even a negative relationship, challenging the mainstream assumption of a uniform association over time. Moreover, when we disaggregate financial growth into bank credit growth and stock market growth, clear differences emerge. Our results show that bank-based finance has a stronger and more positive association with economic growth than stock markets. Conversely, stock market growth is often uncorrelated or negatively correlated with growth.

Implications of our findings are deep and widespread. First, by showing a robust account of the non-linearity behind the finance-growth nexus, naive pro-finance, or pro-capital markets policies and considerations should be taken with caution. Second, to assess the relationship with economic growth, the functions of the financial system should be neatly distinguished, otherwise the empirical accounting might underestimate the nil impact that the growth of stock market capitalization has exerted on economic growth over the long run. In addition, the nexus presents gains over time that are exhausting, as clearly shown by the fading-away effect of bank credit. Third, the time-dependent nature of the relationship highlights the importance of the institutional setting as one of the most important transmission channels of the relationship, an aspect still relatively under-investigated. Finally, although our paper relies mostly on data for advanced economies, expectations on the role of finance in fostering real economic growth for developing countries should be formulated. While in fact, advanced economies had the opportunity to benefit from the seeds of financial regulations to promote their economic growth, developing countries are nowadays experiencing the large negative side of hyper-financialization as represented by the growing role of shadow banking and asset managers. As such, while our findings report a nil effect for stock market growth and negative for liquid liabilities, such effects might become even more negative for developing countries.

Indeed, the main limitation of our findings relates to the use of a dataset with limited coverage of countries. Future lines of research would entail the inclusion of a broader set of countries, especially low- and middle-income economies, to assess whether the historical dynamics observed in advanced economies hold, reverse, or intensify under different financial and institutional conditions. However, extending the sample in this way would likely require shortening the time span of the analysis, given the lack of consistent secular data for many of these countries. Furthermore, future research should also address the methodological limitation inherent in the assumption of slope homogeneity across countries. While our time-varying interactive fixed effects (TVIFE) framework accounts for unobserved common factors and time variation, it treats the relationship between finance and growth as structurally identical across all units (Wang et al., 2024). This assumption may be overly restrictive, especially when applied to a more heterogeneous global sample. Extending the model to allow for country-specific time-varying coefficients would enable a more nuanced understanding of how the finance-growth nexus has been shaped by institutional quality, regulatory environments, or stages of development.

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Data Appendix

The finance-growth nexus over the long-run

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Data sources

This study combines a variety of cross-country macroeconomic datasets and historical sources. Below is a detailed description of the sources and imputation strategies used for our key macroeconomic and financial variables.

Real GDP per capita: data are sourced from the Maddison Project Database (Bolt and Van Zanden, 2020). For Japan, data are missing for the years 1882–1884. To fill this gap, we use the 1885 value of real GDP per capita and population figures for 1882–1884 to back-calculate real GDP. Taking constant real GDP in 1885, we divide it by the annual population in 1882, 1883 and 1884 to estimate real GDP per capita for those three years. This method provides a reasonable proxy in 2011 international dollars. At the end of the day, we end up with data for the full sample of 16 countries from 1882 to 2020.

Labor productivity: data are sourced from the Long-Term Productivity Database (Bergeaud et al., 2016). Data are available for the full sample of 16 countries from 1890 to 2020.

Consumer price index: CPI data (1990=100) are taken from the Jordà-Schularick-Taylor Macrohistory Database (Jordà et al., 2017). Data are available for the full sample of 16 countries from 1882 to 2020.

Openness to trade: computed as the sum of imports and exports over GDP. Trade data are primarily sourced from the Jordà-Schularick-Taylor Macrohistory Database (Jordà et al., 2017). For specific country-year gaps, we first supplement with imports and exports data from Federico and Tena-Junguito (2016), including Australia (1914), Switzerland (1882–1884), and Germany (1914–1923). In cases where the Jordà-Schularick-Taylor Macrohistory Database provides data on imports and exports but lacks nominal GDP figures, we supplement with nominal GDP data from the Global Macro Database (Müller et al., 2025). This applies to the Netherlands (1914–1920, 1940–1943) and Norway (1940–1945). For Germany (1944–1947), Japan (1944–1945), and the Netherlands (1944–1945), we estimate trade openness by linearly interpolating the ratio of trade to GDP. At the end of the day, we end up with data for the full sample of 16 countries from 1882 to 2020.

Liquid liabilities: computed as M2 or M3 over GDP. Liquidity data come from the Jordà-Schularick-Taylor Macrohistory Database (Jordà et al., 2017) and are complemented by nominal GDP figures from Global Macro Database (Müller et al., 2025). For Germany (1939–1943), we use M2 estimates from Albert Ritschl's dataset on interwar Germany (Ritschl, 2014), while for 1944 we compute M2 as the sum of demand and time deposits plus savings deposits from the same source. For Spain (1936–1939), we use M1 estimates from Martín-Aceña (2018) (Table 1, page 34), which include money in circulation in both Republican and Nationalist zones during the Civil War. These estimates are consistent with known values for 1935 and 1941. Data are at december values, except for March 1939. For France (1914–1919), we rely on Bordo and Hautcoeur (2003) estimates of money growth, applying their reported growth rates (30%, 70%, 27%, 28%, 40%, and 26%) to Jordà-Schularick-Taylor 1910 money stock level. Missing data for Japan (1945), the Netherlands (1942–1944), Spain (1940), Germany (1923–1924, 1945–1947) have been linearly interpolated. At the end of the day, we end up with data for the full sample of 16 countries from 1882 to 2020.

Stock market capitalization: computed as stock market capitalization over GDP. Stock market data come from Kuvshinov and Zimmermann (2022). For Norway (1940–1945), we use growth rates of stock market indices at December value from Klovland (2004), Chapter 8 - Historical Stock Price Indices in Norway, 1914–2003. For Canada 1927–1933, Germany 1923 and 1945, France 1917–1919 and 1939–1944 we use linear interpolation. At the end of the day, we end up with data for 12 countries (excluding Finland, Italy, Japan and the Netherlands) from 1899 to 2016. Japan is excluded due to the closure of the stock market from 1946 to 1949.

Bank loans: computed as total credit to the private non-financial sector over GDP. Credit data are sourced from the Jordà-Schularick-Taylor Macrohistory Database (Jordà et al., 2017) and combined with nominal GDP from Global Macro Database (Müller et al., 2025) for Norway 1940–1945. For Australia 1946–1947, we use total loans data from Global Credit Project (Müller and Verner, 2024). For Japan 2018–2020, we use World Bank data on domestic credit to the private sector by banks as a % of GDP. For Germany 1921–1923 and 1941–1945, and Japan 1945, we interpolate the loan-to-GDP share directly. At the end of the day, we end up with data for 12 countries (excluding Spain, France, the Netherlands, and Portugal) from 1882 to 2020.

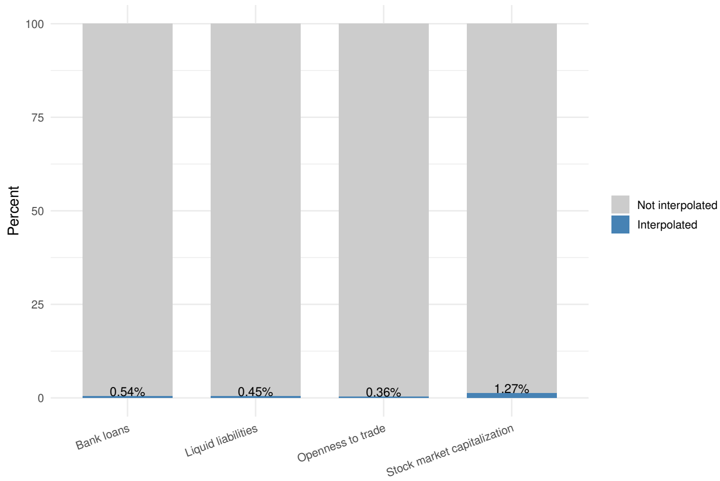

Figure 16: % of interpolated values (blue) over total country-year observations, by variable.

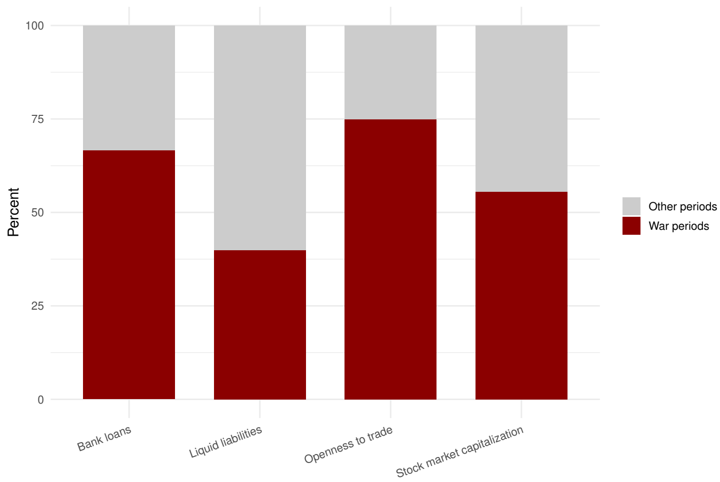

Figure 17: % of war-related interpolated values (red) over total interpolated values, by variable. War periods refer to the two World Wars, 1914-1918 and 1939-1945.

Table 12: **Descriptive statistics - liquid liabilities over GDP, by country**

Country	Avg	Min	Max	Avg 1882-1913	Avg 1929-1971	Avg 1974-2020
Australia	0.59	0.38	1.22	0.48	0.56	0.72
Canada	0.44	0.21	0.97	0.34	0.41	0.54
Denmark	0.5	0.32	0.75	0.58	0.45	0.45
Finland	0.5	0.24	0.82	0.5	0.48	0.51
France	0.62	0.29	1.98	0.65	0.64	0.63
Germany	0.56	0.22	1.13	0.6	0.43	0.64
Italy	0.63	0.3	1.24	0.44	0.64	0.76
Japan	0.74	0.21	2.03	0.29	0.64	1.21
Netherlands	0.59	0.2	1.69	0.26	0.64	0.76
Norway	0.6	0.39	1.11	0.58	0.62	0.52
Portugal	0.51	0.09	1.17	0.12	0.51	0.86
Spain	0.61	0.21	1.26	0.28	0.6	0.91
Sweden	0.62	0.39	0.88	0.59	0.7	0.55
Switzerland	0.93	0.48	1.62	0.57	1.01	1.14
United Kingdom	0.59	0.41	1.18	0.47	0.57	0.72
United States	0.53	0.29	0.85	0.4	0.6	0.56

Table 13: **Descriptive statistics - bank credit over GDP, by country**

Country	Avg	Min	Max	Avg 1882-1913	Avg 1929-1971	Avg 1974-2020
Australia	0.46	0.16	1.61	0.4	0.23	0.79
Canada	0.47	0.14	1.12	0.43	0.26	0.72
Denmark	1.13	0.55	2.04	1.03	0.95	1.35
Finland	0.44	0.09	0.99	0.3	0.34	0.64
Germany	0.63	0.05	1.04	0.74	0.37	0.84
Italy	0.44	0.13	1	0.21	0.4	0.68
Japan	0.57	0.11	1.21	0.26	0.49	0.85
Norway	0.72	0.23	1.5	0.65	0.54	0.89
Sweden	0.68	0.38	1.3	0.64	0.48	0.91
Switzerland	1.12	0.65	1.68	0.95	1.06	1.31
United Kingdom	0.42	0.14	1.18	0.26	0.25	0.75
United States	0.42	0.12	0.7	0.33	0.34	0.56

Table 14: **Descriptive statistics - market capitalization over GDP, by country**

Country	Avg	Min	Max	Avg 1899-1913	Avg 1929-1971	Avg 1974-2016
Australia	0.42	0.13	1.4	0.21	0.29	0.7
Canada	0.71	0.27	1.41	0.47	0.82	0.8
Denmark	0.29	0.07	1.22	0.36	0.14	0.43
France	0.37	0.05	0.97	0.6	0.26	0.43
Germany	0.24	0.02	0.71	0.33	0.15	0.31
Norway	0.22	0.03	0.83	0.23	0.12	0.31
Portugal	0.19	0	0.79	0.08	0.16	0.25
Spain	0.23	0.06	0.73	0.08	0.2	0.35
Sweden	0.4	0.07	1.41	0.35	0.21	0.65
Switzerland	0.71	0.16	2.8	0.34	0.4	1.31
United Kingdom	0.78	0.2	1.88	0.67	0.72	0.95
United States	0.67	0.25	1.53	0.58	0.56	0.89

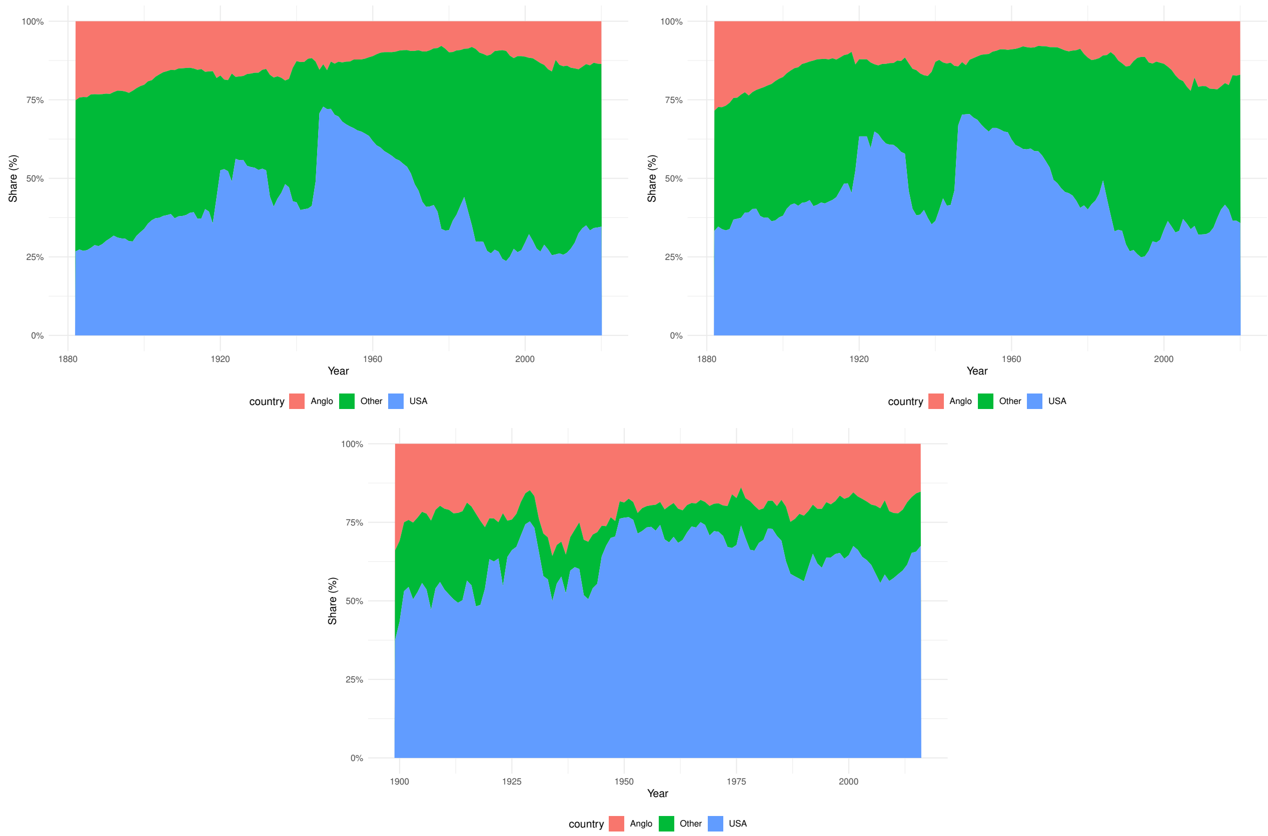

Figure 18: Global composition of liquid liabilities, bank loans, and stock market capitalization. The red area refers to the combined values of Australia, Canada, and the United Kingdom; the blue area represents the United States; and the green area represents all the other countries. The top-left panel refers to liquid liabilities, the top-right panel to total bank loans, and the bottom panel to stock market capitalization. The shares sum to 100%. All series have been converted into millions and expressed in U.S. dollars using the local currency/USD exchange rate from Jordà et al. (2017).

Additional methodological notes

IFE model

The estimation of the IFE model follows an iterative refinement process to ensure numerical convergence and proper identification of the latent factors. The estimation procedure consists of the following steps. First, we begin by estimating a standard Fixed Effects (FE) model as in equation (1). From the residuals μ_{it} of the FE model, we extract the latent common factors using Functional Principal Component Analysis (FPCA). To remove the estimated common factors and isolate the component of economic growth not driven by shared global shocks, we construct an adjusted dependent variable as follow

$$y^*_{it} = y_{it} - \sum_{r=1}^{R} \lambda_{ir} f_{tr} \tag{6}$$

Using the adjusted dependent variable y^*_{it}, we re-estimate the fixed-effects model and compute new residuals. The iterative algorithm updates the estimated coefficients (α, β and γ) and common factor structure (λ_i, f_t) until convergence is achieved. The stopping criterion is based on the relative change in coefficient estimates across iterations

$$distance = \frac{1}{N} \sum_{i=1}^{N} \left(\frac{\beta^{(t+1)} - \beta^{(t)}}{\beta^{(t+1)}} \right)^2 < 10^{-3} \tag{7}$$

Convergence is assumed when this distance falls below a predefined tolerance threshold of 10^{-3}, ensuring stable estimates without unnecessary computational burden. If the model does not converge within 100 iterations, the estimation is stopped to prevent numerical instability.

TVIFE model

A critical aspect of the estimation is the selection of the optimal bandwidth (h), which governs the degree of smoothness in the time-varying coefficient estimates. The bandwidth determines how much local information is used when estimating β_t (but also γ_t and α_t), affecting the balance between bias and variance in the estimation process. A smaller h allows for greater flexibility in capturing short-term fluctuations but increases estimation variance, while a larger h produces smoother estimates at the cost of potentially missing short-run variations in the data.

The bandwidth is selected using a two-step optimization process. Initially, a preliminary estimate is obtained using a modified least-squared cross-validation procedure that minimizes the out-of-sample residual variance. In this step, in order to prevent over-smoothing, we introduce a penalization term directly into the cross-validation criterion used during the estimation. In particular, the mean squared residuals are augmented by a penalty proportional to the square of the bandwidth. This adjustment discourages the selection of excessively large bandwidth values, which could otherwise result in overly smoothed coefficient estimates that fail to capture important short-term variations in the data. The penalty term increases quadratically with the bandwidth, effectively imposing a cost on high values of the bandwidth h during the minimization of the cross-validation error. This ensures that the chosen bandwidth not only fits the data well but also maintains sufficient local sensitivity.

Subsequently, the initial bandwidth is refined using a scaling adjustment as done in Casas et al. (2021)

$$h^* = 2.34 \cdot N^{-1/5} \cdot T^{-2/5} \cdot 2.34 \cdot \sigma^* \tag{8}$$

where N and T denote the number of cross-sectional units and time periods, respectively, and σ^* represents an estimated error variance term from the model. Then, the estimation follows an iterative procedure that ensures both the time-varying coefficients and the latent factors are consistently estimated. Using a local polynomial regression approach, a preliminary estimate of the time-varying coefficients is obtained via kernel-weighted least squares. Then, the residuals from the first-stage estimation are used to estimate the unobserved common factors. As for the IFE model, a functional principal component analysis (FPCA) is applied to these residuals to extract the common factors f_t and their corresponding country-specific loadings λ_{it}. Given the updated estimates of the factors, the dependent variable is adjusted and the new residuals are used to extract updated factors. This process iterates until numerical convergence, defined by equation (7).

TVIFE - common unobservable factors

Real GDP per capita (5-Y growth)

Figures 19, 20 and 21 display the factors identified by the algorithm introduced in Section 3, in relation to the estimates presented in Section 5.3.

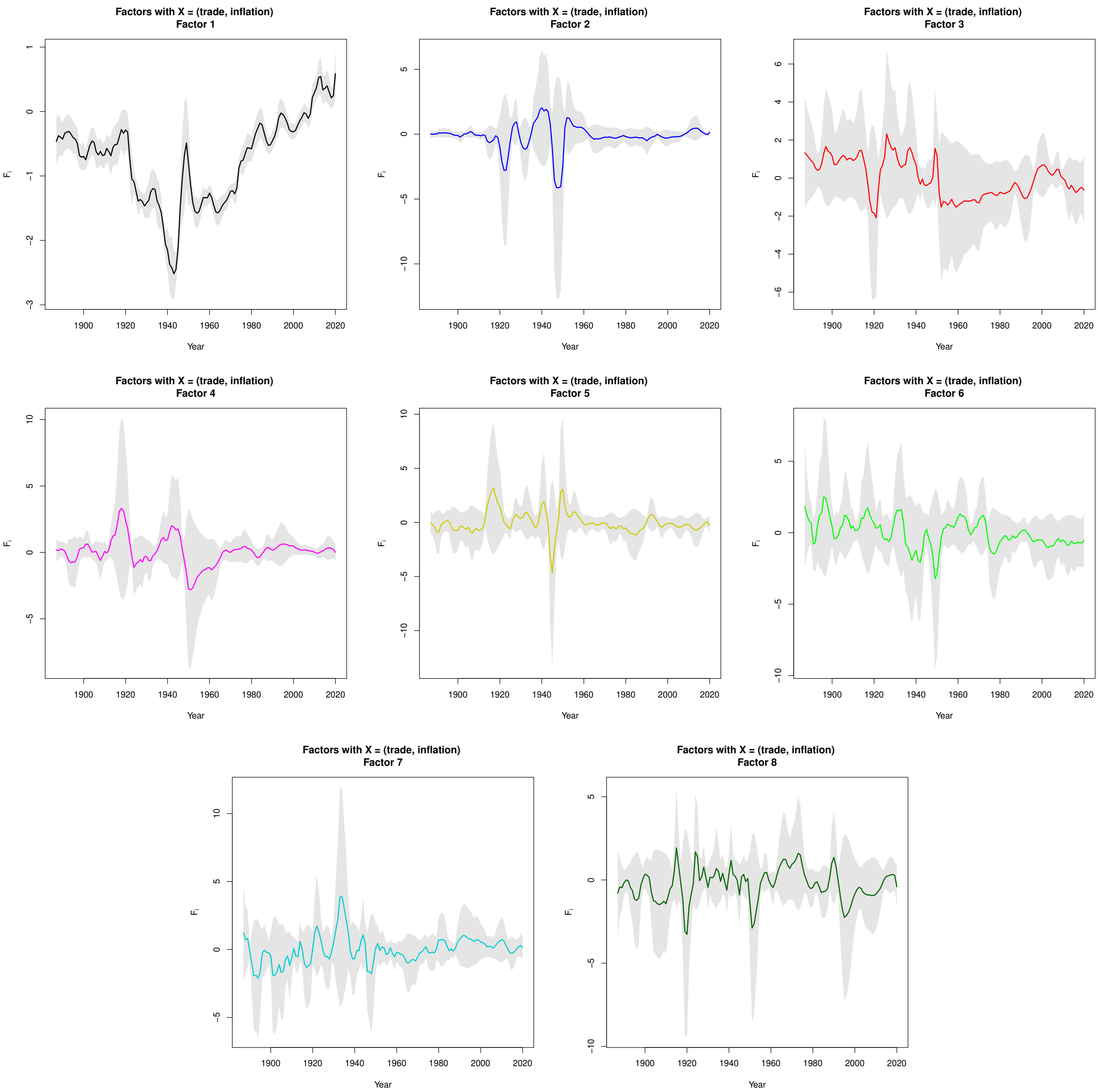

Figure 19: Factors with liquid liabilities growth. The graphs show the estimated values of the factors at each year and their 95% confidence interval (bands). Factors are ordered by their share of explained variance in Y, specifically the proportion of variance explained relative to the total variance captured by the factor structure. In particular, from Factor 1 to Factor 8 we have: 61.29%, 14.65%, 9.11%, 6.29%, 4.18%, 2.22%, 1.97% and 1.36%.

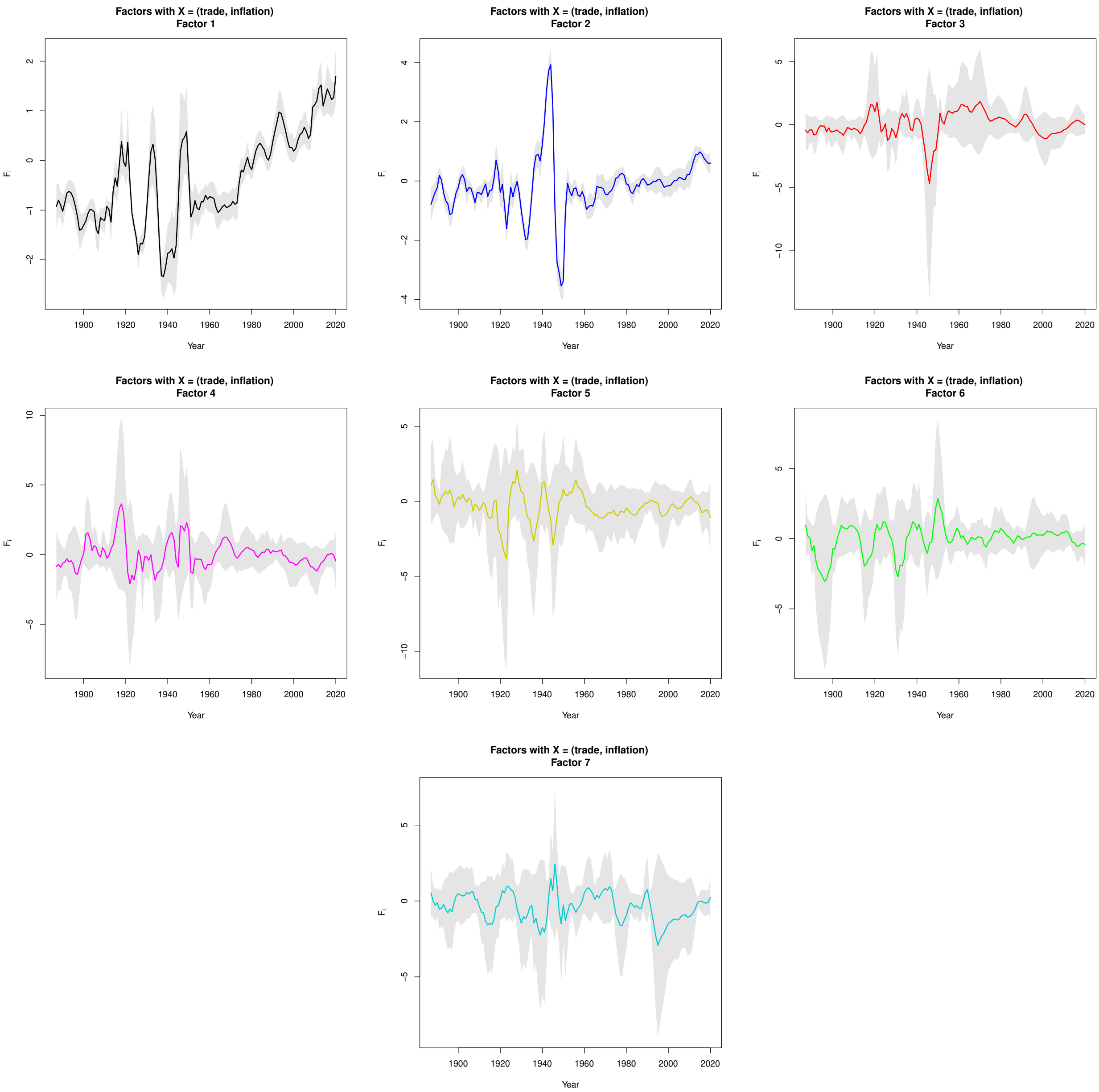

Figure 20: Factors with bank loans growth. The graphs show the estimated values of the factors at each year and their 95% confidence interval (bands). Factors are ordered by their share of explained variance in Y, specifically the proportion of variance explained relative to the total variance captured by the factor structure. In particular, from Factor 1 to Factor 7 we have: 57.14%, 18.95%, 11.37%, 4.42%, 3.49%, 3.04% and 2.41%.

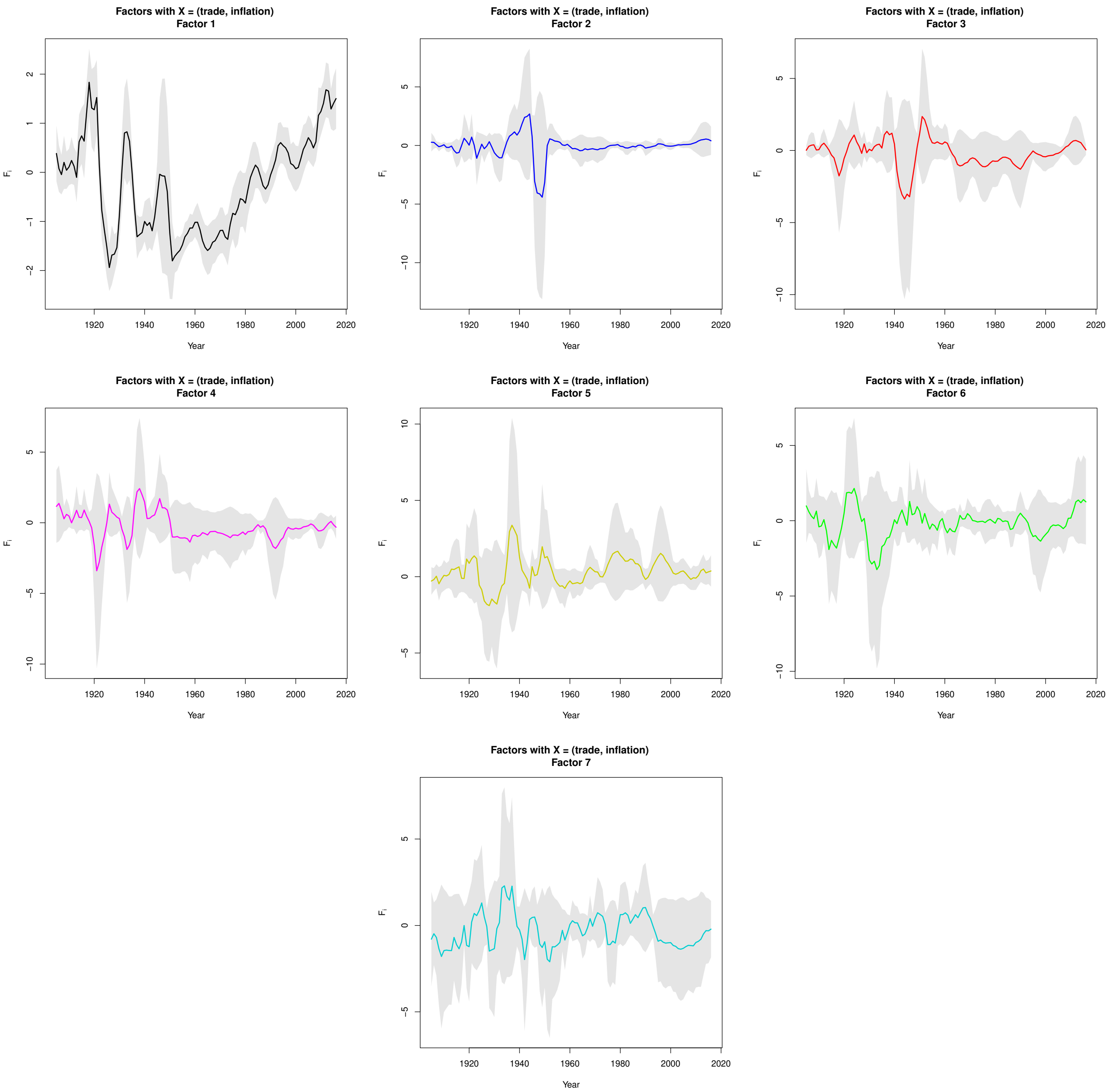

Figure 21: Factors with stock market capitalization growth. The graphs show the estimated values of the factors at each year and their 95% confidence interval (bands). Factors are ordered by their share of explained variance in Y, specifically the proportion of variance explained relative to the total variance captured by the factor structure. In particular, from Factor 1 to Factor 7 we have: 48.03%, 23.88%, 11.77%, 7.99%, 3.52%, 2.72% and 2.18%.

TVIFE estimation - other statistics

Tables 15, 16, 17, 18, 19 and 20 report the statistics related to the bandwidth selection procedure for the time-varying coefficients presented in this paper. Specifically, we present the initial bandwidth (h), the estimated error variance (σ^*), and the final bandwidth ($h*$) chosen for each model specification using equation (8).

Full sample

Table 15: **Bandwidth selection. Dependent variable: real GDP per capita 5-year growth**

Model specification	Initial h	$\sigma*$	Final $h*$
With liquid liabilities growth	0.583	0.222	0.098
With bank loans growth	0.612	0.222	0.104
With stock market growth	0.632	0.217	0.110

Table 16: **Bandwidth selection. Dependent variable: real GDP per capita 3-year growth**

Model specification	Initial h	$\sigma*$	Final $h*$
With liquid liabilities growth	0.513	0.170	0.075
With stock market growth	0.581	0.179	0.089

Table 17: **Bandwidth selection. Dependent variable: labor productivity 5-year growth**

Model specification	Initial h	$\sigma*$	Final $h*$
With liquid liabilities growth	0.548	0.252	0.114
With bank loans growth	0.569	0.289	0.139

Different samples

Table 18: **Bandwidth selection. Dependent variable: real GDP per capita 5-year growth**

Model specification without USA	Initial h	$\sigma*$	Final $h*$
With liquid liabilities growth	0.577	0.220	0.099
With bank loans growth	0.619	0.221	0.106
With stock market growth	0.634	0.219	0.112

Table 19: **Bandwidth selection. Dependent variable: real GDP per capita 5-year growth**

Model specification without Anglo-Saxon	Initial h	$\sigma*$	Final $h*$
With liquid liabilities growth	0.541	0.219	0.103
With bank loans growth	0.593	0.225	0.114
With stock market growth	0.672	0.236	0.129

Different lag structures

Table 20: **Bandwidth selection. Dependent variable: real GDP per capita 5-year growth**

Model specification	Initial h	$\sigma*$	Final $h*$
With liquid liabilities growth	0.531	0.204	0.092
With bank loans growth	0.523	0.196	0.094
With stock market growth	0.657	0.234	0.120

Labor productivity - other growth determinants

Here, we present the time-varying estimates of other determinants of economic growth coming from Section 6.1.

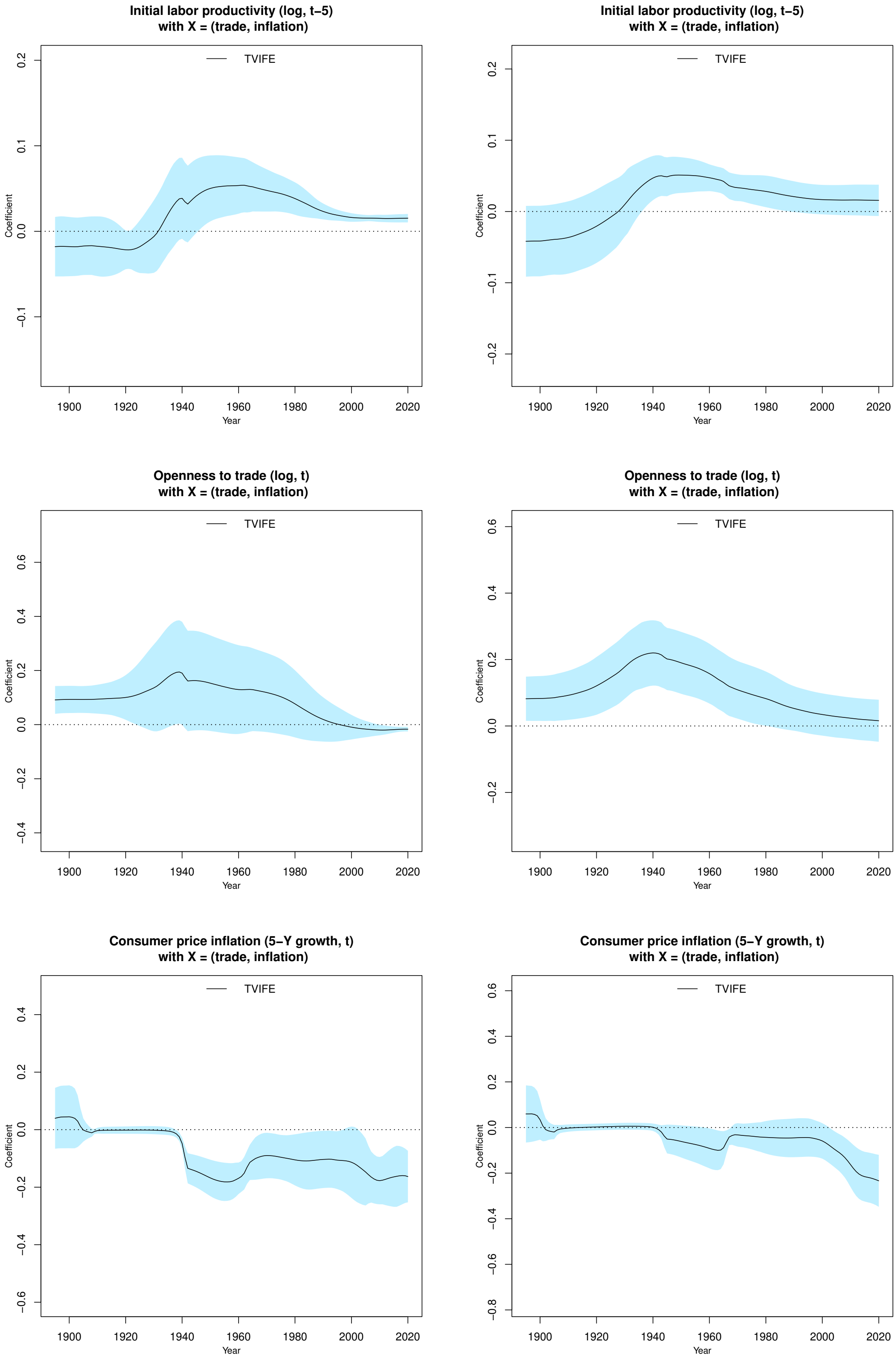

Figure 22: Time-varying estimates of Section 6.1 for lagged labor productivity (top panel), openness to trade (middle panel) and consumer price inflation (bottom panel) using liquid liabilities growth (left column) and credit growth (right column). The graphs show the estimated values of the coefficients at each year and their 95% confidence interval (bands).

Lagged financial variables - other growth determinants

Here, we present the time-varying estimates of other determinants of economic growth coming from Section 6.3.2.

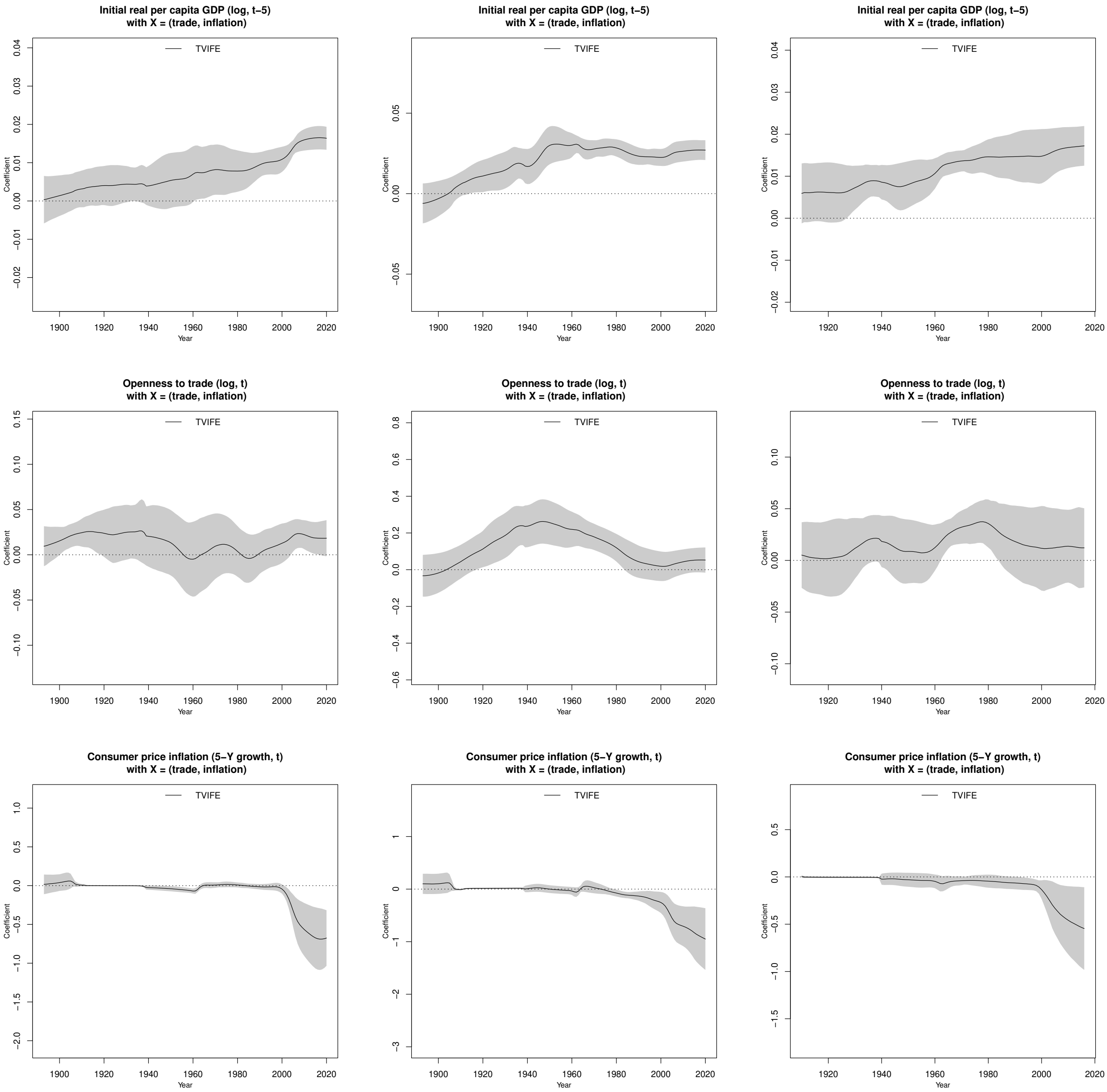

Figure 23: Time-varying coefficient estimates of lagged real GDP per capita (top panel), openness to trade (middle panel) and consumer price inflation (bottom panel) using lagged liquid liabilities growth (left column), lagged bank loans growth (middle column) and lagged stock market capitalization growth (right column). The graphs show the estimated values of the coefficients at each year and their 95% confidence interval (bands). Number of bootstraps used for each estimation: 100.