Accounting and Auditing with Application

www.aaa.reapress.com

Acc. Aud. Appl. Vol. 3, No. 2 (2026) 162–178.

Paper Type: Original Article

Investigating the Role of Countries' Income Levels in the Impact of Financial Development on Total Factor Productivity in Selected Countries

Ebrahim Bahraminia[1,*], Saeed Nematolah Aziminia[2]

[1] Department of Economics, Payam Noor University, Tehran, Iran; e_bahraminia@pnu.ac.ir.

[2] Department of Management, Payam Noor University of Taft, Yazd, Iran; nematolah.aziminia@kep.ir.

Citation:

Received: 15 June 2026 *Revised: 22 September 2026* *Accepted: 19 December 2026*	Bahraminia, E., & Nematolah Aziminia, S. (2026). Investigating the role of countries' income levels in the impact of financial development on total factor productivity in selected countries. *Accounting and Auditing with Application, 3*(2), 162-178.

Abstract

The effects of financial market development on promoting capital productivity and economic growth have been widely discussed by endogenous growth models in the economics literature. Financial development can effectively reduce friction in the economic system and promote Total Factor Productivity (TFP) growth through efficiency improvements and technological progress. However, the effect of financial development on capital allocation is not always positive. Resource optimization can promote TFP growth, and resource mismatch can restrain TFP growth; in other words, at different stages of economic development, financial development has a heterogeneous effect on TFP in different countries. Accordingly, the problem facing the present study is how the effect of financial development on the TFP index is affected by the income level of countries. For this purpose, the selected countries were classified into separate income groups, and the relationship between financial development and TFP was tested in these countries during the period 2010-2023. The results of the model estimation in this study show that the coefficient of the financial development variable in high-income countries and middle-income countries is significant and positive, and is 0.0826 and 0.0121, respectively, meaning that with a 1% improvement in the financial development index, TFP in high-income countries and middle-income countries improves by 0.08% and 0.01%, respectively. Based on the results of the model estimation in low-income countries, this coefficient is not significant. Accordingly, financial development has not been able to improve the TFP index in low-income countries.

Keywords: Financial development, Total factor productivity, Income level, Panel data.

1 | Introduction

Today, financial development is increasingly emerging as the primary driving force and core component of economic development [1]. Financial systems can effectively mitigate adverse selection and moral hazard arising from information asymmetry and allocate funds to investment projects with high profit potential,

Corresponding Author: e_bahraminia@pnu.ac.ir

10.22105/aaa.v3i2.99

thereby enhancing productivity [2]. King and Levine [3] incorporated the financial sector into endogenous growth theory and argued that more efficient financial systems improve productivity and consequently accelerate economic growth.

Financial development primarily affects Total Factor Productivity (TFP) through technological progress and capital allocation [4]. Research on the role of financial development in promoting TFP growth via technological advancement originates from the endogenous growth theory proposed by Romer [5]. Since financially supported technological innovation generates significant positive externalities, investment in research and development fosters endogenous technological progress, thereby contributing to TFP growth.

Buera and Shin [6] suggest that financial development can effectively reduce frictions in the economic system and enhance TFP growth by improving allocative efficiency and facilitating technological progress. However, the impact of financial development on capital allocation is not always positive. While efficient resource allocation can promote TFP growth, resource misallocation may hinder it. Buera et al. [7] find that in some emerging or rapidly growing developing economies, small and medium-sized high-tech innovative firms often face short capital accumulation periods and insufficient collateral conditions, which makes financing difficult and leads to lag-induced resource misallocation. Cole et al. [8] argue that inefficient capital allocation resulting from financial misallocation constrains improvements in TFP in certain countries.

Based on the above evidence, it can be observed that at different stages of economic development, financial development exerts heterogeneous effects on TFP across countries. In this regard, Rioja and Valev [9] note that the relationship between financial development and TFP cannot be adequately explained by a strictly linear specification. Across countries, the role of financial development in promoting TFP growth differs substantially, and an inverted U-shaped relationship exists between the two.

Seven and Coskun [10] find that although financial development has a positive effect on economic growth, this improvement is not evident in some low-income countries. Financial markets with low levels of development, due to insufficient risk diversification functions, are unable to support the formation of high-productivity sectors, while low-productivity non-tradable sectors are more likely to survive. By contrast, a well-developed financial system can provide risk diversification and risk-hedging services, effectively alleviating investors' concerns regarding the risks associated with technological innovation in firms, and thereby encouraging firms to engage in technological upgrading and innovative activities. Ruiz [11] emphasizes that financial development has a nonlinear effect on economic growth. Asteriou and Spanos [12] also find that there are significant differences in the impact of financial development on economic growth before and after the financial crisis.

Based on the above evidence, it can be observed that the effect of financial development on TFP and, consequently, economic growth depends on the level of development of countries. In other words, financial development does not always lead to economic growth. Once financial development reaches a certain threshold, it is no longer conducive to economic growth [13]. Put differently, moderate levels of financial development are beneficial for economic growth, whereas excessive financialization may impede it [14]. Accordingly, the research problem addressed in the present study is how the impact of financial development on the TFP index is affected by countries' income levels. To this end, selected countries are categorized into distinct income groups, and the relationship between financial development and TFP in these countries is empirically examined.

2 | Literature

Financial development is a multifaceted concept that, in addition to banking sector development, encompasses other dimensions such as the development of non-bank financial institutions, monetary sector development, monetary policymaking, banking regulation and supervision, financial openness, and the institutional environment [15], [16]. On the other hand, productivity growth is considered one of the fundamental prerequisites for enhancing the competitiveness of an economic sector and ensuring its success under increasingly intense global competition. This phenomenon is because productivity growth reduces the

unit cost of production by lowering average production costs, thereby increasing the profitability of final goods in production units within that sector. The consequence of such a transformation is a substantial increase in demand and, more importantly, an improvement in the competitiveness of domestic products in international markets. This process leads to the expansion of production and fuller utilization of productive capacities.

As a result, new investments increase, and the use of innovations and technological advancements expands. The fact that developing countries operate below their production possibilities frontier is largely due to low productivity levels across various production sectors. Under this assumption, enhancing productivity can improve sectoral efficiency and, simultaneously, expand production activities and output growth. Given the importance of productivity and the existence of contradictory empirical findings regarding the impact of financial development on this variable, this study investigates the effect of financial development on TFP, taking into account countries' income levels. In this regard, the present chapter first examines the theoretical foundations of the study.

Accordingly, it begins by reviewing and defining financial development and its associated indicators, followed by an explanation of the concept of productivity and its relevant measures. Subsequently, the theoretical relationship between financial development and TFP, as well as the role of countries' income levels in this relationship, is discussed. Finally, the chapter reviews prior empirical studies conducted at both the domestic and international levels.

2.2.1 | Definition of financial development

In the empirical literature, financial development is generally understood to encompass the development of financial intermediation, stock markets, and foreign direct investment. Indeed, a substantial body of research indicates that financial development has become an integral component in stimulating economic development [17]. Financial development refers to the set of factors, policies, and institutions that facilitate efficient access to financial intermediaries and markets, as well as access to capital and financial services. It is a long-term process of building institutions that deepen the informational foundations and analytical capacities of the financial system, thereby enhancing the influence of financial institutions through value creation within them. This process operates by expanding financial instruments, agreements, and contracts in response to environmental changes and the needs of firms, households, and other economic agents [18]. In simpler terms, financial development comprises a set of factors, policies, and institutions that lead to the formation of financial markets and ensure access to financial services [19].

Financial development is a process through which the quantity, quality, and efficiency of financial services and financial intermediation are improved [20]. In general, the main function of the financial system is to transfer loanable funds from lenders (i.e., units with surplus savings) to borrowers (i.e., units facing a deficit). These funds are allocated through negotiation and transactions in financial markets, where suppliers and demanders of funds interact.

In practice, the majority of savings flowing through the financial system originate from households, whereas the primary borrowers in the financial system are business firms and governments [21]. Some scholars conceptualize financial development as a multidimensional phenomenon that, in addition to banking sector development, includes dimensions such as non-banking sector development, monetary sector development, monetary policy, banking regulation and supervision, financial openness, and the institutional environment [15]. Others define it as an increase in the provision of financial services by financial institutions [22], while still others view financial development in terms of the quantity, quality, and efficiency of financial intermediation services [23].

2.2.2 | Dimensions of financial development

Based on theoretical foundations and the literature in financial economics, financial development is typically examined along six dimensions. The first dimension is banking sector development. Banks constitute the core

of the financial and payment systems in most economies and play a crucial role in mobilizing savings, identifying investment opportunities, and facilitating risk diversification. Accordingly, the size, structure, and efficiency of the banking sector are regarded as an independent dimension of financial development. Among the key banking indicators of financial development are the share of deposits and credit extended by non-state banks relative to corresponding variables in the banking system, the share of credit allocated to the private sector in total credit, the ratio of bank and credit institution assets to total financial system assets, and the ratio of reserves held by banks and credit institutions to total deposits of the non-government sector [24], [25].

The second dimension of financial development is the development of the non-banking financial sector. The non-bank financial sector includes stock markets, mortgage and leasing financial institutions, securities markets, insurance companies, and pension funds. Developments in this sector reflect the expansion of capital resources and alternative financial services. The diversity of products and markets within this sector, while facilitating structural transformation in financial system functions, enables firms and households to improve the efficiency of their financing in terms of cost, mobilize financial resources, enhance oversight of financial management, and better distribute risk [25].

The third dimension of financial development is the development of the monetary sector and monetary policymaking. Monetary policy refers to a set of rules and actions implemented by the central bank to achieve its objectives. In many countries, the primary objective of monetary policy is price stability, although some central banks also pursue additional goals such as full employment, maintaining domestic financial stability, and avoiding external balance disequilibria [26]. Financial development can indirectly affect output and inflation, and thereby influence the effectiveness of monetary policy, through monetary transmission mechanisms. For instance, the growth of stock market transactions as a substitute for bank loans can affect money demand and interest rates, thereby indirectly influencing the money supply and reducing the effectiveness of monetary policy [27]. Moreover, the role of banks as financial intermediaries through the credit channel can also shape monetary policy effectiveness.

In particular, an increase in interest rates may negatively affect firms' stock prices. As stock prices and firms' net worth decline due to adverse selection problems, banks become less willing to provide loans to finance investment expenditures. In addition, moral hazard problems, arising from a reduction in firms' net worth, may encourage riskier borrowers to seek credit, which further weakens the effectiveness of monetary policy in influencing output and aggregate demand [28].

The fourth dimension of financial development is banking regulation and supervision. Banks and financial and credit institutions, as the most important financial intermediaries in Iran, play a highly significant role in the country's economic development due to the limited development of financial markets on the one hand and public trust in these institutions on the other. Banking and financial institutions are regarded as key indicators for measuring the level of financial development in a country. Banking and non-banking financial institutions, by mobilizing savings and allocating them to various sectors of the economy, not only facilitate commercial and trade transactions but also contribute to market expansion and overall economic growth and prosperity.

In other words, indicators of the development of banking and non-banking financial institutions influence capital accumulation and its productivity, which in turn affect economic growth [29]. According to Krause and Rioja [30], financial sector development also enhances the efficiency of monetary policy and improves macroeconomic performance [31]. They further examined the effects of central bank independence, inflation targeting, and membership in the European Monetary Union, factors that have received considerable attention in the literature, on monetary policy efficiency. Their results indicate that more developed financial markets, central bank independence, inflation targeting, and participation in the European Monetary Union significantly contribute to more effective monetary policy implementation. Moreover, they find no significant difference in this regard between industrialized and developing countries.

The fifth dimension of financial development is financial openness. Another aspect of financial development concerns the position and status of the domestic financial system in the cross-border allocation and mobility of financial resources. In this dimension, issues such as the openness of financial markets to capital inflows and outflows, appropriate exchange rate regimes, and restrictions on transactions involving financial assets or foreign currency instruments for both non-residents and residents are examined [25].

In general, financial liberalization has increasingly been recognized as a key instrument for strengthening financial systems and transforming the financial structure of countries by making them more competitive. The liberalization process typically enhances the efficiency of the financial system by eliminating inefficient institutions, exerting greater pressure for reforming financial infrastructure, and reducing information asymmetry problems such as adverse selection and moral hazard [32].

The sixth and final dimension of financial development is the institutional environment. The institutional environment of an economy plays a crucial role in determining the level of financial development, as the financial structure consists of a set of contracts whose efficiency is shaped by legal rights and enforcement mechanisms. From this perspective, a well-functioning legal system facilitates the operations of any financial system. The legal and political environment has a decisive influence on the quality of services provided by financial institutions. For instance, in some developing countries, banks are reluctant to expand lending because inefficient judicial systems or corrupt political and administrative institutions hinder loan repayment and contract enforcement. The quality of legal institutions, property rights protection, the efficiency of the bureaucracy, and government accountability all affect the performance of the financial system. Accordingly, the institutional environment is considered one of the key dimensions of financial development [33].

2.3 | Productivity

Productivity is a comprehensive and broad concept, the improvement of which is regarded as a necessity for enhancing living standards, achieving greater welfare, and ensuring human comfort and well-being, an objective that is fundamental to all countries. It has therefore consistently been a central concern for economic policymakers and government authorities. Productivity refers to the maximization of the efficient use of resources, human capital, facilities, and other inputs through scientific methods, along with reducing production costs, expanding markets, increasing employment, and striving to raise real wages and improve living standards in a manner that benefits workers, management, and society as a whole. Given resource scarcity and the unlimited nature of human needs, along with population growth and intense global economic competition, productivity improvement is not merely an option but an unavoidable necessity [34]. For this reason, in recent years, productivity analysis has been widely employed from various perspectives by economists and policymakers in both developed and developing countries [35].

2.3.1 | Definition of productivity

The term “productivity” in its lexical sense refers to the “capacity for production” or being “fertile and productive.” According to the Encyclopaedia Britannica, productivity in economics is defined as the ratio of output produced to the inputs required for its production. In economic literature, various definitions have been proposed for this concept; however, all of them, in one way or another, refer to the efficient and effective use of resources in order to achieve predetermined objectives. Today, this term is among the most frequently used concepts and is present in almost all economic discussions.

The International Labour Organization (ILO) defines productivity as the relationship between the output generated by a production system and the inputs utilized within that system [36]. The European Productivity Agency, in turn, regards productivity primarily as a mindset that continuously seeks to improve the current state of affairs. Accordingly, productivity is understood as requiring ongoing efforts to apply new theories and methods in a systematic and continuous manner.

According to the Asian Productivity Organization, productivity is calculated as the ratio of output to input and is defined as follows:

Productivity refers to the efficiency with which goods and services are produced and the value created through the production process. If a product is manufactured with minimal cost and high quality, and can be sold competitively in the market at a price higher than its production cost, its productivity level is considered high. The objective of productivity is to maximize output while minimizing inputs [37].

In the 1970s, the Japan Productivity Center defined productivity as follows: "Productivity is the maximization of the utilization of human resources, the expansion of markets, and facilities through scientific methods, or the reduction of production costs, the increase in employment, the rise in real wages, and the improvement of living standards in a way that benefits managers, employees, and consumers." From the perspective of this center, productivity is a national priority and choice that contributes to poverty reduction and the enhancement of social welfare.

Based on the definitions provided, it can be observed that productivity serves as a criterion and measurement tool for assessing the efficiency of economic activities in society. Contrary to common perception, productivity is not merely an economic or financial indicator. At its core, productivity represents a mindset aimed at rationalizing activities, implying that organizations can continuously improve the way they perform their tasks and operations over time [38].

Accordingly, the following comprehensive definition of productivity can be presented: productivity refers to the optimal allocation and utilization of resources for the production of goods and services in line with organizational objectives. It consists of two dimensions: efficiency and effectiveness.

2.3.2 | Productivity indicators

Productivity indicators are defined based on concepts derived from economic theory. These include labor productivity, capital productivity, TFP, material productivity, energy productivity, and others. The defining characteristic of these indicators is that their measurement enables comparative analyses at the level of firms, industries, activity groups, sectors, and broader economic units. It is also noteworthy that such comparative assessments can be conducted for each indicator at the national, regional, or international level. In most of the aforementioned general indicators, the numerator consists of value added or total output, while the denominator represents one or a combination of production inputs. In the following section, each of these indicators is introduced in detail [39].

Many scholars in management and economics believe that among the various types of investment aimed at improving productivity and, ultimately, achieving economic and social development, human capital development, through empowering the workforce as the most influential factor in realizing productive efforts, is considered the most important and profitable pillar of development. The labor productivity index is calculated as the ratio of value added to the number of employed persons. In this context, "employed persons" refers to all individuals who have a direct contractual relationship with the firm. Accordingly, the total number of employees includes permanent, contractual, and temporary staff.

$$\text{Labor productivity} = \frac{\text{Added value}}{\text{Number of labor force}}. \quad (1)$$

Capital, as a key factor of production, plays an undeniable role in enabling countries to achieve their development objectives. Therefore, identifying the factors that influence capital productivity provides a foundation for designing appropriate policy measures aimed at achieving economic growth and development. Accordingly, measuring capital productivity, both at the national level and across different sectors, is both necessary and highly useful. The capital productivity index is calculated as the ratio of value added to the value of productive fixed assets, where assets are measured at their real (economic) value rather than their book value.

$$\text{Capital productivity} = \frac{\text{Added value}}{\text{Value of productive fixed assets}}. \quad (2)$$

TFP is obtained as the ratio of value added to a weighted aggregate of all production inputs. Several methods exist for measuring this ratio. One of these approaches, known as the direct method of TFP measurement, estimates the level of TFP without explicitly specifying a production function. In these approaches, because the input factors used in the production process are measured in different units, specific techniques are employed to aggregate heterogeneous inputs into a single composite input index. These methods are therefore referred to as direct methods. The TFP index is calculated as the ratio of the value added index to the weighted composite index of production factors. Given that the production factors in the gas company include labor and capital, the TFP index can be expressed as a ratio in *Eqs. (2)-(3)*.

$$\text{Total productivity} = \frac{\text{Value of output at base} - \text{year prices}}{\alpha L + \beta K}. \quad \textbf{(3)}$$

2.3.3 | Methods of measuring productivity

Productivity improvement is the most effective approach for achieving growth under conditions of resource and input scarcity; the key to productivity enhancement lies in its measurement and analysis. Measuring productivity helps identify the most economically efficient ways of utilizing resources. The assessment of productivity indicators provides a basis for determining the factors affecting productivity growth, identifying strengths and weaknesses, recognizing areas for improvement, forecasting future conditions through trend analysis, and supporting decision-making regarding the allocation of resources across different sectors, ultimately contributing to sustainable economic growth.

In other words, productivity analysis and measurement are only operational when changes in productivity over time are captured using appropriate indicators. Achieving an optimal level of productivity, therefore, requires a clear determination of the current productivity level and the adoption of an appropriate measurement method. It is evident that calculating productivity in any organization can, in addition to assessing the current situation and comparing it with the past, help to outline future directions for achieving organizational objectives [40].

One approach to measuring general productivity indicators is the index-based method, referred to as the index approach. In this approach, the productivity index is defined as the ratio of output volume or value to the value of one or more inputs used in production. In other words, any ratio-type relationship between output and input can be considered a productivity index. Another method used to measure productivity is the production function approach. The production function method is primarily used in economics. In fact, economists derive the average or marginal productivity of each factor by estimating the production function.

Magazzino and Santeramo [41] examined the relationship between financial development, productivity, and economic growth across different income groups. This empirical analysis is based on a sample of 130 economies over the period 1991–2019, which is further divided into four sub-samples: OECD countries, developing countries, least developed countries, and net food-importing countries. The statistical analysis is conducted using forecast error variance decomposition and Panel Vector Autoregressive (PVAR) estimations. The results indicate that higher levels of output stimulate economic development in the agricultural sector primarily through the productivity channel, and in the most developed economies also through access to credit. On the other hand, in developing and least developed economies, the role of credit access is marginal. In less developed economies, priority should be given to investment in technology and innovation, whereas financial markets are more suitable for supporting agricultural sector development in advanced economies.

Ouidir et al. [42] examined the relationship between financial intermediation development and TFP in the Algerian economy over the period 1970–2020. The empirical strategy employed in this study involved the development of an econometric model using a Vector Autoregression (VAR) approach and Granger causality tests. The variables considered include the money supply ratio, domestic credit to the private sector as a percentage of GDP, trade openness, foreign direct investment, and human capital. The results of the VAR model indicate that financial development, through domestic credit to the private sector and trade openness,

has a positive and statistically significant effect on TFP, whereas the remaining variables do not exert a significant impact on TFP.

Pal et al. [43], drawing on neoclassical growth theories, investigated the interaction between financial development, gender-specific human capital, and TFP growth in India using annual data from 1980 to 2019. In this study, variables such as government expenditure on education and foreign direct investment were included as control variables within the TFP growth framework. The findings reveal that while financial development enhances productivity growth in the absence of gender-specific human capital considerations, its effect varies significantly when male and female educational attainment is incorporated.

Notably, financial development positively affects productivity growth when the level of male education is high. Surprisingly, however, it hampers productivity growth when female educational attainment is high. These findings underscore the asymmetric role of gendered educational dynamics in shaping productivity outcomes and highlight the differentiated impact of financial development on economic performance. The study contributes to the literature by emphasizing the importance of gendered human capital in evaluating the effectiveness of financial development as a catalyst for productivity growth. It further suggests that policymakers in India should not overlook the role of male education in strengthening the financial development–productivity nexus, while also carefully assessing the potential adverse effects associated with higher levels of female education in this context.

Li and Liao [1] examined the heterogeneous effects of financial development on green TFP across 40 countries over the period 1991–2014. In this study, financial development is conceptualized along three dimensions: banking, securities, and insurance. The results indicate that in developing countries, there exists an inverted U-shaped relationship between financial development and green TFP, regardless of whether banking, securities, or insurance development is considered. In developed countries, banking and insurance development exert a negative effect on green TFP, whereas securities market development consistently has a positive impact. Moreover, securities market development is found to be more effective than banking development in enhancing green TFP.

Ezzahid and Elouaourti [44] investigated the link between financial development and economic growth through the channel of TFP in African economies over the period 2004–2014. In their study, a composite financial development index was first constructed for 40 African countries. Subsequently, panel data techniques based on the Breusch–Pagan Lagrange Multiplier test and the Hausman test were employed to estimate the model and identify the nature of the effects. The findings suggest that financial sector development does not enhance TFP in low-income and upper-middle-income countries. However, for lower-middle-income countries, the relationship between financial development and TFP is significantly positive. The authors recommend that policymakers design and implement financial system reforms tailored to the specific needs of each economy in order to improve the adequacy and effectiveness of financial services.

Han and Shen [45] estimated the impact of regional financial development on TFP growth in China using provincial panel data for the period 1990–2009 and a non-parametric stochastic frontier data envelopment approach. Their study distinguishes between the roles of financial development in productivity improvement and technological progress, the two main components of TFP. The results show that financial development in China plays a crucial role in promoting TFP growth primarily through technological progress rather than efficiency change. Faster financial development is found to better correct resource misallocation, thereby enhancing TFP growth. The study concludes that China should further optimize the allocation of financial resources and improve its regional financial system.

Arizala et al. [46] examined the impact of financial development on TFP growth at the industry level using a panel model covering 77 countries and data from 26 manufacturing industries over the period 1963–2003. The findings indicate a significant relationship between financial development and industrial productivity. The estimated effects are both statistically and economically significant. Specifically, a one-standard-deviation increase in financial development is associated with an acceleration of TFP growth by up to 0.6 percentage points per year, depending on the external financial dependence of industries.

3 | Data Analysis

This study, to examine the link between financial development and economic growth through the channel of TFP in selected countries, adopts the model proposed by Ezzahid and Elouaourti [44] as follows:

$$\mathrm{TFP}_{it} = \beta_0 + \beta_1 * \text{Finance Index}_{it} + \sum_{k=2}^{8} \beta_k * X_{it.k} + u_{it}. \quad (4)$$

In the above specification, i denotes the country under study and t represents the time period. β_i indicates the coefficients of the variables, while $\text{Finance Index}_{it}$ refers to the financial development index. $X_{it.k}$ represents a set of control variables, including inflation rate, trade openness, population growth rate, human capital level, and public government expenditure.

Furthermore, in order to examine the moderating role of a country's income level in the impact of financial development on TFP, the above model is estimated separately for three groups of countries: high-income countries, middle-income countries, and low-income countries. The classification of countries into these income groups is based on the World Bank database.

3.1 | Stationarity Tests of Variables

Stationarity tests are among the most important procedures for estimating reliable regression coefficients. To avoid the problem of spurious regression, stationarity tests are applied. In panel data analysis, several unit root tests are available; however, the most commonly used is the Levin, Lin, and Chu (LLC) test. The null hypothesis of this test indicates the presence of a unit root in the examined time series. Therefore, if the null hypothesis is accepted, it implies that the series contains a unit root and is non-stationary. In this study, the LLC test is employed to examine the stationarity of the model variables. The results of this test are presented in *Table 1*. The findings indicate that, in high-income countries, the variables trade openness, population growth rate, government expenditure, human capital, and TFP are stationary at the level, whereas the financial development index, inflation rate, and investment rate become stationary after first differencing.

In middle-income countries, the results of the stationarity test show that population growth rate, government expenditure, human capital index, and TFP are stationary at the level, while financial development, inflation rate, trade openness, and investment rate become stationary after first differencing. In low-income countries, the results indicate that trade openness, population growth rate, government expenditure, human capital index, and TFP are stationary at the level. In this group, the financial development index, inflation rate, and investment rate become stationary after first differencing.

Table 1. Stationarity test of variables using the Levin–Lin–Chu method.

Variable	Test Statistic	Probability	Result
High-Income Countries			
FD	-0.77	0.15	Is non-stationary at the level
D(FD)	-3.64	0.002	Difference-stationarity
INF	3.05	0.94	Is non-stationary at the level
D(INF)	-6.89	0.000	Difference-stationarity
OPEN	-2.09	0.04	It is stationary at the level.
POP	-11.07	0.000	It is stationary at the level.
GOVEXP	8.19	0.001	It is stationary at the level.
HC	-9.73	0.000	It is stationary at the level.
INV	-1.33	0.134	Is non-stationary at the level
D(INV)	-12.72	0.000	Difference-stationarity
TFP	-2.03	0.04	It is stationary at the level.

Table 1. Continued.

Variable	Test Statistic	Probability	Result
Middle-Income Countries			
FD	-0.67	0.13	Is non-stationary at the level
D(FD)	-4.15	0.001	Difference-stationarity
INF	3.79	0.91	Is non-stationary at the level
D(INF)	-6.74	0.000	Difference-stationarity
OPEN	-1.25	0.112	Is non-stationary at the level
D(OPEN)	-2.09	0.04	It is stationary at the level.
POP	-9.68	0.000	It is stationary at the level.
GOVEXP	6.19	0.002	It is stationary at the level.
HC	-10.34	0.000	It is stationary at the level.
INV	-1.46	0.135	Is non-stationary at the level
D(INV)	-9.39	0.000	Difference-stationarity
TFP	-6.49	0.001	It is stationary at the level.
Low-Income Countries			
FD	-0.49	0.21	Is non-stationary at the level
D(FD)	-3.26	0.03	Difference-stationarity
INF	-0.79	0.13	Is non-stationary at the level
D(INF)	-4.69	0.003	Difference-stationarity
OPEN	-4.25	0.002	It is stationary at the level.
POP	-7.19	0.000	It is stationary at the level.
GOVEXP	-2.58	0.04	It is stationary at the level.
HC	-5.34	0.03	It is stationary at the level.
INV	-0.46	0.25	Is non-stationary at the level
D(INV)	-7.21	0.001	Difference-stationarity
TFP	-2.38	0.04	It is stationary at the level.

Source: Researcher's calculations

3.2 | Panel Cointegration Test

In order to avoid the possibility of spurious regression, the existence of a cointegrating relationship among the model variables is examined. Several tests for panel cointegration have been developed with fundamentally different approaches, among which the Pedroni [47] and Kao [48] tests can be mentioned. Both the Kao and Pedroni tests are based on regression residuals and are analogous to the Engle–Granger cointegration test in time-series analysis. In this study, the Kao cointegration test is employed to examine whether the variables are cointegrated. The null hypothesis of this test states that the variables in each cross-sectional unit are not cointegrated. The alternative hypothesis indicates that there exists at least one cointegrating vector for each cross-section. One of the advantages of this test is that it does not require the cointegrating vectors to be identical across all cross-sections, as they are not strictly assumed to be homogeneous.

The results of the cointegration test are presented in *Table 2*, indicating that the null hypothesis is rejected for all three groups under investigation.

Table 2. Test for the existence of a long-run relationship.

Test	Statistic	Probability
Regression model for high-income countries	-3.16	0.03
Regression model for middle-income countries	-5.74	0.01
Regression model for low-income countries	-4.92	0.01

Source: Researcher's calculations

3.3 | Model Selection

Given that the statistical population examined in this study is divided into three groups, high-income countries, middle-income countries, and low-income countries, the regression model presented above, which is designed to investigate the impact of financial development on TFP, is estimated separately for each group. However, before estimation, the appropriate model specification is determined using the F-Limer test and the Hausman test.

3.3.1 | F-Limer (Chow) Test

The F-Limer test (Chow test) is used to decide between the pooling (pooled OLS) and panel data approaches. The null hypothesis of the F-Limer test assumes the appropriateness of the pooled model (i.e., no panel structure). To reject the null hypothesis and confirm the use of panel data, the significance level must be less than 0.05. The results of this test, conducted using EViews software, are presented in *Table 3*. The software output regarding model selection is provided.

Table 3. Results of the F-limer test for choosing between Pooled and Panel models.

Regression Model	f-Statistic	p-Value	Test Results
Regression model for high-income countries	4.28	0.001	Application of the Panel Data Method
Regression model for middle-income countries	9.56	0.000	Application of the Panel Data Method
Regression model for low-income countries	5.47	0.002	Application of the Panel Data Method

Source: Research calculations

Based on the results of the F-Limer test, the regression models for all three groups of countries under investigation should be estimated using the panel data approach.

3.3.2 | Hausman Test

As previously noted, the regression models for all three groups of countries should be estimated using panel data methods. In panel data analysis, the Hausman test is employed to determine whether fixed effects or random effects should be used. The null hypothesis of the Hausman test assumes the appropriateness of the random effects model (i.e., that the fixed effects specification is not required). The hypotheses can be stated as follows:

H0. The fixed effects model should not be used in panel data estimation (therefore, the random effects model should be applied).

H1. The fixed effects model can be used in panel data estimation.

In order to reject the null hypothesis and confirm the suitability of the fixed effects model, the significance level must be less than 0.05.

As shown in *Table 4*, the significance level of the Hausman test for the regression equations in high-income, middle-income, and low-income countries is less than 0.05. Therefore, the test results indicate that the fixed effects model should be used for all three groups of countries under investigation.

Table 4. Results of the Hausman test.

Regression Model	f-Statistic	p-Value	Test Results
Regression model for high-income countries	6.34	0.004	Fixed Effects
Regression model for middle-income countries	11.98	0.001	Fixed Effects
Regression model for low-income countries	5.27	0.004	Fixed Effects

Source: Research calculations

3.3.3 | Estimation of the regression models

The results of the F-Limer test and the Hausman test for all three groups of countries under investigation indicate that the regression specification is a fixed-effects panel data model. The estimation results of these models are presented in *Table 5*.

The estimation results of the research model are reported in *Table 5*. It is worth noting that, since the variables in the model are specified in logarithmic form, the estimated coefficients represent elasticities. It can be observed that the p-value of the F-statistic, which is used to assess the overall significance of the regression model, is less than 0.05 in all three examined models, indicating that the estimated regression models are statistically significant. The coefficient of determination (R^2) in the regression models for high-, middle-, and low-income countries is calculated at 83%, 89%, and 69%, respectively. These results indicate that the specified models are able to explain 83%, 89%, and 69% of the variation in the TFP index in high-, middle-, and low-income countries, respectively.

Table 5. Estimation results of the model.

Variable	Coefficient	Standard Deviation	t-Statistic	Probability
High-Income Countries				
C	2.161	0.6738	3.207	0.004
FD(-1)	0.0826	0.0150	5.490	0.002
INF(-1)	0.0104	0.0041	2.522	0.046
OPEN(-1)	0.258	0.1296	1.99	0.048
POP	-0.0341	0.0069	4.890	0.000
GOVEXP	0.426	0.1201	3.574	0.003
HC	0.0855	0.0137	6.023	0.000
INV	0.0293	0.709	5.387	0.001
F statistic	10.562			0.001
R-Squared	83.24			
Number of Countries	16			
Regression Model for Middle-Income Countries				
C	1.815	0.7671	2.366	0.004
FD(-1)	0.0121	0.0018	6.523	0.002
INF(-1)	0.0089	0.0013	3.618	0.000
OPEN(-1)	0.138	0.0660	2.09	0.041
POP	-0.02601	0.0056	4.627	0.000
GOVEXP	0.2756	0.7468	0.369	0.748
HC	0.0042	0.0016	2.547	0.036
INV(-1)	0.0076	0.0028	2.635	0.043
F statistic	15.840			0.000
R-Squared	89.57			
Number of countries	16			
Regression Model for Low-Income Countries				
C	C			C
FD(-1)	FD(-1)			FD(-1)
INF(-1)	INF(-1)			INF(-1)
OPEN	OPEN			OPEN
POP	POP			POP

Table 5. Continued.

Variable	Coefficient	Standard Deviation	t-Statistic	Probability
Regression Model for Low-Income Countries				
OPEN	0.0023	0.0021	1.13	0.485
POP	0.0041	7.160	5.726	0.000
GOVEXP	-0.0652	0.0300	-2.169	0.043
HC	-0.0536	0.1246	-0.43	0.875
INV(-1)	0.0029	0.0011	2.481	0.043
F statistic	9.169			0.001
R-Squared	69.37			
Number of countries	11			

Source: Research calculations

As observed, the coefficient of the Financial Development variable (FD) is statistically significant and positive in both high-income and middle-income countries, with values of 0.0826 and 0.0121, respectively. However, this coefficient is not statistically significant in low-income countries. Accordingly, financial development has not contributed to the improvement of TFP in low-income countries, whereas high-income and middle-income countries have been able to leverage this capacity to enhance productivity outcomes. The Inflation Rate Variable (INF) exhibits a positive coefficient across all three groups of countries; however, it is not statistically significant in low-income countries, while it is statistically significant in both high-income and middle-income countries, with estimated coefficients of 0.0104 and 0.0089, respectively.

The degree of economic Openness (OPEN) also shows a positive coefficient across all groups of countries. Nevertheless, this coefficient is not statistically significant in low-income countries, whereas it is statistically significant in high-income and middle-income countries, with estimated values of 0.258 and 0.138, respectively. These results indicate that trade openness plays an important role in improving TFP in these two groups of countries. The population growth rate (POP) indicates heterogeneous effects across low-income countries compared to high-income and middle-income countries. Specifically, this coefficient is positive and statistically significant in low-income countries, although its magnitude is very small (0.004), implying that a 1% increase in population growth raises TFP by 0.004% in these countries. In contrast, the coefficient is negative and statistically significant in both high-income and middle-income countries. Government Expenditure (GOVEXP) has a positive and statistically significant coefficient in both high-income and middle-income countries, with values of 0.426 and 0.2756, respectively.

However, this coefficient is not statistically significant in low-income countries, where it is negative and significant. Human capital (HC), consistent with theoretical expectations, is positive and statistically significant in high-income and middle-income countries, with coefficients of 0.0855 and 0.0742, respectively. In low-income countries, however, the coefficient is negative and not statistically significant. Accordingly, human capital has not contributed to improvements in TFP in low-income countries, whereas it has played a positive role in enhancing productivity in the other two groups. The Investment rate (INV) is positive and statistically significant across all three groups of countries. The estimated coefficients are 0.0029 for low-income countries, 0.0079 for middle-income countries, and 0.0293 for high-income countries, indicating substantial heterogeneity in the impact of investment on TFP. In particular, a 1% increase in investment has approximately ten times a stronger effect on TFP in high-income countries compared to low-income countries.

4 | Discussion and Conclusion

Financial development primarily affects TFP through technological progress and capital allocation [4], [49]. Research on the role of financial development in promoting TFP growth via technological advancement originates from the endogenous growth theory proposed by Romer [5]. Since technology-driven innovation

supported by finance generates significant positive externalities, investment in research and development fosters endogenous technological progress, thereby promoting TFP growth. Buera et al. [7] argue that financial development can effectively reduce frictions within the economic system and enhance TFP growth through improvements in efficiency and technological progress. However, the impact of financial development on capital allocation is not always positive. Efficient resource allocation can promote TFP growth, whereas resource misallocation may hinder it.

Buera and Shin [6] find that in some emerging economies or rapidly growing developing countries, innovative Small and Medium-sized Enterprises (SMEs) with high technological intensity often face short capital accumulation periods and insufficient collateral conditions, which make financing difficult and generate resource misallocation due to financial underdevelopment. As a result, financial development may not be effective in promoting TFP growth. Cole et al. [8] further emphasize that inefficient capital allocation caused by financial mismatches within the financial system can impede TFP improvement in certain countries. At different stages of economic development, financial development exerts heterogeneous effects on TFP across countries. Rioja and Valev [9] also note that the relationship between financial development and TFP cannot be adequately explained by a strictly linear specification. In different countries, the role of financial development in promoting TFP growth varies significantly, and an inverted U-shaped relationship may exist between the two.

Ezzahid and Elouaourti [44] find that financial sector development may hinder TFP growth in low-, middle-, and high-income economies. Seven and Coskun [10] show that although financial development positively affects economic growth, this effect is not observed in some low-income countries. Financial markets with low levels of development lack adequate risk diversification functions, preventing the formation of high-productivity sectors, while low-productivity non-tradable sectors are more likely to survive. A well-developed financial system can provide risk diversification and hedging services, effectively reducing investors' uncertainty regarding technological innovation in firms and thereby encouraging firms to engage in technological upgrading and innovation activities. Based on the above evidence, it is evident that the impact of financial development on TFP and, consequently, on economic growth depends on the level of development of countries. In other words, financial development does not always lead to economic growth; once it exceeds a certain threshold, it may no longer be conducive to growth [13]. Thus, moderate financial development is beneficial for economic growth, whereas excessive financialization may hinder it [14].

The results of the model estimation in the present study are consistent with the theoretical foundations and previous empirical research, confirming that the impact of financial development on TFP depends on the level of development and the income level of countries. Specifically, the coefficient of the financial development variable is positive and statistically significant in both high-income and middle-income countries, with estimated values of 0.0826 and 0.0121, respectively. These results imply that a 1% improvement in the financial development index leads to an increase in TFP of approximately 0.08% in high-income countries and 0.01% in middle-income countries. Another important point concerns the magnitude of this effect: the estimated coefficient is substantially larger in high-income countries, which is also consistent with theoretical expectations and the existing literature. In contrast, in line with theoretical arguments and the empirical results of the model, this coefficient is not statistically significant in low-income countries. Accordingly, financial development has not been able to improve TFP in low-income countries, whereas middle-income and high-income countries have been able to utilize this capacity to enhance productivity. Based on these findings, the research hypotheses are confirmed.

4.1 | Research Recommendations

The main findings based on country groups indicate that financial sector development does not lead to an improvement in TFP in low-income countries. The absence of an effect of financial development on TFP in these countries can be attributed to the insufficient availability of financial services for economic agents. Since economic development depends more on the quality of existing financial services than on their sources or size [50], [51] the policy implication of the present study for low-income countries, and even for middle-

income countries, in order to better benefit from the relationship between financial development and productivity, is that reforms of financial systems in these countries should be designed and implemented in a way that enhances the adequacy of financial services in relation to the needs of the economy and its level of development. Researchers in future studies may also employ the Human Development Index, instead of income level, in order to gain a deeper understanding of the relationship between the financial development index and TFP across countries with different levels of development. Furthermore, extending this study by incorporating indicators such as financial inclusion and financial innovation may contribute to strengthening the theoretical foundations in this field.

Conflict of Interest

The authors declare no conflict of interest.

Data Availability

All data are included in the text.

Funding

This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

[1] Li, T., & Liao, G. (2020). The heterogeneous impact of financial development on green total factor productivity. *Frontiers in energy research*, *8*. https://doi.org/10.3389/fenrg.2020.00029

[2] Greenwood, J., & Jovanovic, B. (1990). Financial development, growth, and the distribution of income. *Journal of political economy*, *98*(5), 1076–1107. https://doi.org/10.1086/261720

[3] King, R. G., & Levine, R. (1993). Finance, entrepreneurship and growth. *Journal of monetary economics*, *32*(3), 513–542. https://doi.org/10.1016/0304-3932(93)90028-E

[4] Huang, Z., Liao, G., & Li, Z. (2019). Loaning scale and government subsidy for promoting green innovation. *Technological forecasting and social change*, *144*, 148–156. https://doi.org/10.1016/j.techfore.2019.04.023

[5] Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of political economy*, *94*(5), 1002–1037. https://doi.org/10.1086/261420

[6] Buera, F. J., & Shin, Y. (2013). Financial frictions and the persistence of history: A quantitative exploration. *Journal of political economy*, *121*(2), 221–272. https://doi.org/10.1086/670271

[7] Buera, F. J., Kaboski, J. P., & Shin, Y. (2011). Finance and development: A tale of two sectors. *American economic review*, *101*(5), 1964–2002. https://doi.org/10.1257/aer.101.5.1964

[8] Cole, H. L., Greenwood, J., & Sanchez, J. M. (2016). Why doesn't technology flow from rich to poor countries? *Econometrica*, *84*(4), 1477–1521. https://doi.org/10.3982/ECTA11150

[9] Rioja, F., & Valev, N. (2004). Does one size fit all?: A reexamination of the finance and growth relationship. *Journal of development economics*, *74*(2), 429–447. https://doi.org/10.1016/j.jdeveco.2003.06.006

[10] Seven, U., & Coskun, Y. (2016). Does financial development reduce income inequality and poverty? Evidence from emerging countries. *Emerging markets review*, *26*, 34–63. https://doi.org/10.1016/j.ememar.2016.02.002

[11] Ruiz, J. L. (2018). Financial development, institutional investors, and economic growth. *International review of economics & finance*, *54*, 218–224. https://doi.org/10.1016/j.iref.2017.08.009

[12] Asteriou, D., & Spanos, K. (2019). The relationship between financial development and economic growth during the recent crisis: Evidence from the EU. *Finance research letters*, *28*, 238–245. https://doi.org/10.1016/j.frl.2018.05.011

[13] Arcand, J. L., Berkes, E., & Panizza, U. (2015). Too much finance? *Journal of economic growth*, *20*(2), 105–148. https://doi.org/10.1007/s10887-015-9115-2

[14] Fagiolo, G., Giachini, D., & Roventini, A. (2020). Innovation, finance, and economic growth: An agent-based approach. *Journal of economic interaction and coordination*, *15*(3), 703–736. https://doi.org/10.1007/s11403-019-00258-1

[15] Dadgar, Y., & Nazari, R. (2009). Evaluation of financial development indicators in Iran. *International conference on the development of the financing system in Iran, Tehran, Iran*. Civilica. (**In Persian**). https://civilica.com/doc/72379

[16] Gu, Y., Xu, K., Hu, X., & Chen, M. (2024). Research on improving the financial capacity of farmers based on fuzzy analytic hierarchy process. *Management analytics and social insights*, *1*(1), 88–102. https://doi.org/10.22105/6f2des36

[17] Zhang, Y. J. (2011). The impact of financial development on carbon emissions: An empirical analysis in China. *Energy policy*, *39*(4), 2197–2203. https://doi.org/10.1016/j.enpol.2011.02.026

[18] Marashi Aliabadi, S., Saeidi, K., Zandi, F., Lashkarizadeh, M., & Safavi, B. (2021). Comparison and analysis of the impact of financial development indicators on carbon dioxide emissions during Iran's economic boom and recession. *Environmental science and technology*, *23*(2), 261-273. (**In Persian**). https://search.isc.ac/dl/search/defaultta.aspx?DTC=8&DC=1267233

[19] Dizji, M., & Ahangari Gergi, M. (2015). The impact of financial development on income distribution in developed and developing countries. *Quarterly journal of financial economics*, *9*(33), 75-104. (**In Persian**). https://civilica.com/doc/1570287

[20] Abounoori, A., & Teimoury, M. (2013). Investigation of the effect of financial development on economic growth: A comparative study in OECD and UMI countries. *Quarterly journal of economic growth and development research*, *3*(11), 29-40. (**In Persian**). https://civilica.com/doc/405391/

[21] Imam Verdi, G. (1998). *The role of financial markets in economic development*. (**In Persian**). https://www.mbri.ac.ir/

[22] Samadi, S., Samadi, S., Nasrollahi, K., & Karamalian Cichani, M. (2007). Development of financial markets and economic growth. *Economic research and perspectives*, *7*(3), 1-16. (**In Persian**). https://ecor.modares.ac.ir/article_13164.html?lang=en

[23] Choong, C. K., & Chan, S. G. (2011). Financial development and economic growth: A review. *African journal of business management*, *5*(6), 2017–2027. https://doi.org/10.5897/AJBM10.772

[24] Mohammadi, E. (2025). Analytical study of the effects of exchange rate and oil revenues on herding behavior in the Tehran Stock Exchange. *Modern research in performance evaluation*, *4*(4), 281-292. (**In Persian**). https://doi.org/10.22105/mrpe.2026.243084

[25] Ahmad Pour, S. S., & Shirmardi, S. A. (2018). Voluntary social responsibility reporting and financial auditing on comprehensive quality. *The first international conference on new approaches in business management and accounting with an emphasis on value creation and resistance economy, Tehran, Iran*. Civilica. (**In Persian**). https://civilica.com/doc/822498

[26] Loayza, N., & Schmidt-Hebbel, K. (2002). Monetary policy functions and transmission mechanisms: An overview. *Serieson central banking, analysis, and economic policies*, *4*. https://repositoriodigital.bcentral.cl/xmlui/handle/20.500.12580/3649

[27] Ma, Y., & Lin, X. (2016). Financial development and the effectiveness of monetary policy. *Journal of banking & finance*, *68*, 1–11. https://doi.org/10.1016/j.jbankfin.2016.03.002

[28] Bernanke, B. S., & Gertler, M. (1995). Inside the black box: The credit channel of monetary policy transmission. *Journal of economic perspectives*, *9*(4), 27–48. https://doi.org/10.1257/jep.9.4.27

[29] Monfared, S. M., Mohammadi, T., Khazri, M., & Priyor, O. (2021). The role of financial development in the efficiency of Iran's monetary policy in determining output and inflation. *Quarterly journal of economic modeling*, *15*(55), 113–18. (**In Persian**). https://civilica.com/doc/1859856

[30] Krause, S., & Rioja, F. (2006). Financial development and monetary policy efficiency. *Emory economics*, *613*(158), 100–121. https://www.researchgate.net/publication/5013477

[31] Makvandi, R. (2024). Analysis of the impact of macroeconomic factors on the development of financial products: Application of the PESTEL model in identifying opportunities and threats. *Transactions on quantitative finance and beyond*, *1*(2 SE-Articles), 233–246. https://doi.org/10.22105/tqfb.v1i2.40

[32] Claessens, S., Demirgüç-Kunt, A., & Huizinga, H. (2001). How does foreign entry affect domestic banking markets? *Journal of banking & finance*, *25*(5), 891–911. https://doi.org/10.1016/S0378-4266(00)00102-3

[33] Mohammadi Nejad Pashaki, M. B. (2024). Investigating and analyzing economic sanction roles in return spillover to stock, currency, and gold coin markets. *Financial and banking strategic studies*, *2*(1), 60-72. (**In Persian**). https://doi.org/10.22105/fbs.2024.194532

[34] Shahinpour, A., & Karabulut, K. (2022). Presenting a model of the impact of economic variables on the total productivity index in Iran. *Journal of productivity management*, *16*(60), 279-301. (**In Persian**). https://www.magiran.com/paper/2414928

[35] Giang, M. H., Xuan, T. D., Trung, B. H., & Que, M. T. (2019). Total factor productivity of agricultural firms in vietnam and its relevant determinants. *Economies*, *7*(1), 1–12. https://doi.org/10.3390/economies7010004

[36] International Labour Organization (ILO). (2024). *Productivity measurement and analysis: A guidance note*. https://www.ilo.org/publications/productivity-measurement-and-analysis-guidance-note

[37] Antonio D. Kalaw, J. (2015). *Handbook on productivity*. Asian Productivity Organization (APO). https://www.apo-tokyo.org/wp-content/uploads/2015/10/Handbook-on-Productivity-2015

[38] Pritchard, R. (1990). *Measuring and Improving Organizational Productivity: A Practical Guide*. Bloomsbury Academic.

[39] Razavi, S. A., & Rostami, M. (2024). Comparative analysis of economic and institutional efficiency of Iran and selected Southeast Asian countries in the framework of development and productivity indicators. *Strategic studies in financial management and insurance (SSFMI)*, *1*(1), 18-29. (**In Persian**). https://doi.org/10.22105/ssfmi.v1i1.106

[40] Ali Mohammadpour, A., Zabihi, A., & Faghani Makrani, K. (2020). The impact of capital productivity management on capital asset pricing models with emphasis on life cycle. *Productivity management quarterly*, *14*(1), 171-194. (**In Persian**). https://civilica.com/doc/1376911

[41] Magazzino, C., & Santeramo, F. G. (2023). Financial development, growth and productivity. *Journal of economic studies*, *51*(9), 1–20. https://doi.org/10.1108/JES-07-2022-0397

[42] Ouidir, S. M., Kafia, B., & Ribeiro, H. (2024). Financial development, economic growth and total factor productivity in Algeria: An empirical study. *International journal of economic perspectives*, *18*(2), 417–433. https://ijeponline.org/index.php/journal/article/view/568

[43] Pal, S., Mahalik, M. K., Mallick, H., & Heshmati, A. (2024). Does financial development induce total factor productivity growth in an emerging economy? The role of gender human capital. *Journal of public affairs*, *24*(4), e2945. https://doi.org/10.1002/pa.2945

[44] Ezzahid, E., & Elouaourti, Z. (2017). *Financial development and total factors productivity channel: Evidence from Africa*. https://mpra.ub.uni-muenchen.de/81764/

[45] Han, J., & Shen, Y. (2015). Financial development and total factor productivity growth: Evidence from China. *Emerging markets finance and trade*, *51*(1), S261–S274. https://doi.org/10.1080/1540496X.2014.998928

[46] Arizala, F., Cavallo, E., & Galindo, A. (2012). Financial development and TFP growth: Cross-country and industry-level evidence. *Applied financial economics*, *23*(6), 433–448. https://doi.org/10.1080/09603107.2012.725931

[47] Pedroni, P. (2004). Panel cointegration: asymptotic and finite sample properties of pooled time series tests with an application to the ppp hypothesis. *Econometric theory*, *20*(3), 597–625. https://doi.org/10.1017/S0266466604203073

[48] Kao, C. (1999). Spurious regression and residual-based tests for cointegration in panel data. *Journal of econometrics*, *90*(1), 1–44. https://doi.org/10.1016/S0304-4076(98)00023-2

[49] Li, Z., Liao, G., Wang, Z., & Huang, Z. (2018). Green loan and subsidy for promoting clean production innovation. *Journal of cleaner production*, *187*, 421–431. https://doi.org/10.1016/j.jclepro.2018.03.066

[50] Levine, R. (2000). Are bank-based or market-based financial systems better? *Journal econom a chilena (the chilean economy)*, *3*(1), 25–55. https://ideas.repec.org/a/chb/bcchec/v3y2000i1p25-55.html

[51] Beck, T., & Levine, R. (2004). Stock markets, banks, and growth: Panel evidence. *Journal of banking & finance*, *28*(3), 423–442. https://doi.org/10.1016/S0378-4266(02)00408-9