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Transmission Channels between Financial Deepening and Economic Growth: Econometric Analysis Comprising Monetary Factors

Marina Abramova [1,*], Dmitri Artemenko [2,*] and Konstantin Krinichansky [1,*]

[1] Banking and Financial Markets Department, Research Center for Monetary Relations, Financial University under the Government of the Russian Federation, 125993 Moscow, Russia
[2] The Higher School of Business, Southern Federal University, 344000 Rostov-on-Don, Russia
* Correspondence: mabramova@fa.ru (M.A.); dartemen@mail.ru (D.A.); kkrin@ya.ru (K.K.)

Abstract: Contemporary literature continues to foster discussion whether financial development is important for economic growth. In the clash of theoretical arguments, the prevailing idea is that finance exerts a direct positive influence on GDP growth. However, the presence of theoretical counterarguments and contradictory results of empirical studies suggest that scientists, in search of an answer about the direction and power of the net effect, should develop methods of empirical analysis, and the very mystery of the relationship between finance and growth will finally be solved exclusively empirically. In this paper, the authors contribute to the development of the 'finance-growth' literature by answering some existing questions concerning the transmission channels from finance to growth, relying on more recent data compared to already conducted studies. We use panel data covering the period 1995 to 2019 for 168 countries. In addition, the paper touches on the problem of studying the exogenous conditions of such channels, considering the assumption that among these conditions there may be those that hinder the impact of financial deepening on economic growth. Our focus is on monetary conditions, and in the empirical part of the study, we touch upon the problem of the influence of price stability on the operation of these transmission channels. The methods of the conducted study are based on the dynamic panel data analysis techniques (System GMM). The novelty of this paper lies in the development of the modern theory of the financial sector transmission mechanism in the economic growth context. The main result of the study is that productivity channel is the most reliable transmission channel of financial deepening to economic growth. Furthermore, the effectiveness of this channel remains virtually unaffected by inflation. The channel of capital accumulation should be considered less reliable (in terms of statistical reliability of estimates obtained), but it has turned out to be a more economically significant transmission channel. This channel is sensitive to the inflation factor in certain categories of countries. Finally, as follows from the estimates gained, the non-linearity of the "finance-growth" relationship can be explained by the non-linearity of the variable responsible for the capital accumulation channel.

Keywords: financial sector; transmission channels; financial deepening; financial development; monetary conditions; efficient allocation of resources; dynamic panel data models; system GMM estimator; multiplicative interaction models

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1. Introduction

A significant and growing number of academic studies focus on the relationship between financial development and long-run economic growth. While using theoretical assumptions and analytical models as arguments, the authors, as a rule, unanimously conclude that the deepening and development of the financial sectors of countries has a generally positive impact on the GDP level, real per capita growth rates and per capita incomes. There may be various arguments for the existence of a direct positive finance-growth nexus (a review of theoretical studies is presented, for example, in F. Eschenbach [1]

and T. Beck [2]). One of the most common chains of reasoning is built around the specific functions of financial markets and financial systems that provide opportunities for the economic system to create added value. First of all, attention is drawn to the important role financial systems play for the effective resources allocation. In this regard, R. Merton writes that a well-developed, stably functioning financial system promotes efficient (intertemporal) allocation within the household life cycle and the efficient physical capital allocation that makes its exploitation in the business sector more productive [3] (p. 20). R. Rajan and L. Zingales [4] (pp. 559–560) add that the financial sector redistributes funds in favor of the most profitable use, offering mechanisms that reduce the undesirable impact of moral hazard, adverse selection, or transaction costs. Thus, advanced financial systems reduce the costs of firms to attract external capital, provide financing to more companies (than poor financial systems do), reduce financing barriers for relatively young and small firms, facilitate the entry of new firms into markets, etc. (In the empirical part of their study, R. Rajan and L. Zingales show that sectors that require more external financing develop faster than those that are less dependent on external financing in more financially developed countries.) All this serves as a basis for expanding economic activity and increasing the rate of economic growth on a long-term basis.

Financial intermediaries play a specific role in the transmission between financial development and growth. Thus, V. Bencivenga and B. Smith [5] basing on the AK-model show that an economy enjoying developed financial intermediaries has the advantage of higher potential growth rates, since the functioning of financial intermediaries changes the structure of financial assets in the economy—from safe, less risky, but bringing a low return, towards riskier, but at the same time yielding a higher return on investment. V. Bencivenga, B. Smith, and R. Starr [6] complement the picture that demonstrates the advantages of an economy with a well-developed financial services industry, showing its opportunities offered by financial intermediaries and liquid stock markets. Although savers may "suffer from liquidity risk", the financial sector allows savings to accumulate and profitable long-term investment projects to be implemented. Finally, R. King and R. Levine [7], developing the Schumpeterian growth model, show that an advanced financial system contributes to the acceleration of innovation activity in the economy. This happens because the financial sector performs such tasks as accumulating resources, reducing risks (through diversification), while financial intermediaries identify and usually correctly evaluate successful entrepreneurs who promote promising innovative solutions and products.

The theoretical literature almost unanimously interprets financial development as a driving force that positively affects economic development and growth. However, it is not always easy to support these theoretical assumptions with evidence based on empirical data. Here are some of the main problems: the poser of causal direction identification, the omitted variables problem, the question of the non-linearity of the relationship between finance and growth. The motivation for this study is associated with another not completely solved problem, namely, understanding the channels through which financial development translates into output growth. Specifically, we are also interested in whether monetary conditions, inter alia, inflation, affect the effectiveness of financial development policy and the mentioned transmission. The reason for this is that implicitly, having compared the typical style of financial development policy and that of monetary policy, we find that there is usually a combination of expansionary and conservative approaches (allowing financial markets to expand and keeping inflation close to a conservative target). At the same time, as far as the authors know, researchers have dealt too little with the problem of the effectiveness of the policy of expanding financial markets in conditions when inflation deviates from target values or is kept at levels above the average in countries comparable in terms of income and/or average annual inflation rate. In other words, it is important to understand whether it makes sense to allow the markets and lending to expand if the monetary authorities do not control inflation. This is the main practical issue of this study.

The analysis of transmission mechanisms of the impact of financial development on economic growth is important both from the point of view of the economic growth

theory improvement and from the point of view of finding the right solutions for economic policy. Considering the previously presented evidence, it can be argued that there are such channels of transmission from financial development to growth as the channel of external financing and the channel of new firms entering the market. In both cases, well-developed financial systems reduce the cost of external financing by stimulating the firm size enlargement and the increase of the number of firms in the sector, thereby contributing to the expansion of economic activity.

An alternative approach to articulating the channels of financial development transmission to growth is based on identifying the impact of changes in financial development indicators on variables such as savings, fixed capital accumulation and total factor productivity, implying that the positive impact on these indicators from financial development ultimately determines the contribution of finance to economic growth.

Here are some important results of empirical studies that shed light on the work of the channels of transmission of finance to long-run growth. Thus, J. De Gregorio and P. Guidotti [8] work with a sample of 98 countries in the period between 1960 and 1985, using a cross-sectional Barro-type regression [9]. They conclude that the main channel for transmitting impulse from finance to economic growth is to increase the efficiency of investments (but not their volume).

T. Beck, R. Levine, and N. Loayza [10], using cross-country instrumental-variable procedures and a dynamic panel data estimator, found in a sample of 77 countries in the period between 1960 and 1995 that more advanced financial intermediaries provide higher rates of economic growth, leading to an increase in total factor productivity rather than contributing to an increase in physical capital accumulation.

Motivating their research with the theoretical scheme proposed in the work of D. Acemoglu, P. Aghion, and F. Zilibotti [11], according to which, depending on the stage of development (and the distance from the technological frontier), a country will implement a growth strategy based either on capital accumulation or on boosting productivity by stimulating innovation, F. Rioja and N. Valev [12], using an analysis of a panel of 74 countries in the period between 1960 and 1995, find that finance affects economic growth mainly through capital accumulation in low-income countries, while economic development is more promoted by productivity growth in middle-income and especially high-income countries.

A detailed study of the finance-growth nexus transmission channels is proposed by K. Krinichansky and B. Sergi [13]. The authors designate and describe more than ten such channels. The physical capital accumulation channel (in conjunction with the private savings channel) and the channel of total factor productivity can be considered the main ones. The explanation for this is that the corresponding variables are incorporated in the production function directly. In addition, the significant impact of the grade of financial system development for new firms to enter the market, for exporters to enter foreign markets, and for the small and medium-sized enterprises to expand their businesses constitute additional opportunities to stimulate growth by deepening and improving the efficiency of financial markets and systems.

Let us characterize the work of the channel of physical capital accumulation. The influence of the financial system on the rate of economic growth lies in the fact that the national savings rate, the rate of capital accumulation, as well as the size of intersectoral capital flows depend on the intensity and quality of its functioning.

Capital accumulation depends on the savings rate, the availability and performance of the mechanism for reallocating savings, and the costliness of converting savings into investment. A superior financial system is associated with a sounder savings system, equipped with effective compensation mechanisms (deposit insurance, brokerage account insurance, etc.), and wide range of opportunities of investment portfolio diversification both by type (equities, bonds, mutual fund shares, ETFs, futures, etc.) and within specific types (across industries and regions). Financial systems drawn up in this aspect contribute to savings rate to turn up at a level sufficient to cover the demand for financial resources

and keep the savings rate from unexpected drops. The reliability and stability of capital supply at the expense of domestic savings is one of the conditions for achieving higher average long-term economic growth rates.

What is understood by the total factor productivity channel's effect in connection with the finance-to-growth transmission? We will proceed from the postulate that TFP is closely related to allocative efficiency. In other words, the return to production factors is closely related to how they are distributed, in whose possession they are. The optimal situation for the economy is when multifactor productivity is the highest, and it is impossible to redistribute it through market transactions (at market prices and with no obstacles to this) to make it increase further.

In fact, some circumstances make it impossible to sustain the optimal equilibrium, but the development of financial systems allows us to get closer to it. The impossibility of reaching this optimum is associated with well-known costs incurred while undertaking an economic exchange. We are talking here primarily about transaction costs, whose nature is associated with economy-specific phenomena (asymmetric information, moral hazard, agency problem, etc.) These costs are, in fact, a reflection of the features of the relationship between the counterparties involved in making decisions regarding the allocation of resources or, in a broader sense, determining the quality of management decisions, for example, between corporate executives and shareholders. The contribution of financial systems to overcoming these issues and market frictions includes a large number of solutions: from negotiable financial contracts characterized by public credibility to specialized types of financial intermediaries and market infrastructure institutions that assist better coordination of the interests of market participants and adjustment of counter flows of savings supply and loanable funds demand, help overcome risks through monitoring, diversification, various forms of collateral, as well as many other vehicles, including those introduced by governments or central banks. To the extent that financial systems contribute to mitigating market frictions and open up opportunities for exchange, both in the monetary (or investment) sphere or in the trade in goods, thereby ensuring the overflow of resources and their movement to the sectors with the highest returns, they provide an increase in total factor productivity and promote long-run growth.

Let us turn to the examples of efficient allocation of resources provided by banks and stock market as an illustration. Indeed, by developing specialized skills in assessing and monitoring borrowers (or investment projects) and by accumulating a large amount of longitudinal microdata, banks acquire the value that helps them solve the problem of asymmetric information concerning borrowers and lenders. In the specialized literature, based on the study of the historical experience of countries (as an example, we can refer to the highly-cited paper of R. Tilly [14]), it has been repeatedly emphasized that thanks to banks and their ability to effectively recognize the degree of profitability and risk of business projects to provide capital on business-relevant terms, some countries (for instance, Germany, Scotland, Belgium, Japan) were able to achieve success in the development of commercial activities and industrialization from the end of the 19th to the beginning of the 20th century, which predetermined the consistently high rates of economic growth in these countries (as shown by A. Demirgüç-Kunt, E. Feyen, R. Levine [15]; L. Gambacorta, J. Yang, K. Tsatsaronis [16] in today's economic world, the banking sector is particularly important for low-income countries that are backward in economic development, as banks reduce overall costs of risk management and can compensate for weaker institutions.) Among theoretical works that reveal the superior role of the banking sector in overcoming market frictions, thereby ensuring economic development, we point out the papers by D. Diamond [17], J. Stiglitz [18], V. Bencivenga, B. Smith [5], and R. Stulz [19]. (However, there is also a lot of criticism concerning the role of banks, which emphasizes that banks can create obstacles to business innovation and take away resources from the real sector to the detriment of the economy. See, in particular, what R. Levine [20] says in his paper in this regard.)

The purpose of the stock and derivatives markets is revealed slightly differently than that of the banks. A. Boot, A. Thakor [21], F. Allen, D. Gale [22], and M. Thiel [23], emphasize that competitive capital markets are successful in aggregating disparate information signals and effectively transferring this information to investors. The large number of investors and high competition on both the demand and supply sides contribute to the fair pricing in money and capital markets and determine making good resource allocation decisions. Indeed, one would expect that a large number of stock market participants who independently form opinions about the future events determinants will ultimately form the choice that best reflects the true probability distribution of the many factors that affect asset prices. In addition, capital markets make assets liquid, and market for corporate control makes it easier to link managerial remuneration to firms' performance. This conception increases confidence and trust in capital markets and mitigates the problems of uncertainty and information asymmetry. Finally, let us add that the advantage of stock markets is rooted in the possibility of broad diversification, and consequently, the economy is allowed to compose quite a unique portfolio of technologies, including risky high-return ones, as specifically M. Obstfeld mentioned [24]. Consequently, the economy obtains the necessary investment into risky projects implemented by companies and corporations, and, due to achieving and maintaining high efficiency of resource allocation, ultimately reaches higher rates of economic growth. It should be also noted that, as shown by A. Demirgüç-Kunt, E. Feyen, and R. Levine [15], the efficient running of stock markets is more typical of countries with higher incomes and developed institutions.

In addition, organizational and technological solutions implemented in the financial system as a whole lead to the accumulation of excess knowledge and form the basis for increasing productivity in the sector, which, as W. Razzak and E.M. Bentour [25] argue, is positively associated with growth.

However, K. Ehigiamusoe and M. Samsurijan recently showed [26] that the underlying conditions in which financial systems operate in each individual country, and economic units save, attract funding, and invest, may make considerable impact upon finance-growth nexus. This study focuses on analyzing, among other things, the monetary conditions of financial development in the context of their possible impact on economic growth in connection with the impact on the operation of the finance-growth transmission channels.

Let us describe some theoretical prerequisites for considering monetary factors in the work of finance-growth transmission mechanisms. Monetary conditions, which in this paper we understand as price stability, the value of money, and the monetary aggregates' dynamics, significantly affect other macroeconomic parameters and play a key role in ensuring economic activity and growth. Although their impact on the economy is quite well studied, the impact of monetary conditions on the parameters of the transmission mechanism "financial development—economic growth" has hardly ever been practically touched upon in specialized literature. (Earlier K. Krinichansky and N. Annenskaya studied the influence of inflation on financial development. They found that high inflation has an impeding effect on financial depth [27]. However, the authors did not address the transmission mechanism of the relationship between finance and growth.) At the same time, understanding this influence will undoubtedly advance macroeconomic theory and can provide valuable information for the formation of an effective monetary policy.

Before discussing the impact of monetary factors on the transmission from finance to growth, we will briefly review the literature on this issue, focusing on inflation and its impact on growth.

It is known that both theoretical and empirical studies give mixed results regarding the relationship between inflation and long-term growth. Within the framework of neoclassical growth theory, R. Mundell [28] and J. Tobin [29] show that inflation can stimulate economic growth. This happens because increasing the nominal interest rate caused by inflation makes investment more preferable and, therefore, increases capital accumulation (the Mandell–Tobin effect). At the same time, A. Stockman [30] using a Clower constraint model (cash-in-advance constraint), assuming that investment and real money balances

complement each other, finds that inflation reduces investment and real money balances, which negatively affects economic growth.

Having undertaken an empirical study based on panel data from 93 countries, S. Fischer [31] found that GDP growth is negatively related to inflation. He also concluded that the negative impact of inflation on growth takes place because inflation leads to a decrease in productivity and investment. The statistically and economically significant negative impact of high inflation on growth was also found by R. Barro [32], who used panel data comprising 100 countries over the period 1960–1990. R. Barro found out that, for a group of low inflation countries, the statistical significance of coefficients is weak, although the sign of the coefficient remains negative. The uncertainty of the relationship between the low and moderate inflation regimes and economic growth is also shown by the results obtained by M. Bruno and W. Easterly [33].

The conditions of high inflation and inflation expectations are unfavorable for the mobilization of savings and cause a decrease in the savings rate. Countries that do not manage to tame inflation for a long time face obstacles to financial development [34] and cannot provide sufficient domestic supply in the capital market, so businesses in these countries lack the funds required to finance capital investment.

Let us address the arguments that reveal the link between inflation and economic growth through the banking sector. B. Champ and J. Boyd [35] offer a detailed picture in which the banking sector reacts to a certain level of inflation by expanding or reducing lending to the real economy, thereby affecting economic activity. High inflation encourages borrowing, as it is easier for borrowers to repay devalued amounts of principal. However, it is highly likely that new borrowers entering the credit market will face increased risks in such economic conditions. The overall loan portfolio quality is reduced. In addition to the influx of riskier borrowers, banks may suffer from declining real returns on loans to be issued or already granted. The banks' response is likely to be in credit rationing or raising of the level of the nominal credit interest rate. Both results have negative aftermath for the market. The former leaves a certain share of the demand for credit unsatisfied. The latter, due to the effect of adverse selection, aggravates the problem of deteriorating credit quality, since it forces reliable borrowers to leave the market due to their disagreement to pay an increased risk premium that is unfairly imposed on them. All of this has a negative impact on economic activity. More specifically, when financial intermediaries restrict the issuance of loans, one of the results may be a reduction in capital investment. This has long-term negative consequences, since it does not contribute to the renewal of production capacities and, as a result, hinders productivity growth. On the contrary, the low level of inflation does not only cause credit rationing by credit institutions but also allows to definitely accelerate growth, stimulating business activity.

Interesting results regarding the relationship between inflation and growth in the context of the role of the financial system are shown by D. Andolfatto, A. Berentsen, and F. Martin [36]. The authors find that in case of high inflation, the bank-based model of the financial system may be preferable to the market-based one. In this respect, they write: "for high-inflation regimes, banking arrangements deliver superior liquidity risk-sharing outcomes over securities markets, with the benefit larger in environments where securities markets are missing or are subject to limited participation" [36] (p. 34).

M. Khan and A. Senhadji [37] were the first who assessed threshold levels of annual inflation in the context of growth. They found these thresholds to be 1–3% in industrialized countries and 11–12% in developing countries. Subsequently, a few attempts were made to make these estimates more precise (see, for example, [38,39]). In the framework of "finance-growth" perspective a similar issue was studied by P. Rousseau and P. Wachtel [40]. The authors showed that high and long-term inflation impedes financial development due to its negative impact on long-term financial contracts and financial intermediaries.

Finally, besides inflation, we turn to another monetary factor, namely, the interest rate. It can be shown that reasonably low interest rates create a favorable environment for the financial sector to perform its functions. At the same time, historical episodes

indicate that rates can either rise to double-digit levels (usually influenced by accelerated inflation or aggravated downward pressure on the exchange rate due to certain risks) or decline to zero (or even lower). Periods of this kind are unfavorable for the operation of the "finance-growth nexus" transmission mechanism, since economic units receive distorted signals at the time, prompting them to implement strategies of behavior with unjustifiably increased risk or, on the contrary, to be overly cautious when allocating their income (both current income and expected in the future).

Here is an example related to the financial and economic crisis of 2007–2009. The period that preceded it (starting in 2001), when interest rates remained at low levels for a long time, caused undesirable spillover effects of changing economic strategies. The matter is that American households during this period took unjustifiably high risks of investing in the residential real estate sector. Housing prices grew fast under the influence of the low rates, but few people realized the possibility of their looming rapid decline. The accumulation of risks in housing-related obligations were facilitated in various ways by the financial sector, which became too involved in designing risk transfer vehicles and packaging mortgages' cash flows into securities, transferring credit risks to various financial institutions and numerous investors. With the housing markets overheated and the subsequent fall in prices for this type of asset, households, and a large number of financial institutions suffered severe losses, which turned into an unprecedentedly long worldwide recession.

Thus, turning to the subject of our study, we can conclude that the interest rate policy, which determines an important set of the financial development monetary conditions, critically affects the productivity of the financial system. Given certain parameters, interest rate policy can cause a significant spurring in economic activity; however, with weak control over the risks of inflating asset bubbles, it can also lead to a negative market shock and a decrease in long-term economic growth.

Theoretical studies of monetary conditions affecting the transmission from financial development to economic growth show that both the impact of inflation and the interest rate can be multidirectional. It is important for regulators to find out the levels of monetary factors that will improve the transmission facilitating long-term sustainable economic growth. For this purpose, it is not only important to know the theoretical basis but also to build adequate models based on empirical data.

The rest of this paper is organized as follows. Section 2 provides the econometric methods we use. Moreover, the data and model specification are presented here. We show ways of grouping countries used to distinguish the response of "finance to growth" transmission channels for countries with different annual average inflation over the observation period as well. Section 3 provides our results. We are interested in the general nature of the dependence of the growth variable on the variable of financial development (positive or negative); we check whether the inverted U-shaped relationship exists; using multiplicative variables, we propose to identify the role of the channels of capital accumulation and the total factor productivity in the transmission from financial deepening to GDP growth; we also test these multiplicative variables for non-linearities; we examine the effects of inflation on growth in each case; finally, grouping countries by level of inflation, we intend to find out the impact of inflation on the transmission mechanisms from financial expansion to growth. Section 5 concludes the paper.

2. Materials and Methods

The basic approach to assessing the impact of monetary factors of financial development, primarily inflation, on the transmission channel from financial development to economic growth is based on the techniques for estimating dynamic panel-data models. The methodology of this analysis is revealed in the studies of D. Holtz-Eakin, W. Newey, and H. Rosen [41]; M. Arellano and S. Bond [42]; M. Arellano and O. Bover [43]; T. Anderson and C. Hsiao [44]; and others. The instrumental variables approach, often used to solve problems similar to those considered in this paper, does not use all the information available

in the sample. In addition, it is not always possible to collect data for their representation as instrumental variables of the model. In such cases it is proposed to compensate for these weaknesses of the method of instrumental variables by creating a method with internal instruments, based on lagged values of the instrumented variables. This method is the Generalized Method of Moments (GMM). GMM allows to get more efficient estimates compared to alternative methods for analyzing dynamic panels.

Let us consider the equations

$$y_{it} = X_{it}\,\beta_1 + W_{it}\,\beta_2 + v_{it} \quad (1)$$

$$v_{it} = u_i + \varepsilon_{it}, \quad (2)$$

where X_{it} includes strictly exogenous regressors, W_{it} are predetermined regressors (which may include lags of the explained variable y) and endogenous regressors, which may correlate with residuals u_i, responsible for the individual-specific unobservable effects. The equation in the first differences removes the unobservable individual effects u_i and the associated bias caused by the omitted variables.

The approach of M. Arellano and S. Bond, as well as its extension, called the System Generalized Method of Moments (System GMM), are adapted to carry out the assessment, in relation to situations where:

- Panel dataset's characteristics involve a small observation period (small T) and a large number of observed units (large N);
- Functional relationships are subject to linear dependence;
- The dependent variable is dynamic and depends on its own past realizations;
- Regressors are not strictly exogenous, but correlate with past and possibly current random errors;
- There are fixed individual effects implying unobservable heterogeneity;
- Heteroscedasticity and autocorrelation are within the errors of individuals, but not across them.

The estimation according to the Arellano–Bond approach undertakes the problem of the generalized method of moments (GMM), in which the model is given as a system of equations—one for a period of time, where the instruments applicable to each equation differ due to the use of additional lagged values of the instruments.

A potential weakness in the dynamic panel evaluation method with the help the Arellano–Bond approach was shown in the works of M. Arellano and O. Bover [43], R. Blundell, and S. Bond [45]. The problem was that lagged levels are often quite poor instruments for first difference variables, especially if the variables are close to a random walk. However, a solution was found, and the models currently used correspond to the modification of the basic one, namely, they include lagged variables in both differences and levels.

Now it is necessary to show how this study evaluates the operation of the finance-to-growth transmission mechanism. Let us make a reservation that, since early studies proved that the most powerful transmission channel is the channel of total factor productivity (TFP), this study focuses on it. We add an interaction (multiplicative) term to our model, which is constructed as the product of a financial development variable by a variable that reflects the TFP factor. The variable that measures the total factor productivity was calculated as the Solow residual. The Solow residual is the difference between real GDP per capita growth and real capital growth per capita multiplied by the share of capital in the national income accounts, which is usually assumed to be 0.3 (see T. Beck, R. Levine, and N. Loayza [10] (p. 289) for details):

$$TFP_{it} = R\_GDPpc\_gr_{it} - 0.3 \times R\_Kpc\_gr_{it} \quad (3)$$

where TFP is the desired value of the total factors productivity; *R_GDPpc_gr* is the growth rate of real GDP per capita; *R_Kpc_gr* is the rate of real capital growth per capita; *i*, *t* are indices indicating the time period and the country, respectively.

When calculating the TFP using this model, the indicators of gross capital formation per capita and gross fixed capital formation per capita were taken alternately as a variable that tracks capital accumulation (*K*).

We use two-step system GMM estimators to estimate the moment conditions and obtain robust standard errors using the finite sample correction, according to the approach of F. Windmeijer [46]. The model uses two lags of the depended variable. We evaluate three equations of the baseline specification. The first of them is aimed at testing the linear dependence of economic growth on the set of regressors, including the financial variable:

$$\begin{gathered}\Delta R\_GDPpc\_gr_{it} = \alpha + \gamma_1 \Delta GDPpc\_gr_{it-1} + \gamma_2 \Delta GDPpc\_gr_{it-2} \\ +\beta_1 \Delta FD_{it} + \beta_2 \Delta Init\_GDPpc_i + \beta_3 \Delta Infl + \beta_4 \Delta Educ_{it} \\ +\beta_5 \Delta Tr\_GDP_{it} + \beta_6 \Delta GovE\_GDP_{it} + u_i + \Delta\varepsilon_{it}\end{gathered} \tag{4}$$

where *R_GDPpc_gr* is the growth rate of real *GDP* per capita; *Init_GDPpc* is the natural logarithm of per capita *GDP* in the initial year of observations; *Educ* is the average number of years spent in school for citizens under the age of 25 (the variable responsible for the human capital accumulation); *Gov_GDP* is the general government final consumption expenditure as percent of *GDP* (the variable responsible for the contribution to the growth of government spending); *Tr_GDP* is the sum of exports and imports to *GDP* (the variable responsible for the contribution of economic openness in the form of foreign trade turnover to *GDP* growth); *Infl*—the annual rate of consumer inflation (a variable that controls the monetary factor); *i*, *t*—indices indicating the time period and the unit of observation (country), $i \in \{1,2,..., N\}$ and $t \in \{1,2,..., T\}$; β and γ—the estimated coefficients; *u* and ε—the regression residuals.

All variables in our dataset that do not take negative values and do not turn to zero are log transformed using the natural logarithm function. Variables whose series contain negative values are transformed according to the law of inverse hyperbolic sine transformation (about the applicability of this procedure in econometric studies, see, for example, [47,48]):

$$\widetilde{z}_t := \log\left(z_t + \sqrt{z_t^2 + 1}\right) \tag{5}$$

where z_t is the value of the variable to be transformed for the year *t*.

The next type of the estimated model, as shown in the work [49], is intended to test the hypothesis about the nonlinear nature of the relationship between growth and finance. It includes the square of the financial variable on the right side:

$$\begin{gathered}\Delta R\_GDPpc\_gr_{it} = \alpha + \gamma_1 \Delta GDPpc\_gr_{it-1} + \gamma_2 \Delta GDPpc\_gr_{it-2} \\ +\beta_1 \Delta FD_{it} + \beta_2 (\Delta FD_{it})^2 + \beta_3 \Delta Init\_GDPpc_i + \beta_4 \Delta Infl + \beta_5 \Delta Educ_{it} \\ +\beta_6 \Delta Tr\_GDP_{it} + \beta_7 \Delta GovE\_GDP_{it} + u_i + \Delta\varepsilon_{it}\end{gathered} \tag{6}$$

where the symbols correspond to the legend of Equation (4).

Finally, the third type of the estimated equation includes one of the two interaction terms. Its specification is written as follows:

$$\begin{gathered}\Delta R\_GDPpc\_gr_{it} = \alpha + \gamma_1 \Delta GDPpc\_gr_{it-1} + \gamma_2 \Delta GDPpc\_gr_{it-2} \\ +\beta_1 \Delta FD_{it} + \beta_2 \Delta Init\_GDPpc_i + \beta_3 \Delta Infl + \beta_4 \Delta Educ_{it} \\ +\beta_5 \Delta Tr\_GDP_{it} + \beta_6 \Delta GovE\_GDP_{it} + \beta_{7,8} \Delta FD \times TM_{it} + u_i + \Delta\varepsilon_{it}\end{gathered} \tag{7}$$

where $FD \times TM$ is the product of a financial development predictor (in particular, the "Domestic credit-to-GDP ratio") and the variable that controls the "finance-growth nexus" transmission channel (for example, total factor productivity, TFP).

The main source of statistical data is the World Bank's open database, including the World Development Indicators database (WDI), which covers data on 223 countries or jurisdictions (as of the beginning of 2021).

The time span of this study is from 1990 to 2019. The choice of time coverage is explained by the desire to maximize the number of units (countries) included in the study.

As for the selection of objects, we indicate the following. In this study, regression models are evaluated for different samples of countries. At the first stage, a sample of 164 countries is formed, after which two sub-samples are examined within it—countries with moderate consumer inflation (135 countries) and high inflation countries (29 countries). Here and further, the assignment of a particular country to a group with moderate (low) or high inflation is carried out according to a certain threshold value of the country's average consumer inflation rate for the selected observation period. At the second stage, the sample includes high-income countries (according to the World Bank classification). The total number of countries considered for building the sample after excluding countries with incomplete data is 54; the number of low inflation countries among them is 36. At the next stage, upper middle-income countries (according to the World Bank) are left in the sample. The total number of countries initially included in this sample is 39. Twenty of them are classified as moderate inflation countries. At the fourth stage, a sample of countries with lower middle income (according to the World Bank) is formed. The total number of countries tracked for inclusion in this sample is 45; 36 of them are countries with moderate average inflation. Finally, at the fifth stage, a sample of low-income countries is formed. The total number of countries tracked for inclusion in the sample is 26; 20 of them are countries with moderate average inflation.

The composition of the groups of countries described above, as well as the threshold levels of inflation, at which we classify a country belonging to a particular group as a high inflation country, is presented in the Appendices A–E.

3. Results

This section will present and discuss the results of testing the above-mentioned econometric models for assessing the relationship between finance and growth and the role of transmission channels from financial development to economic growth, with an emphasis on the inflation factor.

Descriptive statistics for all variables used in Equations (4), (6), and (7) are given in Table 1. In Table 2, we present a correlation matrix.

Table 1. Descriptive statistics of the variables.

Variables	Definition	Mean	Max.	Min.	Std. Dev.	Obs.
R_GDPpc_gr	Growth rate of real GDP per capita	0.4806	1.8755	−1.9786	0.6735	4050
FD	Domestic credit to private sector (% of GDP)	3.4180	5.7332	−0.9099	1.0379	3965
Init_GDPpc	Initial GDP per capita	7.5454	10.8749	4.90	1.6322	4100
Educ	Average total years of schooling	1.9881	2.6810	−1.2040	0.5057	4050
Gov_GDP	General government final consumption expenditure (% of GDP)	2.6838	4.9954	−0.0930	0.4204	3900
Tr_GDP	Exports plus Imports of goods and services (% of GDP)	4.2977	6.0927	−1.7873	0.5956	3925
Infl	Inflation, consumer prices (annual %)	0.8749	3.9186	−1.7818	0.5750	4052
GFCF	Growth rate of gross fixed capital formation per capita	3.8097	110.58	−67.518	13.711	3540
TFP	Total factor productivity (Solow method)	1.0649	32.731	−69.50	4.89252	3525

Notes: The values of the first seven variables are log-transformed.

Table 2. Correlation matrix.

	R_GDPpc_gr	*FD*	*Init_GDPpc*	*Educ*	*Gov_GDP*	*Tr_GDP*	*Infl*	*GFCF*	*TFP*
R_GDPpc_gr	1								
FD	0.0184	1							
Init_GDPpc	−0.0822	0.7105	1						
Educ	0.0305	0.5934	0.6291	1					
Gov_GDP	−0.1102	0.3139	0.3478	0.2431	1				
Tr_GDP	0.0588	0.3035	0.2863	0.3350	0.1862	1			
Infl	0.0173	−0.3573	−0.3187	−0.1953	−0.2088	−0.1881	1		
GFCF	0.4522	−0.0790	−0.0740	−0.0297	−0.0387	0.0314	0.0216	1	
TFP	0.4283	0.0733	−0.0146	0.0542	−0.0609	0.0368	−0.0065	−0.5375	1

The results of running regressions for these categories and groups of countries are summarized in Tables 3 and 4.

Table 3. Estimations of financial deepening impact. All countries.

Regressor	**OLS**		**GMM-SYS**			
			All Countries		**Moderate Inflation**	
	Linear Model	**Nonlinear Model**	**Linear Model**	**Nonlinear Model**	**Linear Model**	**Nonlinear Model**
1	**2**	**3**	**4**	**5**	**6**	**7**
L1.	–	–	0.176 *** (0.040)	0.159 *** (0.043)	0.136 *** (0.038)	0.120 *** (0.043)
L2.	–	–	−0.033 (0.029)	−0.041 (0.033)	−0.042 (0.030)	−0.059 * (0.033)
FD	0.082 *** (0.017)	0.364 *** (0.059)	−0.477 *** (0.137)	0.276 (0.681)	−0.465 *** (0.157)	0.378 (0.641)
$(FD)^2$	–	−0.046 *** (0.009)	–	−0.134 (0.109)	–	−0.145 (0.096)
Infl	0.006 (0.026)	−0.012 (0.026)	−0.066 (0.043)	−0.077 (0.046)	−0.041 (0.061)	−0.052 (0.054)
Init_GDPpc	−0.084 *** (0.010)	−0.068 *** (0.011)	0.027 (0.085)	0.051 (0.107)	−0.084 (0.115)	−0.044 (0.138)
Tr_GDP	0.081 *** (0.021)	0.080 *** (0.021)	0.715 ** (0.296)	0.746 ** (0.304)	0.949 *** (0.336)	0.973 *** (0.284)
Gov_GDP	−0.147 *** (0.033)	−0.168 *** (0.033)	−0.452 (0.365)	−0.432 (0.293)	−0.903 *** (0.320)	−0.849 *** (0.316)
Educ	0.116 *** (0.029)	0.106 * (0.029)	0.283 (0.332)	0.439 (0.387)	0.353 (0.443)	0.439 (0.365)
Const	0.645 *** (0.115)	0.236 * (0.140)	−0.521 (1.297)	−2.054 (1.900)	0.395 (1.409)	−1.329 (1.757)
AR(2) (*p*-value)	–	–	0.508	0.585	0.716	0.971
Sargan test (*p*-value)	–	–	1.0	1.0	1.0	1.0
N	164	164	164	164	135	135

Notes: Robust standard errors (and Robust Windmeijer standard errors) in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 4. Tests for an inverse U-shape.

Estimated Parameter	Evaluation Value
Slope at $FD_{\min}$	0.432 *** (0.000)
Slope at $FD_{\max}$	−0.280 *** (0.000)
Overall test of presence of an Inverse U shape (t-value)	4.54 (0.000)

p-value is indicated in parentheses. *** $p < 0.01$.

As a financial variable for inclusion in the regression equations, the indicator "Domestic credit to the private sector, % of GDP" is taken. We also tested the models using the indicator "Monetary Sector credit to private sector, % GDP" and got very similar results, so we do not mention results with the second variable of financial development. The choice of a credit-based variable as a proxy for financial development is explained by the predominant role of credit in financing the economy. Since the class of variables constructed in the form of the ratio of the credit market volume to GDP is called "financial depth", we state in the title of the article that the subject of research is the relationship between financial depth and economic growth.

Let us begin the discussion of the results by considering Tables 3 and 4, which present estimates of the model coefficients obtained from the analysis of the full sample.

As it is shown in Table 3, the least-squares estimation of cross-cutting regressions supports a nonlinear, inverse U-shaped relationship between the financial variable and the economic growth variable. This is supported by a positive and significant coefficient for the *DC_Ps* indicator (domestic credit to private sector (% of *GDP*)) and both the negative and significant one with the same regressor squared $(DC\_Ps)^2$ (Column 3). We additionally use the Sasabuchi–Lind–Melam test to test the inverted U-shaped character of the relationship studied (Table 4). This test, proposed in J. T. Lind and H. Mehlum [50], is based on the likelihood ratio approach of S. Sasabuchi [51]. This test checks the joint hypotheses given by conditions (8) and (9):

$$\mathrm{H}_0: \ (\beta_1 + 2\beta_2 FD_{\min} \leq 0) \cup (\beta_1 + 2\beta_2 FD_{\max} \geq 0) \tag{8}$$

against the alternative:

$$\mathrm{H}_1: \ (\beta_1 + 2\beta_2 FD_{\min} > 0) \cap (\beta_1 + 2\beta_2 FD_{\max} < 0) \tag{9}$$

where $FD_{\min}$ and $FD_{\max}$ are, respectively, the minimum and maximum values of the financial indicator which is the regressor in the Equation (4).

The result we obtained allows us to reject the H0 hypothesis that the relationship between financial depth and GRP growth has a U-shape. Hence, we accept an alternative hypothesis implying an inverted U-shape.

The evaluation by the system GMM method does not confirm or reject this fact, since it can be noted that the coefficients for the linear and quadratic terms also get a different sign (plus and minus, respectively), but they are not statistically significant (Columns 5 and 7). At the same time, in the model without a quadratic term (Columns 4 and 6), the coefficients for the financial variable are significant, but negative, which may indicate a negative contribution of financial depth to growth as a characteristic feature of the economic model of the last 25 years. Although in most of the works published in recent years, the authors of the research point out to the non-linearity of relationship in finance-growth nexus (see, for example, the work of J. Arcand, E. Berke, and U. Panizza [52]; and K. Krinichansky [53]), their results cannot be considered quite reliable (this is reported, for example, by J. Cave, K. Chaudhuri, and S. C. Kumbhakar [54]). Moreover, some of the works find relationship studied (for the period starting from the 1990s) negative (Rousseau and Wachtel [55]; L.

Gambacorta, J. Yang, and K. Tsatsaronis [16]). Thus, the estimates obtained are generally consistent with the previously obtained results of those authors who find that financial deepening does not contribute to long-term growth.

However, we are more interested in the contribution of capital accumulation and productivity to economic growth in relation to the dynamics of financial depth, that is, the evaluation of the model expressed by Equation (5). Looking at the results presented in Columns 2 and 3 of Table 5, we see that both factors, supported by changes in the financial variable, have a positive effect on economic growth. The corresponding coefficients have a positive sign and are statistically significant. At the same time, the capital accumulation factor is more economically important—the coefficient of the corresponding term is 3.5 times higher than the coefficient of the second multiplicative term.

Table 5. Financial deepening impact and "finance-to-growth" transmission channels estimations with the inflation factor. All countries.

	All Countries of the Sample		**Moderate Inflation Countries**		**High Inflation Countries**	
1	**2**	**3**	**4**	**5**	**6**	**7**
L1.	0.163 *** (0.036)	0.146 *** (0.032)	0.137 *** (0.038)	0.138 *** (0.036)	0.231 (0.167)	0.013 (0.170)
L2.	−0.050 * (0.029)	−0.046 (0.028)	−0.055 ** (0.026)	−0.050 (0.032)	−0.071 (0.195)	−0.073 (0.121)
FD	−0.949 *** (0.210)	−0.458 *** (0.112)	−0.734 *** (0.258)	−0.482 *** (0.161)	−0.989 (1.152)	0.007 (0.835)
Infl	−0.061 (0.049)	−0.030 (0.051)	−0.042 (0.061)	0.008 (0.059)	−0.246 * (0.144)	−0.242 (0.166)
Init_GDPpc	−0.006 (0.094)	−0.053 (0.101)	−0.108 (0.128)	−0.109 (0.117)	0.496 (0.496)	0.164 (0.550)
Tr_GDP	0.657 * (0.378)	1.146 *** (0.246)	0.906 *** (0.331)	0.996 *** (0.300)	0.419 (1.290)	1.069 (0.784)
Gov_GDP	−0.441 (0.357)	−0.500 ** (0.256)	−0.847 (0.339)	−0.664 * (0.362)	0.160 (0.926)	−0.984 (1.559)
Educ	0.489 (0.400)	0.089 (0.375)	0.464 (0.419)	0.384 (0.517)	−1.383 (3.853)	−0.906 (1.790)
FD × *GFCF*	0.404 ** (0.162)		0.241 (0.208)		0.475 (0.581)	
FD × *TFP*		0.117 *** (0.010)		0.115 (0.012)		0.119 *** (0.032)
Const	−1.466 (1.761)	−1.400 (0.995)	−0.246 (1.606)	−0.363 (1.614)	−1.810 (10.669)	−0.322 (6.491)
AR(2) (*p*-value)	0.446	0.675	0.635	0.865	0.871	0.570
Sargan test (*p*-value)	1.0	1.0	1.0	1.0	1.0	1.0
N	164	164	135	135	29	29

Notes: System GMM-techniques. Robust Windmeijer standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The inflation variable responsible for monetary factors in the model turned out to be negative, but not statistically significant. To better determine the impact of this factor, we narrowed the sample to exclude countries where the average inflation rate for the period from 1995 to 2019 did not exceed the critical level of 13% (this threshold was found in [40]). It turned out that in the remaining sample of 44 countries (Table 5, Columns 6 and 7), the

model showed higher values of coefficients on the inflation term, one of which is statistically significant at 10% level, the second one being at the 15% level. This indicates a possible negative impact of inflation on economic growth but does not indicate a negative impact of inflation on the "finance-to-growth transmission" channels performance. Moreover, it is in the sub-sample of countries with moderate inflation that we find a decrease in the value of the coefficient for the interaction term with capital accumulation, which could indicate the opposite characteristic of the studied relationship, namely, that higher inflation favorably affects the "finance-growth nexus" transmission channels. However, we cannot confirm this hypothesis, since the statistical significance of the reduced regression coefficient is weak (Table 5, Column 4). At the same time, we note once again that the impact of such a monetary factor as inflation on the transmission from financial development to growth can be multidirectional and depends on the level of targeted and actual inflation.

The next step was to test the models in the samples that represented high-income countries. The results obtained are summarized in Tables 6 and 7.

Table 6. Estimations of financial deepening impact. High-income countries.

Regressor	OLS		GMM-SYS			
			All Countries		Low Inflation	
	Linear Model	Nonlinear Model	Linear Model	Nonlinear Model	Linear Model	Nonlinear Model
1	**2**	**3**	**4**	**5**	**6**	**7**
L1.	–	–	0.258 *** (0.062)	0.242 *** (0.062)	0.182 ** (0.072)	0.167 (0.074)
L2.	–	–	−0.127 *** (0.038)	−0.134 *** (0.041)	−0.200 ** (0.073)	−0.231 (0.068)
FD	−0.157 *** (0.032)	0.250 (0.352)	−0.817 ** (0.366)	1.715 (6.468)	−1.138 ** (0.428)	4.726 (10.442)
$(FD)^2$	–	−0.049 (0.042)	–	−0.309 (0.790)	–	−0.679 (1.203)
Infl	0.098 ** (0.047)	0.106 ** (0.046)	−0.074 (0.115)	−0.062 (0.111)	−0.027 (0.128)	−0.029 (0.118)
Init_GDPpc	–	–	−0.180 (0.236)	−0.055 (0.298)	−0.213 (0.619)	−0.396 (0.603)
Tr_GDP	0.043 (0.029)	0.035 (0.030)	0.533 (0.464)	0.590 (0.491)	0.859 (0.578)	0.731 (0.643)
Gov_GDP	−0.192 ** (0.077)	−0.195 ** (0.077)	−0.87 (0.872)	−0.705 (0.567)	−1.128 (0.867)	−1.144 (0.899)
Educ	0.333 *** (0.112)	0.342 *** (0.112)	0.465 (1.422)	0.293 (1.407)	−0.032 (1.885)	0.193 (1.661)
Const	0.633 (0.386)	−0.176 (0.778)	4.625 (5.748)	−1.947 (14.604)	7.092 (7.666)	−3.486 (23.168)
AR(2) (*p*-value)	–	–	0.563	0.654	0.401	0.555
Sargan test (*p*-value)	–	–	1.0	1.0	1.0	1.0
N	54	54	54	54	36	36

Notes: Robust standard errors (and Robust Windmeijer standard errors) in parentheses. *** $p < 0.01$, ** $p < 0.05$.

As for studying the nature of the relationship between finance and growth, we do not find significant differences from the results described above and characterizing a more complete sample of countries. As before, the signs of the coefficients indicate either a negative relationship between financial expansion and long-term growth, or an inverted

U-shape of such a relationship (if we take into account the signs of the corresponding linear and quadratic coefficients), but the significance of the corresponding regression coefficients is not sufficient to confirm the non-linearity of the relationship in question (Table 6, Columns 5 and 7). From the above estimates, it is also impossible to unambiguously interpret the contribution of inflation, since, although the obtained coefficients have a negative sign, they are not statistically significant.

Table 7. Financial deepening impact and "finance-to-growth" transmission channels estimations with the inflation factor. High-income countries.

Regressor	All Countries of This Category		Low Inflation Countries	
1	**2**	**3**	**4**	**5**
L1.	0.251 *** (0.071)	0.225 *** (0.071)	0.140 (0.107)	0.184 *** (0.056)
L2.	−0.176 *** (0.056)	−0.121 *** (0.043)	−0.251 *** (0.088)	−0.166 *** (0.057)
FD	−1.401 * (0.782)	−0.671 ** (0.326)	−2.549 (1.932)	−0.924 (0.333)
Infl	−0.090 (0.170)	0.007 (0.104)	−0.089 (0.145)	−0.013 (0.120)
Init_GDPpc	−0.009 (0.293)	−0.139 (0.241)	−0.150 (0.565)	−0.326 (0.569)
Tr_GDP	0.558 (0.502)	0.707 * (0.383)	1.161 (0.765)	0.533 (0.523)
Gov_GDP	−0.952 (0.899)	−0.462 (0.671)	−.895 (1.018)	−1.036 (0.849)
Educ	0.843 (1.230)	0.005 (0.959)	1.102 (1.999)	0.270 (1.838)
FD × *GFCF*	0.465 (0.626)		0.822 (1.012)	
FD × *TFP*		0.135 *** (0.022)		0.129 *** (0.026)
Const	1.345 (5.694)	2.563 (3.717)	1.902 (9.829)	7.576 (6.028)
AR(2) (*p*-value)	0.279	0.236	0.708	0.833
Sargan test (*p*-value)	1.0	1.0	1.0	1.0
N	54	54	36	36

Notes: System GMM-techniques. Robust Windmeijer standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Let us consider the "financial transmission" coefficients. It turns out that, although the coefficients for the variable indicating the contribution of capital accumulation take higher values in comparison with the coefficients tracing the contribution of the total factors productivity, they lose statistical significance, while the productivity predictor' coefficients remain statistically significant at the 1% level. This conclusion is consistent with the previously obtained results, according to which in developed countries the primary channel of transmission from financial development to growth is the productivity channel [12,56]. At the same time, it should be noted that among the recently published works, there are also those studies that reveal a negative relationship between the expansion of the financial sector and the growth rate of the total factor productivity. An example of this kind of study is the work of S. Cecchetti and E. Kharroubi [57].

Is there a negative impact of inflation with the applied threshold value of 3% on the studied transmission mechanism? We do not detect such an influence. Thus, the coefficient

for the *DC_PsxTFP* variable, when excluding countries with relatively high inflation from the sample, did not increase (Table 7, Column 5), while the coefficient for the variable based on the capital accumulation indicator, although it increased, turned out to be statistically insignificant (Table 7, Column 4).

Expansion of the models evaluated in Columns 2–5 of Table 7 by adding a quadratic term does not significantly affect the result. As before, the coefficient of the variable responsible for the capital accumulation channel remains positive but insignificant and turns out to be somewhat smaller in value, while the coefficient of the variable of the factor productivity channel remains positive, varying in the range of 0.12–0.14, and significant with a high level of significance. The coefficients of the financial variable are the same as in the other model specifications: the linear one has a plus sign, the quadratic one has a minus sign.

The next steps of the study, as announced above, were to evaluate the models given by Equations (2), (4), and (5) on the other three sub-samples of countries. In fact, we found no significant differences in the results compared to the baseline model and the model for estimating the sample of high-income countries. Therefore, we have compiled these results into a single table (see Table 8), omitting the information concerning the control variables estimation.

Table 8. Financial deepening impact and "finance-to-growth" transmission channels estimations with the inflation factor. Other samples of countries.

	Upper-Middle-Income Countries				**Lower-Middle-Income Countries**				**Low-Income Countries**			
	All Countries of the Category		**Countries with Moderate Inflation**		**All Countries of the Category**		**Countries with Moderate Inflation**		**All Countries of the Category**		**Countries with Moderate Inflation**	
Infl	−0.069 (0.149)	−0.124 (0.131)	0.132 (0.124)	−0.075 (0.143)	0.034 (0.107)	0.055 (0.117)	0.030 (0.104)	0.142 (0.131)	−0.087 (0.106)	0.002 (0.118)	−0.087 (0.131)	0.063 (0.124)
FD × *GFCF*	0.831 (0.836)		1.536 (2.394)		0.341 (0.294)		−0.102 (0.660)		0.130 (0.223)		0.447 * (0.276)	
FD × *TFP*		0.143 *** (0.037)		0.058 (0.036)		0.061 ** (0.022)		0.070 ** (0.025)		0.132 *** (0.024)		0.123 *** (0.025)
N	39	39	20	20	45	45	36	36	26	26	20	20

Notes: System GMM-techniques. Robust Windmeijer standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

We found out that although in all the OLS regressions for all the sub-samples, the effect of inflation on growth in the model specifications of equations with financial variables and transmission channel variables is negative and statistically significant at least at the 1% level, this effect is not confirmed by the methods of dynamic panel data analysis. The coefficients tracing the capital accumulation channel remain generally positive but are statistically significant only in one of the sub-samples, namely, in low-income countries with moderate inflation. Although this result is very specific, it can still support the conclusion that follows from the theoretical assumptions that the undesirability of high inflation is due to its negative effect on the motivation to invest.

Considering the criticism of studies using the dynamic panel data analysis technique presented in D. Roodman and other authors' works [58,59] (the criticism of the method used is that the effectiveness of estimates quite often suffers from too many internal instruments of the model. In particular, it occurs in case of violation of the condition "large N with small T". Indeed, in our case, the estimates were carried out for a fairly long time period, while the unavailability of data, as well as the need to narrow the consideration of a certain group of countries, determined the reduction in the number of objects), we undertook additional calculations related to the estimation of regression Equations (4) and (6), aimed at overcoming potential vulnerabilities of the model. To do this, we transformed the original time-series by calculating the 5-year averages of the indicators under consideration. Previously, we extended the time coverage of the data to the period of 1990–2019. As a result, we obtained a sample of data with six non-overlapping 5-year intervals. The

calculations made allowed us to significantly reduce the number of instruments in the evaluated models. In addition, we can expect that the estimates found more accurately characterize the phenomena we analyze, due to the elimination of the influence of the business cycle. Our results are presented in Tables 9 and 10.

Table 9. Linear and nonlinear models of the relationship between finance and growth with the inflation factor. Panel with 5-year averages.

Regressor	OLS		GMM-SYS			
			All Countries		Low Inflation	
	Linear Model	Nonlinear Model	Linear Model	Nonlinear Model	Linear Model	Nonlinear Model
1	**2**	**3**	**4**	**5**	**6**	**7**
L1.	–	–	0.226 *** (0.072)	0.178 ** (0.083)	0.122 (0.156)	0.110 (0.156)
L2.	–	–	−0.004 (0.040)	−0.019 (0.040)	−0.086 (0.094)	−0.087 (0.090)
FD	0.053 ** (0.047)	0.285 *** (0.088)	−0.481 *** (0.084)	0.064 (0.229)	−0.542 *** (0.130)	−0.330 (0.350)
$(FD)^2$	–	−0.037 ** (0.013)		−0.082 ** (0.040)		−0.036 (0.060)
Infl	−0.180 *** (0.047)	−0.183 *** (0.046)	−0.214 *** (0.080)	−0.191 ** (0.082)	−0.184 (0.137)	−0.193 (0.131)
Init_GDPpc	−0.131 *** (0.016)	−0.117 *** (0.017)	−0.069 (0.068)	−0.047 (0.075)	−0.098 (0.085)	−0.091 (0.087)
Tr_GDP	0.045 (0.028)	0.045 (0.029)	0.895 *** (0.122)	0.843 *** (0.137)	0.712 *** (0.189)	0.719 *** (0.188)
Gov_GDP	−0.167 *** (0.058)	−0.192 *** (0.058)	0.191 (0.171)	0.174 (0.184)	0.218 (0.328)	0.206 (0.313)
Educ	0.496 *** (0.070)	0.471 *** (0.071)	0.511 ** (0.224)	0.378 (0.234)	0.650 ** (0.325)	0.649 ** (0.303)
Const	0.436 ** (0.196)	0.140 (0.225)	−2.906 *** (0.744)	−3.271 *** (0.90)	−1.968 (0.970)	−2.255 (1.088)
AR(2) (*p*-value)	–	–	0.523	0.821	0.070	0.059
Sargan test (*p*-value)	–	–	0.581	0.537	0.091	0.113
N	151	151	151	151	109	109

Notes: System GMM-techniques. Robust Windmeijer standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$.

As can be seen, the main findings that follow from these estimates are consistent with those given above. Thus, non-linearity, namely, the inverted U-shaped relationship between finance and growth, is detected using the OLS model, whereas in panel regressions this relationship is not detected (Table 9). It is noteworthy that both of the studied finance-to-growth transmission channels are significant (Table 10). The coefficients of multiplicative variables have a plus sign in linear models. Testing for non-linearity indicates that the capital accumulation channel shows an inverted U-shape. Moreover, in these estimates, we find the negative impact of inflation on growth in six of the ten specifications of the regression equations. At the same time, in the samples of countries with more moderate inflation, the negative impact of inflation was slightly smaller. We also note that the coefficient for the capital accumulation variable is slightly higher, which can be considered as evidence that controlling inflation can favor the operation of the studied transmission channels.

Table 10. Financial deepening impact and "finance-to-growth" transmission channels estimations with the inflation factor. Panel with 5-year averages.

Regressor	All Countries of Sample		Countries with Moderate Inflation	
1	**2**	**3**	**4**	**5**
L1.	0.103 (0.081)	0.121 (0.102)	0.051 (0.138)	0.052 (0.134)
L2.	−0.050 (0.044)	−0.007 (0.043)	−0.133 * (0.080)	−0.049 (0.063)
FD	−1.138 *** (0.178)	−0.429 *** (0.096)	−1.342 *** (0.294)	−0.478 *** (0.140)
Infl	−0.266 *** (0.078)	−0.063 (0.079)	−0.239 * (0.133)	−0.058 (0.096)
Init_GDPpc	−0.086 (0.079)	−0.0277 (0.064)	−0.022 (0.099)	−0.091 (0.070)
Tr_GDP	0.729 *** (0.144)	0.788 *** (0.154)	0.529 *** (0.178)	0.591 *** (0.160)
Gov_GDP	0.066 (0.154)	−0.075 (0.181)	0.096 (0.186)	−0.017 (0.214)
Educ	0.369 (0.242)	0.262 (0.267)	0.351 (0.330)	0.498 (0.339)
FD × *GFCF*	0.682 *** (0.129)		0.821 *** (0.188)	
FD × *TFP*		0.137 *** (0.027)		0.139 *** (0.031)
Const	−3.436 *** (0.960)	−1.754 ** (0.697)	−3.228 *** (1.133)	−0.908 (0.813)
AR(2) (*p*-value)	0.958	0.969	0.111	0.286
Sargan test (*p*-value)	0.608	0.274	0.062	0.375
N	151	151	109	109

Notes: System GMM-techniques. Robust Windmeijer standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

In the development of the model presented by Equation (6), we additionally introduced two dummy variables alternately and simultaneously, which could shed light on the possible hardships of inflation and on the willingness of monetary authorities to follow a clear policy of targeting inflation and keeping its rates in a prescribed range. The first of these dummy variables was created on the basis of calculation of the variance of the inflation rate over a given period for each country. If the obtained indicator was lower than the average value of the inflation variance for the corresponding category of countries (for example, high income), the corresponding dummy variable was assigned the value 0, otherwise it was assigned the value 1. Formally, this will be written as follows:

$$v_{jt}^{*} = Ent\frac{Sign\left(v_{jt} - v_{j}^{0}\right) + 1}{2} \tag{10}$$

where v_{jt} is the current (corresponding to year t) value of the variance of inflation in a country of the category (group) of countries j; v_{j}^{0} is the threshold value of inflation, defined above as the average for category j; v_{jt}^{*} is the reduced current value of the variance of inflation variable in binary form.

The second variable was based on data on the years of introduction of the inflation targeting regime in various countries. This variable was assigned the value 0 if this regime was not introduced and 1, since its introduction in the country. (Data on the period of introduction of a full-fledged inflation targeting regime were borrowed from the work of researchers from the Bank for International Settlements [60]. We also use more recent data provided by central banks of some countries.)

The results of the estimates of the regression equations in the new model specification showed the following. Adding these variables does not affect the indicators showing a significant role of inflation and the operation of finance-to-growth transmission channels. The coefficient with inflation volatility variable, as one might expect, has a negative sign, but is not statistically significant. (Presumably, this result is due to the fact that, as shown in the study by the European Central Bank, over the past two decades, the volatility of inflation has been the same in different countries, even taking into account the intensity of monetary policy [61].) The coefficient of the inflation targeting variable turns out to be positive and, in some model specifications, significant at the 10% level. The last of the above-mentioned remarks supports the fact that a balanced policy of monetary regulation creates significant conditions for economic growth, but these conditions do not affect the credit channel for financing the economy.

Finally, from the results we have obtained, we are more confident that the most reliable channel of finance-to-growth transmission is the total factor productivity channel. The coefficient of the *DC_PsxTFP* variable has a positive sign everywhere and is statistically significant with the exception of one model being tested. This result, as stated above, is applied more to high-and middle-income countries but not to low-income countries [12]. However, in our study, such a differentiation of the role of this factor as determining the impact of financial development on growth is not found. Moreover, we note that, apparently, the average rate of inflation does not affect the operation of this transmission channel, at least this effect is not detected by the methods used in the study. (The main method, as it is known, was to build different groups with different average inflation. We confirm that the change in the threshold value of the average inflation in these groupings does not affect our conclusions. However, we do not exclude that alternative methods of testing our hypothesis, for example, based on the methods of time series analysis applied to particular countries, could lead to other conclusions.)

While referring to the findings contained in a large number of studies which interpret the dependence of long-term growth on financial development as nonlinear, we additionally tested the hypothesis of a possible nonlinear nature of the dependence of economic growth on the variables responsible in our study for the finance-to-growth transmission channels. Based on theoretical assumptions, it should be assumed that the non-linearity of the finance–growth relationship can be explained by the non-linearity imported into our model of the variable responsible for the capital accumulation channel. Our calculations show that such non-linearity is highly probable. Indeed, the coefficients of the linear and quadratic interaction terms that capture the contribution of fixed capital accumulation have different signs. However, among the pairs of coefficient estimates obtained in various model specifications (linear and nonlinear terms of the variable of interest), as a rule, only one is statistically significant at the level of at least 10%. The result noted here is consistent with well-known models that assume the marginal return on investment decreases.

In addition, we note that the non-linearity of the dependence of economic growth on the contribution of financial development to the growth of factors productivity is not found in our models, which is quite an expected result.

We also briefly mention some of the related results of the evaluation of the considered econometric models. Thus, we have found that the coefficients for the variable "General government expenditures to GDP" are almost always estimated with a negative sign. A stable negative sign and a high significance of the coefficient for this variable indicate either an unsatisfactory distribution of these incomes on average, a low allocative efficiency of the public finance system, or a countercyclical policy of government spending (higher

expenditures on average are more often seen in periods when the economy slows down or stagnates, on the contrary, when the economy grows, governments try to reduce spending or, at least, do not increase them).

4. Discussion

The study sheds light on the impact of inflation on economic growth and the role of inflation in the transmission from financial development to growth. Dynamic panel data models we applied herein show that the impact of inflation on growth is predominantly negative. This impact becomes less pronounced when the estimate is made for a sample of low to moderate inflation countries. At the same time, we can say that the impact of inflation on growth is difficult to discern. (In our study, the manifestation of this was that although most of the estimates of the coefficient responsible for inflation were negative and statistically significant; however, some of them turned out to be negative but not statistically significant, while the remaining ones were positive.) One of the ways to characterize this impact is to conduct an analysis separately in groups of countries with high and moderate inflation. These results are consistent with the conclusions of scientists analyzing the relationship between inflation and GDP growth. Thus, O. Blanchard et al. argue that the effects of inflation on growth are barely sensible when inflation is in single digits [62]. Extensive literature today shows that the relationship between inflation and growth obeys regularities, according to which the negative impact of inflation occurs only after its rates reach a certain threshold or step over it (see [39,63]).

When analyzing the transmission channels from finance to growth, we found the contribution of the capital accumulation channel to be more economically significant, and the contribution of total factor productivity channel to economic growth is more reliable. Partly, these findings are at odds with the results obtained by previous authors, which showed that the channel of total factor productivity is more important in the transmission from finance to growth [10] and also that in high-income countries the productivity channel is more important, in lower-income countries the capital accumulation channel is [56]. Our conclusion is that the productivity channel is important and significant for all groups of countries, regardless of income level, whereas the channel for capital accumulation is indeed more important in low-income countries, but only in those where policymakers have been able to curb inflation. This result is consistent with theoretical assumptions and is useful for the authorities, since it shows that the success of policies aimed at increasing economic growth through increased investment and fixed capital accumulation depends on the success of monetary policy aimed at controlling inflation.

Paying attention to the fact that, according to our estimates, the contribution of productivity turned out to be lower than the contribution of capital accumulation, let us point out two circumstances that favored this conclusion. Firstly, in our study, we worked with only one indicator of financial development—domestic credit to the private sector as percent of GDP. (In addition, it is obvious the finance-growth literature has not thoroughly covered the issue of transmission channels yet. Authors mainly used financial depth indicators but used other types of indicators, particularly the accessibility and efficiency ones much more rarely.) At the same time, according to a number of studies, capital market mechanisms are more important for productivity than the institutions of the credit market [64].

Secondly, in spite of the importance of productivity, it may not necessarily be dominant at all times. It is possible that the business cycles, combined with financial ones, introduce an alternation in leadership of productivity growth and capital accumulation as important channels for growth. As applied to the studied period, the world faces a cyclical slowdown in productivity growth. Indeed, credit is an important source of funds for increasing stock of fixed capital in all countries. In turn, the fixed capital formation constitutes the basis for increasing productivity only on the condition that money is directed to more productive sectors and enterprises. However, this kind of distribution of investment can be hampered by various frictions (among such frictions, in our opinion, distortions introduced

by monetary policy are of great importance. First of all, we paid attention to the policy of quantitative easing, which has a strong influence on allocative processes in the economy of both those countries whose monetary authorities have pursued such a policy in recent years, and other countries with weaker (and therefore less independent in terms of portfolio solutions) by financial markets.) Among such frictions, externalities (distortions) that are caused by monetary policy are of great importance. First of all, let us pay attention to the policy of quantitative easing, which has a strong influence on allocative processes in the economy of both those countries whose monetary authorities have pursued such a policy in recent years and other countries with weaker (and therefore more dependent on the largest markets in terms of portfolio decisions) financial markets. As a result, suboptimal allocation decisions lead to a slowdown in productivity growth. As recent studies show, this slowdown has really become a serious problem a lot of countries face. The duration of decline in productivity growth period coincides by $\frac{3}{4}$ with the period covered by our study. (The time has been particularly unfavorable since the events known as the Great Recession of 2007–2009, when the decline in labor productivity affected about 70 percent of countries, regardless of their level of development [65].) The poor dynamics of productivity growth observed over the past 20 years is one of the significant causes why, as our paper found, the contribution of productivity to GDP growth has decreased whereas the contribution of the capital formation has increased.

Thirdly, as T. Beck et al. recently showed [66], the liquidity created by banks promotes only tangible investment, so that the industries using intangible assets do not benefit from the expansion of bank credit. This is a very important circumstance for us, since it can be directly related to our results, which are that capital accumulation turns out to be a more economically significant consequence of credit deepening in comparison with the growth in country-level TFP.

Finally, let us touch on the issue of future research directions to continue our study. As far as the authors are informed, the study of the role of monetary conditions for the finance to growth transmission channels' functioning has hardly been undertaken before. In this paper, we have touched upon only one of these conditions, namely, price stability. Exploring the role of other correlates, in particular, real interest rates, is in our opinion a promising area of further studies. This can be explained both by the fact that the interest rate is the main policy instrument of central banks and by the fact that situations that arise due to the interest rate being relatively high or low can significantly change in the conditions for the financial sector's functioning.

Thus, under the negative real interest rates, the role of the financial sector in overcoming the problem associated with asymmetric information increases sharply, since such conditions induce more firms and households to demand external financing and to expand this demand. On the contrary, positive real rates can restrain investment activity and at the same time increase the role of capital markets, creating more preconditions for the growth of productivity channel's weight in the transmission from finance to growth.

In addition, the very study of inflation as a factor influencing the channels of capital accumulation and productivity growth in the analysis of the link between finance and growth has good prospects if we talk about the use of alternative approaches to assessing the impact of inflation on growth and transmission channels. In particular, in our work, we use the variant of grouping countries by inflation rate, which is based on the assumption that the threshold after which inflation will hamper growth is 3% for high-income countries and 13% for the rest of the sample countries, explaining this by the parameters of monetary policies of developed countries and the results obtained by Russo and Wachtel concerning the nonlinear nature of the relationship between finance and growth [40]. At the same time, it is advisable to apply other criteria for grouping, including those based on the results of studies that investigated the threshold levels of inflation in connection with the "inflation-growth" analysis [39]. Finally, it is important, in our opinion, to find out what the significance of inflation for transmission channels from finance to growth is, if we talk in one case about short periods and in the other case about long periods of high inflation.

5. Conclusions

Summing up the results of the study, we will focus on the following conclusions.

First, the constructed econometric model for assessing the work of transmission channels from financial development to economic growth, taking into account monetary factors, indeed allows us to identify significant characteristics of the statistical relationship between financial development and economic growth in countries with different levels of monetary factors. It complements the chain of findings related to the impact of macroeconomic stability on the finance–growth link, while avoiding categorical claims that, for example, high (low) inflation has an unfavorable (beneficial) effect on the finance–growth relationship, as presented in the recent review by K. Ehigiamusoe and M. Samsurijan [26].

Second, we record similar characteristics of the relationship between growth and financial depth, calculated using indicators of the ratio of loans granted to private sector (as a % of GDP), for categories of countries with different income levels. Since the average inflation varies greatly in these categories of countries, the impact of inflation was assessed separately for each category. Nevertheless, we come to the same finding that finance-to-growth transmission is more reliable if the channel of the total factor productivity is concerned while the channel of capital accumulation is more economically significant. This finding partly coincides with the previously obtained ones (for example, [10]), but at the same time draws attention to the global problem of declining productivity growth [65] and raises the issues of finding out the causes of the decline of capital accumulation effectiveness that has been taking place in the last quarter of a century including the explanation of what prevents financial systems from being allocatively efficient at present (an attempt to solve the latter issue can be found in [66]).

Third, inflation in various categories of countries by per capita income does not manifest itself in any significant way. The addition or exclusion of countries with extremely high average annual inflation over the current 25-year period has little effect on the transmission variable coefficients, indicating that high average inflation over the period does not indicate a distortion of the transmission channels. It is also common for all categories of countries that there is no obvious negative impact of inflation on growth. On the one hand, this contradicts many empirical results that show a negative relationship between (high) inflation and growth [31,32], on the other hand, given the sample's peculiar properties (it covers the period in which an increasing number of countries implemented and succeeded in anti-inflationary policy), it might not be possible to capture this inverse relationship by means of the types of groupings that are used in the paper. Thus, we are inclined to conclude that the assessment of the relationship between inflation and growth is becoming more the aim of a case study than of works using panel datasets covering a large number of countries.

Fourth, referring to the economic policy measures that the outcomes of this study relate to, we note the following. First of all, we find out that the strategies adopted by a significant number of central banks that rely on policies to contain and target inflation are correct, taking into account the fact that, having achieved some success in recent decades, the most diverse categories of countries, as our estimates show, do not experience a negative impact of inflation on growth, or this impact is extremely small. This is supported, among other things, by the evaluation of models with the addition of a dummy variable that controls the inflation targeting regime. Finally, we did not find a significant impact of the inflation and its volatility on the operation of the TFP finance-to-growth transmission channel in the studied categories of countries in relation to the studied observation period. At the same time, the capital accumulation channel is still sensitive to inflation and, apparently, has the characteristics of non-linearity in its relationship with growth, so that the over-accumulation of fixed capital in combination with the expansion of financial depth tends to lead to a negative effect of further capital growth and financial depth on economic growth. The latter generally corresponds to the spirit of the literature, which reveals a nonlinear relationship between finance and growth [52,54] and, moreover, corresponds to more special results in which the hypothesis of non-linearity is not confirmed for all

financial deepening indicators, but only for the measure of domestic credit to the private sector, as recently shown by I. Matei [67].

Fifth, since this article presents the results of the influence of only one of the possible monetary conditions and monetary policy emanations, namely, inflation, we do not rule out that studying other conditions, primarily the interest rate, will have a more tangible impact on the transmission mechanism of the relationship between financial and economic development. Such a study should be considered a promising direction for further research of the problem addressed in this paper.

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Appendix A

Table A1. Basic sample of countries grouped by inflation rate.

Moderate Inflation Countries *	High Inflation Countries
Albania, Algeria, Argentina, Armenia, Australia, Austria, The Bahamas, Bahrain, Bangladesh, Barbados, Belgium, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Comoros, Rep. Congo, Costa Rica, Cote d'Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, Egypt, Arab Rep., El Salvador, Equatorial Guinea, Eritrea, Estonia, Eswatini, Ethiopia, Finland, France, Gabon, The Gambia, Germany, Greece, Guatemala, Guinea, Guinea-Bissau, Haiti, Honduras, Hong Kong SAR (China), Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Rep.Korea, Kyrgyz Republic, Latvia, Lebanon, Lesotho, Liberia, Lithuania, Luxembourg, Macao SAR (China), Madagascar, Malaysia, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Morocco, Mozambique, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, North Macedonia, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Rwanda, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Syrian Arab Republic, Tanzania, Thailand, Timor-Leste, Togo, Trinidad and Tobago, Tunisia, Uganda, United Arab Emirates, United Kingdom, United States, Uruguay, Vanuatu, Vietnam, West Bank and Gaza	Angola, Azerbaijan, Belarus, Bulgaria, Dem. Rep. Congo, Ecuador, Ghana, Georgia, Iran, Islamic Rep., Kazakhstan, Lao PDR, Malawi, Montenegro, Myanmar, Nigeria, Romania, Russian Federation, Serbia, South Sudan, Sudan, Suriname, Tajikistan, Turkey, Venezuela RB, Ukraine, Uzbekistan, Zambia, Zimbabwe, Rep. Yemen

* For this sample of countries, inflation was considered moderate if its average annual rate did not exceed 13 per cent for the entire observation period.

Appendix B

Table A2. Sample of high-income countries grouped by inflation rate.

Low Inflation Countries *	High Inflation Countries
Australia, Austria, The Bahamas, Bahrain, Belgium, Brunei Darussalam, Canada, Croatia, Cyprus, Denmark, Finland, France, Germany, Greece, Hong Kong SAR (China), Ireland, Israel, Italy, Japan, Rep. Korea, Luxembourg, Macao SAR (China), Malta, Netherlands, New Zealand, Norway, Oman, Panama, Portugal, Saudi Arabia, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States	Barbados, Chile, Czech Republic, Estonia, Hungary, Iceland, Latvia, Lithuania, Mauritius, Poland, Qatar, Romania, Seychelles, Slovak Republic, Slovenia, Trinidad and Tobago, United Arab Emirates, Uruguay

* For the category of high-income countries, inflation was considered high if its average annual rate in the country exceeded 3 per cent. (When setting the threshold values for moderate/high inflation, we used the results from the literature on the relationship between inflation and economic growth, as well as between finance and growth, and also took into account the declining trends in average inflation rates over the past 15–20 years. Therefore, M. Khan and S. Senhadji [37], having studied the presence of threshold effects in the inflation–growth relationship in developing and developed countries (using a set of panel data covering 140 countries for the period 1960–1998), found that for developed countries, the threshold above which inflation has a negative impact on economic growth equals 3%, while for developing countries, it equals 11–12%. The results obtained by P. Rousseau and P. Wachtel [40] regarding the problems of finance and growth were mentioned above.)

Appendix C

Table A3. Sample of upper-middle-income countries grouped by inflation rate.

Moderate Inflation Countries *	High Inflation Countries
Albania, Belize, Bosnia and Herzegovina, Botswana, China, Colombia, Dominican Republic, Equatorial Guinea, Gabon, Guatemala, Jordan, Lebanon, Malaysia, Mexico, Namibia, North Macedonia, Paraguay, Peru, South Africa, Thailand	Argentina, Armenia, Azerbaijan, Belarus, Brazil, Bulgaria, Costa Rica, Ecuador, Georgia, Indonesia, Islamic Rep. Iran, Jamaica, Kazakhstan, Montenegro, Russian Federation, Serbia, Suriname, Turkey, RB Venezuela

* For the category of upper-middle-income countries, inflation was considered high if the average annual rate of inflation in the country exceeded 9 per cent.

Appendix D

Table A4. Sample of lower-middle-income countries grouped by inflation rate.

Moderate Inflation Countries *	High Inflation Countries
Algeria, Bangladesh, Benin, Bhutan, Bolivia, Cabo Verde, Cambodia, Cameroon, Comoros, Rep. Congo, Cote d'Ivoire, Arab Rep. Egypt, El Salvador, Eswatini, Honduras, India, Kenya, Kyrgyz Republic, Lesotho, Mauritania, Moldova, Mongolia, Morocco, Nepal, Nicaragua, Pakistan, Papua New Guinea, Philippines, Senegal, Sri Lanka, Tanzania, Timor-Leste, Tunisia, Vanuatu, Vietnam, West Bank and Gaza	Angola, Ghana, Lao PDR, Myanmar, Nigeria, Ukraine, Uzbekistan, Zambia, Zimbabwe

* For the category of lower-middle-income countries, inflation was considered high if its average annual rate in the country exceeded 13 per cent.

Appendix E

Table A5. Sample of low-income countries grouped by inflation rate.

Moderate Inflation Countries *	High Inflation Countries
Burkina Faso, Burundi, Central African Republic, Chad, Eritrea, Ethiopia, The Gambia, Guinea, Guinea-Bissau, Haiti, Liberia, Madagascar, Mali, Mozambique, Niger, Rwanda, Sierra Leone, Syrian Arab Republic, Togo, Uganda	Dem. Rep. Congo, Malawi, South Sudan, Sudan, Tajikistan, Yemen, Rep.

* For the category of low-income countries, inflation was considered high if its average annual rate in the country exceeded 13 per cent.

References

1. Eschenbach, F. *Finance and Growth: A Survey of the Theoretical and Empirical Literature*; Tinbergen Institute Discussion Paper No. TI 2004-039/2; Erasmus University Rotterdam (EUR): Rotterdam, The Netherlands, 2004.
2. Beck, T. Finance, Institutions, and Development: Literature Survey and Research Agenda. In *The Handbook of Economic Development and Institutions*; Baland, J.-M., Bourguignon, F., Platteau, J.-P., Verdier, T., Eds.; Princeton University Press: Princeton, NJ, USA, 2020; pp. 218–252. [CrossRef]
3. Merton, R.C. Operation and regulation in financial intermediation. A functional perspective. In *Operation and Regulation of Financial Markets*; Economic Council: Stockholm, Sweden, 1993.
4. Rajan, R.; Zingales, L. Financial Dependence and Growth. *Am. Econ. Rev.* **1996**, *88*, 559–586. [CrossRef]
5. Bencivenga, V.R.; Smith, B.D. Financial Intermediation and Endogenous Growth. *Rev. Econ. Stud.* **1991**, *58*, 195. [CrossRef]
6. Bencivenga, V.R.; Smith, B.D.; Starr, R.M. Transactions Costs, Technological Choice, and Endogenous Growth. *J. Econ. Theory* **1995**, *67*, 153–177. [CrossRef]
7. King, R.G.; Levine, R. Finance and Growth: Schumpeter Might Be Right. *Q. J. Econ.* **1993**, *108*, 717–737. [CrossRef]
8. De Gregorio, J.; Guidotti, P.E. Financial development and economic growth. *World Dev.* **1995**, *23*, 433–448. [CrossRef]
9. Barro, R.J. Economic Growth in a Cross Section of Countries. *Q. J. Econ.* **1991**, *106*, 407. [CrossRef]
10. Beck, T.; Levine, R.; Loayza, N. Finance and the sources of growth. *J. Financ. Econ.* **2000**, *58*, 261–300. [CrossRef]
11. Acemoglu, D.; Aghion, P.; Zilibotti, F. Distance to Frontier, Selection, and Economic Growth. *J. Eur. Econ. Assoc.* **2006**, *4*, 37–74. [CrossRef]
12. Rioja, F.; Valev, N. Finance and the Sources of Growth at Various Stages of Economic Development. *Econ. Inq.* **2004**, *42*, 127–140. [CrossRef]
13. Krinichansky, K.V.; Sergi, B.S. Financial Development and Economic Growth in Russia. In *Modeling Economic Growth in Contemporary Russia*; Bruno, S.S., Ed.; Emerald Publishing: Bingley, UK, 2019; pp. 1–28. [CrossRef]
14. Tilly, R. Germany, 1815–1870. In *Banking in the Early Stages of Industrialization: A Study in Comparative Economic History*; Cameron, R., Ed.; Oxford University Press: New York, NY, USA, 1967; pp. 151–182.
15. Demirgüç-Kunt, A.; Feyen, E.; Levine, R. The Evolving Importance of Banks and Securities Markets. *World Bank Econ. Rev.* **2013**, *27*, 476–490. [CrossRef]
16. Gambacorta, L.; Yang, J.; Tsatsaronis, K. Financial Structure and Growth, BIS Quarterly Review, Bank for International Settlements. March 2014. Available online: https://www.bis.org/publ/qtrpdf/r_qt1403e.htm (accessed on 9 September 2021).
17. Diamond, D.W. Financial Intermediation and Delegated Monitoring. *Rev. Econ. Stud.* **1984**, *51*, 393–414. [CrossRef]
18. Stiglitz, J.E. Credit Markets and the Control of Capital. *J. Money Crédit Bank.* **1985**, *17*, 133. [CrossRef]
19. Stulz, R.M. Financial Structure, Corporate Finance and Economic Growth. *Int. Rev. Financ.* **2000**, *1*, 11–38. [CrossRef]
20. Levine, R. Chapter 12 Finance and Growth: Theory and Evidence. In *Handbook of Economic Growth*; Elsevier: Amsterdam, The Netherlands, 2005; Volume 1, pp. 865–934.
21. Boot, A.W.A.; Thakor, A.V. Financial System Architecture. *Rev. Financ. Stud.* **1997**, *10*, 693–733. [CrossRef]
22. Allen, F.; Gale, D. Diversity of Opinion and Financing of New Technologies. *J. Financ. Intermed.* **1999**, *8*, 68–89. [CrossRef]
23. Thiel, M. *Finance and Economic Growth—A Review of Theory and the Available Evidence*; European Economy—Economic Papers 2008–2015; Directorate General Economic and Financial Affairs (DG ECFIN), European Commission: Brussel, Belgium, 2001; p. 158.
24. Obstfeld, M. Risk-Taking, Global Diversification, and Growth. *Am. Econ. Rev.* **1994**, *84*, 10–29. Available online: https://www.jstor.org/stable/2117774 (accessed on 18 October 2021).
25. Razzak, W.; Bentour, E.M. *The Transitional Dynamic of Finance Led Growth*; EERI Research Paper Series EERI RP 2020/05; Economics and Econometrics Research Institute (EERI): Brussel, Belgium, 2020.
26. Ehigiamusoe, K.U.; Samsurijan, M.S. What matters for finance-growth nexus? A critical survey of macroeconomic stability, institutions, financial and economic development. *Int. J. Financ. Econ.* **2021**, *26*, 5302–5320. [CrossRef]
27. Krinichanskii, K.; Annenskaya, N. Monetary requirements for financial development. *Financ. Crédit* **2020**, *26*, 349–368. [CrossRef]

28. Mundell, R.A. Inflation and Real Interest. *J. Polit. Econ.* **1963**, *71*, 280–283. [CrossRef]
29. Tobin, J. Money and Economic Growth. *Econometrica* **1965**, *33*, 671. [CrossRef]
30. Stockman, A.C. Anticipated inflation and the capital stock in a cash in-advance economy. *J. Monet. Econ.* **1981**, *8*, 387–393. [CrossRef]
31. Fischer, S. The role of macroeconomic factors in growth. *J. Monet. Econ.* **1993**, *32*, 485–512. [CrossRef]
32. Barro, R. Inflation and Economic Growth. *Inflat. Econ. Growth* **1995**, *41*, 3–26. [CrossRef]
33. Bruno, M.; Easterly, W. Inflation Crises and Long-Run Growth. *J. Monet. Econ.* **1998**, *41*, 3–26. [CrossRef]
34. Bittencourt, M. Inflation and financial development: Evidence from Brazil. *Econ. Model.* **2011**, *28*, 91–99. [CrossRef]
35. Champ, B.A.; Boyd, J.H. Inflation, Banking, and Economic Growth. Economic Commentary, Federal Reserve Bank of Cleveland. 2006. Available online: https://www.clevelandfed.org/en/newsroom-and-events/publications/economic-commentary/economic-commentary-archives/2006-economic-commentaries/ec-20060515-inflation-banking-and-economic-growth.aspx (accessed on 30 September 2021).
36. Andolfatto, D.; Berentsen, A.; Martin, F.M. *Money, Banking and Financial Markets*; Review of Economic Studies; Oxford University Press: Oxford, UK, 2019; Volume 87, pp. 2049–2086. [CrossRef]
37. Semlali, A.S.; Khan, M.S.; Senhadji, A. Threshold Effects in the Relationship between Inflation and Growth. *IMF Work. Pap.* **2000**, *48*, 1. [CrossRef]
38. Drukker, D.; Gomis-Porqueras, P.; Hernandez-Verme, P. *Threshold Effects in the Relationship between Inflation and Growth: A New Panel-Data Approach*; Working Paper; University Library of Munich: Munich, Germany, 2005.
39. Kremer, S.; Bick, A.; Nautz, D. Inflation and growth: New evidence from a dynamic panel threshold analysis. *Empir. Econ.* **2013**, *44*, 861–878. [CrossRef]
40. Rousseau, P.L.; Wachtel, P. Inflation thresholds and the finance–growth nexus. *J. Int. Money Financ.* **2002**, *21*, 777–793. [CrossRef]
41. Holtz-Eakin, D.; Newey, W.; Rosen, H.S. Estimating Vector Autoregressions with Panel Data. *Econometrica* **1988**, *56*, 1371. [CrossRef]
42. Arellano, M.; Bond, S. Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *Rev. Econ. Stud.* **1991**, *58*, 277. [CrossRef]
43. Arellano, M.; Bover, O. Another look at the instrumental variable estimation of error-components models. *J. Econ.* **1995**, *68*, 29–51. [CrossRef]
44. Anderson, T.W.; Hsiao, C. Estimation of Dynamic Models with Error Components. *J. Am. Stat. Assoc.* **1981**, *76*, 598–606. [CrossRef]
45. Blundell, R.; Bond, S. Initial conditions and moment restrictions in dynamic panel data models. *J. Econ.* **1998**, *87*, 115–143. [CrossRef]
46. Windmeijer, F. A finite sample correction for the variance of linear efficient two-step GMM estimators. *J. Econ.* **2005**, *126*, 25–51. [CrossRef]
47. Aihounton, G.B.D.; Henningsen, A. Units of measurement and the inverse hyperbolic sine transformation. *Econ. J.* **2021**, *24*, 334–351. [CrossRef]
48. Burbidge, J.B.; Magee, L.; Robb, A.L. Alternative Transformations to Handle Extreme Values of the Dependent Variable. *J. Am. Stat. Assoc.* **1988**, *83*, 123. [CrossRef]
49. Krinichansky, K.; Fat'kin, A. Studying the «Vanishing Effect» of the Impact of Financial Development on Economic Growth: From the Cross-Country to the Subnational Scale. *Appl. Econom.* **2018**, *51*, 33–57. Available online: https://ideas.repec.org/a/ris/apltrx/0348.html (accessed on 15 October 2021).
50. Lind, J.T.; Mehlum, H. With or Without U? The Appropriate Test for a U-Shaped Relationship. *Oxf. Bull. Econ. Stat.* **2010**, *72*, 109–118. [CrossRef]
51. Sasabuchi, S. A test of a multivariate normal mean with composite hypotheses determined by linear inequalities. *Biometrika* **1980**, *67*, 429–439. [CrossRef]
52. Arcand, J.L.; Berkes, E.; Panizza, U. Too much finance? *J. Econ. Growth* **2015**, *20*, 105–148. [CrossRef]
53. Krinichansky, K.V. Non-Monotonic Impact of Financial Development on Economic Dynamics in the Russian Regions. *Reg. Econ. Sociol.* **2018**, *1*, 52–68.
54. Cave, J.; Chaudhuri, K.; Kumbhakar, S.C. Do banking sector and stock market development matter for economic growth? *Empir. Econ.* **2020**, *59*, 1513–1535. [CrossRef]
55. Rousseau, P.L.; Wachtel, P. What is happening to the impact of financial deepening on economic growth? *Econ. Inq.* **2011**, *49*, 276–288. [CrossRef]
56. Rioja, F.; Valev, N. Stock markets, banks and the sources of economic growth in low and high income countries. *J. Econ. Financ.* **2011**, *38*, 302–320. [CrossRef]
57. Cecchetti, S.; Kharroubi, E. *Why Does Financial Sector Growth Crowd out Real Economic Growth?* BIS Working paper No. 490; Bank for International Settlement: Basel, Switzerland, 2015.
58. Roodman, D. A Note on the Theme of Too Many Instruments. *Oxf. Bull. Econ. Stat.* **2009**, *71*, 135–158. [CrossRef]
59. Roodman, D. How to do Xtabond2: An Introduction to Difference and System GMM in Stata. *Stata J. Promot. Commun. Stat. Stata* **2009**, *9*, 86–136. [CrossRef]
60. Agénor, P.-R.; da Silva, L.A.P. *Integrated Inflation Targeting: Another Perspective from the Developing World*; Bank for International Settlements: Basel, Switzerland, 2019; Available online: https://www.bis.org/publ/othp30.pdf (accessed on 5 September 2021).

61. Balatti, M. *Inflation Volatility in Small and Large Advanced Open Economies*; Working Paper Series, No 2448; European Central Bank: Frankfurt, Germany, 2020. [CrossRef]
62. Blanchard, O.; Dell'Ariccia, G.; Mauro, P. Rethinking macroeconomic policy. IMF staff position note, SPN/10/03. *J. Money Credit Bank.* **2010**, *42*, 199–215. [CrossRef]
63. Baharumshah, A.Z.; Slesman, L.; Wohar, M.E. Inflation, inflation uncertainty, and economic growth in emerging and developing countries: Panel data evidence. *Econ. Syst.* **2016**, *40*, 638–657. [CrossRef]
64. Heil, M. Finance and Productivity: A Literature Review. Special Issue: Contemporary Topics in Finance: A Collection of Literature Surveys. *J. Econ. Surv.* **2018**, *32*, 1355–1383. [CrossRef]
65. Dieppe, A. *Global Productivity: Trends, Drivers, and Policies*; Advance Edition; World Bank: Washington, DC, USA, 2020.
66. Beck, T.; Döttling, R.; Lambert, T.; Van Dijk, M.A. *Liquidity Creation, Investment, and Growth*; CEPR Discussion Papers 14956; 2020; Available online: https://ideas.repec.org/p/cpr/ceprdp/14956.html (accessed on 12 October 2021).
67. Matei, I. Is financial development good for economic growth? Empirical insights from emerging European countries. *Quant. Financ. Econ.* **2020**, *4*, 653–678. [CrossRef]