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Article

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Sectoral allocations of domestic credit and their effects on economic growth in Ethiopia

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ABSTRACT

The optimal allocation of financial resources by well-established financial systems is crucial for fostering economic growth. Nevertheless, due to imperfections in real-world settings, financial systems inadvertently distribute credit to unproductive sectors, resulting in inefficiencies in economic performance. Thus, this study aims to investigate the sectoral allocations of credit and how, in turn, such credit allocations affect the performance of each economic sector, from 1991 to 2022. To this effect, it employed the Cross-Section Augmented Error Correction (CS-ECM) model, and this model has a PMG estimation technique; hence, heterogeneous (short-run) and homogeneous (long-run) coefficients are computed as a result. The descriptive results show that domestic credits that are allocated to agriculture, industry, services, and the private and public sectors are not only small but also misallocated to inefficient sectors. Similarly, the econometrics results indicate that credits given to the public and industry sectors have a negative effect on output growth in the short term, while credits distributed to the agricultural, service, and private sectors have a small but positive effect on growth. Besides, the long-term results show that the overall credit allocation to the economy has negative effects on growth, indicating credit misallocation has unfavorable long-term effects compared to short-term effects. Financial policies and strategies should therefore be designed to welcome foreign banks as well as capacitate the existing domestic financial institutions so that substantial financial resources can be mobilized, both from the external and internal economies, and distributed in such a way as to 'give more credit to an efficient sector'.

IMPACT STATEMENT

Since credit is essential to many business and economic endeavors, it ought to be distributed to the most prosperous industries, which make significant contributions to both economic expansion and improved living standards. Nonetheless, the majority of developing nations experience inefficiencies in their economic performance as a result of financial institutions lending to less productive economic sectors. This study also looks into the sectoral distribution of credit and how each Ethiopian economic sector performed from 1991 and 2022 as a result of these credit distributions. And the study's findings first showed that there is a misallocation of credit to less productive sectors in addition to financial institutions' inadequate lending to each industry. Second, it showed that the misallocation is the reason behind the negligible contributions of industry and the public sector to economic growth, as well as the little contributions of services, agriculture, and the private sector. As a result, these findings provide pertinent information to enterprises, sectors, and financial institutions. It also provides information for researchers who need to do more study in relevant fields. The results of this study are also very beneficial to policymakers, who should create proper financial and economic policies.

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1. Introduction

A well-developed financial sector opens up progressive ways for investments, economic growth, and living standards. That is, by identifying entrepreneurs with the highest likelihood of launching new products and production processes, it lowers information acquisition and processing costs, increases the rate

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of technological innovation, and then boosts the production and productivity of the economy. Similarly, an appropriate financial intermediation by the finance sector guarantees the effectiveness and efficiency of the financial system and distributes credits to the most advantageous economic sectors, which contribute a lot to economic growth and better quality of life (Temsas et al., 2021).

Bank credit, however, is unfortunately directed toward less productive economic sectors in the majority of developing nations; that is, the manufacturing sector is the largest consumer of bank credit, while the two dominant agriculture and service sectors still have low penetration in the domestic credit market. In other words, in these countries, the industrial and public sectors receive a large percentage of domestic credit from total advancement; therefore, the first question that naturally comes up at this point is related to the relative unwillingness of the banking sector to offer credit to the agricultural sector, even though this sector plays a significant role in the majority of developing economies in terms of output, employment, and foreign exchange (Asuquo & Ibiyingibo, 2021).

Likewise, out of the new loans that financial institutions supplied to various sectors in Ethiopia, approximately 31.9 percent were used to finance international trade; the remaining credits went to domestic trade (14.3 percent), industry (12.2 percent), mines, power, and water resources (8.4 percent), housing and construction (7.9 percent), transport and communication (6.7 percent), and agriculture (5 percent). Additionally, about 43.4 percent of domestic credits came from the two government-owned banks: Development Bank and Commercial Bank of Ethiopia, while other private banks and microfinance organizations provided the remaining 56.6 percent.

Moreover, though private-sector credit and domestic credit as a percentage of GDP climbed from 8.7 percent to 11.7 percent and from 28.3 percent to 32.1 percent in 2016, respectively, state-owned enterprises (SOEs), however, received an uneven amount of domestic credit (i.e. 17 percent of domestic credit between 2014 and 2016), indicating that, due to policy preferences for low-cost SOE financing, the domestic credit market intended to push out the private sector. Above all, according to the credit accessibility ranking in the 2017 Doing Business Report, Ethiopia ranks 170th out of 190 countries, indicating that it is among the lowest in the world and down two spots from the previous year's ranking. Similarly, the 2015 Enterprise Survey also indicated that only 7.8 percent of enterprise investment in Ethiopia is bank-financed, with the majority of investment (83.3 percent) coming from private sources, suggesting financial disintermediation in the nation's economy.

And the majority of developing nations, whose economic expansion is mostly supported by the expansion of the agricultural and service sectors, frequently exhibit these realities. This also attracted the interest of academics who made significant contributions to the credit-growth nexus themes. Additionally, in earlier empirical studies, some researchers looked at the connection between sectoral credit and economic growth, focusing on the credit given to particular industries and how much of that credit went into real GDP growth (Alzyadat, 2021; Chukwunweike, 2018, Tekilu et al., 2018; Ndubuisi, 2017; Were et al., 2012) and while this was going on, Qichun (2012), Muthusamy et al. (2018), Qinglu and Huan (2022) examined the relationship between sectoral credit and growth, taking into account the understanding that an appropriate allocation or reallocation of credit that has been distributed to various sectors has significant effects on its own sector growth as well as others sector output growth and overall economic growth in general; however, a crucial problem that has been overlooked in these studies is that, despite the dynamic nature of the models used in all of them, it is challenging to track the precise impact of sectoral credit allocations on the increase of output in each individual sector. Similar to these studies, Kirikkaleli and Athari (2020) and Athari et al. (2021a) examined the time and frequency dynamic causal link between sectoral credit (bank credit supply) and growth, although they used a novel estimation technique called the 'wavelet coherence test technique'; they calculated economic growth based on aggregate output (GDP per capita). Thus, this study aims to explore the distribution of credit across the various economic sectors and how, in turn, this credit distribution impacts the output growth of each sector independently in Ethiopia between 1991 and 2022.

In view of that, this study make the following contributions to economics and finance literatures: first, it investigated how efficiently domestic credit allocated to agriculture, industry, service, private, and public sectors in doing so it tried to find out to which sector domestic credit misallocated and to which sector should credit be reallocated; second, using time dynamic Cross-Section Augmented Error Correction Model technique, it examined the link between credit that provided to agriculture sector and agricultural output growth, credit that provided to industry sector and industrial output growth, credit that provided to service sector

and the growth of service sector in particular as well as credit that provided to private and public sectors and real GDP growth in general; third, another novelties of this study is it take into account the dependencies problem among agriculture, services, and industry output which otherwise results econometrics problems (i.e. parameters inconsistencies and biasedness). To sum up, as far as the researchers comprehend, this study offers novelties due to the aforementioned contributions, and the findings of the descriptive and econometric analyses provide the following important insights: First, the descriptive result reveals not only that banks provided an insufficient amount of credit to each sector but also that there is a misallocation of credit to less productive sectors. Second, the econometrics result reveals that domestic credit provided to agriculture, services, and the private sector has a positive but insignificant impact on growth, while credit provided to industry and the public sector has a negative impact on growth. Therefore, these results can be useful for researchers who need to carry out additional research on related areas or topics, as well as for policymakers who need to develop appropriate economic and financial policies.

2. Literature review

2.1. Theoretical literature review

Credit allocation refers to the distribution of cash and other credit resources among different users. Credit allocation efficiency is the process of extending more credit to sectors of the economy that generate higher GDPs. It has a lot to do with how well 'prices of financial assets provide market signals for resource allocation and market valuations reflect fundamentals' (Tobin, 1984). Financial markets fail to allocate resources efficiently due to a number of flaws that are not related to government intervention, such as missing markets, asymmetric and incomplete information, and different externalities that are not mediated by markets, in addition to the distorting effects of speculation on asset prices and resource allocation (Datta-Chaudhuri, 1990; Greenwald & Stiglitz, 1986). These kinds of market failures, which are more prevalent in developing nations than in developed ones, tend to impede learning, which is essential to modern industrialization. According to Friesen (1979), in the world of perfect market theory, there should not be an individual party with the ability to influence prices. All parties would have equal access to borrowing and lending conditions and circumstances. There would be no discriminatory taxes. There would be homogeneity, divisibility, and tradable financial titles, and there should not be information, transactions, or insolvency costs. Market imperfections, however, are the reason behind the existence of the financial intermediation theory (Allen & Santomero, 1997). In short, financial intermediaries fulfill the desires of various agent categories by mobilizing savings from various surplus units and then disbursing those funds to deficit units. In the process of carrying out this fund mobilization and allocation activity, financial intermediaries eliminate information asymmetry and transaction costs that would have arisen among the parties in direct dealing with each other. Ultimately, by doing this, financial intermediaries promote economic growth. According to Greenwood and Jovanovic (1990), financial intermediaries have the ability to stimulate economic growth by providing better information about firms, managers, and economic conditions. This is made possible by the demand for scarce funds from many entrepreneurs seeking capital, which makes it possible for financial intermediaries to provide better information about firms. In turn, this information leads to the funding of more promising businesses, which in turn stimulates more efficient credit allocation and further economic growth. Similar to this, the integration of the global financial markets gives domestic financial intermediaries the chance to network with those in other nations. This type of financial networking gives lenders knowledge about the reliability of all investors and their investments, allowing them to grant credit to dependable investments that in turn spur economic growth. However, the integration of global financial markets also results in financial and economic risks, as well as a feedback loop between these two risks (Kondoz et al., 2021). For this reason, credit ratings are crucial when taking calculated risks (Athari et al., 2021b). Alternatively, two opposing theories—the financial liberalization hypothesis and the financial repression hypothesis—also contribute significantly to the explanation of credit allocation. The former hypothesis is based on the use of regulated intermediation, which includes the use of credit ceilings, artificial interest rate ceilings, credit rationing, sectoral credit distribution, and directed credit programs by developing country governments to support economic growth. Such practices are mainly witnessed in the realistic world of the economy, where information is costly and highly imperfect. Hence, in this world, government involvement in credit allocation is justified because of information asymmetries that lead to the provision of credit to the wrong customers and uncertainty about project returns. Similarly,

the involvement of governments in the allocation of credit and other instruments of financial repression practices supports occasions where commercial banks are generally apathetic to financing risky projects whose payback periods are longer, even with the promise of higher overall returns. Banks are reluctant to finance profitable, innovative, and productive small enterprises with inadequate collateral. Besides, it is on the ground that the government has superior information and a comparative advantage in resources with lower costs of enforcing contracts through taxation and policy powers to ensure a superior industrial strategy to direct economic growth. The hypothesis was successful in nations that established long-term credit banks, which specialize in providing long-term investment funds in agricultural and industrial projects aimed at closing credit gaps created by commercial banks that lend on a short-term basis. Stiglitz supports this theory because it uses directed credits that are channeled towards profitable export-oriented sectors. Opponents of this theory contend, however, that in addition to low and erratic savings and investment in a fiscally constrained economy, badly carried out actions also go against the application of market forces in resource allocation. They also cautioned that the quantity and caliber of savings and investments as a whole would be suppressed if interest rates were to remain too high and prevent the money and credit markets from clearing. Besides, they point out that it has flaws such as corruption, rent-seeking, diverting resources that private companies could use profitably, crowding out resources, and increasing severe market distortions that impede growth and development. McKinnon and Shaw (1973), in contrast to the theories of financial repressions, propose that artificial interest rate ceilings and other intervention practices may result in a decrease in savings, capital accumulation, and the formation of disincentives for efficient resource allocation. Both individuals confirmed that the proper pricing of financial resources is determined by the unrestricted interaction of market forces, which in turn encourages investment and savings. The hypothesis is predicated on the idea that savings are influenced by interest rates and that higher savings rates encourage greater investment financing, which in turn spurs economic growth. Financial liberalization, according to Levine (1997), is comparable to an efficient use of resources that raises investment levels, savings rates, and real growth. To bolster this idea, Mishkin (2001) contends that financial liberalization improves the efficiency with which financial systems operate and makes capital more accessible and permits cross-border risk diversification; lessens moral hazard and adverse selection; promotes accountability and transparency; and eases liquidity issues in financial markets, all while guaranteeing that financial resources are directed toward the most fruitful uses possible, regardless of the nation in need (Kaminsky & Sergio, 2002; and Montiel, 2003). Financial liberalization in developing nations frequently modifies the sectoral allocation of credit in a substantial way. Additionally, data indicates that, generally speaking, industry shares tend to decline as consumer loans, property-related credit, and service sector shares rise. This could be the consequence of less directed credit being allocated, which frequently benefits industry and is not always a sign of worse resource allocation. It is crucial to remember, though, that when liberalization occurs in an unstable environment and leads to extremely high and volatile interest rates, these changes are frequently linked to the shortening of maturities and declines in demand for manufacturing investment credits. Notwithstanding these defenses, the theory is flawed in nations with weak corporate governance and scant legal safeguards. Its opponents claimed that, in certain nations, financial liberalization causes macroeconomic instability. Diaz-Alejandro (1985) offers an analogy on the theory's weakness, arguing that attempts to end financial repression in Latin American economies during the 1970s were made through financial sector liberalization, which resulted in crises that ultimately led to institution failure and low domestic savings.

2.2. Empirical literature review

This section of the review shows that some research on the relationship between credit availability and growth examined the specific industries to which credit was provided and how those allocations affect growth, while other studies examined how credit was provided in relation to the financial policies of particular nations, including financial deregulation and/or financial regulation. All of these empirical research projects, nevertheless, have produced conflicting and ambiguous results. Were et al. (2012), employing Kenyan sectoral panel data, examined how access to bank loans affected the performance of important economic sectors and found that, as measured by real value added, credit had a positive impact on the sectoral gross domestic product. A study by Nadeem et al. (2012) looked at the impact of farm finance on growth. Using secondary data from 1970 and 2010, they showed a positive but insignificant relationship between loan use and agricultural GDP. Hartarska et al. (2015) investigated the relationship between finance and growth in rural

areas. They evaluated the relationship between economic growth between 1991 and 2010 as well as the credit extended by major rural lenders, such as commercial banks (CBs) and Farm Credit System (FCS) establishments. As a result, they discovered a link between increases in agricultural GDP per rural resident and agricultural lending. The impact of sectoral credit allocation by commercial banks on the growth index of the Nigerian economy was studied by Ndubuisi (2017). And the vector error correction result demonstrated that a positive and significant function of between economic development and credit to industrial, credit to general services, and credit to agriculture. Furthermore, according to Granger causality, lending to the industrial sector directly drives economic growth, whereas credit to the agriculture sector has a two-way relationship with it. Chukwunweike (2018) focused on how bank loans affected Nigeria's economic growth. This study separated growth into the manufacturing sector, the growth in the agriculture sector, and the growth in the commerce sector using the ex-post facts research design and the ordinary least squares regression method. The annualized time period covered the years 1981 through 2015. The study's conclusions show that, although overall growth is not statistically significant, there is a positive association between the amount of bank credit and the expansion of the manufacturing, commercial, and agricultural sectors. Tekilu et al. (2018) investigated the connection between Ethiopia's sectoral output growth and financial development between 1975 and 2016 using ARDL plus VECM. The study focused specifically on bank loans to the agriculture, industrial, and service sectors as well as their growth as indices of financial development. The study's empirical results suggest that, although there was no substantial short-term correlation between financial development and increases in production in the agriculture and service sectors, there was a less significant long-term correlation. Nonetheless, financial development has a positive and significant impact on the growth of industrial and total output over long and short durations. Abina and Obi (2020) looked at the link between sectoral production growth and bank lending in Nigeria from 1981 to 2019. The Granger Causality result showed that there is bi-directional causality in all three models and that bank credit to the production sector, general commerce, and services, as well as the production sector's GDP contribution to that of general commerce and services, are all positively and significantly correlated. More evidence supporting the uneven impacts of credit Praise (2020) examined the distribution of bank credits by sector and the economic development of Nigeria. Information was gathered from 1985 to 2019. The results showed that bank credit to the manufacturing, mining, and general commerce sectors had the opposite effect from bank loans to the public sector, real estate, and agricultural sectors, which all had positive effects on economic development. Using a time and frequency dynamic analysis technique called the wavelet coherence test, Athari et al. (2021a) investigated the causal link between sectoral credit and economic growth in Australia between 1994Q4 and 2018Q4. And they indicate the existence of a causal relationship between growth and sectoral credit. In particular, they indicate that the growth of agriculture credit is caused by the growth of output, while the growth of manufacturing credit causes economic growth. Besides, they also prove the presence of a favorable link between growth and service sector credit. Alzyadat (2021), examined the connection between sectoral credit facilities delivered by banks and Saudi Arabia's non-oil economic growth, 1970–2019. The nine economic sectors for which bank loan facilities are provided include manufacturing, services, trade, construction, energy and water, manufacturing, mining, transportation and communications, health services, and finance. All industries are determined to have significant and positive long-term benefits, with the exception of the mining and agriculture sectors. Similarly, the entire sector has positive and significant short-term effects, with the exception of those in construction, finance, services, transportation, and communications. Temsas et al. (2021) used annual data (1998–2020) and ARDL to examine the association between agricultural credits and growth and found that agricultural credit has a long-term positive effect on economic development. They also discovered a causal relationship between bank credit to the agriculture sector and economic growth. Yuanyuan et al. (2021) similarly examined the relationship among agricultural financing, regional agricultural output growth, and regional development using the GMM and RE models. As per their research, all agricultural credit has a positive influence on the agricultural and economic prosperity of the area. Alternatively, Asuquo and Ibiyingibo (2021) also looked at how bank credits to agriculture affect the industry's performance using time series annual data. The cointegration test result showed that there was a long-run equilibrium relationship between the GDP share of agriculture and the underlying explanatory factors. Nevertheless, the ECM findings demonstrated that deposit money banks' lending to the agricultural sector has a negligible beneficial effect on the industry's GDP contribution. Furthermore, this finding demonstrated that financial support from the banking sector has a relatively little role in the advancement of agriculture, even though it is in line with theoretical a

priori assumptions and economic theory. Anjugam and Parthiban (2022) investigated the function of agricultural loans in India's agriculture using a range of economic analyses. The results showed a negative correlation between agriculture industries output and institutional credit but a positive correlation between fertilizer practices. It also discussed the long-term positive association between India's agricultural GDP and agricultural credit, as well as the causal linkage that runs from agricultural GDP to agricultural credit.

Meanwhile, one of Qichun's (2012) main worries was whether financial liberalization promotes growth. He focused more on China's experience with advancing financial liberalization in this study. The results, which used panel data for Chinese provinces from 1981 to 1998, suggested that financial reform in China leads to economic growth. Furthermore, the reallocation of credit among sectors is primarily responsible for its influence, rather than the rates of savings and investment. Similarly, Muthusamy et al. (2018) investigated the impact of the sectoral dissemination of bank lending on Sri Lanka's economic performance using data spanning from 2005 to 2017. The results, which were based on the ARDL model, demonstrated that the allocation of loans to the industrial and agricultural sectors does not significantly explain Sri Lanka's short-term economic progress. In the short run, however, credit allocation to the labor force and service sector has a significant role in explaining economic growth. The long-run research indicates a strong positive long-run correlation between loan allocation to the industrial sector and economic growth. And demanded that the way credit is distributed in the pertinent businesses affect economic expansion. Using the wavelet coherence test, which takes into account both the time and frequency dynamism of the data, Kirikkaleli and Athari (2020) examined the link between credit provided by banks that have different ownership structures and growth in Turkey from 1993Q4 and 2017Q3. And found a strong correlation between credit supplied by public and private banks and economic growth but a weak correlation between credit supplied by foreign banks and growth. Using error correction modeling (ECM), Chuba and Inedu (2022) also carried out an empirical investigation on the influences of credit extended by commercial banks on agricultural sector growth in Nigeria, 2014 Q1–2020 Q4. The investigation's conclusions indicate that loans from commercial banks to the agriculture sector greatly accelerated Nigeria's economic growth. Commercial banks' lending to those and other businesses and service sectors neither helped nor hindered economic expansion. Accordingly, they recommended that the Central Bank order commercial banks to allocate the lion's share of their lending to the agricultural industry. Qinglu and Huan (2022), using a dynamic panel model and panel data from 2007–2017 in the 19 industries of China, comprehensively investigated the effects of bank credit misallocation on the economy. Additionally, their data show that a number of Chinese enterprises experience structural credit misallocation. In particular, China's sectors have seen a large fall in credit deviation, even if structural volatility has remained high. While the agriculture and manufacturing sectors receive very little capital, the tertiary industry obtains a substantial portion of it. Moreover, credit misallocation exerts a detrimental influence on industry growth and demonstrates a slight acceleration effect.

3. Data and methodology

3.1. Data set and variable description

Sectoral panel data covering the years 1991–2022 was used in this study. The Ministry of Finance and Economic Development (MoFED) and the World Bank Development Indicator database provided us with annual time series data on real per capita GDP, GDP from agriculture, GDP from industry, GDP from services, and statistics on human and physical capital. Similarly, the WB, IMF, and NBE all gave us information on domestic credit that was distributed to the public and private sectors, including the sectors of industry, agriculture, and services. Besides, information regarding the inflation rate and labor force (employed) was gathered from the World Bank Development Indicator database, the Ethiopian Economic Association, and the National Bank of Ethiopia (NBE). Further details regarding the variables, their measurements, and the hypothesized link between the independent and dependent variables are given in Table 1 below.

Table 1. Variables, their measurements, and hypothesized relationships.

Variables	Measurements and the hypothesized relationship between dependent and independent variables
Dependent Variables	
Economic growth (Y)	Measured by the annual growth of real GDP per capita at constant local currency (birr).
Agriculture sector growth (Y_A)	Measured by the annual growth of total agriculture value-added products at constant local currency (birr).
Industry sector growth ($Y_{I)}$	Measured by the annual growth of total industry value-added products in constant local currency (birr).
Service sector growth ($Y_{S)}$	Measured by the annual growth of total service value-added products at constant local currency (birr).
Independent Variables	
Physical capital (KS)	Measured by gross capital formation, which is made up of expenditures on fixed asset additions as well as net changes in the level of inventories. And depending on the amount of net inventories, KS has a positive or negative link with Y, Y_A, Y_I, and Y_S.
Human Capital (HC)	Measured by government expenditure on the education and health sectors. As more money is invested in the provision of education and health facilities, the productivity of workers increases, so that HC has a positive relationship with Y, Y_A, Y_I, and Y_S.
Private credit (PrCr)	Measured by the amount of credit supplied to the private business as % of GDP. Though credit provision to private firms has many beneficial impacts on their production, depending on the credit allocation policies, PrCr may have a positive or negative link with Y.
Public Credit (PuCr)	Measured by the amount of domestic credit provided to the public sector as % of GDP. In most developing countries, the provision of credit to the public sector creates a crowd-out effect on the provision of credit to private firms; thus, PuCr has a negative link with Y.
Agriculture credit (ACr)	Measured by domestic credit provided to the agriculture sector as % of agriculture's value-added product. Since the agriculture sector contributes a lot to the Ethiopian economy, the provision of credit to this sector improves its productivity, and hence ACr has a positive link with Y_A.
Industry credit (ICr)	Measured by the provision of domestic credit to the industry sector, which is also measured as % of industrial value added product. However, in the economic context of developing countries, the industry sector is a less contributory and productive sector; therefore, the provision of more credit to this sector may result in either a positive or negative effect on its own growth (Y_I).
Service credit (SCr)	Measured by the provision of domestic credit to the service sector as % of service value added product. As banks give more credit to this sector, the quantity and quality of services provided by this sector increase, hence SCr has a positive link with Y_S.
Inflation (INF)	Measured by the yearly percentage change in the CPI. Since inflation increases the cost of production and decreases the real wage, it has a negative relationship with Y, Y_A, Y_I, and Y_S.

3.2. Methodology

3.2.1. Model specification

The functional relationship between credit allocations and real output growth is demonstrated in this paper through an extension of the standard production function. The endogenous AK (i.e. stock of knowledge and capital, respectively) growth model, created by Romer (1990) and expanded by Romerian, serves as the foundation for the framework.

$$Y_t = A_t^{\sigma} L_t^{\alpha} K_t^{1-\alpha} \tag{1}$$

Where, Y_t in Eq. (1) is the total output produced by a production function that has constant returns to objects (labor (L) and capital (K)) and increasing returns to objects and ideas (A) together. In the goods production function, the parameter σ quantifies the extent of growing returns to scale. Additionally, the availability of financial resources to researchers who search for novel concepts and who receive an appropriate patent that grants them exclusive rights to their inventions makes their efforts successful and acts as a carrot to encourage further research into novel concepts. In this instance, capital stock (A)'s general function is expressed as follows:

$$A_t = f(HC, SCrD\_rgdp) \tag{2}$$

Sectoral credit allocations (SCrD_rgdp) are represented by the following measures: agriculture sector credit as a fraction of real agriculture GDP (ACr), industry sector credit as a fraction of real industry GDP (ICr), service sector credit as a fraction of real service GDP (SCr), and private sector credit as a fraction of real GDP (PrCr) and public sector credit as a fraction of real GDP (PuCr), respectively.

Substituting Eq. (2) into Eq. (1) and taking the log transformation on the resulting equation gives:

$$lnY_{it} = \beta_0 + \beta_1 HC_{it} + \beta_2 KS_{it} + \beta_3 lnempt + \beta_4 PrCr_{it} + \beta_5 PuCr_{it} + \beta_6 ACr_{it} + \beta_7 SCr_{it} + \beta_8 lCr_{it} + \beta_9 INF_{it} + \varepsilon_{it} \tag{3}$$

Where *i* denotes cross-section unit that denotes the five sectors, *t* denotes the time dimension, INF denotes inflation and *lnempt* denotes employed labor force.

3.2.2. Methods of the analysis

A lot of macroeconomic analysis uses dynamic panel data models because static models have drawbacks from various econometric perspectives. In practice, however, there are two major econometric problems with estimating dynamic models: first, when the dynamics are heterogeneous across the cross-section units, the homogeneity assumption can lead to significant biases; second, parameter estimates in a fixed effects model and lagged explained variables are inconsistent. In light of these issues, we employed the cross-sectional augmented error correction model (CS-ECM). The model is essentially meant to be estimated using pooled mean group (PMG) techniques, and instrumental variables are not required. It offers long-run homogeneous coefficients as well as short-run heterogeneous coefficients (Ditzen, 2021). In macro panels, these models are intended for moderate time series (T) and moderate cross-sectional units (N), where 'moderate' usually refers to at least 15 time-series or cross-section observations, particularly when T is greater than N. It is also advantageous because it accounts for inter-unit dependencies by adding cross-sectional averages and using IV regressions. The following is a sequence of the model's estimation procedures: First, we determine whether there is cross-sectional dependence on the variables by using the Pesaran (2021) test. Second, using second-generation stationarity tests, we check the unit root of the variables. The Pedroni (2004) and Westerlund panel co-integration tests were both used in the third step to evaluate the co-integration. Slope heterogeneities and Hausman tests were then performed, and the dynamic panel data model (CS-ECM) was finally estimated.

3.2.3. Cross-section dependence test

Unaccounted residual independence, unobserved common factors, and macroeconomic linkages among the agriculture, service, and industry sectors could all contribute to the cross-section dependency in this paper. And so, we essentially used Pesaran (2021) to test for the presence of cross-sectional dependency (CSD). This test is based on stata syntax dcce2 and the average pair-wise correlation coefficients of the OLS residuals from the individual regressions. The CSD test is given by:

$$CSD_{\rho} = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho ij}\right) \Rightarrow N(0,1) \tag{4}$$

Where, $\hat{\rho}ij$ is the sample approximation of the pairwise correlation of the variables for panel unit *i* and *j*. Moreover, cross-sectional dependence among the panel units is the alternative hypothesis, whereas cross-sectional independence among the panel units is the null hypothesis.

3.2.4. Sectoral panel unit root test

The panel stationarity test, which is frequently used to ascertain the correct relationships among the macroeconomic variables, is another crucial pre-analysis that must be completed in macro-panel data analysis. And the most popular augmented Dickey-Fuller (ADF) unit root test in univariate analysis is extended in the majority of panel unit root tests. As a result, the ADF regression for panel data analysis is provided like this:

$$\Delta Y_{it} = \delta_i Y_{it-1} + \sum_{j=1}^{p}\pi_j \Delta Y_{i,t-1} + \varepsilon_{it} \tag{5}$$

Where $\delta_i = \rho_i - 1$, $H_0 : \delta_i = 0\ (\rho_i = 1)$*is null hypothesis and* $H_1 : \delta_i < 0\ (\rho_i < 1)$

Nevertheless, we employed a second-generation unit root test, which appropriately addresses cross-section dependence and guarantees the consistency of estimation results, since ADF and other extended first-generation unit root tests do not take the cross-section dependency issue into account. Thus, the following equation is the second-generation cointegration function, which is developed based on a cross-sectionally augmented Dickey-Fuller (CADF) regression:

$$\Delta Y_{it} = \alpha + \beta_{it} Y_{it} + \omega_i \bar{Y}_{i,t-1} + \delta_i \Delta \bar{Y}_{t-1} + \varepsilon_{it} \tag{6}$$

3.2.5. Sectoral panel cointegration test

We employed the Westerlund and Pedroni (2004) panel cointegration tests, which presuppose cross-sectional dependence and cross-sectional independence of the error term, respectively, to determine whether

a cointegrated relationship existed between the variables in the panel data. The first differences in the panel-data model of the dependent variable y serve as the foundation for the Pedroni test.

$$Y_{it} = \beta_i x_{it} + z'_{it}\tau_{it} + \varepsilon_{it} \tag{7}$$

Where $t = 1, 2, 3, \ldots, T,$ and $i = 1, 2, 3, \ldots N$ are the time-period index and cross-sectional index, respectively, and for each panel $i,$ the covariates are x_{it} is I (1) series; however, the covariates should not be integrated amongst themselves. Pedroni created seven test statistics based on residuals; the first four are called panel statistics (panel v, panel rho, panel t, and panel ADF), and the remaining three are called group rho, group t, and group ADF. These statistics fall between dimension (group mean) statistics. Additionally, for within-dimension statistics, the alternative hypothesis is 'all panels are cointegrated', and for between-dimension statistics, it is 'some panels are cointegrated'. All seven statistics test for these null hypotheses. Though it is not based on any common factor restriction, Westerlund developed an error-correction-based panel cointegration test with four test statistics: two panel test statistics (Pt and Pa) and two group mean statistics (Gt and Ga). This test enables the test statistics to be bootstrapped in order to produce a robust p-value that accounts for the effects of CSD. And this study's ECM-based cointegration model can be expressed as follows:

$$\Delta y_{it} = \alpha_i d_i + \mu_i y_{it-1} - \mu_i \beta_i x_{it} + \sum_{j=1}^{p_i} \lambda_{ij} \Delta y_{it-j} + \sum_{j=-q_i}^{p_i} \theta_{ij} \Delta x_{it-j} + \varepsilon_{it} \tag{8}$$

3.2.6. Empirical model estimation

This paper employs the Cross-section Augmented Error Correction Model (CS-ECM) for the estimation of the dynamic panel model. The pooled mean group model by Shin et al. (1999), which is a compromise between the MG results (heterogeneous short-run effects) and the pooled results (homogenous long-run effects), is essentially the foundation of this model. Additionally, using Eq. (9), which is provided below, the Shin et al. model estimated the long-run coefficients using the Maximum Likelihood (ML) method and the short-run coefficients using the OLS method:

$$Y(i,t) = V\ (i) * \big(Y(i,t-1) - w0(i) - X(i,t) * w2(i)\big) + f1(i) * [Y(i,t) - Y(i,t-1)] + [X(i,t-1)] * f2(i) + \varepsilon(i,t) \tag{9}$$

Where $V\ (i)$ is the cointegration vector, $w(i)$ captures the long-run effects and $f1(i)$ and $f2\ (i)$ the short-run effects.

But using the OLS approach, the Cross-section Augmented Error Correction Model (CS-ECM in cross-sectional time series dynamic common correlation effect 2, or xtdcce2) calculated the long-run and short-run coefficients as shown in Eq. (10) below:

$$Y(i,t) = b0(i) + V(i) * \big(Y(i,t-1) + X(i,t) * b2(i)\big) + f1(i) * [Y(i,t) - Y(i,t-1)] + [X(i,t-1)] * f2(i) + \varepsilon(i,t) \tag{10}$$

Where, $w2(i)$ = -b2(i)/v(i) and $w0(i)$ = -b0(i)/v(i)

Subsequently, the levels of y and x are included as long-run variables using the long-run variable list and pooled variable list options, and the first differences are added as independent variables in order to estimate Eq. (10). The ability to apply IV regressions and include cross-sectional averages to account for dependencies between units is the primary benefit of estimating Eq. (10) by OLS (Ditzen, 2021).

4. Results and discussion

4.1. Descriptive result

The analysis of this sub-section emphasizes the efficiency of domestic credit distribution across different economic activities, specifically detailing the allocation of credit to various sectors of the economy. It conducts a comparative analysis of credit distribution by economic sectors (agriculture, service, and industry) and by business ownership (private and public). This comparison utilizes the credit distribution to GDP ratio and credit collection to distribution ratio as indicators of credit allocation efficiency. Figure 1 below shows the annual distribution of total domestic and/or sector credit to the GDP ratio from 1991 to 2022. According to this figure, initially in the in the 1990s, the percentage of credit allocations to GDP was less than 1 percent; however, it showed an increase over time, although it never exceeded 15 percent in the entire study period.

Similarly, from Figure 2, compared to the public sector, although it had the lion's share of the total domestic credit distribution, it accounted for just under 12 percent of credit as calculated from GDP. Thus, these two figures indicate that for more than 30 years, the allocation of domestic credit to various economic activities has been very minimal and extremely lower than that of developed countries.

Figure 3 and Figure 4 also indicate that in the 1990s, the share of agriculture, services, and industry in GDP was 65 percent, 27 percent, and 8 percent, respectively. The agriculture sector's dominance continued until its share decreased to 39.8 percent or its dominance exceeded 42 percent of the service sector's share in 2012 and later; however, from 1991 to 2012, the distribution of agricultural credit, calculated as a percentage of its own GDP, was 6 percent or less, and this trend continues until 2022, when only about 3 percent of its GDP was credit. Credit to industry and services as computed from their respective GDPs is below 10 percent, except for 2010–2015. During this period, the industrial sector acquired 11–27 percent of its own GDP as credit, and after 2020, the service sector accounted for 10–23 percent of its own GDP as credit. This leads not only to an insufficient allocation of domestic loans to the three sectors of the economy but also to a misallocation of loans to the industrial sector, which had a low contribution to the economy throughout the monitored period (see Figure A1 in the appendix).

The second indicator of the efficiency of credit allocation used in this descriptive section is the ratio of domestic credit collection to domestic credit distribution. Figure 5 thus shows that there is a strong fluctuation in domestic credit collection in all sectors; however, the minimum (34 percent) of credits collected from each sector annually Moreover, over the past three decades, on average, of the total number of credits distributed to the industrial sector, about 70 percent of them have been collected; of the total loans allocated to the agriculture sector, about 87 percent of them were collected; and of the total number of loans distributed to the service sector, about 92 percent were drawn, indicating that the industrial sector is a less efficient sector in repaying its loans to the bank. Similarly, Figure 6 shows that of the total loans

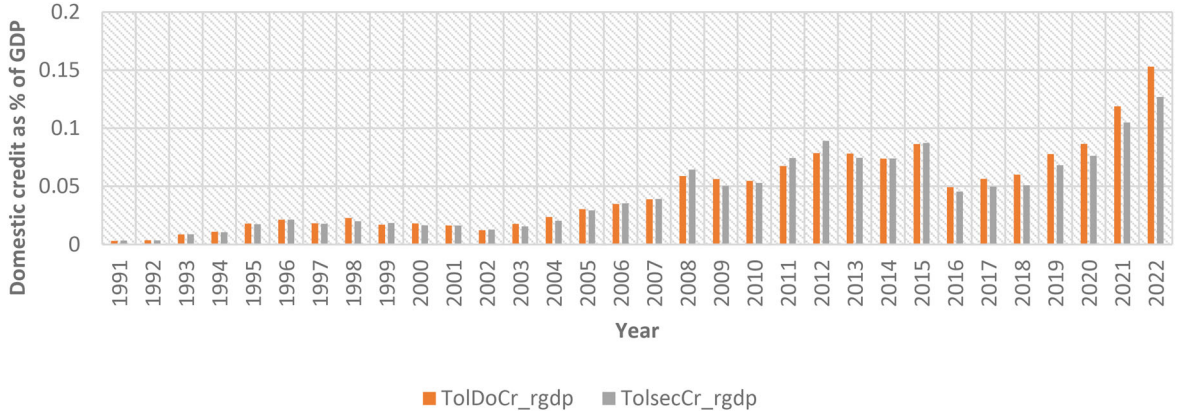

Figure 1. The distribution of total domestic and sectoral credit to GDP ratios.
Source: Own computation using the NBE, MoFED, and WB datasets.

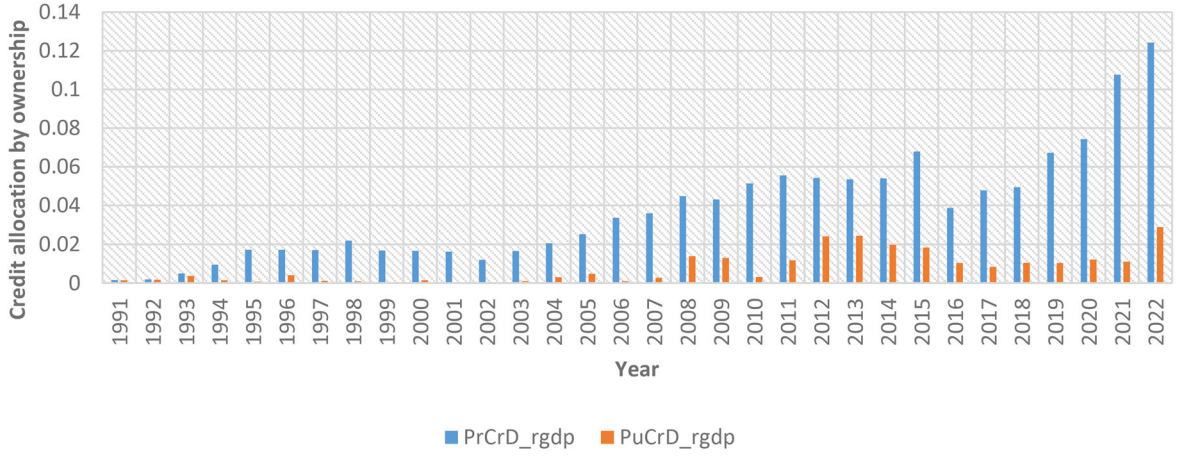

Figure 2. The distribution of domestic credit to the private and public sectors according to GDP ratios.
Source: Own computation using the NBE, MoFED, and WB datasets.

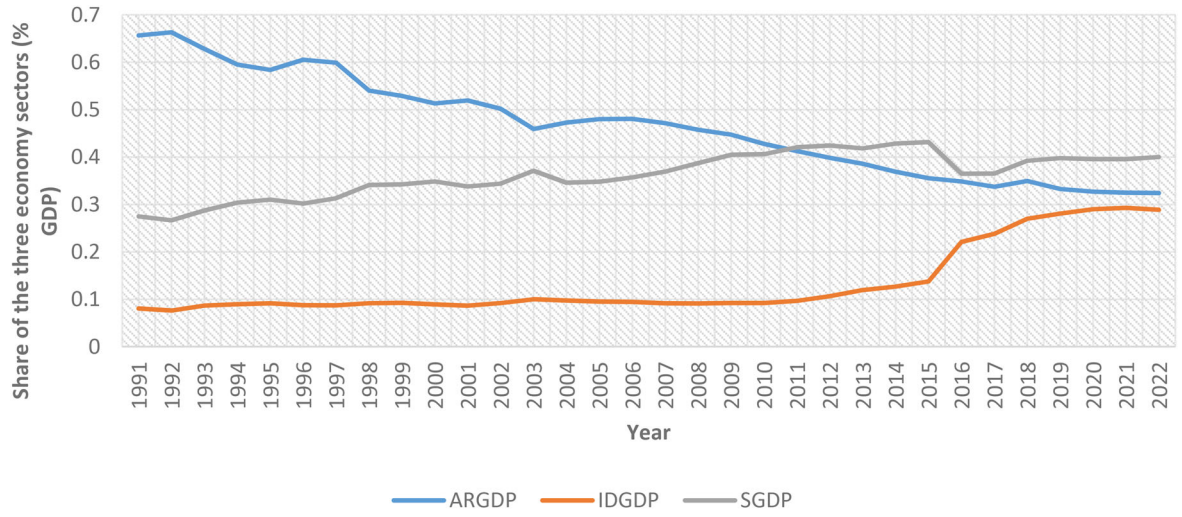

Figure 3. The percentage share of the agriculture, service, and industry sectors in GDP.
Source: Own computation using the MoFED and WB datasets.

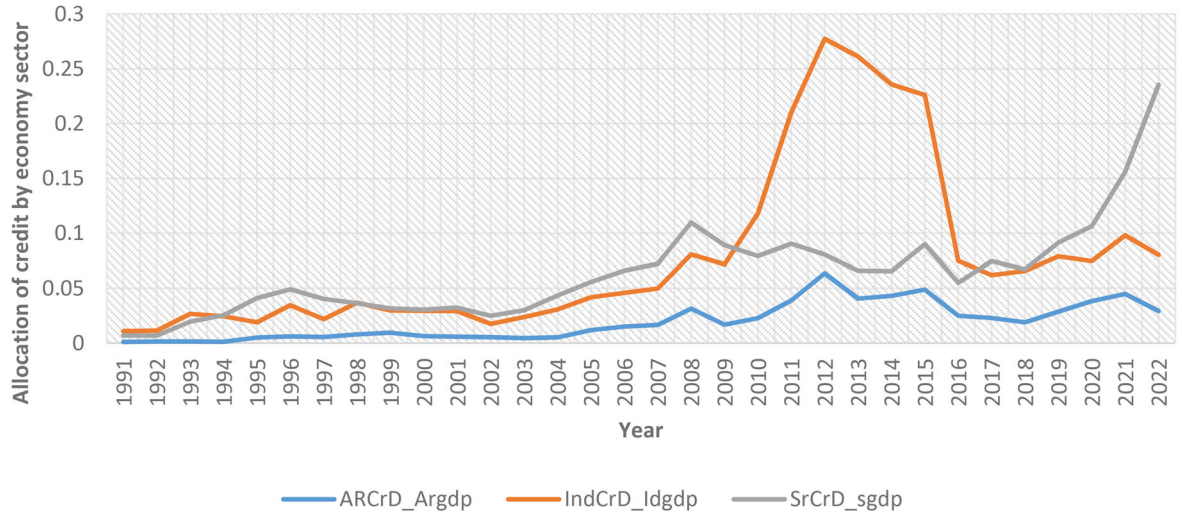

Figure 4. The annual distribution of domestic credit to the agriculture, service, and industry sectors as a proportion of their own GDP.
Source: Own computation using the NBE and MoFED datasets.

distributed to the private sector, on average, about 83 percent of them are collected annually, and of the total loans distributed to the public sector, on average, more than 100 percent of them are collected, indicating that the public sector is a relatively efficient sector in repaying its loans to the bank.

4.2. Econometric result

4.2.1. Cross-sectional dependency (CSD) test result

Identifying sector panels, referred to as "', include cross-sectional units such as agriculture, services, and industrial output. These units can exhibit interdependencies, as seen in the case of many developing countries, including Ethiopia, where the agricultural sector supplies raw materials to industry and services while also consuming the final products of these sectors. Consequently, this interdependence poses problems in panel model estimation. To solve and correct this problem and ensure a consistent and unbiased result, we used Pesaran, 2021's CSD test technique in conjunction with Stata's recent syntax, xtcd2. Table 2 illustrates the probability values of CD, CDw, CDw+, and CD*, which demonstrate the presence of strong CSD in the panel units, excluding labor and capital formation. This subsequently requires further econometric analyses, as the presence of CSD in at least one of these model variables could lead to erroneous conclusions about the estimation of the variables and their relationship.

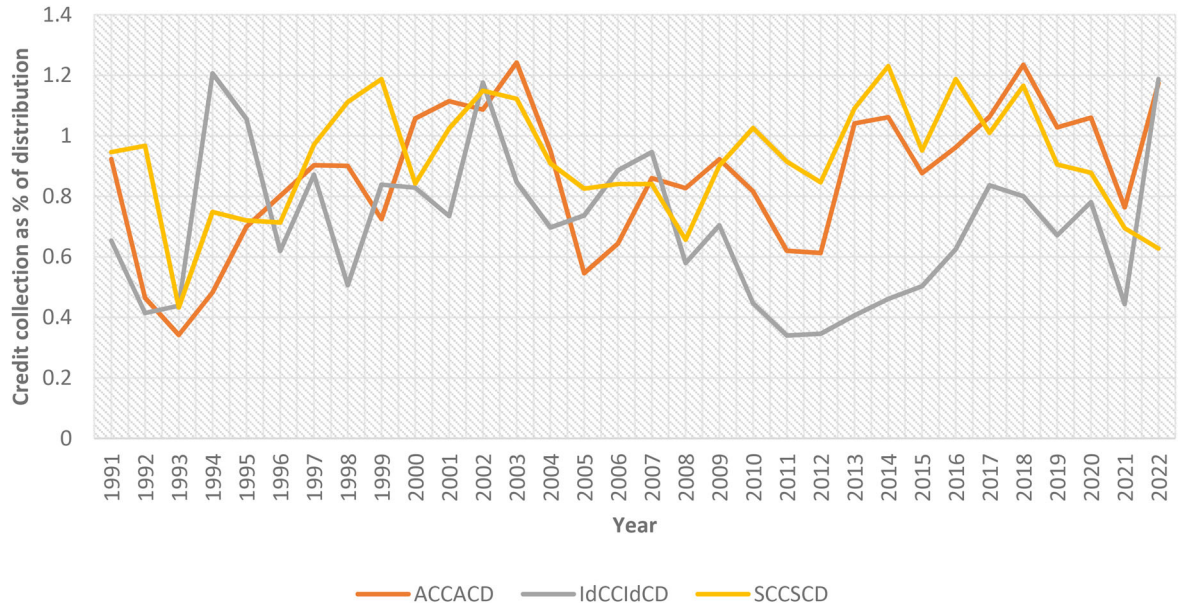

Figure 5. Annual credit collections in agriculture, industry, and service as a fraction of sectoral credit distribution.
Source: Own computation using the NBE dataset.

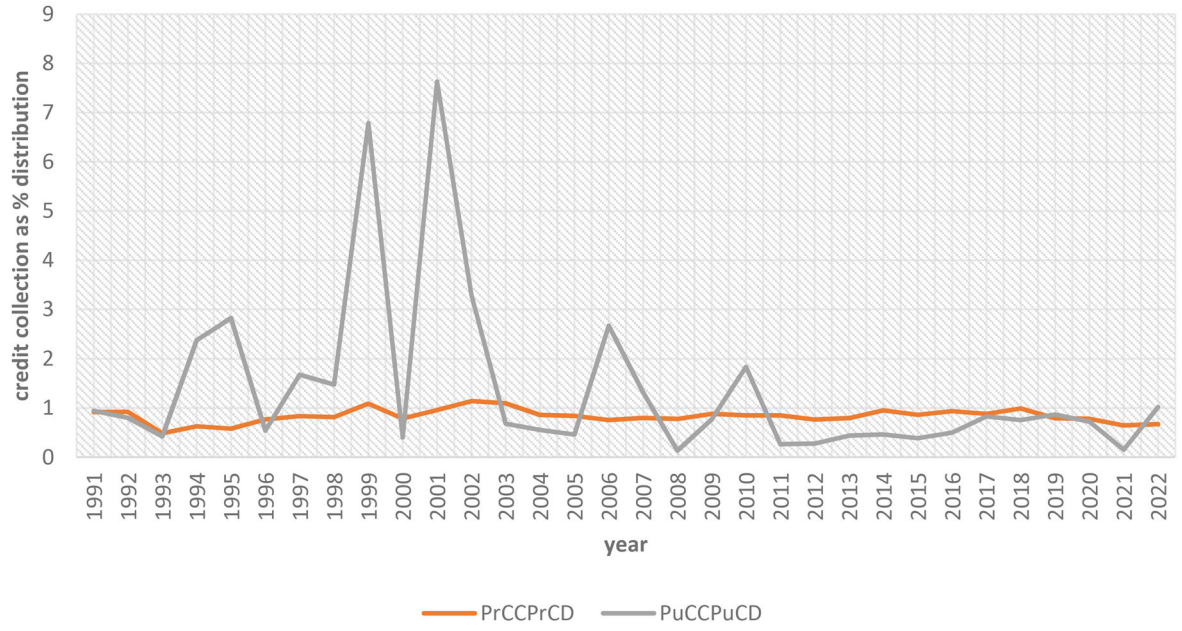

Figure 6. Annual credit collections from the private and public sectors as a fraction of credit distribution.
Source: Own computation using the NBE and WB datasets.

4.2.2. Sectoral panel unit root test result

Using the second-generation panel unit root testing method, we conducted our analysis at this point. The level and first-difference specifications, with and without trends, were both handled using this method. With the exception of the labor force's natural logarithm, none of the variables in the trend-free level specification exhibit a unit root when tested for stationarity, as shown by the results in Table 3. All variables, with the exception of the sectoral distribution of loans, are stationary in their original form after the trend level test. All variables are first-order integrated, as indicated by the Zt column statistic and the matching P-values that follow from differentiating each variable separately. This suggests that the panel cointegration test is the next step or test to be conducted.

Table 2. Cross-sectional dependency test results.

Variables	CD	CDw	CDw+	CD*
Real GDP	17.07	3.22	57.20	3.55
	(0.000)	(0.001)	(0.000)	(0.000)
Human capital	16.60	3.13	55.61	3.72
	(0.000)	(0.002)	(0.000)	(0.000)
Capital formations	8.22	−0.58	25.18	0.13
	(0.000)	(0.560)	(0.000)	(0.895)
Labor force (employed)	1.06	1.03	27.85	4.6e + 29
	(0.289)	(0.304)	(0.000)	(0.000)
Sectoral credit distributions	9.56	2.05	32.29	1.88
	(0.000)	(0.040)	(0.000)	(0.060)
Inflation	13.98	3.11	47.33	3.5e + 31
	(0.000)	(0.002)	(0.000)	(0.000)

Source: Own computation using Stata software.
Note.
1. Stata syntax 'xtcd2' is used to test cross-sectional dependency and p-values given in the parenthesis.
2. CD developed by Pesaran (2015, Pesaran & Xie, 2021), CDw developed by Juodis and Reese (2022), CDw + developed by Fan et al., and CD* developed by Pesaran and Xie (2021).

Table 3. Sectoral panel unit root test result.

	In level				In first difference			
	Specification without trend		Specification with trend		Specification without trend		Specification with trend	
Variables	Zt-bar	p-value	Zt-bar	p-value	Zt-bar	p-value	Zt-bar	p-value
Log real GDP	−4.478	0.000^{z}	−5.596	0.000^{z}	−10.360	0.000^{z}	−10.098	0.000^{z}
Human capital as % of GDP	−3.849	0.000^{z}	−3.528	0.000^{z}	−9.087	0.000^{z}	−9.399	0.000^{z}
Capital formation as % of GDP	−1.867	0.031^{y}	−2.061	0.020^{y}	−10.055	0.000^{z}	−9.924	0.000^{z}
Log labor force (employed)	2.990	0.999	−3.681	0.000^{z}	−3.220	0.001^{z}	−1.731	0.042^{y}
Sectoral credit distribution as % of GDP	−1.346	0.089x	0.051	0.520	−6.329	0.000^{z}	−5.513	0.000^{z}
Inflation	−8.787	0.000^{z}	−8.537	0.000^{z}	−10.490	0.000^{z}	−10.367	0.000^{z}

Source: Own computation using Stata software.
Note. x, y, and z indicate significance levels at 10%, 5%, and 1%, respectively.

4.2.3. Sectoral panel cointegration test result

We employed both first- and second-generation cointegration tests in this section because of the CSD issue. Furthermore, estimating the baseline model solely results from applying the cointegration test, which incorrectly dismisses the cointegration of the majority of macroeconomic series relationships. Consequently, we employed a cointegration test to eliminate these inadequacies in the baseline model, which looked at real sectoral GDP as the dependent variable, and the auxiliary model, which looked at the sectoral distribution of credit as the dependent variable. Ultimately, Table 4's first-generation cointegration results demonstrate that, out of seven group and panel statistics, only 'rho for group' verified cointegration when it came to the baseline model; in contrast, five group and panel statistics verified cointegration when it came to the auxiliary model scenario. Second-generation cointegration results show that for the auxiliary model, two out of four statistics (assuming appropriate bootstrap and robust likelihood values) support the existence of cointegration, while four statistics of the base model do not support the existence of cointegration. Based on the two cointegration results, we should therefore have both short-term and long-term estimates in the estimation part of the model.

4.2.4. Slope homogeneity test result

The slope homogeneity tests of Blomquist and Westerlund (2013) and Pesaran and Yamagata (2008) were utilized in this section. The test's null hypothesis for both approaches is homogeneous slopes, which means that every slope coefficient is the same for every cross-sectional unit. A rejection of the null hypothesis of slope homogeneity is implied by large test statistic values (delta values) or significant p-values at any level of significance. Because the slope parameters vary throughout the panel units, Table 5's p-values are significant at 1%. In addition to this, the Hausman test results between DFE and PMG and between MG and PMG selected PMG as the suitable model for this study analysis (Table A1 in the appendix).

Table 4. Sectoral panel cointegration results.

First generation cointegration test (Pedroni)				
	Dependent variables			
	Real sectoral GDP		Sectoral credit distribution	
Test Statistics	Panel	Group	Panel	Group
v	−.1288	–	.228	–
rho	1.349	2.022	1.92	2.589
t	.1307	.3497	1.674	2.164
adf	1.127	−.831	1.775	.893
Second generation cointegration test (Westerlund)				
Statistic	Z-value	Robust P-value	Z-value	Robust P-value
Gt	6.790	0.990	−0.509	0.720
Ga	4.306	1.000	−1.623	0.000[z]
Pt	2.070	0.980	0.433	0.020[y]
Pa	2.350	0.990	−1.489	0.140

Source: Own computation using Stata software.
Note.
1. y and z indicate the significance level at 5% and 1%, respectively.
2. The stata syntax used for the first generation test is xtpedroni, and for the second generation, it is 'xtwest'.
3. In Westerlund, only one dependent and one independent variable were applied.

Table 5. Testing for slope heterogeneity.

Pesaran and Yamagata (2008)			Blomquist and Westerlund (2013)		
	Delta	p-value		Delta	p-value
adj.	11.942	0.000	adj.	15.397	0.000
	13.511	0.000		17.42	0.000

Note. H0 assumes slope coefficients are homogenous, and H1 assumes slope coefficients are heterogeneous.

4.2.5. Model estimation results

The estimator used in this instance is the dynamic common correlation effect form, or dcce2 version, of the PMG (Pooled Mean Group,) or cross-section augmented error correction model (CS-ECM). The mean group and pooled estimations are combined in this method. Hence, it has heterogeneous short-run and homogenous long-run coefficients accordingly. In light of this, Table 6 below shows the pooled (long-run) and mean group (short-run) coefficients. Additionally, there are two short-run effects of the mean group estimate for both the individual panel and the panel as a whole. And the results indicate the z-vale of the sectoral credit distribution coefficient, which comes from the entire short-run panel result, is 0.35, suggesting that domestic credit that is provided to the economy as a whole has a positive but negligible impact on economic growth in the short run; hence, this result is an expected result, especially in countries where a negligible amount of credit is supplied to the economies, and also consistent with that of Were et al. (2012); Chukwunweike (2018); and Oko (2023). Similarly, the short-run sector-specific results in Table 6 indicate the sectoral distribution of credits to enhance the productions of the agriculture sector, services sector, industry sector, private sector, and public sector, and the z-value of the sectoral credit distribution for the agriculture sector is 0.11, for the service sector is 0.61, and for the private sector is 0.81, while the industry and public sector credit have negative coefficients and z-values less than 2. To put it another way, the results demonstrate that, despite the fact that the agriculture and service sectors account for the majority of the Ethiopian economy, the domestic credit supplied to them is abnormal. For example, between 1991 and 2022, the agriculture sector received 3–6% of its own GDP in credit, and the service sector received 10–23% of its own GDP in credit (see Figures 3 and 4 in the descriptive result). These amounts are insufficient to significantly alter the growth of their respective sectors' output. Thus, these results are in line with the findings of Nadeem et al. (2012); Tekilu et al. (2018); Asuquo and Ibiyingibo (2021); Alzyadat (2021); and Yuanyuan et al. (2021).

On the contrary, the domestic credit that supplied to the industry sector has negative but insignificant correlation with the output growth of this sector indicating the industry sector received more credit than agriculture and service sector though it has been unproductive and contributed less to GDP implying the misallocations of credit, especially in a situation where the availability and supply of credit fund is a problem to the financial institutions, undermine the effect of credit on economic growth and this logical interpretations also holds true for

Table 6. The short-run and long-run estimation results of the cross-section augmented error correction model.

Short run estimate					
Short run mean group result					
Variables		Coefficients	Std. Err	z	P>|z|
Human capital (DHK)		379.4676	687.0855	0.55	0.581
Capital Formation (DKS)		−.7712767	.2573473	−3.00	0.003[z]
Labor force Employed (Dlnempt)		−.4302881	.8684224	−0.50	0.620
Sectoral credit distributions (DSCrD)		.2015008	.5705961	0.35	0.724
Inflation (DINF)		−.0010287	.0009792	−1.05	0.293
Short run individual result					
Individual sector	Variables	Coefficients	Std. Err	z	P>|z|
Agriculture sector	Human capital (DHK)	−704.1832	4196.675	−0.17	0.867
	Capital Formation (DKS)	−.6879284	.2934085	−2.34	0.019[y]
	Labor Employed (Dlnempt)	.5631347	2.20731	0.26	0.799
	Credit distributions (DSCrD)	.1899775	1.790725	0.11	0.916
	Inflation (DINF)	.0003016	.0010738	0.28	0.779
Industrial Sector	Human capital (DHK)	1679.877	808.047	2.08	0.038[y]
	Capital Formation (DKS)	−.2233257	.0713849	−3.13	0.002[z]
	Labor Employed (Dlnempt)	−1.658956	2.504395	−0.66	0.508
	Credit distributions (DSCrD)	−.5212218	.5735104	−0.91	0.363
	Inflation (DINF)	−.0048169	.0035035	−1.37	0.169
Private Sector	Human capital (DHK)	−691.7646	8886.298	−0.08	0.938
	Capital Formation (DKS)	−.983105	.8375928	−1.17	0.241
	Labor Employed (Dlnempt)	1.882103	6.304939	0.30	0.765
	Credit distributions (DSCrD)	1.996113	2.468329	0.81	0.419
	Inflation (DINF)	−.0008198	.001776	−0.46	0.644
Public Sector	Human capital (DHK)	2397.894	8235.352	0.29	0.771
	Capital Formation (DKS)	−1.646033	.7373041	−2.23	0.026[y]
	Labor Employed (Dlnempt)	−3.062946	4.152948	−0.74	0.461
	Credit distributions (DSCrD)	−1.378995	3.988142	−0.35	0.730
	Inflation (DINF)	.0005868	.0017239	0.34	0.734
Service Sector	Human capital (DHK)	−784.4846	2766.429	−0.28	0.777
	Capital Formation (DKS)	−.3159913	.3109799	−1.02	0.310
	Labor Employed (Dlnempt)	.1252241	.5313373	0.24	0.814
	Credit distributions (DSCrD)	.7216308	1.174939	0.61	0.539
	Inflation (DINF)	−.000395	.001621	−0.24	0.807
Long run estimate (pooled)					
Variables		Coefficients	Std. Err	z	P>|z|
Adjustment term (ECT)		−.6493273	.1734851	−3.74	0.000[z]
Human capital (HK)		−13506.71	3527.62	−3.83	0.000[z]
Capital Formation (KS)		.0157492	.3111183	0.05	0.960
Labor Employed (lnEmpt)		−.1249351	.4059366	−0.31	0.758
Credit distributions (SCrD_rgdp)		−2.250898	.8799627	−2.56	0.011[y]
Inflation (INF)		.0002114	.0011501	0.18	0.854
Number of observations		155			
Number of groups		5			
Observations per group (T)		31			
CSD test statistic				1.29	
(CSD p-value)				(0.1967)	

Source: Own computation using Stata software.
Note.
1. x, y, and z indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
2. The DCCE technique used in this study is the Dynamic Common Correlated Effects Estimator-Pooled Mean Group (CS-ECM).
3. Stata syntax 'xtdcce2' is used to get the results.

the long-run result and consistent with the results of Muthusamy et al. (2018); Anjugam and Parthiban (2022); Mathias, and Hitlar Inedu (2022); Qinglu and Huan (2022) and Ozili et al. (2023).

Regarding the distributions of credit to the public and private sectors, credit that is provided to the private firms has a positive but insignificant relation to economic growth, while credit that is provided to the public sector has negative effects on economic growth, indicating that the private sector, in fact, benefited more from the 1991–1992 economic reforms (liberalization policy) than the public sector, yet the industry sector received domestic credits, which is not sufficient to contribute a significant amount to economic growth. Moreover, both the private and public sectors access credit from limited domestic financial institutions, particularly the Commercial Bank of Ethiopia and the Development Bank of Ethiopia, so that the public sector mostly creates the crowd-out effect in this credit market and the private sector is sometimes forced to receive credit at a higher interest rate and with a lower return, which could not bring

the intended change to economic growth. In tandem with this, relying more heavily on the saturated commercial banks eventually led to rent-seeking activities, notably corruption, which completely directed credit to unproductive activities, so these findings are in agreement with the results of Praise (2020); Olannye et al. (2023); Kamara et al. (2024); and Jalles and Medas (2024). Finally, in Table 6, the coefficient of convergence is -.6493273 and has 1 percent significant level, indicating approximately 64% of disequilibrium is eliminated annually. Besides, the CSD test statistic and p-value are 1.29 and 0.1967, respectively, indicating both the short-run and long-run parameters are consistent and unbiased estimators.

5. Conclusion and recommendation

The aim of this paper is to examine credit allocations and the changes in economic growth that result from these allocations. It specifically looked at the distribution of domestic credit among the three economic sectors (agriculture, industry, and services), the two categories of business owners (public and private), and the changes in GDP growth in each sector and the overall economy. We performed CSD, slope heterogeneity as well as Hausman tests after putting second-generation unit root and cointegration tests into practice. The results of these tests showed interdependencies between the cross-sectional units, heterogeneous panel, and pooled mean group estimator, respectively. Because of this, we employed the cross-section augmented error correction model (CS-ECM), which incorporates a pooled mean group estimation technique and appropriately addresses biased issues and parameter inconsistencies resulting from the interdependence of panel units.

The descriptive results show that a very small amount of domestic credit has been distributed to each economic sector, and the majority of these credits have been provided to the unproductive sectors. In a similar vein, the econometrics results indicate that domestic credits, which are provided to boost agriculture and industry production as well as enhance the private sector's contribution to GDP, have a positive but insignificant effect on output growth. Furthermore, domestic sectoral credit, which is allocated to the industry and public sectors, has a negative effect on industrial output growth and economic growth, respectively. In conclusion, due to the inadequacy of the availability and supply of domestic credit as well as sectoral credit misallocation, the overall effects of sectoral credit on economic growth are insignificant and even negative in the long run, highlighting the relevance of resource mobilization and reallocation of credit to efficient economic sectors.

Thus, to mobilize sufficient resources from domestic economies and maximize the impact of sectoral lending on growth, the government should promote a competitive environment within the financial industries. Furthermore, through the creation of suitable financial development policies, the government (the National Bank of Ethiopia) should encourage the reallocation of sectoral credit and optimize the effect of domestic credit on economic growth. The government should also promote a welcoming business environment for international banks, and in this way, it can generate more loanable money for the economy.

Finally, despite being a valuable addition to the existing empirical literature, this study has certain limitations. The study lost the benefits of using huge data in dynamic analysis because there was not enough time series data available for certain of the study variables. The dynamic model used in this study disregards the frequency dynamism of the variables; however, the wavelet coherence test that was recently used in other empirical works totally takes time and frequency dynamic analysis into account. Besides, the allocation efficiency of sectoral credit in this study was measured based on the contribution of each sector to GDP, which ignored the cost effectiveness of each sector. And hence, the researchers recommend further work be conducted, taking into account these gaps.

Authors' contributions

The corresponding author, Tesfamlak Gizaw, organized and conceptualized the research, collected, examined, and interpreted the data, composed the paper, verified its intellectual content, and assisted in approving the version that was going to be published. Zerihun Getachew and Malebo Mancha oversaw the conception and design of the study, revised the intellectual content, and assisted in approving the finished draft before it was published.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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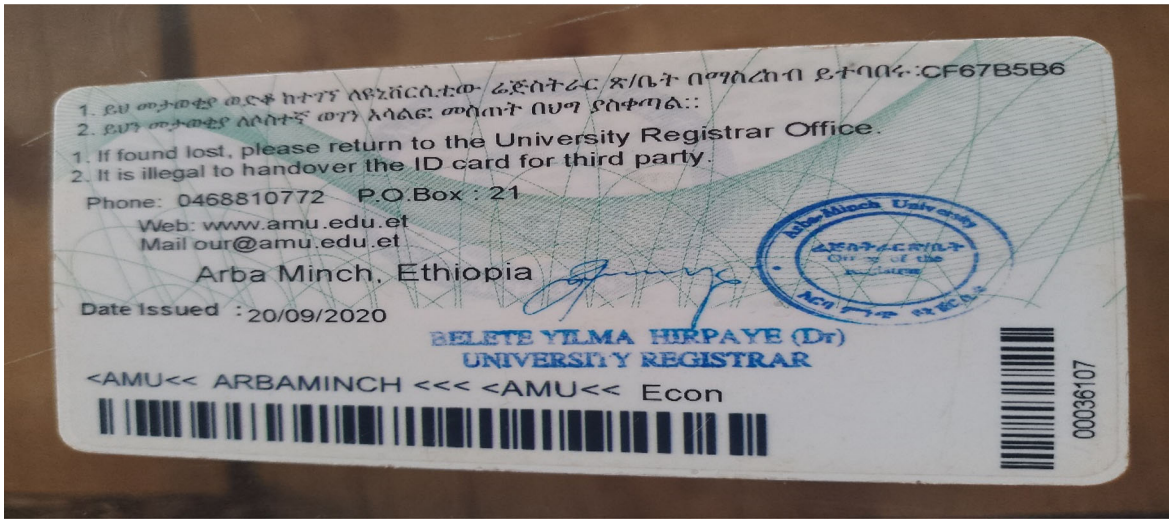

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Data availability statement

Annual time series panel data on labor force participation, capital formations, inflation, and sectoral outputs are publicly available on the websites of the Ministry of Finance and Economic Development (MoFED) at https://www.mofed.gov.et and the World Development Indicators dataset at https://data.worldbank.org. Also, information regarding domestic lending to the public and private sectors, as well as to the agricultural, service, and industrial sectors, is collected from the National Bank of Ethiopia and World Bank datasets, which are publicly accessible at https://data.worldbank.org. Additionally, you can download from the data repository using DOI: 10.4121/ebd3079a-7760-48cc-adda-8a659075717e, or the corresponding author shares this data directly by email at tesfanatan@yahoo.com.

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Appendix

Table A1. Hausman test between MG, DFE and PMG.

Hausman test between MG and PMG				Hausman test between DFE and PMG			
Coefficients				Coefficients			
(b) mg	(B) pmg	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E	(b) dfe	(B) pmg	(b-B) Difference	Sqrt(diag(V_b-V_B)) S.E
221.3527	16.7526	204.6001	220.8101	−20.01672	16.7526	−36.76932	N.A
.2194124	.4167977	−.1973853	N.A	−.1064919	.4167977	−.5232896	N.A
chi2(2)= (b-B)'[(V_b-V_B)^(-1)](b-B) = 0.80				chi2(2)= (b-B)'[(V b-V_B)^(-1)](b-B) = −0.65			
Prob > chi2 = 0.6687				Prob > chi2 = 0.4786			

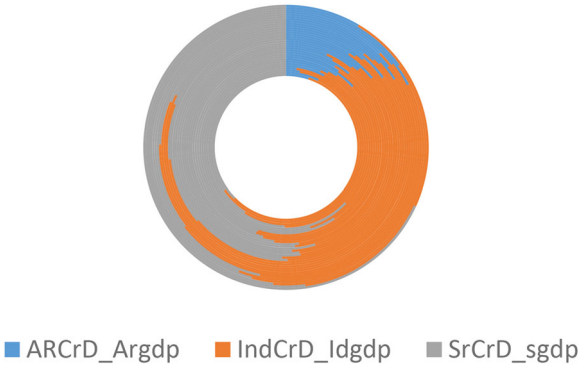

Figure A1. The total distribution of domestic credit to agriculture, service and industry sector as percentage of their own GDP from 1991 to 2022.