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Article

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Does real exchange rate matter better than trade volumes in triggering labour productivity growth? Evidence from Ethiopia

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Abstract: The trade-growth relation remains one of the controversies unsettled to this date. We test this hypothesis taking Ethiopia as a case study. Ethiopia is a developing economy aspiring to achieve a middle-income level, yet its labour force remains one of the least productive. The study draws on data between 1950 and 2019 to explore the impacts of exports, imports, capital, and the real exchange rate on labour productivity growth of Ethiopia. The Dynamic Ordinary Least Square results reveal mixed results across the time periods. In the long- run, the real exchange rate and imports positively influence labour productivity growth while exports have a negative effect, and the short-run effects of capital and imports are negative but exports have a positive impact. The multivariate Granger-causality

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PUBLIC INTEREST STATEMENT

Ethiopia has been catching the eye of the world as one of the fastest growing economies since 2004. It registered a double-digit growth in real Gross Domestic Products in the row during 2004-18. Thanks to development partners, this remarkable achievement has significantly reduced poverty and improved living standards in terms of access to infrastructure, education, and health. Yet, a double-digit inflation remains a challenge for the citizenry to meet the basic needs. Unemployment has still been the daunting problem of the economy due to a sluggish growth of private sector in general and labour-intensive industries particularly. In the midst of these challenges, the country aspires to reach a middle-income level. Achieving the target requires doubling the past efforts and improving the productivity of the labour force which is one of the least even by Sub-Saharan Africa standard. Thus, the study was conducted against this backdrop to examine sources of Ethiopia's labour productivity. The results of the study indicated that labour productivity could improve by imports of capital goods and by prudent exchange rate policy instruments which facilitate the benefits of international trade to materialize. The findings could be applicable to African countries with similar characteristics as Ethiopia.

analysis shows that: in the long-run, the real exchange is exogenous, and capital, exports, and imports have two-way causal relationships with labour productivity. In the short- run, only capital Granger—causes labour productivity, and the reverse causation runs from labour productivity to exports and to the real exchange rate. The Variance Decomposition analysis demonstrates that the real exchange rate stands out as a macroeconomic policy variable stimulating not only productivity growth but also capital, exports, and imports. To improve the productivity of labour force, it is suggested that Ethiopia adopts a prudent trade policy to better reap the benefits of international trade, and to facilitate the transfer of foreign technology through importation. It also needs to diversify its export basket and switch exports from raw materials and semi-finished goods to high-value products.

Subjects: Economics and Development; Macroeconomics; Econometrics; International Economics; Development Economics

Keywords: Ethiopia; Labour productivity; exports; imports; real exchange rate

1. Introduction

Investigation into the driving or hindering forces of labour productivity growth has been one of the central questions of theoretical and empirical economists aiming to study disparity in the living standards among the countries. The differences in economic growth rates are also reflections of disparities in productivity growth rates across countries. Therefore, labour productivity growth is a matter of considerable attention as the force shaping living standards in the long run and economic performance in the short run (Fachin et al., 2010; Samargandi, 2018). The neoclassical growth theory identifies technical progress as the longrun, and factor accumulation as the short-run determinants of labour productivity. Romer (1986), Lucas (1988) and Bond et al. (2010) argue that other variables including investment could determine a steady-state living standards. The endogenous growth theorists argue that the disparity in the living standards goes on indefinitely owing to innovation-driven productivity (Coe & Helpman, 1995). Consistent with the comparative advantage theory international trade boosts economic growth by achieving efficiency in resource allocation and enhancing TFP through technological diffusion. It is expected that outward oriented countries will outperform those producing only for home markets (Edwards, 1998; Rodriguez & Rodrik, 2000). The new structural economists on the other hand emphasize the roles of complementary policies in triggering and sustaining economic growth (Lin & Monga, 2010). However, neither theoretical nor empirical literature has conclusively identified the determinants of labour productivity.

The trade-growth relation is one of the controversies in theory reflecting the underlying complexities. An extensive empirical literature investigates the relationship by ignoring the roles of complementary policies. To this date, there is no clear measure of trade openess. Many studies use trade GDP ratio while others independently use either exports or imports. However, trade- growth analysis ignoring either imports or exports are biased as both play confounding roles to reinforce each other. Though trade-growth relationship a two way conceptually, many studies employ a unidirectional framework making it prone to endogeneity. As a result, the empirical literature has not provided a clear view on the trade-growth relation as results remain mixed and inconclusive across time periods, studies and countries.

This study attempts to fill the gaps in literature by examining the trade-growth relation in light of labour productivity taking Ethiopia as a case study. Ethiopia has been one of the fastest growing economies since 2004 resulting from huge public investments in infrastructure and human capital development. The growth has been accompanied by reduction in poverty, improvements in access to education, health, and infrastructure (MoFED, 2020). The government aspires to take the

country to a lower middle-income level by 2025 by doubling the efforts to sustain the achievements of the past decades. Yet, Ethiopia is one of the least labour productive countries even by Sub-Sahara Africa standard (McMillan et al., 2014). An average Ethiopian worker produced goods and services worth of $ 5248 (at 2017 PPP dollars) a year in 2019 compared to the average labour in America and South Africa whose contributions are 25 and 8 times as high respectively (Table A1 in Appendix). But, in 1970 labour productivities for the two countries were respectively about 42 and 16 times as high as Ethiopia's. The persistent low productivity of the country reveals its vulnerability to external shocks such as oil prices, supply, and debt crises (Naz et al., 2015).

The trend analysis of growth accounting variables[1] shows that over 1950–2019 period, capital deepening(CD), labour productivity(LP) and total factor productivity(TFP) grew on average by 4.3,2.4 and −0.2% respectively (Table A1 in Appendix). Except during the Derge regime,[2] TFP recorded negative average growth rates despite significant improvements during Ethiopian People Revolutionary Democratic Front (EPDRF) regime. LP and CD increased throughout the imperial regime, but grew by a lesser rate during the Derge regime. All variables have been increasing drastically since 2000. However, the contributions of TFP and CD to LP growth varies across the time periods. In the imperial period, labour productivity grew on average by 1.88% and the TFP shares about 52% of the increment. During the Derge regime, labour productivity growth was almost totally determined by TFP. This scenario was reversed during during 2016–19 period. The rising contribution of capital accumulation at expense of diminishing influence of TFP could be mainly attributed to excessive public investment in infrastructure and the sluggish growth of labour-intensive industries (PSI, 2020). This entails a setback for a developing country aspiring to reach a lower middle -income level by creating decent employment opportunities. Therefore, identifying the sources of labour productivity has high practical relevance. We pursue this major objective by specifically investigating whether Ethiopia's LP growth is a trade-led or policy-led influence.

The reminder of the paper is organized as follows: section 2 presents a review of empirical and theoretical literatures. The descriptions of the research methods and the data are presented in section 3. Part 4 discusses the empirical results, while section 5 sums up the discussions with conclusion and policy implications.

2. Review of literature

The Neo-classical growth models drawn from the Solow-Swan model ascribe major roles to technological progress as a long-term determinant of economic growth. There is a limit to economic growth driven by physical capital and labour inputs because of diminishing returns to capital. In the absence of technological progress that triggers steady-state growth, the effect of production inputs on economic growth gradually diminishes. According to this tradition, poorer countries would catch up with richer economies by acquiring capital and technology. However, sources of productivity growth differed between rich and poor countries incessantly (Chen, 1997), and convergence hypothesis has not yet been materialized. Increasing returns to capital and knowledge caused rich countries to grow indefinitely richer while LDCs may become permanently impoverished (Romer, 1986). Romer suggests investment by forward-thinking, profit-maximizing agents determine a sustained steady state of living standards. Bond et al. (2010) argue that investment has a growth effect on labour productivity in the steady state as well as a temporary effect during the transition to a new steady state growth path. Thus, factors other than technology could be considered as the determinants of economic growth (Lucas, 1988).

Endogenous growth models replaced the conventional thinking about exogenous technological change by a theory of continuous growth fueled by increasing returns to investment on a broad class of physical and human capital (Lin & Monga, 2010). The new theories build around innovation-driven productivity developments (Coe & Helpman, 1995) which could go on indefinitely and determine the disparity in the living standards across countries. The models incorporate imperfect competition and R&D theories into analysis to explain how technological diffusion takes place across countries and generates and sustains growth, and why it does not take root in others (Lin & Monga, 2010). Based on the observation that a country's TFP depend on its own R&D capital stocks as well as on the R&D capital stocks of its trade partners, international trade underlines the

mechanism that link a country's productivity gains to economic development in its trade partners (Coe & Helpman, 1995). The shocks to productivity also come from a state acting as an enabling agent to make up for market failures that retard development. In this regard, the roles of complementary policies in enhancing the benefits of a more open trade regime are emphasized. To achieve fast and sustainable growth through integration into global economy, Lin and Monga (2010) suggest that the state should be committed, credible and be capable of designing prudent macroeconomic policies that direct resource use towards country's comparative advantage while simultaneously avoiding excessive exchange rate appreciation among others. Such policies should be supplemented by market supporting institutions, infrastructures, appropriate business regulations, well-functioning credit markets, and flexible labor markets (Chang et al., 2009). The next sections extend the neo-classical model along these lines of arguments.

2.1. Trade and labour productivity

Romer (1986), Lucas (1988) and Grossman and Helpman (1991) have analyzed the role of international trade in transmission of knowledge, the accumulation of human capital, and the increasing returns embodied in foreign technology. Trade stimulates growth by directing resources towards the production of the good for which the country has an absolute advantage. Participation in foreign trade generates externalities which manifest themselves in the domestic economy as increased efficiency, new manufacturing techniques, learning by doing, and management systems. It is believed that open economies have a better ability to capture new technologies developed elsewhere (Edwards, 1998; Rodriguez & Rodrik, 2000), and are likely to experience faster productivity growth (Söderbom & Teal, 2003). A plethora of micro and macro studies have identified pathways for disseminations of the static and dynamic gains from trade.

Foreign trade exposure induces firms to self-select into export markets while forcing the least productive ones to exit (Melitz, 2003). To compete in foreign markets, exporting firms adopt advanced technologies and imitate foreign competitors. Exports reallocate resources from less productive to more productive uses, resulting in increased capacity utilization and the economies of scale (Awokuse, 2008; Onafowora et al., 1996), which reduces unit production costs and increases production efficiencies. Last but not least, exports eliminate foreign exchange constraints for acquiring capital and intermediate goods (Esfahani, 1991).

Yet, imports are more important channels for economies with limited natural resource endowment. Imports of capital goods and intermediate inputs embody foreign technology that otherwise are too costly to produce locally (Mazumdar, 2001). It enables the importing country to jumpstart productivity growth by leveraging new technologies developed by its trading partners (Coe & Helpman, 1995). Coe et al. (1997) argue that importing intermediate products and capital equipment containing foreign R&D knowledge can boost a country's productivity. Similarly, imports of consumer goods increase the incentive for domestic import-substituting firms to innovate and restructure themselves in order to compete with foreign rivals. Thus, imports increase productive efficiency (Kim et al., 2007).

This line of stylized facts forms the trade-led growth hypothesis which states that trade openness results in economic growth by stimulating TFP passing through advanced technology and know-how from the developed countries. The trade-led growth hypothesis predicts the causal link runs from trade to productivity. Likewise, for a various reason, the reverse causality from productivity growth to trade is intuitively plausible. To the extent that productivity embodies more knowledge and competency, it is likely to enhance the competitiveness of the domestic products. It is necessary for firms to be more efficient in order to reap the benefits of welfare gains from a country's exposure to the export market in the form of market share and profits (Melitz, 2003). According to Thangavelu and Rajaguru (2004, positive productivity shocks result in higher exports due to lower prices and higher product quality. *Bhagwati (*1988), on the other hand, observes a virtuous circle in which growth-induced trade generates more output, which in turn facilitates more trade. This line of arguments

form the growth-led trade hypothesis and state that domestically generated productivity growth leads to the international competitiveness of domestic products.

A vast body of empirical literature examining the relationship between trade and growth has documented mixed and conflicting results across time periods, countries and methodologies. Numerous studies have documented evidence in favour of trade-led growth hypothesis. For example, the more recent studies by Manwa and Wijeweera (2016), DiBerardino et al. (2017), Abdillahi and Manini (2017), Siyakiya (2017), Malefane (2018), Amna Intisar et al. (2020), Duodu et al. (2020), Sghaier (2020), Abendin et al. (2021) reported positive effect of trade openness on economic growth. Similarly, Hye et al. (2016), Keho and Grace Wang (2017), Doan (2019), Duodu et al. (2020),Koutima-Banzouzi (2023) found that trade openness stimulates economic growth both in the short and long run. Moreover, Jouini (2015) and Jalil and Rauf (2021) confirmed the trade-led growth hypothesis which is robust to various measures of trade openness, model specification and estimators. Naz et al. (2015) developed two models to investigate the impact of trade openness on TFP growth in a panel of 94 countries from 1964 to 2003. They discovered that trade has a positive effect on TFP. The more open the economies, the greater the benefits due to greater ability to absorb new and advanced technology created in more developed countries. In the study on the Brazil, Russia, India, China, South Africa (BRICS) from 1991–2018 Rath and Ridhwan (2020) found cointegrating relationship among employment, LP and trade openness, and a unidirectional causality running from trade openness to labour productivity in the agricultural sector. In a similar vein, Mallik (2015) based on dynamic panel data models found that international trade significantly influenced LP growth in BRICS during 1990 – 2011. Malawi and AlMansi (2014) estimated the ARDL model for Jordan during 1980–2010, and found that economic globalization has positive influence on LP in the long-run, but it has negative impact in the short-run. Samargandi (2018) investigated the factors that influence LP in 19 Middle Eastern and North African countries. He used the Fully Modified OLS and Dynamic OLS frameworks to report the positive effects of trade openness, innovation, and capital stock on LP. Using ARDL, Asada (2020) discovered that exports and imports are the long-run drivers of LP growth in Vietnam over 1990–2017 period.

In contrast, Trejos and Barboza (2015) and Manwa et al. (2019) reported that trade has an ambiguous effect on economic growth. Azenui and Rada (2021) by investigating effect of trade on LP in thirty sub-Sahara African LDCs over 1991–2018, they documented weak evidence for trade-led productivity growth, and conclude that trade and growth relationship remain unsettled. Likewise, Ijirshar (2019), and Gabriel and David (2021) found mixed trade effect that is positive in the long run but negative in the short run. Bunje et al. (2022) generate four measures of trade openness to investigate their impacts on economic growth using a panel data from 52 African countries covering 2000–2018 period. They concluded that the growth effects of trade openness are mixed across the various openness measures and robustness regression estimates. A group of literature focusing on Africa, for example, Khobai et al. (2018), Guei and Le Roux (2019), Adu-Gyamfi et al. (2020), Farahane and Heshmati (2020) and Ari et al. (2022) found that trade has negative impact on economic growth. Senbeta (2008) by employing fixed effect estimator discovered a negative static effect of trade openness on TFP for a panel of 22 SSA countries. In the study on 42 SSA countries covering 1980 – 2012, Zahonogo (2017) found an inverted U-curve relationship between trade and economic growth which is robust to changes in trade openness measures and to alternative model specifications. The non-linear pattern between trade openness and economic growth was also observed for a panel of 82 countries spanning 1980–2014 by Ramzan et al. (2019) who confirmed that trade openness boosts GDP growth only once countries achieve a minimum threshold of TFP development level. Similarly, Huchet-Bourdon et al. (2018) by analyzing the non-linear relationship for a panel of 169 countries over 1988 – 2014, conclude that openness impacts positively growth of countries exporting high-quality and variety products while it affects negatively those specialized in low quality products.

Another strand of studies has tried to overcome complexities involved into the growth-trade nexus by separately or jointly analyzing impacts of exports and imports on economic growth. Iyoha and Okim (2017) and Farahane and Heshmati (2020) confirmed the export-led growth hypothesis for ECOWAS covering 1990–2013 period and SADC 2005–2017 respectively, based on dynamic panel data models. Kacou et al. (2022) investigated the relationship between trade openness and labour productivity in 61 developing countries from 1999 to 2018 by controlling for openness tier and export structure. Their finding supports both the export-led productivity and the productivity-driven export hypotheses, the benefits of which are dependent on the degree of openness to export diversification. Amirkhalkhali and Dar (2019) construct three groups of Organization for Economic Cooperation and Development (OECD) countries based on their trade openness, and two sub-periods 2000–2007 and 2008–2015 each. To that end, they estimated growth accounting model using a random varying coefficients method and showed that the export growth has positive impacts on total factor productivity which increase monotonically with the degree of openness. Feddersen et al. (2017) drawing on dynamic time series models analysis of South Africa, found that export stimulate growth directly in the short-run, but through capital formation in the long run. Herrerias and Orts (2010) used the VAR model to show that China's rapid labour productivity growth since the 1960s has been attributed to exports, investment, and real exchange rates. Kunst and Marin (1989) investigated the Granger causality between LP in the manufacturing sector and exports in Australia using Subset Model Autoregression (SMAR). They discover a reverse causal relationship between productivity and exports. The authors attribute the absence of export-led productivity to counteracting forces of export stimulus that increase productivity through own production and the concentration effect. Similarly, Marin (1992) attempts to answer the same question for four industrialized countries by using co-integration analysis. In contrast, he discovered that export Granger—not only causes productivity, but also accounts for differences in productivity between Germany, Japan, the United Kingdom, and the United States. Yamada (1998), on the other hand, used a Toda and Yamamoto (1995) causality to reject the export-led productivity hypothesis for six OECD countries. Participating in export activities, according to Sjöholm (1999), boosts productivity growth in Indonesian manufacturing firms. A number of authors, however, argue that exporting activities do not reduce unit costs of production and do not distinguish exporters' productivity from non-exporters' productivity. Clerides et al. (1998), for example, find evidence in support of self-selection of more efficient firms into export markets by analyzing firm-level panel data for Colombia, Mexico, and Morocco. Bernard and Jensen (1999) confirm the reverse causality by examining US manufacturing firms.

Awokuse (2008) investigated the causal links between exports, imports, and economic growth for Argentina, Colombia, and Peru based on Vector Error Correction Model (VECM) analysis. The study presented strong evidence in support of import led hypothesis, and suggest that the singular focus of past studies on exports as the engine of growth may be misleading. Panta et al. (2022) analyzed the same links for Nepal during 1965–2020, and reported evidence in favour of feedback links between import and growth only in the short run. Carrasco and Tovar-García (2021) analyzed the trade- growth nexus based on dynamic panel data models, and found that high-tech import and capital import goods have positive effects on economic growth of 19 developing countries. MacDonald (1994) discovers that imports of intermediate and final goods positively influence LP by exerting pressure on domestic producers to seek more efficient methods of production in order to compete by examining a panel of 94 US manufacturing industries. Lawrence and Weinstein (1999) provide evidence for the import-driven productivity hypothesis using Japanese and Korean firms, arguing that imports of competing products force domestic industries to adopt new technologies, reduce "X-inefficiency," and cut costs wherever possible. According to Kim et al. (2007), TFP growth in South Korea is driven by competitive pressures associated with consumer goods imports as well as technological transfers embodied in capital goods imports from developed countries, supporting the role of imports as a conduit of technology transfer. Thangavelu and Rajaguru (2004) used a multivariate VAR framework on data sets spanning 1960 to 1996, and confirmed import-led LP growth in India, Indonesia, Malaysia, the Philippines, Singapore, and Taiwan, but export-led productivity growth in Singapore.

2.2. The real exchange rate and labour productivity

The real exchange rate is usually defined in two ways: One way to define the real exchange rate (RER) is as the price of domestic tradable goods relative to the price of foreign goods: i.e., $q \cong \frac{EP^D}{P^d}$, where P^F and P^D are the foreign and domestic price levels and E is the nominal exchange rate. The other is as the ratio of domestic price of tradable basket to the non-tradable basket i.e., $q \cong \frac{P^T}{P^N}$. As the relative price, any factors which cause a shift in production orientation between domestic and foreign sectors and between the domestic tradable and non-tradable sectors will likely to influence the RER. Then, being itself an endogenous variable, how can the real exchange rate matter for LP growth?

A depreciation of RER implies a higher price of foreign goods relative to the price of domestic goods which will induce a switch of both domestic and foreign demand in favor of domestic goods. Similarly, the RER represents a higher price of tradables relative to that of non-tradables, and will switch domestic demand towards non-tradables against tradables and production towards tradables against non-tradables. In both cases, a depreciation of RER implies improvement in domestic productivity (Manwa et al., 2019), and would lead to improvement in current account balance which comes together with an increase in national saving (Rapetti, 2020). This forms "foreign saving" channels through which real exchange rate influences economic growth process.

An intriguing intuition could be drawn from the Balassa-Samuelson effect. As a country grows rich, the lower productivity in non-tradable sectors increases the sectors' relative prices which reduce the real wage, and depresses the equilibrium ratio between non-tradable and tradable prices. The ensuing RER appreciation creates an incentive, in terms of profitability, to move labour from the tradable industry to the non-tradable sector (DiBerardino et al., 2017). Likewise, RER appreciation resulting from capital inflows, remittances and foreign aid cause resource movements that favor the non-tradable sector at the expense of tradable production (Lartey et al., 2012; Rajan & Subramanian, 2011). This Duch disease phenomenon adversely impacts a country's competitiveness and may retard structural transformation of the country by provoking de-industrialization.

One way this situation could be circumvented is through industrial policy that favor tradable goods. Countries could often facilitate resource mobilization towards manufacturing export by maintaining competitive levels of exchange rate without driving down prices insofar as external demand is elastic. Therefore, for a developing economy seeking to jumpstart growth by encouraging export of manufactures, exchange rate is a development-relevant policy tool (Eichengreen, 2007). Knowledge intensity and a high—productivity are hallmarks of the modern tradable which generates different forms of externalities such as learning by doing, learning by investing and technological spillovers Rapetti (2020). However, according to Rodrik (2008) tradables suffer disproportionately compared to non-tradables from the institutional and market failures that block structural transformation and economic diversification. The author suggests that any policy that can induce the RER depreciation will have a growth-promoting effect. Though not a direct policy variable, the RER can be seen as a second-best policy instruments either as an instrument of macro-prudential policy or as an instrument of industrial policy Rapetti (2020). Monetary policies such as tight money supply, capital controls, hoarding foreign reserves and sterilization, and fiscal policies targeting tradable sectors such as tariffs, tax, subsidy, employment and preferential credits can be adopted as real exchange rate policy instruments to improve current account balance. On this ground, the RER enters the LP equation as exogenous policy variable (Eichengreen, 2007; Rodrik, 2008).

The empirical evidence about higher RER levels leading to higher saving and investment is documented by Rapetti et al. (2012), Levy-Yeyati et al. (2013) and Bresser-Pereira et al. (2014). Hausmann et al. (2005) by examining instances of rapid acceleration in economic growth, they identified 80 episodes that are sustained for at least eight years tend to be associated with

increases in investment, trade and with RER. McMillan and Rodrik (2011) by a panel analysis of nine sectors in 38 countries over the period 1990–2005 found that a higher levels of the RER favor structural transformation towards modern tradables and the flow of labour from low-productivity to high productivity tradable activities. Similarly, the positive productivity growth effect of RER deprecation is documented by Aghion et al. (2009), Eichengreen (2007), Rodrik (2008), Rapetti (2020) and Adu-Gyamfi et al. (2020). However, the positive effect on productivity growth of the real exchange rate is contested by studies that failed to find one (Al Mamun et al., 2015; Farahane & Heshmati, 2020; Manwa et al., 2019) and by others that found negative impact (Guei & Le Roux, 2019; Iyoha & Okim, 2017). Similarly, Duodu et al. (2020) finds mixed effect of RER that is positive in the long run and negative in the short run.

Regarding Ethiopia, there is a dearth of literature investigating determinants of LP. Altaseb and Singh (2018) conducted qualitative appraisal of recent studies investigating determinants of growth in Ethiopia. Some studies reported positive impact of trade on economic growth while others obtained either negative or insignificant coefficients. Geda (2007) explored the determinants of labour productivity growth of Ethiopia over 1960–2000 period, and found that capital deepening is the major contributor followed by education per person and TFP, whose contribution is negative in years of bad weather and wars. Negera (2021) explored sources of Ethiopia's economic growth during 1991–2018 by employing ARDL model. The study observed that trade is negative influence in the long run. Rao and Bedada (2017) based on VECM analysis reported that export has no effect on economic growth. Getinet and Ersumo (2020) based on ARDL model estimation found mixed effects that is negative in the long-run, but positive in the short run. Gizaw et al. (2022) based on VECM framework found positive effects of exports and RER on economic growth of Ethiopia. Thus, Ethiopia's evidence is also far from settled.

Therefore, the current study aims to fill these gaps by attempting to solve the controversy between trade and economic growth in light of LP by taking Ethiopia as case study. One complexity into trade-growth nexus relates to the fact that export is a component of national income identity. We transform the neoclassical production function into LP to overcome the problem. We then extend the analysis in line with the endogenous growth models and the new structural economics framework to emphasize the roles of trade and policy simultaneously. In addition, separately incorporating exports and imports helps to capture the confounding roles of the two in trade-growth relation and to avoid measurement errors regarding trade openness. Therefore, the study tests the hypothesis of positive effects of capital,exports,imports and RER on LP.We believe that the trade-growth relations are better represented in a two way framework, and also propose the alternative estimator in case the econometric issues related to diagnostic tests become a concern. Finally, the study examines the nature of the relationships in terms of causal links and investigates the dynamism in trade-growth relation to figure out the determinant variables.

3. Research methods

3.1. Theoretical model

Based on the discussions in the last sections, we express the neoclassical production function in terms of capital, TFP and trade policy. Exports and imports enter the equation as technological spillovers on TFP. Thus, increasing returns to the scale production function is expressed as:

$$Y = AF[(K, L), Z] = \omega X^{\gamma} M^{\theta} K^{\alpha} L^{\beta} Z^{\rho} \tag{1}$$

Where Y denotes aggregate output, A is total factor productivity, X is export, M is import,$K$is capital input, L is labour input, Z is trade policy variable.

Following the literature,[3]dividing Equation (1) by labour units employed gives the log linear expression of econometric model defined by:

$$\ln y_t = \delta + \alpha \ln k_t + \gamma \ln X_t + \theta \ln M_t + \rho \ln RER_t + \varepsilon_t \quad (2)$$

Given that $\delta = \ln \omega$

Where y_t is labour productivity, k_t is capital deepening, RER_t is the real exchange rate and ε_t is white noise stochastic process that measures effects of all excluded variables. The coefficient α, γ, θ & ρ are elasticities that measure effects on LP of capital, exports, imports, and RER respectively, and δ and ω are constant parameters.

The right hand variables in Equation (2) are themselves consequences of policies and process influencing the macroeconomy,and they are endogenous to the system.Therefore,Vector Autoregressive (VAR) approach which account for the interdependencies among the variables is used as analytical framework of the study.

3.2. Econometric model

The empirical methodology involves five steps. The first examines a uni-variate property of the series using unit root tests. The second step investigates co-integration among the model variables. The third step obtains model estimates using Dynamic Ordinary Least Square (DOLS) estimator. The fourth step explores the causal relationships among the variables by using Granger—causality test. This is followed by Variance decomposition analysis in the fifth step to measure the strength of the causal relationships and capture the dynamism beyond the sample period.

3.2.1. Johansen co-integration tests

The cross dependence among the *k*- variables is expressed in $VAR(P)$ form as:

$$X_t = \mu + \theta_1 X_{t-1} + \cdots + \theta_p X_{t-p} + \vartheta_1 Z_{t-1} + \cdots + \vartheta_p Z_{t-p} + \zeta_t \quad (3)$$

Where X_t & Z_t are the k vector of non-stationary $I(1)$ endogenous and exogenous variables respectively, μ is vector of constants, p is the lag length and ζ_t is vector of innovations. First differencing equation (4) yields VECM representation as:

$$X_t = \mu + \prod \begin{pmatrix} X \\ Z \end{pmatrix}_{t-1} + \sum_{P-1}^{i=1} \Gamma_i X_{t-1} + \varphi Z_t + \sum_{i=1}^{P-1} \varphi_i Z_{t-1} + \gamma_i D_s + \sum_{P-1}^{i=1} D_{s-1}^{\gamma_i} + \zeta_t \quad (4)$$

Where $\prod$ and Γ_i are *kxr* and *k x k* coefficient matrices respectively,and D_s is the matrix of shift-level dummy. Johansen co-integration tests whether the rank r of matrix $\prod$ is $r \neq 0$, that is $\prod \neq 0$. In other words, if $\prod^{X_{t-1}}$ is integrated process $I(1)$ the matrix $\prod$ has a rank $0 \leq r \leq k$ with r co-integrating relationships as:

$$\prod^{=} \alpha \beta^{|} \quad (5)$$

Where α is a vector of error correction coefficients, which measures the speed of adjustment toward equilibrium and β is a vector of co-integrating relations.This parameterization (4) removes the level effects in the matrix $\alpha\beta^{|}$ and r_i …, r_p yields the short-run dynamics of the process Johansen (1995).

The Johansen co-integration test is based on the trace and maximum eigenvalue statistics. The trace statistic tests the null hypothesis of at most *r* co-integrating vectors against the alternative hypothesis of *r* co-integrating vectors. It is written as:

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{n} \ln(1-\lambda_i) \tag{6}$$

On the other hand, the maximum eigenvalue statistic compares the alternative hypothesis of $r+1$ co-integrating vectors to the null hypothesis of r co-integrating relations (Maddala & Kim, 1999). It spelled as follows:

$$\lambda_{max}(r, r+1) = -T\Sigma(1-\lambda_{r+1}) \tag{7}$$

The Johansen's procedure produces full information of Maximum Likelihood estimates of co-integrating relation. However, the method is highly dependent on the lag length selection, and the specification of one equation has an impact on parameter estimates of the other. This may lead to endogeneity, autocorrelation, and non-normal residuals, and result in inconsistent estimates of VECM.

3.2.2. Dynamic ordinary least square estimator

Stock and Watson (1993) propose a single equation estimator which overcomes these issues through lead and lag differences. The Dynamic Ordinary Least Square (DOLS) possesses the same asymptotic distribution as Johansen's maximum likelihood estimator for variables that co-integrate with endogenous regressors (Herzer et al., 2006).

$$\begin{aligned} lny_t = \alpha \ &+ \beta lnk_t + \gamma lnx_t + lnm_t + lnrer_t + \sum_{i=-p}^{i=p} \varphi_1 \Delta lnk_{t+1} + \sum_{i=-p}^{i=p} \varphi_2 \Delta lnx_{t+1} \\ &+ \sum_{i=-p}^{i=p} \varphi_{3\Delta} lnm_{t+1} + \sum_{i=-p}^{i=p} \varphi_4 \Delta lnrer_{t+1} + \varepsilon_{1t} \end{aligned} \tag{8}$$

3.2.3. Granger—causality

When the variables are co-integrated, Vector Error Correction model (VECM) is a useful framework for investigating long run and short run Granger—causality (Panta et al., 2022). As a result, the Granger—causality test is carried out by estimating the following VECM:

$$\Delta X_t = \mu + \alpha ECT_{-1} + \sum_{i=1}^{P-1} \Gamma_i \Delta X_{t-i} + \zeta_t \tag{9}$$

Where ECT_{-1} is error correction term obtained from co-integrating relationship (6).

3.3. The Data

The data was obtained from Penn World Table version 10.0 databases,and covers 1950–2019 period. A total of 10 variables were extracted from the databases and converted into five variables namely labour productivity, real capital stock, real exports, real imports, and real exchange rate. The output-side real GDP at current PPPs (in mil. 2017US$) and capital stock at current PPPs (in mil. 2017US$) were divided by the number of persons employed to convert them into labour productivity and capital deepening respectively. The capital labour ratio, exports, and imports at current national prices were deflated by respective Price levels to turn them into real values. The real rate was obtained by normalizing the foreign price level to unity, and dividing the nominal exchange rate by the GDP deflator.

4. Results and discussions

4.1. Descriptive statistics

Table 1 summarizes the descriptive statistics of the time series over the study period. It can be observed that average labour productivity is $1827.26 in 2017 Purchasing Power Party Dollars. Each employee operates a capital worth 2723.94 dollars on average. Ethiopia exported and imported on average goods worth 34, 735.14 and 92, 902.47 million dollars in real terms, respectively. The average real value of one US Dollar is 28.13 Birr. All of the variables are positively

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Table 1. Descriptive statistics of the variables

Variable	*y*	*k*	*x*	*m*	*rer*
Mean	1827.262	2723.943	34735.14	92902.47	28.13607
Std. dev.	822.2697	2707.821	72526.04	206590	19.11571
Maximum	5248.32	11173.6	350718.8	951692.4	95.50617
Minimum	997.3646	609.0568	966.7354	617.5226	5.64379
Skewness	2.218767	1.446871	2.631202	2.644255	1.303841
Kurtosis	7.789773	3.860804	9.366312	9.116897	4.606157
Observation	70	70	70	70	70

skewed with values greater than 1. And they have kurtosis statistics greater than 3. Therefore, they are all leptokurtic (long- tailed or high-peaked).

4.2. Unit root test results

The study employs the Kwiatkowski, Phillips, Schmidt, Shin (KPSS), Augmented Dickey-Fuller (ADF), and Philip Peron (PP) unit root tests to investigate stationary properties of the variables. The KPSS test is more powerful than the other two in detecting the unit roots. It tests the null hypothesis of a stationary series while the null hypothesis for ADF and PP tests is a unit root process.

The results in Table 2 indicate that the series are non-stationary at levels, but stationary at first differences. Since all variables are integrated of the same order $I(1)$ or stationary at the first difference, Johansen's co-integration tests can be performed (Enders, 2004).

Before trying the co-integration test, 2 lags were determined as the optimal lag length by using Final Prediction Error (FPE), Hannan-Quinn Information Criteria (HQIC), and Akaike Information Criterion (AIC) (Table 3). There are neither autocorrelations nor normality problems in residuals at these lags. Therefore, the VAR(2) model is enough to capture the dynamic effects among the variables.

Table 2. Unit root tests' results

	KPSS test statistics		ADF test statistics		PP test statistics	
Variables	Level	1st difference	Level	1st difference	Level	1st difference
ln *y*	0. 30***	0.02	1.21	−4.58 ***	0.99	−9.05 ***
ln *k*	0.74***	0.16	−0.64	−3.86 **	−0.23	−3.25 **
ln *x*	0.72***	0.12	−0.38	−4.73 ***	−0.23	−7.86 ***
ln *m*	0.76***	0.151	−0.35	−4.88 ***	−0.18	−7.67 ***
rer	0.74***	0.08	0.004	−5.50 ***	0.314	−6.46 ***

Note: The KPSS (1992) 1% critical value = 0.216, the MacKinnon (1996) 1% critical values for the ADF and the PP tests = −4.020. For KPSS (ADF& PP), ***, ** and * respectively denote significance (rejections) at the 1%, 5% and 10% levels.

Table 3. Results for lag selection criteria

Lag	LL	LR	FPE	AIC	HQIC	SBIC
0	19.7923	NA	0.000027	0.817422	0.920885	1.07854
1	335.275	710.13	1.2e-09	−9.15514	−8.84475	−8.37179*
2	362.376	54.202*	9.0e-10*	−9.48164*	−8.96433*	−8.17605

*denotes selected lags per criterion.

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Table 4. Johansen's co- integration test results

Null hypothesis	λ-Trace statistic	1% critical value	λ- Max statistic	1% critical value
$r \leq 0$	89.7514	76.07	51.1510	38.77
$r \leq 1$	38.6004***	54.46	18.9238***	32.24
$r \leq 2$	19.6766	35.65	10.4673	25.52
$r \leq 3$	9.2093	20.04	7.6402	18.63
$r \leq 4$	1.5691	6.65	1.5691	6.65

r denotes the hypothesized co-integrating equation. *** indicates rejection at 1% significance level.

4.3. Johansen's co-integration test results

The Johansen (1988) method has the power to detect a number of co-integrating equations over the alternative tests, and treats the variables as potentially endogenous. Table 4 presents Johansen's test results based on the trace and maximum-eigenvalue statistics. By comparing the test statistics against their respective critical values, we reject the null hypothesis of no co-integration at a 1% significance level for both tests, but we fail to reject the null hypothesis of at most one co-integrating relation and above. This suggests the presence of a unique co-integrating vector among the variables of the model. Therefore, we conclude that the variables LP, real capital; real exports, real imports, and RER share a common trend in the long run though they are unit roots in levels.

The evidence of co-integrating relations suggests VECM representation of the VAR (2) model (Engle & Granger, 1987). However, we used the framework to analyze causality since the estimates fail to meet the classic OLS diagnostic tests. Instead, the study applied the DOLS estimator proposed by Stock and Watson (1993) to overcome the econometric issues.

Table 5. DOLS regression results

Dependent variable: $\ln y_t$	**Coef.**	**Std. Err.**	**t**	***P*>|t|**
$\ln k_t$	0.564	0.546	1.03	0.326
$\ln x_t$	−1.2388	0.43769	−2.83	0.018
$\ln m_t$	0.8398	0.3895	2.16	0.056
$\ln rer_t$	0.0214	0.0065	3.29	0.008
Δlnk_{t-2}	−2.99447	1.4849	−2.02	0.071
Δlnx	0.79866	0.3648	2.19	0.053
Δlnx_{t-1}	0.8436	0.31772	2.66	0.024
Δlnx_{t-2}	0.7936	0.3686	2.15	0.057
Δlnx_{t-3}	0.7413	0.2552	2.90	0.016
Δlnm	−0.6279	0.2722	−2.31	0.044
Δlnm_{t-1}	−0.7391	0.2578	−2.87	0.017
Δlnm_{t-2}	−0.666	.30435	−2.19	0.053
Δlnm_{t-3}	−0.6115	0.233	−2.62	0.026
$\Delta lnrer_{t-1}$	−0.0134	0.00733	−1.83	0.097
Constant	6.2597	1.772	3.53	0.005
Adj R-squared = 0.9888	Durbin-Watson d-statistic = 2.128	JB = 0.8632(0.6495)	_hat = 0.73622 (0.293)	_hatsq = 0.01743 (0.705)
ARCH(1) = 0.573 (0.4491)	ARCH(2) = 1.305 (0.5208)	ARCH(3) = 1.737 (0.6287)	ARCH(4) = 2.562 (0.6336)	ARCH(5) = 3.59 (0.6098)

H0: no ARCH effects vs. H1: ARCH(p) disturbance

4.4. The DOLS estimation results

We estimated the DOLS model with the first difference 5 leads and lags. The results presented in Table 5 are only for significant coefficients except for the sake of emphasis. As per our results, capital has no significant contribution for LP growth in the long run. This result is in line with Zelleke and Sraiheen (2012) and PSI (2020) who found that Ethiopia's LP growth is determined by the TFP growth.But, it contradicts the positive contribution of capital to economic growth of Ethiopia (Gizaw et al., 2022; Negera, 2021). Samargandi (2018) established positive effects of capital stock on LP that are robust to different specifications. Likewise,Bond et al. (2010) showed that capital is the main determinant of productivity growth, regardless of the functional form.

The RER and imports account for productivity improvement while exports have negative effects on productivity growth in the long—run. All else remain constant, LP improves by average 8.4% and deteriorates by average 12.4% as a result of 10% increment in real imports and real exports respectively. For one ETB[4] increase in the real value of the Dollar, the long—run LP increases in by 0.02% on average ceteris Paribus. The positive effect of imports in the long run is in line with Thangavelu and Rajaguru (2004) and Asada (2020). Over the long term, imports embodied knowledge spillovers and through learning by doing, domestic workers will acquire skills to adapt to foreign technology which translate into higher productivity. Consistent with Herrerias and Orts (2010), Aghion et al. (2009), Eichengreen (2007), Rodrik (2008) Rapetti (2020), Duodu et al. (2020) and Gizaw et al. (2022) real exchange rate improves productivity growth. The positive effect of RER on labour productivity emerges from policies encouraging resource allocation and employment in favour of tradable sectors which help to correct trade deficits and encourage capital formation. In contrast to Thangavelu and Rajaguru (2004), Herrerias and Orts (2010) and Asada (2020) the dynamic benefits and other positive externalities resulting from export participation fail to materialize to Ethiopia's case primarily due to the low quality of Ethiopia's export baskets (Hausmann et al., 2007),and the erratic export earnings. Ethiopia's export sector is characterized by demand-side factors such as a low-income elasticity of commodity exports, prices fluctuations and limited destinations, and supply side factors such as the dominance of primary commodities in the export basket and a very high degree of concentration of exports on few commodities (Geda, 1999).

Capital s and imports have negative effects while the exports exports have positive effects on LP growth in the short—run. Exports raise the demand for domestic products and bring in foreign exchange that help to pay for capital and intermediate goods. It stimulates output growth by relocating resource use towards a country's comparative advantage. The negative short run effect of imports could reflect competitive pressure on producers of consumer imports. It also indicates the delay it takes to new firms to start production and workers for learning and adopting skills to utilize technology embodied in imported capital goods (Asada, 2020; Malawi & AlMansi, 2014).

The coefficients of explanatory variables are jointly significant with F (4, 10) = 20.41(0.0001). This result shows that the capital, exports, imports, and exchange rate jointly explain 98.9 % variation in labour productivity. Furthermore, the model passes all the diagnostic tests presented at the bottom panel of Table 6. The _hat and _hatsq show that the model is well specified. The Durbin-Watson statistic shows that there are no autocorrelation problems, and the residual is normally distributed as indicated by the Jarque Berra (JB) test. Furthermore, the model is robust to auto-regressive conditional heteroscedasticity (ARCH(k)) of order k = 1, 2,3, 4,5. Moreover, the author checked the stability of the model parameters by cumulative Sum of Squares of Recursive Residual CUSUMSQ test. If CUSUMSQ moves outside the critical lines of the 5% significance level, the null hypothesis will be rejected, meaning that the model is unstable. The test result presented in Figure 1 shows that the model is stable over the period of the study.

4.5. The granger causality results

The VECM is an effective tool for determining long-run and short-run causality among co-integrated variables (Ratanapakorn & Sharma, 2007). A variable x_t is said to Granger- cause another variable $y_t$if the one step ahead forecast of y_t in the regression model improves the

quality of the model by considering the historical values of x_t (Osińska, 2011). In this framework, one year past error correction term; ECT_{-1} indicates joint long—run causality from the right hand side variables. In contrast, the joint significance of the difference explanatory variable's coefficients indicate short-run causality of the variable on the dependent variable.

After estimating Equation (9), we applied a t-test on the ECT_{-1}s to test for the long—run causality and a Wald χ^2 - test on the difference lags of each independent variable to explore the short-run causality. Table 6 presents the long-run and short-run Granger-causality test results quantitatively in panel A and qualitatively in panel B. The ECT_{-1} the coefficient of LP equation is statistically significant at a 1% and hence, the t-statistics rejects the null hypothesis that capital, exports, imports and RER do not jointly Granger—cause the LP. As a result, capital, exports, imports, and RER Granger—cause the LP in the long run. Considering the same equation, the Wald χ^2 – test statistic is only significant for capital at 10% and indicates that capital Granger—cause the LP in the short run. Similarly, the statistical significance of the ECT_{-1} coefficients in capital, export and import equations indicate the long—run causalities among the five variables. In the short run, import and RER Granger—cause capital; capital, LP and RER Granger—cause exports; and capital, exports and RER Granger—cause imports. Considering the RER equation, the insignificance coefficient of ECT_{-1} indicates that capital, exports, imports and LP do not Granger—cause the RER in the long-run while only LP Granger—causes it in the short run.

Panel B of Table 6 presents a qualitative summary of Granger—causality results. There are a long-run bi-directional causations running from capital, exports and imports to LP,and running from labour productivity towards capital, exports and imports. Also, there is a long- run unidirectional causation from the RER to LP. However, there is a causality from capital to LP and a reverse causation from LP to exports and to the real exchange rate in short run. The feedback effects

Table 6. Granger—causality tests results based on VECM

	$\Delta \ln y_t$	$\Delta \ln k_t$	$\Delta \ln x_t$	$\Delta \ln m_t$	Δrer_t	ECT_{-1}
Panel A: Short run and long run Granger - causality tests results						
$\Delta \ln y_t$	-	2.96* (0.086)	1.00 (0.31)	0.30 (0.58)	0.01 (0.94)	−0.11*** (0.008)
$\Delta \ln k_t$	0.78 (0.37)	-	0.62 (0.42)	7.18*** (0.007)	3.98** (0.05)	−0.06*** (0.000)
$\Delta \ln x_t$	3.47* (0.06)	9.77**** (0.002)	-	0.50 (0.47)	12.33*** (0.0004)	−0.47*** (0.00)
$\Delta \ln m_t$	0.28 (0.59)	9.69*** (0.002)	5.31** (0.02)	-	3.40* (0.07)	−0.38*** (0.00)
Δrer_t	10.47*** (0.001)	1.23 (0.26)	0.02 (0.88)	0.00 (0.94)	-	−4.1 (0.15)

Causality From	**To**	**Long Run**	**Short Run**	**Summary of causality**
Panel B: Direction of causality				
k	*y*	Yes	Yes	Feedback
y	*k*	Yes	No	
x	*y*	Yes	No	Feedback
y	*x*	Yes	Yes	
m	*y*	Yes	No	Feedback
y	*m*	Yes	No	
rex	*y*	Yes	No	Feedback
y	*rex*	No	Yes	

Figures in brackets are P-values for error correction coefficients and Wald χ^2test. ***, ** & denote rejection at 1%, 5% and at 10%, respectively.

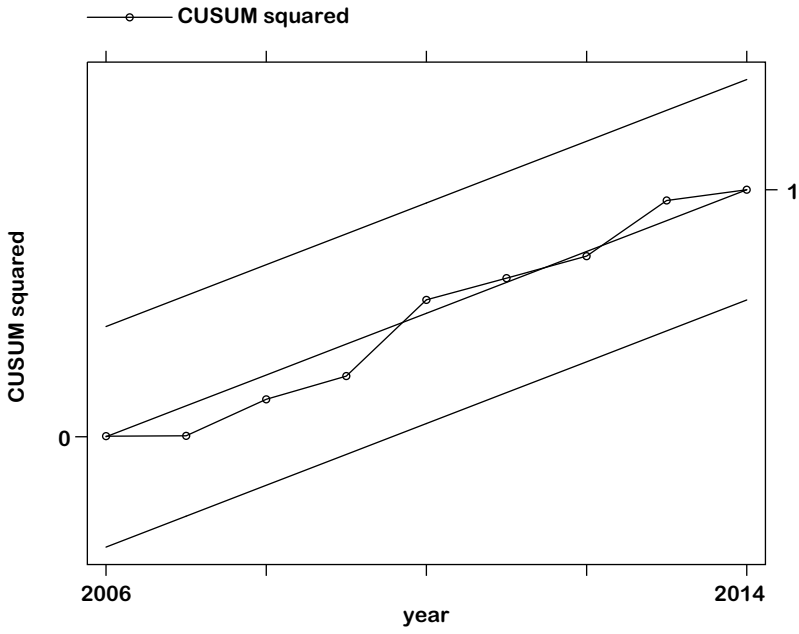

Figure 1. The model stability test result.

between LP and the four variables implicate that LP is as much important to capital, exports, and imports in real terms as they are essential determinants of LP growth. The feedback effects of LP with exports and imports are consistent with that Thangavelu and Rajaguru (2004) found for Malaysia. However, the Granger—causality does not determine the strength of the effects and the dynamic impacts ahead of the sample period.

4.6. The variance decomposition analysis results

The Variance Decomposition measures percentage of the predicted error variance of a variable that is explained by its own shocks and innovations generated by other variables over the long time horizons. By performing out-sample test, it analyzes the dynamic interaction of the variables when the system exposes to shock. The variance decomposition results are shown in Table 7. Five year a head forecast error of the variance of LP is predominantly caused by its own innovations,i.e., by variables not included in the model. However, the influence of the model variables gain strength as the time horizon extends. Innovations to the RER cause more changes to labour productivity than any variable. Exports are are predominantly explained by innovations in the real exchange rate over the long term. This suggests that RER induced changes in exports are strongest in effects. Also, the influence of shocks in the RER on capital and imports are significant. The RER is mostly influenced by its own innovative shocks across the time horizons.

The variance decomposition analysis is consistent with the Granger-causality results that establish the real exchange rates as a weakly exogenous variable and reinforces the Granger-causality analysis. The four variables play complementary roles in enhancing LP growth in Ethiopia. Moreover, the strong influence of the RER on the other variables suggests the relative effectiveness of the exchange rate policy in stimulating LP, capital, exports, and imports.

5. Conclusion and policy implications

The study examines the trade-growth relation in regard to drivers of LP growth in Ethiopia over 1950–2019 period. It tests the trade-growth led hypothesis by dissolving sources of LP into three components viz capital, trade volumes and exchange rate. It estimated the DOLS model to explore short-run and long-run effects of explanatory variables on LP. The model is robust to all the diagnostic tests required for time series analysis. Like its predecessor literature, the study obtains mixed results across the time horizons. The real exchange rate and imports have positive

Table 7. Variance decomposition results

Period	y	k	x	m	rer
Variance decomposition of labour productivity					
5	91. 954	1.1733	0.3991	3.0351	3.4385
10	75.2993	2.7751	2.004	7.7153	12.2064
15	56.4765	8.8	3.6527	10.5022	20.6587
20	42.3686	14.9499	4.7842	11.7963	26.101
Variance decomposition of capital					
5	2.723	86.3402	1.72447	0.159	9.0531
10	4.4229	79.4818	2.5747	0.2564	13.2641
15	5.2808	75.9064	3.0068	0.5205	15.2855
20	5.7786	73.7958	3.2585	0.7342	16.4328
Variance Decomposition of exports					
5	3.3999	0.8641	55.0571	7.0496	33.6293
10	6.6761	5.0031	32.7649	10.3625	45.1934
15	8.4997	10.676	21.2162	11.0651	48.543
20	9.4759	15.0549	15.0322	11.1095	49.3275
Variance Decomposition of Imports					
5	1.6664	2.754	16.327	62.6034	16.6491
10	4.1698	1.9955	9.0014	59.0343	25.7991
15	5.9212	4.6696	5.4099	53.5025	30.4967
20	7.0076	7.6339	3.5604	48.9266	32.8715
Variance Decomposition of Real exchange rate					
5	1.8281	17.1366	7.4553	1.4594	72.1205
10	0.7901	17.7037	7.1367	1.6398	72.7297
15	0.503	18.0483	6.9474	1.699	72.8024
20	0.3704	18.2837	6.8153	1.7327	72.7978

long run effects, but they are negative impacts on labour productivity in the short-run. Exports' cases are opposite. In the short- run, exports prop up the economy as sources of foreign currency to finance imports of foreign production technology. In the long- run, however, exports of primary products tend to be an unstable source of finance due to the deterioration of terms of trade. In the long- run, the benefits of technology and know-how embodied in capital goods offset the competitive pressure arising from imports of intermediate and final goods while the reverse happens in the short- run. The RER has far a greater impacts on LP growth in the long-run resulting from policies encouraging resource allocation and employment in favour of tradable sectors which help to correct trade deficits and encourage capital formation. Finally, the insignificance contribution of capital to LP growth could implicate the fact that Ethiopia's economic growth achievement has yet not been supported by expansion of labour-intensive industries.

The multivariate Granger-causality analysis reveals that the real exchange tends to be exogenous while the rest variables are endogenous. Consistent with theoretical discussion, there are two-way causations between capital, exports, and imports with labour productivity. The Variance Decomposition analysis reinforces the same causal links. The RER as a macroeconomic policy variable stimulates LP growth directly and indirectly through its influence on capital, exports, and imports. The relative strengths of effects on LP are ranked as capital, imports, and exports in descending order.

The results of the study implicate that Ethiopia adopts complementary trade policies to better reap the benefits of international trade and facilitate capital formation for improving the productivity of labour. It is suggested that the state: maintain competitive exchange rate through macro-prudential policy instruments such as tighter monetary policy, capital control, and foreign reserve management; use industrial policy instruments such preferential tariffs, tax, subsidy, employment and credits to shift resources towards the tradable sector and to encourage competitiveness of the exports. In addition to the second-best policy instruments, public investment into infrastructures and market supporting institutions are recommended. The heavy dependence on exports of primary products is detrimental to the sustainable balance of payments in line with the Prebisch—Singer thesis of deteriorating terms of trade. To circumvent this situation, the country needs to diversify its export basket and switch exports from raw materials and semi-finished goods to high-value products. Moreover, to facilitate the transfer of foreign technology through importation, it should promote capital-intensive investments and human capital development. Finally, it is suggested that using trade control instruments such as tariffs, quotas and licensing systems to limit imports of consumer goods while simultaneously encouraging imported capital goods could improve the performance of the economy.

Nevertheless, these results are not immune to some limitations of the study. First, aggregates of exports and imports do not provide useful information about the underlying relationships. More insights could have been generated from either firm-level or sector-wise analysis. Second, more insights can be generated by including other relevant variables in the relationships investigated. Moreover, future studies that employ non-linear frameworks can better handle these relationships.

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Notes
1. Assuming constant returns to the scale Cobb- Douglas production function in equation (1) and dividing it by labour units employed and taking difference, we decomposed sources of labour productivity into total factor productivity (Solow's Residual) and capital deepening as: $\Delta \ln y_t = \Delta \ln A + \alpha \Delta \ln k_t$ and following Zelleke and Sraiheen (2012), the we adopted a capital share α of 0.63. The contribution share of capital deepening-(ck)=$\frac{\alpha \Delta \ln k_t}{\ln y_t}$, and of TFP growth(ctfp)= $\frac{\Delta \ln A}{\Delta \ln y_t}$.
2. The military junta ruled the country as socialist regime after overthrowing the Imperial government.
3. See Yamada (1998), Herrerias and Orts (2010), Zelleke and Sraiheen (2012), Samargandi (2018), and Asada (2020).
4. Ethiopia's domestic currency.

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Appendix

Table A1. Growth accounting analysis results of labour productivity and country level figures

	Growth rates (%)			Contribution to labour productivity (%)	
Period	**Labour productivity**	**Capital deepening**	**Total Factor Productivity**	**Capital**	**Total factor productivity**
Average (2019–1950)	2.40	4.13	−0.197	33.85	66.15
EPRDF	3.71	7.07	−0.74	41.54	58.45
2019 –2016	10.31	8.58	4.89	92.10	7.89
2015 –2011	5.53	2.34	4.05	42.37	57.62
2010– 2006	6.29	6.55	2.16	17.98	82.01
2005 –2001	6.66	11.33	−0.47	48.55	51.44
2000 – 1996	−2.00	9.06	−7.71	56.54	43.45
1995–1991	−3.18	4.86	−6.25	1.79	98.20
Derg period(1990–1974)	0.88	0.65	0.46	0.96	99.03
1990 – 1985	−1.34	3.25	−3.39	−27.31	127.31
1984 – 1980	5.22	−1.62	6.25	0.05	99.94
1979 – 1974	−0.35	−0.70	0.09	41.47	58.52
Imperial period(1973–1951)	1.88	2.99	−0.004	48.47	51.52
1973 – 1971	0.55	1.38	−0.31	37.54	62.45
1970 – 1966	0.84	3.92	−1.62	−182.93	282.93
1965 – 1961	2.74	4.668	−0.19	415.71	−315.718
1960 – 1956	1.16	4.12	−1.43	−84.98	184.98
1955 – 1951	3.56	0.22	3.42	52.66	47.33

Labour productivity levels at 2017 PPP dollars

Year	**Ethiopia**	**Kenya**	**Malawi**	**Nigeria**	**South Africa**	**USA**
1950	997.36	3251.63	-	4658.37	12809.73	39600.94
2019	5248.32	8903.48	2733.81	13626.96	39429.2	129918.4

Source: author computation from Penn World Tables.