Comparative Advantage Development Strategy and Cross-Country Labour Productivity Growth: An Approach of New Structural Economics

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Research

Keywords: CAF development strategy, CAD development strategy, Technology Choice Index, Labour productivity growth

Posted Date: February 15th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1216884/v1

Abstract

The stagnation of labour productivity growth over the last decades, as well as the changing role of conventional variables, has revived policy makers' and scholars' interest in exploring other potential sources of growth. Hence, this study uses a recent data of 102 countries from 1990 – 2017 and the New Structural Economics Hypothesis, to investigate the impact of comparative advantage development strategy on labour productivity growth. The results, based on the two-step Generalized Methods of Moments, show that defying comparative advantage development strategy has a detrimental effect on labour productivity growth. However, further analysis of the existence of a non-linearity impact indicates some heterogeneity across countries. High and upper middle-income countries benefit from defying their comparative advantage till a certain point where the gains turn negative, while the negative effect between the defiance of comparative advantage and labour productivity persisted for lower middle- and low-income countries. Also, the results provide evidence of positive impact of institutional quality and trade openness on labour productivity growth.

1. Introduction

Labour productivity plays a vital role in economic growth (Bakas, Kostis, & Petrakis, 2020). Evidence suggests that it induces per capita income growth, which in turn is an important determinant of poverty reduction (Dieppe, Kilic Celik, & Kindberg-Hanlon, 2020). However, labour productivity growth has been stagnant during the last two decades not only across regions, but also across income level (see Figures in appendix)[1]. According to Dieppe (2021), labour productivity growth in advanced economies (AEs) has not experienced any upward trend before and after the 2007 global financial crisis (GFC). Meanwhile in emerging market and developing economies (EMDEs), labour productivity growth trended up from almost 0 percent in 1990 to its peak of 6.6 percent in 2007 before the crisis. In the post-GFC, productivity growth slowdown has persisted to a value of 3.5 percent in 2018.

Although the factors affecting cross-country differences in productivity growth have been subject to may studies, the evidence remain inconsistent and the roles of various factors have changed over time, with some increasing in importance, and other decreasing due to the structural changes that economies have undergone during the last decades (Dieppe, 2021). Early studies (Belorgey, Lecat, and Maury, 2006; Supachet, 2010; Najarzadeh et al., 2014;) focused their attention on the neoclassical growth equation variables (proximate variables) such as physical capital, human capital, and technology. However, the neoclassical growth model provided little information about what drives Total Factor Productivity Growth (TFPG) and how to improve it, and also when examining the accumulation of physical capital or human capital (Bloch and Tang, 2004). Hence, a growing body of literature draws the attention to the importance of shifting the debate from proximate factors to deeper or fundamental factors such as geography, culture, and institutions (Rodrik, 2003; Acemoglu, 2009), suggesting that while proximate variables such as physical capital, human capital and technology provide a starting point in understanding the cross-country differences, that information is incomplete as those factors are themselves affected by fundamental causes (Acemoglu, 2009). There has been recent empirical evidence on the growth effect of fundamental or deeper factors. For instance, studies by Acemoglu et al. (2002 ,2003) have established a causal relationship between institutions and growth. They find that stronger institutional quality causes higher per capita income and lower macro economic volatility and crises.

However, another line of growing literature leaded by the New Structural Economics (NSE), argues that institutional variables themselves are endogenously shaped by a country's development strategy. Subsequent studies (Gnangnon, 2020; Lectard and Rougier, 2018; Siddique, 2016; Bruno et al., 2015; Lin and Liu, 2006; Lin, 2003) did find evidence of the impact of comparative advantage (CAF/CAD) development strategy on macroeconomic outcomes.

Despite the evidence of the comparative advantage development strategy on cross-country macroeconomic performance, little is known about its effect on labour productivity growth. To the best of my knowledge, this study is the first that investigates the impact of comparative advantage development strategy on labour productivity growth.

This study contributes to the existing literature in the following ways. First, it expands on the fundamental determinants of differences in economic performance and growth literature by providing evidence on the significant effect of development strategy proxied by the Technology Choice Index (TCI) as a significant determinant. This paper's interest in analysing labour productivity growth is coherent with policy makers and scholars' quest of a proactive policy approach to boost productivity growth.[2] Second, it adds on the growing literature of New Structural Economics and economic outcomes which argues that economic outcomes are endogenously determined by a country's economic structure (Lin , 2003). While previous studies provide evidence on the effects of TCI, Chang's argument – on the existing inverted-U-sahped relationship between an economy's deviation from comparative advantage and its growth rate – was barely investigated and previous findings were based on the assumption that the effect is linear irrespective of the country's level of development (Lin and Chang, 2009). Only one study, conducted by Lectar and Rougier (2018) using a different measure of TCI found the non linearity effect of TCI on structural transformation. Finally, this study takes advantage of a recent dataset of lower middle and low income countries.

The rest of the paper is organized as follows. The next section provides the literature review of the NSEs and the link between TCI and macroeconomic outcomes. Section 3 describes the empirical strategy and data. Section 4 presents and discusses the results, and section 5 concludes.

Footnote:

[1] As a context, the trend in this study is based on 102 countries over a period of 1990 to 2017, by income groups and by regions. Meanwhile the trend in the global productivity book covers a much longer period (1981-2018) with 103 countries divided into advanced economies, emerging markets, and developing economies, and global.
[2] This book provides an extensive analysis of the trends, drivers or labour productivity at country level, sectoral level, and firm-level. See Dieppe (2021) for details.

2. Literature Review

NSE, Development strategy proxied by TCI and Empirical studies

2.1 NSE and CAD/CAF Development strategy

The development thinking has undergone major changes since the 1950s, from the old structuralism approach advocated by Lewis (1954) and Prebisch (1959) to the Neoliberalism approach in the 1990s which has underpinned the Washington-Consensus advocated by the Bretton Woods institutions, including the World Bank and IMF. As a response to the failure of developing countries to achieve industrialization and modernization, despite the implementation of both the structuralism and neoliberalism, the New Structural Economics (NSE) has emerged in the development thinking literature as an alternative approach to development (Lin , 2019). The NSE approach builds from the structural economics and the neoclassical approach (Lin 2010, 2019) to structure and change in the process of economic development, by emphasizing the importance of economic structure and industry upgrading. It sees economic development as a dynamic process characterized by structural changes, industrial upgrading, and improvements in hard and soft infrastructure at each level (Lin 2010).

According to Bruno et al. (2015), the NSE approach takes advantage of structural approach to growth and neoclassical economics, and so is based on the three elements: an understating of comparative advantages as the evolving potential of a country's endowment structure; a reliance on the market as allocation mechanism at any stage of development; and the importance of the role of state in facilitating the process of industrial upgrading. The premise of the foundation of the NSE development approach is that economic structure of a country is endogenous to the structure of its factor endowments, and the market is the basic mechanism for effective resource allocation. The state's role in this context should be restricted to providing information about new industries, coordinating related investments across different firms within industries, compensating for information externalities, and fostering new industries through incubation and foreign direct investment encouragement (Lin 2010).

As a result, development strategies could be categorised as Comparative Advantage Following (CAF) development strategy or Comparative Advantage Defying (CAD) development strategy. The CAF development strategy requires a country to follow its comparative advantage when promoting industries, and in the case of developing countries, labour intensive sectors. The CAD strategy consists of developing capital-intensive (heavy) industries that are incompatible with their comparative advantage, as determined by their factor endowments. The CAF approach requires that governments supplement the function of market mechanism in ensuring effective resource allocation by actively promoting structural changes, such upgrading and improving hard and soft infrastructure.

2.2 TCI as a proxy for CAD/CAF development strategy

To test whether a country has adopted a CAD or CAF development strategy appears challenging. Hence, Lin and Liu (2004) introduce the TCI as a proxy for development strategy CAD or CAF, which is computed as follow:

$$\mathrm{TCI}_{it} = \frac{\mathrm{AVM}_{it}/\mathrm{LM}_{it}}{GDP_{it}/L_{it}},$$

Where AVM_{it} is the added value of manufacturing industries of a given country *i*, at time *t*, GDP_{it} is the total added value of the country *i*; LM_{it} stands for the labour in the manufacturing industry and L_{it} is the total labour force.

If a government adopts a CAD strategy to promote its capital-intensive industries, the TCI in this country is expected to be larger than it would otherwise be. This is because, if a country adopts a CAD strategy, in order to overcome the viability issue of the firms in the prioritized sectors of the manufacturing industries, the government might give the firms monopoly positions in the products markets – allowing them to charge higher output prices – and provide them with subsidized credits and inputs to lower their investment and operation costs. The above policy measures will result in a larger AVM_{it} than otherwise. Meanwhile, investment in the prioritized manufacturing industry will be more capital-intensive and absorb less labour, other things being equal. The numerator in the equation will therefore be larger for a country that adopts CAD strategy. As such, given the income level and other conditions, the magnitude of the TCI can be used as a proxy for the extent that a CAD strategy is pursued in a country.

2.3 Empirical Studies

The relationship between development strategy (CAD/CAF) proxied by TCI and economic outcomes has attracted widespread attention in the past decades and there have been a large number of studies in this area which articulated theoretical and empirical ways in it contributes to economic outcomes. Empirical studies investigate macroeconomic outcomes, such as growth of GDP per capita (Lin, 2003; Bruno et al., 2015), poverty reduction (Lin and Liu, 2006; Siddique, 2016), structural change in production (Gnangnon, 2020). However, evidence on the exact impact of CAF/CAD has been mixed.

Lin (2003) argues that economic outcomes in a country are endogenously determined by the country's long-term economic development strategy. In a study conduted using data for 51 countries over the period of 1970 - 92, the author found that development strategy based on defying the comparative advantage can have an adverse effect on annual growth rates of per capita real GDP. In a different study, Lin and Liu (2006) investigated the effect of CAD/CAF on poverty incidence in rural China (28 provinces). They found that TCI is positively and significantly associated with poverty incidence. In other words, the more a province deviates from its comparative advanatge the higher is the poverty rate in that province. Another study with similar findings include Siddique (2016) who investigated CAD effects on poverty of 113 countries over the period of 1980 to 2000. His study extended the work of Lin and Liu (2006) to a cross-country analysis as the Chinese experience could not be generalized to the rest of world. He found that that cross-country poverty incidence was positively associated with CAD development strategy. However, a high level of financial development reduces the poverty-increasing impact of adopting CAD.

On the other hand, there is some mixed evidence of the relationship between development strategy (CAD/CAF) and economic outcomes. For instance, Bruno et al. (2015) tested the New Structural Economics (NSE) theory by exploring the relationship between development policies, finance, and growth on a sample of 164 countries in the period of 1963 – 2009. They found that high TCI and financial distortions negatively affect growth. However, the negative effect of a higher ratio of TCI on midterm growth is partly mitigated by moderate level of financial distortions. An extension analysis of transitions economies reveals some contradictory results. For instance, the study finds that TCI is positively related to growth in Central and Eastern Europe (CEEB) countries while there is a negative impact on Commonwealth of Independent States (CIS). They argue that NSE propositions are more valid for middle income countries and less for High income countries and advanced economies.

Recent work on CAD/CAF development strategy and macroeconomic outcomes includes Gnangnon (2020) who uses the system GMM and an unbalanced panel data of 81 countries from 1996 – 2016 to investigate its effect on structural change in production in developing countries. The study finds that defying the comparative advantage (CAD) is associated with structural change in production. Further analysis of the income level suggests that as country develop, the extent of structural change in production is positively driven by CAF development strategy but CAD induces a higher extent of structural change in production mainly in low-income countries.

A review of the literature showed that the results regarding the effects of CAD/CAF on economic outcomes has been mixed. While some studies provided some empirical support to the NSE theory, other failed to and contradicted it. These mixed findings revive the debate on whether should developing countries follow their comparative advantage when designing economic policies and industrial development or, to what extent or how much deviation can hinder growth. While the former has been subject to subsequent studies, the latter is yet to be empirically tested.

3. Empirical Strategy And Data

3.1 Identification and estimation strategy

This empirical analysis investigates the impact of the CAD/CAF development strategy on labour productivity growth. The baseline econometric specification is drawn from Lim (2019) and the literature of development strategy and macroeconomic outcomes. The estimating equation of interest is such that:

$$y_{it} = \alpha + \beta_1 TCI_{it} + \beta_2 TCI^2_{it} + \beta_2 X_{it} + \delta_i + \omega_t + \varepsilon_{it} \qquad (1)$$

Where y_{it} is the labour productivity growth by country i in year t. TCI defined as Technology Choice Index, is used as a proxy for development strategy implemented in a country i in year t is the variable of interest. X is a vector of control variables, δ_i denotes a set of country-specific fixed effects and ω_t is a vector of year fixed effects. ε_{it} is an error term with mean zero.

The Equation (1) is estimated using a standard panel data estimation methods by odinary least squares (OLS). I employ the fixed effects (FE)[3] estimation approach which allow to control for country and time invariant unoberved heterogeneity within each country and each year. Then I employ a cluster-robust approach for standard errors at the country level to correct for heteroskedasticity by following Abadie, Athey, Imbens, and Wooldridge (2017). To ensure the findings are robust, I control for linear time trend, linear time trend squared, region-specific time trend and region-specific time trend squared. According to Lim (2019) the rationale behind the alternative specification is, in a cross-country study the time effects often differ across regions even with the countrols for country fixed effects, regional fixed effects, and year fixed effects.

However, the results from the baseline equations by OLS could be biased with some estimations issues with the absence of the one-period lag of the dependent variable as regression (Gnangnon, 2020). Furthermore, the presence of one-period lag of the dependent variable as regressor in equation (2) could induce another endogeneity bias due to the correlation between the unobserved country-specific effects and the lags of the dependent variable.

To address simultaneity and endogeneity, I opt for the two-step GMM-System estimator (Arellano and Bover, 1995; Blundell and Bond, 1998) to estimate the dynamic model (2) that has better small-sample properties in terms of bias and root mean squared error than GMM-Difference (Arellano and Bond, 1991). GMM-System is suitable in this study as it outperforms GMM-Difference in unbalanced panels (Roodman, 2009). GMM-System combines one first-difference equation where the endogenous varibales are instrumented by their lagged levels, with one level equation in which variables are instrumented by their own lagged first-difference. In GMM-System estimation, valid instruments are generally at least two-period lags for the endogenous variable and one-period lags for the predetermined variable. In order to avoid-fitting of the instrumented variable, I use only two-, three- and four-period lag in the set of instruments and maximize the Hansen tests of the estimations[4]. Therefore, the Dynamic panel model is estimated as follows:

$$y_{it} = \alpha + \beta_1 y_{it-1} + \beta_2 TCI_{it} + \beta_3 TCI^2_{it} + \beta_4 X_{it} + \delta_i + \omega_t + \varepsilon_{it} \qquad (2)$$

where y_{it-1} is the labour productivity level by country i in year t.

3.2 Data

The study uses an unbalanced panel data of 102 countries, including (10) low-income, (22) lower middle-income, (30) upper middle-income and (40) high income countries, covering the period of 1990 – 2017 and is constructed using multiple sources. The sample countries and the coverage period were determined based on the data availability. The data for labour productivity level and growth rates are drawn from the World Bank Global Productivity report 2020 (Dieppe et al., 2020). They are measured as real GDP in US dollars measured in 2010 prices and exchange rates, divided by employment. The Technology Choice Index (TCI) is used as a proxy for development strategy based on comparative advantage (CAD/CAF). In addition to our variable of interest, the analysis account for a number of control variables. Those variables include trade openness (openness), foreign direct investment (FDI), the quality of institution (institution), human capital index (HCI), the depth of financial development (Findev_1), the population growth (POP), GDP per capita (gdpc) ,and the share of arable land (A_land). The description and source all the variables and descriptive statistics are provided in Table A5 and Table A6 respectively.

Footnote:

[3] The baseline regression is run with the use of Correia (2014)'s estimator REGHDFE in Stata, which runs linear regressions with multiple fixed effects, and also supports individual FEs with group-level outcomes.
[4] In order to reduce the number of instruments (that should be inferior to the number of groups) I use Roodman's (2009) xtabond2 and its collapse command, which reduces the number of instruments (lagged values). In order to address the validity of the instruments, and consequently of GMM estimation, the Arellano-Bond serial correlation and the Hansen tests of over-identifying restrictions have been reported at the bottom of the Tables.

4. Results And Discussion

4.1. Nonparametric Results

Figure 1 shows the non-parametric regressions by income groups of the labour productivity growth rate (%) on the Technology Choice Index (TCI), estimated by kernel smoothing.

The figure shows the regression of labour productivity growth rate (%) on the comparative advantage development strategy (TCI), by income groups estimated by Kernel smoothing. The bandwidth is .15, .2, 1.25 and 1.61 for High, upper middle, lower middle- and low-income groups, respectively.

The interesting fact about the graphical representation is the different pattern of each regression line by income group. For the high-income countries, there appears to be a positive relationship between labour productivity growth and TCI. While the relationship in upper middle-income appears to be an inverted U-shape. The similarity between the two income groups is the lower value of TCI compared to those of lower and low-middle income groups. Unlike the previous relationship, in lower middle-income there is a negative relationship between TCI and labour productivity growth. Similarly, the negative relationship is also observed in low-income countries with extremely high level of distortion. However, these results are limited to the correlation of the two variables of interest and do not account for other confounding factors. Hence, the next section will provide parametric results accounting for other covariates with different specifications.

4.2. Econometric results: Baseline estimation

I started the baseline estimation with a most parsimonious to a least parsimonious regression. The first estimation consisted of a simple bivariate regression of labour productivity growth rate on TCI. Then, I progressively include a set of confounding factors to test how stable the estimate of interest is with or without the control variables. In each estimation, I control for country fixed effects in all the models, and country-specific year fixed effects in column (1), time trend in column (2), time trend squared in column (3), region-specific time trend in column (4), and region-specific time trend squared in column (5).

Table 1 shows the regression results of the baseline estimation. The coefficient of TCI is negative and significant at 1% level, even when controlling for different sets of fixed effects. The sign and the direction of the coefficient are in line with literature and my expectation. The findings implies that a country defying its comparative advantage when designing an industrial policy induces a negative effect on aggregate labour productivity growth. In another term, a 10% increase in TCI decreases labour productivity growth by around 0.12 percentage point.

I then estimate the relation between the control variables and labour productivity growth rates. The estimation results of the quadratic relationship between labour productivity growth rates and economic development 1990-2017 are shown in **Table A 1** (Appendix). Since GDP per capita and human capital index are highly correlated, they are used separately as regressors. A higher institutional quality and trade openness have no direct impact on labour productivity growth rate (column 1 to 10). As for human capital, it has an adverse impact on labour productivity, with an impact that vanishes from column 2 to 5. An increase in FDI net inflows contribute significantly to labour productivity growth rate. The domestic credit to private sector contributes negatively to labour productivity growth. The effect holds even when I control for GDP per capita. Lastly the quadratic relationship between labour productivity growth and economic development is supported by the estimation in **Table A 1** as the coefficients of GDP per capita and squared GDP per capita are significant.

In order to test the linear and quadratic impact of CAF/ CAD development strategy on labour productivity growth, TCI and squared TCI are added to the baseline model. The results are presented in Table 2. This implies that the effect of TCI is not linear, since weakly defying the comparative advantage contributes to productivity growth while strongly defying it begins to have an adverse effect.

Table 1
Baseline estimation of TCI effect on labour productivity growth 1990-2017

VARIABLES	**Dependent variable: labour productivity growth rate (%)**				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
TCI	-1.182***	-0.828**	-0.828**	-0.865***	-0.870***
	(0.326)	(0.327)	(0.327)	(0.325)	(0.325)
Constant	3.324***	2.924***	2.924***	2.965***	2.971***
	(0.375)	(0.377)	(0.377)	(0.375)	(0.375)
Observations	2,656	2,656	2,656	2,656	2,656
R-squared	0.228	0.167	0.167	0.160	0.161
Country FE	Yes	Yes	Yes	Yes	Yes
Country Year FE	Yes	No	No	No	No
Time trend	No	Yes	No	No	No
Time2 trend	No	No	Yes	No	No
Region-specific time trend	No	No	No	Yes	No
Region-specific time2 trend	No	No	No	No	Yes

Note: The variable TCI is presented in log. Robust standard errors in parentheses. Significance level at *** p<0.01, ** p<0.05, * p<0.1. Source: Author's calculation

This implies that the effect of TCI is not linear, since weakly defying the comparative advantage contributes to productivity growth while strongly defying it begins to have an adverse effect. The effect holds when I control for GDP per capita which is also significant, indicating that it is not only driven by the economic development, but also the non-linear dynamics of TCI impact. However, the effects of both TCI and squared TCI vanish when I control for human capital index. Financial development, proxied by the domestic credit to private sector by banks, has a negative effect on labour productivity growth from column (1) to (10). This finding is in line with a study conducted by Ghani and Suri (1999) which, investigated the effect of capital accumulation and the Banking sector on productivity growth in Malaysia. In the case of Malaysia, rapid growth in bank lending was associated with falling total factor productivity. This finding suggests that financial development plays a crucial role in enhancing productivity growth only when capital is efficiently allocated to most productive activities. As expected, the estimated coefficient of FDI is positive and significant, suggesting that an increase in FDI net inflow in a country induces labour productivity growth.

However, the estimates from Table 2might be biased and doesn't account for the lag value of labour productivity level in the equation 1. Therefore, the next analysis account for it and assess the robustness of the findings using System GMM.

Table 2
Estimation of the effects of TCI and TCI2 on labour productivity growth FE

VARIABLES	**labour productivity growth rate (percent)**									
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
TCI	1.716	2.056*	2.056*	2.012*	2.011*	0.418	0.851	0.851	0.806	0.808
	(1.146)	(1.192)	(1.192)	(1.186)	(1.186)	(1.064)	(1.107)	(1.107)	(1.101)	(1.101)
TCI^2	-0.537*	-0.600**	-0.600**	-0.607**	-0.610**	-0.261	-0.431	-0.431	-0.427	-0.430
	(0.285)	(0.296)	(0.296)	(0.295)	(0.295)	(0.266)	(0.275)	(0.275)	(0.274)	(0.274)
Arable land (% of land area)	-0.006	-0.008	-0.008	-0.004	-0.004	-0.011	-0.013	-0.013	-0.012	-0.012
	(0.048)	(0.050)	(0.050)	(0.050)	(0.050)	(0.046)	(0.048)	(0.048)	(0.048)	(0.048)
Institution	0.003	0.010	0.010	0.002	0.001	0.005	0.030	0.030	0.020	0.019
	(0.040)	(0.041)	(0.041)	(0.041)	(0.041)	(0.038)	(0.039)	(0.039)	(0.039)	(0.039)
Domestic credit to private sector by banks (% of GDP)	-0.026***	-0.031***	-0.031***	-0.031***	-0.031***	-0.020***	-0.020***	-0.020***	-0.020***	-0.020***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Population growth (annual %)	-0.079	-0.095	-0.095	-0.096	-0.096	-0.281***	-0.316***	-0.316***	-0.303***	-0.304***
	(0.108)	(0.112)	(0.112)	(0.111)	(0.111)	(0.099)	(0.103)	(0.103)	(0.103)	(0.102)
Trade Openness	-0.705	-0.087	-0.087	-0.157	-0.149	-0.790	-0.114	-0.114	-0.212	-0.207
	(0.646)	(0.661)	(0.661)	(0.658)	(0.658)	(0.597)	(0.609)	(0.609)	(0.606)	(0.606)
Foreign direct investment, net inflows (%GDP)	0.024***	0.020**	0.020**	0.021**	0.021**	0.015*	0.011	0.011	0.013	0.013
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
lngdpc	1.884***	0.839***	0.839***	0.795**	0.784**					
	(0.714)	(0.323)	(0.323)	(0.322)	(0.322)					
Human Capital Index						-2.262**	-0.290	-0.290	-0.260	-0.275
						(0.991)	(0.568)	(0.568)	(0.566)	(0.567)
Constant	-14.193**	-5.254*	-5.254*	-4.772	-4.676	9.567***	3.892**	3.892**	3.943**	3.991**
	(6.611)	(3.138)	(3.138)	(3.126)	(3.129)	(2.774)	(1.909)	(1.909)	(1.900)	(1.902)
Observations	2,036	2,036	2,036	2,036	2,036	2,101	2,101	2,101	2,101	2,101
R-squared	0.260	0.202	0.202	0.192	0.192	0.233	0.175	0.175	0.165	0.165
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Year FE	Yes	No	No	No	No	Yes	No	No	No	No
Time trend	No	Yes	No	No	No	No	Yes	No	No	No

Note: The variable TCI is presented in log. Robust standard errors in parentheses. Significance level at *** p<0.01, ** p<0.05, * p<0.1. Source: Author's calculation

VARIABLES	labour productivity growth rate (percent)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Time2 trend	No	No	Yes	No	No	No	No	Yes	No	No
Region-specific time trend	No	No	No	Yes	No	No	No	No	Yes	No
Region-specific time2 trend	No	No	No	No	Yes	No	No	No	No	Yes
Note: The variable TCI is presented in log. Robust standard errors in parentheses. Significance level at *** p<0.01, ** p<0.05, * p<0.1. Source: Author's calculation										

4.3. Econometric results: Dynamic estimation and extension analysis

Table 3 reports the estimates from the dynamic model illustrated by equation 2 for the period 1990 - 2017. Regression models (1) to (7) use the System GMM approach to obtain the estimates. The variables in model (1) include only the proxy for development strategy, TCI (log), and the initial labour productivity level (log), whereas model (2) account for the squared TCI (log) and then from model (3), other control variables that capture institutional quality, size of the population, foreign direct investment, trade openness and land size were progressively added. However, due the high correlation between financial development, proxied by the domestic credit to private sectors by banks (% of GDP), human capital index, GDP per capita (log) and the one-period lag of the initial level of labour productivity (in 2011 international PPP exchange rate), these variables were not included in the dynamic model.

Before interpreting the estimation results, it is worth mentioning that the diagnostic test of system GMM estimator was satisfactory. The autocorrelation test shows that the residuals are an AR(1) process which is what is expected. The test statistic for second order serial correlation is based on residuals from the first-difference equation and it rejects the null hypothesis of serial correlation of second order. The instrument set is valid as evidenced by the Hansen test of over-identified restrictions and the variables of interest have expected signs. We note across all these columns that the p values related to AR(1) test are 0. While the p-values of AR(2) test are higher than 10%. Moreover, the p-value of the Hansen test is always higher than 10% and the number of instruments used in the regressions is always lower than the number of countries. In the regression I used maximum of 2 lags of dependent variable as instruments and 2 lags of endogenous variables as instruments.

The results in column (1) of Table 3 indicate that the TCI has the expected negative effect and is highly significant. This finding supports the idea that the further a country pursued a CAD strategy, the worse the labour productivity growth during the period 1990 – 2017. From the estimates I can infer that a 10 percent increase in the TCI from the mean may result in approximately a 0.74 percentage point in the reduction in the country's average annual labour productivity growth for the entire period 1990 – 2017. Unlike the results in Table 2, TCI^2 is positive across model (1) to (7) but significant only in model 6 and 7 even when controlling for other covariates. This indicates a nonlinear relationship between the comparative advantage development strategy on labour productivity growth. As unexpected this implies that slightly defying the comparative advantage may have a diminishing contribution to labour productivity growth during the period 1990 – 2017, while beyond a certain point, strongly defying it yields positive contribution to growth. This is finding is puzzling for the advocates of the NSE who advise for very small to zero deviations from the comparative advantage, and also unexpected against Chang's suggestion of rather an 'inverted-U-shaped relationship' between an economy's deviation from comparative advantage and growth.

The regression results also show that the initial level of labour productivity have the expected sign and significant effect, institutional quality combines with openness to trade strongly contribute to labour productivity growth during the period of 1990-2017. The results are in line with previous literatures on institutional quality (Acemoglu et al., 2002, 2003), trade openness (Alcala and Ciccone, 2004; De Loecker, 2013; Frankel and Romer, 1999; Hall and Jones, 1999) and labour productivity growth. However, the coefficients of FDI are positive but insignificant, implying that FDI did not play any major role in contributing on average on productivity growth during the period 1990 – 2017.

Table 3
GMM-system estimation of TCI effect on labour productivity growth 1990-2017

	Dependent variable: labour productivity growth rate (%)						
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lpxr (lag)	-4.987***	-4.606***	-5.647***	-5.325***	-5.679***	-6.102***	-7.109***
	(1.378)	(1.280)	(1.952)	(1.538)	(1.566)	(1.661)	(2.091)
TCI	-7.453***	-11.272**	-11.814**	-9.356**	-9.769**	-10.882**	-13.567**
	(2.273)	(4.394)	(5.302)	(4.123)	(4.121)	(4.301)	(5.501)
TCI^2		1.263	1.388	1.020	1.050	1.235*	1.518*
		(0.799)	(0.854)	(0.697)	(0.704)	(0.700)	(0.814)
Institution			0.429**	0.315**	0.321**	0.341**	0.433***
			(0.195)	(0.134)	(0.134)	(0.130)	(0.160)
Population growth (annual %)				-1.240*	-1.273*	-0.900*	-0.994*
				(0.743)	(0.714)	(0.529)	(0.544)
FDI					0.047	0.014	0.009
					(0.043)	(0.023)	(0.023)
Trade Openness						3.403***	3.616***
						(1.242)	(1.362)
Arable land (% of land area)							-0.121*
							(0.066)
Constant	61.583***	60.038***	68.744***	65.760***	69.591***	71.840***	86.387***
	(16.607)	(16.518)	(23.540)	(18.672)	(18.895)	(19.283)	(25.667)
Observations	2,554	2,554	2,405	2,403	2,385	2,341	2,235
Number of countries	102	102	97	97	97	97	97
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.193	0.206	0.326	0.427	0.436	0.470	0.460
Hansen	0.425	0.344	0.445	0.452	0.467	0.532	0.496
Number of Instruments	33.000	34.000	35.000	36.000	37.000	38.000	39.000

Note: The variables lprx (lag), TCI are presented in log. Robust standard errors in parentheses. Significance level at *** p<0.01, ** p<0.05, * p<0.1. Source: Author's calculation

In order to enhance our understanding of this puzzling finding of TCI effect on growth, I conducted specific sub-periods analysis as suggested by Bruno et al. (2015), and also to test the extent to which TCI is a more stable determinant in explaining productivity growth unlike other conventional determinants which have proven to vary in significance and importance during the last decades (Dieppe, 2021). Therefore, the period of analysis is divided into three periods, the pre global financial crisis (1990 – 2007), during the financial crisis and the period of recovery (2007 – 2012) and the post global financial crisis (2012 – 2017).

Table 4 reports results of the estimation of the dynamic model for the period between 1990 – 2007, representing the pre-GFC. The results are similar to those of Table 3 with evidence of the negative effects of TCI on labour productivity growth and the non-linearity effect as shown by the significant level of TCI^2. Both institutional quality and openness to trade significantly contribute to labour productivity growth, while there is no evidence of the effect of FDI during this period of 1990-2007. However, the coefficients of all significant variables are much larger than those of Table 3, implying the major role of these factor in the period of 1990-2007 compared to 1990-2017. The possible explanation of the positive and significant coefficient of institutional quality and trade during this period, is that in the 1990s and early 2000s, many countries embarked on some institutional reforms and trade liberalization advocated by the Bretton Woods institutions followed by the debt crisis. Institutional prerequisites such as protection of property rights, rule of law, efficient bureaucracy have been identified as factors limiting the influence of foreign aid, foreign investment, and education (Easterly, 2001). This explanation is supported by previous studies suggesting that lack of property rights protection hinders investment in both physical and human capital which are proximate determinants of economic growth (North and Thomas, 1973; Jones, 1981; North, 1981). As for trade openness, the literature theoretically and empirically provides evidence of its impact on growth. One way is, it can influence growth directly through absolute and/ or comparative advantage, and it can also increase efficiency indirectly through technology transfer, economies of scales, and competition with firms in domestic and international markets (Bloch and Tang, 2004). A possible reason for a non-significant effect of FDI during this period may be due to the environment. FDI inflows is conditioned by business-friendly environment. During this period, institutional quality may have not been high enough to spur the effect of growth, as suggested by Li and Tanna (2019) that countries that fall below a minimum level of institutional quality may have either a negative or statistically insignificant impact. The other way is this could be due to the lack of enough absorptive capacities (human capital) in developing countries which is one mechanism through which the gains of technology and the productivity Spillover effect associated with such investment are maximized.

Table 4

GMM-system estimation of TCI effect on labour productivity growth 1990-2007

VARIABLES	**Dependent variable: labour productivity growth rate (%)**						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Lpxr (lag)	-7.049***	-6.099***	-8.684**	-8.859***	-11.217***	-12.377***	-12.094***
	(2.613)	(2.166)	(3.779)	(2.898)	(3.595)	(3.923)	(4.553)
TCI	-11.169**	-20.527**	-22.822**	-19.912**	-25.182**	-27.739**	-30.450**
	(4.410)	(8.338)	(11.142)	(8.499)	(10.304)	(11.465)	(14.255)
TCI^2		2.986**	3.197*	2.714*	3.417**	3.660**	4.072*
		(1.431)	(1.732)	(1.385)	(1.654)	(1.798)	(2.194)
Institution			0.706**	0.597**	0.705**	0.739**	0.787**
			(0.331)	(0.242)	(0.294)	(0.310)	(0.349)
Population growth (annual %)				-2.128	-2.386*	-1.632	-1.708
				(1.369)	(1.431)	(1.083)	(1.204)
FDI					0.121	0.025	0.006
					(0.132)	(0.054)	(0.064)
Trade Openness						6.994**	5.536*
						(2.908)	(2.852)
Arable land (% of land area)							-0.225
							(0.146)
Constant	88.648***	84.916***	108.780**	111.059***	139.380***	148.205***	153.050***
	(31.676)	(29.344)	(47.100)	(36.117)	(44.326)	(46.821)	(57.941)
Observations	1,534	1,534	1,435	1,433	1,415	1,376	1,366
Number of countries	102	102	97	97	95	93	93
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.190	0.249	0.555	0.792	0.947	0.941	0.856
Hansen	0.040	0.015	0.054	0.087	0.171	0.273	0.079
Number of Instruments	33.000	34.000	35.000	36.000	37.000	38.000	39.000

Note: The variables lprx (lag), TCI are presented in log. Robust standard errors in parentheses. Significance level at *** p<0.01, ** p<0.05, * p<0.1. Source: Author's calculation

Table 5
GMM-system estimation of TCI effect on labour productivity growth 2012-2017

VARIABLES	Dependent variable: labour productivity growth rate (%)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lpxr (lag)	-2.559*	-2.287*	-2.173	-1.999**	-1.769*	-1.858**	-2.000**
	(1.304)	(1.162)	(1.327)	(0.992)	(0.906)	(0.931)	(0.973)
TCI	-2.378	8.417**	13.434***	13.114***	14.249***	14.353***	16.027***
	(2.052)	(4.064)	(5.070)	(4.390)	(4.841)	(4.945)	(5.058)
TCI^2		-4.140***	-5.663***	-5.158***	-5.463***	-5.558***	-6.188***
		(1.428)	(1.909)	(1.488)	(1.629)	(1.673)	(1.815)
Institution			0.180	0.070	0.043	0.052	0.074
			(0.130)	(0.077)	(0.069)	(0.070)	(0.074)
Population growth (annual %)				-1.071***	-1.038***	-0.994***	-1.033***
				(0.387)	(0.373)	(0.337)	(0.333)
FDI					0.042*	0.034*	0.033**
					(0.025)	(0.017)	(0.015)
Trade Openness						0.836	1.019
						(0.698)	(0.734)
Arable land (% of land area)							-0.027
							(0.035)
Constant	30.628*	21.636	15.920	15.456	12.132	12.329	12.703
	(15.510)	(13.712)	(14.048)	(11.309)	(10.587)	(10.366)	(11.410)
Observations	612	612	582	582	582	581	485
Number of countries	102	102	97	97	97	97	97
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.189	0.185	0.227	0.323	0.327	0.390	0.440
Hansen	0.495	0.499	0.480	0.488	0.315	0.310	0.413
Number of Instruments	33.000	34.000	35.000	36.000	37.000	38.000	39.000

Note: The variables lprx (lag), TCI are presented in log. Robust standard errors in parentheses. Significance level at *** p<0.01, ** p<0.05, * p<0.1. Source: Author's calculation

The same regressions are run to test the effect of TCI during the transition period 2007 – 2012. The estimation results of the dynamic model for the period 2007 – 2012 are reported in appendix (**Table A 2**). There is no significance evidence of the impact of TCI on labour productivity growth. During this period, labour productivity growth is only affected by the initial value of labour productivity level (lag).

The results for the period 2012 – 2017, representing the post-crisis period or post-GFC, are reported in Table 5. TCI shows the expected sign, but it is not significant. The squared TCI is negative and significant from model (2) to (7). Unlike the results of TCI^2 in Table 3, the nonlinear relationship during this period implies that defying comparative advantage positively contribute to labour productivity growth during this period 2012 – 2017, and beyond a certain point the gain decreases and becomes negative. This finding is in line with Chang's argument of the 'inverted-U-shaped' relationship between deviating from comparative advantage and growth rate (Lin and Chang, 2009).

The regression results also show that the initial level of labour productivity have the expected sign and significant effect, FDI plays a positive and significant role in increasing labour productivity growth during this period. Unlike during the pre-GFC, the positive and significance effect of FDI during the post-GFC could be explained by developing countries having reached an acceptable level of absorptive capacities, or other characteristics such openness to trade as suggested by Balasubramanyam et al. (1996) and institutional quality having set up a low level of corruption and property rights. However, institutional quality and trade openness have no significance effects on labour productivity growth during the period of 2012 -2017. As mentioned, and evidenced earlier, almost 2 decades may have been a long and good period to have a certain level beyond which the marginal effect of these two variables may be small or insignificant.

To go further, I augment the dynamic model with an interaction term of TCI (log) and the regions dummy, and the results are shown in appendix (**Table A 3**). The relationship between TCI (log) and labour productivity growth in seven (7) different regions was tested, through the use of separate sets of dummy and interactions term for East Asia and Pacific (EAP), Europe and Central Asia (ECA), Latin America and Caribbean (LAC), Middle East and North Africa (MNA), North America (NAM), South Asia (SAR), and Sub-Saharan Africa (SSA).

The results in column 1 show that the interaction term between TCI (log) and EAP, LAC, SAR, SSA is negative and significant whereas it is negative but not significant in MNA. However, the interaction term between TCI (log) and ECA, NAM is positive and significant. In further attempt to explore the validity of the non-linear effect of TCI, I added the squared value of TCI in model 2. The results in column 2 show positive and negative significant coefficients of TCI and the squared TCI, for EAP, ECA, and NAM, indicating in fact that the effect is not linear for countries in those regions. To show this, I graph the predictive marginal effects of the changes in TCI for the results in column 2, in Figure 2. It confirms the linear effects in SSA, SAR, but a nonlinear and non-significant effect in MNA and LAC. However, it shows that slightly challenging the factor endowment increases labour productivity growth in EAP, ECA and NAM. Nevertheless, above a certain threshold of TCI (log), productivity growth tends to decrease. The turning point beyond which it has a negative impact on productivity growth in those regions are .73, .98 and .78 respectively in EAP, EAC and NAM. A better understand of the results above would require an income level analysis, as regions are heterogenous with countries of different level of development.

The relationship between the TCI and labour productivity may be heterogeneous with respect to the country's economic development level. Therefore, I rerun the regression on four income groups by adding an interaction term of TCI and income dummy. The results of the relationship between TCI (log) and labour productivity growth in four (4) different income groups, through the use of separate sets of dummy and interactions term for High income, Upper middle income, Lower middle income, and low-income countries are shown in appendix (**Table A 4**).

The results in column 1 show that the interaction term between TCI (log) and high-income countries is positive and significant similar to the findings of Bruno et al. (2015), while it is not significant in upper middle income. The interaction term between TCI (log) and lower middle- and low-income countries is negative and significant. To test whether the non-linearity of effect holds or differs from income group, I include an interaction term between the squared value of TCI and income dummies in model 2.

The results in column 2 show positive and negative significant coefficients of the interaction term between TCI and the squared TCI, for high income and upper middle-income group, indicating that challenging the comparative advantage in high and upper middle-income groups increases the average level of labour productivity. Nevertheless, above TCI (log) value of 1.02, labour productivity growth during the period 1990 – 2017 tends to decrease in high income countries, while above a TCI (log) value of 1.03 labour productivity tends to decrease in upper middle-income countries.

As for lower middle- and low-income countries, the results reported in **Table A 4** show that the coefficients are both negative and significant for TCI. There is no evidence of a nonlinear relationship between TCI and labour productivity growth in both lower middle- and low-income countries. This finding implies that defying comparative advantage might not be sustainable for countries in these income groups, as illustrated in Figure 3.

5. Conclusion

The aim of this paper appears to be relevant in the present-day context as labour productivity growth has been disappointing, and there is an advocacy for a policy approach to boost productivity growth, with the importance to explore new sources of productivity growth capable of countering the diminishing influence of conventional drivers such as demographics, education, and global value chains (Dieppe, 2021). While there is more than enough evidence linking CAD/CAF proxied by TCI on economic outcomes, considerably less attention has been devoted to its effect on productivity growth. Hence, this paper contributes to the literature by providing new evidence on the TCI and labour productivity growth relationship, using an unbalanced panel data sets of 102 countries for the period 1990 – 2017 in Fixed Effects regressions and System-GMM.

The findings reveal that defying the comparative advantage has a negative effect on labour productivity growth. However, the evidence presented in this study suggests that the benefits from defying comparative advantage are not homogenous across development levels. It is found that defying comparative advantage may help both high income and developing countries – and most notably upper middle-income countries – to successfully enhance their labour productivity growth. However, the marginal benefits to growth from defying comparative advantage turns negative beyond certain thresholds. Also, the strategy of defiance could prove to be less beneficial for others - and most notably lower middle- and low-income countries - to successfully enhance their labour productivity growth, as conforming to their comparative advantage appears be a more sustainable strategy. These findings reflect on the regional analysis where countries accounted for a good number of high income or upper middle income exerted the same relations as described above.

In relation to the changing importance of conventional drivers, a sub-period analysis is run by comparing the results for 3 different periods, the pre-GFC (1990-2007), during the crisis (2007-2012) and the post-GFC (2012-2017). During the pre-GFC, the role of institution and openness to trade seems to be more pronounced, reflecting a period of massive institutional and liberalization of trade advocated by international organization. This is supported by the literature (Dieppe, 2021), and also evidenced by the size of coefficients during this period compared to other periods in this study. In the post-GFC, the role of FDI may reflect the gains from the institutional and trade reforms implemented during the pre-GFC, as FDI inflow is preconditioned but a certain minimum level of those factors. These findings consolidate the argument of the changing role of conventional variables due to changing economic structures of many developing countries.

Another finding is the magnitudes of TCI's impact on the labour productivity growth rates in the period 1990-2007 are much larger those of the period 2012-2017. The disparities between these two periods are most likely due to the fact that many developing countries weakened their CAD strategy and pursued economic reforms in the latter period.

The policy suggestion from the empirical evidence in this study is developing countries – mainly lower middle- and low-income countries – government should comply to their country's comparative advantage while maintaining a higher degree of institutional quality and openness to trade. In future work, I hope to analyse how can lower middle- and low-income countries mitigate the negative effect of slightly defying their comparative advantage without harming the productivity growth on the long run.

Declarations

Availability of Data and Materials

I confirm that the data supporting the findings of this study are available and will be submitted upon request.

Competing interests

I have no conflicts of interest to disclose.

Funding

I received no financial support for the research, authorship, and publication of this article.

Authors' contributions

I am the sole contributor of this research article.

Acknowledgments

Not applicable

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Figures

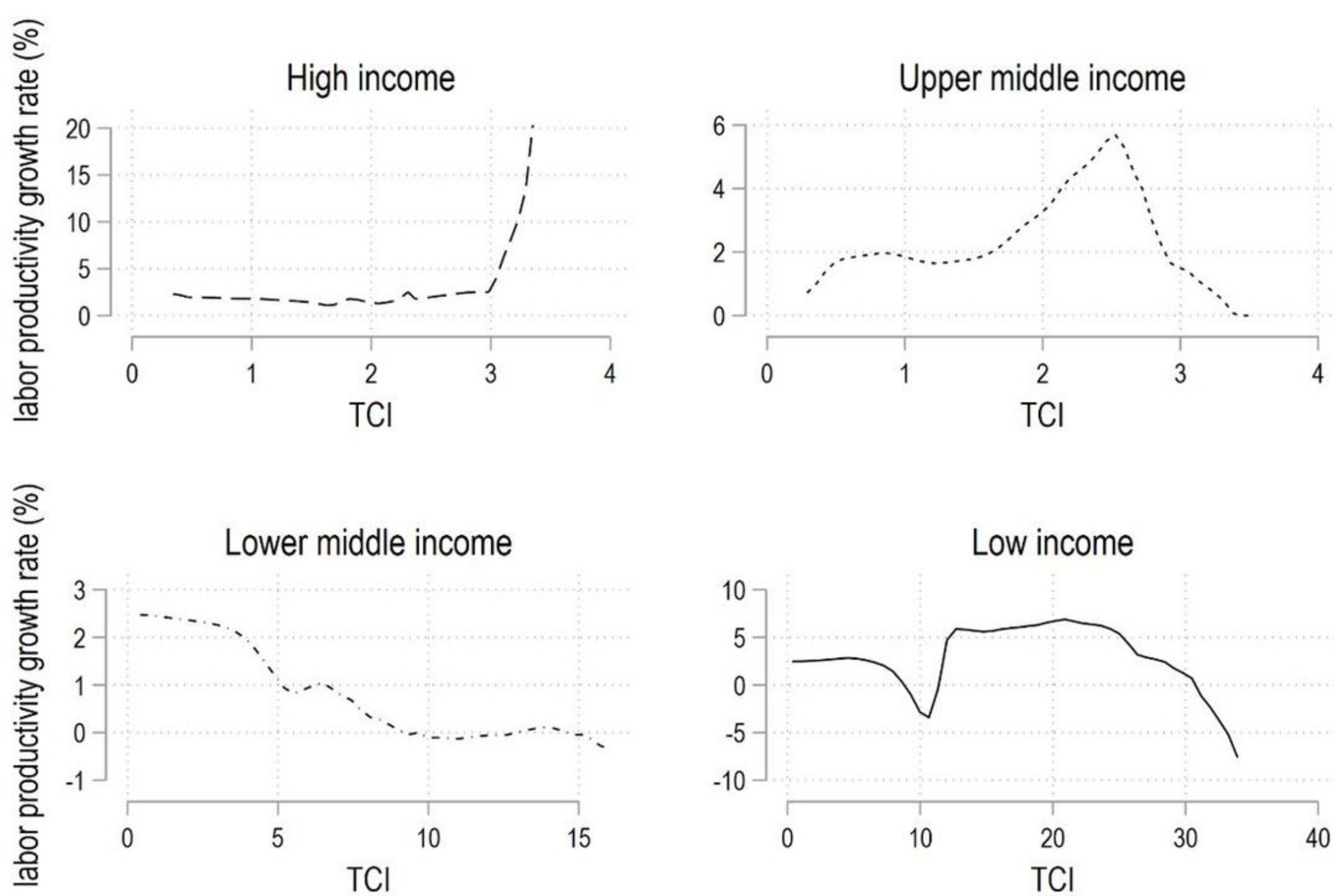

Figure 1

Labour productivity growth rate regressions 1990 - 2017

Note: The figure shows the regression of labour productivity growth rate (%) on the comparative advantage development strategy (TCI), by income groups estimated by Kernel smoothing. The bandwidth is .15, .2, 1.25 and 1.61 for High, upper middle, lower middle- and low-income groups, respectively.

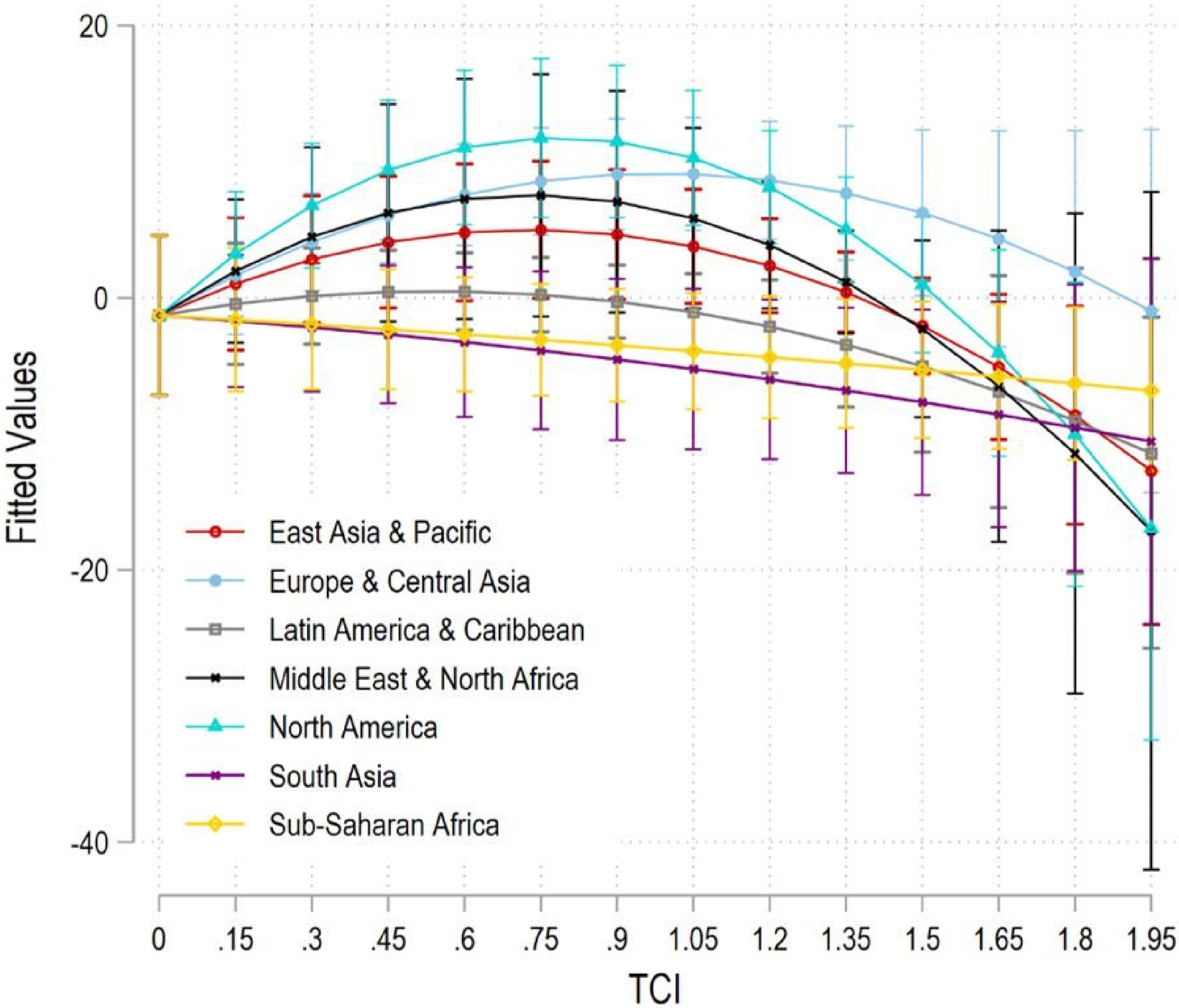

Figure 2

Marginal effects of TCI on labour productivity growth rates, by regions 1990-2017

Notes: Marginal effects are obtained from regression of **Table A 3**, column 2. Confidence interval for 95%.

Source: Author's calculation.

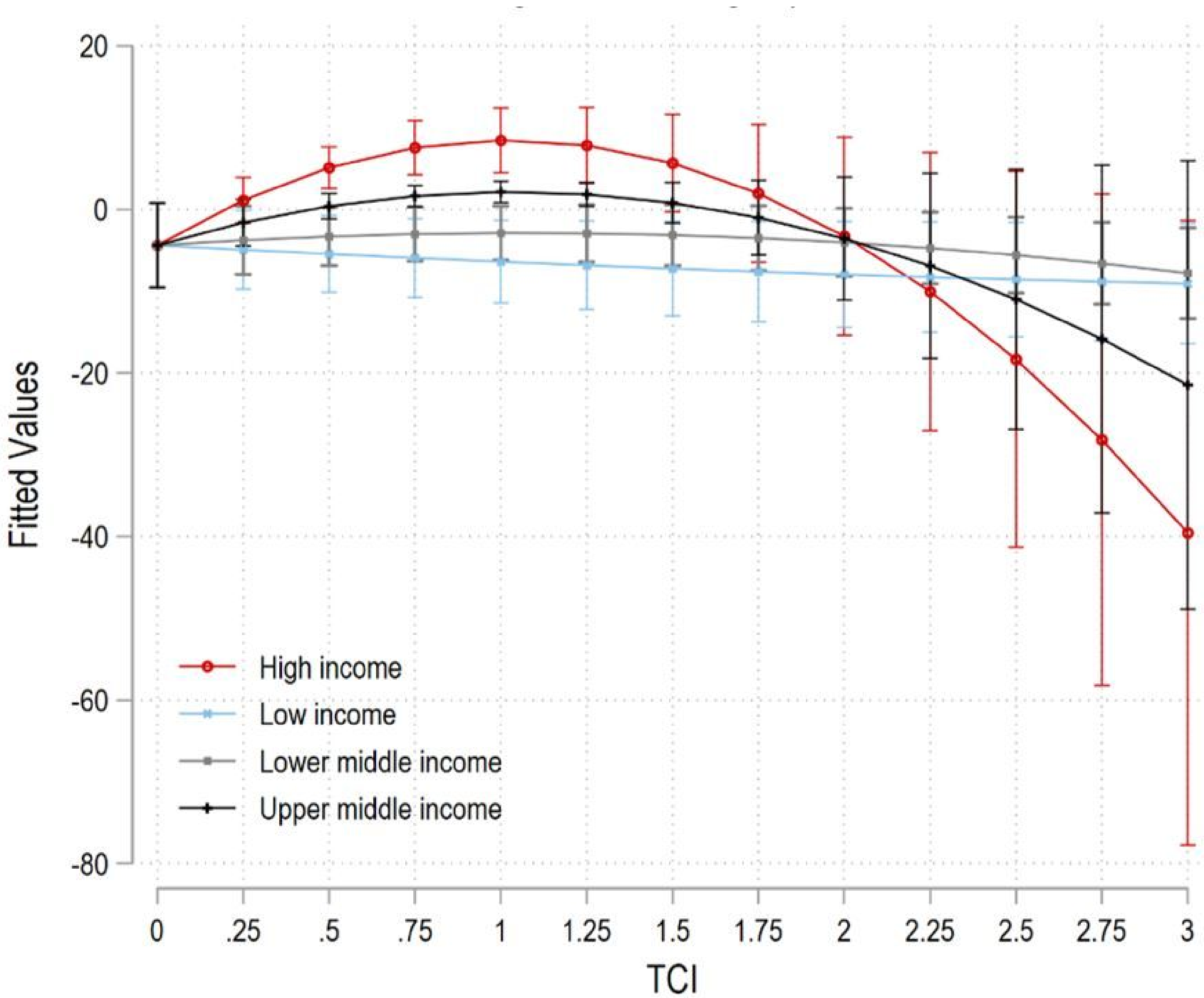

Figure 3

Marginal effects of TCI on labour productivity growth rates, by income level 1990-2017

Notes: Marginal effects are obtained from regression of **Table A 4**, column 2. Confidence interval for 95%.

Source: Author's calculation.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Appendix.docx