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Evaluating the β-Convergence of Labour Productivity under Varying Political Regimes

Weerasak SAWANGLOKE
https://orcid.org/0000-0003-4819-6244
Mahasarakham Business School, Mahasarakham University, Thailand
weerasak.sa@acc.msu.ac.th

Aphichat WIYO[1]
https:/ /orcid.org/0009-0000-5223-7577
Mahasarakham Business School, Mahasarakham University, Thailand
wiyo.ap@gmail.com

Mana LUKSAMEE-ARUNOTHAI
https://orcid.org/0009-0005-4833-6931
Department of Economics, Faculty of Economics, Kasetsart University, Thailand
fecomnl@ku.ac.th

Suteera CHANTHES
https://orcid.org/0000-0001-6774-6462
Mahasarakham Bussiness School, Mahasarakham University, Thailand
suteera.c@acc.msu.ac.th

Phubet SENBUT
https://orcid.org/0009-0000-1560-6468
Parliamentary Budget Office, The Secretariat of the House of Representatives, Thailand
p.senbut.93@gmail.com

Nut THANCHAROEN
https://orcid.org/0009-0003-1865-298X
Mahasarakham Business School, Mahasarakham University, Thailand
nut.t@acc.msu.ac.th

Supattra NUTTEE
https://orcid.org/0000-0001-5463-5712
Mahasarakham Business School, Mahasarakham University, Thailand
supattra.n@acc.msu.ac.th

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[1] Corresponding author

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Abstract:
This paper evaluates the β-convergence of labour productivity across the political regimes. The analysis provides insight into the extent and pattern of labour productivity convergence differentiated by political system, controlling for economic and political stability variables. Data were collected from 129 countries, which were grouped by four political regime types and using fixed effects and Generalized Method of Moments (GMM) estimations on dynamic panel data, we examine the unconditional and conditional convergence of three separate periods. The control variables include gross fixed capital formation, life expectancy, foreign direct investment, trade openness, and political stability. The results show a significant relationship between labour productivity growth rates and the initial levels of productivity across all regime types, with full democracies exhibiting the most rapid β-convergence relative to the other system types. The analysis reveals that the impact of political stability on convergence rates is profound; specifically, more politically stable regimes tend to converge at higher rates of labour productivity. This explains considerable variance in labour productivity convergence paths across political contexts. The paper provides new evidence on the relevance of the political regimes for β-convergence of labour productivity, while employing political regime typologies rather than traditional geographic or sector classifications.

Keywords: labour productivity; β-convergence; political regimes; political stability; economic growth; dynamic panel data.

JEL Classification: J10; J08; P10.

Introduction

The convergence of labour productivity is one of the most important determinants of the economic development of each country (Dieppe & Matsuoka, 2025). In economics, convergence describes the process in which less efficient economies grow at faster rates than more efficient economies, resulting in a reduction of productivity gaps across time (Temoso et al., 2025). The convergence pattern of labour productivity across countries is heterogeneous and is driven by various factors, especially institutional quality, structure of the economy, and critically, political regimes and political stability (Akin, 2019). This study classifies the analysis of the convergence of labour productivity by political regime and political stability for comparative purposes. It is in this context where the political regime of a country (Aisen & Veiga, 2013; Hall, 2015), whether authoritarian, hybrid and flawed, to full democracies, influences the capacity of the available workforce could be to participate in a sustainable process of development. It is a widespread notion that democratic governments create favourable conditions for economic development by prioritizing the rule of law, transparency, and accountability (Mohammadi et al., 2023; Zhumabekova & Mukanov, 2025). They usually protect property rights, enforce contracts and reduce transaction costs, which promotes investment in physical and human capital (North, 1990). In addition, democracies generally have more robust mechanisms for ensuring political stability via regular, peaceful transfers of power (Rodrik, 2000; Acemoglu & Robinson, 2005) and a reduced likelihood of abrupt policy reversals that could interrupt labour productivity growth and economic planning.

In contrast, authoritarian regimes can also promote rapid economic growth through their ability to pursue long-term policies without being hampered by electoral cycles that can prevent significant investment in human and physical capital to raise labour productivity (Przeworski & Limongi, 1993). However, a lack of accountability in authoritarian governance can result in misallocation of resources, corruption, and economic inefficiencies (Patalinghug, 2025) that ultimately impede patterns of convergence in labour productivity. Hybrid regimes, those that combine features from both democratic and authoritarian systems, represent a more complex case. Although these regimes can benefit from some of the characteristics of being both democratic and despotic, they are most threatened by institutional instability and policy incoherence.

Therefore, it remains unclear whether they fit the labour productivity convergence; probably, other variables, such as social cohesion/institutional effectiveness, and the impact of political stability on labour productivity convergence, are considerably more relevant in this process. The FDI is primarily attracted to countries where the political situation is stable (Le et al., 2023). This is where domestic entrepreneurship is boosted, and the politicians are the ones maintaining a stable environment (Campos & Nugent, 2002; Groznykh et al., 2020). Besides this, the stable political environment not only promotes the sustained growth of domestic entrepreneurs but also provides a climate of certainty that allows them to conduct long-term planning for that growth.

Nations that experience frequent changes in government, sustained political instability or entrenched corruption cannot expect to develop an environment for long-term labour productivity growth. Political instability creates economic-policy uncertainty, which deters investment in physical and human capital. As a result, poorer economies are less able to converge with more prosperous economies, and labour productivity diverges rather than converges. Consequently, political stability is linked to the quality of a country's political institutions, necessary to uphold contracts and ensure property rights protection as well as efficient resource allocation (Bertrand et al., 2024). Political instability is known to affect economic growth negatively. Still, institutions can attenuate their effect by providing predictable incentives and constraints for economic agents even in the face of a turbulent political environment (Acemoglu & Robinson, 2013).

The convergence of labour productivity revolves around several dynamics, including political stability, human capital investments, the accumulation of physical capital, and the contested landscape of international trade, that together influence the path of productivity performance. Aside from these factors, a critical point of reflection is that the rate and kind of convergence are driven by political factors (Feng et al., 2000; Lopez-Gomez, 2024). Shahzad et al. (2012) and Okara (2023) add that democratic governance driven by open and competitive politics, the rule of law and holding decision makers accountable is needed to create a conducive environment for sustained productivity growth, as political peace provides the enabling condition necessary for future investment decisions, including strategic economic planning. Political instability and/or autocratic rule, though, could work in the opposite direction toward drag (or leap) depending on their form. There is a relationship between political regimes and economic performance (Rodrik, 1997).

This extends to analysing labour productivity convergence across different political regimes: authoritarian, hybrid, flawed, and full democracies (Table 1). It also investigates the determinants of patterns of labour productivity convergence.

Table 1. The democracy index, classifying countries into four types of regimes based on their scores, ranging

Full Democracy (Scores 8.01-10)	Flawed Democracy (Score 6.01-8.00)		Hybrid Regime (Scores 4.01-6.00)	Authoritarian Regime (Scores 0-4.00)	
Norway	Chile	Namibia	Bangladesh	Kyrgyzstan	Guinea-Bissau
New Zealand	Czechia	Croatia	Peru	Algeria	Niger
Iceland	Estonia	Mongolia	Fiji	Qatar	Nicaragua
Sweden	Malta	Romania	Bhutan	Lebanon	Russian
Finland	United States	Dominican	Tunisia	Mozambique	Federation
Denmark	Israel	Republic	Senegal	Rwanda	Guinea
Ireland	Portugal	Bulgaria	Armenia	Pakistan	Gabon
Switzerland	Slovenia	Thailand	Ecuador	Oman	China
Netherlands	Botswana	Ghana	Tanzania	Kazakhstan	Uzbekistan
Germany	Italy	Albania	Madagascar	Cambodia	Saudi Arabia
Canada	Belgium	Moldova	Hong Kong, China	Comoros	Belarus
Australia	Cyprus	Singapore	Georgia	Jordan	Islamic Republic
Uruguay	Latvia	North Macedonia	Mexico	Zimbabwe	of Iran
Japan	Lithuania	Paraguay	Kenya	Togo	Tajikistan
Costa Rica	Malaysia		Morocco	Egypt	Sudan

Full Democracy (Scores 8.01-10)	Flawed Democracy (Score 6.01-8.00)		Hybrid Regime (Scores 4.01-6.00)	Authoritarian Regime (Scores 0-4.00)	
Austria	India		Honduras	Iraq	Republic of Congo
United Kingdom	Poland		El Salvador	Haiti	Chad
Mauritius	Slovakia		Benin	Azerbaijan	Central African Republic
Republic of Korea	South Africa		Nepal	Democratic Republic of the Congo	
Greece	Panama		Uganda	Eswatini	
France	Hungary		Gambia	Burkina Faso	
Spain	Brazil		Guatemala	Vietnam	
	Philippines		Turkey	Mali	
	Argentina		Sierra Leone	Cameroon	
	Colombia		Cote d'Ivoire	Bahrain	
	Indonesia		Bolivia		
			Mauritania		

Source: Economist Intelligence Unit (2023)

1. Literature Review

β-convergence is commonly distinguished into unconditional and conditional convergence (Bhattarai & Qin, 2022). Examining these classifications is crucial because they help identify potential drivers of long-term growth, from natural catch-up dynamics to the economic, institutional, and political factors that shape development trajectories (Acemoglu et al., 2001). Previous literatures on labour-productivity convergence have primarily concerned with geographical scales such as regions, nations, or industrial sectors (Bernard & Jones, 1996; Islam, 2003). Moving beyond these conventional boundaries, the present study adopts a different lens by analysing labour productivity convergence across types of political regimes, offering a fresh perspective on how governance structures may influence convergence processes. However, by exclusively studying β-convergence, this does not mean that productivity inequality truly decreases in the long-run. Therefore, σ-convergence matters as well since it reveals whether the dispersion of labour productivity in the sample grows or declines over the development process (Lähdemäki, 2024; Eder et al., 2024). Thus, by assessing both β- and σ-convergence, this study provides not only a more thorough understanding of the speed of convergence but also, interestingly, how gaps between countries develop over time under different political regimes.

1.1. Unconditional β-convergence of labour productivity

Unconditional β-convergence in labour productivity implies that the countries will converge towards a common steady-state level of productivity (Inklaar & Marapin, 2025). The basis of this idea has been recognizable in research of economic growth and functioning. This principle argues that poorer or less productive economies grow quickly than rich or more productive economies (Bernard & Jones, 1996). This differential rate of growth continually narrows inequalities in the long run (Barro & Sala-i-Martin, 1992).

There are many empirical studies that investigate unconditional β-convergence of labour productivity across different countries and regions in the literature. Bernard & Jones (1996) analysed productivity convergence among OECD countries using both panel and time-series data and found unconditional convergence in economy-wide manufacturing and services. Their results show that less productive countries have consistently closed the gap with more productive ones. Islam (2003) carried out an analysis of unconditional β-convergence using panel data techniques.

Further contributions to the literature deepened our understanding of unconditional β-convergence in labour productivity due to the focus on sectoral dynamics and mechanisms that drive productivity growth. For a wide range of sectors in the economy, Mulder & De Groot (2007) have found that labour productivity tended to converge unconditionally over time. The strongest convergence is in manufacturing and several service industries. It is due to the competitive pressure to innovate and the exchange of knowledge, which allows latecomer countries to adopt advanced technologies rapidly. This finding suggests that both technology diffusion and structural transformation

contribute to the catching-up process, such as reallocating resources from low-productivity agriculture to higher-productivity industries and services. In terms of reallocating resources and adopting the best-practice methods of production, these forces narrow productivity gaps even if there are substantial initial differences in capital or infrastructure.

From the sectoral perspective, AlKathiri (2022) further analysed the global manufacturing through nonparametric production frontiers and documented in detail what contributes to the convergence. The study indicated that the primary driver is capital accumulation. The poor investment in machinery, infrastructure, and human capital enables less industrialised economies to expand their capacity and close the gap. In contrast, technological changes often sustained divergence as the frontier-biased shifts were better absorbed in high-tech economies with better institutions. The increments due to technical efficiency were minor. A slow pace of conversion suggests that catching up requires not only technology but also the ability to absorb large inflows of capital and new technologies.

We expand on these ideas in the present study. We consider unconditional β-convergence in labour productivity and classify countries by their political regime: authoritarian, hybrid, flawed democracy, and full democracy. Most earlier studies compare countries geographically or by sector (Bernard & Jones, 1996; Mulder & De Groot 2007; AlKathiri, 2022). Incorporating political-institutional heterogeneity factors within the analysis framework and exploring whether different political regimes display divergent productivity convergence patterns. This study introduces political-institutional heterogeneity into the analysis framework

1.2. Conditional β-convergence of labour productivity

Conditional β-convergence of labour productivity refers to the convergence in a country's level of productivity, driven by heterogeneous factors or country-specific characteristics, such as the political regime. On the contrary, if β-convergence happens without considering these other factors, the phenomenon is named as unconditional β-convergence (Kinfemichael & Morshed, 2019). They examined the role of the size and volatility level of government on the speed of labour productivity level (Afonso & Furceri, 2010; Alexandre et al., 2022).

In addition, Naveed & Ahmad (2016) analysed labour productivity convergence among 19 European Union (EU) nations and six sectors from 1991 to 2009 by utilising both the LSDV and GMM to estimate conditional β-convergence after accounting for structural changes. According to them, structural variations significantly affect the convergence rates. Bhattarai & Qin (2022) explored β-convergence of labour productivity based on 31 provinces and eight production sectors in China from 2006 to 2019. Applying static, dynamic and quantile panel data models, the human capital, physical capital and FDI were identified as constraints on productivity convergence. They find asymmetrical convergence in provinces and sectors, and human capital and FDI remain the most critical factors for productivity. The paper shows that although inequality and industrial concentration foster divergence, place-based policies promoting competition and attenuating inequality favour convergence. Additionally, trade openness speeds up productivity growth particularly in regions with existing infrastructure and technology readiness, and as a result, that reflects on the convergence of labour productivity (Shahbaz, 2012; Amna Intisar et al., 2020; Vatsa & Pino, 2023).

Likewise, Castelló-Climent & Doménech (2022) have explored the influence of human capital on income and labour productivity convergence in a global sample that included 140 countries over the period 1970-2021. The higher the educational achievement of a province or region, the faster its convergence in labour productivity, thereby indicating that human capital is crucial to enabling conditional convergence. This supports the theory that countries with stronger development of human capital are also more likely to converge. Cuerva (2012) investigated labour productivity convergence in the EU agricultural sector between 1985 and 2004 for a sample of 125 regions. Cross-sectional models were estimated using the β-convergence equation and Ordinary Least Squares (OLS) estimation with White's heteroskedasticity-consistent standard errors.

The study considers the influence of such factors as human capital, sectoral investment and migration. The findings showed a slow rate of convergence, in which migration and investment contributed highly to the growth in productivity of labour. In their convergence analysis, Martín-Retortillo & Pinilla (2015) explored the influence of age dependence on productivity growth in the context of labour productivity divergence with β-convergence models to measure the trends in disparities between nations over time. To study how youth and elderly dependency ratios affect productivity convergence, dynamic panel data models, especially GMM, were applied. In another paper across developing and developed countries, Choudhry et al. (2016) emphasise the impact of demographic factors on the divergence and convergence patterns.

Based on the preceding review of convergence literature, this study employs panel data analysis and GMM dynamic panel data methodologies to examine both unconditional and conditional convergence. The determinants influencing labour productivity convergence include political stability, gross fixed capital formation (as a proxy for physical capital), life expectancy (as a proxy for human capital), foreign direct investment, and trade openness.

1.3. σ-convergence of Labour Productivity

While β-convergence focuses on differences in growth rates, it does not necessarily reflect whether productivity inequality among countries is decreasing. Thus, σ-convergence is used to investigate whether the dispersion of labour productivity across countries becomes smaller over time (Elouaourti & Ibourk, 2025). If the standard deviation of productivity levels declines, this indicates that countries are not only catching up in growth rates but are also reducing their productivity gaps, which reinforces the outcome of true convergence. Recent empirical evidence suggests that σ-convergence has occurred in the global economy, although not uniformly across all countries. Eder et al. (2024) examined labour productivity across developed and emerging economies and found a decline in productivity dispersion over time, alongside a shift from a dual-peak distribution toward a more unified global productivity structure. They identify improvements in capital deepening and technological capabilities as important factors contributing to this reduction in productivity inequality.

Complementary findings are provided by Inklaar & Marapin (2025), who demonstrate that σ-convergence in aggregate labour productivity has been strongly driven by structural transformation, particularly productivity improvements in agriculture and the reallocation of labour toward more productive sectors. Their results show that convergence in agriculture and changes in economic structure are key mechanisms reducing dispersion in cross-country productivity levels

Taken together, these studies highlight that σ-convergence provides meaningful insights beyond β-convergence, because it evaluates whether productivity improvements are accompanied by lower inequality across economies. Therefore, with σ-convergence as part of the findings of this study, the probability of differences in levels of development across different political systems assessed relative to not only catch-up speeds but also whether productivity differences are actually decreasing is greater, as it is a more general form of assessment relative to convergence tendencies.

2. Methodology and Data

This research employs fixed-effects, random-effects, and dynamic panel data methodologies to estimate each equation of the model. The analysis is divided into 3 main sub-period, there are 1994-2003, 2004-2013, and 2014-2023 of 4 political regime classifications: authoritarian (41 countries), hybrid (27 countries), flawed democracies (39 countries), and full democracies (22 countries). The empirical framework grounded in neoclassical growth theory to estimate convergence is used (Barro & Sala-i-Martin, 1992, 2004), which derived from the relationship between initial productivity levels and growth rates of labour productivity (Castellanos-Sosa, 2020). The presence of unconditional labour productivity convergence is specified in equation (1) (Kinfemichael & Morshed, 2019).

$$\Delta \ln LP_{i,t} = \alpha + \beta \ln LP_{i,t-1} + \epsilon_{i,t} \quad (1)$$

where: $\Delta \ln LP_{i,t}$ is the growth rate of labour productivity in the political regime group of each country *i* over period *t*, $\ln LP_{i,t-1}$ is the natural logarithm of initial labour productivity in period $_{t-1}$, α is a constant term, and β is the convergence coefficient. A statistically significant and negative β coefficient, it suggests unconditional convergence, implying that countries with lower initial labour productivity levels are catching up with those experiencing higher labour productivity, $\epsilon_{i,t}$ is the error term.

Equation (1) is also estimated by including country-specific fixed effects to determine whether there is any indication of conditional convergence (Barro & Sala-i-Martin, 2004). Since the error term can be related to sub-sectors within the same country, a standard error is used, clustered on countries that take into account the non-independence of the error terms, estimated using a number of cross-sectional and panel data estimation techniques as shown by Equation (2) (Bhattarai & Qin, 2022).

$$\Delta \ln LP_{i,t} = \alpha + \beta \ln LP_{i,t-1} + \gamma X_{i,t} + \lambda_t + \epsilon_{i,t} \quad (2)$$

where: $\Delta \ln LP_{i,t}$ is the growth rate of labour productivity in the political regime group of each country or political stability group of each country $_i$ over period $_t$, $\ln LP_{i,t-1}$ is the initial labour productivity log-transformed in period $_{t-1}$, α is a constant term, $X_{i,t}$ is a vector of conditioning variables namely: gross fixed capital formation as a percentage of GDP (GFC), life expectancy (LIF), FDI net inflows as a percentage of GDP, trade openness (TRA), political stability index (PSI) influencing labour productivity in country i during period.

The data has been extracted from the databases of Worldwide Governance Indicators, the World Bank, and the International Labour Organization. Furthermore, γ refers to the coefficient on the conditioning variables, (γ) shows the impact of various factors on labour productivity growth, λ_t represents the year-fixed effect, accounting for global shocks, macroeconomic trends, or other factors constant across countries but vary over time, β is the conditional convergence coefficient, with a negative β indicating convergence, similarly, in the unconditional case, $\epsilon_{i,t}$ is the error term.

To complement β-convergence, σ-convergence is evaluated to determine whether differences in labour productivity across regime groups decline over time. This approach examines whether convergence in growth is accompanied by a reduction in productivity inequality. Following Bhattarai & Qin (2022), Coto-Millán et al. (2025), σ-convergence is measured by the standard deviation of logged labour productivity.

$$\sigma_t = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(lnLP_{it} - \overline{lnLP_t})^2} \quad (3)$$

where: σ_t represents the cross-country dispersion in period t, $LP_{i,t}$ denotes the labour productivity of country $i$at time t, and $\overline{lnLP_t}$ is the cross-country mean of log labour productivity in period t. A declining $\sigma_t$or $\Delta\sigma < 0$ indicates the presence of σ-convergence, reflecting a narrowing of productivity inequality among the sampled economies.

3. Results and Discussion

As presented in Table 2, throughout the period 1994 - 2023, full democracy exhibits the highest average labour productivity, followed by flawed democracy, authoritarian, and hybrid regimes, respectively. The literature review indicates that multiple factors influence the β convergence of labour productivity. Prior to empirical analysis, Table 2 presents descriptive statistics including means, standard deviations (SD), and minimum and maximum values of model variables across political regimes.

Table 2: Descriptive statistics

Political Regime	Variable	Mean	Std. dev.	Minimum	Maximum
Authoritarian regime	LP	12,468.8500	17,273.7700	475.0000	99,547.0000
	$\Delta lnLP_{i,t}$	0.0156	0.0592	-0.3949	0.6621
	$lnLP_{i,t-1}$	8.6730	1.2226	6.1633	11.5084
	GFC	23.9960	9.7433	0.8508	76.7823
	LIF	63.8955	9.3653	14.1000	81.5600
	FDI	3.4564	5.5311	-17.2921	55.0729
	TRA	72.2339	34.9690	0.0200	191.8700
	PSI	-0.7226	0.8289	-3.1800	1.2200
Hybrid regime	LP	9,532.9810	13,624.7000	869.3600	91,131.1100
	$\Delta lnLP_{i,t}$	0.0161	0.0414	-0.2179	0.2038
	$lnLP_{i,t-1}$	8.6232	0.9630	6.7678	11.3970
	GFC	22.8619	9.3991	-2.4244	93.5475
	LIF	66.2654	7.9901	42.0700	85.5300
	FDI	3.8183	6.0785	-11.1917	58.5184
	TRA	73.5638	58.1778	22.8700	442.6200
	PSI	-0.4068	0.6684	-2.2600	1.3400
Flawed democracy	LP	29,325.3800	26,698.8100	1,846.7700	128,591.0000
	$\Delta lnLP_{i,t}$	0.0217	0.0378	-0.2962	0.1961
	$lnLP_{i,t-1}$	9.8787	0.9237	7.4811	11.7644
	GFC	23.0975	5.2300	4.4522	48.4123
	LIF	73.0401	6.5344	50.6300	83.6000
	FDI	7.5686	27.4891	-103.1570	449.0830
	TRA	101.6630	65.3229	15.6400	437.3300
	PSI	0.2072	0.7579	-2.3800	1.6000
Full democracy	LP	80,007.1700	34,174.3300	11,056.7000	199,473.0000
	$\Delta lnLP_{i,t}$	0.0134	0.0242	-0.1024	0.2023
	$lnLP_{i,t-1}$	11.1569	0.5463	9.2883	12.1986
	GFC	22.4453	4.3436	10.6874	54.2742
	LIF	79.6347	2.6601	70.1585	84.5600
	FDI	3.8531	8.2936	-36.1403	86.4791
	TRA	79.0426	35.7523	15.8103	252.4950
	PSI	0.9333	0.4141	-0.4746	1.7587

Source: Authors' estimations.

Table 3 illustrates the application of four distinct stationarity test methodologies across three time periods for variables within authoritarian regimes, hybrid regimes, flawed democracies, and full democracies. Stationarity is confirmed when significant p-values (≤0.05) are obtained, indicating constant statistical properties (mean and variance) over time. The findings indicate that certain variables, namely ΔlnLPi,t in authoritarian regimes stationaries across different time frames with p-values below 0.05. In contrast, there are some variables display non-stationarity during certain periods such as $lnLP_{i,t-1}$ and LIF, suggesting temporal evolution in their statistical

characteristics. As Table 2 shows a combination of stationary and non-stationary variables that may share long-term relationships, thus, cointegration testing becomes essential.

Table 3. Stationary test according to political regime and period studied

Time Period Studied	Variables	Levin-Lin-Chu		Im-Pesaran-Shin		Hadri LM Test		Fisher-type	
		Statistics	P-value	Statistics	P-value	Statistics	P-value	Statistics	P-value
Authoritarian Regime									
1994-2003	$\Delta lnLP_{i,t}$	-12.2346	0.0000	-6.4543	0.0000	4.6530	0.0000	21.1533	0.0000
	$lnLP_{i,t-1}$	0.5824	0.7199	2.2337	0.9872	22.4021	0.0000	1.2214	0.1110
	GFC	-4.9649	0.0000	-3.1919	0.0007	9.9965	0.0000	2.1901	0.0143
	LIF	-0.9931	0.1603	6.2748	1.0000	22.4825	0.0000	-0.2846	0.6120
	FDI	-9.4603	0.0000	-3.0314	0.0012	10.8456	0.0000	10.8552	0.0000
	TRA	-3.1465	0.0008	-0.9165	0.1797	17.1291	0.0000	0.3681	0.3564
	PSI	-3.3490	0.0004	2.9279	0.9983	12.7574	0.0000	9.4618	0.0000
2004-2013	$\Delta lnLP_{i,t}$	-6.5029	0.0000	-5.2347	0.0000	5.8866	0.0000	4.0645	0.0000
	$lnLP_{i,t-1}$	-4.1157	0.0000	2.7337	0.9969	26.9641	0.0000	0.0535	0.4787
	GFC	-5.0993	0.0000	-1.8048	0.0356	13.1010	0.0000	2.1375	0.0163
	LIF	-4.5826	0.0000	7.8359	1.0000	24.4519	0.0000	1.2085	0.1134
	FDI	-4.6020	0.0000	-2.9970	0.0014	16.6098	0.0000	4.1325	0.0000
	TRA	-8.1413	0.0000	0.6038	0.7270	17.6868	0.0000	5.2436	0.0000
	PSI	-10.7152	0.0000	-0.8748	0.1908	17.8957	0.0000	9.5289	0.0000
2014-2023	$\Delta lnLP_{i,t}$	-9.0387	0.0000	-4.8934	0.0000	2.6379	0.0042	12.9853	0.0000
	$lnLP_{i,t-1}$	-6.0945	0.0000	1.5316	0.9372	27.8573	0.0000	2.4725	0.0067
	GFC	-10.5328	0.0000	2.4638	0.9931	13.2842	0.0000	8.4030	0.0000
	LIF	194.1379	1.0000	7.1765	1.0000	4.9422	0.0000	-4.2090	1.0000
	FDI	-1.0845	0.1391	-0.5443	0.2931	7.1191	0.0000	0.4272	0.3346
	TRA	-2.5798	0.0049	-0.8345	0.2020	8.8160	0.0000	5.4258	0.0000
	PSI	-6.6741	0.0000	-1.1649	0.1220	18.4284	0.0000	0.3079	0.3791
Hybrid Regime									
1994-2003	$\Delta lnLP_{i,t}$	-4.7784	0.0000	-6.3256	0.0000	-0.6642	0.7467	5.8802	0.0000
	$lnLP_{i,t-1}$	-2.0166	0.0219	2.2718	0.9885	22.8003	0.0000	-0.1481	0.5589
	GFC	-8.9252	0.0000	-1.3559	0.0876	8.5305	0.0000	9.5369	0.0000
	LIF	-21.3787	0.0000	4.4403	1.0000	22.7401	0.0000	6.4392	0.0000
	FDI	-4.9209	0.0000	-3.3044	0.0005	3.7558	0.0001	1.3257	0.0925
	TRA	-17.0010	0.0000	-2.5647	0.0052	5.7164	0.0000	14.0401	0.0000
	PSI	-4.0098	0.0000	0.7607	0.7766	13.1979	0.0000	18.3687	0.0000
2004-2013	$\Delta lnLP_{i,t}$	-5.0532	0.0000	-3.8479	0.0001	2.7266	0.0032	2.6004	0.0047
	$lnLP_{i,t-1}$	-0.5382	0.2952	3.3767	0.9996	22.7789	0.0000	-0.7674	0.7786
	GFC	-2.6899	0.0036	0.8459	0.8012	8.1935	0.0000	0.6555	0.2561
	LIF	-5.8717	0.0000	5.1993	1.0000	25.3045	0.0000	9.0369	0.0000

Time Period Studied	Variables	Levin-Lin-Chu		Im-Pesaran-Shin		Hadri LM Test		Fisher-type	
		Statistics	P-value	Statistics	P-value	Statistics	P-value	Statistics	P-value
	FDI	-6.1431	0.0000	-2.5207	0.0059	5.7739	0.0000	2.6771	0.0037
	TRA	-5.9009	0.0000	-1.6818	0.0463	16.7556	0.0000	2.6109	0.0045
	PSI	-5.6013	0.0000	-0.2591	0.3978	17.1271	0.0000	4.0030	0.0000
2014-2023	$\Delta lnLP_{i,t}$	-10.5462	0.0000	-6.0910	0.0000	-0.3211	0.6259	11.1525	0.0000
	$lnLP_{i,t-1}$	-6.5131	0.0000	0.5068	0.6939	19.2169	0.0000	7.9880	0.0000
	GFC	-1.9880	0.0234	1.3816	0.9164	12.5360	0.0000	-0.1224	0.5487
	LIF	149.4131	1.0000	7.2921	1.0000	4.1927	0.0000	-2.7075	0.9966
	FDI	-2.5764	0.0050	-1.9354	0.0265	7.1261	0.0000	1.1629	0.1224
	TRA	-8.0383	0.0000	-2.4187	0.0078	5.5009	0.0000	7.6163	0.0000
	PSI	-4.5691	0.0000	-2.0589	0.0198	9.1532	0.0000	3.0787	0.0010
Flawed Democracy									
1994-2003	$\Delta lnLP_{i,t}$	-8.2231	0.0000	-5.9260	0.0000	3.6591	0.0001	6.3289	0.0000
	$lnLP_{i,t-1}$	-4.7783	0.0000	1.9065	0.9717	26.9661	0.0000	0.2168	0.4142
	GFC	-3.3620	0.0004	-1.8082	0.0353	16.9647	0.0000	2.3914	0.0084
	LIF	1.4043	0.9199	7.6494	1.0000	28.8597	0.0000	1.2453	0.1065
	FDI	-5.0833	0.0000	-2.9588	0.0015	5.0331	0.0000	1.3894	0.0824
	TRA	0.4222	0.6636	-2.3648	0.0090	11.6648	0.0000	0.3894	0.3485
	PSI	-12.3058	0.0000	2.3065	0.9895	9.4804	0.0000	12.7520	0.0000
2004-2013	$\Delta lnLP_{i,t}$	-11.1030	0.0000	-6.7117	0.0000	0.9781	0.1640	10.5410	0.0000
	$lnLP_{i,t-1}$	-5.3578	0.0000	-0.8339	0.2022	26.6580	0.0000	1.2565	0.1045
	GFC	-5.6812	0.0000	2.3784	0.9913	15.4375	0.0000	2.3758	0.0088
	LIF	6.2811	1.0000	7.0694	1.0000	29.9397	0.0000	-2.8709	0.9980
	FDI	-6.9904	0.0000	-3.1494	0.0008	14.8954	0.0000	1.9640	0.0248
	TRA	-6.5516	0.0000	-0.9238	0.1778	18.9160	0.0000	1.7556	0.0396
	PSI	-12.5652	0.0000	-3.3392	0.0004	16.3691	0.0000	11.8685	0.0000
2014-2023	$\Delta lnLP_{i,t}$	-8.3445	0.0000	-7.6571	0.0000	-0.4140	0.6605	8.4483	0.0000
	$lnLP_{i,t-1}$	-1.3792	0.0839	2.1289	0.9834	25.3774	0.0000	-1.2993	0.9031
	GFC	-9.3034	0.0000	1.7875	0.9631	15.4206	0.0000	4.2130	0.0000
	LIF	-6.0102	0.0000	-2.1797	0.0146	9.9455	0.0000	0.3039	0.3806
	FDI	-5.4022	0.0000	-4.0926	0.0000	5.6930	0.0000	11.8548	0.0000
	TRA	-8.4904	0.0000	-1.9820	0.0237	12.7531	0.0000	9.6091	0.0000
	PSI	-14.3094	0.0000	-2.9409	0.0016	14.6002	0.0000	9.5721	0.0000
Full Democracy									
1994-2003	$\Delta lnLP_{i,t}$	-9.1648	0.0000	-4.8331	0.0000	1.8632	0.0312	9.2725	0.0000
	$lnLP_{i,t-1}$	-4.2512	0.0000	1.8337	0.9667	22.2885	0.0000	-2.0164	0.9781
	GFC	-4.9404	0.0000	0.0734	0.5292	13.4413	0.0000	1.2899	0.0985
	LIF	-6.7535	0.0000	9.2175	1.0000	22.3247	0.0000	-0.4925	0.6888

Time Period Studied	Variables	Levin-Lin-Chu		Im-Pesaran-Shin		Hadri LM Test		Fisher-type	
		Statistics	P-value	Statistics	P-value	Statistics	P-value	Statistics	P-value
	FDI	-3.6960	0.0001	-1.5571	0.0597	6.0429	0.0000	-0.9039	0.8170
	TRA	-4.8287	0.0000	-0.6221	0.2669	14.1209	0.0000	0.5711	0.2840
	PSI	2.1682	0.9849	0.3337	0.6307	3.1127	0.0009	-0.0893	0.5356
2004-2013	$\Delta \ln LP_{i,t}$	-6.6239	0.0000	-5.0751	0.0000	1.1528	0.1245	3.0206	0.0013
	$\ln LP_{i,t-1}$	-2.2820	0.0112	-0.4981	0.3092	18.9341	0.0000	0.5632	0.2866
	GFC	-4.7780	0.0000	0.8095	0.7909	16.9165	0.0000	0.5338	0.2968
	LIF	-0.9465	0.1719	3.6456	0.9999	22.3699	0.0000	-2.1653	0.9848
	FDI	-10.3647	0.0000	-4.1925	0.0000	0.7991	0.2121	11.9470	0.0000
	TRA	-3.8699	0.0001	-1.1678	0.1214	17.0137	0.0000	-0.1917	0.5760
	PSI	-5.7794	0.0000	-1.3766	0.0843	9.5849	0.0000	4.1960	0.0000
2014-2023	$\Delta \ln LP_{i,t}$	-8.5206	0.0000	-5.9789	0.0000	-2.6342	0.9958	8.0232	0.0000
	$\ln LP_{i,t-1}$	-2.8949	0.0019	-0.0283	0.4887	19.5731	0.0000	-1.5618	0.9408
	GFC	-5.5907	0.0000	-1.2570	0.1044	2.2240	0.0131	5.5509	0.0000
	LIF	313.2389	1.0000	9.4742	1.0000	3.6878	0.0001	-3.8212	0.9999
	FDI	-4.9776	0.0000	-3.7648	0.0001	7.8088	0.0000	4.8625	0.0000
	TRA	-5.3784	0.0000	-0.7314	0.2323	8.0358	0.0000	6.8911	0.0000
	PSI	-4.0793	0.0000	-3.2351	0.0006	10.4856	0.0000	0.3742	0.3541

Source: Authors' estimations.

Table 4 presents the Kao cointegration test results for the panel data on studied political regimes over three time periods. The results suggest that there is a strong relationship between all political regimes as well as all time periods, confirming long-term relationships among the variables. Although, there is presence of non-stationary variables, their cointegration permits proceeding with regression analysis. In addition, prior examining labour productivity β-convergence, Hausman tests are conducted to determine the appropriate model specification. Meanwhile, to test for heteroscedasticity and independence of observations across political regimes for all three periods of time, a Modified Wald Test and Pesaran's Cross-section independence test are employed.

Table 4. Cointegration test

Political Regime	Time Period Studied	Augmented Dickey-Fuller Test	
		Statistics	P-value
Authoritarian regime	1994-2003	3.9048	0.0000
	2004-2013	-1.8048	0.0356
	2014-2023	-6.0963	0.0000
Hybrid regime	1994-2003	-1.3845	0.0831
	2004-2013	-2.8638	0.0021
	2014-2023	-3.1882	0.0007
Flawed democracy	1994-2003	-3.9305	0.0000
	2004-2013	-6.1557	0.0000
	2014-2023	-2.5606	0.0052
Full democracy	1994-2003	-3.5099	0.0002

Political Regime	Time Period Studied	Augmented Dickey-Fuller Test	
		Statistics	P-value
	2004-2013	-5.8676	0.0000
	2014-2023	-6.8427	0.0000

Source: Authors' estimations.

As shown in Table 5, Hausman test results favour fixed effects models over random effects specifications. Furthermore, the data exhibit heteroscedasticity and cross-sectional correlation, particularly in the unconditional model. Consequently, robust estimation techniques are implemented to address heteroscedasticity and cross-sectional correlation issues.

Table 5. Hausman tests, heteroscedasticity test, and panel cross-section dependence across political regime

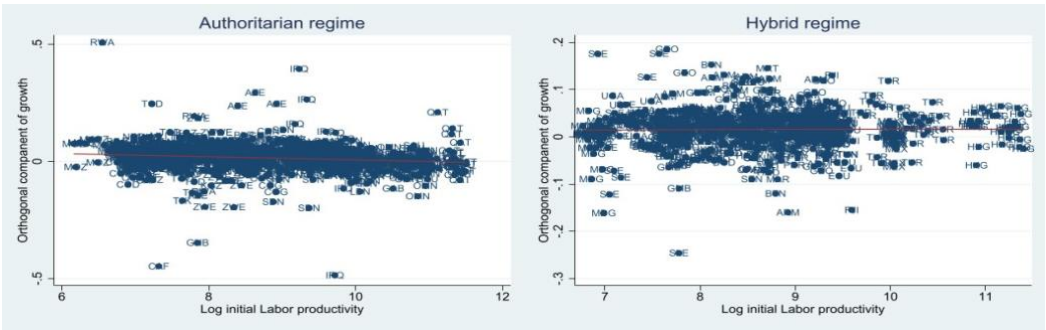
Models	Period Studied	Hausman Tests		Modified Wald Test for Heteroscedasticity		Pearson Test for Cross-sectional Independence	
		Chi2	Prob	Statistical Value	Prob	Statistical Value	Prob
		Authoritarian Regime					
Unconditional model	1994-2003	38.50	0.0000	26,390.47	0.0000	12.680	0.0000
	2004-2013	45.15	0.0000	6,721.38	0.0000	8.780	0.0000
	2014-2023	19.36	0.0000	4,553.98	0.0000	5.776	0.0000
Conditional model	1994-2003	49.70	0.0000	8,580.58	0.0000	0.844	0.3987
	2004-2013	44.70	0.0000	8,212.35	0.0000	1.379	0.1678
	2014-2023	14.31	0.0002	23,267.76	0.0000	-1.233	1.7826
Conditional model with controls	1994-2003	33.56	0.0000	10,628.30	0.0000	0.488	0.6256
	2004-2013	48.21	0.0000	7,689.79	0.0000	1.392	0.1640
	2014-2023	23.87	0.0006	5,206.94	0.0000	-1.091	1.7247
		Hybrid Regime					
Unconditional model	1994-2003	5.07	0.0244	11,784.13	0.0000	0.398	0.6905
	2004-2013	14.97	0.0001	7,335.25	0.0000	5.175	0.0000
	2014-2023	26.27	0.0000	6,366.49	0.0000	7.535	0.0000
Conditional model	1994-2003	7.07	0.0078	1,204.68	0.0000	-0.878	1.6199
	2004-2013	13.48	0.0002	1,067.52	0.0000	-1.376	1.8311
	2014-2023	24.06	0.0000	2,158.50	0.0000	0.017	0.9868
Conditional model with controls	1994-2003	27.51	0.0248	1,443.26	0.0000	-1.325	1.8150
	2004-2013	39.40	0.0006	692.77	0.0000	-1.688	1.9085
	2014-2023	38.94	0.0000	1,434.33	0.0000	-0.963	1.6646
		Flawed Democracy					
Unconditional model	1994-2003	18.57	0.0000	7,593.99	0.0000	5.589	0.0000
	2004-2013	43.47	0.0000	2,264.81	0.0000	23.620	0.0000
	2014-2023	36.17	0.0000	2,76.99	0.0000	30.595	0.0000
Conditional model	1994-2003	31.28	0.0000	3,365.59	0.0000	0.311	0.7558
	2004-2013	27.09	0.0000	712.81	0.0000	-0.868	1.6146
	2014-2023	35.29	0.0000	1,062.32	0.0000	-1.808	1.9295
	1994-2003	26.31	0.0002	4,143.78	0.0000	-0.604	1.4544

Conditional model with controls	2004-2013	34.93	0.0000	817.27	0.0000	-1.976	1.6710
	2014-2023	44.26	0.0000	951.75	0.0000	-1.849	1.9355
		Full Democracy					
Unconditional model	1994-2003	16.88	0.0000	447.94	0.0000	3.644	0.0003
	2004-2013	28.21	0.0000	143.62	0.0000	12.659	0.0000
	2014-2023	25.96	0.0000	6,343.15	0.0000	17.980	0.0000
Conditional model	1994-2003	12.49	0.0004	488.89	0.0000	-1.621	1.8951
	2004-2013	12.36	0.0004	1,132.83	0.0000	-1.672	1.9056
	2014-2023	25.23	0.0000	2,295.80	0.0000	-1.734	1.9171
Conditional model with controls	1994-2003	20.23	0.0025	538.65	0.0784	-1.803	1.9287
	2004-2013	15.04	0.0200	804.70	0.0000	-1.645	1.9001
	2014-2023	40.97	0.0000	1,619.11	0.0000	-1.743	1.9187

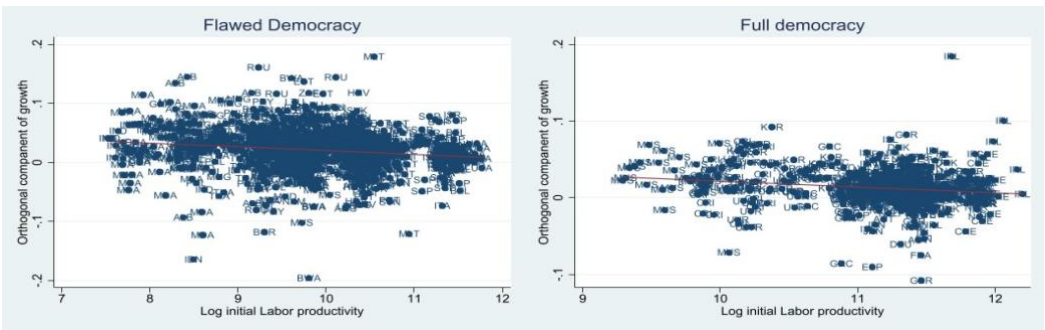
Source: Authors' estimations.

Figure 1 plots labour productivity growth against initial productivity levels across different political regimes from 1994 to 2023. Using a component-plus-residual approach, the data shows a clear negative correlation (unconditional convergence) that is distinct for each regime type. Full democracies (Figure 1.4) exhibit the strongest negative relationship; their steeper slope implies faster productivity growth compared to the other regimes (Figure 1.1, 1.2, and 1.3). As Taymaz et al. (2021) suggest, the transition from authoritarian to democratic governance serves as a catalyst for enhanced political competition and increased participation in political and labour union activities (Brown, 2023). These mechanisms function as critical drivers of accelerated labour productivity growth within democratic systems (Van Noort, 2024).

Figure 1: β - Convergence of labour productivity in political regimes, 1994–2023



1.1 1.2



1.3 1.4

However, the initiation of a democratic system in nations without a strong legal structure can impact labour productivity development and poses a huge cost to the ability of governments to implement effective policies (Polterovich & Popov, 2005). This is due to the fact that labour development in an authoritarian state is impeded by tight state control policies that influence labour to grow at a lower productivity level than that of a democratic state (Kim & Gandhi, 2010; Cooke & Wood, 2022).

This research explores whether labour productivity is converging across different political system. For convergence to occur, the β coefficient must be negative and statistically significant. Our results in Table 6 confirm this, showing consistently negative and significant β coefficient across all three of our models (unconditional, conditional, and dynamic panel). This provides strong evidence that productivity gaps between countries are indeed narrowing over time, regardless of their system of governance.

When analysing unconditional convergence in labour productivity among countries with authoritarian regimes during 1994-2003, the results reveal a highly significant β coefficient of -0.2212 for initial labour productivity levels. When incorporating year-fixed effects to estimate conditional convergence, the β coefficient remains negative and statistically significant, with the conditional convergence coefficient (-0.2649) exceeding the unconditional convergence coefficient (-0.2212) in magnitude. Comparative analysis with other regime types indicates that labour productivity convergence during 1994-2003 proceeded more rapidly in authoritarian regimes than in hybrid regimes (unconditional: -0.0657; conditional: -0.0855), flawed democracies (unconditional: -0.0895; conditional: -0.1606), and full democracies (unconditional: -0.0799; conditional: -0.1220)

During the period 1994-2003, both unconditional and conditional convergence β coefficient values in authoritarian regimes exceeded those in other political regimes. However, a temporal analysis reveals that the unconditional convergence β coefficient in authoritarian regimes diminished from -0.2212 (1994-2003) to -0.1493 (2004-2013) and further to -0.0953 (2014-2023). Similarly, the conditional convergence coefficient decreased from -0.2649 to -0.1808 and to -0.0847 across the same periods. This pattern indicates that authoritarian regimes with lower initial labour productivity levels are converging at progressively slower rates with higher-productivity countries across hybrid regimes, flawed democracies, and full democracies (Barro & Sala-i-Martin, 1992).

Conversely, hybrid, flawed, and full democracies all exhibited an accelerating pattern of productivity convergence. For Hybrid Regimes, the results show that unconditional β coefficients strengthening from -0.0675 between 1994 and 2003 to -0.0864 between 2004 and 2013, and further to -0.1751 between 2014 and 2023. The conditional β coefficients followed a similar trajectory, increasing from -0.0855 to -0.0986 and finally to -0.1865, respectively. Flawed Democracies demonstrated comparable acceleration. The unconditional β coefficient intensified from -0.0895 to -0.1500 and to -0.1662 across the successive periods. Concurrently, the conditional β coefficients increased progressively from -0.1606 to -0.1706 and to -0.1931. In full democracies, the unconditional β strengthened from -0.0799 to -0.1803 and to -0.1820. The conditional β coefficients also followed a similar progressive trajectory, advancing from -0.1220 to -0.1462 and to -0.1773.

The deterioration of labour productivity β-convergence in authoritarian regimes could be explained by several structural factors. These include the misallocation of resources, a lack of innovation, weak institutions (Caraway et al., 2015), limited civil liberties, and constraints on the functioning of trade unions (Shareef & Kiani, 2020).

This finding is consistent with the argument from Magee & Doces (2015) that authoritarian governments have an incentive to manipulate growth statistics and exaggerate economic performance. This suggests that any alleged economic benefits of authoritarianism may prove to be mirages. Consequently, policies based on fictitious growth numbers can lead to misplaced strategies for labour productivity development. Khan et al. (2016) found similar results, showing that authoritarian governance usually impedes both productivity and economic growth.

Furthermore, autocratic systems tend to invest less in critical social services such as education, healthcare, and infrastructure for safe drinking water and sanitation. As a result, a transition from authoritarian regimes to hybrid and democratic systems would likely be beneficial for both human capital development and for more rapid labour productivity convergence between countries (Sharma, 2007).

Authoritarian regimes value means of control and stability over economic change, which, over time, even more, negatively impacts labour productivity growth. Acemoglu & Robinson (2005) note how such political institutions curtail economic freedoms and entrepreneurial growth, reducing market contestability and increased ineffective firm tenure, thus lowering overall productivity growth.

Moreover, ineffective political institutions complicate human capital investment and technology development, which is critical for labour productivity growth (Rodrik, 2000), which makes decreases in productivity worse. This also applies for exploitative economic systems. These models disproportionately reward elite minorities while neglecting broader social welfare and overall well-being. Such patterns often lead to suboptimal capital allocation in key sectors that enhance productivity, like education, infrastructure, or research and development (Acemoglu et al., 2001). Economies in such politically unstable and opaquely governed regimes can also eschew frustrated foreign investment, a critical powerful source of productivity improvements (Barro, 1996). These political systems have seen declining labour productivity convergence due to the cumulative effect of systemic inefficiencies and inadequate adaptation to global technological advancements.

Specifically, this study estimates year-fixed effect models and uses the Arellano and Bond GMM dynamic panel estimator to estimate convergence with additional control variables. Referring to the analysis of temporal stability of empirical model estimates on β, the authors of the econometric statistics state the β coefficients in authoritarian regimes carries the highest magnitude across all regime segments (1994-2003 conditional model with controls: -0.2103; dynamic model with controls: -0.4863); they proceed to provide the summary for subsequent periods, 2004-2013 findings distinguish -0.1839 and -0.3973, whereas 2014-2023 yields -0.0936 and -0.3290 respectively. Econometric estimates indicated that the coefficients for $Growth_{t-1}$ (-0.1616 and -0.2706) were significant at the 0.10 level, capturing the notion that periods of strong productivity growth are followed by episodes of weaker growth. The coefficients of GFC, LIF, TRA, and PSI are significant at the 0.10, 0.05, and 0.01 levels, and they are essential to validate their influence on labour productivity convergence in authoritarian regimes. While the positive significance of LIF on labour productivity convergence persists during 1994-2003 and 2004-2013, the negative significance during 2014-2023 indicates that higher life expectancy corresponds to a decline in labour productivity convergence (Bloom et al., 2010). This phenomenon is due to fertility rates that are declining, resulting in labour force contraction (Daniele et al., 2019; Turan, 2020).

The following findings will validate the hypotheses for hybrid regimes with the following findings. The hybrid regimes exhibit β coefficients for the conditional model with controls of -0.1796, -0.1306, -0.2489 for the three temporally successive windows and -0.2983, -0.3572, and -0.5188 for the dynamic model with controls. The $Growth_{t-1}$ β coefficients of -0.3709 and -0.2109 are significant, that substantiate the argument for declining productivity trajectories after extended periods of strong growth. Moreover, the β coefficients for GFC, LIF, FDI, TRA and PSI are significant 0.10, 0.05 and 0.01 levels indicate that they each have a contributively nature to labour productivity convergence in hybrid regimes. However, FDI is significant with a negative contribution to labour productivity convergence in hybrid regimes due to conditions which work against indigenous firms regardless of attracting FDI to promote production (Görg & Greenaway, 2004). The negative contribution of FDI to labour productivity convergence in hybrid regimes is framed within the context of what it's like to operate in hybrid regimes at times that send negative signals to foreign governments about their governance (Le Billon, 2005; Lujala, 2010; Stølan, 2012). This constitutes ineffective governmental action, corruption or political strife. Furthermore, FDI is heavily concentrated in less capital-intensive industries which may freeze wage growth and innovation in hybrid regime host nations which causes lower productivity growth over time (Saha, 2024).

The analysis for both flawed and full democracies provide a clear story of convergence. In the conditional models, it is demonstrated consistently negative coefficients across all time periods, generally hovering in the -0.15 to -0.20 range. However, the dynamic models showed a much more powerful convergence effect. The coefficients were significantly stronger, often falling in the -0.40 to -0.59 range, which confirms a more rapid catch-up in productivity. $Growth_{t-1}$ coefficients (-0.2146 and -0.3837) are significant at the 0.05 and 0.01 levels, confirming productivity deceleration following high-growth episodes. The coefficients for gross fixed capital (GFC), life expectancy (LIF), foreign direct investment (FDI), trade openness (TRA), and political stability index (PSI) demonstrate significance at the 0.10, 0.05, and 0.01 levels, indicating their influence on labour productivity convergence in both regime types. While GFC generally exhibited positive effects on labour productivity convergence across political regimes, full democracies demonstrated a statistically significant negative impact at the 0.01 level during 2014-2023. Kumar & Russell (2002) imply this finding demonstrates that capital deepening does not automatically promote labour productivity convergence, with technological advancement now emerged as a factor of greater convergence concern. Mere capital deepening without improvements in technology may not lead to convergence in labour productivity and even has the potential to eventually decelerate the convergence (Rodrik, 2013).

In 1994-2003, in full democracies, PSI had a statistically significant negative impact on convergence of labour productivity at 0.10 level (thus, higher political stability in this period was associated with slower convergence) (Aisen & Veiga, 2013). During 2004-2013 (2007-2013) and 2014-2023 (2018-2023), however, PSI had a positive yet not statistically significant effect. The positive effects were statistically significant across all time periods examined by PSI, confirming that political stability is generally conducive to convergence in labour productivity across regimes over time, consistent with findings for other political regimes. Aligning with findings by Alexandre et al. (2022), this study demonstrates that political stability positively influences labour productivity development through two primary mechanisms: within-sector dynamics and structural change components. Political stability creates a predictable environment, which helps businesses run effectively. It reduces the uncertainty that might otherwise stop them from investing in new technologies (Graafland, 2023). This stability also aids the economy put its resources to better use in two ways. There are (1) within industries, firms feel more secure, so they can improve productivity by innovating their technology and management and (2) across industries, it becomes easier for workers and money to move from less productive sectors to more productive ones (Shahzad & Azam, 2023).

Table 6. Unconditional and conditional convergence of labour productivity by political regime

Variables	Unconditional Model	Conditional Model	Conditional Model with Controls	Conditional Dynamic Model with	Unconditional Model	Conditional Model	Conditional Model with Controls	Conditional Dynamic Model with
	Authoritarian Regime				Hybrid Regime			
	1994-2003				1994-2003			
$lnLP_{i, t-1}$	-0.2212*** (0.0335)	-0.2649*** (0.0348)	-0.2103*** (0.0589)	-0.4863*** (0.0864)	-0.0675*** (0.0280)	-0.0855*** (0.0302)	-0.1796** (0.0758)	-0.2983*** (0.1107)
GFC			0.0009 (0.0005)	0.0004 (0.0008)			0.0013*** (0.0004)	0.0028*** (0.0010)
LIF			0.0080*** (0.0033)	0.0133*** (0.0032)			0.0027 (0.0027)	0.0055 (0.0058)
FDI			-0.0000 (0.0006)	-0.0006 (0.0008)			0.0005 (0.0006)	0.0001 (0.0010)
TRA			0.0005* (0.0003)	0.0006* (0.0003)			0.0002 (0.0003)	0.0012*** (0.0005)

Variables	Unconditional Model	Conditional Model	Conditional Model with Controls	Conditional Dynamic Model with	Unconditional Model	Conditional Model	Conditional Model with Controls	Conditional Dynamic Model with
PSI			0.0254 (0.0207)	0.0364 (0.0321)			0.0271** (0.0111)	-0.0022 (0.1489)
Growth $_{t-1}$				0.0393 (0.1146)				-0.3709*** (0.0649)
Constant	1.8866*** (0.2843)	2.1946*** (0.2947)	1.2806*** (0.4963)	3.3174*** (0.7463)	0.5817*** (0.2370)	0.7178*** (0.2548)	1.3403** (0.6427)	2.0567** (0.8863)
	2004-2013				2004-2013			
$lnLP_{i, t-1}$	-0.1493*** (0.0198)	-0.1808*** (0.0244)	-0.1839*** (0.0483)	-0.3973*** (0.0669)	-0.0864*** (0.7671)	-0.0986*** (0.0263)	-0.1306*** (0.0423)	-0.3572*** (0.0857)
GFC			0.0004 (0.0009)	0.0002 (0.0011)			0.0002 (0.0006)	-0.0004 (0.0006)
LIF			0.0074** (0.0031)	0.0085*** (0.0033)			0.0073 (0.0053)	0.0094** (0.0048)
FDI			-0.0003 (0.0009)	0.0006 (0.0008)			-0.0002 (0.0008)	-0.0014* (0.0008)
TRA			0.0003 (0.0003)	-0.0003 (0.0005)			0.0007 (0.0005)	0.0019*** (0.0005)
PSI			0.0155** (0.0080)	0.0356*** (0.0122)			0.0226* (0.0122)	0.0346 (0.0215)
Growth $_{t-1}$				-0.1616* (0.0871)				-0.1147 (0.1026)
Constant	1.3204*** (.01719)	1.5870*** (0.2089)	1.1364*** (0.3584)	2.9783*** (0.5485)	0.7671*** (0.1870)	0.8700*** (0.2238)	0.6258 (0.5193)	2.3596*** (0.6227)
	2014-2023				2014-2023			
$lnLP_{i, t-1}$	-0.0953*** (0.1974)	-0.0847*** (0.0204)	-0.0936*** (0.0380)	-0.3290*** (0.0675)	-0.1751*** (0.0332)	-0.1865*** (0.0370)	-0.2489*** (0.0663)	-0.5188*** (0.1090)
GFC			0.0007* (0.0004)	0.0000 (0.0003)			0.0022 (0.0014)	0.0011 (0.0022)
LIF			-0.0010* (0.0005)	-0.0002 (0.0001)			-0.0023 (0.0030)	0.0013 (0.0042)
FDI			-0.0002 (0.0004)	0.0001 (0.0007)			-0.0009 (0.0007)	-0.0005 (0.0009)
TRA			-0.0002 (0.0001)	0.0001 (0.0001)			0.0011** (0.0005)	0.0018*** (0.0006)
PSI			0.0141* (0.0078)	0.1826* (0.0106)			0.0039 (0.0151)	0.0031 (00133)
Growth $_{t-1}$				-0.2706** (0.1188)				-0.2109** (0.1118)
Constant	0.8514*** (0.1747)	0.7620*** (0.1796)	0.9137*** (0.3365)	2.9364*** (0.6018)	1.5525*** (0.2918)	1.6508*** (0.3232)	2.2108*** (0.5583)	4.3280*** (0.9273)
Year-fixed effect		yes	yes			yes	yes	
Countries	41	41	41	41	27	27	27	27
	Flawed Democracy				Full Democracy			
	1994-2003				1994-2003			
$lnLP_{i, t-1}$	-0.0895***	-0.1606***	-0.1971***	-0.3817***	-0.0799***	-0.1220***	-0.1809***	-0.3168***

Variables	Unconditional Model	Conditional Model	Conditional Model with Controls	Conditional Dynamic Model with	Unconditional Model	Conditional Model	Conditional Model with Controls	Conditional Dynamic Model with
	(0.0205)	(0.0277)	(0.0404)	(0.0824)	(0.0174)	(0.0322)	(0.0640)	(0.0917)
GFC			0.0018*** (0.0005)	0.0032*** (0.0011)			-0.0001 (0.0012)	-0.0003 (0.0012)
LIF			0.0051** (0.0023)	0.0309*** (0.0097)			0.0100 (0.0076)	0.0107 (0.0108)
FDI			0.0003 (0.0005)	0.0002 (0.0006)			0.0005 (0.0003)	0.0012*** (0.0004)
TRA			8.88e-06 (0.0003)	0.0002 (0.0006)			0.0002 (0.0003)	0.0005 (0.0004)
PSI			0.0204 (0.0098)	0.0061 (0.0113)			-0.0125 (0.0125)	-0.0201* (0.0117)
Growth $_{t-1}$				-0.2145*** (0.0728)				-0.1295 (0.0989)
Constant	0.8874*** (0.1973)	1.5492*** (0.2639)	1.5197*** (0.3251)	1.4343*** (0.4702)	0.8990*** (0.1913)	1.3585*** (0.3522)	1.2406 **(0.5252)	2.6706*** (0.3833)
	2004-2013				2004-2013			
$lnLP_{i, t-1}$	-0.1500*** (0.0198)	-0.1706*** (0.0296)	-0.1873*** (0.0537)	-0.4961*** (0.0796)	-0.1803*** (0.0300)	-0.1462*** (0.0374)	-0.1541*** (0.0411)	-0.5873*** (0.1473)
GFC			0.0013 (0.0009)	0.0010 (0.0016)			0.0006 (0.0008)	0.0016 (0.0015)
LIF			-0.0005 (0.0024)	0.0165*** (0.0055)			0.0013 (0.0077)	0.0116 (0.0078)
FDI			5.07e-06 (0.0000)	0.0001** (0.0001)			0.0003** (0.0001)	0.0001 (0.0004)
TRA			-0.0002 (0.0001)	0.0007*** (0.0002)			-0.0001 (0.0003)	0.0014** (0.0006)
PSI			0.0036 (0.0106)	0.0402* (0.0215)			0.0017 (0.0114)	0.0116 (0.0184)
Growth $_{t-1}$				-0.2814*** (0.0369)				-0.2146** (0.0932)
Constant	1.5104*** (0.1962)	1.7076*** (0.2889)	1.8936*** (0.5839)	3.6334*** (0.7690)	2.0266*** (0.3353)	1.6542 *** (0.4156)	1.6288*** (0.6282)	5.4960*** (1.5526)
	2014-2023				2014-2023			
$lnLP_{i, t-1}$	-0.1662*** (0.0258)	-0.1913*** (0.0302)	-0.2045*** (0.0408)	-0.4538*** (0.0604)	-0.1820*** (0.0331)	-0.1773*** (0.0326)	-0.1974*** (0.0295)	-0.4883*** (0.0867)
GFC			0.0005 (0.0006)	-0.0008 (0.0006)			-0.0014 (0.0008)	-0.0052*** (0.0008)
LIF			-0.0007 (0.0024)	-0.0051** (0.0024)			0.0054** (0.0025)	-6.73e-06 (0.0001)
FDI			-0.0000 (0.0000)	0.0002** (0.0001)			0.0000 (0.0002)	-0.0003 (0.0003)
TRA			-0.0001 (0.0002)	0.0009*** (0.0003)			-0.0010 (0.0005)	0.0027*** (0.0004)
PSI			0.0184* (0.0105)	0.0393** (0.0196)			0.0126 (0.0117)	0.0368 (0.0233)
Growth $_{t-1}$				-0.2719***				-0.3837***

Variables	Unconditional Model	Conditional Model	Conditional Model with Controls	Conditional Dynamic Model with	Unconditional Model	Conditional Model	Conditional Model with Controls	Conditional Dynamic Model with
				(0.0510)				(0.0647)
Constant	1.6904*** (0.2602)	1.9327** (0.3023)	2.1178** (0.3813)	4.8903*** (0.5409)	2.0612*** (0.3727)	2.0012 ***(0.3664)	1.7598*** (0.3807)	5.3758*** (0.9821)
Year-fixed effect		yes	yes			yes	yes	
Countries	39	39	39	39	22	22	22	22

Note: Standard errors are in parenthesis, *p < 0.1 **p < 0.05 ***p < 0.01. The unconditional, conditional, conditional models with controls are fixed effect models; the conditional dynamic panel model with controls is estimated by the Arellano and Bond GMM estimator.

To scrutinize the robustness of the convergence results in Table 6, the models are re-estimated using the System GMM estimator to mitigate potential endogeneity between political regimes and labour productivity growth. The post-estimation diagnostic are satisfactory; the tests AR(1) and AR(2) reveal the expected behaviour, and the Hansen test supports the validity of the instrument set. Whereas, certain specifications yield Sargen test statistics that reject the null hypothesis (Table 7), this discrepancy is well-documented in applied System GMM literature. Specifically, the Sargan test is prone to over-rejecting the validity of overidentifying restrictions in the presence of instrument proliferation or heteroskedasticity (Roodman, 2009; Bun & Windmeijer, 2010). Similar inconsistencies between Hansen and Sargan statistics have been documented in empirical applications, where the Sargan test rejects instrument validity despite acceptable Hansen results (Liu et al., 2017; Bazzi & Clemens, 2013).

The System GMM estimates continue to indicate β-convergence across political regimes, although the magnitude of the convergence coefficients is smaller than those reported in Table 6. This suggests that the baseline estimations may have overstated the speed of convergence. Authoritarian regimes show statistically significant, convergent trends, albeit slower, whereas hybrid regimes, mixed democracies, and full democracies to a lesser extent, less reliable and even statistically insignificant after adjusting for endogeneity. In addition, the System GMM specifications also adjust the estimated political stability, FDI and life expectancy impact downward as the scholars already know the relative impact of the variables. This is consistent with the robustly tested GMM estimator that findings for this estimator adjusted coefficient size for dynamic panel bias and endogeneity are smaller (Arellano & Bond, 1991; Blundell & Bond, 1998). In conclusion, although not all specifications are up to the gold standard of diagnostics, the findings from the System GMM specification indicate that labour productivity continues to converge, albeit at a slower pace, with authoritarian regimes exhibiting the most definitive patterns of convergence after adjusting for endogeneity.

Table 7: Robustness check using system GMM across political regimes

Variable	Authoritarian regime			Hybrid regime		
	1994-2003	2004-2013	2014-2023	1994-2003	2004-2013	2014-2023
$lnLP_{i, t-1}$	-0.0197** (0.0073)	-0.0130*** (0.0039)	-0.0124** (0.0059)	-0.0293 (0.0188)	-0.0031 (0.0176)	0.0065 (.0106)
GFC	0.0010 (0.0006)	-0.0001 (0.0006)	0.0006 (0.0005)	0.0003 (0.0004)	0.0010 (0.0007)	0.0008 (0.0005)
LIF	0.0015* (0.0008)	0.0014* (0.0007)	0.0001 (0.0001)	0.0021 (0.0017)	-0.0001 (0.0016)	-0.0016 (0.0016)
FDI	0.0008* (0.0004)	0.0012 (0.0011)	-0.0004 (0.0007)	0.0001 (0.0015)	0.0003 (0.0010)	-0.0008 (0.0012)
TRA	0.0001	--0.0002	-0.0000	0.0002	0.0000	0.0002

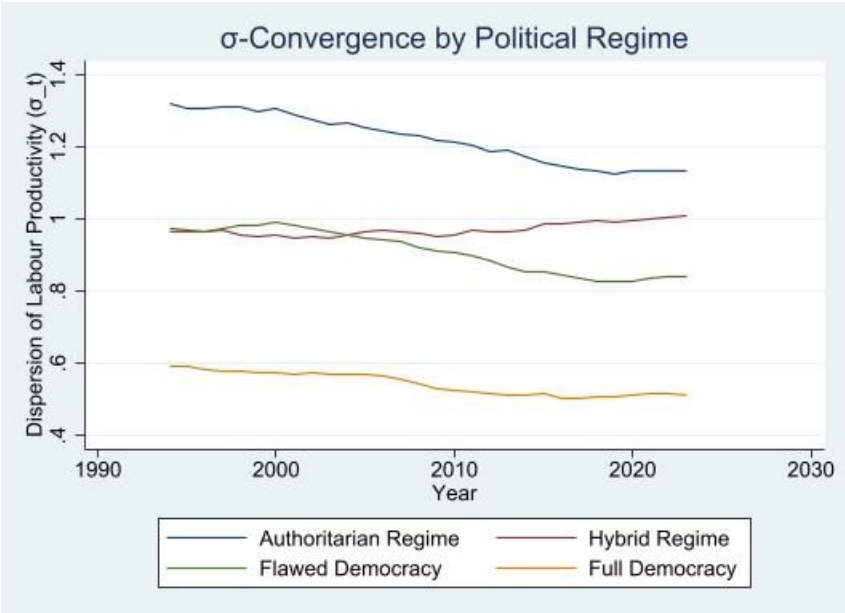
Variable	Authoritarian regime			Hybrid regime		
	1994-2003	2004-2013	2014-2023	1994-2003	2004-2013	2014-2023
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0002)
PSI	0.1859** (0.0084)	0.0038 (0.0026)	0.0153* (0.0079)	-0.0007 (0.0100)	0.0032 (0.0102)	-0.0076 (0.0114)
$Growth_{t-1}$	-0.2776 (0.3223)	0.5738** (0.2392)	-0.4356 (0.4366)	-0.1402 (0.3731)	-0.0311 (0.1670)	-0.2633 (0.1966)
Constant	0.0756** (0.0322)	0.0476 (0.0289)	0.1208** (0.5578)	0.1068 (0.0763)	0.0299 (0.2430)	0.0261 (0.0694)
AR (1)	0.8370	0.0050	0.6790	0.2110	0.1670	0.3440
AR (2)	0.4760	0.8470	0.340	0.7290	0.2430	0.2850
Hansen p- value	0.1960	0.1900	0.0680	0.0200	0.1590	0.0680
Sargan	0.0220	0.0630	0.0000	0.0660	0.0000	0.0000
lnLPi, t-1	-0.1082 (0.0040)	-0.0138 (0.0065)	-0.0049 (0.0062)	0.0003 (0.0062)	-0.0156** (0.0070)	-0.0141 (0.0090)
GFC	0.0009** (0.0006)	0.0014** (0.0010)	0.0013* (0.0007)	0.0016 (0.0008)	0.0009 (0.0006)	-0.0001 (0.0007)
LIF	0.0010 (0.0004)	0.0003 (0.0010)	0.0003 (0.0009)	-0.0042* (0.0020)	0.0001 (0.0015)	0.0000 (0.0001)
FDI	-0.0001** (0.0004)	-1.15e-06 (0.0000)	0.0001* (0.0001)	0.0007* (0.0005)	0.0002 (0.0002)	0.0009 (0.0007)
TRA	-0.0001 (0.0001)	-0.0000 (0.0000)	0.0001 (0.0001)	-0.0001 (0.0001)	0.0000 (0.0001)	0.0003** (0.0001)
PSI	0.0078 (0.0051)	0.0030 (0.0045)	-0.0023 (0.0092)	0.0062 (0.0117)	0.0018 (0.0048)	0.0123 (0.0103)
$Growth_{t-1}$	0.2151 (0.2496)	-0.1528 (0.1538)	-0.5126*** (0.0888)	-0.1583 (0.2198)	-0.1033 (0.1359)	-0.4232*** (0.1219)
Constant	0.0338 (0.0317)	0.1098** (0.0510)	0.0144 (0.0576)	0.3053** (0.1243)	0.1506* (0.0733)	0.1345 (0.0960)
AR (1)	0.0320	0.0320	0.0210	0.1540	0.0570	0.0650
AR (2)	0.8040	0.3800	0.0060	0.0800	0.0270	0.0100
Hansen p- value	0.0910	0.0010	0.0010	0.0460	0.0310	0.0320
Sargan	0.0150	0.0000	0.0000	0.0110	0.0000	0.0000

Note: Standard errors in parentheses. *p <0.10, **p <0.05, ***p < 0.01. AR(1) and AR(2) are Arellano–Bond tests for serial correlation. Hansen and Sargan are tests of overidentifying restrictions; Hansen statistics are generally acceptable, while some Sargan results indicate instrument-related limitations in certain specifications.

Figure 2 and Table 8 present the evolution of labour productivity dispersion (σ_t) across political regimes during 1994–2023. The graphical evidence shows a clear decline in labour productivity dispersion within authoritarian regimes, flawed democracies, and full democracies throughout the study period. This downward trend indicates that labour productivity differentials across countries within these political systems have narrowed over time, suggesting the presence of σ-convergence. This complements the earlier β-convergence results, which revealed that less productive countries within these regime groups have experienced faster productivity growth. Hence, these findings collectively imply true convergence, where both growth dynamics and productivity levels become increasingly aligned.

The regression results provide strong support for the observed trends. The estimated time coefficients for authoritarian regimes (–0.00768), flawed democracies (–0.00638), and full democracies (–0.00338) are negative, confirming that labour productivity dispersion has decreased over time in these three regime groups. Among this group, authoritarian regimes experience the quickest convergence, and flawed democracies are the second fastest. The slowest, yet consistently steady, are full democracies. Thus, it would appear that democratic governance helps with productivity gains, but it's the productive institutions, not the type of regime, that allows for levels of convergence. (Rodríguez-Pose & Ganau, 2022). In contrast, hybrid regimes exhibit a positive coefficient (0.00157), indicating that productivity dispersion has increased over the period. This finding reflects σ-divergence, implying that productivity gaps among hybrid regime countries have widened rather than diminished. Although β-convergence is observed in hybrid regimes, the absence of σ-convergence suggests that faster productivity growth in lower-productivity countries has not been sufficient to reduce cross-country disparities. This highlights the presence of persistent structural and institutional inequalities that undermine the equalisation of productivity levels (Alexandre et al., 2022).

Figure 2: σ-convergence of labour productivity across political regimes, 1994–2023



Overall, these results lend credence to the argument that political institutions influence trajectories of productivity inequality. Authoritarian, flawed democratic, and full democratic regimes show signs of convergent productivity growth, while hybrid regimes remain characterised by widening productivity inequalities, which means that the institutional weaknesses still prevail and prevent convergent productivity growth. (Kpognon & Bah, 2019).

Table 8. Estimated trend of labour productivity σ-convergence across political regimes, 1994-2023

Political Regime	Coefficient on Time (t)	Std. Error	t-Statistic	R^2	Convergence Direction
Authoritarian Regime	–0.00768***	0.00025	–31.29	0.9722	Convergence
Hybrid Regime	0.00157***	0.00024	6.54	0.6044	Divergence
Flawed Democracy	–0.00638***	0.00040	–16.09	0.9024	Convergence
Full Democracy	–0.00338***	0.00023	–14.81	0.8868	Convergence

Note: *** p < 0.01. Dependent variable: σ_t (standard deviation of log labour productivity). Negative coefficient indicates σ-convergence; positive coefficient indicates σ-divergence.

Conclusions

This research has estimated and established multiple econometric specifications unconditional, conditional, conditional with controls, and dynamic conditional models to analyse labour productivity β-convergence across 129 countries. The analysis classifies political regimes into authoritarian, hybrid, flawed democracies, and full democracies across three distinct time periods, employing fixed-effects models and GMM dynamic panel estimators.

The empirical results provide strong evidence in favour of β-convergence across all political regime types, despite significant differences in economic structure across countries, with σ-convergence results likewise indicating a gradual decline in productivity dispersion over time. The model specification was extended, covering some other essential control variables of the form: gross fixed capital formation (GFC), life expectancy (LIF), foreign direct investment (FDI), trade openness (TRA) and political stability index (PSI). Political stability emerges as a strong driver of labour productivity convergence: the higher the political stability registered in each regime type, the faster the convergence achieved. Interestingly, in the 1994–2003-decade, full democracies had a negative statistically significant relationship between political stability and convergence, whereas for subsequent time periods, the effects were positive, albeit not statistically significant. The political regime GFC has overall positive effects on labour productivity convergence across political regimes, except within full democracies, where the effect is significantly negative during 2014-2023. This result implies that capital deepening is not always conducive to labour productivity convergence, and technological progress is a more effective force for convergence. In the absence of technological catch-up, labour productivity convergence can stagnate or slow over time.

Increased life expectancy, improved health, and better material living conditions, which in turn enhance the workforce's efficiency. As life spans extend and good health is maintained over longer periods, workers can remain more efficient, thereby promoting convergence in labour productivity. Nevertheless, autocratic regimes as well as flawed democracies exhibited a considerably negative association between life expectancy and convergence 2014-2023 because prolonged life expectancy may eventually impede labour productivity convergence through declining fertility rates and a shrinking working-age population. FDI and trade openness are the key factors behind the speedup of labour productivity convergence. FDI brings not just capital, but also technology, managerial skills and access to international markets. These effects raise labour productivity by improving the skills of workers, adopting technologies and increasing the level of production efficiency, hence encouraging convergence across political regimes.

However, hybrid regimes appeared during 2004-2013, with the adverse effect of FDI on labour productivity convergence based on competitive market asymmetries, which put domestic companies at a disadvantage. Under this regime type, countries often experience from governance failures, corruption and political instability. Secondly, since FDI concentration in labour-intensive sectors can dampen increases in wages as well as technological development in hybrid regime countries, this may contribute to a decline in the degree of convergence in labour productivity over time. Trade openness facilitates the convergence of labour productivity through increased competition, greater access to markets and technology transmission. International market exposure encourages domestic firms to innovate and improve their production process, leading to convergence in labour productivity levels among various political structures.

Credit Authorship Contribution Statement

Sawangloke, W. contributed to the conceptualization of the study, methodology design, formal analysis, and interpretation of results. Wiyo, A and Luksamee-Arunothai, M. were responsible for data curation, investigation, and validation of the empirical analysis. Chanthes, S. and Senbut, P. contributed to the literature review, visualization of results, and writing of the original draft. Thancharoen, N. and Nuttee, S. participated in the review and editing of the manuscript, supervised the research process, and supported project administration. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Conflict of Interest Statement

The authors declare that there is no potential conflict of interest in conducting and completing the research.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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