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Hassan Daliri\*

## WHY DO SOME COUNTRIES LAG BEHIND? THE ROLE OF GOVERNANCE QUALITY IN ACCELERATING ECONOMIC CATCH-UP

**ABSTRACT:** *This study investigates the role of governance quality in accelerating economic catch-up with advanced economies, using a panel dataset of 145 countries (51 countries in the lower-middle-income group and 94 countries in the higher-middle-income group) over the period 2002–2022. A novel catch-up index is constructed, capturing the relative income dynamics of each country vis-à-vis the G7 benchmark. The analysis is conducted separately for lower-middle-income and higher-middle-income country groups using a panel ARDL model with pooled mean group estimators.*

*The results demonstrate a robust and significant long-run effect of governance on economic convergence, particularly for lower-middle-income countries, where a 1% improvement in the governance index is associated with an approximate 0.1071% increase in the convergence index. In contrast, the effect is positive but notably weaker (0.0201%) in higher-middle-income countries, indicating diminishing returns to governance reforms in more institutionally developed settings. Importantly, we also find statistically significant short-run effects of gov-*

*ernance for lower-middle-income economies, suggesting that governance reforms can yield not only long-term but also immediate gains in economic catch-up. In contrast, short-run effects remain insignificant for higher-middle-income economies, where convergence appears to rely more heavily on innovation, education, and technology upgrading. Moreover, the estimated speed of adjustment towards the long-run equilibrium is approximately 1.4 times higher in lower-middle-income economies than in higher-middle-income economies, indicating a faster return to equilibrium in the former.*

*Overall, the findings confirm that governance quality is a critical and catalytic driver of long-term convergence, especially where institutional gaps remain wide. The study highlights the importance of incorporating governance reform into development strategies and provides new empirical evidence on the asymmetric impact of institutions across income levels.*

**KEY WORDS:** *good governance, economic catch-up, panel ARDL, governance.*

**JEL CLASSIFICATION:** O11, O43, D73, H11, P16

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## **1. INTRODUCTION**

Good governance encompasses a set of institutions and practices that foster transparency, accountability, regulatory quality, and effective rule of law, establishing a framework that enables sustainable economic growth. Economic theory suggests that while traditional factors such as capital accumulation and technological progress are pivotal, the quality of governance can substantially enhance or inhibit these processes, particularly in economies aiming to catch up with more developed nations. Empirical evidence underscores that robust governance structures mitigate risks, promote efficient resource allocation, and attract both foreign and domestic investment, all of which are essential to accelerating economic growth.

Economic convergence, often referred to as "catch-up" growth, is a process where less-developed economies grow at a faster pace than more advanced ones, gradually narrowing the income and productivity gaps (Abramovitz, 1986). This concept lies at the heart of growth theory and has spurred extensive research into the factors that enable countries to move closer to the global productivity frontier. The convergence hypothesis, initially formulated within the framework of the neoclassical growth model (Solow, 1956), posits that poorer economies tend to grow faster than wealthier ones due to diminishing returns on capital. As these economies gain access to advanced technologies, capital, and best practices from developed nations, they are theoretically positioned to accelerate their growth. However, empirical studies highlight that convergence is not automatic; institutional quality, governance structures, and various socio-political factors significantly influence a country's ability to catch up (Rodrik et al., 2004). Abramovitz (1986) explores why some countries have successfully "caught up" to economic leaders while others lag. He argues that catching up largely depends on a country's "social capability", a concept that includes the institutions, education systems, and technological adaptability necessary for economic growth.

Institutions and governance play a pivotal role in fostering an environment conducive to sustained growth and economic catch-up. Good governance, characterised by effective legal frameworks, property rights protection, corruption control, and regulatory quality, provides the necessary stability for investment and economic activity (North, 1990). North argues that institutions reduce transaction costs and shape incentives, thereby enabling or constraining

economic growth. Institutional change, driven by evolving economic and political demands, is essential for sustained development, as it allows societies to adapt to new challenges. North's analysis underscores the critical role of high-quality institutions in achieving economic development, positing that differences in institutional quality are a primary reason for disparities in economic performance across nations (North, 1990).

Research shows that poorer countries tend to grow faster than wealthier ones, but this trend, known as conditional convergence, heavily depends on factors such as institutional quality, human capital, and governance structures. For instance, Barro (1991) found that conditional convergence only holds when countries share similar savings rates, population growth, and levels of human capital. This aligns with the observation that governance factors such as rule of law and control of corruption play a critical role in facilitating convergence for countries at different development stages (Barro & Sala-i-Martin, 1992). Barro and Sala-i-Martin's study demonstrates that poorer economies tend to grow faster than wealthier ones, reducing income disparities over time. They examine beta convergence, which is the faster growth of low-income economies relative to high-income ones, conditioned on factors such as savings, population growth, and human capital. Additionally, they analyse sigma convergence, which assesses whether income dispersion across economies decreases over time. Their findings support conditional convergence, suggesting that income levels converge only when structural differences are considered. This research has been pivotal in growth economics, emphasising the role of economic policies and institutions in facilitating or hindering convergence.

Studies show that well-functioning institutions not only reduce transaction costs but also increase incentives for productive investment, which is essential for economic catch-up (Acemoglu et al., 2001)<sup>1</sup>. Good governance and institutions

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<sup>1</sup> The central idea of Acemoglu et al., (2001) is that differences in economic development across countries are rooted in the types of institutions established during the colonial period. The authors argue that European colonisers implemented different institutional frameworks depending on local conditions, particularly settler mortality rates. In areas with high settler mortality, extractive institutions were established, focusing on resource extraction with little regard for local development. In contrast, in regions with lower settler mortality, Europeans settled and established inclusive institutions, promoting property rights, legal protections, and economic incentives. These early institutional choices had long-lasting effects, with inclusive institutions fostering development and extractive institutions hindering it.

are fundamentally interconnected, as robust institutions provide the foundation upon which effective governance can operate. Institutions create the environment within which governance functions. Good governance relies on the presence of high-quality institutions that promote transparency, accountability, and rule of law, which in turn enable efficient public administration, safeguard property rights, and foster trust within society. This institutional framework ensures that governance processes are inclusive, responsive, and equitable, thereby supporting sustainable development. Conversely, weak or extractive institutions can undermine governance by fostering corruption, impeding economic growth, and eroding public trust. Therefore, the quality and structure of institutions are pivotal in determining the effectiveness of governance and the achievement of long-term development goals. Governance indicators, such as control of corruption, political stability, and government effectiveness, are critical to sustaining economic growth. Studies indicate that improved governance structures help countries attract investment, facilitate trade, and promote efficient resource allocation, all of which are essential for convergence. Fayissa and Nsiah (2013) explore the critical role of governance quality in shaping economic outcomes across African nations. They argue that governance including encompassing factors such as political stability, control of corruption, rule of law, and government effectiveness, is a key determinant of economic growth. The authors posit that improvements in governance can significantly enhance economic performance by creating a stable environment that promotes investment, reduces transaction costs, and fosters trust in public institutions. In many higher-middle-income countries, advanced governance indicators such as rule of law and regulatory quality are associated with significant gains in productivity and catch-up. In contrast, lower-middle-income countries often experience barriers to effective governance, such as corruption and weak legal systems, which restrict their ability to capitalise on trade and foreign direct investment (FDI) (Kaufmann et al., 1999). Institutions and governance play a pivotal role in fostering an environment conducive to sustained growth and catch-up.

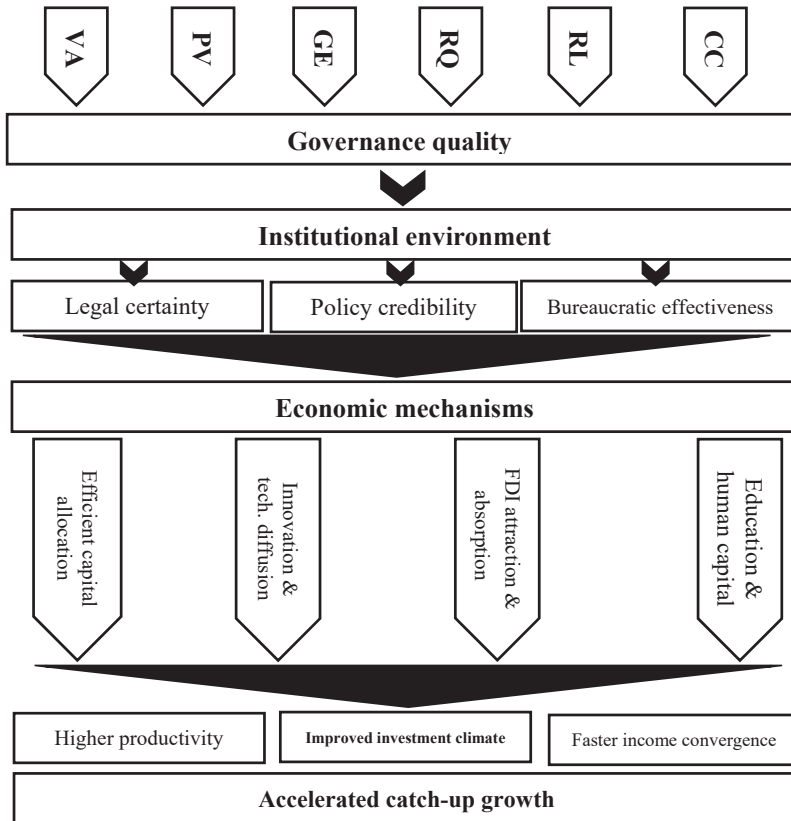
This article explores how specific dimensions of governance and good governance influence the rate and sustainability of economic catch-up, offering insights into the policies that enable less developed countries to bridge the income gap with their advanced counterparts. This article utilises the World Bank's

Governance Index to measure governance quality, which includes the following six subcomponents: Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. While the role of governance in economic development has been extensively studied, existing research has typically focused on its direct association with income levels or growth rates. Unlike previous literature that often examines governance dimensions in isolation, this study addresses the issue of multicollinearity and conceptual overlap by synthesising six core governance indicators into a single, unified measure. It introduces a key methodological advancement by constructing a composite governance index using principal component analysis (PCA). This PCA-based index captures the shared institutional variance while reducing noise and redundancy in estimation, thus enhancing the robustness and parsimony of the empirical model. Moreover, this study offers a novel contribution by linking composite governance quality constructed from the six WGI indicators via PCA to a formal measure of economic catch-up relative to G7 countries. To the best of our knowledge, this is the first empirical work to incorporate a PCA-based governance index into the dynamic modelling of economic convergence using a panel ARDL framework. In addition, the paper contributes to the literature by highlighting the asymmetric effect of governance across different income groups, offering new insights into how institutional quality accelerates or constrains convergence depending on a country's development stage. The methodology therefore contributes both technically and substantively to the empirical growth literature, especially in the context of convergence analysis under institutional asymmetries.

## **2. LITERATURE REVIEW**

The concept of economic catch-up refers to the process by which less-developed countries grow faster than more advanced economies, gradually closing the economic gap between them (Lee, 2014) and depends critically on the quality of institutions and governance. Institutional economics, from the foundational works by North (1991, 1994), through Barro and Sala-i-Martin (1992, 1995), has emphasised the importance of “market-enhancing” governance in enabling efficient resource allocation (Barro & Sala-i-Martin, 1995; North, 1991, 1994). Specific dimensions, such as rule of law, control of corruption, regulatory quality, government effectiveness, voice and accountability, and political stability

collectively shape the environment enabling catch-up (Kaufmann et al., 2010). The relationship between governance and economic convergence has been widely examined, with political institutions increasingly recognised as essential to closing income gaps across countries. In this context, governance quality plays a crucial role in facilitating this convergence process. Institutions shape economic performance by creating stable conditions for investment, reducing corruption, and enhancing regulatory quality. Studies by Acemoglu and Robinson (2012), among others, argue that well-structured political systems can support economic stability, enabling income convergence in regions such as the Eurozone. Conversely, institutional weaknesses, such as low democratic quality or poor governance, can trap countries in low-income states, hindering their ability to converge with wealthier economies (Daliri, 2023). The theoretical foundation for understanding the role of governance in economic convergence lies in the broader framework of institutional economics. North (1990) argues that institutions comprise formal and informal rules that shape economic behaviour and are fundamental in determining a country's economic performance. Strong, effective governance ensures that these institutions function efficiently, thereby fostering economic growth and convergence. Similarly, Acemoglu et al. (2001) emphasise the importance of inclusive institutions that provide secure property rights, enforce contracts, and ensure political stability, which are necessary conditions for economic growth, particularly in developing countries. The channels through which these governance dimensions affect convergence outcomes are multifaceted. Good governance and its indicators can affect economic convergence and catch-up through various mechanisms. Figure 1 illustrates the conceptual framework linking governance quality to economic catch-up, highlighting the key institutional channels that drive this process.

**Figure 1:** Conceptual framework linking governance to economic catch-up

**Note:** VA = Voice and Accountability; PV = Political Stability and Absence of Violence/Terrorism; GE = Government Effectiveness; RQ = Regulatory Quality; RL = Rule of Law; CC = Control of Corruption .

**Source:** Author's own elaboration.

Good governance (e.g., control of corruption, bureaucratic efficiency) reduces distortions and transaction costs (Cumming & Ge, 2022), promoting productive investment decisions. North (1991, 1994) argued that institutions reduce uncertainty in economic exchanges and support contract enforcement, property rights, and credible commitments. With well-functioning legal systems and regulatory frameworks, markets more accurately match resources with productive uses (Hall & Jones, 1999; North, 1991). According to the International Monetary Fund (IMF, 2003), governance metrics (e.g., corruption, bureaucratic

efficiency) are strongly correlated with GDP per capita differences, highlighting institutions' role in shaping resource allocation and enabling convergence. By lowering risk and reducing rent-seeking, institutional quality fosters efficient capital and labour allocation, accelerating growth in economies that are initially lagging behind.

Quality institutions and good governance are indispensable for attracting FDI (Nam & Ryu, 2023; Ross, 2019) and enabling technology transfer (Liu et al, 2022), which are key drivers of convergence. Political stability and the absence of violence are paramount for attracting long-term FDI. Strong rule of law and control of corruption protect foreign investors' assets. Effective governance ensures predictable policies and efficient bureaucracy. FDI brings capital, advanced technology, managerial expertise, and access to global markets, acting as a potent catalyst for catching up. It directly boosts growth in host economies and facilitates knowledge spillovers to domestic firms (Borensztein et al., 1998). Good governance will ensure that property rights are properly respected. Clearly defined and enforced property rights reduce expropriation risk and transaction costs. Effective contract enforcement facilitates complex, impersonal exchanges necessary for specialisation and market expansion. Lower risk encourages domestic investment and savings. Secure long-term investments in physical and human capital become viable, raising the steady-state income level towards which poorer economies converge conditionally. Nguyen et al., (2018) find that institutional quality not only directly fosters growth but also amplifies the positive spillover effects from trade openness and FDI in emerging economies. In low-income countries, efficient, transparent governance allows multinationals to invest with confidence in stable contracts and protects their intellectual property. By ensuring contractual and legal security, these institutions unlock the productivity gains associated with global integration and knowledge diffusion (Nguyen et al., 2018). Economies with stronger rule of law exhibit significantly higher investment-to-GDP ratios (Knack & Keefer, 1995). Rodrik et al. (2004) identified institutions protecting property rights as the most fundamental determinant of long-run growth differences.

Government effectiveness and regulatory credibility build macroeconomic stability (Centinaio et al., 2024; Orlowski, 2025), which encourages domestic investment and entrepreneurship – critical for convergence. Macroeconomic

stability lowers uncertainty, encourages long-term planning and investment, and prevents crises that devastate capital stocks and set back convergence efforts. It is a prerequisite for sustained growth and economic catch-up. Kaufmann & Kraay (2002) show that effective governance fosters predictable policy environments, enabling long-term planning and reducing uncertainty. According to Frye and Shleifer (1997), good governance strengthens the “helping hand” of the state, facilitating rather than appropriating entrepreneurial efforts and leading to sustained per-capita growth. These dynamics reduce discount rates and promote capital deepening, which is vital for catch-up growth (Rodrik, 2004). Effective governance ensures that policies are implemented efficiently, creating an environment conducive to growth. North (1990) and Rodrik (2000) highlight that strong institutions provide the foundation for sound economic policies, such as effective taxation, public spending, and investment in human capital, which are critical for closing the development gap between countries.

Governance affects the public goods and investment environment for human capital formation and innovation (Zhu et al., 2023). According to a study by Zhu et al., (2023), good governance enhances economic freedom, which acts as a key mechanism for promoting innovation. The authors argue that governance that ensures transparency, political stability, and corruption control creates an environment conducive to the free flow of resources and ideas, thereby stimulating innovation. Innovation, as a process of creative destruction, thrives in economies where economic freedom is robust, as it allows for the recombination of factors of production without excessive government interference. This, in turn, contributes to sustainable economic growth and development. The study, conducted over a sample of 112 countries from 2011 to 2021, finds that the positive effects of good governance on innovation are particularly significant in emerging markets and developing economies.

Similarly, Dincer (2019) argues that effective governance, particularly through corruption control, directly impacts innovation by creating an environment where new ideas can flourish. Mungiu-Pippidi (2015) also emphasises the role of governance in innovation, noting that low corruption levels are strongly correlated with higher innovation outputs.

Effective public service delivery ensures quality education and healthcare reach the population. Accountability mechanisms (VA) pressure governments to invest efficiently in human capital. Low corruption ensures resources allocated to education and health are used effectively. Human capital is a key determinant of an economy's steady-state income level and its "absorptive capacity" for technology. Investments in health and education yield high returns, particularly in developing economies, accelerating conditional convergence (Mankiw et al., 1992). Coccia (2020) finds that democratisation and institutional reform enhance investment in research and development (R&D) and adoption of new technologies. Transparent regulation, accountability, and the rule of law reduce barriers for education, skill development, and technology entrepreneurship (Hall & Jones, 1999; Rodrigues et al., 2020; Rodrik, 2004). These effects are especially salient during convergence: early stages rely on absorbing existing technologies, while later phases require innovation to sustain growth and industry upgrading.

Effective institutions support education systems and R&D development. Sound regulatory frameworks foster competitive markets that incentivise innovation and technology diffusion. Political stability provides the long-term horizon necessary for innovation investments. Voice and accountability can pressure governments to invest in enabling infrastructure. Technology transfer and innovation are key drivers of catching up (Abramovitz, 1986). Good governance lowers the costs and risks associated with adopting frontier technologies, allowing lagging economies to grow faster than the frontier (conditional  $\beta$ -convergence). Acemoglu et al. (2006) model how institutions shape technology adoption incentives. Economies with higher government effectiveness and regulatory quality exhibit faster total factor productivity (TFP) growth – a key component of catching up (Easterly & Levine, 2001). Stronger intellectual property rights protection (related to RL) encourages technology transfer (Falvey et al., 2006).

Several studies have investigated the link between governance quality and economic convergence. Barro (1996) provides an important contribution by analysing the relationship between economic growth and governance across countries, highlighting that nations with higher levels of political stability and better governance systems tend to experience faster economic growth and thus accelerate their catch-up with richer countries. Bardhan (2005) further expands on these ideas and argues that while institutions play a crucial role in economic

development, not all institutions are equally effective in promoting growth. He makes the case that the quality and type of institutions are key determinants of economic outcomes. Bardhan critiques the over-simplified notion that economic growth depends solely on formal institutions (such as property rights and legal systems), highlighting that informal institutions (such as trust and social norms) also significantly affect economic performance. He concludes that the relationship between institutions and development is complex and that effective institutions must be adaptable to local realities, focusing on equity and governance as central to sustainable growth. Similarly, Beyene (2022) found that good governance in African countries contributed to faster economic growth, demonstrating the importance of institutional quality in the catch-up process. Empirical evidence supports the claim that good governance accelerates economic convergence. Easterly and Levine (1997) find that countries with better governance quality, particularly in terms of political stability and regulatory quality, experience faster convergence with richer nations. In contrast, nations with weaker governance structures tend to stagnate, failing to catch up with the global frontier. Cavalcanti and Novo (2005) estimate that a 1% improvement in institutional indices raises output per worker by over 5% on average.

In summary, governance is not merely a background condition but a central mechanism shaping the trajectory of economic convergence. High-quality institutions enable countries to absorb capital, technology, and knowledge more effectively, thereby accelerating their progress toward income parity with advanced economies.

### **3. MODEL AND DATA**

As delineated by Figure 1, the core objective of this research is to empirically investigate the impact of governance quality on the level of economic catch-up among countries. To this end, the architecture of the research data will be elucidated by first introducing the economic catch-up index, which serves as the dependent variable. Subsequently, the discourse will turn to the good governance index, outlining its constituent dimensions and explicating the methodological process for constructing this composite metric. Concluding this section, the econometric methodology adopted for model estimation and hypothesis testing will be presented. The empirical model employed in this study to analyse the determinants of catch-up is specified as follows:

$$\ln(\text{catch}_{it}) = \alpha + \beta \ln(\text{inst}Q_{it}) + \gamma X_{it} + \varepsilon_{it} \quad (1)$$

In this specification,  $\ln(\text{catch}_{it})$  is the logarithm of the catch-up index for country  $i$  at time  $t$  (the dependent variable), and  $\ln(\text{inst}Q_{it})$  represents the logarithm of the institutional quality index (the key explanatory variable). The vector of control variables,  $X_{it}$ , comprising  $\ln\text{Trade}$  (trade as a percentage of GDP),  $\ln\text{Capital}$  (gross capital formation as a percentage of GDP), and  $\ln\text{Employ}$  (employment-to-population ratio as a percentage), is the set of independent variables representing the logs of trade, gross capital formation, and employment, respectively. Finally,  $\alpha$  denotes the constant term, and  $\varepsilon_{it}$  is the error term. This specification allows for a rigorous examination of the role institutional quality plays in facilitating or hindering catch-up, while controlling for other relevant economic conditions. Table 1 presents the variables employed in the model along with their respective data sources.

**Table 1:** Data in model

| Variable                                                                                                                                    | Data source                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| Trade (% of GDP); Gross capital formation (% of GDP); Employment-to- population ratio (%)                                                   | World Bank, World Development Indicators (WDI)    |
| Rule of law; Control of corruption; Regulatory quality; Government effectiveness; Political stability no violence; Voice and accountability | World Bank, Worldwide Governance Indicators (WGI) |
| Catch-up index                                                                                                                              | Constructed by the authors                        |

### 3.1 CATCH-UP INDICATOR

To measure economic catch-up, we construct a catch-up index for each country following Kant (2019), with the G7 economies serving as the benchmark. The index is defined as:

$$I_{jt} = \frac{R_{jt}}{R_{j0}},$$

where  $R_{jt} = \frac{y_{jt}}{y_{Bt}}$  is the ratio of GDP per capita of country  $j$  ( $y_{jt}$ ) to that of the benchmark economies ( $y_{Bt}$ ) in year  $t$ , and  $R_{j0}$  is this ratio in the base year. The

benchmark is the G7 group (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States), and the base year is set to 2002. The index is normalised to 1 in the base year; values greater than 1 indicate convergence towards the benchmark, while values below 1 indicate divergence. The analysis covers 145 countries over the period 2002–2022, divided into two income groups following the World Bank classification: lower-middle-income countries (51 countries) and higher-middle-income countries (94 countries).

### **3.2 GOVERNANCE INDICATORS**

In this study, the World Bank's composite Worldwide Governance Indicators (WGI) index is employed to measure the good governance variable. This comprehensive metric is conceptualised to capture the fundamental aspects of a country's institutional quality and the process by which authority is exercised. Conceptually, the WGI defines governance as the traditions and institutions through which governmental power is exercised. Developed by Kaufmann et al. (2010), the WGI provides the most widely used operationalisation of governance quality across six dimensions. These indicators are scored on a scale from –2.5 to +2.5, where higher values indicate stronger governance performance. Each of these indicators reflects distinct dimensions of governance quality:

- Voice and Accountability (VAA): perceptions of citizen participation in selecting government, freedom of expression, association, and media.
- Political Stability and Absence of Violence/Terrorism (PSNV): perceptions of the likelihood of political instability or politically motivated violence.
- Government Effectiveness (GE): perceptions of the quality of public services, civil service, policy formulation and implementation, and government credibility.
- Regulatory Quality (RQ): perceptions of the government's ability to formulate and implement sound policies and regulations fostering private sector development.
- Rule of Law (ROL): perceptions of confidence in and adherence to societal rules, particularly contract enforcement, property rights, police, courts, and likelihood of crime/violence.
- Control of Corruption (COC): perceptions of the extent to which public power is exercised for private gain.

The correlation matrices presented in Tables 2 and 3 reveal a consistently high level of association among governance indicators for both higher-middle-income and lower-middle-income country groups. In the higher-middle-income group (Table 2), the rule of law (lnROL), control of corruption (lnCOC), regulatory quality (lnRQ), and government effectiveness (lnGE) exhibit very strong pairwise correlations – often exceeding 0.90 and all statistically significant at the 1% level. Similarly, although to a slightly lesser extent, a similar pattern is observed in the lower-middle-income group (Table 3), where the correlations remain high, particularly between lnROL and lnGE (0.8077) and between lnCOC and lnGE (0.7493). These strong correlations suggest the likely presence of multicollinearity, making it statistically inappropriate to include all governance indicators simultaneously as independent variables in a single regression model. This concern is further confirmed by variance inflation factor (VIF) tests, which also indicate high multicollinearity. Therefore, to address this issue and avoid model instability, the PCA method will be employed to aggregate these highly correlated governance indicators into composite components, allowing for more robust and parsimonious econometric modelling.

**Table 2:** Correlation matrix of governance indicators for the higher-middle-income group

| Variables | lnROL     | lnCOC     | lnRQ      | lnGE      | lnPSNV    | lnVAA  |
|-----------|-----------|-----------|-----------|-----------|-----------|--------|
| lnROL     | 1.0000    |           |           |           |           |        |
| lnCOC     | 0.9334*** | 1.0000    |           |           |           |        |
| lnRQ      | 0.9095*** | 0.8478*** | 1.0000    |           |           |        |
| lnGE      | 0.9443*** | 0.9182*** | 0.9144*** | 1.0000    |           |        |
| lnPSNV    | 0.7577*** | 0.7388*** | 0.6449*** | 0.6934*** | 1.0000    |        |
| lnVAA     | 0.6967*** | 0.6538*** | 0.7035*** | 0.6598*** | 0.5731*** | 1.0000 |

**Table 3:** Correlation matrix of governance indicators for the lower-middle-income group

| Variables | lnROL     | lnCOC     | lnRQ      | lnGE      | lnPSNV    | lnVAA  |
|-----------|-----------|-----------|-----------|-----------|-----------|--------|
| lnROL     | 1.0000    |           |           |           |           |        |
| lnCOC     | 0.8493*** | 1.0000    |           |           |           |        |
| lnRQ      | 0.7011*** | 0.5762*** | 1.0000    |           |           |        |
| lnGE      | 0.8077*** | 0.7493*** | 0.7398*** | 1.0000    |           |        |
| lnPSNV    | 0.5636*** | 0.6001*** | 0.2829*** | 0.3946*** | 1.0000    |        |
| lnVAA     | 0.5505*** | 0.4447*** | 0.4103*** | 0.3525*** | 0.3995*** | 1.0000 |

**Note:** \*, \*\*, \*\*\* refer to statistical significance at the 10%, 5%, and 1% levels, respectively.

**Source:** Calculated by the author.

To reduce dimensionality and multicollinearity among the six governance indicators, we employ PCA on the sample of upper-middle-income and high-income countries, excluding the G7 economies, and on the sample of lower-middle-income countries. The PCA was applied to the six institutional variables: rule of law, control of corruption, regulatory quality, government effectiveness, political stability, and voice and accountability, using a correlation-based decomposition. This technique allows the construction of a composite governance index by extracting the most informative linear combination of variables, thus reducing redundancy while preserving explanatory power. The results in Table 4 show that the likelihood ratio test (lower-middle-income group  $\chi^2 = 4,430.49$ , and higher-middle-income group  $\chi^2 = 15,000.00$ ) strongly rejects the null hypothesis that the variables are uncorrelated, confirming that the correlation matrix is not an identity matrix and that the data are suitable for factor analysis or principal component extraction. Furthermore, the results in Table 4 show that the first principal component (PC1) explains a substantial share of the total variance in both income groups: 81.57% for higher-middle-income countries and 64.46% for lower-middle-income countries. These high levels of explained variance justify the use of *PC1* as a single proxy for governance quality.

**Table 4:** Principal component analysis – eigenvalues and explained variance

| Component                                                                              | Eigenvalue | Proportion of variance | Cumulative variance |
|----------------------------------------------------------------------------------------|------------|------------------------|---------------------|
| Higher-middle-income group                                                             |            |                        |                     |
| PC1                                                                                    | 4.894      | 81.57%                 | 81.57%              |
| PC2                                                                                    | 0.454      | 7.57%                  | 89.14%              |
| PC3                                                                                    | 0.412      | 6.87%                  | 96.01%              |
| PC4                                                                                    | 0.134      | 2.23%                  | 98.24%              |
| PC5                                                                                    | 0.058      | 0.97%                  | 99.21%              |
| PC6                                                                                    | 0.047      | 0.79%                  | 100.00%             |
| <b>Likelihood ratio (LR) test:</b> $\chi^2(15) = 15,000.00$ ; $p < .001$ ; $N = 1,846$ |            |                        |                     |
| Lower-middle-income group                                                              |            |                        |                     |
| PC1                                                                                    | 3.868      | 64.46%                 | 64.46%              |
| PC2                                                                                    | 0.832      | 13.87%                 | 78.33%              |
| PC3                                                                                    | 0.673      | 11.21%                 | 89.54%              |
| PC4                                                                                    | 0.324      | 5.41%                  | 94.95%              |
| PC5                                                                                    | 0.180      | 3.00%                  | 97.95%              |
| PC6                                                                                    | 0.123      | 2.05%                  | 100.00%             |
| <b>Likelihood ratio (LR) test:</b> $\chi^2(15) = 4,430.49$ ; $p < .001$ ; $N = 1,067$  |            |                        |                     |

**Source:** Calculated by the author.

Table 5 further reveals that in both groups, all six governance variables load positively on PC1, with relatively balanced and consistent contributions. In higher-middle-income countries, the strongest loadings come from Rule of law (0.440), Government effectiveness (0.432), and Control of corruption (0.428). Similarly, in lower-middle-income countries, Rule of law (0.480), government effectiveness (0.441), and Control of corruption (0.454) also dominate the principal component. These patterns suggest that despite income differences, a broadly similar underlying institutional dimension governs both groups.

**Table 5:** Principal component loadings (eigenvectors)

| Variable                               | PC1   | PC2    | PC3    | PC4    | PC5    | PC6    |
|----------------------------------------|-------|--------|--------|--------|--------|--------|
| Higher-middle-income group             |       |        |        |        |        |        |
| Rule of law                            | 0.440 | -0.128 | -0.132 | -0.067 | -0.081 | -0.873 |
| Control of corruption                  | 0.428 | -0.209 | -0.124 | -0.676 | 0.475  | 0.274  |
| Regulatory quality                     | 0.422 | 0.061  | -0.355 | 0.688  | 0.439  | 0.164  |
| Government effectiveness               | 0.432 | -0.144 | -0.308 | -0.013 | -0.756 | 0.356  |
| Political stability <b>no violence</b> | 0.366 | -0.359 | 0.824  | 0.220  | -0.016 | 0.097  |
| Voice and accountability               | 0.354 | 0.887  | 0.260  | -0.129 | -0.059 | 0.024  |
| Lower-middle-income group              |       |        |        |        |        |        |
| Rule of law                            | 0.480 | -0.048 | -0.038 | -0.238 | -0.138 | -0.831 |
| Control of corruption                  | 0.454 | 0.041  | -0.275 | -0.495 | -0.478 | 0.493  |
| Regulatory quality                     | 0.400 | -0.468 | 0.227  | 0.658  | -0.351 | 0.117  |
| Government effectiveness               | 0.441 | -0.379 | -0.132 | -0.114 | 0.772  | 0.187  |
| Political stability <b>no violence</b> | 0.331 | 0.663  | -0.441 | 0.490  | 0.130  | 0.012  |
| Voice and accountability               | 0.316 | 0.441  | 0.812  | -0.115 | 0.126  | 0.132  |

**Source:** Calculated by the author

Figure 2 displays the scree plots of eigenvalues derived from the PCA for both higher-middle-income and lower-middle-income countries. In both panels, the first principal component clearly dominates, with an eigenvalue well above the Kaiser criterion threshold of 1 (indicated by the horizontal line), while subsequent components contribute only marginally. The steep drop after the first component supports the use of PC1 as a valid composite governance index. The sharper decline in the higher-middle-income group indicates more uniformity in institutional quality compared to the more gradual slope seen in the lower-middle-income group.

**Figure 2:** Eigenvalues of higher-middle-income group

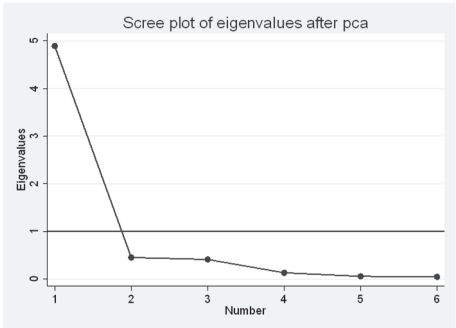
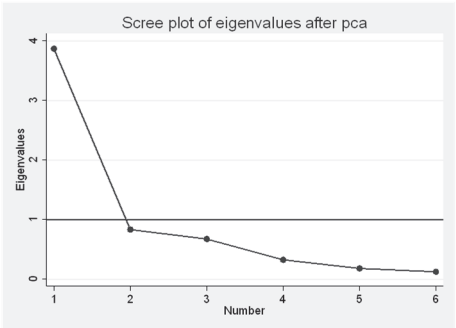


**Figure 3:** Eigenvalues of lower-middle-income group



**Source:** Calculated by the author.

Due to the strong correlations observed among the six dimensions of governance, using them simultaneously in a regression model could result in multicollinearity, undermining the reliability of the coefficient estimates. To address this issue, we apply PCA to condense the information contained in these six variables into fewer uncorrelated components. The first principal component, which captures the majority of the shared variance among the original indicators, is then used as a composite governance index in the subsequent empirical analysis. This approach enhances model parsimony while retaining the essential institutional information. Therefore, in the model analysing the impact of governance on economic catch-up, we employ the PCA-based composite governance index.

#### 4. DESCRIPTIVE ANALYSIS

Table 6 and Table 7 present a summary of the descriptive statistics for each variable, along with an interpretation of the distribution and range of values over the period 2002–2022. Distinct contrasts in governance quality and economic indicators emerge when comparing higher-middle-income countries (classified as above-average in Table 6) with lower-middle-income countries (classified as below average in Table 7). Higher-middle-income countries display positive mean values for governance indicators such as rule of law, control of corruption, regulatory quality, and government effectiveness, suggesting more robust institutional frameworks. This group also reports higher averages in economic variables such as trade and capital formation, indicating greater economic

openness and stronger investment climates. In contrast, lower-middle-income countries have negative mean values for governance indicators, reflecting weaker institutional quality, which may impede economic growth and discourage investment. These countries also show lower averages in economic variables, suggesting limited trade activity and capital investment compared to their higher-middle-income counterparts. Overall, the data highlight the role of governance quality in fostering economic development and supporting economic performance, with better governance being closely associated with stronger economic indicators in higher-middle-income countries.

**Table 6:** Descriptive statistics for each variable in higher-middle-income group

| Variable                                 | Observations | Mean  | Std.<br>Dev. | Min.  | Max.   |
|------------------------------------------|--------------|-------|--------------|-------|--------|
| Trade (% of GDP)                         | 1,980        | 98.46 | 62.71        | 15.68 | 442.62 |
| Gross capital<br>formation (% of<br>GDP) | 1,976        | 24.21 | 6.77         | 7.61  | 58.15  |
| Employment to<br>population ratio<br>(%) | 1,994        | 56.39 | 9.06         | 29.90 | 88.52  |
| Catch-up index                           | 1,995        | 1.13  | 0.38         | 0.46  | 3.67   |
| Rule of law                              | 1,995        | 0.41  | 0.95         | -1.84 | 2.12   |
| Control of<br>corruption                 | 1,993        | 0.41  | 1.00         | -1.65 | 2.46   |
| Regulatory quality                       | 1,993        | 0.53  | 0.88         | -1.99 | 2.25   |
| Government<br>effectiveness              | 1,993        | 0.51  | 0.89         | -1.96 | 2.25   |
| Political stability<br>no violence       | 1,994        | 0.28  | 0.81         | -2.18 | 1.75   |
| Voice and<br>accountability              | 1,995        | 0.32  | 0.95         | -2.05 | 1.80   |

**Table 7:** Descriptive statistics for each variable in lower-middle-income group

| Variable                           | Observations | Mean   | Std.<br>Dev. | Min.  | Max.   |
|------------------------------------|--------------|--------|--------------|-------|--------|
| Trade (% of GDP)                   | 1,070        | 68.015 | 31.11        | 2.70  | 186.66 |
| Gross capital formation (% of GDP) | 1,070        | 23.85  | 10.16        | 1.23  | 76.78  |
| Employment to population ratio (%) | 1,071        | 58.64  | 13.43        | 30.99 | 85.87  |
| Catch-up index                     | 1,071        | 1.11   | 0.30         | 0.30  | 2.37   |
| Rule of law                        | 1,071        | -0.73  | 0.52         | -1.87 | 0.91   |
| Control of corruption              | 1,071        | -0.72  | 0.53         | -1.60 | 1.62   |
| Regulatory quality                 | 1,067        | -0.68  | 0.44         | -2.20 | 0.34   |
| Government effectiveness           | 1,067        | -0.75  | 0.51         | -2.23 | 0.70   |
| Political stability no violence    | 1,071        | -0.68  | 0.75         | -2.81 | 1.38   |
| Voice and accountability           | 1,071        | -0.65  | 0.60         | -2.12 | 0.81   |

**Data Source:** Worldwide Good Governance Indicator and WDI; Catch-Up index, Calculated by the author.

**Note:** The variables presented in this table are reported in their non-logarithmic, original scale, while the empirical model will employ the logarithmic transformations of these variables for estimation purposes.

Table 7 presents the descriptive statistics of the catch-up index relative to the G7 benchmark for the two income groups. For higher-middle-income countries, the mean catch-up index is 1.13, with a standard deviation of 0.38. The between-country variation in the catch-up index is 0.34, which is considerably larger than the within-country variation over time (0.18). This indicates that structural differences between countries, rather than temporal fluctuations, account for the majority of the variation in economic catch-up. In contrast, lower-middle-income countries exhibit a slightly lower mean catch-up index of 1.11, with a standard deviation of 0.30. The between-country variation in this group is 0.26, implying that the dispersion of catch-up performance among lower-middle-income nations is less pronounced compared to higher-middle-income countries. This suggests that while lower-middle-income countries are generally lagging behind, they tend to exhibit more homogeneous patterns of economic convergence, possibly due to similar structural constraints, such as lower levels of technological absorption, weaker institutions, and limited access to global capital

markets. A critical comparative insight emerges from the relative positioning of the two income groups: the higher-middle-income group shows a greater spread in economic catch-up, meaning some countries are significantly ahead while others lag behind, reflecting heterogeneity in growth strategies, industrial policies, and innovation capacities. In contrast, the lower-middle-income group demonstrates a more compressed distribution, indicating that their economic trajectories are more constrained and potentially less influenced by individual policy choices and more by overarching global economic conditions.

## 5. ECONOMETRIC METHODOLOGY

The choice of the panel autoregressive distributed lag (Panel-ARDL) specification is justified on several grounds. First, preliminary unit-root diagnostics indicate that the variables exhibit mixed integration orders, specifically a combination of  $I(0)$  and  $I(1)$ . The Panel-ARDL model, as formalised by Pesaran et al. (1999), is well-suited for such cases, provided no variable is  $I(2)$ . Second, this approach simultaneously captures short-run dynamics and long-run equilibrium relationships, which is essential for understanding how institutional changes affect growth trajectories over time. The general model is specified as:

$$\ln(\text{catch})_{i,t} = \alpha_i + \sum_{p=1}^P \rho_{ip} \ln(\text{catch})_{i,t-p} + \sum_{q=0}^Q \beta_{iq} \ln(\text{inst}Q)_{i,t-q} + \sum_{r=0}^R \gamma_{it} X_{i,t-r} + \varepsilon_{i,t}, \quad (2)$$

where  $\ln(\text{catch})_{i,t}$  is the dependent variable for entity  $i$  at time  $t$  (logarithm of the catch-up index for country  $i$  at time  $t$ ),  $\alpha_i$  is the entity-specific intercept,  $\ln(\text{inst}Q)_{i,t-q}$  represents the logarithm of the institutional quality index (independent variable(s)) and  $X_{i,t-r}$  is a vector of control variables.  $\rho_{ip}$ ,  $\beta_{iq}$ , and  $\gamma_{it}$  are coefficients for the lagged values of  $\ln(\text{catch})$ ,  $\ln(\text{inst}Q)$ , and  $X_{i,t-r}$ , respectively, while  $\varepsilon_{i,t}$  is the error term. The short-run adjustments (error correction representation) towards long-run equilibrium can be modelled as:

$$\Delta \ln(\text{catch})_{i,t} = \lambda_i (\ln(\text{catch})_{i,t-1} - \theta_1 \ln(\text{inst}Q)_{i,t-1} - \theta_2 X_{i,t-1}) + \sum_{q=0}^{Q-1} \delta_q \Delta \ln(\text{inst}Q)_{i,t-q} + \sum_{r=0}^{R-1} \eta_r \Delta X_{i,t-r} + \alpha_i + \varepsilon_{i,t}, \quad (3)$$

where  $\lambda_i$  is the error-correction term coefficient representing the speed of adjustment, and  $\theta_1$  and  $\theta_2$  represent the long-run coefficients for

$\ln(instQ)$  and  $X_{i,t}$ , respectively;  $\eta_r$  and  $\delta_q$  are the short-run coefficients, and  $\varepsilon_{i,t}$  is the error term for the short-run dynamics. For estimation, we utilise the pooled mean group (PMG) estimator. The PMG approach is particularly beneficial as it allows for heterogeneity in short-run coefficients and error variances across countries while constraining the long-run parameters to be identical.

In this study, the dependent variable represents the log of the catch-up index relative to the G7 economies for country  $i$  at time  $t$ . The independent variables in this model include the institutional quality index,  $\ln Trade$ , (trade as a percentage of GDP),  $\ln Capital$  (gross capital formation as a percentage of GDP), and  $\ln Employ$  (employment to population ratio).  $\alpha_i$  denotes the country-specific effects,  $\varepsilon_{i,t}$  is the error term.

The governance quality is captured through the six dimensions defined by the World Bank. To avoid multicollinearity and ensure a comprehensive measure, these dimensions are consolidated into a composite index (PCAgov) using PCA. Finally, the model is estimated for two distinct groups to allow for comparative analysis. Following the World Bank classifications, we consolidate countries into two groups: higher-middle-income countries (comprising upper-middle and high-income economies) and lower-middle-income countries (lower-middle and low-income economies).

## **6. MODEL ESTIMATION AND RESULTS**

The results from the Fisher unit root tests (Table 8) for the various variables suggest mixed findings with respect to stationarity. In the table, the inverse chi-squared and inverse normal statistics are used to test the null hypothesis of a unit root across all panels. For most variables, such as  $\ln FDI$ ,  $\ln Capital$ ,  $\ln ROL$ ,  $\ln COC$ ,  $\ln RQ$ ,  $\ln GE$ ,  $\ln PSNV$ , and  $\ln VAA$ , the inverse chi-squared statistics and inverse normal statistics are both highly significant (with  $p$ -values close to 0 or below 0.01). Taken together, these results suggest that the null hypothesis of a unit root is rejected and that these variables are stationary at the panel level, indicating that these series do not follow a random walk. By contrast,  $\ln Trade$ ,  $\ln Employ$ , and  $\ln Catch$  show weaker evidence of stationarity.  $\ln Trade$  is significant at the 5% level in the inverse chi-squared statistic, indicating stationarity, while  $\ln Catch$  and  $\ln Employ$  are not statistically significant in either

test, with  $p$ -values of 0.9997 and 1.000 in the respective tests, which suggests that these variables likely have a unit root and are therefore non-stationary. Overall, the two tests provide broadly consistent evidence on stationarity.

Following the literature on panel ARDL, we estimate the panel ARDL-PMG specification in levels because the panel contains variables of mixed integration order,  $I(0)$  and  $I(1)$ . Prior to estimation, we verified that no variable is integrated of order two,  $I(2)$ , by applying panel unit root tests on second differences (results shown in Table 8). Therefore, the ARDL framework is valid.

**Table 8:** Fisher stationarity test

| Variable                                 | Label       | Inverse chi-squared     | Inverse normal        |
|------------------------------------------|-------------|-------------------------|-----------------------|
| Trade (% of GDP)                         | lnTrade     | 339.72 <sup>**</sup>    | -1.59 <sup>*</sup>    |
| Gross capital formation (% of GDP)       | lnCapital   | 493.4234 <sup>***</sup> | -6.31 <sup>***</sup>  |
| Employment to population ratio (%)       | lnEmploy    | 315.17                  | 1.47                  |
| First difference of employment           | D.lnEmploy  | 1625.55 <sup>***</sup>  | -28.37 <sup>***</sup> |
| Rule of law                              | lnROL       | 431.66 <sup>***</sup>   | -4.18 <sup>***</sup>  |
| Control of corruption                    | lnCOC       | 467.64 <sup>***</sup>   | -4.78 <sup>***</sup>  |
| Regulatory quality                       | lnRQ        | 451.05 <sup>***</sup>   | -3.73 <sup>***</sup>  |
| Government effectiveness                 | lnGE        | 600.57 <sup>***</sup>   | -6.16 <sup>***</sup>  |
| Political stability no violence          | lnPSNV      | 713.18 <sup>***</sup>   | -10.55 <sup>***</sup> |
| Voice and accountability                 | lnVAA       | 446.84 <sup>***</sup>   | -3.12 <sup>***</sup>  |
| Catch-up                                 | lnCatchG7   | 216.07                  | 7.71 <sup>***</sup>   |
| First difference of catch-up index       | D.lnCatchG7 | 1462.07 <sup>***</sup>  | -23.27 <sup>***</sup> |
| PCA index for lower-middle-income group  | lnPCAlow    | 395.75 <sup>***</sup>   | -1.10 <sup>***</sup>  |
| PCA index for higher-middle-income group | lnPCAhigh   | 403.61 <sup>***</sup>   | -1.68 <sup>***</sup>  |

**Note:** \*, \*\*, \*\*\* refer to statistical significance at the 10%, 5%, and 1% levels, respectively.

**Source:** Calculated by the author.

Following the panel unit root tests (Table 8), we estimate a dynamic heterogeneous panel model using the panel ARDL (PMG) approach proposed by Pesaran et al. (1999). To examine the residual properties and ensure robust inference, we construct the error-correction representation (ECM) of the PMG model using the estimated long-run coefficients. We then re-estimate the short-run equation with country fixed effects and perform diagnostic tests for cross-sectional dependence (Pesaran CD test), first-order serial correlation (Wooldridge test), and groupwise heteroscedasticity (Modified Wald test). The results indicate the presence of all three issues ( $p < 0.01$  in all tests, see Table 9).

**Table 9:** Diagnostic test results

| Test                                                   | Null hypothesis                | Lower-middle-income group | Higher-middle-income group |
|--------------------------------------------------------|--------------------------------|---------------------------|----------------------------|
| Pesaran test of cross-sectional dependence             | No cross-sectional dependence  | 23.57***                  | 66.34***                   |
| Wooldridge test for autocorrelation ( $F$ )            | No first-order autocorrelation | 34.43***                  | 9.25***                    |
| Modified Wald test for heteroscedasticity ( $\chi^2$ ) | Homoscedasticity across panels | 1043.9***                 | 1729.4***                  |

**Note:** \*, \*\*, \*\*\* refer to statistical significance at the 10%, 5%, and 1% levels, respectively.

The diagnostic tests reveal significant evidence of cross-sectional dependence, heteroscedasticity, and serial correlation in the panel ARDL model. These violations imply that conventional fixed-effects estimates may yield biased standard errors and, consequently, unreliable inference. To address this issue, we re-estimated the panel ARDL-ECM specification using fixed effects with Driscoll–Kraay standard errors, which are robust to heteroscedasticity, serial correlation, and cross-sectional dependence. This approach ensures that the reported coefficients and standard errors are consistent and reliable. By employing the Driscoll–Kraay correction, the model adequately addresses these econometric issues, providing consistent coefficient estimates and robust inference. Notably, the error-correction term (ECT) is negative and statistically significant in both models, confirming the existence of the long-run relationship and the presence of convergence dynamics.

Given the diagnostic procedures and corrections applied, the panel ARDL–ECM specification is now econometrically robust, addressing issues of heteroscedasticity, autocorrelation, and cross-sectional dependence. This allows us to proceed with the estimation of both short-run dynamics and long-run equilibrium relationships. In particular, the model can now be applied separately to the two income-based country groups (below-median and above-median income), enabling a comparative assessment of how governance factors influence catch-up performance in the short run and in the long run. The estimation results can be seen in Table 10<sup>2</sup>. Accordingly, an ARDL(1,1,1,1,1) specification is adopted, reflecting a parsimonious lag structure selected in consideration of the dataset's time dimension ( $T = 21$ ). This choice effectively balances the capture of dynamic effects with the preservation of degrees of freedom.

Table 10 reports the long-run and short-run coefficients, as well as the ECT, for both groups of countries. The results highlight the critical role of governance in shaping the dynamics of economic catch-up, with significant differences between higher-middle-income and lower-middle-income countries. For lower-middle-income countries, the coefficient on PACgov is 0.1071, statistically significant at the 1% level. This relatively large and robust coefficient indicates that improvements in governance are strongly associated with accelerated long-run convergence. In other words, a 1% improvement in the governance index leads to an approximately 0.1071% increase in the catch-up index, suggesting that better institutions in these countries substantially enhance their ability to catch-up economically with G7 countries.

In the long run, governance quality (PACgov) exerts a positive and statistically significant effect in both groups, but the magnitude is far greater in lower middle-income countries (0.1071) than in higher-middle-income countries (0.0201). This asymmetry suggests that improvements in institutional quality, such as rule of law, regulatory effectiveness, and control of corruption, have a

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<sup>2</sup> To verify the appropriateness of the pooled mean group (PMG) estimator, a Hausman test was conducted against the mean group (MG) alternative. The test statistic was insignificant ( $p > 0.05$ ), indicating that the null hypothesis of long-run homogeneity cannot be rejected. Given that countries within each income group share similar structural and institutional characteristics, this result supports the use of the PMG estimator, which allows for heterogeneous short-run dynamics while assuming a common long-run equilibrium relationship.

disproportionately larger impact on the convergence process of lower-middle-income economies. These countries often face greater institutional bottlenecks and weaker administrative capacity; therefore, governance reforms generate more substantial efficiency gains and provide stronger incentives for productive investment, trade facilitation, and human capital development. In contrast, in higher-middle-income countries, where governance frameworks are relatively more developed, incremental improvements in governance yield smaller marginal effects on convergence, consistent with the notion of diminishing returns to institutional quality once a certain threshold is achieved.

In the short run, governance again exhibits a differentiated effect across income groups. For lower middle-income countries, the short-run coefficient of governance (0.0146) is both positive and significant, indicating that even immediate improvements in institutional capacity can stimulate catch-up by reducing transaction costs, enhancing trust in regulatory frameworks, and attracting FDI. Conversely, in higher-middle-income countries, the short-run governance coefficient is small (0.0034) and statistically insignificant, implying that institutional reforms in these economies manifest their effects primarily in the long-term trajectory rather than in short-term fluctuations. This pattern underscores the path-dependent nature of institutional development: while lower-income countries benefit immediately from even modest reforms, higher-middle-income require deeper, structural changes for governance improvements to translate into measurable short-run economic performance.

The significantly negative ECT indicates the presence of a long-run equilibrium relationship between the dependent variable ( $\ln\text{Catch}$ ) and the set of explanatory variables included in the model. Its magnitude measures the fraction of the deviation from the long-run equilibrium that is corrected within one period. For lower-middle-income countries, the adjustment speed is  $-0.0822$ , implying that approximately 8% of any deviation from the long-run equilibrium is corrected in each period. For higher-middle-income countries, the speed of adjustment is lower ( $-0.0583$ ), indicating a slower return to equilibrium. This difference suggests that convergence dynamics may vary across income groups and could reflect underlying structural or institutional differences.

**Table 10:** ARDL model estimation results in two income groups

| Model                   | Higher-middle-income group | Lower-middle-income group |
|-------------------------|----------------------------|---------------------------|
| Long-term coefficients  |                            |                           |
| <b>lnTrade</b>          | 0.4223 <sup>***</sup>      | 0.3401 <sup>***</sup>     |
| <b>lnCapital</b>        | 0.5301 <sup>***</sup>      | 0.0453 <sup>**</sup>      |
| <b>lnEmploy</b>         | -0.5136 <sup>***</sup>     | 0.2922 <sup>***</sup>     |
| <b>PACgov</b>           | 0.0201 <sup>**</sup>       | 0.1071 <sup>***</sup>     |
| Short-term coefficients |                            |                           |
| ec                      | -0.0583 <sup>***</sup>     | -0.0822 <sup>***</sup>    |
| Constant                | -0.0825 <sup>***</sup>     | -0.2119 <sup>**</sup>     |
| $\Delta$ lnTrade        | -0.02375                   | 0.0226                    |
| $\Delta$ lnCapital      | 0.0069                     | 0.0162 <sup>*</sup>       |
| $\Delta$ lnEmploy       | 0.2924 <sup>**</sup>       | 0.2957 <sup>***</sup>     |
| $\Delta$ PACgov         | 0.0034                     | 0.0146 <sup>***</sup>     |

**Note:** \*, \*\*, \*\*\* refer to statistical significance at the 10%, 5% and 1% levels, respectively.

Driscoll–Kraay standard errors are robust to heteroscedasticity, autocorrelation, and cross-sectional dependence. Diagnostic test results (Pesaran CD, Wooldridge, and Modified Wald) are reported in Table 9 and confirm the need for robust inference.

**Source:** Calculated by the author.

The estimation results confirm that governance quality (PACgov) plays a decisive role in enhancing long-term economic convergence, with a markedly stronger effect in lower-middle-income countries (coefficient = 0.1071) compared to higher-middle-income countries (coefficient = 0.0201). This difference reflects the wider institutional gap in the former group, where improvements in governance generate substantial efficiency gains and facilitate catch-up dynamics. In the short run, however, governance effects remain significant only for lower-middle-income countries, while in higher-middle-income economies the impact is negligible, underscoring the inherently gradual and path-dependent nature of institutional transformation. These findings suggest that governance reforms should remain a strategic priority in development policy, especially for economies at earlier stages of convergence.

The results provide compelling evidence that improvements in governance quality are particularly powerful in fostering economic convergence among

lower-middle-income countries, both in the short and long term. This highlights the strategic importance of institutional reforms, including strengthening the rule of law, enhancing regulatory quality, improving government effectiveness, and combating corruption, as catalytic tools for accelerating development. For higher-middle-income countries, while governance remains relevant, the relatively modest coefficients suggest that complementary structural drivers, such as technological innovation, education quality, and productivity upgrading, may play a more prominent role in closing the gap with advanced economies.

The control variables, including trade, capital formation, and employment, display distinct patterns across income groups, underscoring structural differences in the convergence process. In higher-middle-income countries, both trade (0.4223) and capital formation (0.5301) exert strong and significant positive effects on long-term catch-up, consistent with their greater integration into global markets and higher absorptive capacity for investment-driven growth. However, employment exerts a negative effect (−0.5136), suggesting that expanding labor force participation without corresponding productivity gains or improvements in job quality may hinder convergence at more advanced stages of development. By contrast, in lower-middle-income countries, the impact of capital formation is modest (0.0453), reflecting constraints in translating investment into sustained growth, while trade remains positive though smaller in magnitude (0.3401). Notably, employment plays a constructive role (0.2922), indicating that labor mobilisation continues to be a central driver of growth in economies at earlier stages of structural transformation. These findings highlight that while higher-middle-income countries advance primarily through trade and capital deepening, lower-middle-income countries rely more on employment expansion alongside gradual improvements in market integration and investment efficiency.

## **6. CONCLUSION AND RECOMMENDATIONS**

This study highlights the significant role of governance in promoting economic catch-up for lower- and higher-middle-income countries. By examining the impacts of governance indicators such as rule of law, regulatory quality, and control of corruption, it is evident that effective governance frameworks foster stable economic environments, enabling these countries to narrow income gaps with advanced economies. The comparative analysis highlights significant

differences in the drivers of economic convergence between higher-middle-income and lower-middle-income countries.

The empirical results reveal a striking asymmetry in the long-run impact of governance quality on economic convergence between lower-middle-income and higher-middle-income countries. In the former group, the effect of improved governance is not only statistically significant but also economically substantial, with a 1% rise in the composite governance index associated with a 0.1071% increase in the convergence index. This highlights the centrality of institutional development in narrowing income gaps in economies that still face considerable structural deficiencies. In contrast, higher-middle-income countries experience only a modest, albeit significant, governance effect (coefficient: 0.0201), suggesting diminishing marginal returns to institutional improvements in more advanced contexts where governance infrastructure may already be well-developed. Additionally, the speed of adjustment toward equilibrium is around 1.4 times as fast in lower-middle-income countries ( $-0.0822$  vs.  $-0.0583$ ). The short-run results reveal an important asymmetry: while governance exerts a positive and significant effect on convergence in lower-middle-income countries, its short-run impact is insignificant in higher-middle-income economies. This contrast suggests that in countries with weaker institutional foundations, even modest improvements in governance can quickly enhance investor confidence, reduce transaction costs, and support catch-up dynamics. By contrast, in higher-middle-income countries, governance reforms manifest their effects mainly over the long term, reflecting the more gradual nature of institutional transformation once basic frameworks are already established. Together, these findings suggest that governance is an important driver of convergence, with its influence appearing more pronounced in lower-middle-income countries than in higher-middle-income ones. This nuanced role, however, operates alongside other significant factors such as trade and employment, which also show substantial effects in the analysis.

The comparison of results across income groups reveals that while trade, capital formation, and governance improvements all promote economic catch-up, their effects differ significantly by development level. In higher-middle-income countries, trade and capital formation have stronger impacts, reflecting greater absorptive capacity, stronger institutions, and more efficient resource allocation

that allow these economies to leverage openness for innovation and growth. In contrast, although trade and capital also contribute positively in lower-middle-income countries, their effects are weaker due to structural barriers such as limited infrastructure, weaker financial systems, and less effective institutions, which constrain the immediate benefits of openness and investment. These differences highlight that while higher-middle-income countries can sustain convergence through deeper integration and capital efficiency, lower-middle-income countries must prioritise institutional strengthening and more effective capital allocation to fully realise the growth potential of trade and investment.

From a policy perspective, our results provide robust empirical support for the centrality of institutional quality in driving income convergence, particularly for lower-middle-income economies. The statistically significant long-run coefficient of governance and the negative, significant error-correction term confirm that improvements in governance have both persistent and corrective effects on the trajectory of economic catch-up. For policymakers, this implies that institutional reform is not merely a complementary measure but a necessary precondition for sustained convergence. In practical terms, reform agendas should prioritise strengthening the rule of law, improving regulatory quality, curbing corruption, and professionalising public administration – measures that reduce transaction costs, enhance contract enforcement, and increase investor confidence. Such reforms not only attract foreign investment and enable technology transfer, but also raise domestic productivity by improving allocative efficiency and reducing distortions in factor markets. The presence of a gradual adjustment mechanism, as reflected in the speed-of-adjustment parameter, highlights that these benefits materialise over time, requiring continuity and political commitment to institutional change. For higher-middle-income countries, where our results indicate a smaller marginal effect of governance improvements, convergence strategies should increasingly pivot toward complementary drivers of growth such as innovation ecosystems, human capital development, and technological upgrading. Nevertheless, governance reforms remain crucial in these contexts as well – less as a catch-up accelerator and more as a safeguard against institutional regression, policy inconsistency, and rent-seeking dynamics that can undermine convergence gains.

Overall, our findings reinforce the view advanced by the “institutions first” literature (e.g., Acemoglu & Robinson, 2012) that institutional quality constitutes a foundational pillar of convergence-oriented development policy. While the intensity and sequencing of reforms should be tailored to a country’s stage of development, embedding institutional strengthening within long-term development strategies appears essential for transforming convergence from a cyclical phenomenon into a sustained process.

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**APPENDIX 1**

The following countries are classified as higher-middle-income in the analysis: Albania (ALB), Algeria (DZA), Argentina (ARG), Armenia (ARM), Azerbaijan (AZE), Belarus (BLR), Belize (BLZ), Bosnia and Herzegovina (BIH), Botswana (BWA), Brazil (BRA), China (CHN), Colombia (COL), Costa Rica (CRI), Cuba (CUB), Dominican Republic (DOM), Ecuador (ECU), El Salvador (SLV), Equatorial Guinea (GNQ), Fiji (FJI), Gabon (GAB), Georgia (GEO), Guatemala (GTM), Indonesia (IDN), Iran (IRN), Iraq (IRQ), Jamaica (JAM), Kazakhstan (KAZ), Malaysia (MYS), Mauritius (MUS), Mexico (MEX), Moldova (MDA), Mongolia (MNG), Namibia (NAM), North Macedonia (MKD), Paraguay (PRY), Peru (PER), Serbia (SRB), South Africa (ZAF), Thailand (THA), Tonga (TON), Turkey (TUR), Ukraine (UKR), Australia (AUS), Austria (AUT), Bahamas (BHS), Bahrain (BHR), Barbados (BRB), Belgium (BEL), Brunei Darussalam (BRN), Bulgaria (BGR), Chile (CHL), Croatia (HRV), Cyprus (CYP), Czech Republic (CZE), Denmark (DNK), Estonia (EST), Finland (FIN), Greece (GRC), Hong Kong SAR (HKG), Hungary (HUN), Iceland (ISL), Ireland (IRL), Israel (ISR), South Korea (KOR), Kuwait (KWT), Latvia (LVA), Lithuania (LTU), Luxembourg (LUX), Macao SAR (MAC), Malta (MLT), Netherlands (NLD), New Zealand (NZL), Norway (NOR), Oman (OMN), Panama (PAN), Poland (POL), Portugal (PRT), Qatar (QAT), Russian Federation (RUS), Saudi Arabia (SAU), Singapore (SGP), Slovak Republic (SVK), Slovenia (SVN), Spain (ESP), Sweden (SWE), Switzerland (CHE), United Arab Emirates (ARE), and Uruguay (URY).

**APPENDIX 2**

The following countries are classified as lower-middle-income in the analysis: Burkina Faso (BFA), Burundi (BDI), Central African Republic (CAF), Chad (TCD), Gambia (GMB), Guinea-Bissau (GNB), Madagascar (MDG), Mali (MLI), Mozambique (MOZ), Niger (NER), Rwanda (RWA), Sierra Leone (SLE), Sudan (SDN), Togo (TGO), Uganda (UGA), Angola (AGO), Bangladesh (BGD), Benin (BEN), Bhutan (BTN), Bolivia (BOL), Cambodia (KHM), Cameroon (CMR), Comoros (COM), Republic of the Congo (COG), Côte d'Ivoire (CIV), Egypt (EGY), Eswatini (SWZ), Ghana (GHA), Guinea (GIN), Haiti (HTI), Honduras (HND), India (IND), Jordan (JOR), Kenya (KEN), Kyrgyz Republic (KGZ), Lebanon (LBN), Mauritania (MRT), Morocco (MAR), Nepal (NPL), Nicaragua

(NIC), Pakistan (PAK), Philippines (PHL), Senegal (SEN), Solomon Islands (SLB), Tajikistan (TJK), Tanzania (TZA), Tunisia (TUN), Uzbekistan (UZB), Vanuatu (VUT), Vietnam (VNM), and Zimbabwe (ZWE).

*Madiha Saleem\**

## SEPTEMBER AND NOVEMBER EFFECT IN GOLD MARKETS: AN ASIAN PERSPECTIVE

**ABSTRACT:** *The current study explores the seasonal patterns and volatility dynamics in gold returns for emerging Asian economies – China, India, Iran, Japan, Malaysia, Pakistan, Singapore, and Sri Lanka – using monthly data between 2013 and 2022. Preliminary diagnostic tests ensured the suitability of the return series by confirming their normality, stationarity, white noise, and ARCH effects. Seasonality was examined through monthly coefficients, average returns, and seasonal indices. ANOVA and Kruskal–Wallis tests yielded non-significant results for monthly coefficients, while monthly averages and seasonal indices suggested an upward trend between August and February, with the highest returns in the months of September and November. These findings are consistent with calendar-based demand shifts and corroborates*

*the autumn effect in Asian gold markets. Volatility estimation through GARCH(1,1) revealed that the Asian gold market exhibits low volatility with persistence up to 21%, implying that short-term shocks do not persist for a longer time and revert more quickly than in Western economies. Overall, the findings suggest that Asian gold markets are relatively efficient with no significant evidence of seasonality, though cultural and festival-related factors may influence end-of-year price dynamics. The study offers implications for investors, portfolio managers, and policymakers, while outlining limitations and suggesting new avenues for broader comparative research.*

**KEY WORDS:** *gold returns; seasonality; seasonal index; seasonal effect; September–November effect, Asian gold market*

**JEL CLASSIFICATION:** Q02, D53, E44, F62

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## **1. INTRODUCTION**

Gold has long been acknowledged as a hedge and a safe-haven asset, used for preserving wealth during periods of inflation, financial instability, or geopolitical shocks (Baur & Lucey, 2010). Unlike traditional markets, gold is less tied to the performance of individual economies, which makes it particularly attractive during downturns and crises (Shiva & Sethi, 2015; Wang et al., 2013). However, its role as a hedge and a safe haven is influenced by emerging phenomena, such as seasonality and volatility persistence, attracting the attention of researchers, investors, and policymakers alike (Khan et al., 2023; Li & Umair, 2023). The existing financial economic literature provides insights into seasonal anomalies and volatility persistence, mainly for Western economies; its implications for Asian markets remain relatively limited. Asia contributes significantly to the consumption and demand of gold (Li & Umair, 2023; Shukla & Katiyar, 2023; Vu & Hoang, 2024); therefore, understanding the unique seasonal patterns and volatility dynamics in these markets holds substantial importance.

In Asia, gold is acknowledged not merely as an investment instrument but also as having cultural and social importance. In India and Pakistan, for example, it is considered a symbol of wealth and status, and is used frequently in traditions such as weddings, festivals, and religious ceremonies (Kumari et al., 2024; Mughal, 2018; Zulfiqar, 2022). According to Shukla and Katiyar (2023), gold demand in Asian countries is shaped not only by macroeconomic variables but also by deep-rooted traditions, festivals, and ceremonies. Shukla and Katiyar (2023) found that in India, gold demand peaks during cultural festivals, such as Diwali and the wedding season at the end of the year. Similarly, Sreejith and Ramanathan (2025) reported a surge in Chinese gold demand around the Lunar New Year. Overall, the findings underscore that gold demand in Asian markets is strongly linked to cultural and festive-related events, suggesting systematic anomalies are more likely to appear in these markets (Singh et al., 2026; Vu & Hoang, 2024). Moreover, structural issues in Asian financial systems, such as inflation, currency instability, and limited asset diversification, intensify the volatility of gold returns. Together, these cultural and economic characteristics make Asia a unique setting for exploring the perplexing phenomena of seasonality and volatility in Asian gold markets.

Seasonality, or seasonal anomalies, refers to the occurrence of systematic and recurring patterns in asset returns at specific times of the year, such as certain months or periods, often influenced by calendar, economic, or cultural factors (Brown & Rozeff, 1979). The Western literature reports several seasonal anomalies in the context of equity markets, such as the January effect and the Ramadan effect (Baur & Lucey, 2010; Blose, 2010; Chia et al., 2007; Husain, 1998; Yu & Shih, 2011). In reference to gold, scholars, such as Lucey and Tully (2006), have reported a weekday effect and Ball et al. (1982) have reported weekend anomalies. Another study by Baur (2013) identified the so-called autumn effect of gold, using monthly returns, suggesting that higher returns occur in September and November. However, the consistency of these findings across Asian markets is unclear, raising concerns about whether gold returns in Asian markets exhibit statistically significant seasonal patterns across different months or not, and which months yield abnormal returns. Without systematic evidence, investors are unable to optimize trading strategies around seasonal variations, and policymakers are unaware of how gold-related capital flows evolve during culturally significant months.

While seasonality measures whether gold returns vary across months, volatility measures the extent of variations in gold returns over time and serves as a key measure of financial risk (Engle, 1993). Gold returns are characterised by time-varying volatility, often shaped by crises, inflationary pressures, investor sentiment, and other market-related factors (Baur & Lucey, 2010; Niu et al., 2024). However, the dearth of literature in the Asian context hampers our understanding of how volatility behaves across Asian gold markets. An additional layer of complexity emerges when these dynamics are evaluated against the efficient market hypothesis (EMH), which posits that asset prices should reflect all available information, leaving no room for predictable anomalies, such as seasonality and volatility. However, the consistent presence of these patterns in gold returns raises questions about whether Asian gold markets function efficiently. If these seasonal anomalies and volatility persistence challenge gold's role as a hedge and a safe haven and influence the extent of market efficiency, the implications for both investors and policymakers in Asia are profound.

To address these gaps, this study seeks to examine seasonal anomalies in gold returns in Asian markets and evaluate whether gold returns in Asian markets

exhibit persistent volatility that clusters over time or recovers immediately. By examining seasonality and volatility, the study assessed the role of gold as a hedge and safe-haven asset in the context of Asia, thereby determining whether the Asian gold market functions efficiently. The study employed monthly gold returns data for major Asian economies – China, India, Iran, Japan, Malaysia, Pakistan, Singapore, and Sri Lanka – between 2013 and 2022. The selection of these countries was based on their regional importance and the availability of data. Seasonality was examined using monthly coefficients, monthly averages, and monthly seasonal indices. Volatility was estimated using a baseline model from the generalized autoregressive conditional heteroscedasticity (GARCH) family, specifically GARCH(1,1). Additionally, to ensure robustness, standard diagnostic tests, such as the augmented Dickey–Fuller, Jarque–Bera, Ljung–Box Q, and ARCH-LM (Lagrange Multiplier) tests were employed. Overall, the selected methodology enhanced the rigour and credibility of the results compared to earlier research relying on descriptive summaries or limited econometric tools.

This study offers valuable insights to both theory and practice. Theoretically, it adds to the financial economics literature by assessing the presence of seasonal anomalies and volatility persistence in the Asian context, where gold prices are driven not only by economic but also by cultural factors. By combining seasonality and volatility, it captures the extent of market efficiency and evaluates the role of gold as a hedge and a safe haven in Asian markets. Practically, it provides useful insights for investors by assisting them in optimal trading windows, portfolio diversification, and risk management strategies. It also offers valuable implications for the policy makers who are responsible for monitoring gold-related capital flows and stabilising commodity-driven financial systems. For academics and readers, it offers a novel perspective of gold market behaviour in underexplored markets. In sum, the study strives to extend the discourse of gold market dynamics to Asia, offering a timely, relevant, and significant addition to the global financial economic literature.

The next section outlines the study's research questions and the corresponding objectives, followed by a comprehensive literature review necessary for identifying gaps and laying the foundations for the study. The methodology used to address these gaps is then explained. Next, the detailed data analysis and discussion section is provided to discuss the findings of the study in the light of

the research questions. Finally, a conclusion is presented to summarise the whole study, outlining the limitations of the study and extending suggestions for future research.

## **2. RESEARCH QUESTIONS AND OBJECTIVES**

### **Research Questions:**

This study is guided by three interrelated and overarching research questions.

**RQ1:** Do gold returns in Asian markets exhibit statistically significant seasonal patterns?

**RQ2:** Which specific months yield abnormal returns, and do these align with cultural or economic events?

**RQ3:** How does volatility behave across Asian gold markets, and to what extent does volatility persist over time?

### **Objectives of the study:**

To address the above research questions, this study aims to:

- Examine the statistical significance of seasonal fluctuations in Asian gold markets
- Identify the pattern of seasonal fluctuations across countries and months.
- Examine whether the theories developed for Western contexts, such as the autumn effect of gold, apply to Asian markets.
- Analyse and forecast volatility dynamics in Asian gold markets using GARCH modelling, thereby capturing persistence and clustering effects.
- Evaluate the extent of market efficiency that Asian gold markets exhibit, thereby contributing to the EMH literature.
- Evaluate the role of gold as a hedge and a safe haven in the presence of seasonal anomalies and volatility.
- Contribute to theory by extending the debate on seasonality and volatility in underexplored regions such as Asia.
- Provide practical insights for investors on timing and diversification strategies, and for policymakers on anticipating gold-related capital flows.

### **3. LITERATURE REVIEW**

The role of gold as a hedge and safe-haven asset has long been documented in the financial economics literature. For example, Baur and Lucey (2010) and Kahn et al. (2023) found that gold functions as both a hedge and a safe haven against stock market movements. However, later studies reported that gold's role is conditional on market types, time horizons, severity of crises, investor sentiment, contextual considerations, and macroeconomic uncertainty (Niu et al., 2024; Salisu et al., 2023; Singh et al., 2026). Nowadays, emerging concepts such as seasonality and volatility have gained increasing scholarly attention, which often challenge gold's reliability as a protective asset. Seasonality driven by cultural and cyclical demand often distorts its protective function, while its volatility can undermine its reliability in times of crisis. These phenomena directly challenge the EMH, as recurring seasonal effects and volatility patterns indicate partial market inefficiency. Furthermore, scholars suggest that the protective role of gold may not be universal; it provides stronger benefits in developed markets than in emerging ones (Baur & McDermott, 2010; Li & Umair, 2023). The existing literature on gold's seasonality and volatility has largely focused on Western markets, while the Asian context, where cultural demand and market structures differ significantly, remains underexplored.

Earlier studies on seasonality have highlighted predictable calendar effects. For instance, Chia et al. (2007) proposed the day-of-the-week effect in equity markets, and Husain (1998) proposed the Ramadan effect in Muslim-majority economies. In the context of commodities, Lucey and Tully (2006) identified weekday anomalies in gold and silver returns, Hoang et al. (2020) reported the January effect in gold returns, while Baur (2013) introduced the concept of the autumn effect, documenting abnormally high returns in September and November. These findings stress that even highly liquid and globally traded assets such as gold are not immune to seasonality. However, the consistency of such anomalies remains debated. For instance, Bentes et al. (2022) observed that global disruptions altered traditional patterns of return and volatility, weakening some calendar effects while reinforcing others. Bentes et al. (2022) also suggested that ESG-driven (environmental, social, and governance) portfolio reallocation is beginning to reshape commodity demand, thereby influencing cyclical price behaviour. Taken together, these studies suggest that while seasonality is observable, its magnitude

and persistence may shift under changing global and regional conditions, reinforcing the value of updated and geographically specific research.

While gold is viewed as a primary investment in Western countries, in Asia it functions as a store of value and cultural commodity. The demand for gold in Asian countries is not only tied to financial uncertainty, but also to seasonal festivals, such as weddings, religious observances, and cultural events. Arshad et al. (2023) empirically confirmed that cultural drivers significantly affect gold demand in Asia even when macroeconomic variables are controlled, while Yu and Shih (2011) found that holiday-related demand cycles contribute to volatility clustering in commodity markets. Shukla and Katiyar (2023) reported an upsurge in gold demand in India around festivals, such as Diwali and the wedding season. Similarly, Chinese events such as the Lunar New Year and Ramadan in Muslim-majority economies generate predictable upsurges in gold consumption (Husain, 1998; Sreejith & Ramanathan, 2025). This integration of cultural and financial factors underscores a structural difference between Asian and Western markets, where gold consumption is less culturally embedded.

Despite Asia's dominance in global gold consumption, with India and China alone accounting for more than half of worldwide gold consumption (Shukla & Katiyar, 2023), systematic academic research on seasonal anomalies in these markets remains limited. Existing studies are fragmented and often confined to single-country contexts, such as China (Hoang et al., 2020) and Pakistan (Husain, 1998; Zaman et al., 2024), without offering a comparative regional perspective. Even fewer have explicitly linked anomalies such as the September–November effect to cultural and economic cycles in Asia. Similarly, although volatility clustering in commodities has been well documented in literature (Chen & Rehman, 2021; Yang et al., 2021), only few studies have applied robust econometric modelling such as GARCH or EGARCH to systematically assess volatility persistence across Asian gold markets. Together these limitations represent a critical research gap; without comprehensive multi-country analysis, it is difficult to assess whether Asian gold returns reflect universal market inefficiencies or region-specific cultural drivers.

Recent developments further highlight the urgency of these gaps. For example, Khan et al. (2023) stressed that the COVID-19 pandemic disrupted global gold

markets, not only intensifying investor reliance on safe-haven assets but also altering cyclical consumption patterns. At the same time, ESG-driven investment practices are reshaping portfolio allocation, with implications for gold demand in both developed and emerging markets (Asih et al., 2024). For Asian economies, Immanuel and Lazar (2022) stressed that cultural and economic shifts may have compound effects on seasonal fluctuations and return volatility. Yet, there is little empirical research, which can directly address how these global and local dynamics interact in shaping gold price behaviour.

Collectively, the existing literature recognises gold as both a hedge and a safe haven. However, its effectiveness is dependent on seasonal demand fluctuations and volatility, both of which vary across contexts. It also recognises that, like other financial markets, the gold market is prone to recurring anomalies and the persistence of these effects is context dependent. Finally, it demonstrates that cultural and economic changes in Asia have the potential to produce systematic seasonal patterns in gold returns. What is lacking, however, is a rigorous multi-country analysis of Asian gold markets that integrates statistical testing of seasonal anomalies and robust volatility modelling. This study fills this gap by examining monthly gold returns across eight Asian economies – China, India, Iran, Japan, Malaysia, Pakistan, Singapore, and Sri Lanka – over the period 2013–2022. By using descriptive analysis, monthly averages, seasonal indices, and GARCH-based modelling, it extends the literature of financial economics, contributes to the debate on the EMH, evaluates gold's role as a hedge and a safe haven, captures gold market seasonality and volatility persistence, and provides practical implications for investors, policymakers, and researchers.

#### **4. DATA AND METHODOLOGY**

The study examines gold return seasonality and volatility across eight Asian economies: China, India, Iran, Japan, Malaysia, Pakistan, Singapore, and Sri Lanka. The rationale behind the selection of these countries is threefold. First, these countries collectively represent a substantial share of global gold demand, with China and India alone accounting for over half the global consumption of gold (Shukla & Katiyar, 2023). Second, these countries reflect a range of market structures, spanning from emerging economies with high cultural demand for gold (India, Pakistan) to advanced economies with developed financial systems (Japan, Singapore). Third, consistent high-quality monthly gold price data (in

troy ounces) were available for the 2013–2022 period. Monthly gold price data were computed by converting US dollar-denominated gold prices, extracted from the World Gold Council (n.d.), using the respective monthly exchange rates sourced from the International Monetary Fund (n.d.). The gold prices were converted into monthly gold returns to stabilise variance and allow for cross-country comparability. The final sample includes 960 observations, with 120 observations for each sample country.

The empirical design adopted to pursue this study is closely aligned with the study's research questions. To address the first two research questions (RQ1 and RQ2), investigating “whether gold returns in Asian markets exhibit statistically significant seasonal patterns” and “which specific months yield abnormal returns, and whether these align with cultural or economic events”, descriptive statistics, normalised monthly averages, and monthly seasonal indices were computed. These were supplemented with inferential tests – ANOVA and Kruskal-Wallis non-parametric tests – to establish whether observed seasonal differences are statistically significant. The seasonality was checked using the following regression model, in which monthly seasonal coefficients  $\beta_{m,c}$  for each country  $c$  were computed using Equation (1), derived from Baur (2013).

$$r_{t,c} = \alpha_c + \sum_{m=1}^{11} \beta_{m,c} D_{m,t} + \varepsilon_{t,c} , \quad (1)$$

where

$r_{t,c}$  = the gold return at time  $t$  for country  $c$

$\alpha_c$  = the intercept or the average return of the reference month

$\beta_{m,c}$  = the monthly seasonal coefficient for country  $c$  for month  $m$

$D_{m,t}$  = the seasonal dummy variable, which takes the value of ‘1’ if observation  $t$  occurs in month  $m$ , and 0 otherwise

$\varepsilon_{t,c}$  = the error term

$m$  = month = 1,2,3,...11 (the month of December is omitted to avoid the dummy variable trap)

$c$  = the country indicator for China, India, Iran, Japan, Malaysia, Pakistan, Singapore, and Sri Lanka

The normalised monthly averages ( $AR$ ) were computed using Equation (2), where  $\bar{r}_m$  is the monthly average and  $\bar{r}_{\text{annual}}$  is the overall annualised average, computed using Equation (2.1) and Equation (2.2), respectively. These normalised monthly returns allow for cross-month and cross-country comparisons of seasonal patterns in gold returns.

$$AR = \frac{\bar{r}_m}{\bar{r}_{\text{annual}}} \quad (2)$$

$$\bar{r}_m = \frac{1}{T_m} \sum_{t \in m} r_t \quad (2.1)$$

$$\bar{r}_{\text{annual}} = \frac{1}{12} \sum_{m=1}^{12} \bar{r}_m \quad (2.2)$$

The monthly seasonal indices,  $SI$ , were computed using Equation (3). The sum of seasonal indices equals one.

$$SI = AR * 12 \quad (3)$$

To address the third research question (RQ3), which examines “how volatility behaves across Asian gold markets, and the extent to which volatility persists over time”, a GARCH(1,1) model was applied. Additionally, diagnostic tests, such as the augmented Dickey–Fuller (ADF), Jarque–Bera (JB), Ljung–Box Q-statistic, and ARCH-LM tests underpinned each stage of analysis. The ADF test ensures stationarity of return series; the Ljung–Box Q-statistic test confirms the absence of autocorrelation; and the ARCH-LM test confirms the presence of conditional heteroscedasticity, justifying the application of GARCH models.

Among the models of the GARCH family, the baseline GARCH(1,1) model was employed for its parsimony and proven effectiveness in capturing volatility clustering (Engle, 2001). It allows for a deeper examination of volatility persistence across markets, revealing structural heterogeneity in gold price behaviour. However, to enhance robustness, the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) were used for model selection. As per best practice, the model with the lowest AIC and highest log-likelihood function (LLF) values was considered the most suitable for estimating volatility. The baseline GARCH(1,1) was compared with other models in the GARCH

family, such as EGARCH, GARCH-M, GARCH (p, q), where p and q > 1. GARCH(1,1) yielded the best-fitting values – that is, the lowest AIC and highest LLF – among them, hence qualifying for volatility estimation. After confirming the suitability of the return series, the GARCH model was specified and volatility was forecasted using Equation (4) through Equation (8), sourced from Engle (1993, 2001).

GARCH(1,1) mean equation:

$$r_t = \mu + \varepsilon_t , \quad (4)$$

where:

$r_t$  = the monthly gold return at time  $t$

$\mu$  = the constant mean return

$\varepsilon_t$  = the error term

GARCH(1,1) variance equation:

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1} , \quad (5)$$

where:

$\alpha_0 > 0$  is the constant term

$\alpha_1 \geq 0$  represents the ARCH effect (short-run shock response)

$\beta_1 \geq 0$  represents the GARCH effect (volatility persistence)

$\alpha_1 + \beta_1 < 1$  ensures covariance stationarity

Volatility persistence is measured as follows:

$$\text{volatility persistence} = \alpha_1 + \beta_1 , \quad (6)$$

where:

$\alpha_1 + \beta_1 \approx 1$  indicates high and persistent volatility

$\alpha_1 + \beta_1 < 0.5$  indicates low volatility persistence

$\alpha_1 + \beta_1 > 1$  represents explosive variance (model misspecification)

Forecasted volatility ( $k$ -step-ahead), in this case 18 steps, is calculated as:

$$\hat{h}_{t+k} = \alpha_0 \left( \frac{1 - (\alpha_1 + \beta_1)^k}{1 - (\alpha_1 + \beta_1)} \right) + (\alpha_1 + \beta_1)^k h_t \quad (7)$$

Forecasted volatility in terms of standard deviation expressed in percentage terms,  $STD = \sigma_t(\%)$ , is obtained as follows:

$$STD = \sigma_t(\%) = \sqrt{h_t} \times 100 \quad (8)$$

Together, these analytical techniques ensure the reliability and validity of the methodological choices for two reasons. First, they offer econometric rigour to the results. Monthly averages provide descriptive insights, while monthly coefficients and seasonal indices contribute statistical reliability for academic contributions. Second, these techniques balance both theoretical and practical insights. Theoretically, the study contributes to the ongoing debate on market efficiency by testing persistent anomalies. Practically, it informs policymakers and investors by quantifying seasonal patterns and volatility dynamics. Overall, by analysing seasonal variations and volatility forecasts through the adopted methods, the study offers a comprehensive framework for comprehending gold market behaviour in the Asian context. Figure 1 presents the methodological framework of the study, beginning with data collection, transformation into monthly returns, and analysis of the descriptive statistics. Then the monthly coefficients, monthly averages, and monthly indices were computed and compared. The volatility dynamics were modelled with GARCH(1,1). Finally, the results were interpreted in terms of seasonal anomalies, future variability, and field implications.

**Figure 1:** Methodological framework



## 5. ANALYSIS AND DISCUSSION

This section presents a rigorous analysis of the monthly gold return series for selected Asian markets, incorporating statistical tests, seasonal patterns, and volatility modelling to address the research questions.

### 5.1. Descriptive statistics

The descriptive statistics provide an initial overview of the behaviour of the return series. Table 1 presents key statistics of gold returns, including mean, standard deviation, skewness, kurtosis, minimum, maximum, and quartile values. The mean monthly returns were positive but not significantly different from zero across all countries. The standard deviations ranged from 3.88% in Singapore to 4.36% in Iran, reflecting low volatility in all the countries. The skewness values were generally closer to zero, confirming approximate symmetry in returns. The kurtosis values were near zero for most countries, revealing thin tails. Overall, the descriptive statistics indicated that the return series were following symmetric distribution with thin tails.

**Table 1:** Summary statistics of monthly gold returns

| Country   | Average | Std.<br>deviation | Skewness | Excess<br>kurtosis | Median | Min     | Max    | Q1      | Q3     |
|-----------|---------|-------------------|----------|--------------------|--------|---------|--------|---------|--------|
| China     | 0.0076  | 0.0425            | -0.05    | 0.20               | 0.0070 | -0.1182 | 0.1084 | -0.0205 | 0.0371 |
| India     | 0.0127  | 0.0436            | 0.17     | 0.58               | 0.0115 | -0.1051 | 0.1394 | -0.0169 | 0.0364 |
| Iran      | 0.0165  | 0.0462            | 0.25     | 0.60               | 0.0140 | -0.1157 | 0.1567 | -0.0131 | 0.0439 |
| Japan     | 0.0097  | 0.0403            | -0.27    | 0.41               | 0.0117 | -0.0934 | 0.1235 | -0.0081 | 0.0320 |
| Malaysia  | 0.0087  | 0.0407            | 0.09     | 0.33               | 0.0073 | -0.1053 | 0.1205 | -0.0143 | 0.0311 |
| Pakistan  | 0.0154  | 0.0422            | 0.08     | 0.29               | 0.0157 | -0.1156 | 0.1254 | -0.0151 | 0.0422 |
| Singapore | 0.0074  | 0.0388            | 0.12     | 0.63               | 0.0073 | -0.1100 | 0.1202 | -0.0178 | 0.0297 |
| Sri Lanka | 0.0127  | 0.0438            | -0.06    | 0.30               | 0.0104 | -0.1121 | 0.1207 | -0.0159 | 0.0425 |

The results of the diagnostic tests carried out to check the suitability of data – the ADF, JB, Ljung–Box Q, and ARCH tests – are presented in Table 2. In the ADF test of stationarity, the null hypothesis of a unit root are rejected for all the countries, as the associated  $p$ -values are below 0.05, confirming stationarity of time series for all countries. The test statistics are significantly lower than the critical values, ensuring the absence of unit roots, making the data appropriate for seasonality and volatility modelling. To test normality, the JB test was applied. The null hypothesis of normally distributed returns cannot be rejected for most

countries as the associated  $p$ -values exceed 0.05, indicating that the return series follow a normal distribution without significant skewness or excess kurtosis.

Further, the  $p$ -values associated with the Ljung–Box Q test exceed 0.05 for all the countries; therefore, the null hypothesis of no autocorrelation cannot be rejected, implying that the return series exhibit no significant serial correlation across lags. Finally, the  $p$ -values associated with the ARCH test also exceed 0.05; thus, the null hypothesis of no ARCH effects cannot be rejected, indicating that the return series do not exhibit significant conditional heteroscedasticity. In sum, the diagnostic tests indicate that all the return series are stationary and normal, exhibit white noise characteristics, and are free from conditional heteroscedasticity, making them suitable for further analysis.

**Table 2:** Robustness and diagnostic tests of gold return series

| Test      | Augmented Dickey–Fuller (ADF) |            |             | Jarque–Bera (JB) |            |            | Ljung–Box Q |            |              | ARCH test |            |              |
|-----------|-------------------------------|------------|-------------|------------------|------------|------------|-------------|------------|--------------|-----------|------------|--------------|
| Country   | Stats                         | $p$ -value | Stationary? | Stats            | $p$ -value | Normality? | Stats       | $p$ -value | White noise? | Stats     | $p$ -value | ARCH effect? |
| China     | -9.6                          | 0.001      | Yes         | 0.15             | 0.9295     | Yes        | 2.86        | 0.7209     | Yes          | 9.08      | 0.1060     | No           |
| India     | -10.4                         | 0.001      | Yes         | 1.84             | 0.3985     | Yes        | 3.33        | 0.6492     | Yes          | 6.80      | 0.2357     | No           |
| Iran      | -10.7                         | 0.001      | Yes         | 2.61             | 0.271      | Yes        | 2.64        | 0.7545     | Yes          | 3.97      | 0.5539     | No           |
| Japan     | -9.3                          | 0.000      | Yes         | 1.97             | 0.3748     | Yes        | 4.89        | 0.4290     | Yes          | 8.78      | 0.1178     | No           |
| Malaysia  | -10.5                         | 0.001      | Yes         | 0.51             | 0.7746     | Yes        | 1.50        | 0.9137     | Yes          | 2.66      | 0.7529     | No           |
| Pakistan  | -10.3                         | 0.001      | Yes         | 0.38             | 0.8256     | Yes        | 0.91        | 0.9695     | Yes          | 4.91      | 0.4275     | No           |
| Singapore | -10.1                         | 0.001      | Yes         | 1.79             | 0.4092     | Yes        | 1.88        | 0.8651     | Yes          | 4.00      | 0.5483     | No           |
| Sri Lanka | -9.7                          | 0.001      | Yes         | 0.34             | 0.8417     | Yes        | 2.91        | 0.7136     | Yes          | 4.30      | 0.5072     | No           |

## 5.2. Seasonality analysis

After ensuring robustness, the monthly seasonal coefficients, monthly averages, and monthly seasonal indices were computed to confirm seasonality. Monthly seasonal coefficients were computed by regressing monthly unadjusted gold returns on the seasonal dummy variables as given in Equation (1), whereas monthly averages were computed using Equation (2). Table 4 presents seasonal coefficients and associated  $p$ -values obtained by regressing returns series on seasonal dummies. While the Positive coefficients, such as 0.0103 for China in January indicate that the Chinese gold market, on average, experiences a 1.03 percentage point higher return than the baseline month (December: 0.36%),

negative coefficients, such as -0.0015 for China in March indicate 0.15% lower returns than the baseline value. The significance of monthly variations was assessed using ANOVA and the Kruskal–Wallis test. The results, reported in Table 3, indicate whether these monthly variations are statistically significant.

**Table 3:** Overall Seasonality (ANOVA and Kruskal–Wallis test) and significant months

| Country   | ANOVA               |                 | Kruskal–Wallis Test |                 | Significant months<br>( $p < 0.05$ ) | Highest return months<br>(coefficients) |
|-----------|---------------------|-----------------|---------------------|-----------------|--------------------------------------|-----------------------------------------|
|           | <i>F</i> -statistic | <i>p</i> -value | <i>H</i> statistic  | <i>p</i> -value |                                      |                                         |
| China     | 0.5045              | 0.9078          | 5.7001              | 0.8926          | None                                 | September and November                  |
| India     | 0.7384              | 0.7112          | 11.4926             | 0.4030          | None                                 | September and November                  |
| Iran      | 0.8407              | 0.6087          | 4.8732              | 0.9371          | None                                 | September and November                  |
| Japan     | 0.6077              | 0.8316          | 6.5182              | 0.8367          | None                                 | February, September and November        |
| Malaysia  | 0.6674              | 0.7790          | 8.5056              | 0.6674          | None                                 | September and November                  |
| Pakistan  | 0.5626              | 0.8675          | 6.7243              | 0.8210          | None                                 | September and November                  |
| Singapore | 0.6341              | 0.8089          | 6.8926              | 0.8077          | None                                 | September and November                  |
| Sri Lanka | 0.4310              | 0.9478          | 5.7013              | 0.8925          | None                                 | September and November                  |

The test results indicated that returns do not significantly differ across months for all the countries, as the associated *p*-values exceed 0.05, indicating that seasonality is not statistically significant. This also suggests the absence of strong systematic seasonal patterns in Asian gold markets. These findings contrast with the existing literature, which has reported strong calendar effects, such as the weekend effect or the January effect (Ball et al., 1982; Hoang et al., 2020). These findings support the notion that gold prices are largely driven by broader macroeconomic and financial market factors rather than predictable yearly seasonal patterns (Shiva & Sethi, 2015; Pachiyappan & Chandrakala, 2022; Vu & Hoang, 2024). The absence of statistically significant seasonality provides support for the EMH, implying that asset prices fully reflect available information, thus

weakening the case for gold as a hedge and a safe haven by eliminating the opportunities for systematic arbitrage. Investors should focus on other factors, such as financial, economic, or global events, rather than seasonal factors, for making informed decisions. Moreover, the investors who base their decisions on seasonal factors, such as cultural or festive-related events should take the weak significance of seasonality into account.

After calculating seasonal coefficients, monthly average returns (AR) and seasonal indices (SI) were computed for all sample countries. AR were computed using Equation (2), while SI were computed using Equation (3), and both are presented in Table 5. The results exhibit a clear trend, with higher positive returns towards the end of the year. A seasonal index of 1.83 represents a 0.83 increase from the average return in January in the Chinese gold market, while a seasonal index of 2.25 represents an increase of 1.25 in February. Although not statistically supported by the regression coefficients, this trend may provide an explanation for regional differences in gold consumption due to cultural and religious festivals. It may also reflect portfolio management at the fiscal year-end, or certain hedging activities carried out in response to inflationary pressures that typically intensify in the last months of the year (Arshad et al., 2023; Baur & Lucey, 2010). The discrepancy between monthly coefficients and seasonal indices may also suggest that, although gold markets do not exhibit statistically significant anomalies, there may still be economically meaningful demand patterns. Overall, the findings contribute to the literature by showing that gold returns in Asian markets are relatively stable and demand-driven.

Table 4: Monthly seasonal coefficients and significance

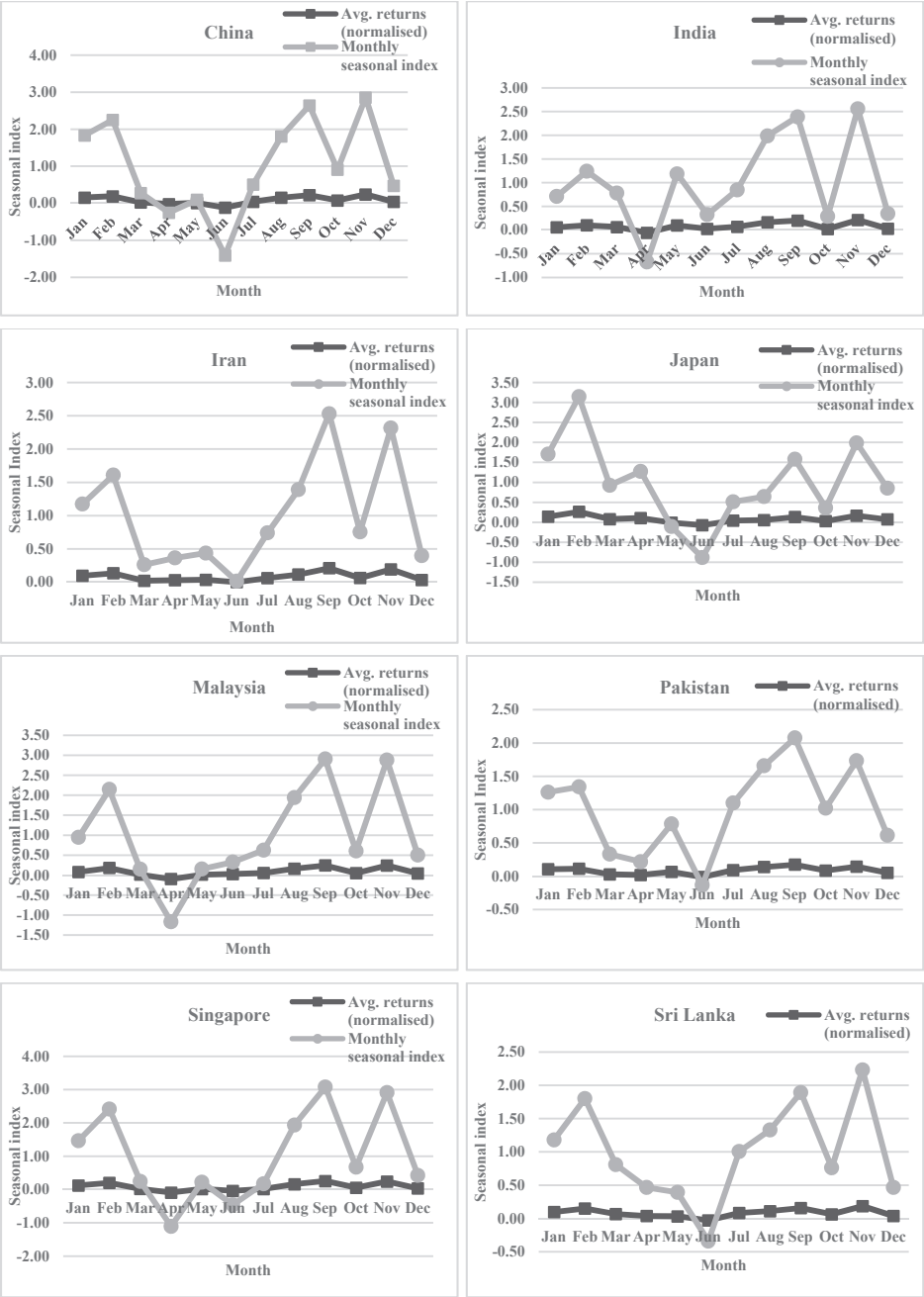
| Country   | China       |        |             | India  |             |        | Iran        |        |             | Japan  |             |        | Malaysia    |        |             | Pakistan |             |       | Singapore   |       |             | Sri Lanka |  |  |
|-----------|-------------|--------|-------------|--------|-------------|--------|-------------|--------|-------------|--------|-------------|--------|-------------|--------|-------------|----------|-------------|-------|-------------|-------|-------------|-----------|--|--|
| Month     | Coefficient | p-val  | Coefficient | p-val  | Coefficient | p-val  | Coefficient | p-val  | Coefficient | p-val  | Coefficient | p-val  | Coefficient | p-val  | Coefficient | p-val    | Coefficient | p-val | Coefficient | p-val | Coefficient | p-val     |  |  |
| January   | 0.0103      | 0.5977 | 0.0046      | 0.8148 | 0.0128      | 0.5406 | 0.0082      | 0.6559 | 0.0039      | 0.8343 | 0.0100      | 0.6069 | 0.0077      | 0.6640 | 0.0091      | 0.6525   |             |       |             |       |             |           |  |  |
| February  | 0.0135      | 0.4902 | 0.0114      | 0.5648 | 0.0200      | 0.3394 | 0.0221      | 0.2305 | 0.0144      | 0.4398 | 0.0112      | 0.5633 | 0.0147      | 0.4063 | 0.0170      | 0.4008   |             |       |             |       |             |           |  |  |
| March     | -0.0015     | 0.9391 | 0.0055      | 0.7801 | -0.0023     | 0.9138 | 0.0007      | 0.9705 | -0.0031     | 0.8681 | -0.0044     | 0.8216 | -0.0013     | 0.9396 | 0.0044      | 0.8293   |             |       |             |       |             |           |  |  |
| April     | -0.0055     | 0.7774 | -0.0130     | 0.5126 | -0.0006     | 0.9783 | 0.0040      | 0.8257 | -0.0146     | 0.4332 | -0.0061     | 0.7524 | -0.0113     | 0.5228 | 0.0000      | 1.0000   |             |       |             |       |             |           |  |  |
| May       | -0.0029     | 0.8829 | 0.0107      | 0.5889 | 0.0006      | 0.9759 | -0.0093     | 0.6141 | -0.0030     | 0.8707 | 0.0026      | 0.8926 | -0.0015     | 0.9320 | -0.0009     | 0.9628   |             |       |             |       |             |           |  |  |
| June      | -0.0143     | 0.4649 | -0.0003     | 0.9895 | -0.0063     | 0.7612 | -0.0168     | 0.3619 | -0.0015     | 0.9347 | -0.0115     | 0.5512 | -0.0066     | 0.7114 | -0.0103     | 0.6106   |             |       |             |       |             |           |  |  |
| July      | 0.0002      | 0.9898 | 0.0064      | 0.7462 | 0.0056      | 0.7873 | -0.0033     | 0.8580 | 0.0011      | 0.9531 | 0.0074      | 0.7004 | -0.0019     | 0.9163 | 0.0069      | 0.7336   |             |       |             |       |             |           |  |  |
| August    | 0.0101      | 0.6048 | 0.0209      | 0.2921 | 0.0163      | 0.4337 | -0.0021     | 0.9108 | 0.0126      | 0.4981 | 0.0160      | 0.4074 | 0.0112      | 0.5287 | 0.0110      | 0.5862   |             |       |             |       |             |           |  |  |
| September | 0.0164      | 0.4008 | 0.0260      | 0.1905 | 0.0352      | 0.0938 | 0.0070      | 0.7032 | 0.0210      | 0.2590 | 0.0225      | 0.2463 | 0.0196      | 0.2702 | 0.0182      | 0.3693   |             |       |             |       |             |           |  |  |
| October   | 0.0033      | 0.8663 | -0.0007     | 0.9718 | 0.0059      | 0.7778 | -0.0048     | 0.7958 | 0.0009      | 0.9600 | 0.0062      | 0.7473 | 0.0018      | 0.9181 | 0.0038      | 0.8526   |             |       |             |       |             |           |  |  |
| November  | 0.0180      | 0.3555 | 0.0282      | 0.1565 | 0.0316      | 0.1313 | 0.0110      | 0.5519 | 0.0208      | 0.2645 | 0.0172      | 0.3744 | 0.0183      | 0.3012 | 0.0225      | 0.2666   |             |       |             |       |             |           |  |  |
| December  | 0.0036      | 0.7939 | 0.0044      | 0.7529 | 0.0066      | 0.6542 | 0.0083      | 0.5257 | 0.0044      | 0.7397 | 0.0095      | 0.4898 | 0.0032      | 0.8007 | 0.0059      | 0.6768   |             |       |             |       |             |           |  |  |

Note: Coefficient =  $\beta_{m,c}$  is calculated using Equation (1) by regressing monthly gold returns on seasonal dummies.

Table 5: Monthly averages (normalized) and seasonal indices

| Month     | China |       |       | India |      |      | Iran  |       |       | Japan |       |       | Malaysia |       |       | Pakistan |    |    | Singapore |    |    | Sri Lanka |    |    |
|-----------|-------|-------|-------|-------|------|------|-------|-------|-------|-------|-------|-------|----------|-------|-------|----------|----|----|-----------|----|----|-----------|----|----|
| Month     | AR    | SI    | AR    | SI    | AR   | SI   | AR    | SI    | AR    | SI    | AR    | SI    | AR       | SI    | AR    | SI       | AR | SI | AR        | SI | AR | SI        | AR | SI |
| January   | 0.15  | 1.83  | 0.06  | 0.71  | 0.10 | 1.17 | 0.14  | 1.70  | 0.08  | 0.94  | 0.11  | 1.26  | 0.12     | 1.47  | 0.10  | 1.18     |    |    |           |    |    |           |    |    |
| February  | 0.19  | 2.25  | 0.10  | 1.24  | 0.13 | 1.61 | 0.26  | 3.15  | 0.18  | 2.14  | 0.11  | 1.34  | 0.20     | 2.42  | 0.15  | 1.80     |    |    |           |    |    |           |    |    |
| March     | 0.02  | 0.28  | 0.07  | 0.78  | 0.02 | 0.26 | 0.08  | 0.93  | 0.01  | 0.15  | 0.03  | 0.33  | 0.02     | 0.25  | 0.07  | 0.81     |    |    |           |    |    |           |    |    |
| April     | -0.02 | -0.25 | -0.06 | -0.67 | 0.03 | 0.37 | 0.11  | 1.27  | -0.10 | -1.17 | 0.02  | 0.22  | -0.09    | -1.10 | 0.04  | 0.47     |    |    |           |    |    |           |    |    |
| May       | 0.01  | 0.10  | 0.10  | 1.19  | 0.04 | 0.44 | -0.01 | -0.11 | 0.01  | 0.15  | 0.07  | 0.78  | 0.02     | 0.22  | 0.03  | 0.39     |    |    |           |    |    |           |    |    |
| June      | -0.12 | -1.41 | 0.03  | 0.33  | 0.00 | 0.02 | -0.07 | -0.88 | 0.03  | 0.33  | -0.01 | -0.14 | -0.04    | -0.46 | -0.03 | -0.34    |    |    |           |    |    |           |    |    |
| July      | 0.04  | 0.51  | 0.07  | 0.85  | 0.06 | 0.74 | 0.04  | 0.51  | 0.05  | 0.62  | 0.09  | 1.10  | 0.01     | 0.18  | 0.08  | 1.01     |    |    |           |    |    |           |    |    |
| August    | 0.15  | 1.81  | 0.17  | 1.99  | 0.12 | 1.39 | 0.05  | 0.64  | 0.16  | 1.94  | 0.14  | 1.66  | 0.16     | 1.94  | 0.11  | 1.33     |    |    |           |    |    |           |    |    |
| September | 0.22  | 2.64  | 0.20  | 2.39  | 0.21 | 2.53 | 0.13  | 1.58  | 0.24  | 2.91  | 0.17  | 2.08  | 0.26     | 3.08  | 0.16  | 1.89     |    |    |           |    |    |           |    |    |
| October   | 0.08  | 0.91  | 0.02  | 0.29  | 0.06 | 0.76 | 0.03  | 0.36  | 0.05  | 0.61  | 0.08  | 1.02  | 0.06     | 0.67  | 0.06  | 0.76     |    |    |           |    |    |           |    |    |
| November  | 0.24  | 2.86  | 0.21  | 2.56  | 0.19 | 2.32 | 0.17  | 1.99  | 0.24  | 2.88  | 0.14  | 1.73  | 0.24     | 2.91  | 0.19  | 2.23     |    |    |           |    |    |           |    |    |
| December  | 0.04  | 0.48  | 0.03  | 0.35  | 0.03 | 0.40 | 0.07  | 0.85  | 0.04  | 0.50  | 0.05  | 0.61  | 0.04     | 0.43  | 0.04  | 0.47     |    |    |           |    |    |           |    |    |

**Figure 2: Monthly average returns (normalised) and seasonal indices**



The trend of monthly averages and seasonal indices in Figure 2 indicates that gold returns increase progressively from August to February in all countries, with the peak seasonal effects consistently observed from September to December. While September displays higher positive returns, November consistently exhibits the highest returns across all sample countries, thereby supporting prior findings, specifically those of Baur (2013). December, January, and February also show elevated returns in most cases, though slightly less consistently than September and November. The return series experience decreased or negative returns between March and June in most countries. Low or negative returns in specific months imply that investors face increased uncertainty, market corrections, or systematic external shocks, such as macroeconomic cycles, monetary policy shifts, or global demand slumps.

The year-end positive trend reflects localised seasonality or increased demand due to cultural festivals and wedding season across Asian markets, which may differ from Western economies. This may also imply that investors tend to invest more in the final months of the year, supporting the year-end anomaly or the September and November effect of gold. This may also imply that investors and portfolio managers engage in “window dressing” practices at the end of the year. Higher returns at year-end indicate the presence of seasonal anomaly that can be exploited by investors. However, this seasonality is not statistically significant, leading to the conclusion that Asian gold markets are relatively efficient. This efficiency further implies that gold’s role as a hedge and a safe haven is weak in these markets, as asset prices fully reflect all available information, making it difficult to rule out risk and largely eliminating the opportunities for arbitrage. Some countries, such as Japan, exhibit positive returns in September and November; however, the highest returns occur in February, followed by November, January, and September. This discrepancy in returns contradicts the findings of Baur (2013), who suggested that the highest returns occur in September and November. Overall, all the markets experience positive returns between August and February, which turn negative between April and June. Practically, these findings have implications for investors and portfolio managers, highlighting the need for active risk management strategies, such as hedging and diversification. Taken together, the findings suggest that theories developed in Western contexts, such as the autumn effect of gold, are observable in Asia but

the evidence is weak, emphasizing the importance of localised analysis for investment and policy-related decisions.

### **5.3. GARCH modelling and volatility forecasting**

Volatility in returns was estimated by employing a baseline GARCH(1,1) model over the next eighteen terms (from January 2023 to June 2024). Before applying the GARCH model, the return series were tested for stationarity, normality, white noise, and ARCH effects. The descriptive statistics, presented in Table 1, indicate that the sample average is approximately zero, and the standard deviation is equal to 1. The skewness and kurtosis are approaching their expected values, which indicates a Gaussian normal distribution. The diagnostic checks, presented in Table 2, confirmed the stationarity, absence of serial correlation, and adequacy of the model for forecasting volatility in the gold market of all the sample countries. After conducting a suitability analysis, the GARCH modelling was used to forecast volatility using Equations (4) to (8).

The GARCH modelling results, provided in Table 6, reveal that forecasted volatility, measured in terms of percentage ( $STD = \sigma_t, \%$ ), decreases in some countries – namely China, India, Iran, Pakistan, and Sri Lanka, while increasing in others – namely Japan, Malaysia, and Singapore. However, volatility persistence, measured by  $(\alpha_1 + \beta_1)$ , ranges from 0.05 in Iran to 0.21 in China. These low persistence values provide very limited evidence of long-lasting volatility clustering, implying that shocks to gold returns in Asian markets dissipate quickly. These findings contrast with those of other financial markets where bond, stock, and energy markets experience deep market integration and stronger speculation, indicating volatility spillovers and longer memory effects (Engle, 2001; Li & Umair, 2023; Singh et al., 2026; Vu & Hoang, 2024).

The evidence for low volatility persistence suggests that the gold returns in the selected markets exhibit relatively stable and less vulnerable behaviour. This aligns with the findings that in certain asset classes, such as precious metals, volatility persistence is short-lived, often driven by episodic geopolitical or macroeconomic events (Arshad et al., 2023). Furthermore, the lower persistence also implies that Asian gold markets may offer a natural hedge for investors with quick volatility adjustments (relatively efficient), unlike equity or energy markets, where volatility persists over longer periods (Husain, 1998; Shukla & Katiyar,

2023). The findings also imply that gold in Asian markets is prone to fast changes and may provide less protection against risk. Investors, therefore, should explore other strategies for managing risk, such as diversification or active management. They should also include assets of varying volatility when selecting assets for their portfolios.

Figure 3 offers a visual display of forecasted volatility for each country separately, while Figure 4 provides a comparative view of the estimated volatility across countries. STD represents standard deviation measured in percentages, while TS represents term structure, defined as the cumulative standard deviation. Together, these results indicate that Asian gold markets are relatively stable, efficient, and free from significant seasonal differences. The absence of significant seasonal patterns reduces the opportunities for systematic arbitrage, while the low volatility persistence suggests gold volatility remains resilient to clustering for longer periods. The results imply that gold's role as a hedge and a safe haven is weaker in emerging Asian markets. The dynamics of gold are shaped by local and institutional factors rather than global financial cycles, emphasising the need for contextual studies.

**Table 6:** GARCH modelling and volatility forecasting

| Country   | $\mu$<br>(mean<br>return) | Constant<br>( $\alpha_0$ ) | ARCH<br>( $\alpha_1$ ) | GARCH<br>( $\beta_1$ ) | Volatility<br>persistence<br>score<br>( $\alpha_1 + \beta_1$ ) | LLF    | AIC     | Convergence<br>(Check = 1) | Forecasted<br>volatility STD<br>range (18M) | Volatility<br>persistence<br>remarks | Market behaviour      | Country rank based on<br>volatility persistence score |
|-----------|---------------------------|----------------------------|------------------------|------------------------|----------------------------------------------------------------|--------|---------|----------------------------|---------------------------------------------|--------------------------------------|-----------------------|-------------------------------------------------------|
| China     | 0.0076                    | 0.0015                     | 0.1054                 | 0.1054                 | 0.2107                                                         | 210.24 | -414.47 | 1                          | 4.41% $\rightarrow$ 4.32%                   | Low                                  | Shocks short-lived    | 8                                                     |
| India     | 0.0127                    | 0.0017                     | 0.0939                 | 0.0939                 | 0.1879                                                         | 206.31 | -406.62 | 1                          | 4.76% $\rightarrow$ 4.55%                   | Low                                  | Shocks short-lived    | 7                                                     |
| Iran      | 0.0165                    | 0.0021                     | 0.0580                 | 0.0580                 | 0.1161                                                         | 199.11 | -392.23 | 1                          | 5.11% $\rightarrow$ 4.91%                   | Low                                  | Shocks short-lived    | 3                                                     |
| Japan     | 0.0097                    | 0.0016                     | 0.0273                 | 0.0273                 | 0.0547                                                         | 215.23 | -424.46 | 1                          | 4.09% $\rightarrow$ 4.14%                   | Very Low                             | Explosive Volatility  | 1                                                     |
| Malaysia  | 0.0087                    | 0.0015                     | 0.0554                 | 0.0554                 | 0.1108                                                         | 214.10 | -422.20 | 1                          | 4.12% $\rightarrow$ 4.17%                   | Low                                  | Persistent volatility | 2                                                     |
| Pakistan  | 0.0154                    | 0.0017                     | 0.0786                 | 0.0786                 | 0.1572                                                         | 209.97 | -413.93 | 1                          | 4.63% $\rightarrow$ 4.50%                   | Low                                  | Shocks short-lived    | 6                                                     |
| Singapore | 0.0074                    | 0.0013                     | 0.0702                 | 0.0702                 | 0.1405                                                         | 220.34 | -434.68 | 1                          | 3.94% $\rightarrow$ 3.95%                   | Low                                  | Shocks short-lived    | 4                                                     |
| Sri Lanka | 0.0127                    | 0.0018                     | 0.0704                 | 0.0704                 | 0.1408                                                         | 205.52 | -405.05 | 1                          | 4.63% $\rightarrow$ 4.56%                   | Low                                  | Shocks short-lived    | 5                                                     |

Figure 3: Volatility forecasts for individual countries

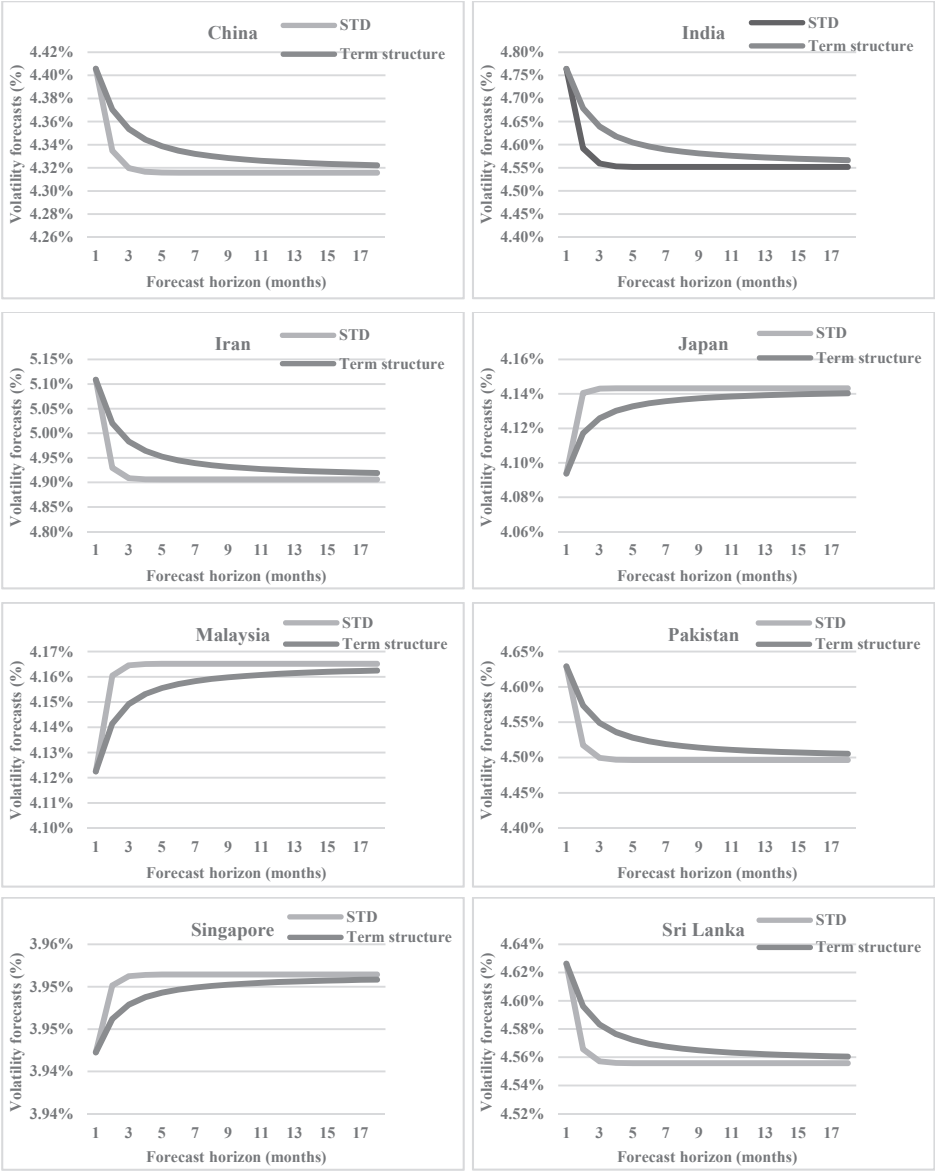
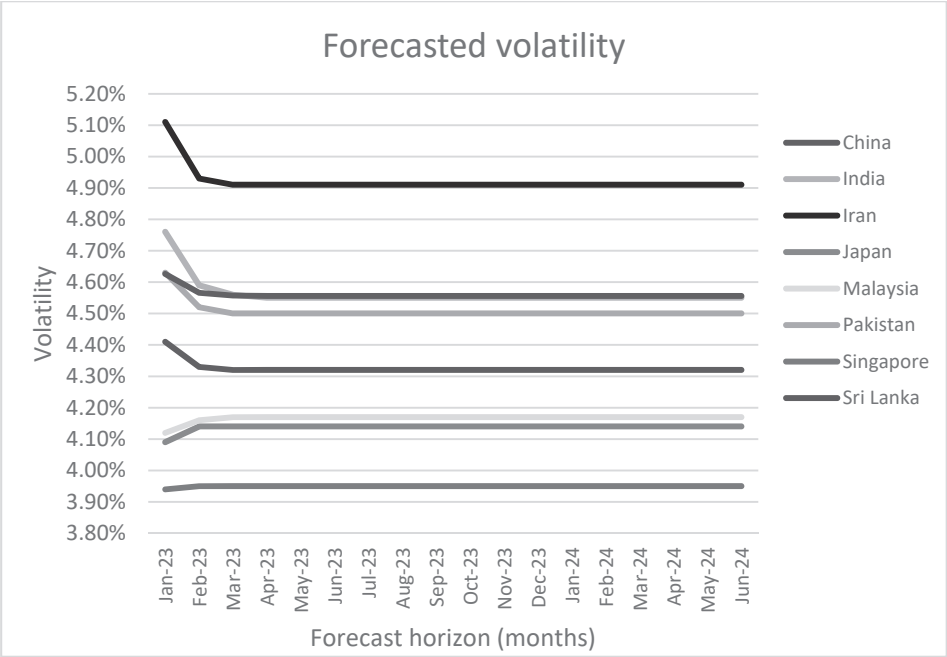


**Figure 4:** Volatility forecasts for all countries



**6. CONCLUSION**

This study examined the seasonal patterns and volatility dynamics of gold returns in selected Asian countries – China, India, Iran, Japan, Malaysia, Pakistan, Singapore, and Sri Lanka – over the 10 years from 2013 to 2022. It further estimated volatility for the 18 terms from January 2023 to June 2024. It aimed to address three interrelated research questions: first, whether gold returns in Asian markets exhibit statistically significant seasonal anomalies across months; second, which specific months yield abnormal returns and whether these anomalies align with cultural or economic events; and third, how volatility behaves across Asian gold markets. By addressing these questions, the study contributes an evidence-based gold market narrative in the context of Asia, a region underrepresented in gold market research.

The descriptive statistics and diagnostic tests were conducted to confirm stationarity, normality, white noise, and ARCH effects. The stationarity was checked through the augmented Dickey–Fuller test, which confirmed the stability

of mean and variance across time. The normality was confirmed through the Jarque–Bera test, which suggested that the return series follow a normal distribution in all markets. The summary statistics indicated that the return series possess white noise, confirming the randomness and lack of serial correlations among returns. Further, Ljung–Box Q and ARCH-LM tests also confirmed the absence of autocorrelation and heteroscedasticity at the residual level. Overall, the diagnostic tests confirmed that all the return series are stationary, normal, and free from serial correlation and autocorrelation, providing a strong foundation for examining seasonality and forecasting volatility in gold returns.

For the examination of seasonality, a combination of parametric (ANOVA) and non-parametric (Kruskal–Wallis) approaches was employed to determine the significance of differences in mean returns across months. The results from both tests revealed the absence of strong systematic seasonal effects, confirming that the differences in mean returns were not statistically significant. This finding contradicts the existing literature, which reports the existence of strong calendar effects, such as the weekend effect or the January effect (Ball et al., 1982; Hoang et al., 2020). Non-significant seasonality implies that asset prices fully reflect available information, thus supporting the efficient market hypothesis and largely eliminating opportunities for systematic arbitrage. The investor should therefore discount the importance of seasonal factors and instead place greater emphasis on financial and economic factors when making investment decisions.

While the monthly coefficient revealed seasonal patterns that were not statistically significant, monthly averages and seasonal indices showed subtle patterns, indicating that gold returns consistently demonstrated positive behaviour from the end of the year into the early months, from August to February, with the highest values in September and November. This pattern reflects localised seasonality or increased demand due to cultural practices, festivals, wedding traditions, risk management or window-dressing practices in the final months of the year, thereby supporting the year-end anomaly or the September and November effect of gold. This finding showed that the theories developed for Western contexts, such as the autumn effect of gold, are observable in Asia but with weak evidence, emphasising the importance of localised analysis for investment and policy-related decisions. Volatility was estimated by employing a baseline GARCH(1,1) specification, as this produced the best-fitting

AIC (lowest) and LLF (highest) values, reinforcing its appropriateness for estimating volatility in gold returns. The results indicated that volatility in gold returns differs across countries, with Iran, Japan, and Malaysia exhibiting increasing volatility, while others demonstrating moderate to declining trends. The estimated persistence of volatility, as measured through the sum of  $\alpha$  (ARCH effect) and  $\beta$  (GARCH effect), ranges from a minimum of 5.47% for Japan to a maximum of 21.07% for China, indicating that volatility shocks in Asian gold markets dissipate quickly rather than clustering for long durations. In other words, sudden shocks in gold returns due to macroeconomic cycles, global events, local market disturbances, or investment sentiments are short-lived and dissipate in a short time, supporting the EMH. This finding contrasts with the previous literature on equity markets, which reports higher persistence, with  $(\alpha_1 + \beta_1)$  approaching unity, and volatility clustering for longer periods (Engle, 2001; Husain, 1998; Li & Umair, 2023; Shukla & Katiyar, 2023; Singh et al., 2026). This efficiency also weakens gold's role as a hedge and a safe-haven asset, as its volatility is less predictable and more prone to rapid changes. Investors, therefore, should explore other strategies, such as diversification or active management for managing risk. When selecting assets for their portfolios, they should include assets of varying volatility. Overall, the results underscore that while returns may follow predictable seasonal trends, underlying volatility dynamics vary across markets, emphasising the importance of localised analysis for investment and policy decisions.

While this study provides useful insights, it has certain limitations. First, the study sample is confined to eight Asian countries. Future research may extend the analysis to include other Asian, Western or African countries to broaden the scope of the study and provide cross-regional comparisons. Second, the analysis employs 10 years of monthly data from 2013 to 2022. Future studies may consider higher-frequency data, such as daily or weekly returns, to capture short-term variations and evaluate intra-month patterns, which may be especially relevant during periods of heightened demand, such as macroeconomic instability, religious festivals, or wedding seasons. Third, the study broadly discusses seasonality and variability in gold returns without considering the effects of macroeconomic, geopolitical, or behavioural drivers of gold prices, such as inflation, exchange rates, and investor sentiment, which could substantially reduce its explanatory depth. Future researchers could integrate macroeconomic

indicators into the seasonality and volatility framework. Finally, the methodological approach is restricted to the baseline GARCH(1,1) model, which, although widely used and well-established for modelling volatility clustering, has limited ability to capture more complex features, such as asymmetry, leverage effects, or regime shifts in volatility. Future researchers may employ asymmetric GARCH-family models, such as EGARCH and TGARCH, to improve forecasting accuracy. Collectively, these limitations underscore the need for caution in interpreting the results and defining future research agendas.

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## EU-UKRAINE TRADE DYNAMICS: CASE STUDY OF EXPORT PROSPECTS IN SELECTED EU ECONOMIES

**ABSTRACT:** *The article investigates recent developments in trade relations between the European Union (EU) and Ukraine, emphasising the impact of geopolitical tensions, including Russia's military aggression. It focuses on analysing the dynamics of trade intensity and assessing export opportunities for Ukraine's main EU trading partners. Using data from 2013 to 2023, the study applies the trade intensity index and export potential indicator to assess bilateral trade flows and uncover untapped opportunities. It highlights the transformative role of the EU-Ukraine Association Agreement and the Deep and Comprehensive Free Trade Area (DCFTA) in fostering economic integration, despite challenges such as corruption and*

*geopolitical instability. The findings confirmed that Ukraine's trade intensity with the EU was higher than that of the EU with Ukraine during the analysed period. Additionally, in 2023, the export potential of EU countries to Ukraine was concentrated in high-value-added commodities, including machinery, motor vehicles, and pharmaceutical products. The analysis identified Poland and Bulgaria as countries with the highest trade intensity with Ukraine in 2022, while Germany showed the greatest untapped export potential in absolute terms.*

**KEY WORDS:** *Ukraine, EU, trade intensity, export potential*

**JEL CLASSIFICATION:** F10, F15, F19

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## **INTRODUCTION**

Trade cooperation between the European Union (EU) and Ukraine has evolved significantly over the past decades, driven by Ukraine's strategic goal of European integration and the EU's support for Ukraine's political and economic reforms. This article examines key developments and challenges in the trade cooperation between Ukraine and the EU, focusing on trade intensity and export potential with selected EU countries.

Ukraine's ambition to integrate with Europe dates to the early 1990s, following its independence in 1991. The foundation for official cooperation with the EU was laid by the Partnership and Cooperation Agreement (PCA) in 1994, which provided a legal basis for collaboration across political, trade, and economic domains (Holovko & Vodolaskova, 2022). This agreement served as a stepping stone for future arrangements aimed at closer integration.

A major development occurred in 2014 with the signing of the Association Agreement (AA), which pursued both political alignment and economic integration. A key component of the agreement was the creation of the Deep and Comprehensive Free Trade Area (DCFTA). The implementation of the AA was supported by the EU–Ukraine Association Agenda, which defined essential reform areas and policy priorities (Rozmaritsyna, 2023).

The trade relationship between Ukraine and the EU has seen significant changes, especially after the AA's implementation. Ukraine's exports to the EU have increasingly consisted of agricultural products, metals, and machinery, while imports from the EU mainly include machinery, chemicals, and consumer goods. This trade pattern highlights Ukraine's role as a supplier of raw materials and intermediate goods, while importing high-value-added products from the EU. The AA and DCFTA have facilitated greater market access for Ukrainian products in the EU and vice versa. The EU's share in Ukraine's total exports and imports has grown steadily, underscoring the EU's importance as Ukraine's largest trade partner (Antoniuk et al., 2021). Despite this, the trade balance has often been negative for Ukraine, primarily due to high imports of EU products.

An essential component of Ukraine's trade integration with the EU lies in the alignment of its legal and regulatory framework with EU standards. This

harmonisation is fundamental to facilitating the free flow of goods and services, while also enhancing the competitiveness of Ukrainian exports within the EU market (Holovko & Vodolaskova, 2022). The process includes the adoption of EU rules in areas such as technical regulation, sanitary and phytosanitary standards, and intellectual property protection. These efforts form part of a broader reform agenda aimed at improving the investment climate, encouraging foreign direct investment, and fostering long-term economic development.

Despite significant progress, several challenges remain. The ongoing war in the country poses severe obstacles to Ukraine's economic stability and European aspirations. Additionally, the internal challenges of corruption, economic crime, and the need for experienced specialists in European integration hinder the full realisation of the AA's benefits. The future of Ukraine–EU trade cooperation depends on sustained reform efforts in Ukraine, continued support from the EU, and the broader geopolitical context. The EU's commitment to supporting Ukraine's sovereignty and territorial integrity, coupled with efforts to deepen economic ties, will be critical in navigating these challenges (Börzel, 2023).

This study examines how geopolitical challenges and institutional reforms have shaped EU–Ukraine trade relations over the past decade. It explores both the dynamics of trade intensity and the unrealised export potential of Ukraine's main EU partners. The analysis finds that Ukraine's exports to the EU have shown higher trade intensity than in the reverse direction, while the EU's untapped export capacity is concentrated in high-value-added sectors such as machinery, motor vehicles, and pharmaceuticals. The remainder of the paper provides an overview of recent EU–Ukraine trade developments, reviews the relevant literature, describes the research design and data, presents the empirical findings, and concludes with policy implications for deepening EU–Ukraine economic integration.

## **EU-UKRAINE TRADE RELATIONS: BACKGROUND AND RECENT DEVELOPMENTS**

The trade relationship between the EU and Ukraine has evolved over decades, shaped by historical, geopolitical, and economic forces and by both parties' shared aspirations for integration. The signing of the EU–Ukraine Association Agreement in 2014 marked a turning point in their bilateral relations. It

established a framework for enhanced political and economic cooperation and initiated Ukraine's gradual alignment with the EU single market. The agreement reinforced both parties' commitment to shared values, institutional convergence and the liberalisation of trade.

Nevertheless, the development of trade relations has been heavily affected by geopolitical disruptions. The annexation of Crimea in 2014, the ongoing conflict in Eastern Ukraine, and the large-scale invasion by Russia in 2022 have profoundly destabilised the economic context. In response, the EU has reiterated its support for Ukraine's sovereignty and has intensified its economic engagement within the broader framework of assistance and solidarity.

Darvas et al. (2023) examined the challenges affecting foreign and grain trade between the EU and Ukraine during the conflict. Following the war's outbreak, the EU suspended all import duties on Ukrainian goods and removed anti-dumping duties on Ukrainian metal products imposed during a prior trade dispute. However, as the commodity structure in Table 4 shows, this liberalisation did not translate into higher metal exports. The removal of duties was more than offset by a severe supply-side shock, as the wartime destruction of Ukraine's metallurgical capacity sharply reduced the volume of iron and steel available for export.

Additionally, the EU introduced Solidarity Lanes to facilitate Ukrainian food exports. Initially designed to ensure Ukrainian grain reached global markets, these routes led to domestic challenges in some EU member states. Low food prices prompted Poland, Bulgaria, Hungary, and Slovakia to restrict imports of Ukrainian products after protests from local farmers unable to sell their crops.

These unilateral embargoes were lifted following an agreement on April 28, 2023, involving these four countries and Romania. The agreement reinstated Solidarity Lanes for the transit of Ukrainian wheat, maize, rapeseed, and sunflower seeds through these states but restricted their free circulation within the five countries. To mitigate the impact on local farmers, the European Commission allocated €100 million from the 2023 agricultural reserve as compensation for farmers in these Member States.

Tables 1 and 2 show that the position of the EU as a trading partner of Ukraine has strengthened in recent years, while the share of CIS (Commonwealth of Independent States) countries has decreased.

**Table 1:** Export of goods from Ukraine to the world (2021 and 2023)

| Territory   | Value (USD bn.),<br>2021 | Share (%) | Value (USD bn.),<br>2023 | Share (%) |
|-------------|--------------------------|-----------|--------------------------|-----------|
| World       | 68.072                   | 100%      | 36.174                   | 100%      |
| Poland      | 5.227                    | 8%        | 4.758                    | 13%       |
| Romania     | 1.543                    | 2%        | 3.764                    | 10%       |
| China       | 8.003                    | 12%       | 2.406                    | 7%        |
| Turkey      | 4.142                    | 6%        | 2.368                    | 7%        |
| Germany     | 2.866                    | 4%        | 2.019                    | 6%        |
| Spain       | 1.677                    | 2%        | 2.008                    | 6%        |
| Italy       | 3.471                    | 5%        | 1.537                    | 4%        |
| Netherlands | 2.262                    | 3%        | 1.490                    | 4%        |
| Hungary     | 1.622                    | 2%        | 1.184                    | 3%        |
| Egypt       | 1.944                    | 3%        | 1.085                    | 3%        |
| Others      | 35.315                   | 51%       | 13.555                   | 37%       |

**Source:** Own preparation based on ITC (2024) data

Table 1 illustrates the structural shift of Ukraine's exports toward EU markets, with the EU share among the top ten destinations rising from 27% in 2021 to 46% in 2023. This highlights the EU's growing importance as Ukraine's key trading partner, particularly due to reorientation following the war and the disruption of trade with China and the CIS region.

Table 2 presents the import of goods to Ukraine from its major trading partners in 2021 and 2023. Overall, the structure of Ukraine's imports remained relatively stable, though notable shifts occurred in the composition of key partners. The strongest growth in import values came from Central and Eastern European countries, particularly Poland, Bulgaria, and the Czech Republic, whose expanded trade reflects both logistical proximity and strong political support for Ukraine during wartime conditions. The inclusion of several new partners, such as India and the United States, further indicates a gradual diversification of

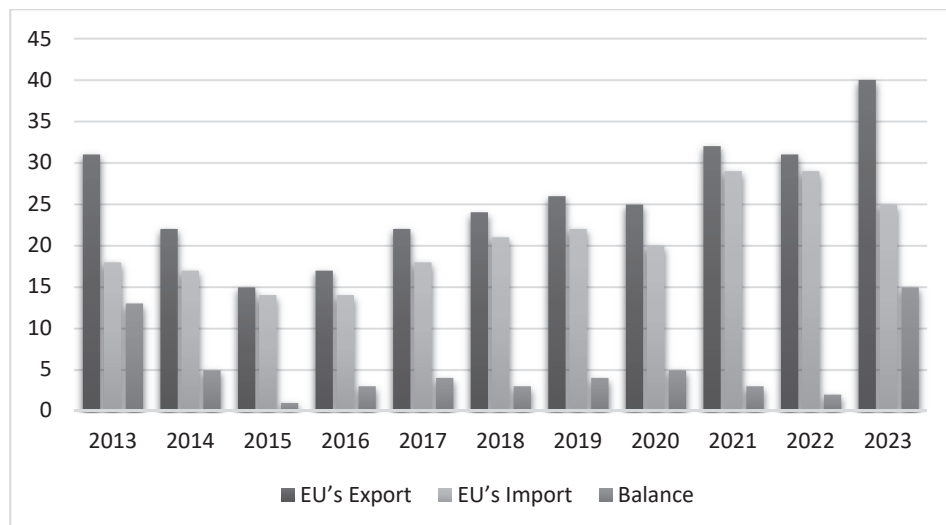
Ukraine's import structure and its increasing integration into global supply chains.

**Table 2:** Import of goods from the world to Ukraine (2021 and 2023)

| <b>Territory</b> | <b>Value (USD bn.),<br/>2021</b> | <b>Share (%)</b> | <b>Value (USD bn.),<br/>2023</b> | <b>Share (%)</b> |
|------------------|----------------------------------|------------------|----------------------------------|------------------|
| World            | 72.842                           | 100%             | 63.561                           | 100%             |
| China            | 10.981                           | 15%              | 10.441                           | 16%              |
| Poland           | 4.962                            | 7%               | 6.577                            | 10%              |
| Germany          | 6.284                            | 9%               | 5.061                            | 8%               |
| Turkey           | 3.260                            | 4%               | 4.722                            | 7%               |
| USA              | 3.337                            | 5%               | 2.866                            | 5%               |
| Italy            | 2.678                            | 4%               | 2.280                            | 4%               |
| Bulgaria         | 0.542                            | 1%               | 2.221                            | 3%               |
| India            | 0.961                            | 1%               | 1.882                            | 3%               |
| Czech Republic   | 1.480                            | 2%               | 1.789                            | 3%               |
| France           | 1.765                            | 2%               | 1.759                            | 3%               |
| Others           | 36.595                           | 50%              | 23.963                           | 38%              |

**Source:** Own preparation based on ITC (2024) data

Figure 1 presents an overview of goods traded between Ukraine and the EU. Since 2014, all data used in this analysis exclude the temporarily occupied territories of the Autonomous Republic of Crimea, Sevastopol and parts of the Donetsk and Luhansk regions.

**Figure 1:** EU trade in goods with Ukraine (2013–2023, USD billion)

**Source:** Own preparation based on ITC (2024) data

Due to strained political and economic relations with the Russian Federation and challenges within the CIS free trade area, Ukraine has increasingly deepened its ties with the EU. Foreign trade between Ukraine and the EU has demonstrated an overall upward trend, with data from the past 15 years pointing to a clear strengthening of bilateral trade relations.

However, in 2009 and 2015, according to the International Trade Centre (ITC, 2024), foreign trade between Ukraine and the EU experienced a sharp decline. The delayed effects of the global economic crisis of 2008 affected the Ukrainian economy in 2009, when exports to the EU fell by almost half compared to the previous year. Trade continued to grow until 2014, when the Russian Federation's aggression took the form of the annexation of Crimea and the beginning of the armed conflict in eastern Ukraine. As a result, in 2015 the volume of trade with the EU decreased by almost 25% compared to the previous year (ITC, 2024). In the following years, trade between Ukraine and EU member states tended to increase. Despite the outbreak of war, at the beginning of 2022, the level of exports from the EU to Ukraine did not change significantly, while imports from Ukraine remained at the same level.

According to the ITC, Ukraine's goods exports to the EU have nearly tripled over the past 16 years. In 2005, exports were USD 10 billion, rising to a record USD 26 billion in 2021 (ITC, 2024). This growth was driven by a strong Ukraine–Europe relationship, leading to open borders, duty-free access for most Ukrainian goods to one of the world's strongest markets, equal economic competition conditions, and increased cooperation with European companies. Additionally, higher demand for Ukrainian products, including in third-country markets, resulted from adopting European standards. In 2023, EU exports to Ukraine reached a record USD 40 billion, primarily due to the ongoing war in Ukraine and increased exports of heavy industry and weapons since 2022.

Table 3 shows the commodity structure of EU goods exported to Ukraine in 2021 and 2023. The years 2021 and 2023 were chosen as comparative years because 2021 showed high values of exported goods as part of the post-COVID economic recovery, and that there was no conflict in the whole of Ukraine that year.

**Table 3:** Export of goods from the EU to Ukraine (2021 and 2023)

| HS2 | Commodity                                                                                            | Value<br>(USD<br>bn.),<br>2021 | Share<br>(%) | Value<br>(USD<br>bn.),<br>2023 | Share<br>(%) |
|-----|------------------------------------------------------------------------------------------------------|--------------------------------|--------------|--------------------------------|--------------|
|     | TOTAL                                                                                                | 32.548                         | 100%         | 40.696                         | 100%         |
| 27  | Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral . . . | 3.086                          | 9.48         | 6.986                          | 17.16        |
| 87  | Vehicles other than railway or tramway rolling stock, and parts and accessories thereof              | 3.242                          | 9.96         | 4.188                          | 10.29        |
| 84  | Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof                        | 4.746                          | 14.58        | 3.802                          | 9.34         |
| 85  | Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television... | 3.036                          | 9.32         | 3.747                          | 9.02         |
| 99  | Commodities not elsewhere specified                                                                  | 0.218                          | 0.67         | 2.114                          | 5.19         |
| 93  | Arms and ammunition; parts and accessories thereof                                                   | 0.052                          | 0.16         | 1.806                          | 4.43         |
|     | Other commodities                                                                                    | 18.165                         | 55.80        | 18.049                         | 44.35        |

**Source:** Own preparation based on ITC (2024) data

In contrast, 2023 represents the second year of the war, during which both the Ukrainian and EU economies had to adapt to exceptional geopolitical and logistical conditions. Despite these challenges, the overall composition of EU exports to Ukraine remained relatively stable, with only moderate structural changes compared to the pre-war period. The most notable increases were observed in categories related to defence and unspecified industrial goods, reflecting wartime needs and emergency assistance flows. This stability suggests that EU-Ukraine trade relations have shown considerable resilience, even amid ongoing conflict and market disruptions.

**Table 4:** Import of goods from Ukraine to EU (2021 and 2023)

| HS2 | Commodity                                                                                             | Value<br>(USD<br>bn.),<br>2021 | Share<br>(%) | Value<br>(USD<br>bn.),<br>2023 | Share<br>(%) |
|-----|-------------------------------------------------------------------------------------------------------|--------------------------------|--------------|--------------------------------|--------------|
|     | TOTAL                                                                                                 | 29.814                         | 100%         | 25.313                         | 100%         |
| 10  | Cereals                                                                                               | 2.076                          | 6.96         | 5.455                          | 21.55        |
| 15  | Animal, vegetable or microbial fats and oils and their cleavage products; prepared edible fats...     | 2.491                          | 8.35         | 2.344                          | 9.26         |
| 12  | Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal ...   | 1.926                          | 6.46         | 2.327                          | 9.19         |
| 26  | Ores, slag and ash                                                                                    | 3.604                          | 12.08        | 2.091                          | 8.26         |
| 72  | Iron and steel                                                                                        | 6.067                          | 20.35        | 1.979                          | 7.81         |
| 85  | Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television ... | 2.602                          | 8.73         | 1.830                          | 7.23         |
|     | Other commodities                                                                                     | 11.045                         | 37.04        | 9.285                          | 36.67        |

**Source:** Own preparation based on ITC (2024) data

The commodity structure of imports from Ukraine to the EU in 2021 and 2023 (Table 4) highlights the continued dominance of agricultural products in Ukraine's export profile. Cereals remained the leading export group, with their share increasing significantly due to the blockade of Ukrainian seaports and the subsequent redirection of grain exports via the EU's Solidarity Lanes initiative

(Darvas et al., 2023). Other key categories, such as fats, oils, and oilseeds, also underline the central role of the agri-food sector in Ukraine's trade with the EU. In addition to these, raw materials and intermediate goods – such as ores, steel, and electrical machinery – continue to form a substantial portion of Ukraine's exports, reflecting the structural characteristics of its export economy (ITC, 2024). The import structure from Ukraine to the EU primarily comprised raw materials and semi-finished products, reflecting the persistent legacy of the past rather than the impact of the Association Agreement or the reorientation of Ukraine's economy towards EU markets. However, due to economic integration with the EU, there is a noticeable trend of increasing exports of finished products, accompanied by a decline in sales of raw materials and semi-finished products (Ministry of Economy of Ukraine, 2023).

A particularly notable development in Table 4 is the sharp decline in iron and steel (HS 72), whose share in Ukraine's exports to the EU fell from 20.35% in 2021 to 7.81% in 2023, together with a contraction in ores, slag and ash (HS 26). At first glance this appears counter-intuitive, since following the outbreak of the war the EU removed the anti-dumping duties previously imposed on Ukrainian metal products (Darvas et al., 2023) – a measure that would normally be expected to stimulate exports. The decline is, however, explained not by trade-policy conditions but by a severe supply-side shock. Russia's full-scale invasion destroyed or led to the occupation of Ukraine's two largest integrated steelworks, Azovstal and Illich in Mariupol, which together accounted for roughly 38–40% of national steelmaking capacity, while the loss of Black Sea port access, damage to energy infrastructure, and the disruption of Donbas coking-coal supplies further curtailed output. As a result, Ukraine's crude steel production fell from approximately 21 million tonnes in 2021 to around 6.2 million tonnes in 2023, and the value of iron and steel exports contracted by roughly 70% (Tahmisoglu, 2025). In other words, the removal of EU trade barriers could not offset the physical collapse of Ukraine's metallurgical production capacity, which explains why iron and steel exports to the EU declined in both absolute and relative terms despite more favourable market-access conditions.

## **LITERATURE REVIEW**

Trade relations between the EU and Ukraine have evolved considerably, particularly following the implementation of the AA and the DCFTA. This

framework not only contributed to growing trade volumes but also stimulated important domestic reforms in Ukraine aimed at aligning national standards with EU regulations. According to Dimitrova and Dragneva (2023), “Ukraine has not influenced the EU *acquis* through the AA/DCFTA framework; instead, the EU has innovated its policies to support the agreement” (p. 1457). These policy adaptations, shaped by asymmetry, politicisation and geopolitics, enabled the agreement’s operationalisation. Russia’s full-scale invasion in 2022 further accelerated EU engagement, culminating in the granting of candidate status to Ukraine in June 2022. While the long-term impact of these strategic shifts remains uncertain, political developments – particularly the leadership change in 2019 – have played a key role in advancing bilateral cooperation. President Volodymyr Zelenskyy’s commitment to European and Euro-Atlantic integration has reinforced Ukraine’s strategic direction towards EU integration, despite the challenges posed by Russian aggression (Singh, 2023, pp. 83–120). Solodkovska and Onoprienko (2019) calculated the EU–Ukraine trade complementarity index, highlighting the potential for sustained growth in export-import relations between the two regions. Redko and Tkachenko (2021) observed a clear trend of deindustrialisation within Ukraine’s export structure, accompanied by an increasing focus on agricultural specialisation. In contrast, Rabinovych (2022) assessed the effectiveness of the broader EU–Ukraine trade agenda, including the implementation of the DCFTA, complementary unilateral support measures from the EU, and the potential for Ukraine’s gradual integration into the EU single market. The EU–Ukraine “deep” trade programme has been assessed as moderately effective, with the main challenges linked to corruption, weak rule of law, and the significant influence of oligarchs. The programme has had a diverse impact on Ukraine, spanning trade, economy, sustainable development, law, and politics. While trade liberalisation between the EU and Ukraine has substantially increased the EU’s share in Ukrainian exports and imports, Ukraine continues to face adverse economic effects from its abrupt pivot away from Russian and CIS markets toward Western markets. Dukhnytskyi (2023) highlights this transition, focusing on its effects on agricultural and food trade, with notable growth in exports and imports between Ukraine and the United Kingdom, reflecting broader trends in Ukraine’s trade with European countries. Yermak et al. (2022) further underscore that despite challenges, such as inflation and rising energy costs, EU–Ukraine foreign trade cooperation has been bolstered by agricultural imports. While the EU’s reliance on imports from the USA and China has

increased, the trade relationship with Ukraine has demonstrated resilience and growth.

However, EU–Ukraine trade cooperation has faced several challenges, primarily due to the geopolitical instability caused by the ongoing war with Russia. This has resulted in economic slowdowns, high inflation, and a challenging investment climate, as noted by Khaietska (2021). These factors have significantly deterred investment and hampered the ambitions of Ukrainian exporters. The adaptation to EU standards and overcoming non-tariff barriers remain substantial hurdles, requiring further intensification of modernisation efforts. Dnistrian and Erfan (2022) emphasise the importance of concluding new free trade agreements and the intensification of existing processes to further integrate Ukraine into the global economy. Strengthening internal measures to boost the competitiveness of Ukrainian goods and services, coupled with systematic financial support for exports and reducing technical barriers, is crucial for sustaining this trade partnership.

Russia's full-scale invasion of Ukraine in 2022 has added further complexity to EU–Ukraine trade relations. Beyond galvanising unified European support for Ukraine, the war has underscored the strategic significance of Ukraine's closer integration into the EU. The conflict has triggered substantial adjustments in EU policy, leading to expanded financial, humanitarian and military assistance aimed at supporting Ukraine's defence efforts and post-war recovery (Raik et al., 2024).

## **METHODOLOGY**

This study explores the bilateral trade dynamics between Ukraine and the EU, with particular attention to the period shaped by the Russian invasion. It investigates the evolution of trade intensity and evaluates the untapped export capacity of the EU's main trading partners with Ukraine.

To guide the analysis, the following hypotheses were formulated:

**H1:** At the aggregate EU level, the intensity of Ukraine's exports to the EU exceeded that of the EU's exports to Ukraine, with the asymmetry becoming most pronounced after the 2022 invasion.

**H2:** In 2023, the leading EU exporters to Ukraine concentrated their unrealised export capacity in sectors characterised by high value added.

The hypotheses are based on observed empirical trends in EU–Ukraine trade relations and prior studies (e.g., Decreux & Spies, 2016; Redko & Tkachenko, 2021). H1 derives from evidence that Ukraine’s exports to the EU are structurally concentrated and have grown disproportionately since the implementation of the DCFTA, with this orientation intensifying markedly after 2022; the hypothesis is framed at the aggregate EU level, recognising that individual member states may deviate from this pattern. H2 follows from the expectation, grounded in gravity model theory, that high-value-added sectors dominate unrealised export capacity in advanced EU economies.

The study investigates the progression of bilateral trade between the EU and Ukraine over the 2013–2023 period. The classification of traded goods follows the Harmonised System at the HS2 level, with in-depth comparisons focused on the years 2021 and 2023 due to their distinct economic conditions. These years were selected for their distinct economic contexts: 2021 marked a period of strong export performance driven by post-COVID economic recovery and relative peace across Ukraine, whereas 2023 represented the second year of war, with the economies and trade relations of Ukraine and the EU adapting to the ongoing conflict.

To evaluate geographical disparities in trade intensity, the analysis focuses on the five EU member states with the highest trade volumes with Ukraine in 2023. While the trade intensity index (TII) analysis covers Germany, Poland, Hungary, Bulgaria, and Italy, the export potential indicator (EPI) analysis focuses on Germany, Poland, Hungary, and Bulgaria, as these countries show the most pronounced gaps between actual and potential export flows and thus offer the greatest analytical value for identifying untapped trade opportunities.

Hypothesis H1 was examined using the TII, which serves to determine whether bilateral trade flows surpass or lag behind expected levels, given the countries’ positions in the global trade system. This index is computed by comparing the share of a country’s exports to a specific partner with the overall global exports allocated to that partner (Shirotori et al., 2010). The formula is defined as follows:

$$TII = \frac{\frac{x_{ij}}{X_{it}}}{\frac{x_{wj}}{X_{wt}}}, \quad (1)$$

where  $x_{ij}$  denotes the value of exports from country  $i$  to country  $j$ ;  $X_{it}$  represents the total exports from country  $i$ ;  $x_{wj}$  indicates the total exports to country  $j$  (equivalently, the imports of country  $j$  from the world); and  $X_{wt}$  stands for the aggregate global exports.

The value of the TII can range from 0 to positive infinity. A  $TII > 1$  suggests that country  $i$  exports to country  $j$  at a higher rate than its average exports to other global partners, indicating above-average bilateral trade intensity. Conversely, when  $TII < 1$ , it reflects a low trade intensity, meaning that country  $i$  exports fewer goods to country  $j$  compared to its global export share. A TII value of 1 signifies that the trade intensity is at the expected level, indicating that country  $i$  exports to country  $j$  in proportion to country  $j$ 's share of global imports.

To assess hypothesis H2, the EPI was employed. This metric identifies goods that a country already exports and that hold substantial untapped potential in a specific target market. The estimation methodology is grounded in a gravity model applied at the product level, following the framework developed by Decreux and Spies (2016). The model operates under the premise that, in the absence of trade barriers, trade flows are shaped by interactions between exporter–product, importer–product, and bilateral country-specific characteristics. This decomposition is consistent with the structural gravity framework formalised by Anderson and van Wincoop (2003, 2004), which models bilateral trade as a function of trading partners' economic masses (proxied by GDP), bilateral trade costs, and multilateral resistance terms reflecting relative market access. Building on this framework, Decreux and Spies (2016) define the estimated potential export value  $v_{ijk}$  of product  $k$  exported from country  $i$  to country  $j$  as follows:

$$v_{ijk} = \mu_{ik} \varphi_{ij} \beta_{jk}, \quad (2)$$

where  $\mu_{ik}$  captures the supply capacity of exporter  $i$  in product  $k$ , constructed from the exporter's global market share adjusted by projected GDP growth relative to competing suppliers and any applicable tariff advantages;  $\beta_{jk}$  captures

the demand potential of importer  $j$  for product  $k$ , estimated from GDP per capita growth projections, income elasticities of demand, and bilateral tariff reductions specific to the product; and  $\varphi_{ij}$  measures market access, defined as the ratio of actual to hypothetical bilateral trade and reflecting the combined effects of geographic proximity, institutional compatibility, and trade facilitation conditions, analogous to the bilateral trade-cost term in Anderson and Van Wincoop (2003).

The *supply* component is based on the exporter's global market share in product  $k$ , adjusted by projected GDP growth relative to competing suppliers and any tariff advantages, with filters applied where re-exports distort performance.

The *demand* component estimates expected imports of product  $k$  by country  $j$  from projected GDP per capita growth, income elasticities, and product-specific bilateral tariff reductions.

The *ease of trade* reflects how favourably exporter  $i$  trades with market  $j$  relative to global averages, defined as the ratio of actual to hypothetical trade, where values above 1 indicate strong compatibility and values below 1 indicate barriers. Together, these components embed the gravity equation's standard drivers – exporter GDP, importer GDP and demand elasticities, and bilateral trade costs – into a single product-level export-potential estimate.

Actual export data are averaged from validated direct and mirror statistics over the past five years. The model allows for quantifying realised export potential as the share of the predicted trade *value* that has materialised, highlighting where performance exceeds, meets, or falls short of expectations. Discrepancies may arise from exceptional exporter competitiveness in some areas or underperformance due to regulatory or informational frictions in others.

Table 5 illustrates the application of the EPI using a simplified example of motor vehicles exported from Germany to Ukraine in 2023. The indicator compares the actual export value with the potential trade value estimated through a gravity-based model. The potential value represents the level of exports that would be expected given macroeconomic conditions, tariff preferences, and the structural characteristics of trade between the two economies.

**Table 5:** Illustrative example of EPI calculation

| Parameter                          | Symbol                                       | Value | Description                                                            |
|------------------------------------|----------------------------------------------|-------|------------------------------------------------------------------------|
| Actual export value                | $X_{ij}^{actual}$                            | 523   | Actual exports of motor vehicles from Germany to Ukraine (USD million) |
| Predicted (potential) export value | $X_{ij}^{potential}$                         | 719   | Predicted trade flow according to the gravity model (USD million)      |
| Export Potential Indicator         | $EPI = X_{ij}^{actual} / X_{ij}^{potential}$ | 0.73  | Indicates 73% realisation of potential export                          |

**Source:** Own calculations based on ITC (2024) data

In this case, Germany realises 73% of its estimated export potential in the motor vehicle sector, meaning that approximately 27% remains untapped. This unrealised potential may stem from logistical and regulatory barriers, differences in product certification, or demand constraints due to the ongoing war.

The predicted trade values used in the model are derived following Decreux and Spies (2016), who estimate export potential at the product level by incorporating (i) exporter GDP growth relative to competitors, (ii) importer GDP per capita and demand elasticities, (iii) tariff reductions under the DCFTA, and (iv) a bilateral “ease of trade” coefficient that captures geographic proximity, trade facilitation, and institutional compatibility. In practice, this approach quantifies the trade that could occur under optimal conditions and allows identification of sectors with unrealised growth opportunities.

The analysis is based on data from the ITC (2024) covering EU–Ukraine trade flows from 2013 to 2023. For each country pair, both direct (reported by the exporting or importing country) and mirror (reported by the partner country) trade statistics were available. Ideally, a country’s reported exports should correspond to its partner’s recorded imports, aside from differences due to valuation methods: exports are reported as FOB (free on board), while imports include insurance and freight. In practice, however, discrepancies between direct and mirror data are common, making it challenging to determine which source

provides a more accurate reflection of trade volumes. Before conducting the empirical analysis, a descriptive overview of the dataset was prepared to ensure data consistency and transparency (Table 6). Minor discrepancies between the two sources were addressed by calculating the average value for each country pair.

These descriptive statistics indicate that both Ukrainian and EU trade flows exhibited significant variability during the observed period, reflecting the combined effects of post-crisis recovery, institutional reforms, and the disruptions caused by the Russian invasion.

**Table 6:** Descriptive statistics of input and output data, observation period 2013–2023

| Variable                         | Mean<br>(USD m.) | Min.      | Max.      | Standard<br>deviation |
|----------------------------------|------------------|-----------|-----------|-----------------------|
| Ukraine's exports to the EU      | 19,842           | 11,205    | 26,473    | 4,572                 |
| EU exports to Ukraine            | 24,310           | 13,826    | 40,696    | 7,581                 |
| Ukraine's total exports to world | 45,936           | 32,640    | 68,072    | 9,422                 |
| EU total exports to world        | 5,829,100        | 4,276,000 | 7,092,000 | 832,412               |

**Source:** Own calculations based on ITC (2024) data

On average, EU exports to Ukraine exceeded Ukraine's exports to the EU, confirming the asymmetry in absolute trade volumes. However, H1 concerns trade intensity, not absolute volumes; Ukraine's higher TII values, as shown in the empirical analysis, confirm that Ukraine's exports to the EU are disproportionately concentrated at the aggregate level relative to its global export structure. The variability in EU exports (as shown by the higher standard deviation) also reflects the strong post-2022 surge in machinery, energy, and defence-related goods.

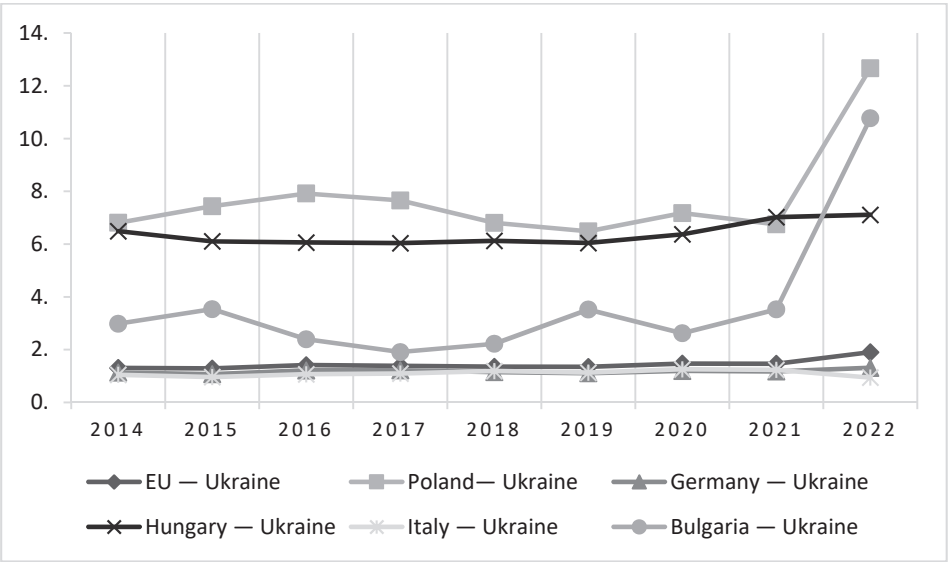
RESULTS AND DISCUSSION

Trade intensity of mutual foreign trade

In addition to examining the growth of bilateral trade, it is also important to evaluate trade intensity between Ukraine and EU member states in relation to their global economic weight. This type of assessment provides valuable insight into the prospects and direction of trade cooperation. Our analysis focused on trade intensity patterns, particularly among EU countries with the highest export values to Ukraine. By doing so, we were able to highlight key sectors with the strongest export potential for these countries.

Figure 2 illustrates the level of export intensity from the EU to Ukraine.

**Figure 2:** Evolution of the TII between the EU and Ukraine, focusing on Ukraine’s top five EU trading partners, 2014–2022



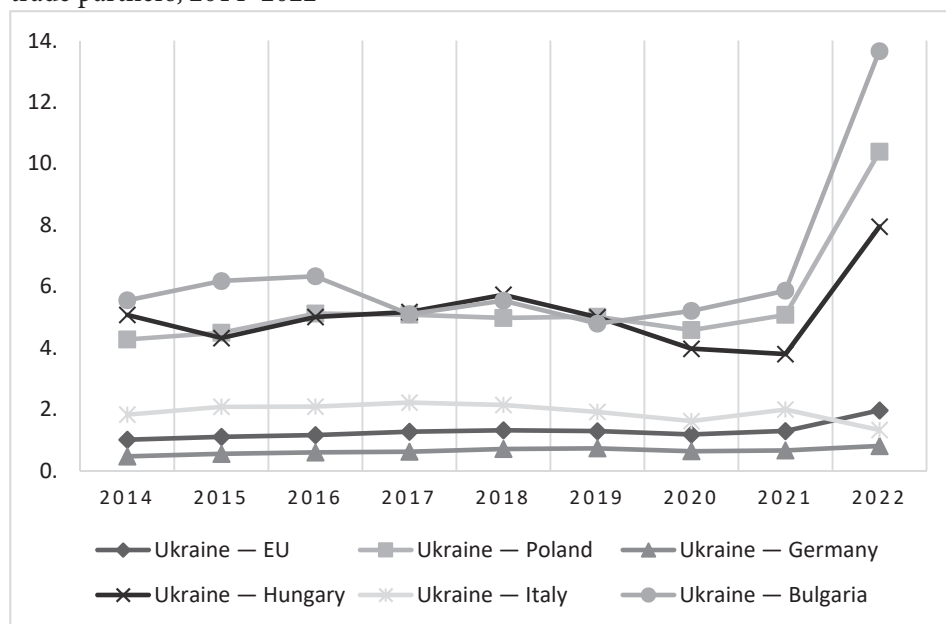
Source: Own preparation based on ITC (2024) data

Throughout the observed period, both the EU as a whole and each examined member state recorded a TII greater than 1, indicating high European export intensity. In 2022, Poland reached the highest index value, at 12.66, up from 6.75 in 2021, showing substantial changes in Polish exports to Ukraine during the war.

This TII value identifies Poland as the leading EU exporter to Ukraine. Bulgaria also recorded substantial growth in export activities, with the index rising from 3.53 in 2021 to 10.77 in 2022. Other examined countries did not show substantial changes in trade intensity between 2014 and 2022, maintaining values above 1. However, Italy's index fell below 1 in the last examined year, to 0.94, indicating that although Italy is a key export destination for Ukraine, trade intensity in the opposite direction was relatively low.

Figure 3 highlights the growing importance of trade between Ukraine and certain EU countries, especially Poland and Bulgaria, over the examined period. The substantial increases in trade intensity for these countries in 2022 may reflect changes in trade dynamics due to the geopolitical situation.

**Figure 3:** Evolution of the TII from Ukraine to the EU and its five leading EU trade partners, 2014–2022



Source: Own preparation based on ITC (2024) data

The TII between Ukraine and Bulgaria shows a significant increase, especially in 2022, when it surged to 13.66. This rise indicates a substantial growth in trade relations, likely influenced by geopolitical factors and economic changes in the

region. The trade between Ukraine and Poland also shows a marked increase in 2022, reaching 10.38. This indicates a strengthening trade relationship, potentially driven by Poland's geographic proximity and political support for Ukraine. The TII between Ukraine and Hungary demonstrates a general upward trend over the years, peaking at 7.94 in 2022.

The TII for Ukraine's trade with Italy and Germany shows minor fluctuations but remains relatively stable, pointing to steady trade relations without significant volatility. This indicates that, while trade is consistent, it is less intensive compared to that with other EU countries.

The results presented in Figures 2 and 3 provide broad support for hypothesis H1 at the aggregate EU level, while also revealing important nuances at the level of individual member states. For the EU as a whole, Ukraine's TII for trade with EU markets remained above 1 and exceeded the EU's TII for trade with Ukraine across the analysed period. At the bilateral level, however, the relationship was not uniform. For several member states, most notably Poland and Hungary, the export intensity of the EU partner towards Ukraine at times matched or exceeded Ukraine's intensity in the opposite direction. In 2022, for instance, Poland's TII towards Ukraine reached 12.66, compared with 10.38 for Ukraine's exports to Poland, indicating that in that year Poland was relatively more oriented towards the Ukrainian market than vice versa; a comparable pattern is observable for Hungary. These cases qualify the assumption embedded in H1 that Ukraine's export intensity exceeded that of the reverse direction for every partner throughout the entire timeframe.

The evidence further indicates that the pronounced intensification of Ukraine's export orientation towards the EU is primarily a post-2022 phenomenon rather than a stable feature of the whole 2013–2023 period. It was in 2022–2023, following the full-scale invasion and the collapse of trade with the CIS region, that Ukraine's dependence on EU markets and the corresponding asymmetry in trade intensity increased most sharply. Hypothesis H1 is therefore accepted at the aggregate EU level, but with the qualification that some individual member states, particularly Poland and Hungary, displayed a stronger export orientation towards Ukraine than the reverse, and that the intensification of Ukraine's dependence was concentrated in the post-invasion years.

**Untapped export capacity of the EU's major trade partners with Ukraine**

Germany, France, Italy and the Netherlands maintained a strong share of total EU exports to Ukraine throughout the observed period. Nevertheless, exports from certain countries, such as Bulgaria and Poland, recorded more dynamic growth in recent years compared to others such as Germany or Hungary. Despite these increases, the export potential of these countries cannot be considered fully realised. Therefore, based on the previously described methodology, we estimate their current export potential relative to their existing export performance.

**Table 7:** Germany's export potential to Ukraine, the top five commodities (USD million)

| Commodity                                                         | Export potential | Actual export | Untapped potential |
|-------------------------------------------------------------------|------------------|---------------|--------------------|
| Motor vehicles for the transport of < 10 persons                  | 719              | 523           | 196                |
| Medicaments for retail sale, n.e.s.                               | 438              | 265           | 173                |
| Tractors                                                          | 115              | 57            | 58                 |
| Human & animal blood, blood fractions, and immunological products | 94               | 54            | 40                 |
| Powered aircraft                                                  | 85               | 31            | 54                 |

**Source:** Own calculations

Germany shows the highest absolute gap between potential and actual exports to Ukraine, with an unrealised export capacity estimated at USD 521 million. Most of this potential lies in sectors such as motor vehicles, pharmaceutical products for retail use, and blood-based products for human or veterinary purposes. Table 7 provides a detailed overview of goods with the greatest export potential.

Poland has an uncovered export potential to Ukraine valued at approximately USD 271 million. Regarding sectoral composition, Polish exports to Ukraine show the greatest potential in mineral/chemical fertilisers, followed by motor vehicles for the transport of goods, reception apparatus, dog/cat food, and insecticides, rodenticides, fungicides, and herbicides. Table 8 highlights the five commodities with the highest export capacity.

**Table 8:** Poland's export potential to Ukraine, the top five commodities (USD million)

| Commodity                                                               | Export potential | Actual export | Untapped potential |
|-------------------------------------------------------------------------|------------------|---------------|--------------------|
| Mineral/chemical fertilisers with nitrogen, phosphorus, and potassium   | 158              | 91            | 67                 |
| Motor vehicles for the transport of goods                               | 127              | 80            | 47                 |
| Reception apparatus for television, colour                              | 102              | 32            | 70                 |
| Dog/cat food                                                            | 96               | 57            | 39                 |
| <b>Insecticides, rodenticides, fungicides, herbicides, and the like</b> | 71               | 23            | 48                 |

Source: Own calculations

**Table 9:** Hungary's export potential to Ukraine, the top five commodities (USD million)

| Commodity                                                               | Export potential | Actual export | Untapped potential |
|-------------------------------------------------------------------------|------------------|---------------|--------------------|
| Motor vehicles for the transport of < 10 persons                        | 208              | 133           | 75                 |
| <b>Insecticides, rodenticides, fungicides, herbicides, and the like</b> | 80               | 41            | 39                 |
| Insulating fittings for electrical purposes, of plastics                | 64               | 51            | 13                 |
| Reception apparatus for television, colour                              | 52               | 30            | 22                 |
| Maize seed for sowing                                                   | 38               | 25            | 13                 |

Source: Own calculations

Hungary's unrealised export potential to Ukraine is estimated at USD 162 million. The most promising product categories include motor vehicles, various agrochemical products such as insecticides, rodenticides, fungicides, and herbicides, as well as electrical insulating fittings, television reception equipment, and maize seed for planting. A detailed list of these goods is presented in Table 9.

Ukraine also represents the largest prospective market for Bulgarian exports, with an export potential gap of USD 57.1 million. This indicates room for further trade expansion. The most promising product categories include sunflower seeds, electrical energy, combine harvester-threshers, and nitrogen-based mineral or chemical fertilisers, including anhydrous forms. A detailed overview of these commodities is presented in Table 10.

**Table 10:** Bulgaria's export potential to Ukraine, the top five commodities (USD million)

| Commodity                                                             | Export potential | Actual export | Untapped potential |
|-----------------------------------------------------------------------|------------------|---------------|--------------------|
| Sunflower seeds                                                       | 32               | 0.04          | 32                 |
| Electrical energy                                                     | 9.8              | 0             | 9.8                |
| Combine harvester-threshers                                           | 7.6              | 0.03          | 7.6                |
| Mineral/chemical fertilisers with nitrogen, phosphorus, and potassium | 5.1              | 2.3           | 2.8                |
| Anhydrous ammonia                                                     | 4.9              | 0             | 4.9                |

**Source:** Own calculations

The results of the export potential analysis confirm H2, which posited that the unrealised export capacity of EU member states to Ukraine would be concentrated in sectors with high value added. As shown in Tables 7–10, the largest potential gaps are observed in machinery, motor vehicles, pharmaceutical products, and advanced chemical or electrical equipment. These industries are capital- and technology-intensive, aligning with the structural characteristics predicted by the gravity model framework (Decreux & Spies, 2016). This finding also underlines the asymmetric nature of trade specialisation between the EU and Ukraine – while Ukraine's exports are dominated by raw materials and agricultural goods, the EU's comparative advantage lies in high-technology sectors where the greatest potential for trade expansion exists. While these results support H2 and identify concrete sectors for EU export expansion, they also reflect a structural challenge for Ukraine: high import dependency on capital-intensive goods from EU partners may deepen trade deficits and limit domestic industrial capacity. Future post-war recovery strategies should therefore balance trade liberalisation with targeted industrial policy aimed at developing domestic production capacity in key high-value-added sectors.

The EU–Ukraine DCFTA is one of the EU’s most comprehensive trade agreements, enabling Ukraine to integrate into various sectors, including labour markets and energy, significantly advancing its alignment with the EU single market, even at an early stage of its EU accession process. Economically, Ukraine’s size is comparable to that of Hungary or Romania when they joined the EU, while in terms of wealth, it aligns with Latvia, Lithuania, and Romania during their application periods. If Ukraine were to join the EU today, it would increase the bloc’s GDP by approximately 1% and its population by about 9%, similar to Poland’s impact upon its accession in 2004 (Grievesson et al., 2024).

Ukraine’s current economic structure remains more dependent on agriculture and extractive industries, with a relatively weaker industrial base than most EU member states and countries in Central and Eastern Europe. However, similar structural characteristics were observed in several CEE economies at the time of their accession to the EU. In terms of economic composition and foreign direct investment potential, Ukraine shows parallels with countries such as Hungary or Romania during their respective pre-accession periods.

Accession to the EU would require governance reforms and institutional reforms in Ukraine that would contribute to deeper economic integration between the EU and Ukraine. This could lead to a potential increase in trade of 40% on average (at constant prices) over the period 2030–2040, with the high-growth scenario predicting an increase of 140%. However, realising this potential would require a stable peace agreement, a successful reconstruction process, and fundamental reforms of governance and institutions in Ukraine (Grievesson et al., 2023).

The DCFTA has already enabled Ukraine to align with the EU in multiple economic sectors. Continued progress in governance and institutional reforms could pave the way for deeper integration and expanded trade relations.

The ongoing war has further emphasised the strategic significance of EU–Ukraine trade, with the EU becoming a key player in Ukraine’s external trade structure. As highlighted by ITC data (2024), EU exporters should concentrate on high-potential sectors such as machinery, electrical energy, motor vehicles and components, and pharmaceutical products. The most substantial unrealised export potential lies in the machinery and electrical energy sectors.

## CONCLUSION

This study examined the evolution of EU–Ukraine trade relations over the 2013–2023 period by applying the trade intensity index and the export potential indicator to bilateral trade data. The aim was to assess whether Ukraine’s export orientation toward the EU exceeded the reverse direction in terms of intensity, and to identify sectors where the leading EU trading partners hold the greatest unrealised export capacity in the Ukrainian market.

The empirical results confirm both hypotheses. Regarding hypothesis H1, although average EU exports to Ukraine exceeded Ukraine’s exports to the EU in absolute terms, confirming the asymmetry in trade volumes, this finding should not be conflated with trade intensity. Ukraine’s TII values for trade with the EU remained above 1 throughout the analysed period and, at the aggregate level, exceeded the EU’s corresponding values. However, for individual partners such as Poland and Hungary, the EU member states’ export intensity towards Ukraine occasionally exceeded Ukraine’s export intensity towards the EU – an asymmetry that became most pronounced after 2022. This finding confirms that Ukraine’s export orientation toward EU markets is disproportionately strong relative to its overall global export structure and reflects the deepening structural dependence on EU markets driven by the Association Agreement and the disruption of trade with CIS countries. The higher variability in EU exports, as reflected by the elevated standard deviation in Table 6, further underlines the significant post-2022 surge in machinery, energy, and defence-related goods exported to Ukraine.

With respect to hypothesis H2, the export potential indicator analysis confirms that the largest unrealised export capacity of selected EU member states – Germany, Poland, Hungary, and Bulgaria – is concentrated in high-value-added sectors. Germany records the greatest absolute gap, with an untapped potential of approximately USD 521 million, primarily in motor vehicles, pharmaceutical products, and agricultural machinery. Poland’s unrealised potential of approximately USD 271 million is strongest in agrochemicals and motor vehicles, while Hungary and Bulgaria show meaningful gaps in motor vehicles, electrical equipment, and specialised agricultural inputs. These findings are consistent with the gravity model framework underpinning the EPI methodology, which associates high-value-added trade with advanced economies’ comparative advantages.

At a broader level, the results reveal a persistent structural asymmetry in EU–Ukraine trade. While EU exports to Ukraine are concentrated in technologically advanced and capital-intensive goods, Ukraine’s exports to the EU remain dominated by agricultural commodities, cereals, oilseeds, and raw materials such as iron, steel, and ores. This pattern reflects a structural feature of Ukraine’s economy that deeper trade liberalisation alone cannot resolve. The ongoing dependence on high-value-added imports from the EU, rather than being straightforwardly positive, underscores the need for Ukraine’s industrial upgrading and the development of domestic production capacity in capital-intensive sectors as part of any credible post-war reconstruction strategy.

Future research should focus on areas that follow directly from the limitations of this study. A longitudinal analysis covering the post-war reconstruction period and, potentially, Ukraine’s EU accession process would allow researchers to assess how institutional convergence and trade liberalisation reshape Ukraine’s TII values and export structure over time. Additionally, scenario-based modelling of the trade and investment impacts of EU membership could provide policymakers with actionable insights for adjusting trade and industrial policy in the medium term.

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## THE ASSOCIATION BETWEEN MASS RAPID TRANSIT AND RESIDENTIAL PROPERTY VALUES: EVIDENCE FROM BENGALURU'S NAMMA METRO

**ABSTRACT:** *Transit networks significantly influence city evolution, with mass rapid transit systems enhancing access to jobs, housing, and infrastructure. The Indian government is promoting metro rail projects to strengthen public transport, and many cities are developing their metro rail corridors, making an understanding of their impact crucial in the Indian context. This study investigates the relationship between the mass rapid transit system (Namma Metro) and residential property values in Bengaluru, India. Additionally, it examines the association between newly operational and existing metro lines on property values across neighbourhoods in Bengaluru. The study uses an empirical quantitative approach, combining quantitative data analysis with hedonic price regression based on household surveys for the year*

*2023. The regression results indicate a positive relationship between residential property values, proximity to metro stations, and household income levels, suggesting that properties in closer proximity to metro stations have higher predicted values, while higher-income households are more likely to reside in these areas. The findings have significant implications for urban planning and policy decisions. They help understand how building metro stations may be associated with real estate development and value creation in the vicinity of the metro corridor and how transit-oriented development policies around metro stations can support land value capture.*

**KEY WORDS:** *Mass rapid transit, Hedonic price model, Housing prices, Property values, India*

**JEL CLASSIFICATION:** L90, R21, R32

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## **1. INTRODUCTION**

Cities in developing countries have undergone substantial transformations over the last three decades, driven by population growth and rapid infrastructure development. They are, therefore, facing a massive increase in transport demand (Kurle & Sohani, 2022). India is one of the countries facing this rapid urban growth. To address this challenge, the Indian government has expanded access to the Mass Rapid Transit Systems (MRTS), which has several benefits, including reduced vehicle travel, lower pollution, and economic growth (Boarnet et al., 2013; Mohammad et al., 2013). Currently, about 1,036 kilometres of metro rail network operate in 24 cities across the country. In the last five years, including 2025–26, 339 kilometres of metro networks were commissioned across the country (Sirothia, 2025). The MRTS project not only improves the transport system but also influences the pattern and spatial structure of metropolitan development and the spatial distribution of urban housing values (Wey & Chang, 2009). Metro accessibility influences house prices by raising demand and boosting property value. Investments near metro stations capitalise on the value of transportation infrastructure and enhance locational conditions, lower transportation costs, and raise house values (Jiang et al., 2020). Land values are also affected by distance to metro lines, as this improves accessibility and desirability (Agostini & Palmucci, 2008; Debrezion et al., 2007; Swamy, 2008; Suzuki et al., 2013; Tan et al., 2019). The rising affluence and changing lifestyles of the urban population have also increased the demand for luxury real estate in major Indian cities (Construction Week Online, 2024).

However, few studies have investigated what influences property values in Indian cities. More importantly, studies have examined various aspects of urban property values rather than the specific impact of the metro accessibility on housing prices. Leveraging the link between infrastructure and real estate is key to inclusive urban growth. Tiwari et al. (1999) used the hedonic price method to study how household characteristics and distance to central business districts (CBDs) affect house rents in Mumbai. Nallathiga (2006) found a close link between infrastructure development and real estate prices in Mumbai. In Pune, the impact of the metro is strongest within 200–350 m of metro stations, persists up to 500 m, and is negligible beyond that (Wagh & Sonar, 2021). Urban rail significantly raises property values in Bengaluru, with average increases of 4.5% and up to 25% near metro stations (Sharma & Newman, 2018). Although their

study primarily focuses on the average effect of proximity of metro stations on the value of land, it fails to adequately incorporate intra-urban differences. Furthermore, the study largely examines the value uplift around metro routes without much consideration being accorded to distance cut-offs and differences between new and existing metro lines.

This study aims to examine the potential relationship between mass transit, specifically the Bengaluru Metro (known as Namma Metro) and resident property values in Bengaluru city. First, it compares the impact of both recently operational and older metro lines on property values. Second, it seeks to define the value capture zone, the area experiencing the most significant property value uplift due to the metro, by comparing property prices within and beyond 1 kilometre (km) of the metro corridor. This specific focus is driven by the concept of a transit station/corridor influence zone (500–800 m), as outlined in the National Transit Oriented Development (TOD) Policy 2017 of the Government of India (Ministry of Housing and Urban Affairs, 2017). The study also seeks to assess other important factors influencing the mass rapid transit system's impact on property values, including population size, the number of years the metro line has been operational, the distance of the property from the city centre, and the cost of using the metro. By addressing these objectives, the study contributes a novel perspective on the relationship between metro systems and property values, informing urban planning efforts and maximising the positive economic impact of metro infrastructure development. It helps understand how metro station construction influences real estate development and value creation along the metro corridor, and how TOD policies around metro stations can support land value capture. The results inform policymakers on how metro investments may contribute to real estate development, generate revenue through land value capture, and promote inclusive and sustainable urban growth.

This article is structured as follows. Section 2 reviews the related literature and identifies the research gap. Section 3 explains the data and methodology used for the study. Section 4 presents the empirical results. Section 5 discusses the findings and provides recommendations based on the estimated results. Finally, Section 6 concludes.

## **2. LITERATURE REVIEW**

### **2.1 Theoretical review**

Transit-oriented development (TOD) is a theory that suggests that property values in areas adjacent to high-capacity public transport systems, such as metro lines, can increase following their development. These systems provide easy access to jobs, education, and amenities, making nearby areas more attractive to potential residents and businesses. The influence zone of a transit station generally encompasses areas within walking distance of the station, with a radius of 500–800m. TOD positively and significantly impacts residential property values (Jiang et al., 2020). Globally, it has been acknowledged that TOD planning policies and value capture mechanisms are efficient means of advancing the sustainability of urban rail transit (Zhao & Larson, 2011). Housing prices for properties in pedestrian-friendly environments and near a station are significantly higher than those for comparable condominiums in similar neighbourhoods not located near a station (Duncan, 2011).

The location theory, developed by Von Thünen's (1826), focused on spatially dividing production processes to minimise transportation costs. Locations further from the city centre have higher transportation expenses, making them less appealing for development. Conversely, areas with lower transportation costs, such as those closer to the city centre or with good public transportation access, become more attractive for development. Landowners can command higher rents due to superior accessibility, incentivising denser development, such as apartments and high-rise buildings, to maximise land potential and cater to the demand for centrally located housing or commercial spaces (Maranzana, 1963).

Alonso's bid-rent theory explains how real estate prices and demand vary with distance from a city's CBD. Different land users, including residential, commercial, and industrial, compete for desirable locations within a city that offer benefits such as accessibility, agglomeration economies, and shared infrastructure (Alonso, 1964). The distance decay effect in urban economics suggests that factors such as accessibility, amenities, and property values decline with increasing distance from a central point, such as the CBD. This can lead to longer commuting times and higher transportation costs, weakening the strength of agglomeration economies and land prices. Distance decay of effective density

may also reflect transport supply and land use in surrounding areas (Hansen, 1959).

## 2.2 Empirical review

Empirical studies explore the impact of transportation infrastructure, specifically metro and light rail network (LRT) systems, on residential and commercial property values in global and Indian contexts. The studies use various methodologies, including hedonic price regression, spatial analysis, and panel data hedonic price modelling. The results show that proximity to metro and LRT stations generally has a positive impact on property values (Anantsuksomsri & Tontisirin, 2015; Camins-Esakov & Vandegrift, 2018; Cervero, 2013; Sharma & Newman, 2018; Pan & Zhang, 2008). However, variations exist based on factors such as housing market type, development stage, rail technology, and distance.

Globally, research on rail transit development and its impact on urban development, particularly in developing countries, has shown a positive correlation between proximity to transit stations and property values. Rail transit also influences land use patterns, with studies showing a shift towards increased development intensity and a mix of residential, commercial, and industrial uses near stations. In Shanghai, higher development intensity and more capital-intensive land uses occur in more accessible areas near stations, while property values increase as distance from metro stations decreases (Pan & Zhang, 2008). Construction impact can also cause temporary dips in housing prices within 500 metres of planned MRT stations (Chun-Chang et al., 2020). However, challenges include data availability and coordination between transportation and land use.

In the context of India, studies have shown that metro development leads to increased property values, particularly in areas near stations (Malhotra et al., 2020; Sharma & Newman, 2018; Wagh & Sonar, 2021). The strongest positive impact is found within 200–500 metres of metro stations, with the effect diminishing as distance increases (Wagh & Sonar, 2021). Construction impacts may cause temporary declines in property values near stations (Singhal & Tyagi, 2021). Overall, these studies provide strong evidence that metro development leads to higher property values and can influence land use patterns. Appendix Table A1 presents a detailed overview of the most relevant empirical studies.

### **3. DATA AND METHODOLOGY**

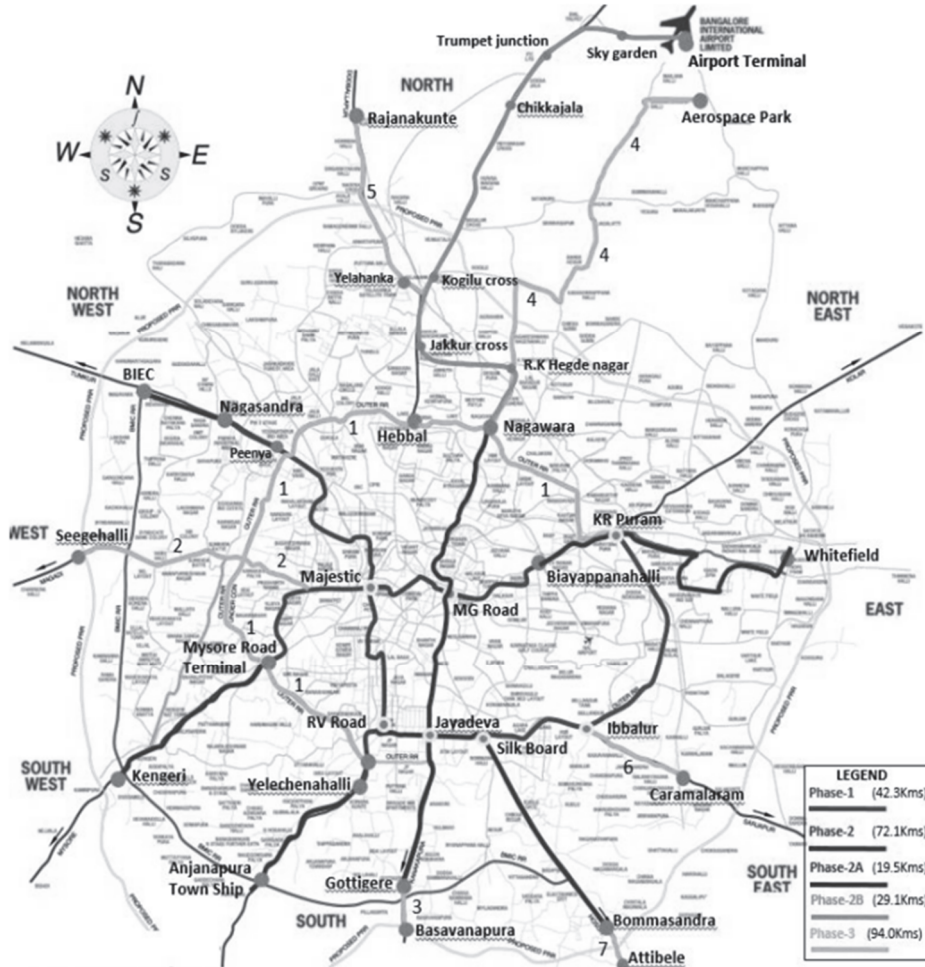
#### **3.1 Case study: Bengaluru city**

Despite its high-tech reputation, Bengaluru, India's tech capital, is plagued by traffic congestion. The city's rapid expansion and inadequate infrastructure planning have worsened traffic issues. Bengaluru presents an ideal study area for examining the impact of metro stations on property values, owing to its rapid metro expansion, diverse neighbourhoods, readily available data, economic significance, and policy relevance. Traffic is a severe concern for the residents of Bengaluru. In 2023, Bengaluru was ranked the sixth most congested city in the world in terms of traffic on its streets, according to the Traffic Index published by TomTom, a Dutch location technology firm (The Indian Express, 2024). Metro construction projects have narrowed roads, causing slower traffic and increased congestion. Despite government promises, public transport initiatives continue to face delays, resulting in long queues for commuters (The News Minute, 2023).

Namma Metro continually strives to enhance the quality of life of its citizens, even though managing traffic congestion and addressing last-mile connectivity remain a challenge. A metro rail system may significantly impact urban traffic, with potential benefits to the economy, environment, and public health. In a developing country such as India, the expansion of road infrastructure and the construction of mass rapid transit systems are envisaged as measures to address this issue (Bishwas et al., 2023). In this context, it becomes essential to understand the impact of the metro in urban development.

Bengaluru is served by the Bengaluru (Namma) Metro, which operates in two phases, as shown in Figure 1. Phase 1, operational since 2011, consists of the Purple Line and Green Line, connecting Whitefield to Silk Institute, covering 72.1 km and 61 stations. Phase 2 will extend the Green Line to Madavara and includes the construction of three new lines – Yellow, Pink and Blue (Magicbricks, 2024).

**Figure 1:** Metro rail map in Bengaluru



Source: Metro Detailed Report Phase 2A

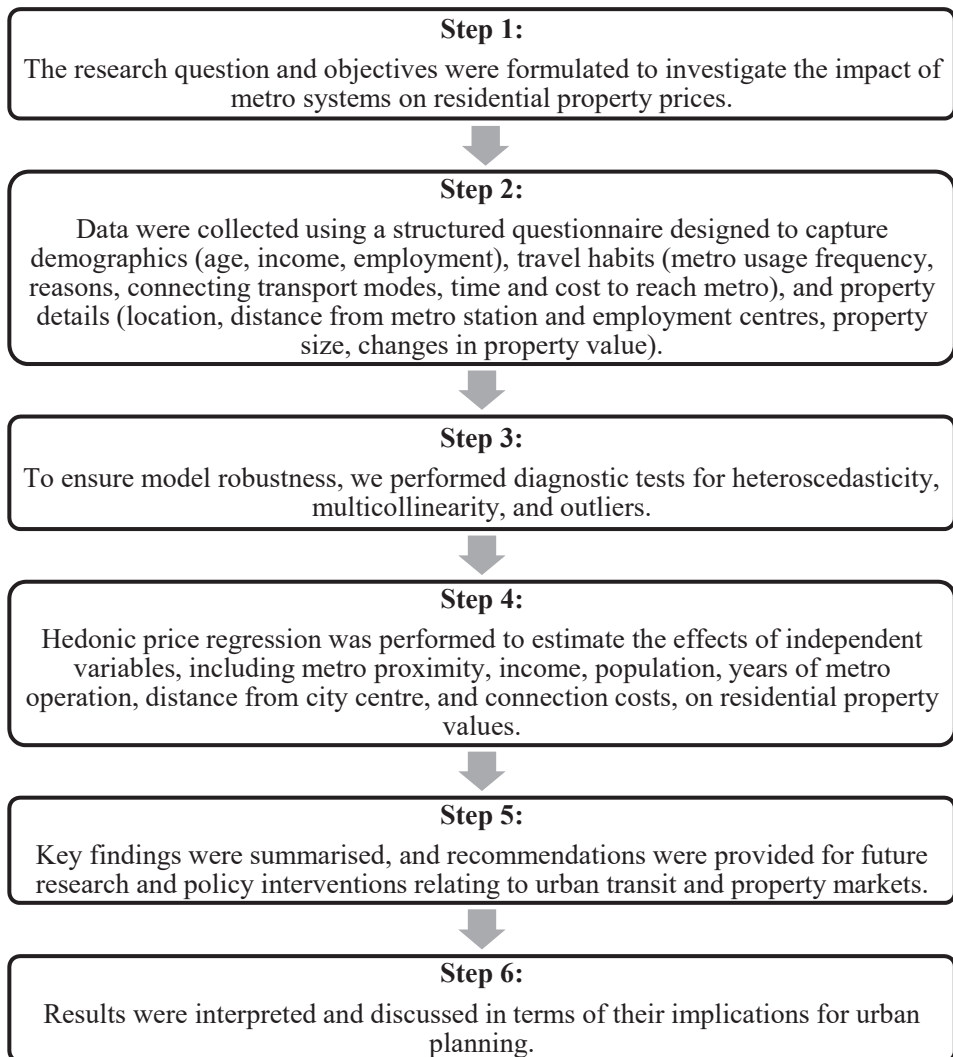
<https://english.bmrc.co.in>

### 3.2 Methodology

The structured questionnaire is designed to investigate the impact of metro systems on residential property prices for the year 2023. By collecting data on demographics (age, income, and employment), travel habits (frequency of metro use, reasons for using it, connecting modes of transport, and the time and cost

spent on reaching the metro), and property details (location, distance from the metro station and major employment centres, property size, and changes in property value), we can analyse how the introduction of, or proximity to, a metro station affects residents' lives and property values.

**Figure 2:** Data collection and interpretation steps



**Source:** Authors' compilation

A variety of methodological approaches are used in the existing literature on how transit infrastructure affects property values. Most empirical studies employ the hedonic pricing model to analyse property prices in terms of structural, locational, and accessibility attributes (Anantsuksomsri & Tontisiri, 2015; Iida et al., 2022; Sharma & Newman, 2018; Singhal & Tyagi, 2021). This approach remains the dominant framework for quantifying transit impacts due to its interpretability and consistency with market behaviour. Advanced methods, such as difference-in-differences (DID) modelling (Chun-Chang et al., 2020; Yen et al., 2022) and geographically weighted regression (Mulley et al., 2018), have also been used to address spatial heterogeneity and dependence. Nonetheless, these techniques expand on the fundamental hedonic regression framework, which remains important for empirical research in this area. Given the unavailability of panel or transaction-level data in the present context, the hedonic regression model is employed here as a theoretically grounded and empirically feasible method. It enables the robust estimation of the association between metro accessibility and residential property values, consistent with established international and Indian literature.

Our econometric model to investigate the impact of transport systems on urbanisation takes the following form:

$$RPV_i = \beta_0 + \beta_1 MSD_i + \beta_2 IL_i + \beta_3 POP_i + \beta_4 YOP_i + \beta_5 DCC_i + \beta_6 TMA_i + \varepsilon_i, \quad (1)$$

where  $RPV$  is the residential property value,  $MSD$  is metro station distance,  $IL$  is household income level,  $POP$  is population,  $YOP$  is years of operation,  $DCC$  is distance from city centre,  $TMA$  is the total money required to access (connect to) the metro,  $\beta_0$  is the intercept,  $\beta_1$  to  $\beta_6$  are regression coefficients,  $\varepsilon$  is the error term, and  $i$  represents each household. Table 1 presents the description of variables used for the regression analysis.

As actual transaction data are not accessible,  $RPV$  is proxied using advertised listing prices collected from publicly available real estate platforms such as Magicbricks (2023) and Housing.com (2023). These listing prices reflect “ask” or “hope” values and are generally more objective than self-reported valuations, which may be influenced by personal bias or limited information. Prior studies (Abidoye & Chan, 2018; Aihie et al., 2025) suggest that listing prices can serve as reasonable proxies in markets with limited transaction transparency.

The analysis is restricted to residential sale listings, excluding rentals, commercial properties, and under-construction units, and focuses only on ready-to-move properties to capture prevailing market conditions. The sample comprises 88 observations across 27 wards in Bengaluru.<sup>1</sup> For each ward, properties located within the respondent's area were identified, and prices were converted to a per square foot basis. Average prices were then computed for each location to reduce the influence of outliers and provide a more stable estimate of local market values. This normalisation also facilitates comparison across properties of different sizes and supports subsequent econometric analysis.

**Table 1:** Description of the variables used for the regression analysis

| Variable                     | Description                                                      | Source                                                                                                                                               | Expected sign (+/-) | Reason for expected sign                                                                                                                                                  |
|------------------------------|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Dependent variable</i>    |                                                                  |                                                                                                                                                      |                     |                                                                                                                                                                           |
| Property value               | Residential property values (Rs per sq. ft)                      | Online websites:<br><a href="https://www.magicbricks.com">https://www.magicbricks.com</a><br><a href="https://housing.com/">https://housing.com/</a> |                     |                                                                                                                                                                           |
| <i>Independent Variables</i> |                                                                  |                                                                                                                                                      |                     |                                                                                                                                                                           |
| Metro station distance       | Distance of the property from the nearest metro station (meters) | Survey                                                                                                                                               | -                   | The urban economic theory of bid-rent suggests that properties near transit hubs have higher land values due to increased accessibility and reduced transportation costs. |
| Household income             | Household income level of the residents in the area (Rs)         | Survey                                                                                                                                               | +-                  | Higher income levels are generally associated with greater ability to pay for premium locations with convenient amenities such as metro access.                           |

<sup>1</sup> A ward is an administrative unit within a city, typically represented by one or more elected councillors.

## HOW BENGALURU'S METRO AFFECTS RESIDENTIAL PROPERTY VALUES

| Variable                         | Description                                                | Source                                                                  | Expected sign (+/-) | Reason for expected sign                                                                                                                                                                  |
|----------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Population                       | Population of the ward                                     | GeoIQ website ( <a href="https://geoiq.ai/in">https://geoiq.ai/in</a> ) | +-                  | Agglomeration economies suggest that urban population density increases housing demand, potentially resulting in higher property prices due to limited land supply in urban areas.        |
| Years of operation of metro line | Years that the nearest metro station has been in operation | Namma Metro records                                                     | +-                  | Metro station maturity allows surrounding areas to develop, capitalise on transportation benefits and increase their desirability and property values.                                    |
| Distance from city centre        | Distance of the property from the city centre (kilometres) | Survey                                                                  | -                   | The monocentric city model suggests that property values increase with proximity to the central business district, indicating a decline in property value as distance from CBD increases. |
| Total money to connect to metro  | Cost of residents to connect to Metro line (Rs)            | Survey                                                                  | -                   | Higher costs associated with connecting to the metro (e.g., bus fare, cab rides) might make the property less attractive to some buyers, potentially leading to lower values.             |

**Source:** Authors' compilation

#### 4. EMPIRICAL RESULTS

Table 2 shows that the coefficient of variation (CV) of property price (0.338) is relatively low, indicating a moderately symmetrical distribution. Conversely, years of operation (1.165) have a higher CV, suggesting a wider range of values across the observations. The data suggests a diverse range of property values likely influenced by location and accessibility. There is a mix of properties in affluent, densely populated areas with established metro access and in less affluent, sparsely populated areas with newer or no metro access.

**Table 2:** Summary statistics of variables

| Variable                             | Mean      | Standard deviation | Minimum | Maximum   | CV    |
|--------------------------------------|-----------|--------------------|---------|-----------|-------|
| Property value (Rs per sq. ft)       | 9,560.77  | 3,256.52           | 3,647   | 19,110    | 0.338 |
| Metro station distance (metres)      | 1,832.386 | 1,647.325          | 250     | 6,000     | 0.893 |
| Household income (Rs)                | 7,65909.1 | 8,17825.7          | 75,000  | 3,500,000 | 1.061 |
| Population (headcount)               | 103,838.6 | 8,0496.56          | 2,510   | 361,799   | 0.77  |
| Years of operation of metro line     | 5.77      | 4.004              | 0       | 12        | 1.165 |
| Distance from city centre (km)       | 10.42     | 6.17               | 3.7     | 33        | 0.589 |
| Total money to connect to metro (Rs) | 37.29     | 43.7               | 0       | 200       | 0.689 |

**Note:** CV denotes the coefficient of variation. The analysis is based on 88 observations.

**Source:** Authors' calculations based on primary survey

Table 3 shows the results of the estimated hedonic price regression models. We estimate parsimonious regression models as they fit the data well while using a minimum number of independent variables. This approach facilitates interpretation and reduces the risk of overfitting by identifying the relevant factors influencing property values without unnecessary model complexity or potential biases. The hedonic price models identified statistically significant relationships between all independent variables and the dependent variable, RPV. Specifically, in Regression Model 1, for every one-metre increase in distance from the nearest metro station, property value decreases by 0.822 rupees per square foot. Conversely, for every one-hundred-rupee increase in household income level, property value increases between 0.07 and 0.09 rupees per square foot. Similar relationships are observed for all other independent variables. The population size of the ward and the years of operation of the metro line have positive and statistically significant associations with the dependent variable. However, the distance of the property from the city centre and the money

required to connect to the metro have negative and statistically significant associations with RPV. All independent variables have the expected signs.

**Table 3:** Determinants of residential property values: Hedonic price regression model

| Variable                         | Dependent variable         |                          |                           |
|----------------------------------|----------------------------|--------------------------|---------------------------|
|                                  | Residential property value |                          |                           |
|                                  | Model 1                    | Model 2                  | Model 3                   |
| Population                       | 0.00954***<br>(0.00316)    |                          | 0.0127***<br>(0.00324)    |
| Years of operation of metro line | 219.9***<br>(64.99)        |                          |                           |
| Metro station distance           | -0.822***<br>(0.163)       |                          |                           |
| Household income                 | 0.000877***<br>(0.000282)  | 0.00101***<br>(0.000317) | 0.000902***<br>(0.000301) |
| Distance from city centre        |                            | -97.48**<br>(45.02)      |                           |
| Total money to connect to metro  |                            | -40.60***<br>(6.318)     | -37.82***<br>(5.894)      |
| Constant                         | 8,136***<br>(718.5)        | 11,319***<br>(584.4)     | 8,959***<br>(539.1)       |
| Observations                     | 88                         | 88                       | 88                        |
| R-squared                        | 0.593                      | 0.478                    | 0.534                     |

**Note:** Standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

To obtain more robust results, we consider dummy variables for two important characteristics: one for existing and recently operational lines and another for properties within and beyond 1km of the metro station.

#### **Comparing existing and recently operational lines:**

Variables: Years of operation (dummy): Captures the age of the nearest metro station.

A value of 0 indicates a station less than 3 years old, considered “recently operations”.

A value of 1 indicates a station older than 3 years, considered “existing”.

**Comparing properties within and beyond 1km:**

Variables: Metro station distance (dummy): Captures the distance of the property from the nearest metro station.

A value of 1 indicates the property is within 1 km of the nearest metro station.

A value of 0 indicates the property is more than 1 km from the nearest metro station.

**Table 4:** Determinants of residential property values with years of operation and metro station distance dummies

| Variables                                                                                                                                 | Dependent variable         |                          |
|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------------|
|                                                                                                                                           | Residential property value |                          |
|                                                                                                                                           | Model 4                    | Model 5                  |
| Population                                                                                                                                | 0.00947***<br>(0.00337)    | 0.0104***<br>(0.00307)   |
| Years of operation dummy (1= metro station older than three years; 0 = metro station less than three years old)                           | 1,218**<br>(593.0)         |                          |
| Household income                                                                                                                          | 0.000962***<br>(0.000298)  | 0.000674**<br>(0.000281) |
| Metro station distance                                                                                                                    | -0.894***<br>(0.171)       |                          |
| Years of operation                                                                                                                        |                            | 250.4***<br>(61.93)      |
| Metro station distance dummy (1= property is within one km of the metro station; 0 = property is more than one km from the metro station) |                            | 2,653***<br>(499.6)      |
| Constant                                                                                                                                  | 8,691***<br>(745.9)        | 5,166***<br>(478.3)      |
| Observations                                                                                                                              | 88                         | 88                       |
| R-squared                                                                                                                                 | 0.560                      | 0.603                    |

**Note:** Standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

According to Table 4, the years of operation dummy indicates that properties near metro stations older than three years have a predicted value Rs 1,218 higher than those near stations less than three years old, all else equal. This suggests that an increase in property value is associated with older metro stations (over three years). This may be due to factors such as better-established infrastructure and

surrounding development in these areas, which can be explained as an "infrastructure maturity effect." Similarly, the metro station distance dummy indicates that properties located within 1 kilometre of the metro station have a predicted value Rs 2,653 higher than those located further than 1 kilometre away, all else equal. Typically, a radius of nearly 500–800m from a transit station (10–12 minutes walking distance) is considered the influence zone of a metro station area. The results show that this zone has a significant and strong positive effect on property values. Properties located closer to metro stations (within 1 km) have significantly higher predicted values, potentially due to increased connectivity and access to amenities.

## **5. DISCUSSION AND RECOMMENDATIONS**

### **5.1 Discussion**

The study examines the relationship between mass transit and property values in Bengaluru, India. It identifies several factors that influence residential property values, including the accessibility effect, income effect, metro maturity effect, distance decay effect, and metro connectivity cost. The accessibility effect indicates that properties near metro stations have higher property values due to greater spatial access to various parts of the city. The years of operation dummy suggests that properties near metro stations older than three years have a predicted value Rs 1,218 higher than those near stations less than three years old. This may be attributed to factors such as better-established infrastructure and surrounding development, resulting in an "infrastructure (metro) maturity effect." This suggests that areas around older metro stations may experience more development and the establishment of amenities over time, driving up property values. In addition, a greater number of residents within the ward is associated with higher property prices. It suggests that a greater demand for housing and easier access to facilities exist in areas with larger populations.

The distance decay effect indicates that properties further from the city centre have lower property values, which may reflect reduced access to amenities and opportunities. Finally, properties with higher costs to access the metro tend to have lower values, underscoring the importance of metro connectivity in determining property prices. The expansion of MRT can improve accessibility and reduce travel costs, which may be capitalised into residential property values.

Evidence from the academic literature generally indicates a positive association between rail-transit accessibility and property prices, although the magnitude varies across locations and neighbourhood characteristics (Wu et al., 2020; Rennert, 2022). Recent evidence from India also suggests that metro accessibility can generate significant property-price premiums, including around Mumbai Metro stations (Suri & Cropper, 2026).

Higher-income residents are willing to pay a premium for desirable locations with amenities such as metro access, contributing to the income effect. Although household income is found to have a positive and statistically significant association with residential property values, this relationship warrants a more nuanced interpretation. Rather than reflecting a purely exogenous income effect, the results may indicate a process of sequential causation. Improved metro accessibility and infrastructure development can directly raise property values through enhanced connectivity and access to amenities, while simultaneously attracting relatively higher-income households to these locations. In this sense, income may serve as both a driver of housing demand and an outcome of infrastructure-led spatial sorting. This is consistent with international evidence from transport infrastructure case studies, such as the Metro cable in Medellín (Bocarejo et al., 2014) and the new metro line in Oslo (Lunke & Throndsen, 2024), which demonstrates that while accessibility improvements benefit all income groups, the largest gains are often seen among the richest households. This indicates a trend where higher-income households are more likely to capitalise on the benefits of improved metro access. Similarly, Meriläinen et al. (2023) found that improved metro accessibility is associated with an increased share of highly educated individuals in surrounding neighbourhoods, suggesting gradual socio-economic restructuring. This is also supported by the infrastructure maturity effect captured by the dummy variable years of operation. Over time, the aggregate of transport connectivity, commercial activity, and urban amenities may make these areas more attractive to higher-income residents, who are willing to pay a premium for improved accessibility and quality of life. Consequently, rising income levels around older metro stations may partly reflect self-selection and residential sorting, rather than a strictly causal effect of income on property values.

## 5.2 Recommendations

The Bengaluru metro serves as a prime example of how metro systems can improve livability by reducing travel times, lowering congestion and pollution, and improving access to jobs and services. Rising housing prices near metro stations often reflect these benefits. According to Global Urban Mobility Indicators 2023, average metro network provision per million residents varies greatly across cities. Among the cities reported, Taipei ranks first with 72 kilometres per million residents, while Oslo is in second position with 69 kilometres, Stockholm third with 64 kilometres, and Doha fourth with 64 kilometres (UITP, 2023). These figures indicate substantial differences in metro network provision across cities. In contrast, Indian cities such as Delhi and Bengaluru lack adequate metro provision, with approximately 12 kilometres, and 5 kilometres per million residents, respectively. This demonstrates that the metro provision in these Indian cities remains relatively low in relation to their rapid population growth and urban expansion. Therefore, significant metro network development is essential. Specifically, with regard to Bengaluru, Phase 2 and Phase 3 expansion are imperative to enhance connectivity.

In addition to network development, another significant challenge faced by Indian cities, particularly Bengaluru, is last-mile connectivity. Although many cities have developed extensive metro networks, inadequate accessibility to metro stations can constrain their effective use. In the case of Bengaluru, Ghosh et al. (2022) found significant spatial gaps in access to metro feeder services and highlight the importance of first- and last-mile connectivity for ensuring effective and equitable use of the metro network.

In addition, there is a need for effective coordination among various transport systems such as government-operated public buses, suburban trains, and metro systems. However, such coordination is inadequate in several cities in India. This can be seen in Bengaluru and Hyderabad, both of which have advanced metro systems, but face challenges in coordinating metro services with buses and other transport modes (The New Indian Express, 2025). Consequently, people rely on apps for cabs, auto rickshaws, and cycle rickshaws to meet their first- and last-mile travel needs (Baski, 2026). This shows that the general advantages of metro systems, including their possible effect on land and property values, may not be realised without a well-coordinated system of last-mile connectivity. Without this

coordination, the extent to which the expansion of metro systems can improve urban accessibility and support property development may be limited.

Finally, a long-term vision for the metro is to promote transit-oriented development (TOD) principles, which encourage sustainable urban growth and reduce dependence on private vehicles. The estimated reductions in emissions associated with the Bengaluru metro are 5.19, 0.54, and 0.66 tons per day for carbon monoxide, hydrocarbons, and nitrogen oxide, respectively (Gavimath & Mahesh, 2023). Densification around metro lines can promote more efficient land use while minimising the distance decay effects observed on property values in surrounding areas. By integrating metro development, cities may achieve significant economic benefits, improved air quality, reduced traffic congestion, and a more livable urban environment. The Bengaluru metro serves as an example of how implementing a strategic transit-oriented development plan can contribute to improved urban accessibility and support more sustainable urban growth.

## **6. CONCLUSION**

The research reveals that mass rapid transit systems are significantly associated with residential property values. Properties located near metro stations experience significant increases in value, which may be due to improved spatial access, reduced commute times, and increased connectivity to employment opportunities and amenities. Higher income levels among residents are also positively and significantly associated with property values, suggesting these residents are willing to pay a premium for locations with amenities such as metro access. Areas with larger populations and longer-established metro lines tend to have higher property values and may therefore be more attractive to residents.

However, the study also identifies potential negative associations with property values, such as distance decay and higher metro connection costs. Properties further from the city centre tend to have lower values, reflecting the concentration of amenities and opportunities in central areas. Moreover, properties facing a higher cost to connect to the metro tend to experience decreased values, potentially highlighting the importance of accessibility costs in determining property value. The findings highlight the importance of TOD policies in supporting land value capture and enhancing urban livability. By understanding

the relationship between property values and metro development, policymakers can make informed decisions to promote equitable development and sustainable urban growth. The results contribute to academic debates on TOD by providing empirical support for the capitalisation of metro accessibility into residential property values, in line with findings by Jiang et al. (2020), Duncan (2011), and Zhao and Larson (2011), while extending this evidence to the Indian metropolitan context.

Consistent with TOD and accessibility theory, this study finds that proximity to metro stations is associated with significantly higher residential property values. The distance decay effect supports the predictions of location and bid-rent theories regarding reduced land values with increasing distance from transit and the city centre. By bringing India's rapidly growing metro systems into the global conversation on land value capture and TOD, the findings strengthen the case for value capture mechanisms in emerging economies by providing empirical support for the theoretical assertion that infrastructure-led accessibility improvements produce quantifiable private value increments, as demonstrated by the spatial gradients of property values around metro corridors. Further additions of this study are to the urban land economics and location theory literature, building on classical frameworks proposed by von Thünen (1826), Alonso (1964), and Hansen (1959), by demonstrating a clear distance decay effect in property values with respect to both the city centre and metro stations.

This study has several limitations, including the absence of panel data, reliance on cross-sectional hedonic regression, and potential omitted variable bias, which restricts the analysis to associations rather than causal effects. Advanced approaches such as difference-in-differences, instrumental variables, or geographically weighted regression, along with transaction-level or longitudinal data, could provide more robust insights. Despite these constraints, the study offers valuable evidence for urban planning and real estate decision-making. Future research should employ panel datasets, track property values over time, and conduct cross-city comparisons to better capture the long-term and context-specific dynamics of mass rapid transit infrastructure on housing markets.

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APPENDIX

Table A1: Detailed Review of the Literature on the Relationship Between Metro Systems and Property Values

| Author Name              | Objective(s)                                                                                                                                                       | Variables                                                                                                                                                                                                   | Methodology                                                                                                                                                                              | Source of Data                                                                                                                           | Findings                                                                                                                                                                                                                                                                                  |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Global context           |                                                                                                                                                                    |                                                                                                                                                                                                             |                                                                                                                                                                                          |                                                                                                                                          |                                                                                                                                                                                                                                                                                           |
| Pan & Zhang (2008)       | Determine the effects of rail transportation on land use mix, land development intensity, and property values in Shanghai, China.                                  | Land use composition: Percentage of land used for residential, commercial, industrial, and other purposes. Land development intensity: Floor area ratio Property values: Sales prices of residential units. | Spatial analysis to identify patterns in land use change around rail transit stations. Hedonic price modelling to estimate the influence of rail transit on residential property values. | The Shanghai Municipal Bureau of Statistics. The Shanghai Municipal Land Administration Bureau. The Shanghai Real Estate Trading Center. | Shanghai's rail transit has shown encouraging results in urban development and land use changes. The transit proximity premium is around 152 yuan/m2 for every 100 metres nearer to the metro station.                                                                                    |
| de Andrade & Maia (2009) | To research the link between modes of transportation and land use in the Recife area of Brazil as well as the impact of metropolitan railway lines on urban growth | The separation between main area, closest metro stops and closest significant transit centre. Neighbourhood infrastructure, the primary land use, HDI, household income, population density.                | The hedonic pricing technique was used to determine how the price of any urban land responds to the recent metro influx to the city.                                                     | Field survey, collecting data on property sales within a 500-metre radius on both sides of the metro line.                               | The model shows a concentration of increased value around metro stations, although this increase is not greater than in other regions of the city. This is likely due to the high use of the metro among residents of informal settlements, which account for almost half the population. |

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| Author Name                        | Objective(s)                                                                                                                                                               | Variables                                                                                                                                           | Methodology                           | Source of Data                                                                                                                                                        | Findings                                                                                                                                                                                                                                                                                                                |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Martinez & Viegas (2009)           | To assess the impact of metro rail access on residential property values in Lisbon, Portugal. To compare local vs. systemwide accessibility models                         | Bedrooms, typology, floor area, age of house, educational index, the entropy index metro rail, road rail                                            | Cross section hedonic price modelling | Cross-sectional data on housing for sale in February 2007, with a total of 8,742 full records inside Lisbon's municipality and the remainder in Amadora and Odivelas. | The metro rail accessibility characteristics coefficients in the two models range from 3.49% to 5.18% for accessibility to two metro rail lines and from 4.62% to 6.17% for accessibility to a single metro rail line, indicating that metro rail proximity has a significant effect on property values.                |
| Cervero (2013)                     | To highlight the challenges of coordinating transportation and land use in developing countries, provide examples of how improved transportation and land-use integration. | Sale price, size, units, bath, bed, age, housing density, income, racial profile, % senior citizens, % vacant land, half-mile LRT, highway/ freeway | Hedonic price regression              | Residential data for year 2000, there were 1,495 parcel records for multi-family housing, 9,672 for condominiums, and 14,756 for single-family homes.                 | Multi-family: Prices for residential properties near 800 metres of an East Line Trolley stop have risen by 17.6%.<br>Condominiums: Prices went up 6.4% near East Line Trolley stations and 46% near Coaster stations. Single-family: A 17% rise in price for homes within 800 metres of a non-downtown Coaster station. |
| Anantsuksomsri & Tontisirin (2015) | Capture the impact of mass transit system in Bangkok, Thailand                                                                                                             | Land value, population density, arterial road, distance to CBD, airports, hospitals, parks, schools and university                                  | Hedonic price modelling               | Cross-sectional data from 622 residential properties in the Bangkok Metropolitan Region for the year 2010.                                                            | United States Dollar \$ 9210 rise in land value per 1 km proximity to the mass transit station seen.                                                                                                                                                                                                                    |

| Author Name                       | Objective(s)                                                                                                                                                                                                                                           | Variables                                                                                                                                                                                | Methodology                                                                                                                                                                                                                  | Source of Data                                                                                                                                                                       | Findings                                                                                                                                                                                                                                                                       |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Xu et al. (2016)                  | Is there a need to control for the spatial dependence effect to obtain unbiased estimates? Does the property value impact of rail transit differ by housing market type, development stage, rail technology and near-station land use characteristics? | Floor mixed with office, distance to urban centre, distance to transport hub, distance to main road, district with primary school in 800m with hospital in 800m, with open space in 800m | Estimate spatial regression models and compare the results with those from OLS models. estimate the models for multi-family and single-family markets separately and add several relevant interaction terms into the models. | Los Angeles County Metropolitan Transportation Authority, property sale transaction data: "single-family and multi-family property sale transactions in Los Angeles during 2003–2004 | The study examines the impact of Wuhan MRT#2 on commercial property values through spatial regression analysis, focusing on the 400m radius of road network distance from Metro stations, which is significantly smaller than the 700–1000m impact scope in residential areas. |
| Camins-Esakov & Vandegrift (2018) | Analyse influence of light rail expansion on property values                                                                                                                                                                                           | Real estate property values, distance from light rail station                                                                                                                            | Longitudinal (before-after) analysis with hedonic price model                                                                                                                                                                | Household survey for residential property values and property characteristics                                                                                                        | Properties closer to new stations experience higher annual price appreciation (0.21–0.25% per minute closer). Appreciation diminishes with distance, disappearing around 12 minutes (0.6 miles) from the station.                                                              |

## HOW BENGALURU'S METRO AFFECTS RESIDENTIAL PROPERTY VALUES

| Author Name              | Objective(s)                                                                                                                             | Variables                                                                                                                                                                                                                                                                                               | Methodology                                                            | Source of Data                                                                                                                                                                                                       | Findings                                                                                                                                                                                                                                                                                                                            |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mulley et al. (2018)     | Determine whether Sydney's Inner West Light Rail has led to sustained long-term increases in residential property prices in its vicinity | Price (transaction price of the property), bedrooms, bathrooms, parking, property type (0 = house, 1 = unit), unemployment rate, buffer of 100m around station (binary variable indicating if the property is within 100m of a light rail station), household income, distance to LRT, CBD and bus stop | Geographically Weighted Regression (GWR)                               | RPdata; 2011 Australian Census; GIS (Accessibility variables, including network distances to the nearest light rail station, bus stop, and the CBD, were calculated using Geographic Information System (GIS) tools) | An average 5.8% price increase per 1km closer to a light rail station, but a negative impact within 100m due to externalities such as noise; light rail uplift is stronger outside the city centre while bus accessibility shows negative or insignificant effects, highlighting mode-specific valuations and spatial heterogeneity |
| Chun-Chang et al. (2020) | Analyse the impact of mass rapid transit (MRT) construction and operation on housing prices                                              | Housing prices MRT construction start time, distance to MRT station                                                                                                                                                                                                                                     | Difference-in-difference (DD) method with spatial lag and error models | A 500-metre distance from an MRT was considered for the research range using GIS                                                                                                                                     | Housing prices within the 500-metre influence range fell by 7.9% following the start of metro construction and had no essential effect on housing prices within the 500-metre influence range after the start of operation.                                                                                                         |

| Author Name        | Objective(s)                                                                                                                                                                                       | Variables                                                                                                                                                                                                                                                                                                             | Methodology                                                                                                               | Source of Data                                                                                                                                                                        | Findings                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Iida et al. (2022) | To empirically examine the financial feasibility of property value capture with land-use control to support the development and operation of a new mass rapid transit (MRT) line in Hanoi, Vietnam | Property characteristics (site area, business advantage, number of building floors), neighbourhood (population/employment density, entropy index), accessibilities (distance to CBD/bus stop, bus frequency), travel time/cost, wait time.                                                                            | Hedonic price models, demand modelling, and analysing multiple hypothetical scenarios for mass rapid transit investments. | Property characteristics from private real-estate companies, Hanoi Statistical Office, Hanoi Urban Planning Institute, Hanoi Transerco, and GIS                                       | Hedonic models show positive influences from densities and bus frequency on property prices; the travel demand model confirms effects from densities and negative from time/cost; scenario analyses indicate property value capture taxation and land-use controls significantly enhance MRT profitability by reducing payback periods and increasing internal rate of return. |
| Yen et al. (2022)  | To study the transit-oriented development (TOD) framework in Taipei City, Taiwan, a high-density city, and quantify its effects on property value uplift                                           | ARIMA: dependent variable- natural log of average quarterly property price; independent variables – dummies for TOD events, metro events, and time periods; DID model: dependent – natural log property price; independent – property attributes, sold year dummies, catchment distance bands and their interactions. | ARIMA on average quarterly property prices; micro-level difference-in-differences (DID) modelling.                        | Ministry of the Interior, Taipei City Government, reports, Taipei Rapid Transit Corporation, Department of Transportation, Taipei City Government, Taipei Joint Bus Management Centre | Macro-level ARIMA analysis reveals no significant changes in property prices following TOD events, possibly due to unfinished projects. In contrast, micro-level DID results show a positive 10.5% uplift in 2018 for properties located 500–1000m from Shilin Station during the TOD announcement, but negative or insignificant effects elsewhere and in other years.        |

## HOW BENGALURU'S METRO AFFECTS RESIDENTIAL PROPERTY VALUES

| Author Name            | Objective(s)                                                                 | Variables               | Methodology                         | Source of Data                                                                  | Findings                                                                                                                                                                                                                                                                            |
|------------------------|------------------------------------------------------------------------------|-------------------------|-------------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Indian Context</b>  |                                                                              |                         |                                     |                                                                                 |                                                                                                                                                                                                                                                                                     |
| Wagh & Sonar (2021)    | Examine impact of Metro & station proximity on real estate values & land use | Metro station proximity | ArcGIS Analysis                     | Real estate transaction data – literature review for NDVI, NDBI, and BU indices | The level of influence is greatest when the distance is between 200m and 350m, and remains notable when the distance is less than 500m, leaving the station as the principal access point. The effect is negligible for houses located more than 500 metres from the metro station. |
| Singhal & Tyagi (2021) | Examine impact of Delhi MRTS stations on commercial property values          | Metro station proximity | Hedonic price analysis (HPA) models | Commercial property sale data (pre & post-commissioning)                        | Negative impact near stations during construction. The coefficients show that the metro rail has induced increase in price premium by ₹732.7978 to ₹246.1906 (station-wise) in the vicinity and the impact extends to almost 500 meters away from MRTS stations.                    |

| Author Name            | Objective(s)                                                                                                                                                               | Variables                                                                                                               | Methodology                                                                                                                                                                                                             | Source of Data                                                                                                                                                                                                                                                           | Findings                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sharma & Newman (2022) | To examine the impact of urban rail on land value uplift in city of Bengaluru, India.                                                                                      | Land value changes, metro line proximity, socio-economic factors, accessibility factors, metro rail specific variables. | Panel data hedonic price modelling and cross-sectional data hedonic price modelling                                                                                                                                     | Real estate transaction data, metro line data, socio-economic data from surveys                                                                                                                                                                                          | Urban rail has a strong positive effect on property values in Bengaluru. Land prices of residences in the city rise by an average of 4.5% following the building of metro stations. The impact is greatest in the immediate area of metro stations, when land prices rise by up to 25%.                                                                                                             |
| Malhotra et al. (2020) | 1. Study property price trends along metro stretches. 2. Identify key attributes impacting property cost 3. Establish a relationship between cost and selected attributes. | Dependent: Cost of residential property (per sq. ft. or total price)                                                    | Control and impact area approach (define impact area radius, select control areas, compare prices). Hedonic regression analysis (develop statistical models to estimate the impact of each attribute on property cost). | Real estate transaction data (sale prices) for residential properties. Data on metro stations, distances, and new developments. Public data on crime rates, traffic patterns, and parking facilities. Socioeconomic data to classify income groups of residential areas. | Property prices are influenced by various factors, including metro distance, new developments, area size, connectivity, accessibility, and neighbourhood characteristics. The impact is stronger in low-income areas that depend more on metro access. Prices typically fall with greater distance from stations, and hedonic regression models can estimate property costs based on these factors. |

Source: Authors' Compilation

Nebojša Janićijević\*

## PLANNED ORGANISATIONAL CHANGE MODELS: REVIEW AND SYNTHESIS

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**ABSTRACT:** *In the contemporary, turbulent business environment, organisations are compelled to undergo frequent and increasingly radical changes. Models of planned organisational change represent a set of managerial activities that must be carried out in a specific sequence to ensure that planned changes are executed effectively. The literature offers a wide range of planned organisational change models, and even a cursory review suggests that they display considerable similarity and overlap, both in terms of the activities they encompass and in the sequencing of those activities. This situation points to the possibility of convergence among these models and their synthesis. The aim of this paper is to synthesise the most popular and in-*

*fluent models of planned organisational change and to develop an integrative model. Based on four relevant reviews of such models, ten of the most influential and widely used models were selected. The analysis of the activities they contain, as well as the sequence of those activities, enabled the synthesis and creation of an integrative model of planned organisational change. This model comprises eleven groups of activities, or phases, which appear – albeit under different labels – in all the analysed models and in a broadly similar order.*

**KEY WORDS:** *change management, change model, planned organisational changes, organisation*

**JEL CLASSIFICATION:** M10

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## **1. INTRODUCTION**

Modern companies, operating in circumstances of globalisation, technological development, political changes, and unforeseen disruptive events such as pandemics and wars, are forced to undergo frequent organisational changes. However, these changes are expensive, risky, and associated with many negative consequences for the organisation and its members (Janićijević & Kotarac, 2024). According to a study by McKinsey & Company, only 26% of organisational change initiatives succeed in improving performance and sustaining results, while 38% have a negative impact and 36% have no effect at all (De Smet et al., 2025). Organisational changes invariably consume substantial resources, including financial resources and the time and energy of both managers and employees. They cause the company to disrupt its usual operations, leading to a decline in operational efficiency and profitability. For example, a large retailer spent \$1.2 billion on a digital transformation project that aimed to improve its online presence and customer experience, but ended up losing \$600 million in sales and reducing its market share by 5% due to technical glitches and customer dissatisfaction (Faster Capital, 2025). Furthermore, organisational change is always accompanied by conflicts that impair interpersonal relationships and organisational climate, generating negative emotions, such as resentment, anxiety, anger, and frustration. Consequently, this reduces employees' motivation, satisfaction, and productivity (Zhou et al., 2006). Therefore, management typically avoids undertaking organisational change; however, when compelled to do so, it strives to implement the changes rapidly, efficiently, and in a planned, systematic, and deliberate manner.

The science of organisational change is in the pre-paradigmatic phase of development (Kuhn, 1970) and contains numerous epistemologically and ontologically different theories, perspectives, and concepts (Alase, 2017; Demers, 2007; Janićijević, 2007; Suddaby & Foster, 2016; Van de Ven & Poole, 1995). Theories, perspectives and concepts are descriptive in their intent, aiming to reveal the nature of organisational change by identifying three key components of organisational change: change cause, change content, and change process (Janićijević, 2007). Unlike theories that are descriptive and reveal the nature and flow of organisational changes as they actually happen, organisational change models are prescriptive in nature and aim to 'prescribe' how the changes should unfold (Rosenbaum et al., 2018). Therefore, organisational change models are

practical guidelines for managing planned changes in the organisation. Here, planned organisational change is understood as moving the organisation from a present state to a desired future state through conscious, pre-planned managerial actions (Teczke et al., 2017). The management of planned organisational changes implies a set of deliberate, planned activities undertaken by the company's management to move the organisation from its present state to a desired future state (Stouten et al., 2018). Planned organisational changes are very complex and involve many activities and participants, and they occur in constantly changing conditions; therefore, their success is far from assured. According to some studies, only one-third of the planned organisational change projects are successful (Jarrel, 2017). This is why the literature is abundant with planned organisational change models designed to assist company management in successfully implementing them. According to one somewhat dated review, over 2,700,000 references to the terms 'managing change' can be found in Google Scholar (Rosenbaum et al., 2018).

If a planned organisational change model is a set of prescriptions that must be taken into consideration in order for management to be able to successfully initiate, lead, and implement organisational changes, then there are two key issues: which actions need to be taken and in which order? Planned organisational change models differ precisely in terms of which activities, grouped into steps, or phases, they include and in what sequence. The number of phases (or steps, i.e., activity groups) in these models can vary widely, ranging from as few as three in Lewin's well-known unfreezing–move–refreezing model (Lewin, 1951) to more than ten steps in the model proposed by Stouten and his associates (2018). The activities in different models are surprisingly similar, although the same activities are often described using different terms. When a larger number of models are analysed, it becomes evident that certain activities appear repeatedly, although not necessarily in all models. The sequence of activities in planned organisational change models is also very similar, yet some variations do exist; thus, in certain models, specific managerial activities precede others, while in other models, they follow them. The conclusion is that organisational change models in the literature converge, with a high degree of overlap between them: the same or similar activities appear in most models, and they tend to occur in a similar order. One of the reasons for this is that all models of planned organisational change are based on the seminal work of Kurt Lewin (1951) and his three-phase model. All

subsequent models have further developed Lewin's initial model. It is therefore not surprising that the models are similar to one another.

Such a situation naturally calls for the synthesis of planned organisational change models and the creation of an integrative model. The evident convergence of all models in the literature allows for the identification of groups of activities (phases or steps) that most frequently appear in the majority of the most significant models of planned organisational change, as well as the identification of the sequence in which these activities are most commonly performed across these models. In this way, an integrative model can be constructed, composed of the activity groups that occur most frequently in the literature and arranged according to the sequence most commonly observed. Given the large number of planned organisational change models available, a synthesis of these models can only be performed on a carefully selected sample. This sample should consist of the most popular and influential models that have emerged over the past several decades. The aim of this paper is to select, analyse, and synthesise these particular planned organisational change models, thereby arriving at an integrative model of planned organisational change.

The structure of the paper is as follows: First, the models of planned organisational change that will be included in the analysis are selected. Next, these models will be briefly presented, outlining their key activities, steps, or phases in their defined sequence. Finally, a synthesis will be performed, resulting in the creation of an integrative model of planned organisational change through the identification and description of the activity groups common to the analysed models.

## **2. LITERATURE REVIEW**

The first step in identifying common activities and interventions of planned organisational change is to select among models of planned organisational change for analysis and comparison. Given the large number of these models in the literature, it is not feasible to analyse them all; rather, it is necessary to select those that are representative. In the literature, four systematic and comprehensive reviews of representative models of planned organisational change have appeared relatively recently: Stouten et al., 2018; Rosenbaum et al., 2018; Siddiqui, 2017; Teczke et al., 2017. The selection of representative models in these reviews was

based on their prevalence and influence in the literature, as well as on the review authors' subjective judgements regarding the importance of certain models. Thus, for example, Stouten and his associates (2018) based their selection on the number of citations in Web of Science, Google web hits, and their conversations with managers and consultants. The other authors of the reviews selected the models to be included in their analyses in a similar manner. The selection of the planned organisational change models to be analysed and synthesised in this study is based both on the cross-comparison of models included in these four reviews and on the present author's own judgement regarding the importance of individual models. First, the models that appear in all four reviews were selected, such as: Lewin's (1951) three-phase model, Kotter's eight-step model (1996), Kanter et al.'s Ten Commandments model (1992), and Hiatt's ADKAR model (2006). Then, based on the present author's assessment of the importance of the models as well as their theoretical and practical significance, some of the models appearing in one or two reviews were added. From the review of Stouten et al. (2018), the following models were selected: Cooperrider & Srivastva's appreciative inquiry (1988), Beer et al.'s six-step model (1990), and Judson's five-stage model (1991). From the review of Teczke et al. (2017), the following models were selected: Nadler's 12-step model (1997), and Pendlebury et al.'s model (1998), while the USAID model (2015) was taken from Siddiqui's review (2017). No additional models were taken from the review of Rosenbaum et al. (2018), as it included almost all the models already selected. Finally, this list of models was complemented by a model developed by Stouten et al. (2018).

All ten above-mentioned models derive from Lewin's (1951) foundational three-phase model (unfreezing–move–refreezing). For this reason, Lewin's model is not included in the list of models to be analysed. The selected models span a period of 30 years (1988–2018), with the most recent having been published seven years ago. This provides sufficient time to assess their popularity and influence on other authors as well as on practice. Accordingly, the most recent models are not included in this analysis, as there has not been enough time for their significance and impact to become evident.

The appreciative inquiry model contains four steps, or groups of activities (4D: Discovery, Dream, Design, Destiny), in the following order (Cooperrider & Srivastva, 1988): 1. Discovery: thinking about what functions well in the current

organisation and what factors contribute to this success. This step identifies the best of “what is” currently working well within the organisation; 2. Dream: encouraging employees to think about their “ideal” new features that would make the organisation even better. This step involves imagining a positive future of “what might be”; 3. Design: determining “what should be”, that is, how to achieve the envisioned future; 4. Destiny: capturing “what will be”, that is, what we will do to achieve our vision and make our dreams a reality.

Beer’s six-step model (Beer et al., 1990) assumes the following steps in planned organisational change: 1. Conduct an accurate diagnosis of the problem situation which contributes to mobilising commitment to the change; 2. Develop a clear and compelling vision of change that outlines the desired future state of the organisation; 3. Establish consensus in support of this new vision by communicating the vision to stakeholders; 4. Implement the change and spread it throughout the organisation through the involvement of stakeholders; 5. Institutionalise the change by integrating it with formal structures and systems; 6. Monitor and adjust the change as needed.

Judson’s five-stage model (Judson, 1991) consists of the following five steps in the change process: 1. Analyse and plan the change; 2. Communicate the change; 3. Gain acceptance for the required changes, particularly in terms of behaviour; 4. Make the initial transition from the status quo to the new situation; 5. Consolidate the new conditions and continue to follow-up to institutionalise the change.

Kanter et al.’s Ten Commandments for effective change management are (Kanter et al., 1992): 1. Analyse the organisation’s need for change; 2. Create a shared vision and common direction in which emphasis is put on the benefits of change; 3. Separate from the past; 4. Create a sense of urgency; 5. Support a strong leadership role; 6. Line up political sponsorship; 7. Craft an implementation plan; 8. Develop enabling structures; 9. Communicate to and involve people; 10. Reinforce and institutionalise the change.

Kotter’s eight-step model (Kotter, 1996) includes the following steps of planned organisational change: 1. Establish a sense of urgency; 2. Form a guiding coalition; 3. Develop the change vision; 4. Communicate this vision to employees; 5. Develop change plans; 6. Create short-term wins to reinforce the change implementation; 7. Include a consolidation stage which strengthens and

continues the change by making additional changes; 8. Institutionalise the change by integrating it with the organisation's structures and systems.

Nadler's 12-step model (Nadler, 1997) contains the following steps: 1. Gain the support of key power groups; 2. Ensure leaders model change behaviour; 3. Use symbols and language; 4. Define areas of stability; 5. Surface dissatisfaction with the present conditions; 6. Promote participation in change; 7. Reward behaviours that support change; 8. Disengage from the old; 9. Develop and clearly communicate an image of the future; 10. Use multiple leverage points; 11. Develop transition management arrangements; 12. Create feedback.

Pendlebury et al.'s 10-factor model (Pendlebury et al., 1998) includes the following activities which should be undertaken in order to execute changes: 1. Define the vision; 2. Mobilise people; 3. Catalyse energy; 4. Steer changes; 5. Deliver results; 6. Obtain participation; 7. Handle emotions; 8. Handle power; 9. Train and coach; 10. Actively communicate.

The ADKAR model (Hiatt, 2006) assumes the following change phases: 1. Awareness of the need for change – describe the reasons for the change; 2. Desire and willingness – develop these to support and participate in the change; 3. Knowledge of how to change – develop the knowledge and skills necessary for conducting changes; 4. Ability to implement change – ensure that the organisation is ready and prepared for the change, and has robust plans in place for any issues; 5. Reinforce change – monitor the change process, resolve any major issues, and support the business to fully embed the change into the day-to-day operations.

The change model developed by USAID (USAID, 2015) consist of 7 steps: 1. Establish a vision – the vision should be clear, simple, and relevant; 2. Involve senior leadership – leaders must be committed and involved in the change process; 3. Develop a change management plan – the plan should be detailed and specific; 4. Engage stakeholders – their involvement is crucial and creates a sense of ownership; 5. Communicate at all levels – this is one of the most important steps in successful change management process; 6. Create infrastructure to support adoption – this involves organisational structure and its policies, procedures, and systems; 7. Measure progress – an appropriate format or procedure that appropriately demonstrates adoption of the desired changes.

Finally, Stouten et al.'s model (Stouten et al., 2018) consists of the following steps: 1. Assess the opportunity or problem motivating the change; 2. Select and support a guiding change coalition; 3. Formulate a clear compelling vision of the change; 4. Communicate the vision; 5. Mobilise energy for change; 6. Empower others to act; 7. Develop and promote change-related knowledge and ability; 8. Identify short-term wins and use as reinforcement of change progress; 9. Monitor and strengthen the change process over time; 10. Institutionalise change in company culture, practices, and management succession.

There is no doubt that the development of the change management field has continued beyond 2018, although this progression is not included in this study. In recent years, the development of organisational change management models has increasingly focussed on digital transformation and the integration of technological and organisational changes. Organisational transformation, alongside the transformation of business processes, business models, and business domains, has become an integral part of digital transformation (Kraus et al., 2021). Organisational change models as an integral part of digital transformation involve discontinuous changes, with a key focus on altering cultural assumptions to ensure the sustainability of technological changes. The development of information and communication technologies and digitalisation have also given rise to agile change management as a new direction in the change management field. Agile change management introduces significant innovations in the organisational change process, reflected in an iterative approach, continuous feedback loops, collaborative team efforts, as well as the application of a servant leadership style, cultural shifts, and cross-functional collaboration (Das et al., 2024; Miceli et al., 2021).

### **3. SYNTHESIS OF PLANNED ORGANISATIONAL CHANGE MODELS**

The content analysis of the identified planned organisational change models demonstrates their convergence in the sense that similar or identical activities appear across these models, often in a similar or even identical sequence. Naturally, there are no complete overlaps, so no one model is identical to another. However, the degree of overlap among these models in terms of the activities they contain is so significant that it calls for synthesis and creation of a unified, integrative model. This synthesis was conducted by grouping together activities similar or identical in content into phases of planned organisational change. This

grouping was performed qualitatively, using comparison logic in content analysis of the activities of planned organisational change in the original models. The key criterion for grouping was the similarity of the purpose, nature, and content of the activities being grouped. The current author's own experience, both in creating an organisational change model and in serving as a consultant in the field of change management, also played an important role in this process. Each of the identified groups of activities and phases in the integrative model can be recognised in several of the analysed models, albeit under different names or with slightly different descriptions. The analysis focused on the content and purpose of the activities appearing in the models, rather than on their names or the terminology used to describe them. Moreover, in some cases, certain phases (steps) in the analysed models were divided into two groups of activities in the integrative model whenever they encompassed activities that were essentially different in nature and belonged to different phases of the integrative model. This led to situations where a model such as Judson's five-stage model was represented in six groups of activities within the integrative model. Conversely, in other cases, two activities from the original model were merged into a single phase, or group of activities, in the integrative model, whenever both, by their nature and objectives, belonged to the same group of activities. Thus, for example, Kanter et al.'s "ten commandments" were consolidated into only seven phases in the integrative model. What is crucial, however, is that all individual activities from all the examined models are represented in the integrative model presented in this paper.

The sequence of activities in the integrative model is also determined by approximating the order in which they appear in the original models, which implies that it follows the basic logic of change and Lewin's (1951) change algorithm: unfreezing, move, refreezing. However, this does not mean that every activity in one of the original models is positioned in the integrative model in the same way as in the original model. Some activities that, in the original model, preceded another activity may, in the integrative model, come after that activity. The sequence of activities in the integrative model followed the dynamics of most of the analysed models, as well as the logic of the current author himself, which did not necessarily coincide with the dynamics in each of the models. This is why, for example, in the integrative model, creating the vision precedes managing power structure, which is also the case in the models of Kanter et al. (1992) and

Pendlebury (1998), whereas in Kotter's model the sequence is reversed. Since creating the vision is exclusively the leader's responsibility and forming a powerful coalition is only a means to achieving it, in the integrative model vision creation precedes managing the power structure. It should also be emphasised that the integrative model presented in this paper assumes that some phases may occur simultaneously for a certain period of time, i.e., that the next phase may begin before the previous one has been completed. This is the case in most of the models.

This analysis and synthesis of the above planned organisational change models resulted in eleven essentially different groups of activities common to most of the models and through which the models overlap. These activities provide a synthesised set of recommendations for management from the various models, outlining the activities necessary for effectively implementing organisational changes. The sequence of activities is tentative since the activities themselves vary across models and several activities can take place simultaneously. In the remaining text, the activities of managing planned organisational change that appear in most of the models will be named and presented in more detail. For each activity, corresponding activities from the models will be listed.

The first step in many planned organisational change models is *raising awareness of change necessity*. In the selected models, this activity is described as: separate from the past and create a sense of urgency (Kanter et al., 1992); raise awareness – the reasons for the change are described (Hiatt, 2006); establish a sense of urgency (Kotter, 1996); surface dissatisfaction with the present conditions, and disengage from the old (Nadler, 1997). This activity is very important for breaking inertia and creating conditions for the beginning of the change process. The objective existence of causes of organisational change will not, by itself, automatically initiate the change process. For change to be initiated, it is necessary that both management and employees develop a prevailing awareness that the changes are necessary and must occur without delay (Kotter, 1996). For this to happen, organisational inertia needs to be broken. Inertia represents the first, and often insurmountable, barrier to change. The causes of inertia are numerous, both individual and organisational (Omidvar et al., 2023), with routines, organisational culture, and the structure of power standing out among the organisational causes, while the individual sources are primarily associated

with fear of uncertainty, incompetence, and loss of power and status. Management must not underestimate people's ability to overlook the causes of change or to rationalise them in a way that suggests change is either unnecessary or impossible. This is why it must undertake a series of activities to clearly show to employees that without changes the survival of the organisation is uncertain. Only then can changes truly begin.

*Evaluating the present state* of the organisation is present in most planned organisational change models with the following descriptions: discovery – identify the best of “what is” currently working well within the organisation (Cooperrider & Srivastva, 1987); diagnose the problem situation accurately (Beer et al., 1990); analyse and plan the change (Judson, 1991); analyse the organisation's need for change (Kanter et al., 1992); define areas of stability (Nadler, 1997); assess the opportunity or problem motivating the change (Stouten et al., 2018). If we understand planned organisational change as a designed transition of the organisation from its current state to some future state, then the starting point of change is certainly understanding the existing state of the organisation. In order to determine where we want to go, we must first establish where we are now. Evaluation of the current state is most often carried out in the form of diagnosing the problems that should be solved through changes (Beer, 1990) or the opportunities that can be exploited if changes are implemented (Stouten et al., 2018). However, the appreciative inquiry model (Cooperrider & Srivastva, 1987) is particularly interesting because, instead of focusing on problems in the first phase of change (Discovery), it focuses on what is good in the organisation and what can serve as a foundation for achieving a desirable future state. Evaluating the present state is usually performed by gathering and analysing information about the organisation and its environment (Senior & Fleming, 2006). The most commonly used diagnostic methods for data gathering are interviews, questionnaires, observations, and secondary data. Data analysis is carried out using both quantitative and qualitative methods. The result of this phase of the planned organisational change process is a clear picture of the causes of the changes that need to be implemented.

*Shaping the future state* of the organisation is an activity that appears in most planned organisational change models under similar names: dream – encouraging employees to think about their “ideal” new features that would make

the organisation even better (Cooperrider & Srivastva, 1987); develop a vision of change (Beer et al., 1990); analyse and plan the change (Judson, 1991); create a shared vision (Kanter et al., 1992); develop the change vision (Kotter, 1996); develop ... an image of the future (Nadler, 1997); define the vision (Pendlebury et al., 1998); know how to change – gain an understanding of precisely how it is necessary to conduct the change (Hiatt, 2006); establish a vision (USAID, 2015); formulate a clear compelling vision of the change (Stouten et al., 2018). After evaluating the organisation's present state, management should, in this step, decide where it wants to be after the changes are implemented. This is done by formulating a vision of the organisation following the changes. It is widely recognised that people will not move away from the existing state, no matter how clearly they perceive it as unfavourable, until they have an alternative provided by the vision itself (Kanter et al., 1992). The vision serves three primary functions (Pendlebury et al., 1998): it explains the changes to employees, thereby reducing uncertainty and resistance to change; it motivates employees to embrace the changes by promising certain benefits for both them and the organisation; and it ensures the coordination of activities among various actors during the change process, since if everyone shares the same vision, their individual actions will be aligned. To fulfill these roles, the vision must be desirable, realistic, feasible, and also simple to communicate (Kotter, 1996). For this reason, it must be formulated in a way that can be understood by everyone in the organisation.

*Communicating* the vision, but also all aspects of the change process, is a very important element of most planned organisational change models. This activity is referred to as: communicate this vision to employees (Kotter, 1996); establish consensus in support of this new vision, a step involving communicating the vision to stakeholders (Beer et al., 1990); communicate the change (Judson, 1991); communicate and involve people (Kanter et al., 1992); clearly communicate an image of the future and use symbols and language (Nadler, 1997); actively communicate (Pendlebury et al., 1998); communicate at all levels (USAID, 2015); communicate the vision (Stouten et al., 2018). The vision of the new organisation must be created, but this alone is not sufficient. In order to fulfill its role in the change process, the vision must be communicated so that it is known to all, or at least the vast majority, of employees and managers. While communicating the vision is unquestionable in planned organisational change models, communicating the other elements of the change process varies in its extent. In

some models, communication is largely limited to conveying the vision (Kotter, 1996; Stouten et al., 2018), whereas other models emphasise a broader aspect of communication. These models highlight the need for communication throughout the entire change process, as well as communicating the topics that necessarily include the vision but are not confined to it (Judson, 1991; USAID, 2015). Alongside the vision, other aspects of the planned change project should also be communicated systematically throughout the organisation. These include, for example, the change plan, progress in implementing changes, results of completed changes, and barriers or difficulties encountered during change implementation (Pendlebury et al., 1998). Since communicating changes needs to be widespread throughout the entire organisation and the messages must reach all employees, communication should be carried out in simple language, be focused, and make use of abundant examples, metaphors, and symbols (Nadler, 1997). Communicating should certainly be planned, and the change communicating plan should include the topic being communicated, the source (author) of the message, the target (recipient) of the message, the media through which the message is delivered, and the timing of the communication (Jick & Peiperl, 2003).

*Motivating and energising people* is a necessary condition for the success of planned organisational change because only motivated and energised people can implement changes. In the analysed models, this appears as: mobilise commitment to the change (Beer et al., 1990); gain acceptance for the required changes, particularly in behaviour (Judson, 1991); promote participation in change (Nadler, 1997); obtain participation, mobilise people, handle emotions, catalyse energy (Pendlebury et al., 1998); have the desire and willingness to support and participate in the change (Hiatt, 2006); involve senior leadership – leaders must be committed and involved in the change process (USAID, 2015); mobilise energy for change, empower others to act (Stouten et al., 2018). It is evident that this phase in the planned change process includes a variety of activities whose common characteristic is working with people. These activities primarily involve motivating employees to accept the changes, as well as energising them to ensure their active participation in the change process. In this way, resistance to change is prevented. Many authors emphasise that employees cannot easily be forced to implement changes, given the wide range of opportunities for obstructing change available to them, and that it is always

preferable to motivate them to accept changes rather than coerce them (Beer et al., 1990; Nadler, 1997). Motivating and energising employees to accept and implement changes is generally accomplished in two main ways: by inducing dissatisfaction with the current state (“stick”) and by developing positive expectations regarding the organisation’s new state (“carrot”) (Pendlebury et al., 1998). Some authors suggest that it is not sufficient for employees to be merely motivated to accept changes; they must also be committed to them (Beer et al., 1990). Only in this way will they actively contribute to the change process. Employee participation in changes represents a means of motivating employees to accept the changes, but at the same time it is also a consequence of their motivation to change (Hiatt, 2006). Employee participation in implementing changes significantly reduces resistance to change. This phase of the change process also includes activities aimed at handling employees’ emotions, which are often intense during change and can hinder employees’ adjustment to it (Pendlebury et al., 1998). Emotions during change are predominantly negative, such as anger, frustration, despair, and resentment, and they often render employees ineffective in implementing the changes. Management must assist employees in coping with their emotions during the change process to ensure they accept the changes as quickly as possible and actively engage in their implementation. Finally, actively identifying and overcoming resistance to change is an integral part of this group of activities in managing planned changes (Senior & Fleming, 2006).

*Managing power structure* is an activity in which management must secure the support of powerful individuals and groups in the organisation. This activity is recognised in many planned organisational change models as: support a strong leadership role and line up political sponsorship (Kanter et al., 1992); form a guiding coalition (Kotter, 1996); gain the support of key power groups (Nadler, 1997); handle power (Pendlebury et al., 1998); engage stakeholders (USAID, 2015); select and support a guiding change coalition (Stouten et al., 2018). Power is an important factor in organisational change for the simple reason that powerful individuals and groups can use their power to block changes that do not serve their interests. For this reason, many planned organisational change models include activity aimed at managing the power structure and securing the support of powerful individuals and groups for the change initiative. This activity involves several steps (Pendlebury et al., 1998). First, the

management leading the change must understand the power structure and assess the amount of power held by individuals and groups within the organisation. Next, the management must evaluate the attitude of powerful individuals and groups toward the changes, based on whether they stand to gain or lose (money, power, status). Finally, a deliberate political action must be directed towards those who hold power. Those who have power and support the changes because they stand to gain should be strengthened, while those who have power but would lose from the changes should be weakened. To this end, various political tactics can be employed, such as negotiation and compromise, coalition building, co-optation, and others (Senior & Fleming, 2006).

*Building capabilities for change* is a necessary precondition for subsequent successful implementation of changes. This step is recognised in the planned organisational change models examined as: ensure leaders model change behaviour and reward behaviours that support change (Nadler, 1997); train and coach (Pendlebury et al., 1998); know how to change by developing the knowledge and skills necessary for conducting the changes; (Hiatt, 2006); create infrastructure to support adoption (USAID, 2015); develop and promote change-related knowledge and ability (Stouten et al., 2018). All the cited authors argue that successful implementation of changes requires employees to possess the knowledge, abilities, and skills that will enable them both to carry out the changes and to perform their jobs under the conditions of the new organisation. Considering that sustainable organisational change can only be achieved when each employee changes the way they work at their workplace, it becomes clear that acquiring new knowledge and developing new capabilities are essential for the success of change. At the same time, this eliminates one of the most common sources of resistance to change – fear of incompetence. The most important activity in this group is undoubtedly ensuring that employees have the opportunity to learn and acquire new knowledge and skills (Hiatt, 2006; Stouten et al., 2018). In addition, it is necessary to model desirable behaviour and reward all behaviour directed towards change (Nadler, 1997). Finally, it is often emphasised that this phase requires employee training and coaching (Pendlebury et al., 1998). While training focuses on acquiring abilities and skills, coaching is aimed at fostering positive attitudes to change.

*Planning and organising changes* include building structures and adopting plans for implementing changes. This activity is recognised in the above models as: design – determine “what should be”, i.e., how to achieve the envisioned future (Cooperrider & Srivastva, 1987); craft an implementation plan and develop enabling structures (Kanter et al., 1992); develop a change plan (Kotter, 1996); develop transition management arrangements (Nadler, 1997); ensure that the organisation is ready and prepared for the change and has robust plans in place for any issues; (Hiatt, 2006); develop a change management plan (USAID, 2015). Since these are models for planning organisational change, it is natural that most of them include activities of planning and organising the implementation of change. A change plan must include activities to be carried out in order to implement the changes, the sequence of these activities, activity carriers, timetable or scheduling of activities, and control parameters for execution of these activities (Kotter, 1996). When it comes to the organisational infrastructure that should support changes, this usually involves teams that perform different roles in the process of implementing change. The literature mentions, among others: steering committee, expert team, facilitating team, and communication team (Hayes, 2002; Janićević, 2007).

*Implementing changes* is a critical activity in the process of managing changes and usually consists of two sub-activities: initial changes and consolidation of changes. Planned organisational change models recognise this activity as: destiny – capture “what will be”, i.e., what we will do to achieve our vision and make our dreams a reality (Cooperrider & Srivastva, 1987); implement and spread the change throughout the organisation through the involvement of stakeholders (Beer et al., 1990); make the initial transition from the status quo to the new situation and consolidate the new conditions (Judson, 1991); create short-term wins to reinforce the change implementation and include a consolidation stage which strengthens and continues the change by making additional changes (Kotter, 1996); use multiple leverage points to implement changes (Nadler, 1997); steer changes and deliver results (Pendlebury et al., 1998); identify short-term wins and use them to reinforce change progress (Stouten et al., 2018). Implementation is at the very heart of the organisational change process and, therefore, this activity should achieve the envisioned result of the changes. The authors of the models mentioned largely agree that the implementation process unfolds in two steps (Judson, 1991; Kotter, 1996; Stouten et al., 2018). The first

step consists of the initial change and the fast achievement of initial results and successes. This is very important because initial successes in the realisation of changes continually motivate and energise employees, eliminate resistance, legitimise the changes, and give new momentum to the change process. Without initial successes in the implementation of changes, it may easily happen, especially in the case of extensive and long-term changes, that the initial motivation and enthusiasm of the participants decline and that doubts and resistance to changes appear. In the second step of this phase of the change process, on the basis of initial successes, changes spread throughout the organisation, cascade to lower hierarchical levels, and include an increasing number of employees and managers. Therefore, in this step, efficient coordination among the many individuals and teams involved in implementing changes is crucial (Kotter, 1996).

*Institutionalising changes* aims at stabilising changes, that is, refreezing in Lewin's terms. This step is recognised in the models as: institutionalisation – institutionalise the change by integrating it with formal structures and systems (Beer et al., 1990); continue to follow up to institutionalise the change (Judson, 1991); reinforce and institutionalise the change (Kanter et al., 1992); institutionalise the change by integrating it into the organisation's structures and systems (Kotter, 1996); support the business to fully embed the change into the day-to-day operations (Hiatt, 2006); institutionalise change in company culture, practices, and management succession (Stouten et al., 2018). Refreezing occurs as changes become embedded in everyday operations and employee behaviour in the workplace. For changes to be sustainable in the long run, they must be incorporated into the structure and systems and be accepted as a model of behaviour in the workplace by all employees and managers. Some authors also include the process of legitimisation of changes in institutionalisation (Janićijević, 2007; Stouten et al., 2018), which implies that changes are included not only in the structure and everyday operations but also in the culture of the organisation. Sustainable changes are only those that employees and managers consider legitimate, that is, justified and useful from the perspective of their values and norms. If the implemented changes require employees to behave at work in a way that is contrary to their values and norms, it is necessary to change those values and norms in order for the changes to be sustainable. Otherwise, employees will quickly return to their behaviour from the time before the changes, and the

changes will remain only a “dead letter” on paper. Since organisational culture determines the shared values and norms of employees, this means that it is necessary to align the changes with the organisational culture (Janićijević, 2007; Stouten et al., 2018).

*Monitoring the changes* is the final step in managing organisational changes. It is described in the planned organisational change models above as: monitor and adjust the change as needed (Beer et al., 1990); create feedback (Nadler, 1997); monitor the change process and resolve any major issues (Hiatt, 2006); measure progress using an suitable format or procedure that appropriately demonstrates adoption of the desired changes (USAID, 2015); monitor and strengthen the change process (Stouten et al., 2018). The final activity in managing planned organisational changes is monitoring and controlling the implemented changes. As with any conscious, planned managerial activity, monitoring and control are necessary in order to determine the results of the planned changes and to undertake any necessary corrections. To carry out this activity, it is necessary to establish a system for gathering and processing the information on the achieved changes. The outcome of these activities is the formal completion of the change project and, potentially, the commencement of a new cycle of changes, through which the organisation will further evolve based on the achievements and/or address any deficiencies identified in the completed project.

The activities included in the integrative model of organisational change are interrelated and cannot be observed in isolation. Although there is a sequence in which these activities are carried out, it is not strictly fixed, and some activities can be undertaken both before and after others. Furthermore, activities may also occur simultaneously. However, some activities are linked by causal relationships and cannot be successfully completed without others. For example, without raising awareness of change necessity, it is not possible to carry out the activities of evaluating the present state or shaping the future state. Nevertheless, the activity of implementation of changes is largely conditioned by the completion of the preceding activities, such as shaping the future state, motivating and energising people, planning and organising changes, and building capabilities for change.

The activities, or phases, of the planned organisational change process in the integrative model, arranged by authors and their respective models, are presented in the following table:

**Table 1:** Activities of the planned organisational change process in the integrative model, arranged by authors and their respective models

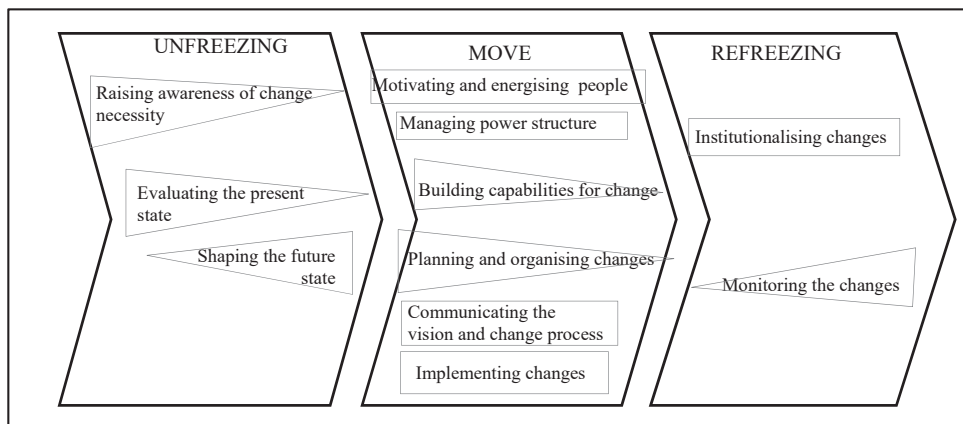
| Change activity                       | Cooperrider & Srivastva, 1987 (AI) | Beer, 1990 | Judson, 1991 | Kanter et al., 1992 | Kotter, 1996 | Nadler, 1997 | Pendlebury et al., 1998 | Hiatt, 2006, ADKAR | USAID, 2015 | Stouten et al., 2018 |
|---------------------------------------|------------------------------------|------------|--------------|---------------------|--------------|--------------|-------------------------|--------------------|-------------|----------------------|
| UNFREEZING (Lewin, 1951)              |                                    |            |              |                     |              |              |                         |                    |             |                      |
| Raising awareness of change necessity |                                    |            |              | √                   | √            | √            |                         | √                  |             |                      |
| Evaluating the present state          | √                                  | √          | √            | √                   |              | √            |                         |                    |             | √                    |
| Shaping the future state              | √                                  | √          | √            | √                   | √            | √            | √                       | √                  | √           | √                    |
| Communicating                         |                                    | √          | √            | √                   | √            | √            | √                       |                    | √           | √                    |
| Motivating and energising people      |                                    | √          | √            |                     |              | √            | √                       | √                  | √           | √                    |
| MOVE (Lewin, 1951)                    |                                    |            |              |                     |              |              |                         |                    |             |                      |
| Managing power structure              |                                    |            |              | √                   | √            | √            | √                       |                    | √           | √                    |
| Building capabilities for change      |                                    |            |              |                     |              | √            | √                       | √                  | √           | √                    |
| Planning and organising changes       | √                                  |            |              | √                   | √            | √            |                         | √                  | √           |                      |
| Implementing changes                  | √                                  | √          | √            |                     | √            | √            | √                       |                    |             | √                    |
| REFREEZING (Lewin, 1951)              |                                    |            |              |                     |              |              |                         |                    |             |                      |
| Institutionalising changes            |                                    | √          | √            | √                   | √            |              |                         | √                  |             | √                    |
| Monitoring the changes                |                                    | √          |              |                     |              | √            |                         | √                  | √           | √                    |

**Source:** Author's analysis and synthesis of planned organisational change models

As noted, the starting point and the model that created the framework within which all subsequent models of planned organisational change have developed is Lewin's three-phase model: unfreezing–move–refreezing. The eleven identified activities of planned organisational change in our integrative model can be

integrated into Lewin's three-phase model (1951) in the manner presented in the following figure:

**Figure 1:** Activities of integrative model of planned organisational change in the framework of Lewin's three-phase model



#### 4. CONCLUSION

In contemporary business conditions, characterised by sudden, rapid, and discontinuous changes, companies must adapt to the environment through frequent changes in their organisation. Since organisational changes are always accompanied by costs, conflicts, and uncertainty, and they disrupt normal operations, companies must approach them in a planned and organised manner in order to implement them as efficiently as possible. Planned organisational change involves a series of managerial activities through which the organisation is moved from its current to the desired state. Models of organisational change are practical guidelines for managing this change. They contain carefully designed, planned, and organised activities that managers should undertake in a certain sequence in order to successfully implement organisational change. The literature contains numerous such models, and reviewing them reveals their relative similarity and even overlap in both the activities they include and the order in which these activities are carried out.

The similarity among different organisational change models points to their convergence and calls for another step in the same direction – their synthesis.

Since the activities required for implementing change are repeated across different models in the same or similar form and in the same or similar sequence, it is possible to create an integrative model of planned organisational change. Such a model would incorporate the most common activities from individual models, arranged in the most frequently observed sequence. The aim of this paper was to synthesise a limited number of models of planned organisational change and, in doing so, to construct an integrative model that would encompass all the experiences and insights contained in the individual models – both with regard to the activities that need to be undertaken to implement planned organisational changes and with regard to the sequence of these activities.

In this paper, the first step was to select the models that would serve as the basis for synthesis. This selection was made on the grounds of four recent reviews of the most popular and influential models of planned organisational change found in the literature. Ten of these models were chosen for analysis, which enabled the development of an integrative model. Lewin's model was excluded from this selection, as it represents the intellectual framework for all subsequent models. The synthesis was carried out qualitatively by examining the content and purpose of individual activities, identifying common elements among them, and determining the most frequently observed sequence of those activities. In this way, a model of planned organisational change was developed that comprises eleven groups of activities, steps, or phases, integrating the activities of all ten analysed models. The names of the groups of activities (or phases) in the integrative model were determined by the present author according to their content. Each individual activity from the analysed models was included in the integrative model, albeit frequently under a different name. The result is the integrative model of planned organisational change with the eleven activities taking place in a specific sequence: 1. Raising awareness of change necessity; 2. Evaluating the present state; 3. Shaping the future state; 4. Communicating; 5. Motivating and energising people; 6. Managing power structure; 7. Building capabilities for change; 8. Planning and organising changes; 9. Implementing changes; 10. Institutionalising changes; 11. Monitoring the changes. These activities are positioned within Lewin's framework, that is, they are referenced to one or two of his three phases of planned organisational change.

The paper is conceptual in its character, and its primary theoretical contribution lies in pointing to the convergence of models of planned organisational change, as well as in demonstrating one possible way to achieve their synthesis. The integrative model presented in this paper may be useful to researchers dealing with organisational change, serving as a direction for further studies. For this purpose, empirical validation of the model would be useful, and it could be carried out in two ways. First, a comparative study could be conducted on a large sample of organisations within one or more sectors, using quantitative analysis to examine the extent to which the activities identified in the integrative model were present in previous organisational change processes and the degree to which they contributed to successful change implementation. The second method for empirical validation of the integrative model would be a longitudinal case study in which changes in a single organisation would be tracked in real time using qualitative methods to determine the relevance of the activities proposed in the model.

The practical contribution of the paper is that the integrative model developed here can be of use to managers, who may apply it as a tool for managing planned organisational changes, given that it synthesises the insights of the ten most influential models found in the literature.

The main limitation of this paper lies in the subjective method of selecting the analysed models and the qualitative method of their synthesis, both of which involve a certain degree of authorial arbitrariness. Clearly, another author might have chosen different models and conducted the synthesis in a different way, which could have possibly resulted in somewhat different activities in the integrative model. The conceptual and review-based nature of this paper is also a limitation, as the result has not been empirically tested. However, it should be noted that empirical validation is also lacking for many of the analysed models of planned organisational change found in the literature. A possible direction for future work in this field could therefore be the development of a strategy designed specifically for empirical testing of the integrative model of planned organisational change.

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## THE ROLE OF PERCEIVED EMOTIONAL INTELLIGENCE DIMENSIONS IN PROJECT MANAGER COMPETENCIES IN THE ICT SECTOR

**ABSTRACT:** *This study examines the relationship between perceived emotional intelligence dimensions and project manager competencies in the ICT sector. Drawing on the trait meta-mood approach, emotional intelligence is observed through three self-perceived emotional dimensions: Attention to Feelings, Clarity of Feelings, and Mood Repair. The empirical analysis is based on a cross-sectional survey of 197 ICT professionals in the Republic of Serbia who perform project management roles. Project manager competencies were measured using items derived from the European e-Competence Framework, while the relationships between the constructs were tested using partial least squares structural equation modelling (PLS-SEM). The*

*results show that Clarity of Feelings and Mood Repair have positive and statistically significant effects on project manager competencies, whereas Attention to Feelings is not a significant predictor. These findings indicate that understanding and regulating emotions, rather than merely attending to them, may support competency development in ICT project environments. The study contributes to project management literature by distinguishing the effects of specific trait emotional intelligence dimensions within an industry-specific context.*

**KEY WORDS:** *trait emotional intelligence, project manager, project manager competencies, ICT industry*

**JEL CLASSIFICATION:** M15, J24

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## **1. INTRODUCTION**

Projects are temporary and goal-oriented forms of work through which organisations implement change, deliver innovation, and create strategic value. In contrast to routine organisational activities, projects are usually characterised by time limits, resource constraints, task interdependence, and the need to coordinate different stakeholders. Previous research emphasises that project manager competencies combine technical, behavioural, and contextual dimensions, which together support effective project execution (Kulej-Dudek, 2021; Liikamaa, 2015). These characteristics make the role of project manager specific in comparison with many functional managerial roles. Project managers often lead teams that are temporary, cross-functional, and composed of members with different professional backgrounds, which makes their competency profile more complex than purely functional managerial roles (Cancela & Ribeiro, 2025; Tabassi et al., 2019). Therefore, project manager competencies include not only technical knowledge related to planning, budgeting, risk management, and control, but also interpersonal competencies related to stakeholder communication, conflict management, delegation, and team coordination (Dias et al., 2023; de Rezende et al., 2021).

These requirements are especially visible in the ICT sector. ICT projects are commonly shaped by rapid technological change, evolving client requirements, short development cycles, and intensive collaboration among highly specialised employees. Digital transformation has increased the importance of technical and digital skills, but it has also made coordination, communication, and knowledge sharing more demanding for project managers (Gonçalves et al., 2023; Marhraoui, 2023). Research on digital-era and mobile project contexts similarly points to new competency requirements for project managers (Obradović et al., 2018; Pereira & Freitas, 2019). In such conditions, project managers are expected to combine technical and digital understanding with the ability to coordinate people, interpret tensions in the team, and maintain commitment under uncertainty. This is why the ICT sector provides a relevant context for examining the socio-emotional side of project manager competencies.

Emotional intelligence is relevant in this context not because it is a necessary condition for motivating others, nor because managers with lower emotional intelligence cannot lead project teams. Rather, emotional intelligence may be

understood as a socio-emotional resource that helps project managers notice emotional signals, understand the causes of interpersonal tensions, and respond more constructively in demanding project situations. In project-based work, these abilities may be useful because project managers often need to coordinate employees without stable hierarchical authority, balance different stakeholder expectations, and react to problems under time pressure. Recent evidence indicates that project managers' emotional intelligence may be related to project performance, although this relationship can depend on project complexity and other contextual mechanisms (Zhang et al., 2023; Zhu et al., 2021). Studies in complex and IT-related project environments also suggest that emotional intelligence may support communication, cooperation, and project success through indirect or mediating mechanisms (Haider et al., 2024; Mohammed et al., 2026).

However, emotional intelligence should not be treated as a single uniform construct. The literature distinguishes ability-based approaches, which conceptualise emotional intelligence as a set of cognitive abilities for processing emotional information, from trait or self-perceived approaches, which focus on how individuals perceive and evaluate their own emotional functioning (O'Connor et al., 2019; Schlegel & Mortillaro, 2019). This study follows the trait meta-mood approach developed by Salovey et al. (1995), according to which emotional intelligence is observed through three dimensions: attention to feelings, clarity of feelings, and mood repair. Attention to Feelings refers to the extent to which individuals attend to their emotional states. Clarity of Feelings reflects the perceived ability to understand emotions and their causes. Mood Repair denotes the perceived ability to regulate negative emotional states and maintain or restore a more constructive affective state.

The distinction between these dimensions is important for project management. The trait meta-mood approach assumes that emotional attention, emotional clarity, and mood repair represent different aspects of perceived emotional functioning, rather than interchangeable indicators of the same ability (Salovey et al., 1995). Reviews of emotional intelligence measurement also emphasise that self-perceived emotional abilities should not be interpreted in the same way as ability-based emotional intelligence tests (O'Connor et al., 2019). Merely paying attention to emotions may not be sufficient if emotional information is not

interpreted correctly or regulated in a constructive way. In some situations, excessive attention to emotions may even distract the project manager from task demands. By contrast, emotional clarity may help project managers understand whether stress, frustration, or conflict comes from task ambiguity, interpersonal disagreement, deadline pressure, or stakeholder expectations. Mood repair may then support self-control, resilience, and constructive communication when project problems occur. For this reason, the three dimensions of trait emotional intelligence may have different relationships with project manager competencies, and their effects should be examined separately.

Although previous studies have examined emotional intelligence in relation to project success, project performance, and conflict management (Castro et al., 2022; Khosravi et al., 2020), recent evidence also connects emotional intelligence with project commitment and project performance (Zhu et al., 2021). Reviews show that the role of emotional intelligence in project management is increasingly discussed through leadership, teams, and project success mechanisms (Barros de Abreu & Monteiro de Carvalho, 2026; Zhang et al., 2023). However, less is known about how specific dimensions of trait emotional intelligence are associated with project manager competencies in ICT project environments. This gap is important because organisations need to know not only whether emotional intelligence matters, but also which emotional dimensions are more relevant for the development, selection, and training of project managers, especially amid continuing concerns about project talent shortages (Project Management Institute, 2025). Accordingly, the aim of this paper is to analyse the effects of Attention to Feelings, Clarity of Feelings, and Mood Repair on project manager competencies among ICT professionals in the Republic of Serbia. By examining these relationships separately, the study contributes to a more precise understanding of the socio-emotional foundations of project manager competencies in an industry-specific context.

## **2. LITERATURE REVIEW**

### **2.1. Project manager competencies in the ICT sector**

Project manager competencies refer to the integrated set of knowledge, skills, and behavioural capacities that enable a project manager to plan, coordinate, and complete project work (Birkhead et al., 2000; Geaney & Engel, 1996). More recent

competency frameworks describe them as a combination of technical knowledge, interpersonal skills, and contextual understanding needed for effective project execution (Dias et al., 2023; Rezende & Blackwell, 2019). These competencies cannot be reduced only to the use of formal project management tools or to the possession of hierarchical authority. In practice, project managers are expected to define project tasks, monitor costs and deadlines, identify risks, communicate with stakeholders, delegate responsibilities, and coordinate team members with different professional backgrounds.

The literature usually distinguishes between technical, behavioural, and contextual competencies. Technical competencies refer to planning, scheduling, budgeting, risk management, and control of project activities. Behavioural competencies refer more precisely to interpersonal and self-management capacities, such as stakeholder communication, conflict handling, delegation, negotiation, and team coordination. Contextual competencies are related to the ability to understand the organisational, technological, and sectoral environment in which the project is implemented (Kulej-Dudek, 2021; Marnewick et al., 2016). This distinction is important because project performance depends not only on formal procedures, but also on how the project manager uses knowledge, manages relationships, and adapts to the project context.

In the ICT sector, project manager competencies are shaped by the specific nature of technology-intensive work. ICT projects often involve changing client requirements, short development cycles, technical uncertainty, and close cooperation among specialists from different fields. Digital transformation research shows that project management is increasingly connected with technical and behavioural competencies in innovative and rapidly changing contexts (Gonçalves et al., 2023). Previous studies on IT project managers also show that personal and performance competencies can be relevant for project outcomes (de Araújo & Pedron, 2015; Marnewick et al., 2016). In such projects, the project manager not only supervises tasks, but also connects technical experts, clients, external partners, and internal stakeholders. In digital environments, project manager competencies increasingly include the ability to use digital tools, coordinate knowledge-intensive work, and adapt to technological change (Liu et al., 2022; Obradović et al., 2018). Therefore, the ICT context makes the

integration of technical, interpersonal, and adaptive competencies especially relevant.

In this study, project manager competencies are understood as perceived abilities related to the management of ICT projects. They include the ability to identify project risks, define project plans, manage budgets, communicate project progress, delegate tasks, manage external resources, and align stakeholder priorities. This approach is consistent with the European e-Competence Framework, which provides a suitable basis for examining project management competencies in ICT-related work. Accordingly, the present study focuses on those competencies that connect technical project execution with coordination, communication, and stakeholder management in ICT project environments.

## **2.2. Trait emotional intelligence and project manager competencies**

Emotional intelligence generally refers to the way individuals perceive, understand, use, and regulate emotional information (Salovey & Mayer, 1990). However, emotional intelligence is not a single theoretical model. A distinction is commonly made between ability-based approaches, which conceptualise emotional intelligence as a set of cognitive abilities, and trait or self-perceived approaches, which focus on how individuals evaluate their own emotional functioning (O'Connor et al., 2019; Schlegel & Mortillaro, 2019). This distinction is important for the present study because the empirical model is based on self-reported emotional abilities rather than on performance-based emotional intelligence tests.

The present research follows the trait meta-mood approach developed by Salovey et al. (1995), operationalized through three related but conceptually different dimensions: Attention to Feelings, Clarity of Feelings, and Mood Repair. These dimensions capture complementary aspects of perceived emotional functioning, including the monitoring of emotional states, the perceived understanding of emotions, and the regulation of negative affect. In this context, the Trait Meta-Mood Scale is understood as a self-report measure of perceived emotional intelligence rather than as a direct performance test of emotional abilities (O'Connor et al., 2019; Salovey et al., 1995).

These dimensions are relevant for project manager competencies because project work includes both task-related and relational demands. A project manager must follow project plans and budgets, but also interpret interpersonal signals, respond to tensions, coordinate different actors, and remain stable under pressure. In this sense, trait emotional intelligence is not treated here as a general explanation of managerial success. It is treated as a set of self-perceived emotional capacities that may support the way project managers use their technical and interpersonal competencies in demanding ICT project situations.

The relevance of emotional intelligence for project managers should be explained through the specific nature of project work. Project managers frequently operate with limited formal authority, temporary teams, multiple stakeholders, and high levels of uncertainty, which makes coordination and interpersonal judgement particularly important (de Rezende et al., 2021; Dias et al., 2023). In such conditions, technical expertise is necessary, but it is not always sufficient for effective project coordination. Emotional intelligence may help project managers recognise when stress, disagreement, or frustration affects communication and decision-making. It may also support more constructive responses to conflict and pressure, especially in complex project settings (Haider et al., 2024; Khosravi et al., 2020).

This does not mean that emotional intelligence is important only for project managers, or that other types of managers do not need it. Sales managers, human resource managers, and functional managers may also benefit from emotional intelligence. The specific point in this study is narrower: project managers represent a theoretically relevant group because their role is strongly based on temporary coordination, stakeholder alignment, and leadership without stable hierarchical control. These features make socio-emotional capacities particularly visible in project management.

Recent project management research supports this argument. Previous studies have linked emotional intelligence with project success, trust, communication, and team-related mechanisms (Castro et al., 2022; Rezvani et al., 2019). Other work connects emotional intelligence with transformational leadership, organisational commitment, and project success (Doan et al., 2020; Fareed et al., 2021). Zhu et al. (2021) found that project managers' emotional intelligence is

related to project performance through project commitment, while project complexity changes the strength of this relationship. Zhang et al. (2023), in a meta-analysis of the relationship between project managers' emotional intelligence and project performance, also emphasise that this relationship depends on contextual and measurement-related factors. These findings suggest that emotional intelligence is not only a personal characteristic, but also a potential resource for managing the relational and emotional demands of project work.

In ICT projects, these demands may be even more pronounced. Project managers often coordinate highly specialised employees, communicate with clients about changing requirements, and manage tensions between technical possibilities, deadlines, and stakeholder expectations. In IT project settings, emotional intelligence has also been discussed as a factor shaping project manager behaviour and project success (Sposito et al., 2022). Studies in software and IT project settings further indicate that emotional intelligence can interact with managerial skills and contribute to IT project outcomes (Ellahi et al., 2024; Mohammed et al., 2026). Therefore, the ICT sector provides a suitable setting for examining whether specific dimensions of trait emotional intelligence are associated with project manager competencies.

The three dimensions of trait emotional intelligence may contribute to project manager competencies through different mechanisms. Attention to Feelings represents the first level of emotional awareness. Since this dimension reflects the extent to which individuals notice and attend to their emotional states (Salovey et al., 1995), it can be relevant in managerial work because emotions may signal stress, dissatisfaction, or emerging interpersonal tension before these issues become visible in behaviour (Dulewicz & Higgs, 2000). In project settings, recent research suggests that emotional intelligence may support interpersonal communication, cooperation, and the management of human-related project challenges (Haider et al., 2024; Zhang et al., 2023). Similar arguments have been made in studies connecting emotional intelligence, empathy, leadership, and project management success (El Khatib et al., 2021; Sergey et al., 2020). A project manager who notices emotional reactions may therefore be better able to recognise early signs of tension in the team. In ICT projects, where pressure and uncertainty are common, this awareness may help the manager detect situations

that require closer communication or coordination. However, emotional attention alone does not necessarily imply that emotions are understood or regulated. For this reason, its expected role is positive, but theoretically more limited than the roles of emotional clarity and mood repair. Therefore, the following hypothesis is proposed:

H1: Attention to Feelings has a positive effect on project manager competencies.

Clarity of Feelings, the ability to understand emotional states and identify their possible causes, is central in the trait meta-mood model because it captures whether individuals can make sense of their emotional reactions rather than merely notice them (O'Connor et al., 2019; Salovey et al., 1995). This ability is important for project managers because many project problems have both technical and interpersonal sources, such as unclear requirements, workload imbalance, communication problems, or different stakeholder priorities. Previous research indicates that project managers' emotional capacities are related to commitment, conflict management, project performance, and project success (Khosravi et al., 2020; Zhu et al., 2021). More recent synthesis also suggests that emotional intelligence operates through leadership, team, and relational mechanisms in project environments (Barros de Abreu & Monteiro de Carvalho, 2026). A project manager with higher emotional clarity may therefore be better able to distinguish sources of problems and respond appropriately. Emotional clarity may support decision-making, conflict handling, communication, and stakeholder coordination, which is consistent with studies linking emotional intelligence with decision quality and project management decisions (Alzoubi & Aziz, 2021; Rodrigues & Matos, 2024). Accordingly, the following hypothesis is proposed:

H2: Clarity of Feelings has a positive effect on project manager competencies.

Within the trait meta-mood framework, Mood Repair captures the regulatory aspect of perceived emotional intelligence (Salovey et al., 1995). It evaluates the self-perceived capacity to mitigate negative emotional states and restore a more constructive emotional baseline. Emotional regulation is especially relevant in project environments because project managers often face deadline pressure, technical problems, client requests, and unexpected changes. Empirical studies show that emotional intelligence can contribute to project performance through

commitment and other mediating mechanisms (Zhang et al., 2023; Zhu et al., 2021). In IT and software project settings, emotional intelligence has also been linked to project success and to the way managerial skills influence work performance (Ellahi et al., 2024; Mohammed et al., 2026). It has also been associated with lower burnout and better job performance under demanding conditions (Gong et al., 2019). The ability to regulate one's emotional state may support self-control, persistence, and calm communication, thereby contributing to leadership, delegation, problem solving, and cooperation within the project team. Accordingly, the following hypothesis is proposed:

H3: Mood Repair has a positive effect on project manager competencies.

### **3. METHODOLOGY**

#### **3.1. Sampling methods and procedures**

The participants in this study were ICT professionals employed in various companies across the Republic of Serbia, specifically in Central and Southern Serbia, who serve as project managers on different projects. A convenience sampling method was employed, and a cross-sectional study design was adopted. The first page of the questionnaire included an informed written consent statement for participants. Potential respondents were provided with information about the academic purpose of the research and were assured of complete anonymity. The questionnaire did not include questions on sensitive personal data. All participants were also guaranteed that their demographic information would be used solely for analysis and would be protected from access by unauthorised individuals. The sampling procedure adhered to the principles outlined in the Declaration of Helsinki and its latest amendments, ensuring compliance with ethical standards. The survey was conducted between January and February 2024, yielding a final sample of 197 ICT professionals. Regarding the sample composition, 118 respondents (59.9%) were men, and 79 (40.1%) were women. In terms of age, 127 respondents (64.5%) were under 40 years old, while the remaining 70 participants were over 40 (35.53%).

#### **3.2. Survey instrument and measurement**

To conduct the research, a structured questionnaire was developed to collect the relevant data necessary for statistical analysis. The questionnaire was divided into

three sections. The first section measured the independent variable, emotional intelligence, while the second section assessed the dependent variable, namely project manager competencies. The third section collected demographic information from the respondents. To ensure accurate measurement of the latent variables in the study, validated measurement scales from relevant previous research were employed, ensuring both reliability and comparability of the results.

The instruments were originally formulated in English. Following the selection of constructs, they were translated into Serbian and adapted to the cultural and linguistic context of the Republic of Serbia. To verify initial validity, a preliminary test was conducted on a sample of 30 respondents, confirming that the items were appropriately adapted to the national context. In the main study, respondents rated each statement using a five-point Likert scale, where 1 indicated complete disagreement and 5 indicated complete agreement with the statement.

Since both the independent variables and the dependent variable were measured using respondents' self-reports, the findings should be interpreted as relationships between perceived emotional abilities and perceived project manager competencies. This issue is also acknowledged in the limitations section.

**Emotional intelligence:** This variable was measured using the statements of the scale developed by Salovey et al. (1995). The construct was measured through statements classified into three factors. The first factor is Attention to Feelings, which was measured using three statements: "I don't pay much attention to my feelings", "I never give in to my emotions", and "I don't usually care much about what I'm feeling". The second factor is Clarity of Feelings, which was also measured through three statements: "I am rarely confused about how I feel", "I almost always know exactly how I am feeling", and "I feel at ease about my emotions". Finally, the third factor is Mood Repair, which was measured through six statements: "Although I am sometimes sad, I have a mostly optimistic outlook", "No matter how badly I feel, I try to think about pleasant things", "When I become upset I remind myself of all the pleasures in life", "I try to think good thoughts no matter how badly I feel", "If I find myself getting mad, I try to calm myself down", and "I never worry about being in a good mood".

Project manager competencies: This variable was measured using the statements of the European e-Competence Framework scale (The European Committee for Standardization, 2016). A total of seven statements were used: "Ability to identify project risks and define action plans to mitigate", "Ability to define a project plan by breaking it down into individual project tasks", "Ability to develop and comply with financial plans and budgets (Ability to develop and compliance to financial plans and budgets)", "Ability to communicate project progress to all relevant parties reporting on topics such as cost control", "Ability to delegate tasks and manage team member contributions appropriately", "Ability to manage external, contracted resources to achieve project objectives", "Ability to optimize project portfolio timelines and delivery objectives by achieving consensus on stakeholder priorities".

4. RESULTS

The relationships between the observed variables were analysed using the partial least squares structural equation modelling (PLS-SEM) approach. To assess the conceptual consistency between theoretically defined constructs and the empirically collected data, a confirmatory factor analysis (CFA) was conducted. This procedure allowed for the evaluation of the reliability and validity of the measurement model, while the PLS-SEM algorithm was employed for statistical processing and for testing the structural relationships. The results of the analysis are presented in Table 1.

Table 1: Measurement model and constructs

| Construct and item description | Convergent validity | VIF   | $\alpha$ | Composite reliability | AVE   |
|--------------------------------|---------------------|-------|----------|-----------------------|-------|
| Emotional Intelligence         |                     |       |          |                       |       |
| AF:                            |                     |       | 0.886    | 0.917                 | 0.787 |
| AF01                           | 0.967               | 2.586 |          |                       |       |
| AF02                           | 0.888               | 3.310 |          |                       |       |
| AF03                           | 0.798               | 2.290 |          |                       |       |
| CF:                            |                     |       | 0.815    | 0.889                 | 0.728 |
| CF01:                          | 0.848               | 1.837 |          |                       |       |
| CF02                           | 0.895               | 1.899 |          |                       |       |
| CF03                           | 0.815               | 1.702 |          |                       |       |

# PROJECT MANAGER COMPETENCIES IN THE ICT SECTOR

| Construct and item description | Convergent validity | VIF   | $\alpha$ | Composite reliability | AVE   |
|--------------------------------|---------------------|-------|----------|-----------------------|-------|
| MR:                            |                     |       | 0.888    | 0.914                 | 0.640 |
| MR01                           | 0.824               | 3.668 |          |                       |       |
| MR02                           | 0.880               | 4.650 |          |                       |       |
| MR03                           | 0.745               | 2.038 |          |                       |       |
| MR04                           | 0.768               | 1.940 |          |                       |       |
| MR05                           | 0.821               | 1.860 |          |                       |       |
| MR06                           | 0.754               | 1.867 |          |                       |       |
| PMC:                           |                     |       | 0.929    | 0.943                 | 0.701 |
| PMC01                          | 0.806               | 2.602 |          |                       |       |
| PMC02                          | 0.839               | 3.257 |          |                       |       |
| PMC03                          | 0.815               | 2.722 |          |                       |       |
| PMC04                          | 0.853               | 2.946 |          |                       |       |
| PMC05                          | 0.832               | 3.077 |          |                       |       |
| PMC06                          | 0.880               | 4.081 |          |                       |       |
| PMC07                          | 0.834               | 2.721 |          |                       |       |

**Note:** AF = Attention to Feelings; CF = Clarity of Feelings; MR = Mood Repair; PMC = Project Manager Competencies.

**Source:** Authors

Convergent validity was assessed using the average variance extracted (AVE), with a value of at least 0.5 considered acceptable (Chin, 2009; Fornell & Larcker, 1981). In this study, all constructs exceeded this threshold, with AVE values ranging from 0.640 to 0.787, particularly for Attention to Feelings. These results indicate that each construct accounts for more than 50% of the variance. Composite reliability (CR) values, which should exceed 0.7 (Hair et al., 2017), ranged from 0.889 to 0.943, demonstrating good internal consistency. The variance inflation factor (VIF) was below 5 for all constructs, indicating no multicollinearity issues in the model (Field, 2000). The results of discriminant validity are presented in Table 2.

**Table 2:** Discriminant validity

| Constructs | 1     | 2     | 3     | 4 |
|------------|-------|-------|-------|---|
| 1. AF      | –     |       |       |   |
| 2. CF      | 0.405 |       |       |   |
| 3. MR      | 0.250 | 0.374 |       |   |
| 4. PMC     | 0.096 | 0.317 | 0.298 | – |

**Note:** AF = Attention to Feelings; CF = Clarity of Feelings; MR = Mood Repair; PMC = Project Manager Competencies.

**Source:** Authors

Discriminant validity was assessed using the heterotrait-monotrait (HTMT) criterion, with a threshold of 0.85, to determine whether the measured constructs were sufficiently distinct and empirically separable (Henseler et al., 2015). Based on the results presented in Table 2, the highest HTMT value was observed for the Clarity of Feelings construct (0.405), while all other values were lower. Since all values are below 0.5, these results indicate good discriminant validity.

**Table 3:** Structural model fit indices

| Construct | Stone-Geisser $Q^2$ | $R^2$ | GOF   |
|-----------|---------------------|-------|-------|
| PMC       | 0.088               | 0.125 | 0.104 |
| SRMR      | 0.067               |       |       |

**Note:** PMC = Project Manager Competencies; SRMR = standardised root mean square residual.

**Source:** Authors

Structural fit indices are presented in Table 3. The cross-validated redundancy index, or Stone–Geisser  $Q^2$ , was calculated for the latent variable to assess its predictive relevance. The obtained  $Q^2$  value was 0.088, indicating a satisfactory level of predictive relevance for the model (Geisser, 1974; Stone, 1974;). The coefficient of determination ( $R^2$ ) was 0.125, meaning that 12.5% of the variance in the dependent variable is explained by the independent variable. The standardised root mean square residual (SRMR) was 0.067, below the 0.08 threshold, indicating good model fit (Hu & Bentler, 1998).

To examine the direct effects, PLS-SEM bootstrapping was employed. For all hypothesised relationships, this technique was used to calculate 95% confidence

intervals (CI) with a two-sided bias correction, providing a more precise and reliable assessment of the statistical significance of the results.

**Table 4:** Direct effects of trait emotional intelligence dimensions on project manager competencies

| Relationship | Path coefficient | <i>t</i> -value | 95% CIs (bias corrected) | Results       |
|--------------|------------------|-----------------|--------------------------|---------------|
| AF → PMC     | -0.022           | 0.243           | [-0.200, 0.115]          | Not Supported |
| CF → PMC     | 0.221**          | 3.082           | [0.109, 0.349]           | Supported     |
| MR → PMC     | 0.222***         | 3.682           | [0.131, 0.328]           | Supported     |

Notes: \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

**Note:** AF = Attention to Feelings; CF = Clarity of Feelings; MR = Mood Repair; PMC = Project Manager Competencies.

**Source:** Authors

The results presented in Table 4 show that Clarity of Feelings has a positive and statistically significant effect on project manager competencies ( $\beta = 0.221$ ,  $p < 0.01$ ), supporting H2. Mood Repair also has a positive and statistically significant effect on project manager competencies ( $\beta = 0.222$ ,  $p < 0.001$ ), supporting H3. In contrast, Attention to Feelings does not have a statistically significant effect on project manager competencies ( $\beta = -0.022$ ,  $p > 0.05$ ); thus, H1 is not supported.

These findings indicate that the ability to understand and regulate emotions is more relevant for perceived project manager competencies than merely attending to emotional states. At the same time, the modest  $R^2$  value suggests that trait emotional intelligence dimensions represent only one group of predictors of project manager competencies. Other individual, organisational, and project-related factors should also be considered. The multigroup analysis is presented in Table 5.

**Table 5:** Multigroup analysis of direct effects

| Relationship | Path<br>coefficient | t-value | Path<br>coefficient | t-value | Invariant |
|--------------|---------------------|---------|---------------------|---------|-----------|
|              | Female              | Female  | Male                | Male    |           |
| AF → PMC     | 0.048               | 0.386   | -0.033              | 0.236   | Yes       |
| CF → PMC     | 0.230               | 2.299*  | 0.224               | 2.209*  | Yes       |
| MR → PMC     | 0.282               | 3.177** | 0.196               | 2.180*  | Yes       |
|              | Age <40             | Age <40 | Age >40             | Age >40 |           |
| AF → PMC     | -0.004              | 0.034   | 0.191               | 0.740   | Yes       |
| CF → PMC     | 0.229               | 2.671** | 0.135               | 1.116   | No        |
| MR → PMC     | 0.173               | 2.215** | 0.262               | 2.351*  | Yes       |

**Note:** AF = Attention to Feelings; CF = Clarity of Feelings; MR = Mood Repair; PMC = Project Manager Competencies. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

**Source:** Authors

The multigroup analysis provides additional insight into the stability of the relationships across gender and age groups. Regarding gender, Clarity of Feelings had a positive and statistically significant effect on project manager competencies for both women ( $\beta = 0.230, t = 2.299$ ) and men ( $\beta = 0.224, t = 2.209$ ). Mood Repair was also significant in both groups, with a somewhat stronger coefficient among women ( $\beta = 0.282, t = 3.177$ ) than among men ( $\beta = 0.196, t = 2.180$ ). Attention to Feelings was not significant in either gender group, with low coefficients for both women ( $\beta = 0.048, t = 0.386$ ) and men ( $\beta = -0.033, t = 0.236$ ). This indicates that the main pattern of results is generally consistent across gender groups: emotional clarity and mood repair are relevant predictors, while emotional attention is not.

Regarding age, Attention to Feelings was not statistically significant in either group. The coefficient was close to zero among respondents younger than 40 ( $\beta = -0.004, t = 0.034$ ), while it was positive but not significant among respondents aged 40 or older ( $\beta = 0.191, t = 0.740$ ). Clarity of Feelings had a significant effect among younger respondents ( $\beta = 0.229, t = 2.671$ ), but not among older respondents ( $\beta = 0.135, t = 1.116$ ). Mood Repair had a significant effect in both age groups, with a somewhat stronger coefficient among older respondents ( $\beta = 0.262, t = 2.351$ ) than among younger respondents ( $\beta = 0.173, t = 2.215$ ). These results suggest that emotional understanding and emotional regulation may not

operate in exactly the same way across age groups. However, the subgroup findings should be interpreted cautiously because the sample was not originally designed for strong subgroup generalisation.

## 5. DISCUSSION

The aim of this study was to examine whether dimensions of trait emotional intelligence are associated with project manager competencies in the ICT sector. The results show that Clarity of Feelings and Mood Repair have positive and statistically significant effects on project manager competencies, while Attention to Feelings is not a significant predictor. This pattern of results supports the view that trait emotional intelligence should not be treated as a uniform construct. Its dimensions may have different roles in project management, depending on whether they refer to noticing emotions, understanding emotions, or regulating them.

The significant effect of Clarity of Feelings suggests that the ability to understand emotional states is relevant for project manager competencies. In ICT projects, project managers often deal with situations in which technical problems, stakeholder expectations, and interpersonal tensions are closely connected. A delay in project delivery, for example, may not be only a scheduling problem. It may also create frustration among team members, pressure from clients, or disagreement about priorities. A project manager who can understand emotional reactions and their possible causes may be better prepared to choose an appropriate response.

This finding is consistent with the trait meta-mood approach, where emotional clarity represents the perceived ability to understand and distinguish emotional states (Salovey et al., 1995). It also supports the argument that interpersonal and self-management capacities are important for coordinating people in complex project settings. In this sense, Clarity of Feelings may support communication, conflict handling, decision-making, and stakeholder coordination. This interpretation is consistent with studies linking emotional intelligence with project management decisions and project success (Castro et al., 2022; Rodrigues & Matos, 2024), and with evidence that socio-emotional capacities operate through commitment, leadership, and team-related mechanisms (Barros de Abreu & Monteiro de Carvalho, 2026; Zhu et al., 2021).

The multigroup analysis indicates that Clarity of Feelings may be more relevant among younger respondents. Younger ICT professionals may rely more on explicit emotional understanding when developing project management competencies, while older respondents may rely more on experience-based judgement. This interpretation should be treated cautiously, but it suggests that age may influence how emotional abilities are connected with project manager competencies.

Mood Repair also has a significant positive effect on project manager competencies. This result indicates that the perceived ability to regulate negative emotional states and restore a more constructive emotional state may be important for project managers in ICT environments. This interpretation is consistent with studies showing that emotional intelligence is relevant in complex project environments where interpersonal relationships, communication, and cooperation influence project outcomes (Haider et al., 2024; Zhang et al., 2023). It is also consistent with evidence that emotional intelligence can reduce destructive conflict and support team trust and performance (Khosravi et al., 2020; Rezvani et al., 2019).

This finding is theoretically meaningful because Mood Repair reflects the regulatory dimension of trait emotional intelligence. While emotional clarity helps the manager understand what is happening emotionally, mood repair refers to the ability to manage the emotional response. This distinction is important in project management because understanding a problem does not automatically mean responding to it effectively. A project manager may recognise tension in the team, but still needs self-control and emotional stability to address it in a productive way.

The multigroup results show that Mood Repair is significant in both age groups, with a somewhat stronger coefficient among older respondents. This may indicate that emotional regulation becomes more closely connected with project manager competencies as professional experience accumulates. However, this interpretation remains suggestive, since the subgroup analysis was not the main objective of the study.

Attention to Feelings did not have a statistically significant effect on project manager competencies. This result is important because it shows that merely

attending to emotions is not enough to explain perceived competencies in ICT project management. Emotional attention may be useful as the first step in emotional processing, but it does not necessarily lead to better decisions, better coordination, or more effective conflict management. For emotional information to become useful in project work, it needs to be interpreted and regulated.

One explanation is that Attention to Feelings captures awareness of emotional states, but not the ability to understand their causes or manage their consequences. In project environments, a manager may notice stress, dissatisfaction, or frustration, but this awareness alone does not show how to respond. Without emotional clarity and mood repair, attention to feelings may remain passive or even distracting. This interpretation is consistent with the results of the present study, where Clarity of Feelings and Mood Repair were significant predictors, while Attention to Feelings was not.

The nonsignificant effect of Attention to Feelings was also stable across gender and age groups. This finding suggests that, in the ICT project context, emotional awareness alone has a limited role in explaining project manager competencies. The result does not mean that attention to emotions is irrelevant in general. Rather, it indicates that emotional attention becomes more useful when it is combined with understanding and regulation of emotions.

The study makes a theoretical contribution by examining trait emotional intelligence dimensions separately rather than treating emotional intelligence as a single general construct. This is important because the results show that the three dimensions do not have the same relationship with project manager competencies. Clarity of Feelings and Mood Repair were significant predictors, while Attention to Feelings was not. The findings therefore support a more differentiated understanding of emotional intelligence in project management research.

The study also makes a contribution by placing this relationship in the ICT sector. ICT project management is shaped by technical complexity, rapid change, and strong dependence on cooperation among specialists. In such a context, competencies are not limited to planning and control, but include communication, stakeholder coordination, delegation, and the ability to respond constructively under pressure. By focusing on ICT professionals in Serbia, the

study provides industry-specific evidence on how self-perceived emotional abilities are associated with project manager competencies.

The findings also have practical implications. Organisations in the ICT sector should not focus only on technical project management skills when selecting and developing project managers. Technical knowledge remains necessary, but the results suggest that emotional clarity and emotional regulation may support project manager competencies in demanding situations. This is aligned with IT project research suggesting that emotional intelligence can strengthen project manager behaviour in project success contexts (Sposito et al., 2022). Training programmes should, therefore, include exercises for recognising sources of emotional tension, interpreting team reactions, and regulating one's response during conflict or pressure.

The results are also relevant for mentoring and professional development. More experienced project managers can help younger colleagues interpret emotional reactions in project work. However, emotional intelligence assessment should complement, not replace, evidence on technical knowledge, project experience, communication skills, and performance.

## **6. LIMITATIONS AND FUTURE RESEARCH**

This study has several limitations. First, the empirical research was conducted among ICT professionals in the Republic of Serbia. Therefore, the results should not be interpreted as universally valid for all project managers or industries. Future research should test the model in other sectors, such as construction, consulting, manufacturing, healthcare, or public administration.

Second, the study used a convenience sample. Although this enabled access to respondents with relevant project experience, it limits generalisability. Future studies should use larger and more diverse samples, preferably with probability-based or stratified sampling procedures, and include cross-country comparisons.

Third, the research design was cross-sectional. The results show statistically significant relationships between trait emotional intelligence dimensions and project manager competencies, but they do not prove causal effects in a strict longitudinal sense. Future research could examine competency development over time.

Fourth, both the independent variables and the dependent variable were measured using self-reported data. The results therefore refer to perceived emotional abilities and perceived project manager competencies. This is appropriate for trait emotional intelligence, but it may introduce common method bias and subjective evaluation. Future studies should combine self-reports with external assessments.

Finally, the model explains a modest share of variance in project manager competencies. This is consistent with research suggesting that emotional intelligence effects are often indirect and context-dependent (Mohammed et al., 2026; Zhang et al., 2023). Future research should include factors such as experience, leadership style, training, organisational support, team climate, and project complexity.

## **7. CONCLUSION**

The aim of this study was to analyse the relationship between trait emotional intelligence dimensions and project manager competencies among ICT professionals in the Republic of Serbia. The findings show that Clarity of Feelings and Mood Repair have positive and statistically significant effects on project manager competencies, while Attention to Feelings does not have a significant effect. These results indicate that understanding and regulating emotions are more relevant for perceived project manager competencies than merely attending to emotional states.

The study contributes to project management literature by showing that trait emotional intelligence dimensions should be analysed separately. In the ICT sector, where project managers coordinate specialised employees, changing requirements, and multiple stakeholder expectations, emotional clarity and emotional regulation may support competencies related to communication, decision-making, delegation, and conflict handling. However, the findings should be interpreted within the limits of the research design. The study was conducted in one industry and one national context, using a convenience sample and self-reported measures. Therefore, future research should test the model in other sectors and countries, and should combine self-reported data with external assessments of project manager competencies.

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## **BOOK REVIEW:**

Ocherki sovetskoï ekonomicheskoi politiki v 1965–1989 godakh [Essays on Soviet Economic Policy, 1965–1989]. 2 Vols. By Nikolai Mitrokhin, Moscow: Novoe Literaturnoe Obozrenie 2023.

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### **1. REFRAMING LATE SOVIET REFORM**

Mitrokhin's (2023) *Essays on Soviet Economic Policy, 1965–1989* is a monumental two-volume study (over 1,000 pages) of the late Soviet economy, focusing on the period when the model forged in the 1930s–1950s (Pozhidaev, 2026b) began to lose momentum and increasingly struggled to reproduce earlier growth dynamics.

This is not the first serious attempt to explain the (mal)functioning of the late Soviet system. International reference points include Ed Hewett's (1988) account of reform debates and constraints in the Gorbachev era and Yegor Gaidar's (2007) post-Soviet interpretation of systemic exhaustion and collapse. A Russian-language antecedent worth flagging is Rem Belousov's *Economic History of Russia: The Twentieth Century*, whose final volume (Belousov, 2006) interprets the late-Soviet slowdown and breakdown within a wider account of end-of-century crisis and contradictory economic governance.

What distinguishes Mitrokhin's contribution is not simply scale, but the way it re-centres the political economy of reform attempts in the 1960s–1980s and reconstructs decision-making as an institutional process rather than as a sequence of policy "episodes." Methodologically, the study leans heavily on unusually rich "primary" evidence: (i) interviews conducted in 2006–2013 with former CPSU Central Committee officials; (ii) dozens of memoirs by representatives of the Soviet economic elite; and (iii) extensive archival materials, including working notebooks of Leonid Brezhnev and other leaders. The book combines a periodising narrative (reform "waves," leadership changes) with thematic deep

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dives into core mechanisms and bottlenecks, including the drift towards an oil-based economy, budgetary imbalance, the dominance of the military-industrial complex, agricultural failure, and technological lag.

## **2. STAGNATION WITHOUT COLLAPSE?**

That the Soviet economic system was beginning to lose momentum by the 1960s was recognised by economists within the USSR (Belousov, 1983) and abroad (Ellman, 1971). The symptoms were increasingly hard to ignore: slowing productivity growth, diminishing returns to extensive expansion, chronic plan distortions (quantity over quality, indicator gaming), and a widening gap between administrative coordination and the needs of a more complex industrial economy.

Within Mitrokhin's chronological scope, the first major attempt to address these mounting difficulties was the Kosygin reform launched in 1965. The reform aimed to reduce the tyranny of compulsory indicators, expand the role of profitability and sales, and grant enterprises limited autonomy inside the plan. Yet, as Mitrokhin notes, neither Soviet economists nor most prominent Western analysts foresaw imminent collapse. Many assumed the system could muddle through via incremental adjustments, stricter enforcement, or partial decentralisation, even if growth rates continued to decline (Nove, 1983).

Mitrokhin's key move is to treat the late-Soviet trajectory as contingent rather than predetermined. He does not deny deep structural constraints, but he insists that the path from stagnation to collapse ran through policy choices, institutional erosion, and elite conflict.

## **3. POLICY WITHOUT COHERENCE**

Was the Soviet economy really planned? At first glance, the question sounds odd: each Five-Year Plan was accompanied by the Main Directions for the Development of the National Economy, which formally set priorities and specified the means to achieve them. Yet Mitrokhin reminds us that Soviet economic governance was constantly punctuated by top-level "policy initiatives" introduced between plan cycles and often only loosely aligned with already approved macroeconomic and fiscal frameworks. The 1982 Food Programme is a classic example, as are the escalating reform packages of Perestroika itself. In practice, these initiatives

functioned as ad hoc interventions into an already overcommitted planning architecture, adding objectives without removing old ones.

Mitrokhin argues that Soviet economic policy, to the extent it existed as something more than plan administration, had three defining features. First, it was ideologically constrained: certain domains were effectively taboo, and when economic rationality conflicted with ideological correctness, the latter prevailed. These no-go areas included meaningful price increases (especially for basic foodstuffs), serious reductions in defence expenditure, relaxation of the state monopoly on foreign trade, and legalisation of private economic activity beyond narrow niches.

Second, Soviet policy-making was marked by progressively deteriorating macroeconomic and fiscal balancing. Mitrokhin treats this as a defining feature of Perestroika, yet the imbalance did not begin in 1985. Late Soviet “policy” was the outcome of bargaining among powerful sectoral lobbies with representation at the top: the military-industrial complex; agriculture; and, increasingly from the late 1970s, the extractive industries, which became a crucial earner of hard currency. By comparison, the consumer-goods interest was typically weaker and more easily postponed.

Perestroika exacerbated this logic by allowing multiple high-cost priorities to run concurrently (defence, agriculture, housing, social commitments) while revenues were simultaneously pressured and central fiscal discipline weakened. Mitrokhin illustrates the deterioration with budget-deficit figures rising from about 18 billion rubles in 1985 to over 90 billion rubles in 1988, with further worsening thereafter. He also explains why revenues collapsed: beyond the sharp reduction in retail-trade revenues from alcoholic beverages (which, he notes, accounted for around 10% of budget revenues), large new investment programmes absorbed funding without generating corresponding returns, while the expansion of enterprise autonomy eroded the base of turnover and profit taxation.

Mitrokhin downplays the oil price shock as a single “trigger” (in contrast to Gaidar, 2007), but treats it as strategically damaging: it constrained hard-currency earnings precisely at the moment when Perestroika’s agenda relied on large-scale technical re-equipment and import of advanced equipment and technology. Even if the oil shock did not “cause” fiscal collapse mechanically, it tightened the external constraint that made an investment-heavy reform programme far less feasible.

A third defining characteristic was that the viability of Soviet economic policy presupposed the continued existence of the administrative-command system itself. Functioning depended on centralised allocation and distribution across thousands of goods, and on the centre's capacity to impose discipline on enterprises and regions. Even if plans were the outcome of bargaining, once approved, they still operated within a hierarchical framework capable of enforcing compliance.

When this structure began to be dismantled during Perestroika, coherence unraveled. Enterprises and collective farms, once empowered to retain and redirect output, increasingly prioritised local or private interests over all-Union obligations. Mitrokhin's examples are telling: kolkhozes curtailed deliveries to the All-Union Fund, undermining supplies to large cities and the armed forces; inter-republican supply chains fragmented as Ukraine reduced shipments of meat and dairy to Moscow and Leningrad; and industrial enterprises diverted state assets into ostensibly "cooperative" activities, converting budgetary resources into private profit while expanding the money supply in an already chronically undersupplied consumer market. Autonomy, in short, arrived faster than rules.

#### **4. PLANNING WITHOUT PRICES**

Mitrokhin is not oblivious to the structural constraint that framed everything else: the Soviet economy was planned. No anti-alcohol campaign or ministerial reshuffle was going to alter that institutional architecture.

He devotes a substantial section to why planning failed to deliver its proclaimed objectives. Notably, he approaches the issue less as a purely technical impossibility and more as a political economy problem, even invoking Gorbachev's (1995) later question of whether the Soviet economy could meaningfully be called "planned" at all.

According to Mitrokhin, the central distortions included a persistent imbalance between political directives and what he terms a "scientific", empirically grounded approach; voluntaristic shifts in priorities; and continuous renegotiation of targets during implementation to accommodate powerful sectoral lobbies. In such a context, planning became less a stable coordinating mechanism and more an arena of bargaining.

These observations are not entirely new. Bergson (1973), Ellman (1971), Kornai (1980), and Zaleski (1967) made similar points decades earlier regarding

bargaining processes, soft planning, and target manipulation in socialist economies. Mitrokhin's contribution lies less in theoretical innovation and more in documentation. He draws extensively on testimonies from ministers and senior officials, grounding his claims in insider perspectives. The resulting picture is of implementation that often operated through discretionary reprioritisation rather than through the plan as a fixed device: a continually shifting hierarchy of urgencies. Such dynamics need not imply the absence of planning, but rather a distinctive form of hierarchical coordination shaped by political priority-setting (Pozhidaev, 2026a). Mitrokhin also concedes the obvious: even if reporting could be manipulated and plans repeatedly adjusted, the economy did develop for long periods and material conditions improved.

His analysis then aligns with two classical critiques of planning raised by Western economists, most prominently Ludwig von Mises (1922) and Friedrich Hayek (1935): the information problem (administering a complex economy without decentralised signals) and the price problem (politically constrained prices that misrepresented scarcity and produced chronic shortages, especially of consumer goods). Mitrokhin illustrates the latter vividly through the leadership's prolonged hesitation over raising administered prices, a measure that was economically necessary to ease excess demand but treated as politically explosive.

At the same time, Mitrokhin does not portray the Soviet system as devoid of feedback. He describes administrative channels designed to compensate for absent market signals: the Committee of Soviet Control, appeals to party committees, letters to newspapers, radio and television communications, and reports compiled by agencies including the KGB and transmitted to senior leadership. The system attempted to simulate feedback loops through political and bureaucratic channels.

What is striking is what Mitrokhin does not conclude. Despite sharp critique, he does not argue that planning is inherently impossible, nor does he adopt a categorical "socialism cannot function" thesis. Instead, he concentrates on the historically specific configuration of planning in the USSR: politicisation, voluntarism, bargaining culture, and ideological constraints. If the failure lay not in planning as such but in its Soviet institutional embodiment, then collapse looks less like inevitability than a historically mediated outcome.

## **5. COULD THE SOVIET SYSTEM HAVE BEEN SAVED?**

Mitrokhin is unambiguous in his normative assessment of the outcome: he characterises the USSR's dissolution as an unconditional benefit for the country's inhabitants. The justification he offers is relatively standard: political unfreedom and low living standards. Yet the absolutist framing is hard to sustain because it largely sidesteps the scale of the 1990s transition shock: Russia's real GDP fell to about 55 (1989 = 100) by 1998 and did not regain its 1989 level until 2007 (Gevorkyan, 2018). The post-Soviet destination was not some neutral "market economy," but an oligarchic form of political capitalism in which accumulation depended heavily on rents and state-connected privilege (Kagarlitsky, 2008).

At the same time, Mitrokhin maintains that Gorbachev and his colleagues faced a historically specific, but real, possibility of preserving the state through a programme of less disruptive reforms. In this respect, he diverges from Gaidar's more deterministic interpretation (Gaidar, 2007), which treats systemic collapse as unavoidable.

Mitrokhin's counterfactual is not premised on rapid modernisation, but on stabilisation through reallocation and a narrowing of acute imbalances. He argues that the economy could, in principle, have been "rescued" (in the limited sense of maintaining solvency, easing shortages, and preserving institutional continuity) if the leadership had: (i) drastically reduced military expenditures (which, according to Mitrokhin's calculation, accounted for about 30% of the total budget in the late 1980s, a figure that invites contemporary comparisons: Russia's total military spending was estimated at 32% of total federal expenditure in 2024 [Cooper, 2025]), redirecting released funds and capacity toward consumer goods and basic social investment; (ii) adjusted administered prices, including politically sensitive increases for bread and other foodstuffs in a context where subsidies covered a very large share of consumption; (iii) increased hard-currency export revenues by reducing transfers to partners priced below world-market equivalents; and (iv) imposed an investment "pause" by freezing new construction while preparing better-selected projects with foreign partners. These measures, he argues, were modest and in principle attainable, but would not have closed the technology gap vis-à-vis advanced capitalist economies.

Mitrokhin emphasises the modesty of the leadership's practical ambitions and judges them attainable: a consumer market less chronically empty, external economic relations more flexible, and service provision closer to the better-performing late socialist cases in Eastern Europe. In aggregate, he treats a

transition toward “market socialism” as plausible: a mixed system combining administered coordination with limited market mechanisms, reduced shortages, and incremental welfare-oriented reallocation. It might have improved living standards relative to the dislocation of the early 1990s, but would likely have preserved a position of relative (and persistent) lag.

In this connection, Mitrokhin points to post-Soviet trajectories such as Belarus and Uzbekistan as partial analogues for a “stabilising” alternative to rupture: gradualist, state-led transitions marked by strong executive control, preservation of large state-controlled enterprise sectors, administrative steering in key markets, and selective liberalisation designed to limit the social costs associated with rapid “shock therapy” (Pomfret, 2019; Yarashevich, 2014).

Mitrokhin does not infer from these measures the possibility of an East Asian-style growth acceleration. He argues that the programme could not replicate the trajectories of China and the East Asian “tigers,” where rapid industrial growth was aided by a large rural labour reserve that could be shifted into low-wage industrial employment (Lin, 2012; Naughton, 2007; World Bank, 1993). No comparable demographic “reserve” existed in the late USSR, unlike in the Soviet Union of the 1930s (Pozhidaev, 2026b). Yet this point is under-argued: the absence of a labour-reallocation engine rules out one extensive pathway, but it leaves underexplored other routes to faster growth based on innovation, technological upgrading, and productivity gains (Mokyr, 1990; Aghion & Howitt, 2008), which could in principle have been strengthened under a more coherent “market socialist” regime with better incentives and information feedback.

Although Mitrokhin does not state this explicitly, his gradualist reform scenario presupposed the continued coherence and authority of the Party as the system’s central coordinating institution. The proposed measures would have required a disciplined administrative chain able to impose unpopular decisions and maintain elite cohesion. The obvious comparator is China, where market reforms unfolded under the uninterrupted monopoly of the Chinese Communist Party.

## **6. COLLAPSE WITHOUT DETERMINISM**

This emphasis on compliance and enforcement is compatible with several established interpretations in Soviet economic historiography. It contrasts, however, with the more deterministic narrative associated with Russian neoliberal reformers and their Western advisers, for whom the Soviet model was

doomed in principle and collapse followed from intrinsic economic irrationality, with reform framed as an unavoidable exit from a non-viable system (Gaidar, 2007; Åslund, 2007).

Mitrokhin's book reconstructs, in unusually fine-grained detail, the political economy of late Soviet reform and, more broadly, the (mal)functioning of the Soviet economy, giving analytical depth and empirical texture through direct evidence from the officials who designed, administered, and contested late Soviet economic policy. It is not, in his telling, simply a morality tale about the "failure" of a social system. Rather, it warns against reforms that neglect the institutional architecture through which economic coordination is sustained, and it foregrounds the relative autonomy of political and administrative elites, whose conflicts may work against systemic functionality and, in extremis, contribute to its destruction even absent an explicit intention to dismantle the system. The book also raises, implicitly but insistently, the question of reform scope and feasibility: while it highlights institutional and ideological constraints that exist in any economic system, it simultaneously invites reflection on how far such constraints are binding limits and how far they reflect choices by elites who treat certain reforms as unthinkable even when they are technically available and economically beneficial. In this sense, the book can be read as an empirical illustration of Lenin's dictum that politics takes precedence over economics, and that to argue otherwise is to forget "the ABC of Marxism" (Lenin, 1921).

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## BOOK REVIEW:

The Measure of Progress: Counting What Really Matters, by Diane Coyle, Princeton, NJ: Princeton University Press, 2025. ISBN: 9780691179025

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### 1. MEASURING PROGRESS IN A CHANGING ECONOMY

Although economic indicators are technical in nature, their importance goes beyond statistics, as they largely shape the public's perception of economic conditions. Indicators such as economic growth, productivity, inflation, and investment affect public policy priorities, the way central banks communicate with citizens, the development of the business environment, and whether people perceive that their quality of life is improving. Coyle, in her book *The Measure of Progress: Counting What Really Matters*, reveals why our centuries-old system of economic measurement is not up to the task in an economy dominated by digital technology and intangible assets, global value chains, planetary boundaries, and things we do not buy and sell.

The book is a well-timed contribution to a debate that has moved far beyond the familiar claim that gross domestic product (GDP) is not a measure of welfare. Coyle avoids simply echoing the now well-known critique that GDP excludes many things people want. Her worry is deeper and far more practical: the conceptual and statistical framework erected for an industrial economy is out of touch with the structure of modern economic life. National accounting was constructed at a time when the production of goods, the distribution of labour and capital, and keeping overall demand in line with supply were things that politicians had to worry about. The economy of the twenty-first century is different. What people use every day is digital, packaged, or simple, and is mediated by platforms, organised globally, or provided for free. In parallel, the destruction of the environment and depletion of natural capital have an ever-greater impact on the prospects for future prosperity. Coyle's book does not just pose the question of how to measure

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progress, but also the question of what societies reveal about themselves through their choice of counting certain things and what remains invisible. Chapter 1 of the book situates this problem in a historical context, suitably titled “Political Arithmetick”. It reminds us that economic measurement is inseparably linked to state capacity, public administration, and political priorities.

Statistics are but one of the many instruments used by governments to both view and understand the world. History shows that the criticisms of GDP are fundamental and not just technical. As Coyle points out, the system we use to measure our economy was conceived at a particular point in history, and those measures are hardly fit for an economy that functions so differently than how it did then.

One of the main strengths of this book lies in Coyle’s view of economic statistics. She does not question the importance of economic measurement as such, but emphasises its key role in informing public policy and economic decision-making. Reliable data are a necessary condition for meaningful public debate and the development of effective policies. According to Coyle, the problem is not measurement itself, but rather the fact that many traditional indicators are increasingly unable to capture the complexity of the modern economy. They often fail to adequately reflect the processes of value creation and the organisation of production in a digitalised and globalised world. The book, therefore, does not advocate abandoning economic measurement, but rather argues for improving existing measurement frameworks.

## **2. PRODUCTIVITY, DIGITALISATION, AND INTANGIBLE VALUE**

Chapter 2, “Productivity without Products”, discusses one of the most important paradoxes of modern economics. Although productivity growth is still considered the main long-term indicator of economic progress, in many developed countries it has slowed significantly in recent decades, despite the rapid development of digital technologies, artificial intelligence, robotics, data analysis, and platform business models. Coyle builds on this tension to question how productivity should be defined in an economy increasingly dominated by services, digital technologies, organisational innovations, and intangible assets. The chapter is particularly valuable in that it does not dismiss the productivity slowdown as a statistical illusion. On the contrary, it examines several non-mutually exclusive explanations and shows why measurement issues have worsened in a world where goods and services become more strongly intertwined by knowledge-based activities.

One key takeaway from this discussion is that productivity is often misrepresented in public discourse. This is not just a matter of workers working harder or employers demanding more work. Sustained productivity growth depends on capital, technology, organisational structures, skills, institutions, and the interaction of these factors. But because output is in the form of convenience, access, customisation, software, data, or quality improvement, it is much more difficult to identify and measure output. The chapter thus acts as a bridge from traditional growth accounting to the broader issues of the digital economy in the next chapters.

Chapters 3 to 5 are where the book's discussion of digitalisation and intangible value comes into its own. In Chapter 3, "Dematerialisation", Coyle considers the growing weightlessness of economic activity. Products are no longer just physical objects traded in markets; they are often bundled with services, advice, maintenance, software, design, logistics, data, and after-sales support. Even seemingly traditional industries are increasingly selling integrated solutions rather than simply goods. This is a development that matters for measurement because the value of a transaction frequently resides less in the physical item itself than in the surrounding intangibles that make it useful. This chapter highlights a key aspect of modern capitalism: that economic value is increasingly created by integrations of material and immaterial parts, and that statistical categories still divide goods and services in ways that are inherited from a previous industrial economy.

### **3. FREE SERVICES, PLATFORMS, AND THE PROBLEM OF VALUATION**

Chapter 4, "(Dis)intermediation", examines the changes that occur through shifts in intermediaries' position. Digital platforms remove certain older forms of intermediation but also create new forms. Online retailers, search engines, delivery platforms, booking platforms, app stores, and electronic markets all shift the producer-consumer relationship. They facilitate new dependencies, concentrations of market power, and data harvesting, but they also provide convenience and reduced search costs. The important aspect is that value is not created where we have traditionally measured it. Some of the benefits to users may be time saved, a better match, or increased access. The monetary transaction may only be partially representative of the total shift. One of the key strengths of this chapter is that Coyle relates familiar everyday experiences to broader questions about the functioning of markets and national accounting systems.

Chapter 5, titled “Free”, is probably the most crucial chapter of the book. In this chapter, Coyle deals with the central conundrum of free digital services. Most of the digital services that people use daily, including search engines, maps, social media platforms, messaging applications, and online encyclopaedias, are available at no monetary cost. Zero price has become something we are all used to as consumers of digital goods. We use countless digital services that provide value to us without paying anything at the point of consumption. Traditional measures of output struggle to capture the value created by these digital services. The problem is reminiscent of a classic distinction, that of use value versus exchange value, but in a new context. How is the value of a service which can be very useful, even essential, in everyday life reflected in economic statistics when the market price is zero? Coyle does not present this as an easy fix. The author demonstrates that the quantification of free digital goods leads to complex issues regarding consumer surplus, advertising-supported business models, data, privacy, consumer attention, and the distinction between production and consumption. The point of this chapter is to demonstrate how GDP often fails to capture changes in the standard of living even when people benefit from better access to information, greater availability of services, and greater convenience in everyday life.

#### **4. BORDERS, PRICES, AND THE MEANING OF VALUE**

The analysis then extends beyond digital goods in a narrow sense. In Chapter 6, “Borders”, Coyle explores the pressure that globalisation and cross-border economic activity place on traditional statistics. Economic figures based on national accounts rely heavily on tools built around territorial economies – even as production, ownership, data flows, intellectual property, e-commerce, and digitally enabled services cross countries in such a way that it is often very difficult to ascertain where economic value is actually created. Measuring trade, output, and productivity is already problematic due to global value chains; digitalisation makes it even more so. You can offer a service in one country, hosted on servers in another, owned by a firm headquartered elsewhere, and monetised through advertising or data in yet another jurisdiction. This is not to underestimate the value of national statistics, but it does illustrate why the concept of a national product becomes increasingly difficult to define of in an ever-more integrated and digital world economy.

Then the discussion moves on to the concept of value and the foundations of economic measurement. For Coyle, the process of taking nominal values and

making them real is not just an intellectual puzzle. It has become more challenging to disentangle nominal from real growth as product quality adjustment, bundles of goods and services, and digital products with an implicit but no explicit price are changing. She demonstrates that the dispute over price indices, inflation, and quality adjustments is truly a judgment about quality, welfare, and comparability over time. A principal contribution of the chapter is to demonstrate that economic statistics, like the economic definitions themselves, are not determined solely by calculations. They also express contested ideas of economic progress.

## **5. WEALTH, SUSTAINABILITY, AND A BROADER FRAMEWORK**

Chapter 8, “Wealth”, expands the analysis from flows of production and income to stocks of assets and potential future wealth. The clearest connections between this work and sustainability are explored in this part of the book. Any society which does not account for the depletion of natural resources, pollution, loss of biodiversity, or climate damage will appear richer than it really is. In other words, annual output may rise even while the underlying asset base upon which future prosperity is dependent is steadily being depleted. Coyle’s engagement with natural capital, although brief in comparison, adds a necessary component to the argument of the book overall. What kind of society measures progress properly when it counts what is produced today but fails to count how environmental conditions become degraded?

The shift from GDP to wealth is a big deal because it alters the time horizon of the discussion. GDP is a flow measure. It tracks economic performance over time. At the same time, progress is also about how much stuff we have built up – physical capital, human capital, knowledge, institutions, social trust, and data and infrastructure – as well as natural systems. While a broader notion of wealth does not remove all measurement difficulties, it provides a much better foundation for thinking about sustainability and the well-being of future generations. The timing of Coyle’s argument is particularly apt, as climate change, biodiversity loss, and resource pressures have shifted from the environmental debate to economic policy.

The final chapter brings together the main ideas and arguments presented in the previous parts of the book. To Coyle’s credit, the book does not call for a single replacement for GDP. It is tempting, of course, to replace one headline figure with another; but are we truly solving the problem, or just recreating it in a different form? The economy is too complex, and the concept of progress

itself is too multidimensional to be captured by just one indicator. Instead of a single indicator, Coyle proposes a broader measurement system that can capture numerous aspects of the modern economy that traditional indicators often overlook. In other words, the final chapter indicates that it is not possible to adequately capture progress with any index of well-being, nor with a simple set of indicators. This is why Coyle favours a comprehensive wealth approach, which relies on the assets and resources on which future prosperity depends: natural, human, and physical capital, as well as knowledge, data, and institutions. The question mark in the title of Chapter 9, “A New Framework?”, is entirely justified. The author does not offer a final and fully developed statistical solution, but presents carefully reasoned proposals for improving the existing measurement system.

## **6. THE CONTRIBUTION OF THE BOOK**

The book’s main contribution is its ability to link economic theory, official statistics, public policy, and everyday experience. Coyle deals with technical issues without making the discussion inaccessible. The reader is taken through productivity, price indices, digital platforms, national accounts, value, wealth, and natural capital. But the underlying question is clear throughout: what kind of economy are we actually trying to measure, and what kind of progress do our measures encourage us to see? This makes the book relevant beyond the community of national accountants and statisticians. The book should be of interest to economists, policy makers, students, and anyone interested in the relationship between technological change and social welfare.

Another merit of the book is that it maintains a balanced tone. Coyle admits the limitations of today’s measures but she does not diminish the achievements of economic statistics. Why should this matter? Well, sometimes the debate about GDP is conducted as if the indicator were completely valid or entirely useless. The book avoids both extremes. GDP is still useful for many purposes, but it was not meant to answer all the questions now asked of it. It is confusing to use it as a comprehensive measure of social progress; not measuring rigorously would be worse. The more persuasive route is the one Coyle takes: to refine the statistical framework to better reflect the realities of a digital, service-based, intangible, globalised, and environmentally constrained economy.

One possible limitation of this book is that it deliberately leaves the direction of reform open. Such an approach reflects intellectual honesty, as Coyle does not

attempt to offer a single technical solution to the complex challenges of economic measurement. However, some readers might expect a more concrete institutional framework that would show how national statistical systems could implement these changes in practice, especially considering the costs, the need for additional data, and political decisions that such reforms would entail.

The book also has obvious policy relevance. Inadequate measurement can lead to wrong decision-making. Productivity trends can be misinterpreted if the value of digital services is underestimated. If we do not include environmental degradation in the indicators of economic progress, there is a risk of overestimating real economic growth. Indicators of living standards can also give a distorted picture if changes in the quality of products and services provided without direct monetary compensation are not properly taken into account. Imprecise measurement of cross-border flows of value creation can lead to a misunderstanding of a country's economic performance. As Coyle shows in her book, these are not secondary statistical questions. On the contrary, they have a significant impact on the way governments allocate resources, societies evaluate technological change, and the public defines economic success or failure.

The educational contribution of this book should be especially emphasised. The book demonstrates to students of economics that the indicators used in textbooks and public policy reports are not fixed or self-evident, but rather the results of statistical design and methodological choices. For researchers it emphasises the importance of connecting empirical work to the changing structure of the economy. It also offers official statisticians a thoughtful but challenging call for innovation in statistical systems. In the end, it reminds policymakers that better data and better concepts are not niceties but necessities for informed policymaking.

## 7. CONCLUSION

*The Measure of Progress* is about much more than GDP. In other words, it is a book about the infrastructure of economic knowledge. Its key message is that societies cannot be governed well if policymakers are blind to what is changing around them. GDP is measured by categories established in the mid-twentieth century. While many of them remain important, they are not sufficient. This calls for a broader, more adaptable framework for considering digitalisation, dematerialisation, platform intermediation, free services, and global production alongside evolving notions of value and environmental limits.

Coyle's book is a significant contribution to the contemporary debate on economic measurement. At the same time, it does not offer a radical manifesto or a simple new indicator that would replace GDP. Its strength resides in its subtler, and therefore more convincing, approach. The author shows why measurement matters, why traditional indicators are under increasing pressure, and why understanding economic progress in the twenty-first century requires rethinking what we consider valuable. The book will be particularly useful to economists and policymakers. At the same time, it is a valuable resource for students because it shows that economic statistics are not simply dry background material, but fundamental means through which societies understand prosperity. In the end, the underlying message of Coyle's book is both practical and profound: if we want to measure what really matters, we must first recognise that what we consider important has changed.

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As a rule, submitted articles should not exceed 8,000 words. All pages apart from the first one should be numbered. Subtitles should be concise, clearly marked in bold, and numbered (up to two levels of numbering). No other entries should be bolded. Formulae should be numbered on the right-hand side of the page. In case of long proofs, these should be inserted in a separate Appendix, following the References. Tables and Figures must not use colour, and should be in a format easy to edit, for instance they should take half a page (or a full page) within the indicated margins. They should be clearly labelled at the top, with a legend at the bottom, and should be logically ordered, using Arabic numerals. Sources of the data should be given below tables and figures.

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Rodrik, R., Subramanian, D., & Trebbi, F. (2004). Institutions rule: the primacy of institutions over geography and integration in economic development. *Journal of Economic Growth*, 9(2), 131-165.

[https://DOI: 10.1023/B:JOEG.0000031425.72248.85](https://doi.org/10.1023/B:JOEG.0000031425.72248.85).

#### • Books

Author surname, initial(s). (Year). *Title*. Publisher location: Publisher

De Grauwe, P. (2020) *Economics of Monetary Union* (13th ed.). Oxford: Oxford University Press.

#### • Edited Book

Author surname, initial(s). (Ed(s)). (Year). *Title*. Publisher location: Publisher

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<http://www.apa.org/science/about/publications/climate-change.aspx>

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