Financial Crises on Durban's Economy: Evidence from a Time-Varying Parameter VAR Model

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Abstract:
This paper investigates the long-term impacts of financial crises on economic growth in Durban, South Africa, using quarterly data spanning from 1995Q1 to 2024Q1. Applying a Time-Varying Parameter Vector Autoregressive (TVP-VAR) framework. The study captures the evolving dynamic responses of key economic indicators, including GDP growth, gross fixed capital formation, employment, and household consumption, to shocks in a financial crisis index. Findings reveal that financial shocks induce pronounced hysteresis effects characterized by an initial transient increase in GDP followed by significant contractions and sluggish recovery, highlighting persistent structural scarring. The evidence outlines Durban's limited economic resilience due to structural rigidities, low sectoral diversification, and weak automatic stabilizers. Policy implications emphasize the need for structural transformation, investments in critical assets and innovation, and urban planning to mitigate spatial inequalities. The study contributes to the understanding of urban macroeconomic resilience in emerging economies, advocating for integrated, multidimensional approaches to crisis management and sustainable urban development.

Additionally, the findings on the impact of financial crises on Durban's economy highlight a range of vulnerabilities that, although distinct in their local manifestation, are closely connected to broader national economic trends. The structural and sectoral challenges faced by Durban mirror patterns of economic strain that are evident across many parts of South Africa. These findings indicate that Durban's experience is not occurring in isolation, but rather forms part of a wider economic landscape shaped by persistent national pressures. As a result, there is an urgent need for coordinated structural transformation and well-targeted policy interventions at both the local and national levels. Such efforts are crucial for enhancing economic resilience, improving productivity, and promoting more inclusive and sustainable growth.

Key Words: Economic Crises; Urban Economic Growth; Financial Instability; Economic Resilience

JEL Classification: E32; R11; O18; H12; O40

1 Introduction

Growing global economic interdependence, the ability of cities to maintain economic stability and resilience in the face of external shocks have become a defining features of sustainable development. Since the 1980s, efforts by many developing economies to implement macroeconomic reforms aimed at growth, stabilization, and structural adjustment have frequently been disrupted by systemic financial crises. These crises have challenged the effectiveness of national policy frameworks and highlighted the vulnerability of subnational economies to global volatility. The 2008–2009 global financial crisis, in particular, represented a turning point for urban economies worldwide. It triggered a sharp contraction in trade, output, and employment, exposing the fragility of financial systems and the limitations of traditional policy tools. For many middle- and low-income countries, the crisis not only stalled economic growth but also eroded industrial capacity, widened inequality, and imposed long-term constraints on public investment and institutional performance, World Bank. (2010).

Durban, South Africa's third-largest city and a key economic hub in the region, has felt the weight of these disruptions. While the city initially showed signs of resilience, the aftermath of the financial crisis revealed deeper vulnerabilities. Durban's recovery was hampered not only by the lingering effects of global financial instability but also by a series of domestic setbacks, including infrastructure damage,loadshedding, socio-political unrest, and recurring economic recessions. These challenges compounded to suppress long-term growth, restrict industrial diversification, and delay the city's structural transformation. Over time, Durban's economic landscape began to shift. The once-dominant manufacturing and logistics sectors experienced relative decline, while the service sector gradually assumed a more prominent role. Though this shift reflects broader global patterns, it has occurred in a context of persistent underperformance, marked by low productivity, inadequate job creation, and widening service delivery gaps. Meanwhile, population growth and rapid urbanisation have placed additional strain on public infrastructure, particularly in strategic assets such as the Port of Durban, where inefficiencies and operational delays have eroded the city's trade competitiveness.

Despite these headwinds, Durban's economy has remained adaptive, navigating a complex environment of global trends and internal pressures. The rise of new service-based industries, the gradual evolution of its labour market, and the city's efforts to reorient its economic planning highlight a degree of institutional dynamism. Yet the question remains whether these shifts are sufficient to place Durban on a path of sustained, inclusive, and resilient economic growth. This study is situated within this context. It aims to interrogate the cumulative impact of successive economic shocks on Durban's long-run economic trajectory. It explores how these disruptions have influenced the city's growth patterns, altered sectoral dynamics, and tested the efficiency of policy and institutional responses. By examining the structural underpinnings of economic stagnation and the uneven nature of recovery, the research seeks to provide actionable insights into the levers required for urban economic transformation in the post-crisis era.

1.1 Problem Statement

Durban's economic performance over the past three decades has unfolded under the persistent shadow of recurrent financial crises, whose cumulative impacts have significantly altered the city's growth trajectory. While Durban remains a key economic hub within South Africa—anchored by its port, manufacturing base, and logistics infrastructure—the aftermath of successive global and domestic financial disruptions has revealed deep structural vulnerabilities that continue to constrain long-term growth. Notably, the 2008 global financial crisis marked a turning point, from which Durban's economy has struggled to recover. Post-crisis GDP growth has remained persistently below pre-crisis levels, indicating that the effects of financial shocks extend beyond temporary output contractions to more enduring structural scarring.

Figure 1: Economic variables.
The $dbngdp$ gross domestic product growth rate $dbngfcf$ gross fixed capital formation $dbnempl$ employment rate $dbnhce$ household consumption $emvfincrises$Financial Crises Index.

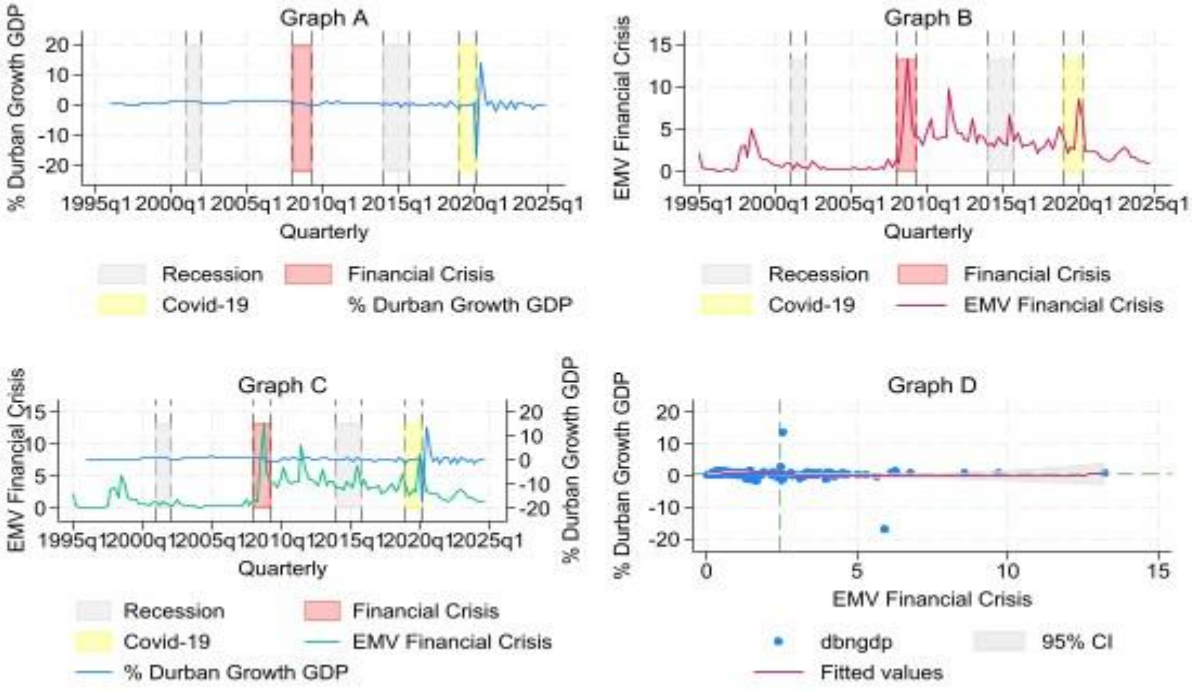


Figure 1 graph (a), illustrates a noticeable decline in Durban's economic growth during the 2008 financial crisis. This downturn coincides with a significant upward shift in the financial crises index, as depicted in graph (b), indicating heightened financial distress in that period. Furthermore, graph (d), reveals a broader negative relationship between elevated levels of financial crises and Durban's economic growth performance. Specifically, periods characterized

by higher values of the financial crises index are consistently associated with subdued or negative economic growth, underscoring the adverse and persistent impact of financial shocks on the city's economic trajectory. As such, the key economic question of the study is, what is the impact of financial crises on economic growth in Durban? The hypotheses are informed by the economic as the following:

H_0 Null: Financial crises have no significant long-run impact on economic growth in Durban.

H_1 Alternative: Financial crises have a significant negative long-run impact on economic growth in Durban.

1.2 Significance of the Study

This study is significant for both academic research and public policy, particularly in the context of emerging urban economies vulnerable to recurring financial shocks. Academically, it contributes to the literature on urban macroeconomic resilience by exploring the long-run effects of financial crises at the subnational level, specifically in Durban, a major African city. While prior studies emphasize national-level impacts, this research fills a gap by analyzing how repeated financial crises shape urban economic trajectories. It provides empirical evidence on the persistent effects of financial distress on GDP growth, capital formation, employment, and household consumption, offering insight into structural economic scarring and sectoral realignment. The study also engages with theoretical debates on hysteresis and path dependence, and advances methodological approaches by employing a financial crisis index and disaggregated urban-level indicators to trace shock transmission and amplification in urban economies. From a policy perspective, the findings identify key structural weaknesses in Durban's economy, such as the decline of manufacturing, reliance on low-wage services, and weak employment recovery, highlighting the need for coordinated, proactive policy responses. These insights are vital for designing strategies that move beyond short-term stabilization toward long-term structural transformation. Moreover, the findings have broader relevance for cities across the Global South that face similar patterns of informality, spatial inequality, and exposure to global financial volatility. Ultimately, the study supports the formulation of evidence-based, inclusive policies that enhance urban resilience and sustainable economic development.

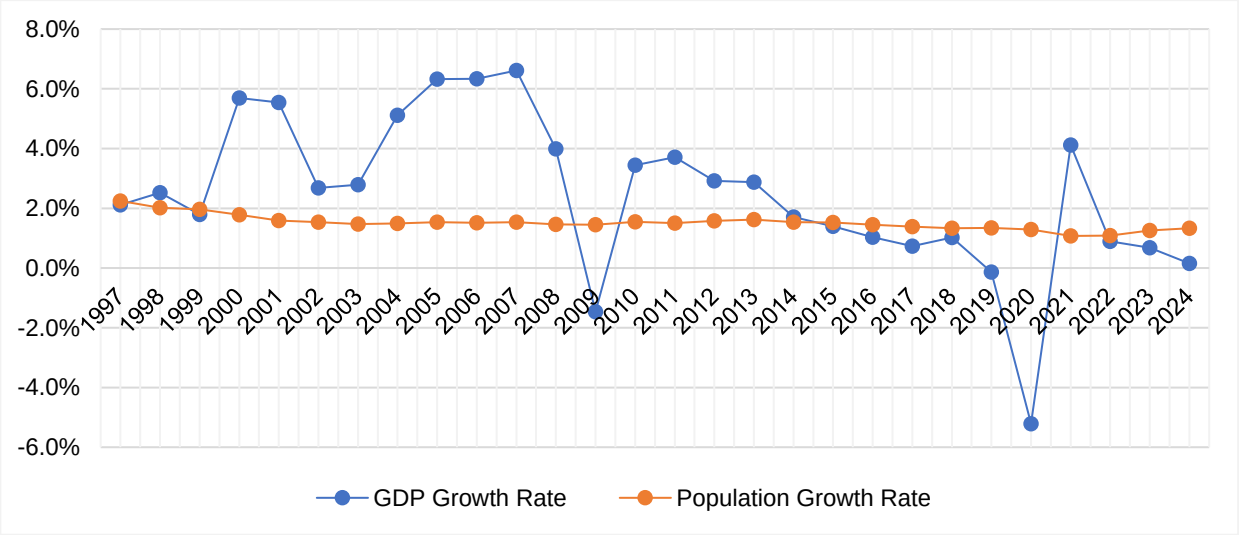
1.3 Macroeconomic analysis of key variables

Since 1997, eThekwini has undergone significant structural shifts in both its economic and demographic profile. Between 1997 and 2008, the city recorded strong economic performance, with GDP growth averaging over 5% per annum and peaking at 6.6% in 2006. During the same period, population growth remained relatively stable at approximately 1.5%–1.6%, resulting in notable gains in productivity, per capita income, and municipal fiscal space. This period reflected a relatively healthy growth model driven by industrial activity, investment, and urban efficiency gains. However, the 2008 Global Financial Crisis (GFC) marked a sharp break in this trajectory, as

GDP contracted by –1.5% in 2009. A modest recovery followed—3.4% in 2010 and 3.7% in 2011—but growth gradually decelerated, falling to 0.7% in 2017 and turning negative again at –0.1% in 2019.The COVID-19 pandemic introduced a deeper shock in 2020, with GDP shrinking by –5.2%. Although a base-effect rebound occurred in 2021 (4.1%), growth rates remained anaemic in subsequent years: 0.9% (2022), 0.7% (2023), and a projected 0.2% in 2024. In contrast, population growth held steady at 1.3%, compounding developmental disparities. Between 1997 and 2024, eThekwini's population expanded by over 52%, from 2.99 million to approximately 4.46 million. However, economic output stagnated, leading to declining per capita income, persistently high unemployment, and rising fiscal pressures on local governance.

Compounding these trends is a significant structural shift in the sectoral composition of the economy. The share of GDP from production sectors (including manufacturing, construction, and utilities) declined from 28.9% in 2008 to just 23% in 2024, while the services sector grew from 71.1% to 77%. Although services have buoyed output, they have not matched the productivity multipliers, wage levels, or innovation spillovers historically linked to industrial activity (Rodrik, 2016; Glaeser, 2011). This shift mirrors broader trends observed in many developing urban economies, where premature deindustrialization constrains structural transformation (Rodrik, 2015; Tregenna, 2016). In global experience, economies that sustain an industrial base of over 30% of GDP often demonstrate greater resilience, innovation, and capital formation, key ingredients for inclusive, long-term growth (World Bank, 1993; UNIDO, 2022). Conversely, service-led urbanisation in the Global South tends to correlate with informality, lower productivity growth, limited wage progression, and vulnerability to external shocks (Sassen, 2001; Kanbur, 2017). These patterns raise critical questions about the long-term sustainability and inclusivity of the nation's and cities' current growth model, particularly in light of mounting infrastructure deficits, climate-related risks, and subdued national economic performance.

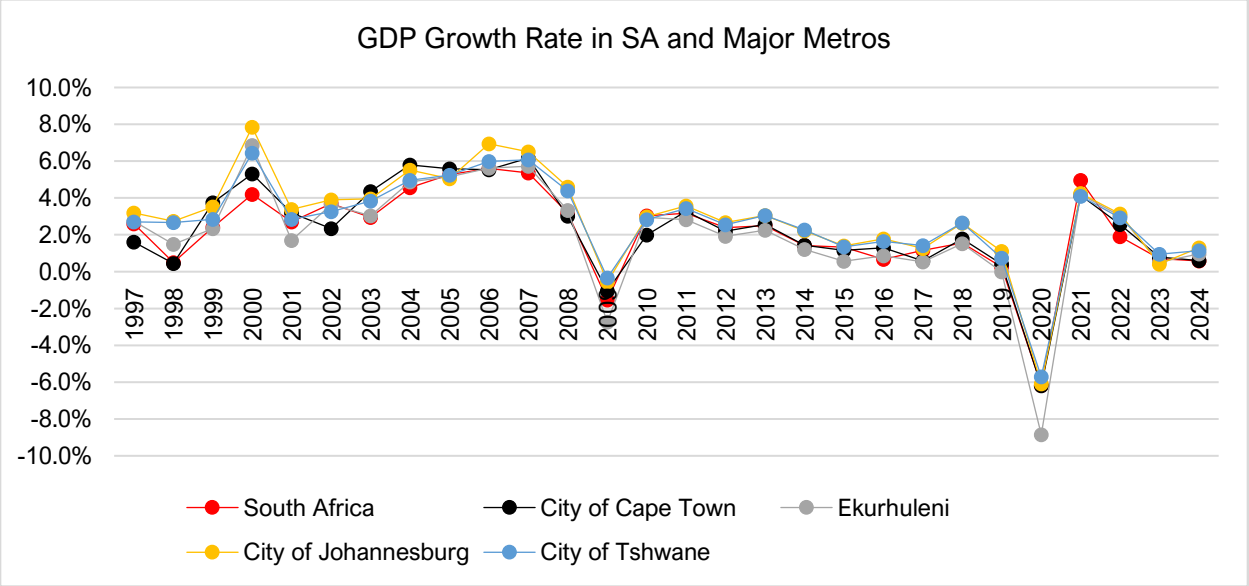
Figure 1.3.1: GDP growth rate and Population Growth



Source: Quantec, 2025

However, Durban's GDP growth trend is not disassociated from broader national patterns and aligns closely with the trajectories observed in other major metropolitan areas. Nationally, South Africa recorded strong growth in the early 2000s, with GDP peaking at 5.6% in 2006 before slowing after the 2008 global financial crisis. The economy contracted sharply by -6.2% in 2020 due to COVID-19, followed by a rebound of 5.0% in 2021. However, growth has since weakened, reaching just 0.6% by 2024, reflecting persistent structural challenges. Across the major metros, Johannesburg consistently recorded a strong performance in the pre-crisis period, with growth reaching 7.8% in 2000 and maintaining robust levels above 5% from 2003 to 2007. Even during the 2020 pandemic, Johannesburg's contraction (-6.1%) was more moderate compared to cities like Ekurhuleni (-8.9%). Post-COVID, Johannesburg rebounded to 4.2% in 2021 and sustained steady, though modest, growth of 3.1% in 2022 and 1.3% by 2024. Tshwane followed a similar trajectory with stable pre-pandemic growth, peaking at 6.4% in 2000 and 6.1% in 2007, contracting by -5.7% in 2020, and rebounding to 4.1% in 2021. It reached 2.9% in 2022 and maintained growth above 1% through 2024. By contrast, Ekurhuleni exhibited weaker and more volatile growth over the long term. Despite a peak of 6.9% in 2000, its performance declined, with a sharp 8.9% contraction in 2020. Though it rebounded to 4.2% in 2021, growth slowed to just 1.0% by 2024. Similarly, Cape Town's economic performance has been mixed, with early 2000s growth of 5.3% in 2000 and 5.8% in 2004. However, it experienced a severe contraction in 2020 (-6.2%) and a relatively weak recovery, 2.6% in 2022, and only 0.6% by 2024.

Figure 1.3.2: GDP growth rate



Source: Stats SA and Quantec 2025

The Financial Crisis Index, developed by the St. Louis Federal Reserve Bank, measures financial market instability based on the frequency of news terms linked to financial distress. From 1999 to 2024, the index highlights multiple episodes of heightened global uncertainty with significant macroeconomic implications worldwide and domestically. Between 1999 and 2007, values stayed below 10, reflecting stable global financial conditions, strong growth, expanding trade, and moderate risk, which supported macroeconomic reforms and investment in

developing economies. In 2008, the index surged to 66.1 amid the global financial crisis. Persistently high readings followed, 51.1 in 2009, 56.3 in 2010, and a peak of 72.2 in 2011, indicating prolonged financial turmoil marked by institutional failures, credit freezes, and investor uncertainty. The index remained elevated, averaging over 50 between 2011 and 2015, signaling continued systemic fragility and uneven recovery. Though moderating after 2015, volatility remained above pre-crisis levels (35–45) until 2019, driven by commodity price swings, trade tensions, and emerging market risks. In 2020, the COVID-19 pandemic caused another spike to 58.4, before gradually declining to 17.4 by 2024, with financial risk still above normal. The index trajectory aligns closely with eThekwini's economic downturns. High values in 2008–2011 and 2020 correspond to major crises preceding significant GDP contractions: –1.5% in 2009 and –5.2% in 2020. Even during calmer periods, elevated index levels from 2012 to 2019 coincided with stagnant growth rarely surpassing 1% annually. This pattern underscores eThekwini's vulnerability to global financial instability.

Table 1: Summary of Trends and Implications

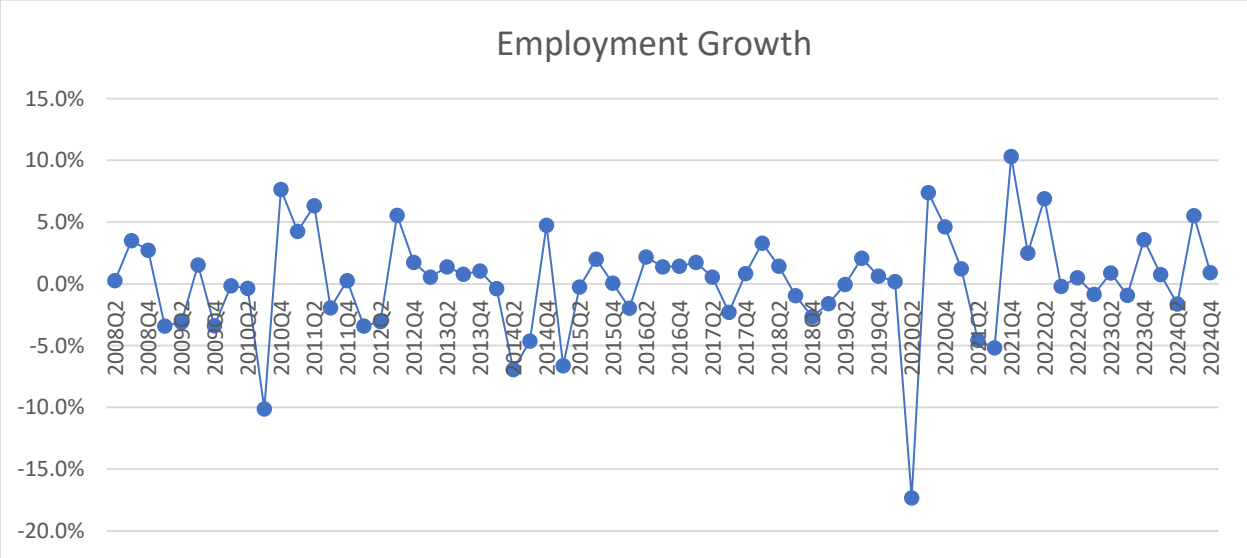
Period	**Financial Crisis Index**	**eThekwini Economic Response**
1999–2007	Low to moderate (avg. ∼8)	High and stable GDP growth, productivity gains, and strong manufacturing
2008–2011	Sharp spike and peak (51–72)	Recession in 2009, partial recovery, growing structural weaknesses
2012–2019	Persistently elevated (34–54)	Stagnant growth, declining manufacturing, and service sector expansion
2020–2024	Renewed spike, gradual decline	Severe COVID-19 contraction, weak and decelerating recovery

Employment growth in eThekwini from 2008 to 2024 reveals a labour market that is highly sensitive to shocks and marked by persistent volatility. Before the 2008 global financial crisis, employment was relatively stable, recording growth of 3.5% in 2008Q3 and 2.7% in 2008Q4. However, the crisis triggered sharp contractions of -3.4% in 2009Q1 and -3.1% in 2009Q2, illustrating the city's exposure to global downturns. This vulnerability echoes international findings on the disproportionate employment impacts of financial crises on emerging city economies (Reinhart & Rogoff, 2009; Lee et al., 2014). Post-crisis, eThekwini's labour market continued to experience instability, highlighted by a severe -10.1% decline in 2010Q3, despite stabilizing GDP figures—a clear indication that employment lagged behind output. This pattern reflects broader macroeconomic trends in South Africa, where employment multipliers weakened due to structural imbalances and declining productivity in labour-intensive sectors (Rodrik, 2006; Bhorat et al., 2016). Though late 2010 and early 2011 saw rebounds, the overall volatility underscored fragility in employment recovery mechanisms. Between 2012 and 2019, growth remained erratic. Frequent contractions (e.g., -3.4% in 2012Q1, -6.9% in 2014Q2, -6.6% in 2015Q1) and only brief recoveries were recorded. Growth rarely exceeded 2% in any quarter during this period, largely due to fiscal consolidation, weakened business confidence, and continued contraction in industrial sectors—particularly manufacturing and construction. Research by Tregenna (2012) and Black & Hasson (2016) reinforces this view, arguing that deindustrialisation and insufficient policy support for localised value chains limited employment

absorption capacity.

The 2020 COVID-19 pandemic dealt the harshest blow, with a historic -17.3% collapse in employment in 2020Q2. Although a rebound followed in Q3 (7.4%) and Q4 (4.6%), the recovery was uneven. Mid-2021 saw renewed contractions, and while Q4 posted a strong rebound, it lacked staying power. This pattern reflects the insights of Posel & Casale (2021), who highlighted increased labour market informality, discouragement, and scarring effects due to the pandemic's disruption. From 2022 to 2023, eThekwini's employment growth continued to alternate between modest gains (e.g., 6.9% in 2022Q2, 3.6% in 2023Q4) and contractions, as demand remained weak, informal employment grew, and formal sector hiring stagnated. Informality and casualisation, especially in retail, logistics, and services, became more prominent, aligning with findings from Fourie (2018) on the dualism of South Africa's labour market and the limited upward mobility it offers. By 2024, volatility remained a defining feature. Modest gains were seen in early quarters, but Q2 saw another contraction (-1.6%), a rebound in Q3 (5.5%), and slower growth in Q4 (0.9%). The sustained instability highlights structural vulnerabilities: mismatches between workforce skills and economic demand, limited industrial renewal, and underinvestment in transformative sectors such as advanced manufacturing, renewables, and ICT.

Figure 1.3.3: Employment Growth Rate



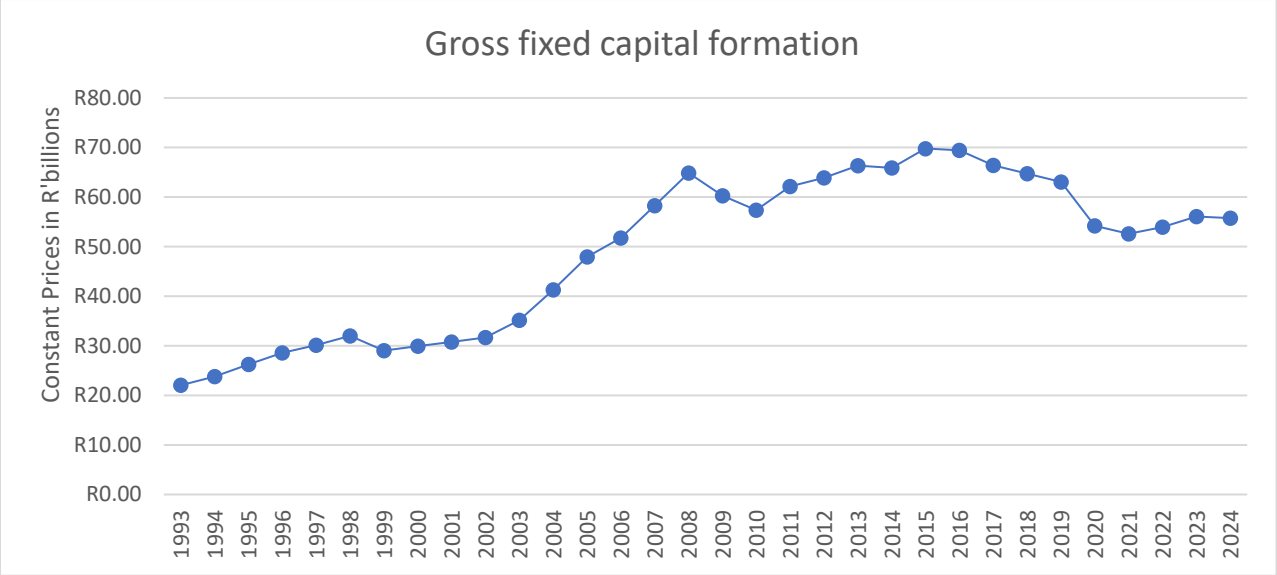
Source: Stats SA QLFS, 2025

Gross Fixed Capital Formation (GFCF), a key driver of long-term economic growth, has shown distinct investment cycles in eThekwini between 1993 and 2024, shaped by both global and domestic dynamics. GFCF rose steadily from R22.0 billion in 1993 to R64.9 billion in 2008, underpinned by investor confidence, infrastructure expansion, and industrial development. Notably, investment surged by 84% between 2003 and 2008, coinciding with favourable global conditions and strong local GDP growth. This trend aligns with findings by Masuku and Ngcobo (2019), who highlight the significant contribution of investment to South Africa's long-term

growth trajectory. However, the 2008 Global Financial Crisis (GFC) marked a turning point, with GFCF contracting by 7% to R60.3 billion in 2009 and declining further to R57.4 billion in 2010 amid heightened financial uncertainty and credit tightening. Although eThekwini saw a modest rebound to R62.1 billion in 2011, post-crisis investment levels remained volatile and never fully regained pre-GFC momentum. Between 2012 and 2015, GFCF plateaued, peaking at R69.8 billion, before steadily declining to R63.0 billion by 2019. The COVID-19 pandemic triggered another sharp decline to R54.2 billion in 2020, as fiscal constraints, supply chain disruptions, and weakened investor confidence weighed on investment (Niyimbanira, 2023). By 2024, GFCF stood at R55.8 billion, still 13% below its 2008 peak, highlighting indicating stagnation and a persistent gap that may limit infrastructure development. Especially after the mega-projects concluded, the structural weakness in both public and private investment became increasingly evident (World Bank, 2020).

This stagnation is compounded by the declining share of the City's capital budget, which currently stands at just 9.5% of the total budget, with capital expenditure averaging between R5 billion and R7 billion annually. This limited fiscal space restricts the City's capacity to drive infrastructure-led growth and catalyse private-sector investment. Furthermore, research by Molele and Niyimbanira (2022) confirms the positive long-run relationship between GFCF and employment in South Africa.

Figure 1.3.4: Gross Fixed Capital Formation (GFCF)



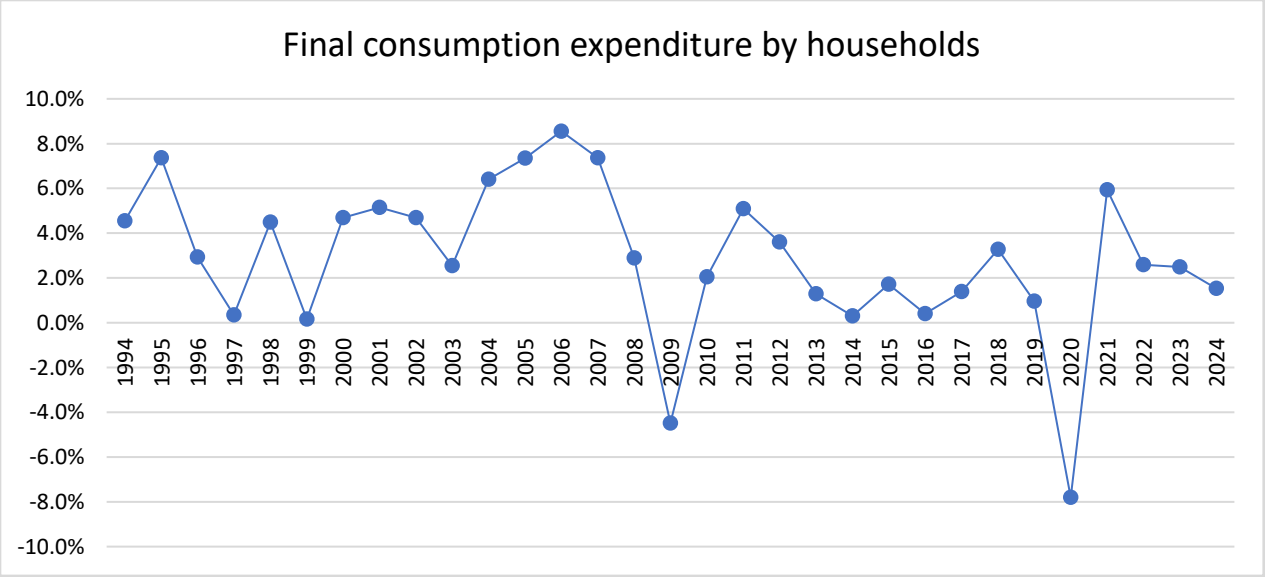
Source: Quantec, 2025

Final consumption expenditure by households reflects economic confidence, income stability, and the underlying strength of domestic demand. From 1994 to 2007, household consumption in South Africa grew steadily, averaging over 5% annually, with notable peaks in 1995 (7.4%), 2004 (6.4%), 2005 (7.4%), and 2006 (8.6%) (SARB, 2024; Quantec, 2024). This robust growth was underpinned by macroeconomic stability, rising household incomes, job creation, improved access to consumer credit, and a shift toward consumption-led growth enabled by

fiscal consolidation and monetary discipline (World Bank, 2010; Bhorat et al., 2013). The 2008/09 global financial crisis abruptly disrupted this trend. In 2009, household consumption contracted by –4.5%, reflecting job losses, restricted credit access, and widespread economic uncertainty. Households responded by curbing discretionary spending and prioritizing savings, closely mirroring GDP and employment declines (National Treasury, 2011; Stats SA, 2010). Between 2010 and 2012, consumption saw a modest recovery of around 3.5% annually, buoyed by policy stimulus and partial labour market recovery. However, from 2013 to 2019, growth slowed significantly—rarely exceeding 2%—as structural constraints, including high debt levels, stagnating real wages, and deteriorating infrastructure, began to weigh more heavily despite the absence of external shocks (TIPS, 2019; Quantec, 2024).

The COVID-19 pandemic in 2020 induced the sharpest annual drop in household spending in democratic South Africa, contracting by –7.8% due to lockdowns, severe income losses, and heightened consumer uncertainty (Stats SA, 2021; SARB, 2021). Consumption trends during this period closely followed GDP and employment losses. A strong rebound of 5.9% followed in 2021, largely reflecting base effects from economic reopening and pent-up demand. However, the momentum did not sustain—growth slowed to 2.6% in 2022, 2.5% in 2023, and further to 1.5% in 2024, underscoring the enduring financial strain on households amid rising inflation, stagnant incomes, and mounting cost-of-living pressures (S&P Global, 2024; Quantec, 2024). Despite the broader macroeconomic recovery, household demand remains weak and fragile, threatening to limit South Africa's long-term growth trajectory unless reinforced by inclusive job creation, debt relief mechanisms, and redistributive policy measures (IMF, 2022; UNDP, 2023).

Figure 1.3.5: Household Consumption



Source: Quantec, 2025

2 Methodology

This study uses quarterly data from 1995Q1 to 2024Q1 and applies the Time-Varying Parameter Vector Autoregressive (TVP-VAR) model to capture evolving relationships between macroeconomic variables. Unlike standard VAR models with fixed coefficients, the TVP-VAR accommodates structural changes, regime shifts, and nonlinearities—making it well-suited for analysing crises such as the 2008 global financial crisis and the 2020 COVID-19 shock.

Internationally, TVP-VAR models are widely used to assess the changing impact of economic shocks. Primiceri (2005) showed how monetary policy effects varied over time in the U.S., while Canova et al. (2015) found that fiscal stimulus responses during the GFC were state-dependent. Baumeister and Benati (2013) applied the model to oil price shocks across G7 countries. In Portugal, Castro et al. (2018) used it to study shrinking fiscal multipliers post-2008. Closer to home, Aye et al. (2015) used TVP-VAR to analyse how financial stress affected South Africa's economic activity over time. By adopting this approach, the study highlights how crisis impacts shift over time, offering deeper policy insight into South Africa's evolving economic vulnerabilities and responses.

Abbreviation	**Description**	**Source**
$dbngdp$	*Gross Domestic Product (GDP) Growth Rate (%)*	*S&P Global Insight, 2025*
$dbngf\_cf$	*Gross Fixed Capital Formation (% of GDP or real growth)*	*Quantec &, 2025*
$dbnempl$	*Employment Rate*	*QLFS Stats SA, 2025*
$dbnhce$	*Household Final Consumption Expenditure*	*Quantec &, 2025*
$emvf$	*Financial Crises Index*	*St. Louis Federal Reserve Bank,2025*

2.1 Theoretical framework

2.2 Theoretical framework: Cobb-Douglas production function

The Cobb-Douglas production function captures the relationship between inputs and output in the production process [?]. The general form is specified as Equation 1.

$$Q(L,K) = AL^{1-\alpha}K^{\alpha} \tag{1}$$

where $Q \equiv y$ denotes total output or GDP growth $L \equiv l$ represents the labour force $K \equiv k$ denotes capital stock, proxied by gross fixed capital formation $A \equiv a$ is a positive constant representing total factor productivity α and $1-\alpha$ are the output elasticities of capital and labour, respectively, and both are bounded between 0 and 1. Following log-linearization, Equation 1 is given as Equation 2.

$$y_t = a_t + +k_t + l_t \tag{2}$$

Equation 2 constitutes the baseline theoretical framework, capturing economic growth (y_t) as a function of lagged output, capital, labour, and productivity. To extend the Cobb–Douglas framework and incorporate the rate $dbngfcf$ gross fixed capital formation $dbnempl$ employment rate $dbnhce$ household consumption $emvfincrises$Financial Crises Index. The extended specification is formulated as:

$$dbngdp_t = dbngfcf_t + dbnempl_t + dbnhce_t + emvfincrises_t \tag{3}$$

where $dbngdp$ gross domestic product growth.

2.3 Model Specification of the TVP-VAR

This study employs a Time-Varying Parameter Vector Autoregressive (TVP-VAR) model to investigate the dynamic effects of financial crises on Durban's economy: evidence from a time-varying parameter VAR model. The TVP-VAR framework captures time-varying relationships and impulse responses, allowing for a flexible analysis of macroeconomic dynamics under evolving conditions.[1] The general form of the TVP-VAR(p) model is expressed as in Equation 4.

$$\mathrm{y}_t = B_t(L)\mathrm{y}_{t-1} + \mathrm{c}_t + \mathrm{e}_t \tag{4}$$

where

$$\mathrm{y}_t = \begin{bmatrix} dbngdp_t \\ dbngfcf_t \\ dbnempl_t \\ dbnhce_t \\ emvfincrises_t \end{bmatrix} \tag{5}$$

where y_t is a vector of endogenous variables representing the gross domestic product growth rate, gross fixed capital formation, employment rate, household consumption, and financial crises index, respectively. $B_t(L)$ is a lag polynomial with time-varying coefficients, c_t is a time-varying constant, and $\mathrm{e}_t = \Theta_{0,t}\epsilon_t$ represents the structural error term with $\epsilon_t \sim \mathcal{N}(0, \Sigma_{\epsilon,t})$. The time-varying lag polynomial is given by Equation 6.

$$B_t(L) = I - B_{1,t}L - B_{2,t}L^2 - \cdots - B_{p,t}L^p \tag{6}$$

In matrix representation, it $B_t(L)$ is structured as matrix 7.

[1] A notable feature of the TVP-VAR model is its ability to account for multiple significant shocks simultaneously—specifically from 2008Q1, 2009Q1, 2014Q1, and 2019Q1.

$$B_t(L) = \begin{pmatrix} B_{1,t}(L) & B_{2,t}(L) & \cdots & B_{5,t}(L) \\ B_{1,t}(L) & B_{2,t}(L) & \cdots & B_{5,t}(L) \\ \vdots & \vdots & \ddots & \vdots \\ B_{1,t}(L) & B_{2,t}(L) & \cdots & B_{5,t}(L) \end{pmatrix} \tag{7}$$

The structural error covariance matrix $\Sigma_{\epsilon,t}$ is assumed to be Equation 6.

$$\Sigma_{\epsilon,t} = \begin{pmatrix} \sigma_{1,t} & 0 & 0 & 0 & 0 \\ 0 & \sigma_{2,t} & 0 & 0 & 0 \\ 0 & 0 & \sigma_{3,t} & 0 & 0 \\ 0 & 0 & 0 & \sigma_{4,t} & 0 \\ 0 & 0 & 0 & 0 & \sigma_{5,t} \end{pmatrix} \tag{8}$$

To identify structural shocks, we use the Cholesky decomposition in Equation 9.

$$A_t \Sigma_{\epsilon,t} A_t, = \Sigma_{e,t} \tag{9}$$

where A_t is a lower triangular matrix 10.

$$A_t = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21,t} & 1 & 0 & 0 & 0 \\ a_{31,t} & a_{32,t} & 1 & 0 & 0 \\ a_{41,t} & a_{42,t} & a_{43,t} & 1 & 0 \\ a_{51,t} & a_{52,t} & a_{53,t} & a_{54,t} & 1 \end{pmatrix} \tag{10}$$

Impulse response functions (IRFs) trace the effect of a structural shock $\boldsymbol{\epsilon}_t$ on $\mathbf{y}_t$ over time. At horizon h, the IRF is computed as in Equation 11.

$$\mathrm{IRF}_{t+h} = \left(\prod_{j=0}^{h-1} B_{t+j}^{-1}\right)\Theta_{0,t}\boldsymbol{\epsilon}_t \tag{11}$$

Expanding the system yield matrix 12.

$$\mathbf{y}_t = \begin{bmatrix} b_{11,t} & b_{12,t} & b_{13,t} & b_{14,t} & b_{15,t} \\ b_{21,t} & b_{22,t} & b_{23,t} & b_{24,t} & b_{25,t} \\ b_{31,t} & b_{32,t} & b_{33,t} & b_{34,t} & b_{35,t} \\ b_{41,t} & b_{42,t} & b_{43,t} & b_{44,t} & b_{45,t} \\ b_{51,t} & b_{52,t} & b_{53,t} & b_{54,t} & b_{55,t} \end{bmatrix} \mathbf{y}_{t-1} + \mathbf{c}_t + \Theta_{0,t}\boldsymbol{\epsilon}_t \tag{12}$$

To assess the differential responses of financial crises on Durban's economy: evidence from a time-varying parameter VAR model, we compute IRFs for selected periods.

$$\mathrm{IRF}_{2001Q1} = B_{2008Q1}^{-1}\Theta_{0,2014Q1}\boldsymbol{\epsilon}_{2019Q1} \tag{13}$$
$$\mathrm{IRF}_{2001Q1} = B_{2008Q1}^{-1}\Theta_{0,2014Q1}\boldsymbol{\epsilon}_{2019Q1} \tag{14}$$

$$\mathrm{IRF}_{2001Q1} = B_{2008Q1}^{-1}\Theta_{0,2014Q1}\boldsymbol{\epsilon}_{2019Q1} \quad (15)$$

$$\mathrm{IRF}_{2001Q1} = B_{2008Q1}^{-1}\Theta_{0,2014Q1}\boldsymbol{\epsilon}_{2019Q1} \quad (16)$$

The full time-path of impulse responses is captured in matrix 17.

$$\mathrm{IRF}_t = \begin{bmatrix} \mathrm{IRF}_{\mathrm{dbngdp},t} & \mathrm{IRF}_{\mathrm{dbngfcf},t} & \mathrm{IRF}_{\mathrm{dbnempl},t} & \mathrm{IRF}_{\mathrm{dbnhce},t} & \mathrm{IRF}_{\mathrm{emvfincrises},t} \\ \mathrm{IRF}_{\mathrm{dbngdp},t+1} & \mathrm{IRF}_{\mathrm{dbngfcf},t+1} & \mathrm{IRF}_{\mathrm{dbnempl},t+1} & \mathrm{IRF}_{\mathrm{dbnhce},t+1} & \mathrm{IRF}_{\mathrm{emvfincrises},t+1} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \mathrm{IRF}_{\mathrm{dbngdp},t+h} & \mathrm{IRF}_{\mathrm{dbngfcf},t+h} & \mathrm{IRF}_{\mathrm{dbnempl},t+h} & \mathrm{IRF}_{\mathrm{dbnhce},t+h} & \mathrm{IRF}_{\mathrm{emvfincrises},t+h} \end{bmatrix} \quad (17)$$

3 Results

Table 2 summarizes macroeconomic indicators for Durban. GDP growth (dbngdp) averaged 0.56%, with high volatility std. dev. = 2.14, ranging from –16.87% to 13.74%. This suggests significant cyclical fluctuations. Gross fixed capital formation $dbngfcf$ grew by 0.68% on average, but was highly unstable std. dev. = 3.44, min –21.75%, indicating sensitivity to investment shocks. Employment growth $dbnempl$ averaged 0.33%, also volatile std. dev. = 3.20, reflecting a fragile labor market. Household consumption $dbnhce$ showed a slightly higher mean growth of 0.71%, though with large swings –20.08% to 17.41%, indicating exposure to income and credit shocks. The financial crises index (emvfincrises) averaged 2.42, ranging up to 13.23, pointing to frequent financial stress episodes. Overall, the data reflect a volatile economic environment. Investment and employment are particularly unstable, while recurring financial stress reinforces the need for strong fiscal buffers and macro-financial stability measures.

Table 2: Summary Statistics of Variables

Variable	Observations	Mean	Std. Dev.	Min	Max
$dbngdp$	116	0.561	2.142	-16.866	13.743
$dbngfcf$	116	0.681	3.445	-21.747	12.595
$dbnempl$	116	0.329	3.202	-17.338	10.327
$dbnhce$	116	0.710	2.625	-20.077	17.412
$emvfincrises$	120	2.416	2.188	0.036	13.225

Table 3 presents the correlation matrix among the selected macroeconomic indicators for Durban. Notably, GDP growth $dbngdp$ exhibits a strong positive correlation with household consumption $dbnhce, \rho = 0.97$ and investment $dbngfcf, \rho = 0.74$, suggesting that aggregate demand components move closely with output fluctuations. This pattern aligns with Keynesian theory, where consumption and investment are primary drivers of short-term growth. The correlation between employment growth and GDP $\rho = 0.56$ is also positive, confirming a procyclical labor market. Similarly, employment correlates moderately with both consumption $\rho = 0.56$ and investment $\rho = 0.51$, indicating that labor demand responds to shifts in economic activity and domestic spending. By contrast, the financial crises index $emvfincrises$ is negatively

correlated with all real sector variables, particularly with investment $\rho = -0.23$ and consumption $\rho = -0.19$. Though these values are relatively low in magnitude, they reflect that rising financial stress dampens economic performance, likely through tighter credit conditions, lower investor confidence, and disrupted capital flows.

Table 3: Correlation Matrix

Variables	$dbngdp$	$dbngfcf$	$dbnempl$	$dbnhce$	$mvfincrises$
$dbngdp$	1.0000				
$dbngfcf$	0.7386	1.0000			
$dbnempl$	0.5550	0.5113	1.0000		
$dbnhce$	0.9719	0.7271	0.5629	1.0000	
$emvfincrises$	-0.1501	-0.2293	-0.1265	-0.1914	1.0000

Table 4 presents the results of the Dickey–Fuller unit root tests for key Durban macroeconomic variables. All variables reject the null hypothesis of a unit root at the 1% significance level. The test statistics for each variable are well below their critical values, with p-values effectively zero, indicating strong evidence of stationarity in first differences[2].

Table 4: Dickey–Fuller Unit Root Test Results (lags = 0)

Variable	**Obs**	**Test Statistic**	**1% CV**	**5% CV**	**10% CV**	**p-value**
$dbngdp$	115	-15.676	-3.505	-2.889	-2.579	0.0000
$dbngfcf$	115	-10.385	-3.505	-2.889	-2.579	0.0000
$dbnempl$	115	-11.613	-3.505	-2.889	-2.579	0.0000
$dbnhce$	115	-15.125	-3.505	-2.889	-2.579	0.0000
$emvfincrises$	119	-4.544	-3.504	-2.889	-2.579	0.0002

Table 5 shows the TVP-VAR lag-order selection for Durban's macroeconomic data. All key criteria—Akaike Information Criterion (AIC), Hannan–Quinn (HQIC), and Final Prediction Error (FPE)—identify lag 1 as optimal, indicating the best model fit with minimal complexity. The LR test also strongly supports lag 1 (p-value = 0.000), confirming a significant improvement over lag 0. This suggests that macroeconomic shocks in Durban are best captured with a one-period lag, aligning with short-term dynamic responses in investment, consumption, and output. The selected lag structure provides a sound basis for further TVP-VAR-based analysis.

Table 5: Lag-Order Selection Criteria

Lag	**LL**	**LR**	**df**	**p-value**	**FPE**	**AIC**	**HQIC**	**SBIC**
0	-1114.43				330.474	19.9899	20.0392	20.1113
1	-1044.12	140.64	25	0.000	147.197*	19.1806*	19.4761*	19.9088*
2	-1019.51	49.204	25	0.003	148.642	19.1877	19.7294	20.5227

[2] This confirms that the variables are integrated of order zero, $I(0)$, and suitable for standard time-series modeling without further differencing. The stationarity of Durban's macroeconomic indicators supports robust econometric inference and suggests that shocks to these series are transitory rather than permanent. This behavior is consistent with typical macroeconomic dynamics where growth rates and financial stress indices tend to revert to long-term means, facilitating reliable forecasting and policy analysis.

3	-996.493	46.042	25	0.006	155.018	19.2231	20.0109	21.1649
4	-975.816	41.355*	25	0.021	169.583	19.3003	20.3343	21.8489

The dynamic response of Durban's GDP to financial crisis shocks, as shown in graph (d), reveals critical vulnerabilities in the city's economic structure. The brief initial uptick in GDP may reflect temporary fiscal buffers or delayed shock transmission. However, the sharp contraction in the second quarter and the sluggish recovery through the tenth quarter indicate structural rigidities, limited diversification, and weak counter-cyclical mechanisms. These findings underscore the need for forward-looking, crisis-responsive policies—such as investing in resilient infrastructure, strengthening institutional capacity, and promoting high-productivity, labor-intensive sectors—to enhance urban economic resilience and reduce vulnerability to external shocks. The counterfactual analysis shows an immediate GDP decline following a shock to the $emvfincrises$ index, with a prolonged recovery extending over eight quarters. The persistent deviation from the baseline suggests weak automatic stabilizers, limited absorptive capacity, and hysteresis effects. Despite a modest rebound, GDP remains below its trend, reflecting sustained damage. This pattern underscores the urgency of structural transformation to foster inclusive, robust, and shock-resilient growth.

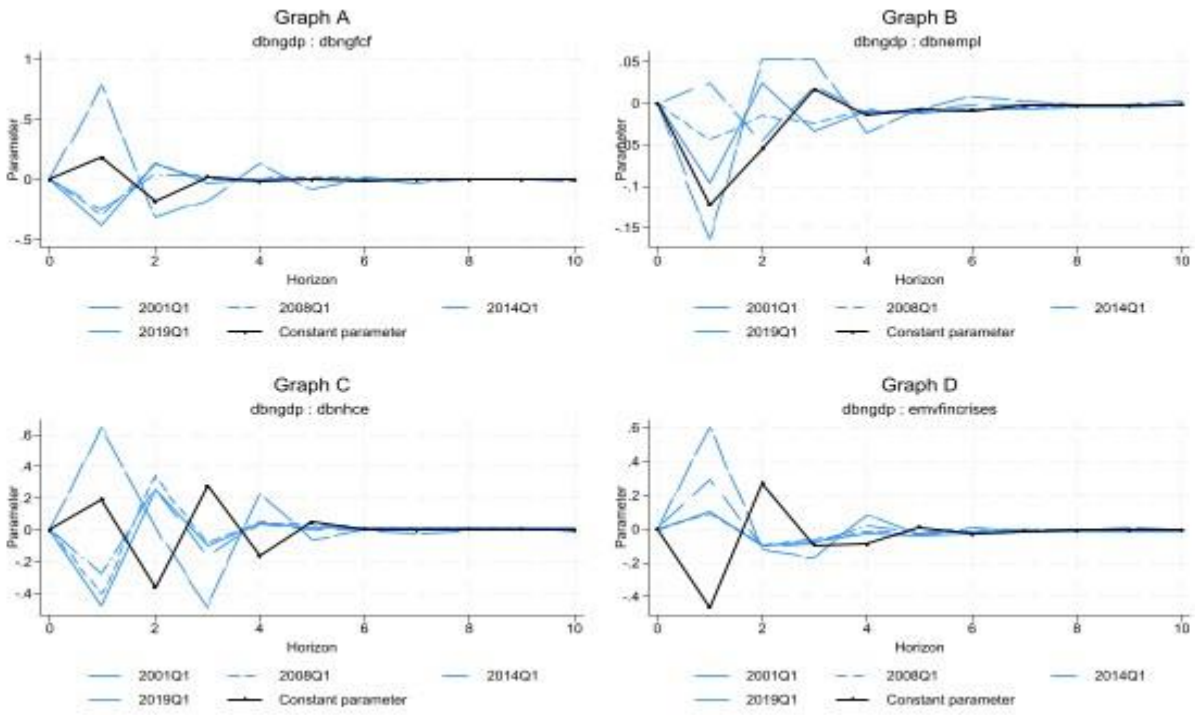


Figure 2: Effect of a shock against economic variables.
The $dbngdp$ gross domestic product growth rate $dbngfcf$ gross fixed capital formation $dbnempl$ employment rate $dbnhce$ household consumption $emvfincrises$ financial crises index.

The impulse response functions in Figures (a)–(d) offer critical insights into how Durban's

economy reacts to external financial crises shocks, highlighting both cyclical dynamics and deeper structural vulnerabilities. Graph (a) reveals a non-linear GDP response to financial shocks. The initial short-lived increase in GDP during the first quarter may reflect lagged transmission effects, automatic stabilizers, or temporary fiscal support. However, this is quickly followed by a sharp decline below the long-run equilibrium, indicating a fragile economic structure with limited absorptive capacity. The gradual recovery toward equilibrium by the eighth quarter suggests that while cyclical stabilization occurs, it is neither immediate nor robust. The constant IRF, in contrast, indicates an immediate and sustained negative response, reflecting the full vulnerability of GDP to external financial shocks when dynamic adjustments are held constant. This divergence underlines the importance of time-varying policy responses and evolving economic resilience mechanisms. Graph (b) shows that gross fixed capital formation (GFCF) declines steadily in response to the shock, bottoming out by the fourth quarter. This indicates that investment is highly sensitive to external uncertainty, with firms likely postponing or cancelling capital projects due to reduced confidence, tighter credit conditions, and demand-side weakness. The delayed nature of this contraction highlights the transmission of financial stress into the real economy through the investment channel.

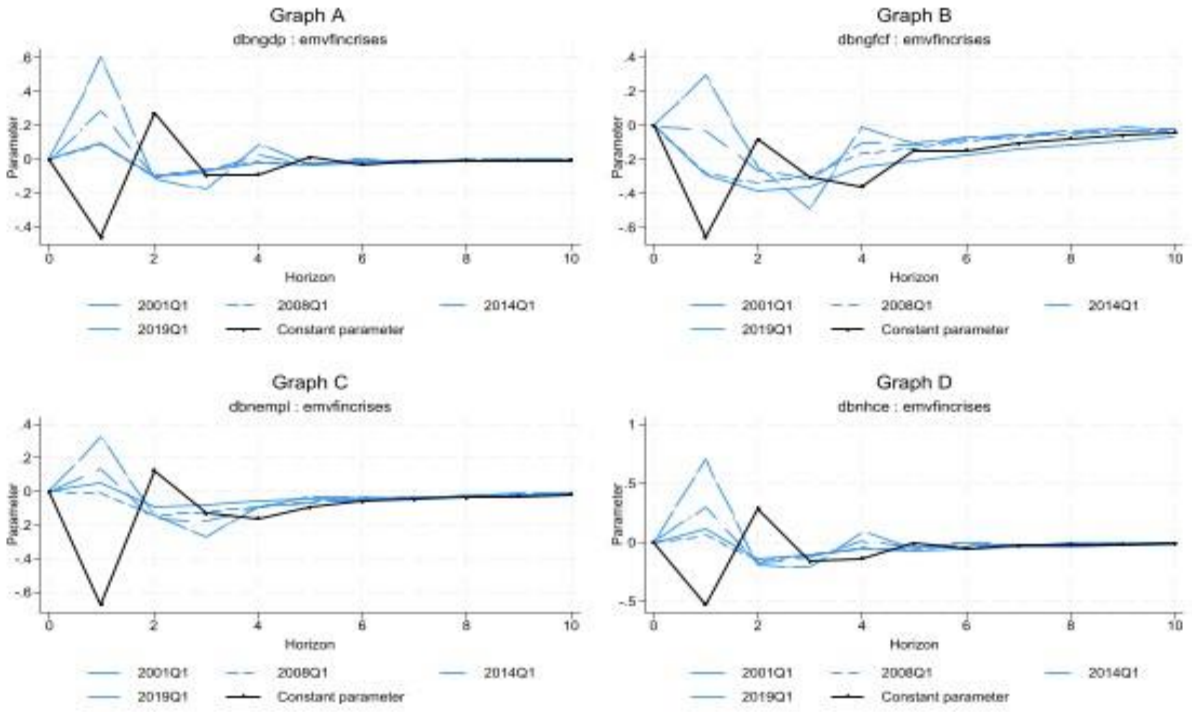


Figure 2: Effect of a shock of $emvfincrises$ financial crises index on economic variables.
The $dbngdp$ gross domestic product growth rate $dbngfcf$ gross fixed capital formation $dbnempl$ employment rate $dbnhce$ household consumption $emvfincrises$ Financial Crises Index.

Graph (c) presents a decline in the employment rate following a financial shock, which reflects typical labour market rigidities and the lagged adjustment of employment to output

contractions. This suggests that Durban's labour market lacks the flexibility to absorb shocks efficiently and may suffer from structural mismatches or high informal sector dependency. The loss in employment, in turn, reduces aggregate demand, exacerbating the downturn and delaying recovery. Graph (d) captures the cyclical nature of household consumption following the shock. The pattern of decline and partial recovery reflects consumer uncertainty, declining disposable income due to job losses, and possible tightening of household credit. Consumption volatility underscores the weakness of automatic stabilizers at the household level and highlights the importance of income protection mechanisms during crisis episodes.

Figure 4 illustrates the impact of financial crisis shocks, measured by the $emvfincrises$ index—on Durban's economic growth. Durban's trajectory over the past three decades reflects the interplay between cyclical stocks and deep structural vulnerabilities. Moderate GDP declines between 1995–2005 reveal persistent fragility rooted in historical, institutional, and spatial legacies, particularly apartheid-era segregation, which limited productive integration and left the city reliant on low value-added sectors such as port activities, informal services, and small-scale manufacturing. Between 2005–2014, growth accelerated alongside global commodity booms and increased foreign investment, but this rebound masked unresolved structural weaknesses. With no significant progress in industrial upgrading or skills development, the post-2008 downturn and stagnation after 2015 reflect hysteresis, where temporary shocks result in lasting economic damage through capital erosion, labour skill loss, and reduced entrepreneurship.

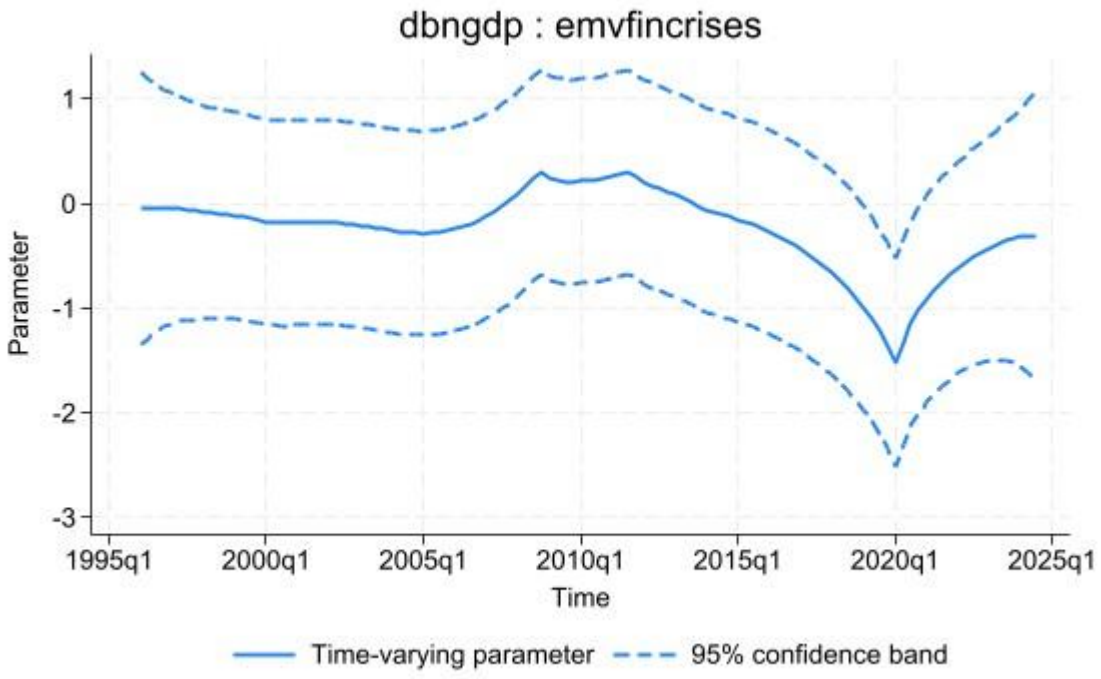


Figure 4: Effect of a shock of $emvfincrises$ financial crises index on economic growth in Dubarn.The $dbngdp$ gross domestic product growth rate $dbngfcf$ gross fixed capital formation $dbnempl$ employment rate $dbnhce$ household consumption $emvfincrises$ financial crises

index.

These hysteresis effects align with theories of path dependence and economic scarring, underscoring the long-term impact of crises. Durban's labour market remains characterized by informality, high unemployment, and skills mismatches, perpetuating poverty and inequality. Weak fiscal autonomy and fragmented governance further limit the city's capacity for counter-cyclical and transformative investment. The city's economic structure remains skewed toward traditional sectors with minimal integration into global value chains, limiting diversification and productivity gains. Spatial inequalities, poor access to services, and economic exclusion heighten vulnerability to shocks, reinforcing structural stagnation. To break this cycle, Durban requires a forward-looking urban economic strategy focused on structural transformation, inclusivity, and resilience. Priorities include investing in skills for emerging industries, promoting innovation and entrepreneurship, and addressing spatial disparities through improved connectivity and infrastructure. Strengthening local institutional capacity and fiscal frameworks is essential for sustained, effective policy implementation. Theoretically, Durban's case enriches urban macroeconomic literature by showing how financial shocks deepen structural weaknesses in developing cities. It challenges conventional stabilization models and advocates for resilience frameworks that integrate social, spatial, and economic dimensions. The implications extend across the Global South, highlighting the need for integrated, evidence-based urban policy to foster inclusive, innovation-driven, and shock-resilient growth.

4. Policy Intervention and Discussion

The empirical findings of this study, alongside the persistent failure of previous economic recovery frameworks in Durban, reveal a structural policy failure: a deep and enduring disconnect between policy formulation and the real economic constraints facing the city. Despite repeated shocks, including the 2008 global financial crisis, the 2021 unrest, and the COVID-19 pandemic, Durban's economic responses have remained fragmented, reactive, and largely ineffective. This reflects not only insufficient local capacity and strategic coherence but also an absence of national support in enabling structural transformation at the city level. Evidence of hysteresis, where temporary shocks generate long-term economic scarring, highlights that Durban's challenges are not merely cyclical but structurally embedded. A fundamental rethinking of the policy architecture is required: one that empowers local government, aligns with national economic objectives, and invests in long-term urban resilience and inclusive growth. The following three policy priorities are central to this transformation.

4.1. Structural Transformation as the Foundation for Inclusive Growth

Durban's economic base remains narrowly concentrated, characterised by deindustrialisation, low productivity, and an increasing reliance on informal and consumption-driven sectors. Reversing this trend demands a long-term structural transformation strategy aimed at diversifying the urban economy into globally competitive, high-value sectors. Key focus areas should include advanced manufacturing, green technologies, port logistics, agro-

processing, and digital services. To maximise impact, these investments must be spatially anchored within strategic economic nodes, such as the Dube TradePort SEZ, the Inner City, the Outer West development corridor, and the port precinct, to stimulate industrial clustering, unlock infrastructure-led growth, and integrate local firms into regional and global value chains.

The national government has a pivotal role in enabling this transformation. Through the Department of Trade, Industry and Competition (dtic), it must coordinate industrial policy, expand Special Economic Zone (SEZ) incentives, and provide infrastructure funding to unlock large-scale urban economic projects. Additionally, regulatory barriers that hinder local industrial growth must be addressed. Crucially, national sector masterplans, such as those for manufacturing, the digital economy, and green industries, must be aligned with local economic development strategies to ensure coherence and integration across spheres of government. If effectively implemented, these efforts will result in increased industrial output and export diversification, the creation of quality employment, particularly for youth and skilled workers, and a more competitive, resilient urban economy that is better equipped to withstand future economic shocks.

4.2. Fiscal Decentralisation and Institutional Capacity for Policy Effectiveness

Durban's capacity to drive transformative change is significantly constrained by limited fiscal autonomy, narrow revenue instruments, and weak institutional agility. Without broader fiscal space and enhanced technical capacity, the city remains confined to short-term service delivery functions, lacking the ability to pursue investment-led growth or respond effectively to economic shocks. Strengthening fiscal decentralisation is therefore essential. This entails enabling municipalities to raise and retain more of their revenue, improving the predictability and flexibility of intergovernmental transfers, and investing in institutional reforms, particularly in local planning, budgeting, and economic development systems.

The national government has a critical role to play in this process. Reforms to the local government fiscal framework, such as adjustments to the Division of Revenue Act (DoRA), equitable share formulas, and conditional grant structures, must better reflect the unique developmental needs of urban centres. In addition, national entities like the National Treasury, COGTA, and the Presidency must support institutional strengthening through targeted capacity-building programmes, technical secondments, and the provision of digital infrastructure such as planning dashboards and monitoring and evaluation (M&E) systems. These reforms will enable stronger local governance and greater financial sustainability, improve the planning, execution, and monitoring of development initiatives, and accelerate the delivery of catalytic, city-specific projects that are essential for long-term economic transformation.

4.3. Institutionalising Crisis Preparedness and Early Warning Systems

Durban has repeatedly experienced the costs of unanticipated economic shocks, from the global financial crisis to COVID-19 and climate-related disasters, yet lacks institutional mechanisms for risk anticipation, rapid response, and economic recovery planning. Establishing

early warning systems and institutionalising economic risk management is essential for resilient urban governance. This includes real-time business and employment data monitoring, scenario-based planning, fiscal stress testing, and formalised contingency planning within municipal finance and development systems.

National departments such as Treasury, DPME, and the Department of Cooperative Governance must provide policy frameworks, data access, and technical assistance to institutionalise crisis preparedness in cities. This includes supporting local economic observatories, enabling integration with national early warning systems (e.g., NT's macro-risk platform), and establishing contingency funding instruments accessible by metros during emergencies. This will lead to faster, evidence-based responses to economic shocks and a reduction in the vulnerability of households and businesses.

5 Conclusion

This study provides compelling empirical evidence that financial crises—particularly the 2008 global financial crisis and the 2020 COVID-19 shock—have had deep, lasting, and multidimensional impacts on Durban's economic trajectory. The Time-Varying Parameter Vector Autoregressive (TVP-VAR) model confirms that these shocks triggered not only sharp, immediate declines in GDP, investment, employment, and household consumption, but also long-term structural scarring. The interpretation of the results reveals a pronounced hysteresis effect, where Durban's economy fails to recover to pre-crisis baselines, reflecting entrenched vulnerabilities, rigidities, and limited adaptive capacity. Transitory rebounds, initially supported by short-term buffers, fade rapidly, giving way to stagnation. This cyclical-to-structural transmission suggests that crises in Durban do not just disrupt the economy temporarily; they permanently alter its trajectory, reinforcing inequality and reducing long-term potential.

The findings also show that Durban's post-crisis recoveries have become weaker and more prolonged over time, especially after 2010. Investment (Gross Fixed Capital Formation) remained subdued, job creation was inconsistent and informalised, and household demand weakened under rising cost-of-living pressures. The results point to a broader structural imbalance: an economy concentrated in low-productivity, consumption-driven sectors, spatially fragmented by apartheid-era legacies, and constrained by fiscal and institutional limitations. These realities confirm that Durban's economic performance is not only vulnerable to external shocks, but also structurally ill-equipped to absorb and recover from them.

This reinforces a central insight of the study: cities are both the frontline of economic vulnerability and the frontline of recovery and transformation. Durban's experience illustrates that when cities are underpowered—fiscally, institutionally, and structurally—their ability to drive inclusive growth, withstand volatility, and contribute meaningfully to national development is severely compromised. Yet, when enabled, cities possess the scale, density, and productive potential to serve as engines of innovation, industrial upgrading, and employment creation. The imperative, therefore, is to make cities like Durban more functional, not just as service delivery

centres, but as dynamic economic systems capable of leading structural transformation.

To address these systemic challenges and shift toward a more resilient growth path, the study proposes three strategic policy interventions. First, Durban must adopt a long-term structural transformation agenda that diversifies its economic base into globally competitive sectors such as advanced manufacturing, green industries, logistics, and digital services. This involves unlocking investment in key spatial nodes (e.g., Dube TradePort, port precincts, Outer West etc), supporting local value chains, and integrating into regional and global markets. Second, the city requires enhanced fiscal decentralisation and institutional capacity to enable effective implementation of transformative policies. This includes expanding own-revenue instruments, reforming intergovernmental fiscal transfers, and building professional capacity in economic planning, project execution, and performance monitoring. The national government, through National Treasury, COGTA, and the Presidency, must play a central role in restructuring the local fiscal framework and providing targeted technical support. Third, Durban must institutionalise crisis preparedness and early warning mechanisms to mitigate the future impact of financial and macroeconomic shocks. Real-time monitoring tools, scenario-based planning, and fiscal stress testing must be embedded in the city's governance systems to ensure timely, data-driven responses and to protect vulnerable households and businesses.

In conclusion, the results of this study reveal that Durban's economic stagnation is neither accidental nor temporary; it is the outcome of repeated shocks interacting with deep-seated structural weaknesses. Reversing this path requires a shift from short-term, reactive strategies toward bold, evidence-based urban economic policies centred on resilience, structural transformation, and inclusion. Durban's case offers vital lessons for metropolitan economies across the Global South: that making cities more functional is not a peripheral issue, it is central to national recovery, productivity, and shared prosperity. With the right policy tools, aligned national support, and strong urban governance, cities like Durban can move from being sites of crisis to becoming platforms for sustained, equitable growth.

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