



Governance, and regional dynamics of inflation persistence: Evidence from South Africa

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ERSA working paper 927

March 2026

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Abstract

Regional inflation patterns within a single economy can have important implications for the effectiveness of fiscal and monetary policy. Yet, much of the existing research has focused on cross-country or monetary union dynamics, often assuming intra-country homogeneity for national policy to transmit uniformly. This assumption may be restrictive in countries like South Africa, where significant regional disparities in economic activity, infrastructure, and governance exist — each of which affects how policy transmits sub-nationally. This study uses consumer price index (CPI) data from 27 local municipalities between 2008 and 2023 to characterise variation in inflation and inflation persistence across South African regions. Using autoregressive specifications, the study tests whether municipal governance, measured by audit outcomes from the Auditor-General of South Africa, moderates persistence. The results indicate substantial regional differences in both inflation levels and persistence. Regions with lower economic activity tend to experience higher inflation persistence, which may mean harsher conditions for already poorer regions. Governance quality appears to moderate this relationship, particularly in administered-prices, while its effect is weaker in market-determined prices.

Keywords: Governance, Inflation, Persistence, Regions

JEL Codes: H70 E31 R11

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1 Introduction

Low and stable inflation supports other macro-economic objectives such as full employment, sustained economic growth, and favourable external balance. Inflation is a crucial economic indicator that captures how quickly prices for goods and services are changing, and therefore real purchasing power. Its relevance to policy reflects its effects on consumer behaviour, the standard of living, and overall economic well-being. Understanding inflation dynamics is crucial for effective monetary policy and its effects. This need has become even more pertinent with the global rise in inflation, even in normally less-inflation exposed developed countries. In much of the research exploring the intricacies of inflation, little attention has been paid to regional differences in inflation. In cases where it is explored, it is often in the context of monetary unions across countries (Angeloni and Ehrmann, 2007; Beck et al., 2009; De Haan, 2010). Yet, similar differences may exist between regions in a country, and local governance may shape overall inflation and inflation persistence across sub-regions (Aisen and Veiga, 2006, 2008; Hammermann and Flanagan, 2009; Ridhwan, 2016)

The emphasis on how heterogeneity at the local or regional government level influences inflation suggests that differences across regions within the same country may be important for monetary policy (Yesilyurt and Elhorst, 2014). Different inflation rates across regions may reflect local economic activity, the policies in place, market structures, and supply side shocks (Winkelried and Gutierrez, 2015). These differences motivate analysing heterogeneous policy transmission. In South Africa, for example, the overall inflation rate varied from 7.2% in 2009 to 3.2% in 2020. Yet, over the same period, there are notable disparities between provinces, including municipalities. Take Limpopo province, for example, where the inflation rate reached a maximum value of 7.9% in 2016, compared to North West province, which saw a lowest rate value of just 0.6% in 2020. Municipal-level heterogeneity is also pronounced. This may reflect differences in municipal governance (see Figure A1), and highlights the importance of understanding regional heterogeneity, as broad monetary policies aimed at managing the national average inflation rate may not transmit uniformly across regions.

High inflation rates have adverse effects on economic growth (Sarel, 1996; Ndoricimpa, 2017; Akinsola and Odhiambo, 2017) and employment (Friedman, 1977; Tobin, 1995; Vermeulen, 2017). High inflation may also exacerbates income inequality (Sintos, 2023; Law

and Soon, 2020; Siami-Namini and Hudson, 2019). Despite the vast literature on the economic impacts of inflation, its regional heterogeneity, or the persistence is not well understood. Given that inflation persistence is the inertia or serial correlation in inflation (Fuhrer and Moore, 1995), that is, the degree to which inflation "persists" or remains correlated with its past values over time, understanding this can be quite important in the context of a country like South Africa, with strong historical disparities that tow regional boundaries. On the other hand, governance encompasses institutional frameworks and policies that may shape economic stability, while regional dynamics refer to variations in economic conditions and inflation across different geographic areas. Effective governance characterized by transparency, accountability, and sound policy implementation can help stabilize local economies. Given South Africa's diverse economic landscape, marked by stark disparities in income, development, and resource access, understanding regional inflation, and inflation persistence dynamics, and how governance features in these dynamics, may provide important insights for monetary policy.

This study contributes to the literature on several fronts: (1) by assessing the existence of regional variation in the inflation experience of municipalities using regional price data, (2) by analysing the potential correlation between regional inflation and the quality of municipal governance and (3) by examining the influence of regional governance on the inflation and inflation persistence across various regions within South Africa, and (4) by accounting for differences in market and municipal influence of the baskets of goods within regional CPI. We find evidence that suggests inflation and inflation persistence varies significantly by region. We also find that regional governance has an influence on regional inflation and inflation persistence, and that this influence remains, but is slightly different when we separate market determined prices from municipal determined prices.

The rest of the paper is organized as follows: Section 2 presents a review of the related literature. Section 3 describes the data, theory and methodology employed in this paper. Section 4 presents the main empirical findings. Section 5 concludes the paper.

2 Regional Inflation Dynamics

Regional variations in inflation rates across different geographic areas may be driven by factors such as local economic conditions, policy differences, and market structures.

Much of the literature has focused on variation in inflation and the persistence thereof at the country level (Benigno, 2004), and sectoral level (Cecchetti and Debelle, 2006), with arguments that sectoral differences are of more importance, and often more pronounced than regional differences. In the context of the European Union (EU), where much of the discourse on variations in inflation persistence has been situated, this makes sense. However, regional variations may be of importance too and, while not arguing that they are more important than sectoral variations or differences, they also need to be better understood, so countries and regions have a better sense of the implications for monetary policy effectiveness and, by inference, other socio-economic implications (Vaona and Ascari, 2012). The reason being the potential for aggregation bias that emanates from this variation, an aggregate series may resemble more the traits of the most persistent sectors (Altissimo et al., 2006), but this can also be argued to be the case for regions too (Cecchetti et al., 1999; Vaona and Ascari, 2012).

Evidence for such aggregation bias has been shown in the EU, where, despite sharing a common currency, member states exhibit varying levels of economic development, fiscal discipline, and institutional strength, leading to regional differences in inflation and its persistence (Altissimo et al., 2006). Regional economic conditions, including local productivity, labour markets, market structures, and development paths, significantly influence inflation. Variations in these factors across regions contribute to differences in inflation experienced (Choi and Matsubara, 2007). It may also be due to spatial disparities in regional economic activity, infrastructure, and local policy responses (Krugman et al., 1999).

Such regional disparities can exist between countries, but also between regions within the same country, as there can be significant disparities in local economic conditions, such as employment levels, cost of living, and local implementation of national economic policies (Mankiw and Reis, 2002). Inflation tends to be higher in regions with greater economic activity or where local supply constraints are more pronounced. These variations are often linked to differences in the cost of living and local prices for goods and services (Blanchard and Katz, 1992). Spatial differences can also create inflation externalities, where inflation in one region affects neighboring regions through trade and economic linkages (LeSage and Pace, 2009). Additionally, the level of development in different regions can contribute to varying inflation rates. Urban areas tend to experience

higher inflation than rural areas due to differences in consumption patterns and economic structures (Gao et al., 2017), whereas market structures also play an important role that may lead to marked variations in inflation (Winkelried and Gutierrez, 2015).

In the context of South Africa, where national economic policy was highly influenced by strong path dependent spatial patterns in development paths, employment, and economic activity, regional variations may also have important implications for the efficacy of monetary policy. Economically backward regions tend to have higher inflation persistence. This means that once prices start rising in these regions, they are more likely to continue rising for a longer period (Vaona and Ascari, 2012; Duran and Dindaroglu, 2021). Lower levels of competitiveness in the retail sector are also associated with higher inflation persistence. Regions with less competitive retail markets may be more prone to price rigidities. Suggestions that inflation targeting, as practiced in South Africa, may help stymie these regional implications lack concrete evidence, with evidence showing that some regions in South Korea experience more persistent inflation despite the central bank's efforts (Tillmann, 2013). The socio-economic and spatial dynamics of this variation do seem to matter. Regions that are geographically close to each other exhibit similar inflation persistence patterns, while regions with higher GDP per capita and lower unemployment rates tend to have lower persistence. Those with higher house prices tend to have higher persistence which tends to spill over onto neighboring regions (Gajewski, 2018).

2.1 Regional governance and inflation

High quality institutions, characterized by transparency, accountability, and the rule of law, are associated with better economic outcomes (Acemoglu et al., 2001; North, 1990) and lower inflation (Eijffinger and De Haan, 1996; Fischer, 1993). Conversely, weak governance can lead to corruption, which undermines performance and can contribute to higher inflation by distorting economic policies and reducing policy effectiveness (Treisman, 2000). This is often because public governance, when properly effected, can help moderate exogenous shocks and the disruption to local economic channels (Bilan et al., 2019; Barro and Sala-i Martin, 1995). Regions with strong institutions are better equipped to manage inflation through credible and consistent policy frameworks, as well as implementation. Corrupt practices can limit, or in some cases counter monetary and fiscal policies,

leading to inefficiencies and inflationary pressures (Mauro, 1995; Wei, 2000). Variations in the quality of governance and institutions across countries, and more so between regions within a country, can lead to significant disparities in inflation outcomes, suggesting a more pronounced role of regional governance structures on experienced inflation at the sub country level (Yesilyurt and Elhorst, 2014).

There are a number of channels through which governance and local municipal characteristics may be correlated with both the rate of inflation experienced and the persistence thereof. If governance is defined as the structures through which institutions and the rule of law are functionalized, it means that similar national level institutions can be functionalized differently at the local government level (Fukuyama, 2013). In South Africa, this can have important implications, given the historical nature of local government structures, constitutional mandates, and the level of autonomy afforded to different local municipalities (Adedeji Amusa and Fadiran, 2024). This is because fiscal decentralization can increase inflation volatility if local governments lack the capacity or discipline to manage public finances prudently (Nasution, 2017). Therefore, the role of governance is potentially an indirect one, one of moderation, whereby the local municipal structures, including governance forms, help markets to adapt to shocks that may lead to more persistent inflation, or that may limit the reach of monetary policy efficacy into these certain regions. For example, Vaona and Ascari (2012); Yesilyurt and Elhorst (2014) both highlight the importance of the retail sector and the proliferation of retail stores as a measure of economic activity, but the quality of governance may, in turn, shape the desire of capital to flow into certain regions to open such stores. However, if the shocks are exogenous supply shocks, then the governance structure may allow for an environment that adapts quickly to such shocks, due to a relatively more stable environment, such that the price shifts do not persist (Aisen and Veiga, 2006). Indeed there is a relationship between economic activity and governance (see Figure 1).

Lastly, governance may operate differently, based on the nature of products being priced. Utilities and similar goods and services often operate within different structures than retail goods and services, and some prices are therefore administered by the local municipality. Local municipality "administered prices" do not change as frequently, but the influence of the quality of governance at the local government level may be more pronounced on the inflation rate experienced by these "administered prices", while the

persistence may be even more so (Alesina and Tabellini, 2007).

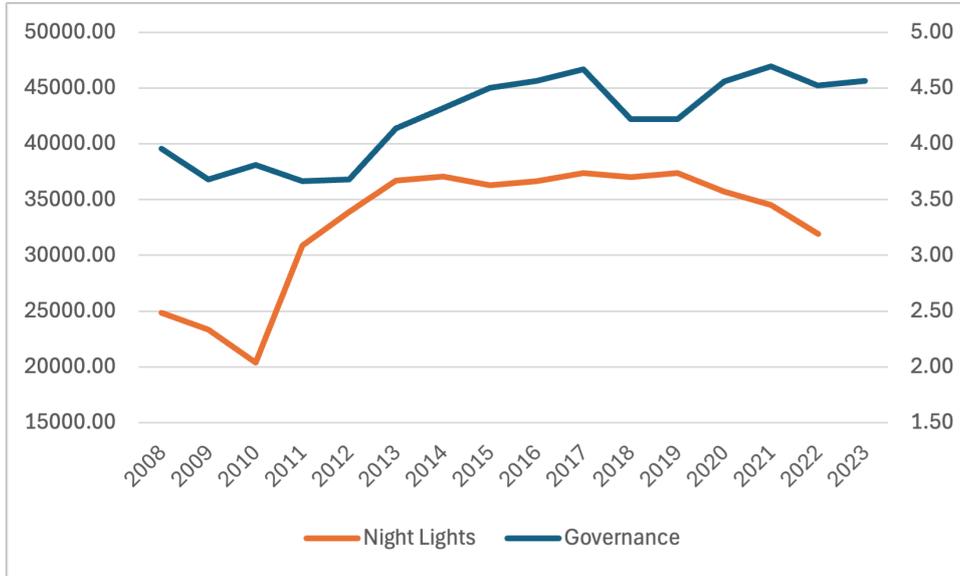


Figure 1: Governance and economic activity (VIIRS Night time lights)

3 Theory and Methodology

In this paper, we draw from the Hybrid New Keynesian Phillips Curve (HNKPC) presented in Yesilyurt and Elhorst (2014). They establish the link between earlier versions of the Phillips curve, including the simple Phillips curve (Friedman, 1977), the expectations-augmented Phillips curve (Gali and Gertler, 1999), and the New Keynesian Phillips Curve (NKPC). In the model, inflation is determined by expected future inflation, past inflation, and a variable that may represent excess demand, output deviations, unemployment rate deviations, or marginal costs, often indicated by wage share. In Yesilyurt and Elhorst (2014), the model integrates both forward-looking and backward-looking behaviors in economic agents, as explained by Gali and Gertler (1999). It proposes a market structure where some firms adjust prices based on expected future marginal costs, while others adjust based on past pricing patterns.

This study borrows from Yesilyurt and Elhorst (2014) and adapts the hybrid New Keynesian Phillips curve to incorporate a governance moderated economic activity channel. In the hybrid NKPC, inflation is determined by expected inflation, lagged inflation, and a forcing variable that may represent excess demand, output deviations, unemployment deviations, or marginal costs. In our context, the forcing variable is interpreted

as capturing local economic activity conditions that shape market thickness, entry, and local bottlenecks, which are central to the regional inflation persistence discussion.

Let A_{it} denote local economic activity, where higher values reflect deeper markets, greater firm presence, and more intense production and consumption. Governance quality is denoted by G_{it} , where higher values indicate stronger governance. We begin with the hybrid NKPC representation:

$$\pi_{it} = \gamma_f \pi_{it+1}^e + \gamma_b \pi_{i,t-1} + \mu x_{it} + \varepsilon_{it} \quad (1)$$

where x_{it} denotes a standard demand pressure term, such as the output gap, unemployment deviations, or marginal cost. We then allow local economic activity to enter the forcing component, and we allow governance to moderate the strength of this activity channel:

$$\pi_{it} = \gamma_f \pi_{it+1}^e + \gamma_b \pi_{i,t-1} + \mu x_{it} + \psi (A_{it} - \bar{A}_i) (1 - \gamma G_{it}) + \varepsilon_{it} \quad (2)$$

where $(A_{it} - \bar{A}_i)$ captures deviations in local economic activity from its local benchmark.

The key feature is that governance moderates how local economic activity translates into inflationary pressure. When governance is stronger, the moderating term reduces the inflationary effect of activity deviations, reflecting a better ability of local markets and municipal systems to adapt to shocks, support entry and competition, and reduce bottlenecks that would otherwise generate persistent price pressures. When governance is weak, the same activity deviation can generate more persistent inflationary responses because local adjustment is slower and market functioning is more constrained.

In this setting, inflation persistence is governed by both intrinsic persistence, captured by γ_b , and the degree to which local activity related shocks propagate through the forcing channel. If the impact of activity deviations on inflation is weaker in better governed municipalities, then shocks transmitted through local activity are less likely to be amplified and propagated over time. Conversely, where governance is weak, activity related shocks are more likely to generate prolonged inflationary responses, implying higher measured persistence. This motivates an interaction specification between local economic activity and governance. It is also important in the South African context,

where municipal governance quality and economic activity vary markedly across regions. Municipalities with weak governance structures may experience both higher exposure to shocks and lower economic activity, which may reinforce inflation persistence. Conversely, well-governed municipalities may benefit from smoother price adjustments and faster convergence to activity-aligned wage norms, thus exhibiting lower inflation persistence even when facing similar macroeconomic conditions.

3.1 Data

We make use of monthly price data at the municipal level from Statistics South Africa (StatsSA), and match this with other annual municipal data over the period 2005–2022. The data were obtained from a few sources including Quantec EasyData, Google Earth Engine, and Auditor General of South Africa (AGSA). The StatsSA price data is collected at the product-by-collection-region-by-month level. This is merged to StatsSA expenditure weights by product and region. Because expenditure weights are only reported for some years, we construct a complete monthly weight series for each product-region cell by carrying the most recently observed weight across missing years (i.e., within each product-region, missing weights are filled using the nearest available observation, with extrapolation where required).¹ Although regional inflation rates tend to move up and down together, one can also observe large differences and identify regions that follow unique region-specific patterns different from the national trend (Yesilyurt and Elhorst, 2014; Vaona and Ascari, 2012), even though the dispersion in these patterns does not show up as an aggregation bias in the national inflation rate. Regional governance data are obtained from AGSA, while economic activity computed using Visible Infrared Imaging Radiometer Suite (VIIRS) nighttime lights data is obtained from Google Earth Engine (Henderson et al., 2012). The remainder municipal characteristics data, such as infrastructure, are obtained from Quantec data.

¹Collection areas are mapped to the 27 municipalities using a municipal shapefile for South Africa, including explicit harmonisation of areas affected by coding changes (e.g., combined collection areas and rural area codes).

3.2 Empirical Approach

First, we compute both the CPI and inflation at the municipal level, calculating inflation at both the monthly and year-on-year rates. This is a crucial aspect of the study, as inflation and CPI data are typically provided at the national level, based on price data obtained from specific collection areas. To compute CPI, the overall product expenditure is used to weight the CPI, averaged over all product prices. This expenditure is captured at the municipal level, making it possible to compute expenditure-weighted regional CPI for the 27 locations.² For each municipality, we normalise the municipal CPI to a common base year (2015) by constructing a product-level price index and then aggregating across products using expenditure weights. Using the resulting CPI series, we compute two inflation measures: (i) month-on-month inflation, $\pi_{it}^m = 100\Delta \ln(CPI_{it})$, and (ii) year-on-year inflation, $\pi_{it}^y = 100 [\ln(CPI_{it}) - \ln(CPI_{i,t-12})]$. The persistence analysis uses the monthly inflation series π_{it}^m , while the year-on-year rate is used as an additional control in robustness specifications. We examine whether there are significant differences in CPI across regions. Inflation persistence is computed by incorporating the monthly inflation values into an auto-regressive (AR) model for each municipality (where price data is collected), with seasonality accounted for by including quarter dummies. The persistence is computed as the sum of the auto-regressive coefficients for each municipality. The equation for each municipality is presented in the form:

$$\pi_{it} = \alpha_i + \sum_{k=1}^{K_i} \beta_{ik} \pi_{i(t-k)} + \sum_{j=1}^3 \gamma_{ij} m_{ij} + u_{it} \quad (3)$$

Where π_{it} is the inflation rate in region i at time t ; m_{ij} represents quarterly dummies accounting for seasonal effects; u_{it} is a stochastic error term; α_i , β_{ik} , and γ_{ij} are the parameters to be estimated. The lag length K_i is selected using the Schwarz information criterion (BIC), searching over a maximum of 24 monthly lags and capping the search where required by the available sample length within each municipality. The persistence indicator p_i is then computed as:

$$p_i = \sum_{k=1}^{K_i} \beta_{ik} \quad (4)$$

²In constructing the municipal panel, we harmonise CPI collection areas to a consistent set of municipal identifiers (including consolidating historical collection-area codes where StatsSA definitions change) and drop ambiguous mappings that cannot be uniquely assigned to a municipality.

This is the same measure adopted by Vaona and Ascari (2012) from Lünnemann and Mathä (2004). It is preferred because it is simple, and can be easily extracted from the inflation computation, and can also be tested for consistency and bias with a single overall sample test. We test for significant differences in the computed regional measures of CPI, inflation, and inflation persistence by estimating a set of fixed-effects models at the municipality level. Building on this, we then examine the determinants of the estimated persistence (p_i) from the auto-regressive analysis. This is done by first graphically exploring the relationships between governance, economic activity, and inflation persistence, highlighting the moderating role of governance in the association between economic activity on persistence. Second, we formally estimate a model of the form:

$$P_{it} = \alpha + \beta_1 j.Gov_{it} + \beta_2 \ln(Lights_{it}) + \delta_1 j.Gov_{it} * \ln(Lights_{it}) + \gamma Z_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (5)$$

where μ_i and λ_t represent municipality and month fixed effects, respectively, and errors are clustered two-ways by municipality and month. P_{it} is persistence; Gov_{it} is a factor (categorical) governance variable (effects are relative to the omitted category); and Z_{it} include other controls (e.g., infrastructure, YoY Inflation, etc.). Place and time fixed effects are included, and standard errors are clustered at the municipality level. This allows us to formally test whether regional heterogeneity in CPI, inflation, and persistence remains significant after controlling for common temporal and spatial effects. We also perform robustness checks by re-estimating the main model using lagged and lead governance, by evaluating whether future governance predicts earlier realised persistence.

We recognise that there are potential selection issues, and distinguish between goods whose prices are determined administratively (municipally determined prices) and those with market-determined prices. If the expenditure share of administratively determined goods is large enough, the analysis could be biased — with a systematically different form of price determination, and indicative persistence thereof. For market-determined prices, local economic activity and governance can jointly shape inflation persistence through market thickness, entry, and the intensity of competition, with important implications for fiscal responsibility through stronger incentives for cost recovery, financial management, more prudent investment, service quality improvements etc. (Tiebout, 1956; Qian and Weingast, 2007; Weingast, 2009). On the other hand, when prices are set by the mu-

nicipal, local politicians may pursue budget-maximizing or rent-seeking behaviour rather than social welfare. Additionally, these prices may be manipulated for political advantage rather than for cost-reflective efficiency (Brennan & Buchanan, 1980). Municipal pricing may lead to expanding a municipality's budget, rather than price efficiency. This leads to redundant costs, where the prices charged to residents are higher than the actual cost of the services, which, in turn, leads to persistent inflation (Wolf Jr, 1979). Governance inefficiency is often visible when municipalities set fees "prices" too high. If a local government increases fees "prices" beyond a certain point to cover administrative waste, it can lead to a shrinking tax base as residents and businesses flee. Municipalities can be deemed inefficient if they operate on the "wrong" side of the curve by increasing the price of living in the city while decreasing total revenue due to capital flight (Tiebout, 1956). Governance structures also shape price dynamics in the broader market. Effective local governance fosters an environment where businesses can operate efficiently, facilitating quicker adjustments to supply and demand shocks that influence prices. As a result, the persistence of inflation may vary significantly between these two categories of goods, with governance quality playing a crucial role in determining the extent to which inflationary pressures are sustained over time.

We subsequently split the analysis into market vs administered goods prices in an attempt to ensure that our findings on governance and inflation persistence are not driven by compositional differences in how prices are set across regions. This also allows us to sharpen the focus on governance as a moderator. If governance truly moderates the relationship between economic activity and persistence, its effects may be more pronounced in avenues where it has more control relative to avenues where it does not. For example, governance in the market system can condition how effectively economic activity reduces persistence through competitive pressures and efficient market adjustment, while in the local government, governance quality may be more directly tied to institutional efficiency and the capacity to implement price-related decisions, plug leakages etc. By separating these two domains, we expect the moderator role of governance to emerge more clearly and with less risk of confounding from mixed price-setting mechanisms

3.3 Regional Inflation Persistence and Governance

The main objective is to examine how local municipal structures, particularly in the form of efficient governance, may either enhance or worsen the persistence of inflation. If indeed there are differences in the persistence of inflation across regions, this would present a dilemma for monetary policy authorities, as this suggests that a unified monetary policy aimed at achieving price stability may not be equally effective across regions.

The governance measures used in this study are sourced from the Auditor-General of South Africa (AGSA), which evaluates municipal audit performance and categorizes outcomes as follows: disclaimer, adverse, qualified, unqualified with findings, and unqualified with no findings. In some cases, audits may remain incomplete. These outcomes serve as indicators of governance quality within South Africa's local municipalities. Governance quality directly impacts service delivery, reflecting how policies, laws, and institutions at all governance levels—from national to local—translate into effective actions. Strong governance structures promote efficient economic functioning, fostering business investment and long-term sustainability. While these economic effects typically unfold over the medium to long term, the effects can be immediate through service delivery disturbances, and more importantly for this study, through its impact on municipal prices, and the resilience of local markets to supply shocks. These governance disparities across municipalities can lead to significant regional differences in inflation persistence, with stronger governance potentially mitigating these disparities.

On paper, Municipal audit outcomes should be free of endogeneity, given the scores are objectively computed, however, an argument may be made that potential endogeneity could arise if auditors apply greater scrutiny to municipalities that have been publicly criticised for poor practices, while municipalities with favourable public branding may face less rigorous auditing. It is also possible the municipalities with better infrastructure and skilled personnel are less likely to have unaccounted expenses and are more equipped to fulfil their governance responsibilities. These factors could introduce bias into the audit outcomes. There are a few counterarguments to endogenous governance: first, the autonomy and independence of the Auditor-General of South Africa (AGSA) ensures that the auditing process is, in principle, applied uniformly and impartially across all municipalities. This standardisation minimizes potential biases stemming from selective scrutiny. Second, the analysis controls for the initial level of infrastructure development, addressing

concerns about bias introduced through infrastructure channels. Lastly, the inclusion of fixed effects accounts for time-invariant unobservable factors that could otherwise drive endogeneity, further enhancing the robustness of the analysis.³ Nevertheless, the analysis is interpreted as associational, with governance treated as a proxy and the estimates presented as conditional correlations rather than causal effects.

3.4 Other Drivers of Regional Inflation Persistence

In addition to governance, we assume, as in Vaona and Ascari (2012), that a key contributor to regional inflation is the availability of outlets through which residents can access goods and services. These outlets, in turn, emerge based on the needs of residents and the feasibility for retailers to expand their branches to such locations. In their study, the area coverage of retail stores is used to capture this phenomenon. However, there are two key limitations to this proxy. First, it assumes that the size of retail stores is directly related to economic activity. Second, there is very limited availability of such data, and it changes slowly over time. In South Africa, for example, retail stores in Cape Town are often smaller in size compared to those found in other metropolitan municipalities like Johannesburg or Pretoria, while the level of activity within these stores appears to be more pronounced. To account for some of these sources of potential bias, nighttime lights data is used. The VIIRS Nighttime Lights (NTL) data provides high-resolution annual measurements of light emissions across the globe. This dataset serves as a robust proxy for economic activity, especially in areas where traditional economic indicators like GDP are unavailable or unreliable. Empirical studies have shown a strong correlation between nighttime light intensity and GDP at the national level, validating its application for sub-national analysis (Henderson et al., 2012). VIIRS nighttime lights data, with its ability to capture economic vibrancy, at the local level, is a great proxy for economic activity, and a useful tool for exploring regional differences in price dynamics, and inherently, regional inflation and inflation persistence. In addition, the demographic and industrial composition, particularly in terms of competition within the municipality, is also captured, as this can account for the effects of competition on price levels in the region.

³Tabel A0 in the appendix reports mean differences by audit category for economic activity (nighttime lights), infrastructure and fiscal capacity proxies, and related municipal controls. It shows that the audit outcomes behave in the expected direction as a governance measure in this setting.

4 Results and Discussion

4.1 Regional CPI

Figure 2 illustrates the trends in the Consumer Price Index (CPI) at the provincial level and compares them to the national level. In the upper left panel (Figure 2a), it shows the CPI trends for various South African provinces from 2008 to 2024, revealing a consistent upward trend in prices across all provinces, which mirrors the national trend of persistent inflation over the 16-year period. Using the "National CPI" line as a benchmark, provinces such as Gauteng and Western Cape appear to experience slightly higher increases. The upper right panel (Figure 2b) shows the relative difference between provincial and national in CPI among various provinces from 2008 to 2024.

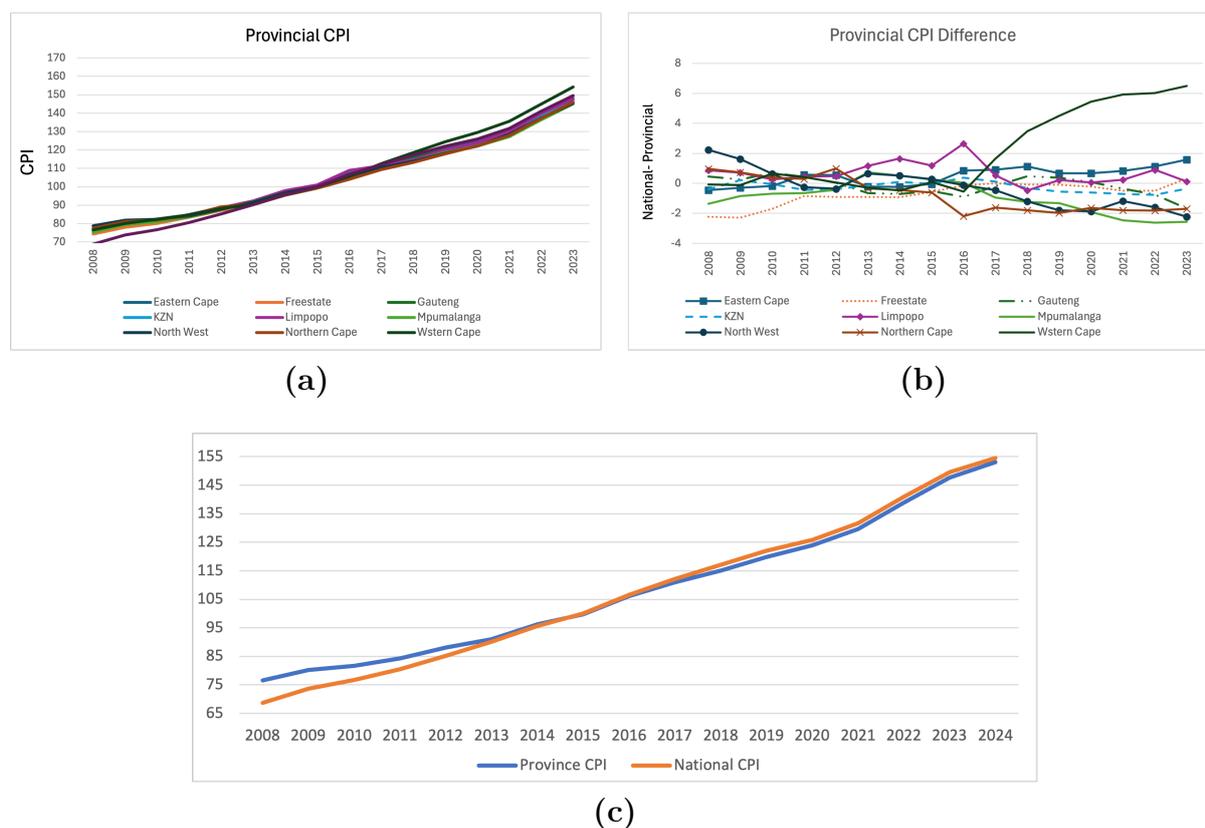


Figure 2: Provincial differences in CPI and National Inflation

Even though most provinces follow similar patterns, some provinces show notable deviations. For example, Western Cape again shows a significant upward deviation from 2016 onward, while Mpumalanga and North West provinces have witnessed a general decline from around 2015. The lower panel illustrates the price level of a basket of goods and services, over time, (from 2008 to 2024) for both the average of provinces and the

entire nation. Both CPIs have more than doubled from around 65–75 in 2008 to around 155 in 2024, reflecting a significant rise in the cost of living. For the period 2008–2015, the provinces’ CPI (blue line) was slightly higher than the national CPI, while for the period 2015 to 2024, the provinces’ CPI remains very close to or slightly below the national CPI.

4.1.1 Distribution of CPI be regions

To get a sense of how CPI has varied across regions, a plot of the distribution of the CPI experienced by different municipalities is presented in a box plot. It shows that the distribution of CPI varies across municipalities, with some municipalities having a wider range of CPI values over the years than others. For example, the City of Cape Town and Drakenstein show a relatively high median CPI, indicating a generally higher CPI level with a moderate range of variability. In contrast, municipalities like UMhlatuze and Nelson Mandela Bay show a median CPI in the mid-range, suggesting a CPI range with less variation. While municipalities like Emfuleni and Moretela show a relatively low median CPI, suggesting generally lower CPI compared to other municipalities.

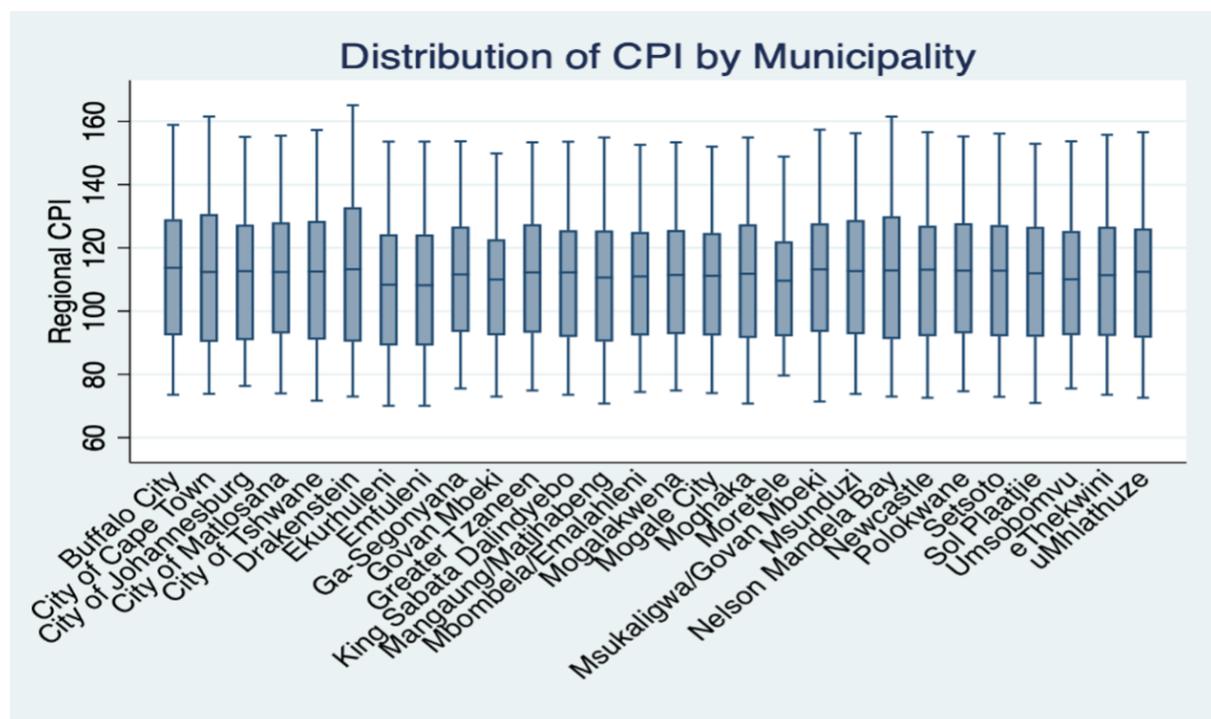


Figure 3: Box plots of CPI distribution across municipalities (2008–2024)

What these box plots show is marked variation in the experienced prices across different municipalities in South Africa. For example, if we compare a few of the municipalities

(See Figure 4), like Cape Town, Ekurhuleni, and Oudtshoorn, we see how this difference in the experienced prices have evolved over time. The Oudtshoorn (green line with spikes) consistently shows the highest CPI almost throughout the entire period, implying it has experienced the highest overall price increase among the three regions. Oudtshoorn and the City of Cape Town (blue line) show relatively similar CPI values and trends, with Ekurhuleni generally exhibiting slightly lower inflation. The gap widens over the years from around 2017 onward, suggesting both a regional and time dynamic to inflation and possibly its persistence across South African municipalities.

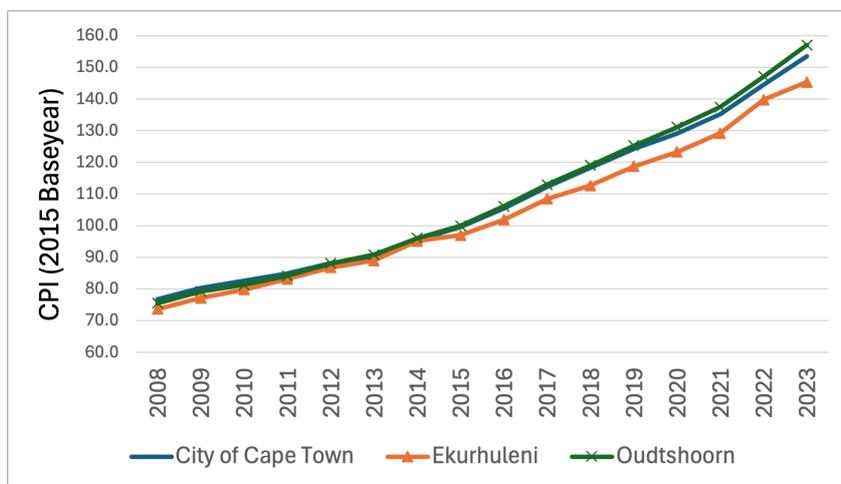


Figure 4: CPI trend comparison between 3 municipalities (2008–2023)

4.2 Regional inflation

Inflation is not spatially uniform in South Africa. Figure 5 shows that provincial inflation co-moves strongly with the national series, but with non-trivial dispersion around the aggregate path. This dispersion is time-varying: there are episodes in which provincial rates cluster tightly around national inflation and others in which the cross-province spread widens, consistent with shifts in the relative importance of common national shocks versus region-specific price dynamics. This heterogeneity is sharper at finer spatial resolution.

Figure 6a makes clear that municipal inflation outcomes in 2023 depart meaningfully from the national benchmark. Municipalities differ not only in the level of year-on-year inflation (capturing accumulated price pressures), but also in the volatility of month-to-month inflation (capturing short-run price instability). Figure 6b reinforces this point

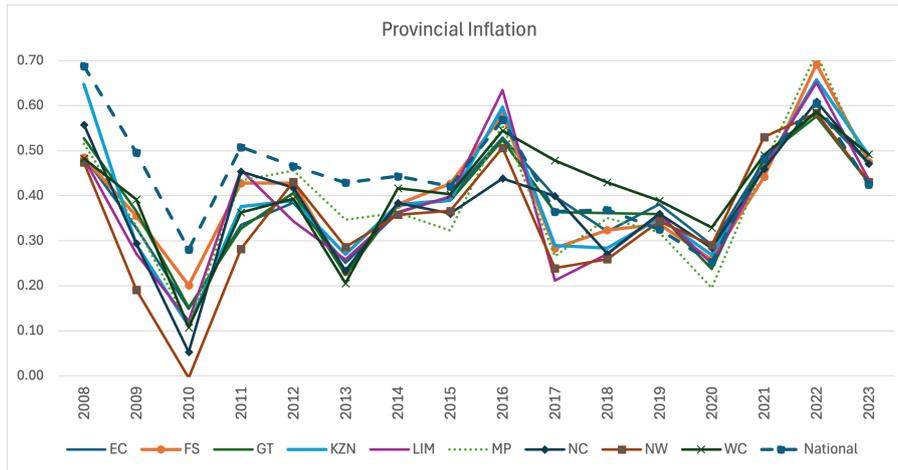
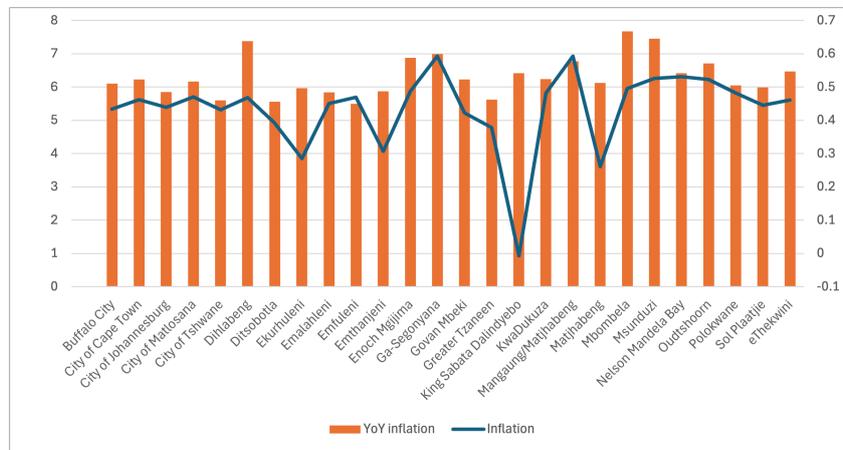
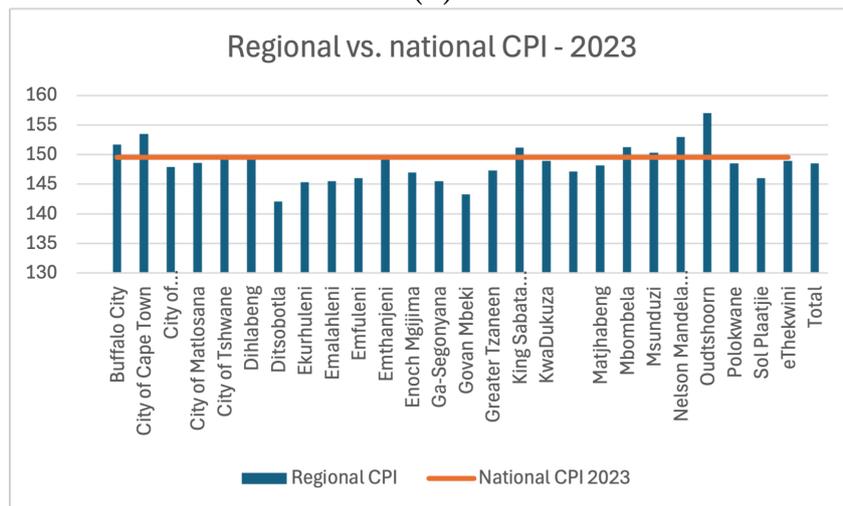


Figure 5: National vs provincial level inflation in South Africa



(a)



(b)

Figure 6: Municipal inflation, and year-on-year inflation

from the price-level side: CPI trajectories differ across regions relative to the national index, indicating that spatial differences in price dynamics are present even before moving

to inflation rates. Regular inflation differs across municipalities, indicating variation in short-run price adjustments and price volatility. In some municipalities, higher YoY inflation coincides with more variation, consistent with more unstable price dynamics that accumulate over time.

The single-year observations may obscure the differences in how various municipalities experience prices and inflation patterns across time. Figures 7a and 7b provide a more granular perspective by illustrating the distribution of CPI and inflation across municipalities during the period 2008 to 2024. In Figure 7a, the box plots reveal the variation in regional CPI, with some municipalities exhibiting narrow inter-quartile ranges, suggesting price stability, while others show broader distributions, indicating greater price volatility. These trends align with Figure 7b, where inflation rates also exhibit considerable variation. Some municipalities experience more stable price growth, while others show wider dispersion, pointing to erratic inflationary pressures. The presence of outliers in both CPI and inflation underscores the occurrence of localised economic shocks. Notably, municipalities with broader CPI distributions tend to experience more volatile inflation, whereas those with narrower CPI distributions generally show greater price stability.

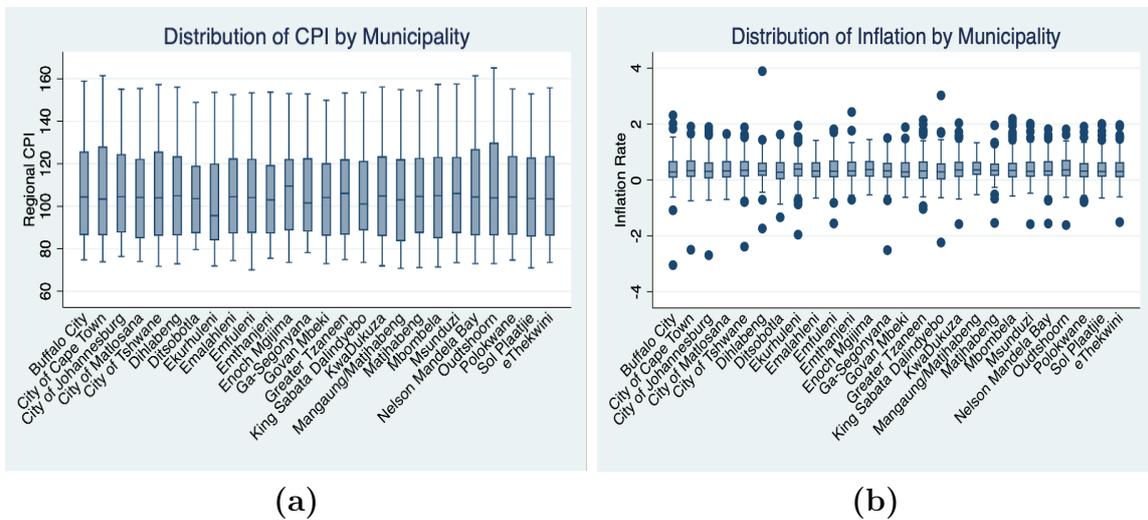


Figure 7: Distribution of CPI and Inflation in municipalities over time (2008–2023)

4.3 Computing persistence

A few different measures of inflation persistence are computed. The first is the national level in attempts to replicate previous computations of persistence in South Africa (Rangasamy, 2009). A second version is the municipal level inflation persistence, based on

the autoregressive (AR) process. This obtains a single measure of inflation persistence per municipality. This has some limitations, as it does not vary overtime. While this measure is useful, there is much more to be gleaned from the dynamic nature of inflation persistence, that is, how has inflation persistence across regions changed overtime? To obtain this, we compute what we call rolling window persistence. Rolling window persistence allows for a computation of inflation persistence, using the first month of each year as the starting point, and capping each window at 48 months.⁴ This yields a measure of monthly inflation persistence that is computed for each rolling (overlapping) window. In computing all forms of inflation persistence, the Schwartz criterion (SC) for optimal lag selection is used to select the optimal lag, p , for the AR process.

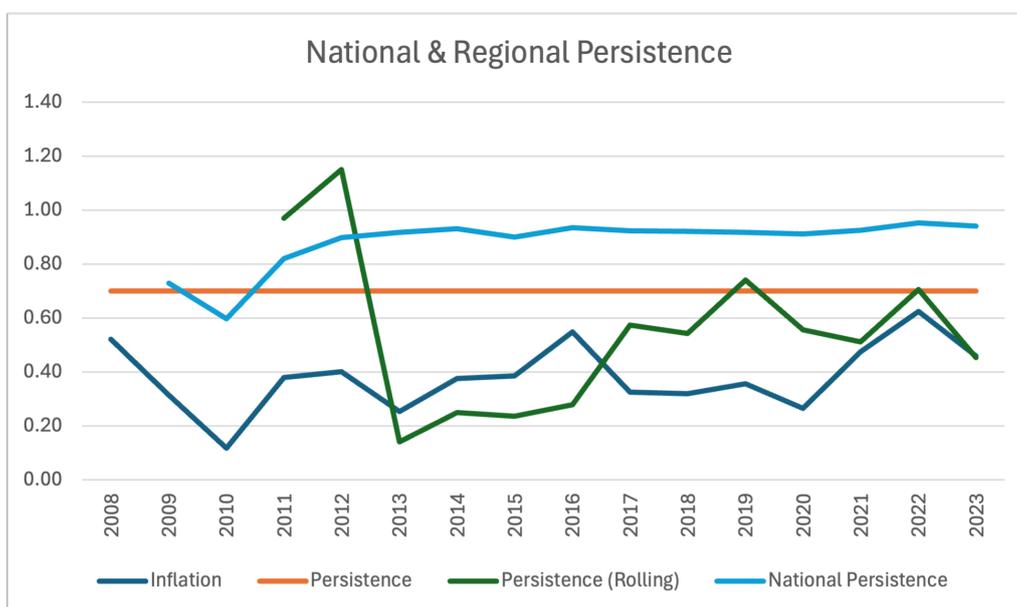


Figure 8: Inflation (Monthly), persistence, persistence (Rolling) and National persistence overtime in South Africa between 2008 and 2023

The results of all three measures of inflation persistence, are plotted with inflation in Figure 8 over the period 2008–2024.⁵ Inflation persistence displays a relatively stable pattern over the years with occasional fluctuations, quite similar to the inflation rate, with a notable peak in 2012. The notable co-movement between the two measures, in most years, highlights interdependence between changes in price levels and inflation persistence in South Africa. We dive deeper in Figure 9, where the bar charts represent YoY inflation levels (RHS), while the black and green lines (LHS) represent monthly

⁴A Window of 48 is recommended for monthly data, because it balances the trade-off between capturing sufficient historical context and maintaining adaptability to recent structural changes

⁵Persistence only starts from 2011 because we use a 48 month rolling window

inflation and inflation persistence in South African municipalities. The obtained level of national persistence is consistent with the literature. For example, Rangasamy (2009) estimated it to be about 0.8 in 2008, though it had shown a steady decline since the 1980s, while others documented smaller values, for example, Gupta et al. (2017) found the half-life for the median quantile using monthly price state data to be about 2.4 periods.

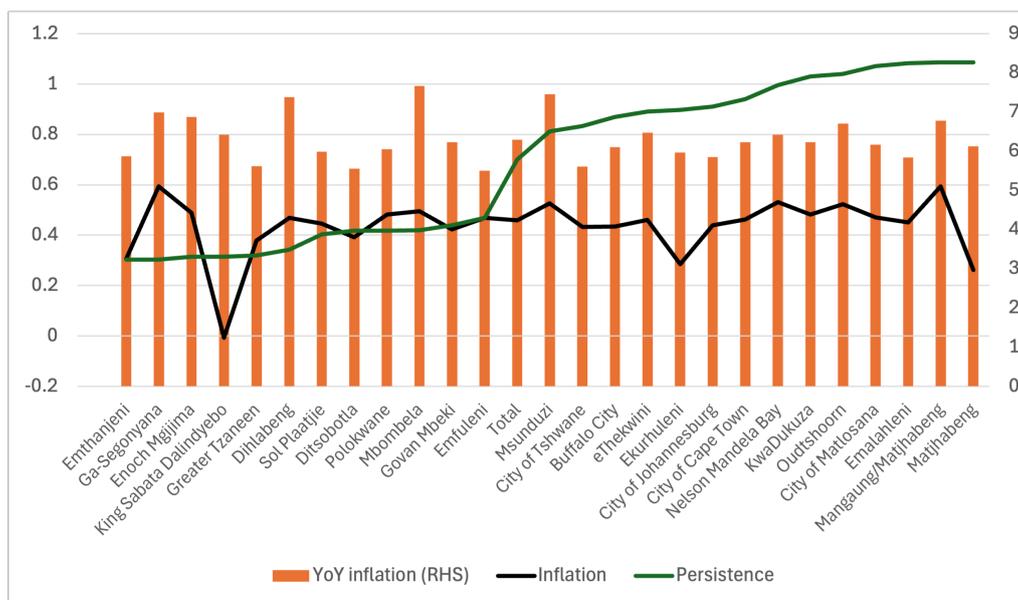


Figure 9: Inflation (Monthly) (LHS), Persistence (LHS) and Year on Year Inflation (RHS), average over 2008–2024 for municipalities

Inflation persistence is heterogeneous across regions, however, it does not follow a similar pattern as observed with monthly inflation, with municipalities like Mangaung/Matjhabeng, Oudtshoorn and Msunduzi showing much higher persistence than the rest. Rolling window inflation persistence also reveals marked variation across municipalities over the years (see box plot in Figure 10). The variation suggests differences in the stability of inflation persistence across municipalities. The presence of outliers indicates that certain municipalities may have experienced periods of significantly higher or lower persistence, potentially driven by localized economic conditions (See Emalahleni, Mangaung, Sol Plaatjie). Some regions display more concentrated distributions, indicating more predictable inflation dynamics (Buffalo City, City of Tshwane, Oudtshoorn)).

with lower levels of income, limited access to social services, and fewer economic opportunities, persistent inflation and higher price levels could exacerbate vulnerabilities for already disadvantaged populations. Consequently, policymakers should be cognisant of, and assess the broader impacts of inflation across regions and tailor strategies that ensure that regional disparities do not undermine the effectiveness of a centralized monetary policy or, in some instances, exacerbate the economic difficulties in relatively more vulnerable regions.

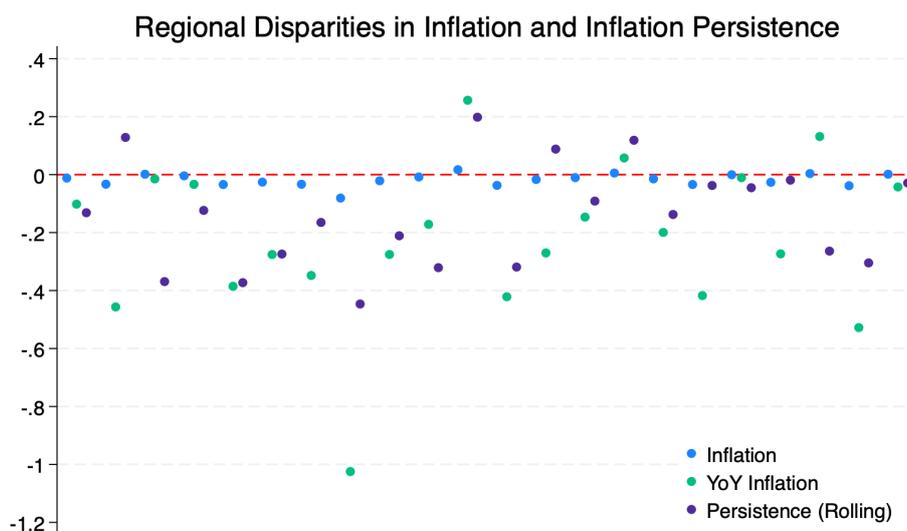


Figure 11: Regional disparities in changes in price levels, inflation, and inflation persistence (2008–2023)

We formally test to see if the heterogeneity observed in the graphs in the previous section is significant across municipalities using a basic fixed effects model that regresses municipalities on inflation and inflation persistence. The outcome is presented in the coefficient plot in Figure 11 and in Table A2 in the appendix.⁶ The results reveal significant disparities across South African municipalities, with Mangaung/Matjhabeng as the reference category. A clear pattern emerges from the results: most municipalities are significantly different across the different measures of price mechanisms. For example, municipalities with relatively higher CPI levels, such as the City of Cape Town (coefficient of 3.040), tend to exhibit lower or modest inflation and persistence (Cape Town’s YoY inflation coefficient is -0.010, while rolling window persistence is -0.045). This suggests that municipalities with higher price levels may experience more stable

⁶CPI is excluded from the coefplot graph due to scale.

price changes, potentially due to better infrastructure, market diversity, or efficient pricing mechanisms. Conversely, municipalities such as Ditsobotla (-2.113 CPI; -0.091 YoY inflation) and Greater Tzaneen (1.308 CPI; -0.385 YoY inflation) record lower CPI levels and more negative inflation coefficients. However, they still exhibit notable inflation persistence—Ditsobotla’s rolling persistence is 0.137, while Greater Tzaneen’s is -0.373.

In some non-metropolitan regions, inflationary shocks tend to last longer, potentially due to weaker competition, infrastructure gaps, or slower adjustment mechanisms. Meanwhile, metropolitan municipalities such as Nelson Mandela Bay also display high persistence, suggesting that regional inflation dynamics are not solely driven by market size or price level. We also conduct joint tests of the municipality indicators conditional on month fixed effects, and the results show statistically significant cross-municipality differences for inflation ($F=44.06$, $p<0.001$), YoY inflation ($F=11.73$, $p<0.001$), and rolling persistence ($F=6.78$, $p<0.001$), but not for the CPI level measure ($F=0.40$, $p=0.994$).

4.5 Governance as a Driver/Moderator of Persistence

Regional heterogeneity in inflation persistence can arise through multiple channels, including infrastructure, retail market integration, and the scale of economic activity, and governance. For example, in Italy, Vaona and Ascari (2012) find that retail coverage per region was more critical for persistence than activity levels themselves, pointing to the importance of distribution systems for goods and services. Figure 12 plots rolling window inflation persistence against economic activity, proxied by nighttime lights, controlling for municipal and year fixed effects, population, electricity infrastructure, spent grants, and unemployment rates. The figure shows a statistically significant downward-sloping relationship, with persistence declining as economic activity rises. While these traditional factors are useful benchmarks, they cannot fully account for the South African context, where disparities between local municipalities suggest additional influences. Among these, governance emerges as a particularly relevant driver to consider. Municipal audit outcomes provides a measure of governance, that may condition how regions experience and transmit price shocks.

Figure 13 plots inflation persistence against municipal governance using the single, municipal-level persistence score. The bivariate slope is positive and statistically significant. That is, municipalities with stronger audit outcomes tend to exhibit higher

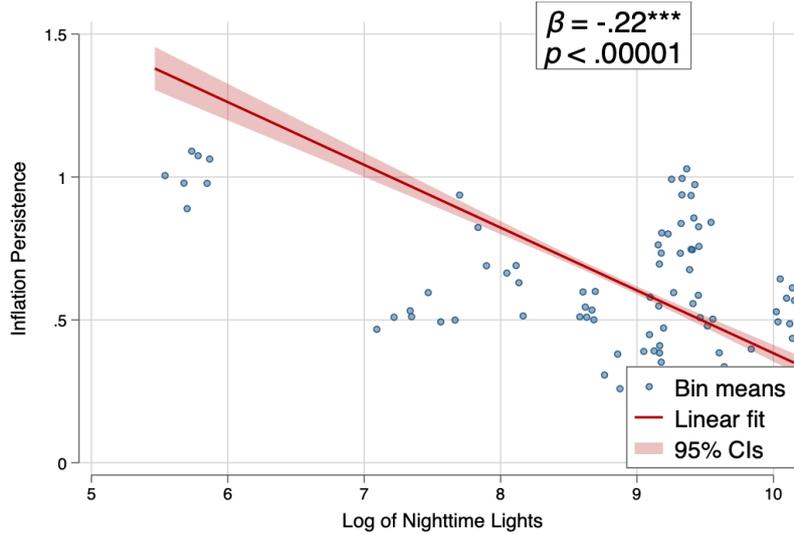


Figure 12: Municipal Economic Activity and Inflation Persistence

overall persistence. We interpret this cautiously. Inflation persistence is the sum of the auto-regressive coefficients ($\sum \beta_k$) in our model. For example, a Score of 0.5 indicates moderate persistence, implying a shock to inflation will decay over time, but at a slower rate than if the score were closer to zero. Specifically, the impact of the shock is reduced by 50% in one period, and the remaining half continues to decay over subsequent periods. For example, after one period, the effect is 50% of the original shock; after two periods, 25% of the original shock persists; after three periods, 12.5% persist, and so on, geometrically decaying. A positive governance–persistence association is thus, not implausible. Better-governed jurisdictions may smooth prices and adjust them more systematically (e.g., via rule-based tariffs or indexation), which can increase measured persistence even as volatility falls.⁷

Furthermore, given the categorical nature of governance, exploring it in its categorical form is more sensible. This is done by categorizing governance into three groups: "bad audit" (adverse, disclaimer, and unfinalised outcomes), "okay audit" (qualified outcomes), and "good audit" (unqualified with findings and unqualified without findings). Figure 14 plots the relationship between governance, economic activity, and inflation persistence. This outcome substantiates our thinking. It shows that there are shifts in the behaviour of how economic activity and persistence relate at different levels of governance, with good audit municipalities having the lower inflation persistence, as the level of economic

⁷On the other hand, these tariff changes will not occur frequently, or haphazardly in well-governed municipalities, and thus much lower persistence measures.

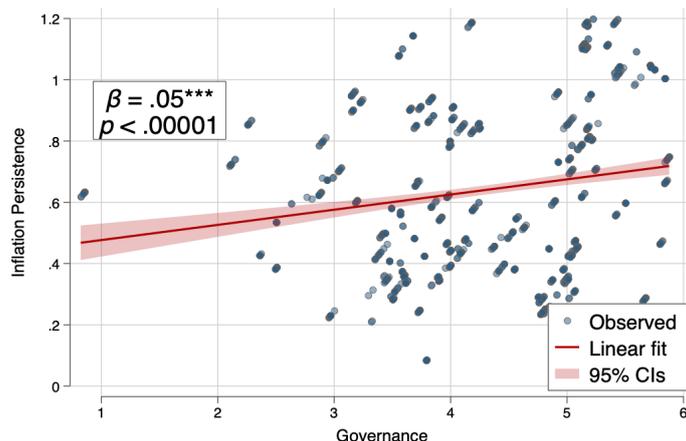


Figure 13: Municipal Governance and Inflation Persistence

activity increases. Our analysis therefore treats governance primarily as a moderator of how underlying economic activity maps into persistence, rather than as a mediator that transmits activity into prices.⁸

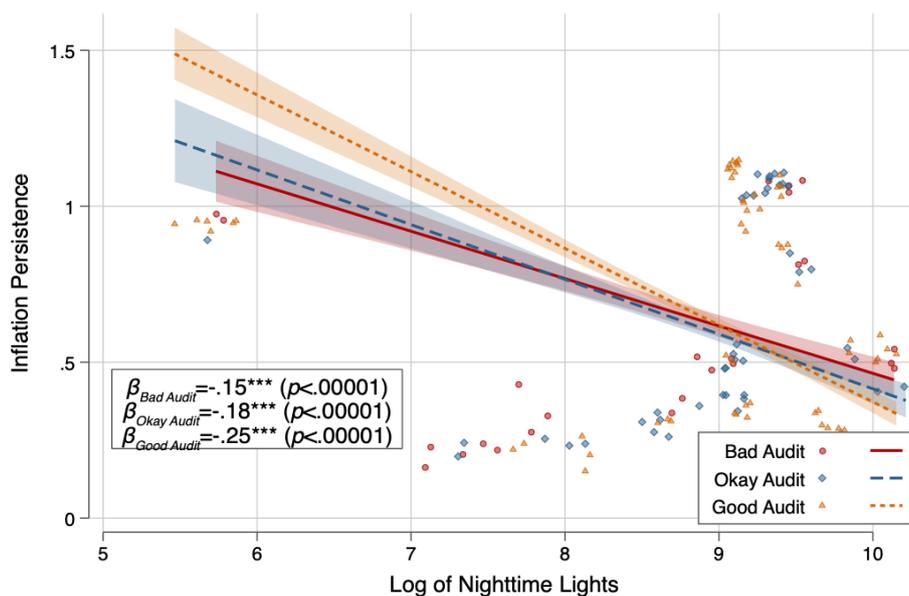


Figure 14: Governance, economic activity, and inflation persistence

To examine this moderator role, a conditional relationship with potential confounders controlled for is estimated. We examine this using the rolling-window measure of persistence, which allows the governance–economic activity relationship to vary over time

⁸In a moderator role, governance changes the strength/sign of the effect of economic activity on persistence (an interaction). In a mediator role, governance would be a channel through which activity affects persistence. We focus on moderation.

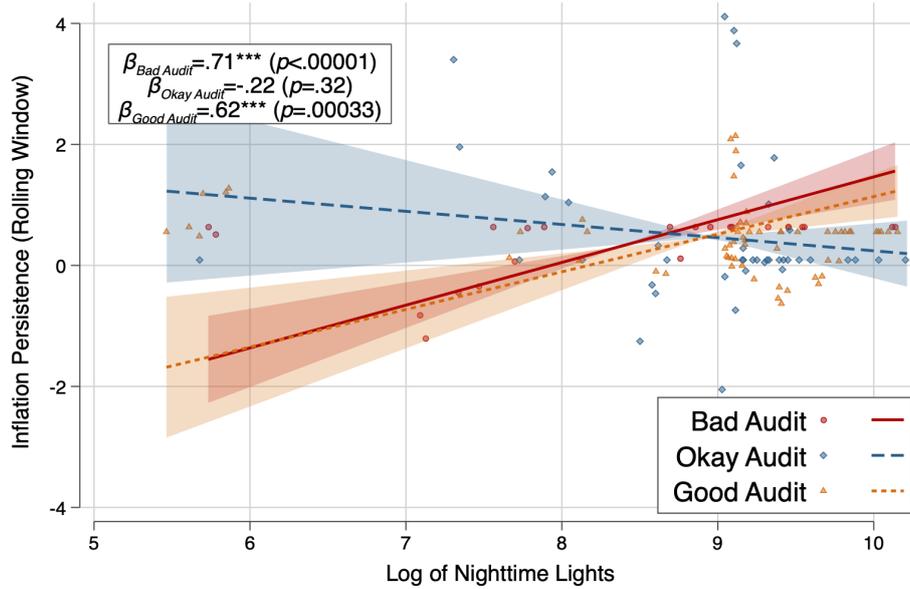


Figure 15: Governance, economic activity, and rolling window inflation persistence

within municipalities. Figure 15 plots this, with separate fits by governance category, and two features emerge. First, the slopes indicate how inflation persistence changes as economic activity changes, is related to the level of governance. For municipalities with good or bad governance (the extreme sides), there seems to be a positive relationship between economic activity and inflation persistence. However, the good audit outcomes still exists below the bad audit outcomes, though this is weak. This apparent contradiction is informative rather than problematic: it suggests that at the sub-regional intertemporal level the persistence process is more nuanced. Governance moderates how activity translates into persistence within windows, even if the unconditional cross-section is positive. The separation of the trend lines suggests that governance is associated with how strongly economic activity translates into lower inflation persistence. Second, the shaded confidence intervals indicate that at lower levels of economic activity, the distinction between governance categories is more uncertain between the tail ends of governance, but clearer for 'okay' levels of governance, as economic activity rises. This suggests that while governance plays a role in moderating the economic activity and inflation persistence relationship, its in municipalities with more just okay governance levels, that this impact is less tainted.

The subsequent conditional analysis in Figure 16 (and Table A3 in the Appendix) indicates that the quality of governance does matter for inflation persistence, but the

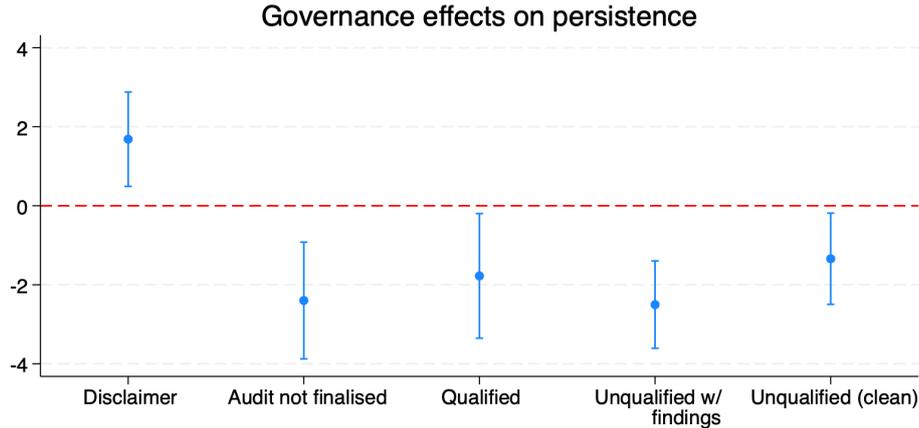


Figure 16: Drivers of inflation persistence across regions

evidence depends on whether one focuses on pooled cross-sectional variation (inflation persistence) or within-municipality and overlapping variation over time (rolling window inflation persistence). In the OLS specifications (columns (1)–(4)), governance-category coefficients are often statistically significant and several interaction terms between governance and economic activity are statistically meaningful—particularly in the full specification (column (4))—suggesting that governance regimes are associated with different persistence profiles and that local activity relates differently to persistence across regimes. In columns (5)–(8), the focus shifts to rolling window inflation persistence, and municipality, taking into account time fixed effects. The estimates become more conservative, and the governance main effects are generally not as strong; however, the moderation signal remains visible in specific governance and economic activity interactions, especially in the full FE specification (column (8)). Accordingly, we interpret governance as conditioning the activity–persistence relationship in parts of the distribution rather than as generating uniformly strong within-municipality effects across all governance categories. This is similar to evidence from the existing literature (Eijffinger and De Haan, 1996; Vaona and Ascari, 2012) that emphasizes governance as a key enabler of economic performance in inflationary settings. The results (column (8)) suggests that the marginal association between economic activity and inflation persistence differs significantly across governance regimes, with several interaction terms statistically different from the adverse baseline (including Disclaimer, Unfinalised, Qualified, Unqualified w. Findings, and Unqualified

(clean))

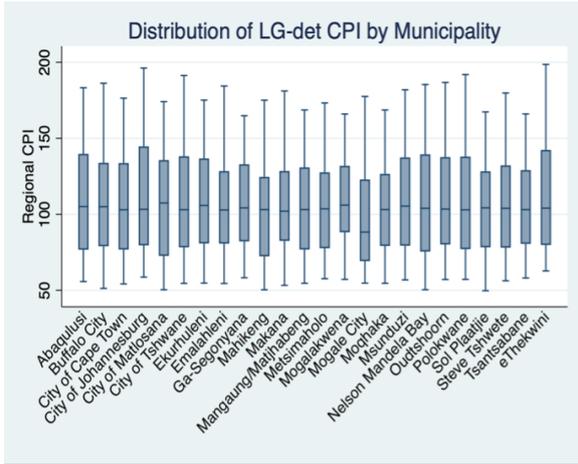
4.6 Endogeneity concerns and Robustness checks

4.6.1 Comparison of municipal and market determined prices

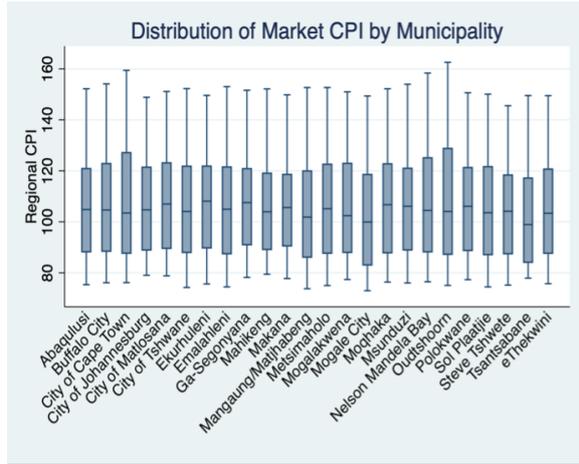
Given that CPI embodies the aggregation of heterogeneous price-setting processes, and price adjustment frequency differs substantially across goods and services (Bils and Klenow, 2004), this has direct implications for measured inflation persistence. If a subset of prices are municipal-stipulated (administered) rather than through decentralized market clearing (Ackley, 1959), the distinction may be important when administered prices account for a meaningful share of household expenditure within some regions. Aggregate regional inflation persistence may reflect the persistence properties of these administered components rather than purely market-driven pricing behaviour. In the context of this paper, governance quality may be more directly related to administered price adjustments through municipal pricing processes, while simultaneously co-moving with broader economic conditions that shape market prices. To account for this, we distinguish between administered prices and market-determined prices. The list of products classified as administered goods is reported in Table A4, and these account for 18 of the 403 products monitored, although they account for about 73% of all expenditures.⁹ Figure 17 compares the CPI for municipal and market-determined prices across municipalities. The figures illustrate distinct patterns in the CPI for municipal determined and market-determined prices across municipalities. On average, the market-determined CPI is lower than municipal-determined CPI. See, for example, Polokwane and eThekweni showing significant differences between the municipal and market-determined CPI.

The CPI distributions for municipal and market-determined prices reveal clear structural differences (See Figure 18). Municipal-determined prices exhibit greater dispersion, reflecting heterogeneity in municipal pricing policies. This is indicative of localized governance structures, where tariff adjustments and cost recovery mechanisms drive variations in price levels across municipalities. In contrast, market-determined prices, governed by supply and demand conditions, exhibit a more uniform distribution, suggesting a stronger

⁹The classification follows the institutional setting of the products, where administered prices include municipal tariffs, regulated fees, and other government-stipulated charges, while market prices capture goods and services whose prices are primarily determined by private sector pricing behaviour.



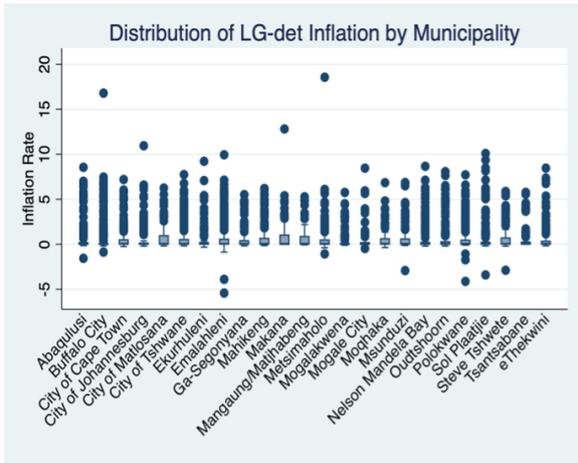
(a)



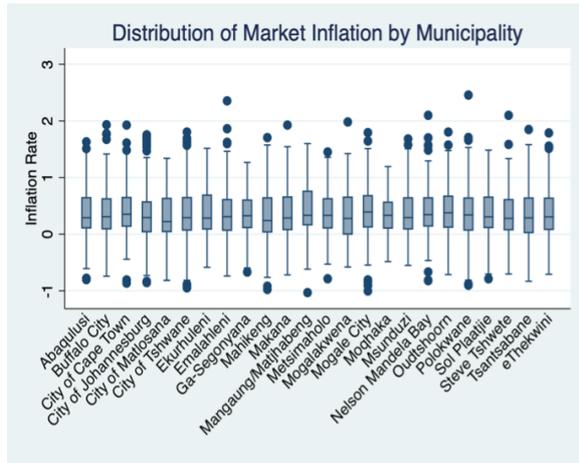
(b)

Figure 17: Comparing CPI for market and municipal determined prices

role for market competition in price formation. What is noticeable across both is the relatively greater dispersion in both the administered and market prices, relative to the joined box plot in Figure 7. As shown in Figure 18, inflation in municipal-determined prices is characterized by periodic spikes, likely associated with regulatory price adjustments, such as utility tariff revisions and municipal service fee adjustments. These price changes are often implemented at discrete intervals, leading to more pronounced outliers and periods of sharp inflationary pressures. Conversely, market-determined prices exhibit a more continuous inflation pattern, with relatively fewer extreme values, reflecting the continuous responsiveness of private-sector pricing mechanisms to economic conditions.



(a)



(b)

Figure 18: Comparing inflation for market and municipal determined prices

The differences in inflation persistence between these two categories are particularly notable (See Figure 19). Municipal-determined prices exhibit higher persistence, sug-

benchmark, indicating that persistence in administered prices differs meaningfully across governance regimes even after controlling for unobserved municipal heterogeneity. More importantly, the interaction for the *Qualified* category is positive and statistically significant in both FE interaction specifications, indicating that the association between local economic activity and persistence differs materially under this governance regime. While not all interaction terms are precisely estimated, the overall pattern is that governance-related heterogeneity is more visible for administered prices than for market prices when identification is based on within-municipality variation.

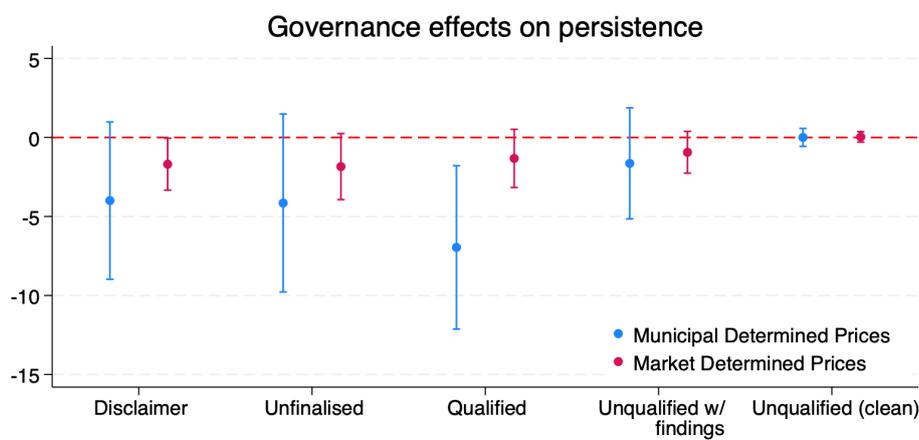


Figure 20: Governance drivers of inflation persistence - Market vs. Municipal determined prices

This regime difference is economically intuitive. Administered prices are set and implemented through municipal administrative processes, such as tariff-setting, billing and enforcement, whereas, governance may be closely lined to cost recovery, procurement, and the management of technical and non-technical losses. Under this interpretation, the stronger administered-price results are consistent with governance, shaping how discrete tariff revisions may co-move with observed inflation persistence. Market prices, by contrast, are driven more directly by competitive conditions and broader supply shocks, and the within-municipality moderation role for audit-based governance is correspondingly weaker once we impose fixed effects.

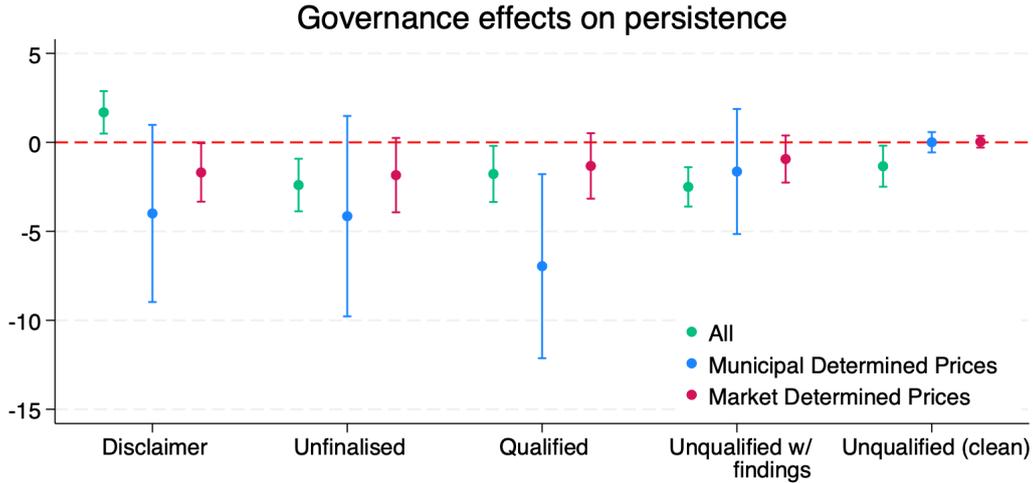


Figure 21: Inflation persistence determinants: All vs. Market vs. Municipal determined prices

4.6.2 Governance as a potential source of endogeneity

As with many studies exploring issues at both regional and national levels within a macro framework, endogeneity concerns are legitimate. This remains, though less important, in situations where causality is not the objective, as in this study. Nevertheless, with governance, it is possible that better resourced municipalities, will tend to have better governance structures in place, as such, the associations observed are reflecting historical governance deficits rather than the effect of changes in the quality of municipal governance. As previously stated, it could also be because, problematic municipalities are more scrutinised. In the former case, one would expect lagged governance to account for all governance effect, whereas in the latter, one would expect there to be lead governance effects. To address these concerns, we consider the lag of governance as a moderator of inflation persistence, and then also consider whether governance is a lead associate of inflation persistence. These tests effectively capture the two key sides through which endogeneity may arise. The results in Tables A7 and A8 indicate that governance is correlated with short-horizon municipal conditions that also relate to inflation persistence, consistent with broader administrative capacity being bundled into the governance indicator. In this sense, the stronger administered-price relationships are consistent with governance being closer to the governance mechanisms that directly govern administered

prices adjustments. This suggests the need for cautious interpretation throughout.

5 Conclusion

This study explores the existence regional differences in CPI, inflation, and inflation persistence, focusing on how economic activity, proxied by nighttime lights, and governance, proxied by municipal audit outcomes, shape these dynamics. By utilising granular price data at the municipal level, this research disaggregates beyond national-level analyses to provide a close look at how inflation patterns differ across municipalities. The analysis also sought to determine the extent to which economic activity is associated with inflation persistence, and whether local governance quality, proxied by municipal audit performances, plays a role in moderating these associations. By employing both single inflation persistence and rolling window inflation persistence measures, the study captured both cross-sectional and temporal dimensions of inflation persistence.

The analysis reveals that significant regional disparities exists in CPI, inflation, and inflation persistence, with lower economic activity regions exhibiting the highest inflation persistence. Additionally, inflation persistence, varies considerably across municipalities, suggesting that local economic conditions and governance factors play a crucial role. This is particularly interesting, as it suggests that the municipalities already facing economic constraints are also the most exposed to prolonged price shocks. In such regions, inflationary pressures persist for longer, and this in-turn may intensify the impact on household welfare and local economic stability. Good governance appears to be associated with lower levels of inflation persistence, though this association differs between market-determined and municipal-determined prices. Given that municipal governance is directly linked to administered prices, its influence on inflation persistence in this category is stronger. In contrast, governance plays a less pronounced role in market-determined prices, where economic activity and competitive market forces interact more dynamically with governance structures.

The findings have some policy implications. The differences in inflation across municipalities, and even at more aggregated levels such as provinces, suggests that uniform national monetary policies may not adequately account for local price dynamics because some component of regional inflation persistence may be rooted in municipal admin-

istrative processes. This suggests potentially allowing for differentiated supplementary support structures for different regions (i.e. regional vulnerability assessments) as monetary policy tools are implemented. The results further suggest that regional persistence partly reflects structural institutional conditions that monetary policy alone cannot address. Therefore, regional heterogeneity should be treated as an informational input into national monetary strategy.

Broadly, the interaction between governance and economic activity in reducing inflation persistence reinforces the urgency of addressing governance failures at the municipal level. If governance indeed moderates inflation persistence, strengthening local institutional capacity and improving governance structures should be considered in efforts aimed at enhancing price stability and economic resilience in South African municipalities. In particular, the regime split further suggests that municipal governance is most tightly linked to persistence where prices are set administratively. Therefore, improving public financial management and tariff-setting processes is consistent with reduced persistence in administered price inflation. It is worth noting that municipal administrators may need to obtain relevant insights from monetary policy authorities, regarding how their price adjustment processes may promote or inhibit the effectiveness of monetary policy, which may in turn improve or worsen the outlook of vulnerable municipalities. This may mean a move towards rule-based, cost-reflective tariff adjustments, which may reduce the spiky and persistent nature of inflation at the municipal level. Therefore, governance reform should be interpreted as a structural complement to macroeconomic stabilisation, particularly through improved public financial management and tariff administration, rather than as a suggestion of monetary policy reform.

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Table A2: Regional disparities in price levels, inflation, and inflation persistence (2008–2023)

Variables	(1) CPI	(2) Inflation	(3) YoY Inflation	(4) Persistence (rolling)
City of Cape Town	3.040** (0.000)	-0.000** (0.000)	-0.010** (0.000)	-0.045** (0.000)
City of Johannesburg	2.329** (0.000)	-0.038** (0.000)	-0.528** (0.000)	-0.305** (0.000)
City of Matlosana	1.136** (0.000)	-0.021** (0.000)	-0.275** (0.000)	-0.211** (0.000)
City of Tshwane	1.804** (0.000)	0.002** (0.000)	-0.015** (0.000)	-0.369** (0.000)
Buffalo City	2.503** (0.000)	-0.015** (0.000)	-0.199** (0.000)	-0.137** (0.000)
Drakenstein	3.759** (0.000)	0.017** (0.000)	0.257** (0.000)	0.198** (0.000)
Ekurhuleni	-0.700** (0.000)	0.001** (0.000)	-0.042** (0.000)	-0.029** (0.000)
Emalahleni	1.030** (0.000)	-0.034** (0.000)	-0.417** (0.000)	-0.037** (0.000)
Ephraim Mogale	1.206** (0.000)	-0.026** (0.000)	-0.276** (0.000)	-0.274** (0.000)
Ga-Segonyana	0.471** (0.000)	-0.037** (0.000)	-0.421** (0.000)	-0.319** (0.000)
Govan Mbeki	-0.478** (0.000)	-0.033** (0.000)	-0.348** (0.000)	-0.165** (0.000)
Greater Tzaneen	1.308** (0.000)	-0.034** (0.000)	-0.385** (0.000)	-0.373** (0.000)
Mafikeng	0.390** (0.000)	-0.081** (0.000)	-1.025** (0.000)	-0.446** (0.000)
Mbombela/Umjindi	1.127** (0.000)	0.004** (0.000)	0.132** (0.000)	-0.264** (0.000)
Mogale City	0.764** (0.000)	-0.033** (0.000)	-0.457** (0.000)	0.129** (0.000)
Moqhaka	1.394** (0.000)	-0.012** (0.000)	-0.102** (0.000)	-0.131** (0.000)
Nelson Mandela Bay	2.755** (0.000)	0.006** (0.000)	0.058** (0.000)	0.119** (0.000)
Newcastle	1.228** (0.000)	-0.004** (0.000)	-0.034** (0.000)	-0.123** (0.000)
Polokwane	1.642** (0.000)	-0.026** (0.000)	-0.273** (0.000)	-0.019** (0.000)
Sol Plaatjie	0.273** (0.000)	-0.008** (0.000)	-0.172** (0.000)	-0.321** (0.000)
The Msunduzi	2.055** (0.000)	-0.010** (0.000)	-0.147** (0.000)	-0.091** (0.000)
eThekweni	1.573** (0.000)	-0.017** (0.000)	-0.270** (0.000)	0.088** (0.000)

Table A3: Drivers of Inflation persistence across regions

VARIABLES	OLS				FE			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disclaimer	-0.361** (0.020)	-0.296** (0.022)	0.100* (0.048)	-0.697** (0.216)	0.426 (0.443)	0.570 (0.497)	-1.614 (3.093)	1.685** (0.576)
Unfinalised	-0.230** (0.014)	-0.154** (0.018)	0.017 (0.024)	0.225 (0.166)	-0.020 (0.232)	0.048 (0.219)	-1.481 (1.374)	-2.399** (0.712)
Qualified	-0.152** (0.010)	-0.109** (0.013)	0.053** (0.018)	-0.376* (0.191)	0.206 (0.196)	0.246 (0.209)	-1.210 (1.372)	-1.776* (0.760)
Unqualified w. Findings	-0.095** (0.008)	-0.088** (0.012)	0.012 (0.017)	0.686** (0.105)	0.207 (0.198)	0.220 (0.204)	-2.355* (1.009)	-2.503** (0.533)
Unqualified (clean)	0.048** (0.012)	0.025 (0.016)	0.153** (0.020)	0.813** (0.132)	-0.127 (0.234)	-0.134 (0.238)	-1.410* (0.673)	-1.342* (0.557)
Adverse x Econ Activity				0.000 (0.000)			0.000 (0.000)	0.000 (0.000)
Disclaimer x Econ Activity				0.097** (0.026)			0.201 (0.366)	-0.215** (0.051)
Unfinalised x Econ Activity				-0.016 (0.018)			0.125 (0.146)	0.235** (0.075)
Qualified x Econ Activity				0.052** (0.020)			0.121 (0.139)	0.168* (0.076)
Unqualified w. Findings x Econ Activity				-0.067** (0.010)			0.245* (0.098)	0.253** (0.049)
Unqualified (clean) x Econ Activity				-0.064** (0.012)			0.124+ (0.071)	0.126* (0.052)
Econ Activity		0.039** (0.004)	-0.086** (0.007)	-0.037** (0.007)		0.304 (0.573)	0.213 (0.713)	-0.738+ (0.380)
Infrastructure			0.104** (0.003)	0.112** (0.004)				0.080 (0.048)
YoY Inflation			0.009* (0.004)	0.008+ (0.004)				0.017 (0.027)
Herfindahl				0.293** (0.057)				-2.456* (1.024)
Constant	0.838** (0.004)	0.445** (0.042)	0.868** (0.052)	0.245** (0.064)	0.377+ (0.192)	-2.547 (5.418)	-1.447 (6.866)	7.776* (3.636)
Observations	4,056	3,780	2,210	2,186	3,045	2,769	2,769	2,186
R-squared	0.075	0.105	0.257	0.301	0.217	0.218	0.223	0.515

Notes: Values in parentheses are the reported standard errors (as provided). **, *, and + denote your significance markings.

Table A4: Municipally determined (government-stipulated) products and summary statistics

Prod Code	Prod Description	Price	CPI	CPI (2015)
4441001	ASSESSMENT RATES	74.079809	0.44669268	107.30332
7241007	DRIVING LICENCES	100.69447	0.405263	129.66898
4511001	ELECTRICITY	65.830537	0.44941353	105.81565
7321001	LOCAL BUS FARE	86.782811	0.42278387	120.27553
7241002	MOTOR VEHICLE REGISTRATION FEES	83.636843	0.43943622	111.14588
10111001	PRIMARY SCHOOL FEES	71.88715	0.44941353	105.81565
6211005	PUBLIC - GENERAL PRACTITIONERS	89.15895	0.42599457	118.295
6211006	PUBLIC- SPECIALISTS	89.458788	0.42599457	118.295
8111002	RENTAL OF POST BOX	76.429222	0.44741162	106.91045
10211001	SECONDARY SCHOOL FEES	70.714863	0.44941353	105.81565
7321002	TAXI FARE	78.566673	0.44941353	105.81565
8311001	TELEPHONE FEES	98.412429	0.44941353	105.81565
9423001	TELEVISION LICENCE	97.647191	0.44941353	105.81565
7241004	TOLL FEES	85.579065	0.43899887	111.42642
7311001	TRAIN FEES	94.262117	0.42197433	120.64253
10411001	UNIVERSITY FEES	79.450178	0.44422403	108.59059
6311001	WARD FEES	81.199391	0.44870035	106.20582
4411001	WATER SUPPLY	66.960656	0.44941353	105.81565

Table A5: Market-determined prices: Governance, Lights, and Controls (OLS vs FE)

VARIABLES	OLS - Persistence				FE - Persistence (Rolling)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2.Governance	-0.278** (0.045)	-0.295** (0.044)	-0.119** (0.024)	-2.990** (0.070)	0.014 (0.302)	0.020 (0.396)	-2.975 (2.568)	-1.693* (0.789)
3.Governance	-0.245** (0.045)	-0.283** (0.043)	-0.155** (0.014)	-3.101** (0.060)	0.067 (0.111)	0.102 (0.115)	-0.350 (1.532)	-1.843+ (1.004)
4.Governance	-0.139** (0.045)	-0.139** (0.043)	-0.010 (0.014)	-4.262** (0.097)	-0.039 (0.048)	-0.047 (0.060)	-0.020 (1.110)	-1.327 (0.884)
5.Governance	-0.241** (0.045)	-0.216** (0.043)	-0.158** (0.013)	-2.019** (0.068)	0.025 (0.043)	0.028 (0.044)	-0.598 (0.494)	-0.938 (0.636)
6.Governance	-0.099* (0.048)	-0.066 (0.046)	0.053* (0.023)	0.252** (0.014)	0.030 (0.068)	0.051 (0.074)	0.129 (0.093)	0.037 (0.160)
Econ Activity		-0.034** (0.004)	-0.048** (0.007)	-0.256** (0.006)		0.267 (0.281)	0.258 (0.345)	-0.207 (0.372)
Adverse x Econ Activity				0.000 (0.000)			0.000 (0.000)	0.000 (0.000)
Disclaimer x Econ Activity				0.304** (0.008)			0.326 (0.303)	0.140 (0.086)
Audit not finalised x Econ Activity				0.321** (0.007)			0.046 (0.162)	0.175 (0.108)
Qualified x Econ Activity				0.453** (0.011)			-0.006 (0.115)	0.118 (0.093)
Unqualified w. findings x Econ Activity				0.197** (0.007)			0.065 (0.049)	0.088 (0.065)
Unqualified (clean) x Econ Activity				0.000 (0.000)			0.000 (0.000)	0.000 (0.000)
Infrastructure			0.013** (0.003)	0.006* (0.002)				0.032 (0.037)
YoY Inflation			0.017** (0.003)	0.008** (0.002)				0.041* (0.017)
Herfindahl				-0.289** (0.032)				-2.173* (0.966)
Constant	0.723** (0.044)	1.038** (0.055)	0.930** (0.054)	3.056** (0.050)	0.453** (0.034)	-2.165 (2.768)	-2.091 (3.411)	2.776 (3.675)
Observations	2,972	2,784	1,638	1,627	2,237	2,049	2,049	1,627
R-squared	0.073	0.108	0.202	0.704	0.182	0.191	0.198	0.466

Notes: Parentheses contain reported standard errors (as provided). **, *, and + denote your significance markings.

Table A6: Administered prices: Governance, Lights, and Controls (OLS vs FE)

VARIABLES	OLS				FE			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disclaimer	0.086 ⁺ (0.052)	0.213** (0.046)	0.375** (0.055)	-0.819** (0.226)	0.518 (0.588)	-0.052 (0.000)	-0.068 (4.648)	-3.995 (2.393)
Audit not finalised	0.007 (0.029)	0.232** (0.035)	0.225** (0.029)	-0.684** (0.109)	1.142 ⁺ (0.628)	0.603 (0.000)	-0.531 (7.221)	-4.148 (2.708)
Qualified	0.144** (0.022)	0.184** (0.031)	0.265** (0.015)	-0.265** (0.096)	0.895** (0.239)	0.636 (0.000)	-7.498** (2.301)	-6.958* (2.486)
Unqualified w. findings	0.384** (0.021)	0.220** (0.031)	0.256** (0.013)	0.294** (0.078)	0.417** (0.090)	0.275 (0.000)	-2.004 (1.211)	-1.639 (1.690)
Unqualified (clean)	0.462** (0.023)	0.225** (0.031)	0.299** (0.014)	0.269** (0.012)	0.176 (0.231)	-0.114 (0.000)	0.178 (0.481)	0.004 (0.274)
Adverse x Econ Activity				0.000 (0.000)			0.000 (0.000)	0.000 (0.000)
Disclaimer x Econ Activity				0.124** (0.028)			-0.015 (0.583)	0.465 ⁺ (0.261)
Audit not finalised x Econ Activity				0.107** (0.014)			0.087 (0.770)	0.427 (0.287)
Qualified x Econ Activity				0.058** (0.010)			0.878** (0.236)	0.781** (0.260)
Unqualified w. findings x Econ Activity				-0.003 (0.007)			0.232* (0.105)	0.188 (0.166)
Unqualified (clean) x Econ Activity				0.000 (0.000)			0.000 (0.000)	0.000 (0.000)
Econ Activity		0.196** (0.003)	0.224** (0.007)	0.171** (0.005)		-3.278 (0.000)	-3.576 ⁺ (1.751)	-1.487 (0.912)
Infrastructure			0.003 (0.005)	0.001 (0.004)				0.041 (0.080)
YoY Inflation			-0.005* (0.003)	-0.002 (0.002)				-0.028 (0.020)
Herfindahl				-1.236** (0.046)				1.751 (2.718)
Constant	-0.239** (0.019)	-2.072** (0.044)	-2.439** (0.044)	-1.600** (0.041)	-1.345** (0.117)	30.967 (0.000)	33.839 ⁺ (17.084)	13.173 (8.820)
Observations	2,986	2,800	1,648	1,633	2,245	2,059	2,059	1,633
R-squared	0.178	0.569	0.628	0.718	0.077	0.087	0.090	0.430

Notes: Values in parentheses are the reported standard errors (as provided). **, *, and ⁺ denote your significance markings.

Table A7: Lag sensitivity: governance moderation and inflation persistence

VARIABLES	(1) Base	(2) 3 Lags	(3) 6 Lags	(4) 9 Lags	(5) 12 Lags
Disclaimer	1.685** (0.576)	2.667** (0.557)	1.666* (0.764)	0.808 (0.932)	0.172 (0.923)
Unfinalised	-2.399** (0.712)	-0.906 (0.682)	-0.663 (0.872)	-0.461 (1.040)	-0.417 (1.079)
Qualified	-1.776* (0.760)	-0.070 (0.670)	0.412 (0.882)	0.559 (1.046)	0.218 (1.141)
Unqualified w. findings	-2.503** (0.533)	-1.081* (0.485)	-0.925 (0.685)	-0.787 (0.846)	-0.771 (0.882)
Unqualified (clean)	-1.342* (0.557)	-0.041 (0.094)	-0.073 (0.101)	-0.059 (0.115)	0.020 (0.125)
Adverse x Econ Activity	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Disclaimer x Econ Activity	-0.215** (0.051)	-0.305** (0.062)	-0.193* (0.082)	-0.088 (0.097)	-0.005 (0.094)
Audit not finalised x Econ Activity	0.235** (0.075)	0.092 (0.074)	0.065 (0.090)	0.045 (0.105)	0.043 (0.108)
Qualified x Econ Activity	0.168* (0.076)	0.005 (0.071)	-0.044 (0.091)	-0.054 (0.105)	-0.010 (0.113)
Unqualified w. findings x Econ Activity	0.253** (0.049)	0.119* (0.049)	0.104 (0.066)	0.093 (0.080)	0.099 (0.083)
Unqualified (clean) x Econ Activity	0.126* (0.052)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Econ Activity	-0.738 ⁺ (0.380)	-0.499 (0.339)	-0.340 (0.274)	-0.272 (0.237)	-0.272 (0.210)
Infrastructure	0.080 (0.048)	0.076 (0.047)	0.073 (0.048)	0.069 (0.050)	0.069 (0.051)
YoY Inflation	0.017 (0.027)	0.010 (0.026)	0.009 (0.025)	0.012 (0.024)	0.016 (0.024)
Herfindahl	-2.456* (1.024)	-2.274* (0.969)	-2.368* (0.926)	-2.566* (0.929)	-2.711* (0.977)
Constant	7.776* (3.636)	5.365 (3.235)	3.871 (2.639)	3.250 (2.281)	3.209 (2.029)
Observations	2,186	2,183	2,180	2,177	2,174
R-squared	0.515	0.514	0.510	0.511	0.516

Notes: Standard errors are in parentheses. ⁺ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Table A8: Lead tests: future governance and current inflation persistence

VARIABLES	(1) 1 Yr Lead	(2) 2 Yr Lead	(3) 3 Yr Lead	(4) 4 Yr Lead
Disclaimer	-4.174** (0.813)	-1.644* (0.749)	-2.028** (0.617)	0.099 (0.450)
Unfinalised	-3.775** (1.078)	-0.529 (0.730)	-0.506 (0.716)	-0.420 (1.394)
Qualified	-3.850** (1.016)	-0.673 (0.710)	-0.547 (0.598)	1.133* (0.410)
Unqualified w. findings	-4.036** (0.687)	-0.609 (0.554)	-0.626 (0.542)	0.999** (0.319)
Unqualified (clean)	-3.517** (0.815)	-0.329 (1.047)	1.031+ (0.553)	0.635 (0.468)
Adverse x Econ Activity	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Disclaimer x Econ Activity	0.366** (0.082)	0.144+ (0.072)	0.233** (0.064)	0.031 (0.055)
Audit not finalised x Econ Activity	0.334** (0.114)	0.050 (0.072)	0.067 (0.078)	0.072 (0.145)
Qualified x Econ Activity	0.347** (0.101)	0.059 (0.069)	0.056 (0.058)	-0.108* (0.040)
Unqualified w. findings x Econ Activity	0.375** (0.064)	0.061 (0.049)	0.065 (0.051)	-0.092** (0.029)
Unqualified (clean) x Econ Activity	0.324** (0.076)	0.049 (0.091)	-0.059 (0.048)	-0.056 (0.044)
Econ Activity	-0.914* (0.403)	-0.604 (0.386)	-0.225 (0.330)	0.159 (0.436)
Infrastructure	0.084 (0.055)	0.088 (0.055)	0.090* (0.042)	0.066+ (0.038)
YoY Inflation	0.029 (0.023)	0.018 (0.025)	0.029 (0.022)	0.021 (0.018)
Herfindahl	-2.217* (1.036)	-2.219* (1.027)	-1.252 (0.905)	-1.032 (0.922)
Constant	9.681* (3.809)	6.307 (3.714)	2.261 (3.243)	-1.414 (4.031)
Observations	2,198	2,166	1,910	1,644
R-squared	0.491	0.498	0.551	0.579

Notes: Each column replaces current governance with a lead of the annual governance measure by 1 to 4 years and interacts it with local economic activity (night time lights). Standard errors are in parentheses. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.