

Non-Resource Economic Growth and Productivity in Saudi Arabia

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Abstract:

This paper examines the sources of economic growth and total factor productivity (TFP) in Saudi Arabia over 1980–2019. Using a standard production-function framework with capital and labor, non-oil output growth is decomposed into factor accumulation and productivity components. The results show that growth has been driven mainly by capital accumulation, while labor contributions are modest. TFP growth is weak and declining. Regression results indicate that short-run macroeconomic variables have limited explanatory power for TFP, while productivity exhibits strong persistence. These findings point to structural constraints and the need for productivity-enhancing reforms under Vision 2030.

Keywords: Economic growth; Total factor productivity; Growth accounting; Non-resource GDP; Trade openness; Saudi Arabia.

Jel Classification Codes: O47; O53; C22; F43; Q32; O43

1. INTRODUCTION

Understanding the sources of economic growth and the role of productivity is central to development policy, particularly in resource-dependent economies. Saudi Arabia has historically relied on oil revenues, making the pursuit of sustained growth alongside diversification a central policy challenge. Since the 1980s, the economy has experienced substantial fluctuations in output growth, shaped by global economic shifts and domestic reform efforts. Growth accounting provides a structured framework to disentangle the contributions of capital and labor accumulation from gains in total factor productivity (TFP). While input accumulation can drive growth in the short run, long-term improvements in living standards depend on productivity gains reflecting efficiency, innovation, and institutional quality (Solow, 1956; Easterly & Levine, 2001).

This paper contributes to the literature by applying a two-input growth accounting framework, in line with Freeman et al. (2021), to estimate TFP and assess the growth dynamics of the Saudi economy over the period 1980–2019. A TFP index is constructed to trace productivity evolution over time, enabling a systematic decomposition of non-resource GDP growth into factor and efficiency components. The analysis is complemented by an econometric investigation of short-run TFP determinants, focusing on the roles of trade openness, government expenditure, and inflation. Together, the growth decomposition and regression evidence offer a clearer understanding of the sources of Saudi Arabia's growth and the structural features that constrain productivity improvements.

The remainder of the paper is organized as follows. Section 2 reviews the literature on growth accounting and productivity in resource-rich economies. Section 3 describes the data and methodological approach. Section 4 presents the empirical results, including growth decomposition and regression analysis. Section 5 concludes with a summary of findings and policy implications.

2. LITERATURE REVIEW

The distinction between growth driven by factor accumulation and

growth driven by productivity improvements has been central to economic analysis since Solow's (1956) foundational model. In the neoclassical framework, sustained long-run growth arises from technological progress, whereas capital deepening and labor expansion generate only temporary gains due to diminishing returns. The augmented Solow model of Mankiw et al. (1992) extended this insight by incorporating human capital, demonstrating the importance of education and skill formation in explaining cross-country income differences.

Empirical evidence further highlights the centrality of total factor productivity (TFP) in advanced economies. Studies such as Hall and Jones (1999) and Jorgenson and Vu (2010) show that a substantial share of long-term output growth in high-income countries stems from efficiency improvements rather than input accumulation. By contrast, developing and resource-rich economies often rely more heavily on capital formation and labor expansion (Bosworth and Collins, 2003; Caselli, 2005). Easterly and Levine (2001) emphasize that accumulation alone cannot account for persistent income gaps, pointing instead to institutional quality and productivity dynamics as fundamental drivers of long-run performance.

Within the Middle East and North Africa (MENA) region, natural resource dependence further complicates growth dynamics. Early contributions such as Al-Marhubi (2000) and Auty (2001) argue that large resource rents can weaken incentives for private sector development, distort fiscal policy, and slow improvements in institutional quality. This line of argument, often summarized as the resource-curse hypothesis, suggests that productivity growth may be systematically lower in resource-abundant economies. Later studies, however, caution that the economic effects of natural resources depend on policy frameworks and governance conditions. Sachs and Warner (2001) and van der Ploeg (2011) note that resource revenues can support productivity when used to finance infrastructure, education, and technological upgrading.

A related strand of research addresses the methodological challenge of measuring productivity in economies where natural resources generate a substantial share of output. Monge-Naranjo et al. (2019) demonstrate that

conventional growth accounting overstates TFP in resource-abundant economies because unpriced natural capital is omitted from the production function, causing resource-driven output to appear as productivity gains. Freeman et al. (2021) propose an alternative approach that adjusts GDP by removing resource rents before estimating TFP, thereby avoiding the need to specify a separate natural-resource input. Manning and Barbier (2025) and Brandt et al. (2017) provide additional evidence that incorporating natural capital, whether directly or through adjusted output measures, substantially alters decompositions of multifactor productivity, especially in oil-exporting economies. These contributions offer a methodological basis for approaches that refine TFP estimation in resource-rich settings, including the resource-adjusted specification used in this study.

Saudi Arabia's growth experience has been examined from several perspectives within this broader discussion. Early analyses such as Looney (1994) identify capital accumulation and government spending as the primary engines of growth, with limited contribution from productivity improvements. Subsequent research by Ramady (2010) and Albassam (2015) emphasizes the increasing relevance of economic diversification under Saudi Arabia's reform programs and identifies productivity enhancement as a central objective for sustainable growth.

More recent empirical studies revisit the drivers of growth and productivity performance in Saudi Arabia and other Gulf Cooperation Council (GCC) economies. Mousa (2018) finds that long-term growth in Saudi Arabia has been dominated by capital accumulation, while TFP growth remains weak and sensitive to macroeconomic fluctuations. Whereas openness and human-capital improvements tend to support productivity, excessive government consumption and credit expansion may hinder it. Bannaga and Lezar (2024) report that TFP growth across GCC economies has generally been stagnant or negative, underscoring the need for efficiency-enhancing reforms. Al Abri and Al Bulushi (2022) highlight the importance of institutional quality and regulatory effectiveness for improving productivity outcomes. Broader cross-country studies yield comparable results, with Malik and Masood (2020) finding that MENA oil

exporters exhibit persistently low TFP contributions compared with more diversified economies, while Raggl (2015) attributes the region's limited productivity growth to inadequate educational attainment and weak absorptive capacity. Kireyev (2025) similarly concludes that negative TFP trends have been a major factor behind the slowdown in GCC growth since the early 2000s.

Growth accounting and structural break tests have been used in various contexts to identify turning points in productivity trends (Bai and Perron, 2003; Kumar and Russell, 2002). Although not all economies display statistically significant breakpoints, such techniques provide a useful diagnostic for assessing whether productivity trajectories align with major economic events or reforms. In the Saudi case, applying such methods helps determine whether shifts in productivity coincide with episodes of fiscal expansion, market liberalization, or global shocks.

Building on these strands of literature, the present study applies a two-input growth accounting framework that removes resource rents from output before estimating TFP, consistent with the approach of Freeman et al. (2021). The analysis is complemented by an econometric assessment of the short-run determinants of TFP growth, focusing on trade openness, government expenditure, and inflation. Together, these contributions refine the measurement of productivity in a resource-rich context and provide a clearer understanding of the structural factors shaping Saudi Arabia's growth trajectory.

3. DATA AND METHODOLOGY

3.1 DATA

This study utilizes annual data for Saudi Arabia covering the period 1980–2019. Real GDP, real oil GDP, and other national accounts components are obtained from the General Authority for Statistics (GASTAT) and expressed in 2018 prices. Capital stock (K), augmented labor (L), and the labor income share (β) are taken from the Penn World Table (PWT 10.0). Augmented labor is computed as employment multiplied by the human-capital index provided by PWT. Natural-resource rents (% of GDP) are sourced from the World Bank's World Development

Indicators (WDI). Following Freeman et al. (2021), natural-resource rents are first expressed in real terms as:

$$rent_value_t = rent_pct_t \cdot Y_t \tag{1}$$

where $rent_pct_t$ denotes resource rents as a share of GDP.

Non-resource GDP is then computed as:

$$Y_{NR,t} = Y_t - rent_value_t \tag{2}$$

This adjustment removes oil-revenue-driven fluctuations from measured output so that TFP captures efficiency and technological dynamics rather than resource cycles. Table 1 reports summary statistics for the main variables used in the growth-accounting and regression analysis. The relatively high average growth rate of non-resource GDP partly reflects the inclusion of the high-growth 1980s and the absence of trend smoothing in the resource-adjusted series.

Table 1. Summary Statistics of Key Variables (1980–2019)

Variable	Mean	SD	Min	Max
Y_{NR}	757,347	642,103	161,661	2,344,213
K	2,604,625	1,739,515	841,293	6,633,051
L	16.431	9.066	5.240	37.301
g_{YNR}	0.097	0.217	-0.133	1.218
g_K	0.054	0.025	0.020	0.099
g_L	0.051	0.040	-0.035	0.156
g_A	0.044	0.206	-0.194	1.129
trade	74.164	11.120	56.088	96.103
govexp	25.649	4.720	15.890	35.222
infl	1.430	2.685	-3.203	9.870

Note: Y_{NR} and K are in real terms (2018 prices). L is effective labor (employment $\times$ PWT human-capital index). Growth rates (g_{YNR} , g_K , g_L , g_A) are log differences. trade and govexp are shares of GDP (%); infl is CPI inflation (%).

Source: Author’s own calculations.

3.2 METHODOLOGY

The production technology is represented by a Cobb–Douglas function with two inputs, capital and effective labor, applied to resource-adjusted output. The specification assumes constant returns to scale:

$$Y_{NR,t} = A_t K_t^{\alpha_t} L_t^{\beta_t} \quad (3)$$

where $Y_{NR,t}$ denotes non-resource GDP, K_t is the real capital stock, L_t is effective labor, and A_t captures total factor productivity.

Effective labor is constructed as:

$$L_t = Employment_t \cdot h_t \quad (4)$$

with h_t taken from the Penn World Table (PWT) human-capital index.

Consistent with Freeman et al. (2021), the labor income share β_t is obtained directly from PWT's labsh series. The capital share is then computed residually as:

$$\alpha_t = 1 - \beta_t \quad (5)$$

This approach avoids imposing fixed factor shares and ensures that the decomposition aligns with observed income data for Saudi Arabia.

Taking growth rates of the production function yields the standard Solow residual expression for TFP growth:

$$g_{A,t} = g_{Y_{NR,t}} - \alpha_t g_{K,t} - \beta_t g_{L,t} \quad (6)$$

where $g()$ denotes the log-difference growth rate of each variable. TFP growth therefore represents the portion of non-resource output growth not explained by changes in capital or effective labor.

The contribution of each input to output growth follows directly from the factor-share weighting:

$$\begin{aligned} \text{Capital contribution} &= \alpha_t g_{K,t}, \text{ Labor contribution} = \beta_t g_{L,t}, \\ \text{TFP contrib.} &= g_{A,t} \end{aligned}$$

These expressions form the basis for the growth-decomposition results reported in Table 2 and Figure 1.

3.3 Econometric Specification:

To complement the growth accounting analysis, an econometric specification is estimated to examine whether short-run macroeconomic and policy conditions are systematically associated with TFP growth. The

baseline specification relates the Solow residual, $g_{A,t}$, to trade openness, government expenditure, and inflation:

$$g_{A,t} = \delta_0 + \delta_1 trade_t + \delta_2 govexp_t + \delta_3 infl_t + \varepsilon_t \quad (7)$$

where $trade_t$ denotes total trade (exports plus imports) as a share of GDP, $govexp_t$ is general government final consumption expenditure as a share of GDP, and $infl_t$ represents the annual CPI inflation rate. The selection of explanatory variables follows the applied productivity literature and IMF practice, focusing on macroeconomic and policy-related factors that may influence productivity growth in the short run rather than deep structural determinants. Trade openness is included to capture channels of technology diffusion and competitive pressure, while government expenditure and inflation serve as controls for fiscal stance and macroeconomic stability. These variables are not intended to fully explain productivity dynamics but to assess whether short-run policy conditions are systematically associated with TFP growth. The models are estimated by ordinary least squares with heteroskedasticity-robust (HC1) standard errors. Accordingly, the econometric analysis is interpreted as descriptive rather than causal, providing evidence on short-run associations without modeling the structural mechanisms underlying long-run productivity growth.

Because macroeconomic conditions may affect productivity with a delay, a second specification incorporates lagged regressors:

$$g_{A,t} = \delta_0 + \delta_1 trade_{t-1} + \delta_2 govexp_{t-1} + \delta_3 infl_{t-1} + \varepsilon_t \quad (8)$$

To account for persistence in productivity dynamics, an autoregressive term is added to the contemporaneous model:

$$g_{A,t} = \delta_0 + \rho g_{A,t-1} + \delta_1 trade_t + \delta_2 govexp_t + \delta_3 infl_t + \varepsilon_t \quad (9)$$

This AR(1) specification improves fit and allows the regression to separate the effect of macroeconomic variables from the inherent inertia in TFP growth. The results of these models are reported in Tables 3–5.

4. RESULTS AND DISCUSSION

4.1 GROWTH ACCOUNTING AND FACTOR CONTRIBUTIONS

Table 2 reports a decade-level decomposition of non-resource GDP growth, revealing substantial shifts in the sources of growth over time. During the 1980s, output growth was driven primarily by strong TFP

contributions, which accounted for more than half of total growth and exceeded the combined contributions of capital and labor. In the 1990s, productivity and factor accumulation played more balanced roles. By contrast, growth in the 2000s and 2010s became increasingly input-driven, with capital accumulation emerging as the dominant contributor and TFP accounting for a much smaller share of output growth. Labor contributions remained positive but modest throughout the period. Overall, the decomposition highlights a transition from productivity-supported growth toward a growth model increasingly reliant on factor accumulation.

Table 2. Growth Decomposition of Non-Resource GDP by Decade (percent)

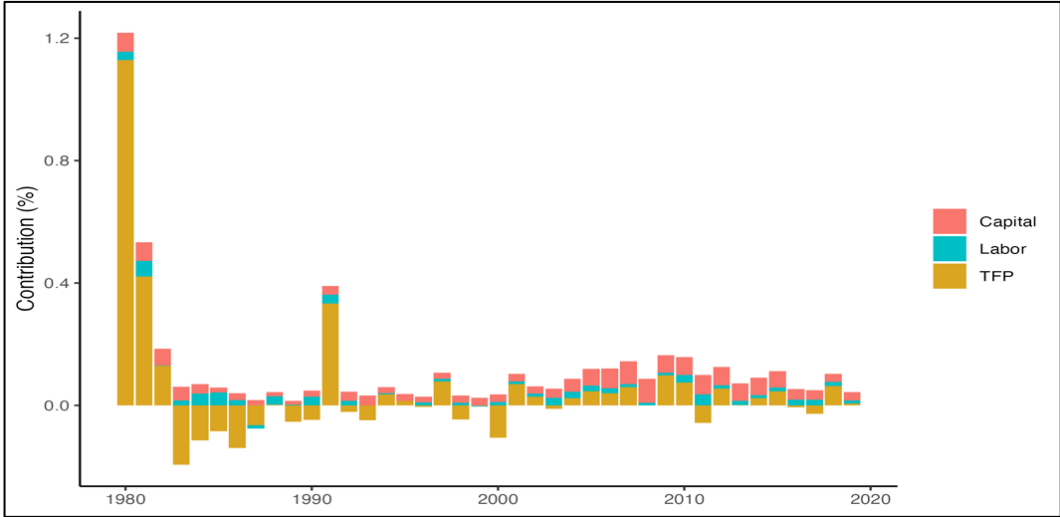
Period	Output Growth	Capital Contribution	Labor Contribution	TFP Contribution
1980s	15.81	3.39	2.11	10.31
1990s	6.31	2.38	0.99	2.94
2000s	8.61	4.75	1.37	2.49
2010s	8.19	4.71	1.69	1.79

Note: All values are annual averages, expressed in percentage points.

Source: Author's own calculations.

Figure 1 further illustrates that capital accumulation consistently contributed more to output growth than labor, especially outside the early part of the sample. This reflects the investment-led nature of the Saudi growth model and is consistent with earlier findings for Saudi Arabia and the broader GCC region, where growth has historically relied on large-scale capital formation financed by hydrocarbon revenues (Looney, 1994; Ramady, 2010; Mousa, 2018).

Fig.1. Contributions to Non-Resource GDP Growth in Saudi Arabia, 1980–2019



Source: Author’s own calculations.

Labor contributed positively but modestly throughout the period, consistent with the structural characteristics of the Saudi labor market. Employment growth has been driven largely by expatriate labor, which has tended to generate limited productivity spillovers. Similar patterns are documented in IMF regional assessments, which show that labor-market expansion in GCC economies has often been associated with weak gains in aggregate productivity (IMF, 2019; Bannaga & Lezar, 2024).

Once resource rents are removed from total output, TFP growth emerges as the most volatile component of non-resource GDP growth and, outside the 1980s, a relatively small contributor on average. In several years, TFP contributions are close to zero or negative, suggesting that efficiency improvements and technological progress have not been sustained drivers of long-run growth. This finding aligns with cross-country evidence showing that oil-exporting economies often experience low or unstable TFP growth due to the dominance of resource-based revenues and slower diffusion of new technologies (Freeman et al., 2021; Malik & Masood, 2020; Raggl, 2015).

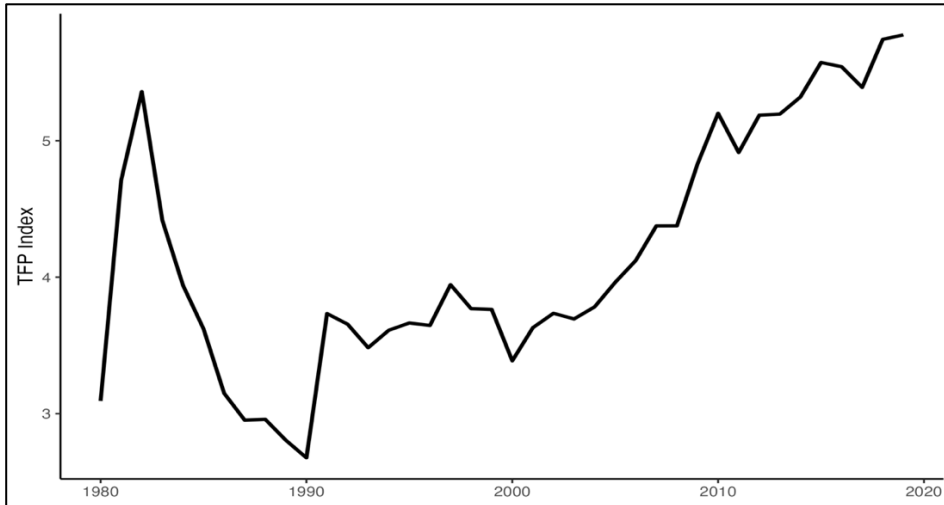
Overall, the decomposition confirms that while productivity played a meaningful role in the early stages of the sample, Saudi Arabia’s growth

model has increasingly relied on the accumulation of physical and human inputs rather than sustained improvements in efficiency. This dependence on input-driven expansion highlights the challenge of transitioning toward a more innovation-driven and productivity-based growth path.

4.2 EVOLUTION OF TOTAL FACTOR PRODUCTIVITY

Figure 2 presents the constructed TFP index, normalized to 1 in 1979. The index displays long periods of stagnation, punctuated by occasional short-run recoveries. Over the full sample, TFP growth averages around 4 percent per year, with substantial year-to-year fluctuations. These patterns resemble those reported for GCC and MENA oil exporters, where productivity improvements have been limited despite high investment rates and rising human-capital indicators (Al Abri & Al Bulushi, 2022; Kireyev, 2025).

Fig.2. Resource-Adjusted Total Factor Productivity Index, 1980–2019 (1979 = 1)



Source: Author's own calculations.

A Bai–Perron structural break test was conducted to assess whether TFP growth exhibited distinct regime shifts. Consistent with the volatility of the series, but contrary to the earlier (log-TFP) specification, the test did not identify statistically significant breakpoints in TFP growth. This suggests that the underlying productivity process has been persistently weak rather than characterized by discrete shifts. The absence of structural breaks is itself informative: it implies that major economic episodes—oil price

cycles, periods of fiscal expansion, and early reform initiatives—did not fundamentally alter the long-run trajectory of productivity.

This result aligns with several studies that emphasize the structural nature of TFP stagnation in resource-dependent economies, where productivity improvements require deep institutional and market reforms rather than cyclical or fiscal adjustments (van der Ploeg, 2011; Bannaga & Lezar, 2024).

4.3 DETERMINANTS OF TFP GROWTH

Tables 3–5 summarize the regression results examining how trade openness, government expenditure, and inflation relate to short-run TFP dynamics. Across the baseline model and the lagged-regressor specification, none of the macroeconomic variables are statistically significant. While trade openness carries a positive coefficient in the baseline regression—as expected for a small open economy—the estimate is imprecisely measured. Government expenditure and inflation also show weak statistical associations with TFP. The marginal significance of government expenditure in the lagged specification is not robust across alternative model specifications.

These findings are consistent with the existing empirical literature showing that macroeconomic variables often exhibit weak contemporaneous relationships with TFP in oil-exporting economies, where productivity is heavily influenced by institutional characteristics, public-sector dominance, and the absorptive capacity of the private sector (Easterly & Levine, 2001; Rodrik, 2008; Mousa, 2018). In Saudi Arabia, a substantial share of government consumption has historically taken the form of wage-related and other current expenditures, which tend to have limited direct effects on productivity growth.

The AR(1) specification introduces a lag of TFP growth, and here the persistence parameter is statistically significant and economically meaningful. This suggests that productivity shocks exhibit inertia—years with weak TFP performance tend to be followed by similar outcomes. Such persistence is frequently documented in TFP studies for GCC economies and indicates that improvements in productivity require sustained and

cumulative reforms rather than short-run policy shifts (IMF, 2019; Kireyev, 2025).

The short-sample regression (1985–2019) yields similar patterns: insignificant coefficients and low explanatory power. This robustness check confirms that the absence of strong macro-TFP linkages is not driven by early-sample observations. Overall, the regression results suggest that TFP dynamics in Saudi Arabia are shaped more by slow-moving structural factors than by short-run macroeconomic fluctuations.

Table 3. Baseline Determinants of TFP Growth (OLS with Robust SE)

Variable	Intercept	Trade openness	Gov. expenditure	Inflation	
Coefficient	0.175	0.003	-0.014	0.004	
Std. Error	0.3174	0.0029	0.014	0.0195	
t-statistic	0.552	1.025	-0.991	0.221	
p-value	0.584	0.312	0.328	0.826	
Observations	40	R-squared	0.212	Adj. R-squared	0.147

Note: *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels based on p-values.

Source: Author's own calculations.

Table 4. Regression with Lagged Regressors

Variable	Intercept	Trade openness (t-1)	Gov. expenditure (t-1)	Inflation (t-1)	
Coefficient	0.294*	-0.001	-0.009*	0.007	
Std. Error	0.1728	0.0018	0.0051	0.0071	
t-statistic	1.701	-0.419	-1.768	0.927	
p-value	0.098	0.678	0.086	0.360	
Observations	39	R-squared	0.224	Adj. R-squared	0.158

Note: *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels based on p-values.

Source: Author's own calculations.

Table 5. AR(1) Regression with Contemporaneous Regressors

Variable	Intercept	TFP growth (t-1)	Trade openness	Gov. expenditure	Inflation
Coefficient	0.081	0.312***	-0.002	0.001	0.017
Std. Error	0.2248	0.0745	0.0017	0.0074	0.0126
t-statistic	0.358	4.185	-1.079	0.171	1.344
p-value	0.722	0.000	0.288	0.866	0.188
Observations	39	R-squared	0.446	Adj. R-squared	0.380

Note: *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels based on p-values.

Source: Author's own calculations.

4.4 DISCUSSION AND POLICY IMPLICATIONS

The results align with a substantial body of work showing that resource-rich economies tend to exhibit growth patterns dominated by factor accumulation rather than sustained gains in efficiency (Bosworth & Collins, 2003; Caselli, 2005; Freeman et al., 2021). Saudi Arabia's experience fits this profile: the decomposition indicates that capital deepening and labor expansion account for most of the increase in non-resource GDP, while TFP growth remains modest and highly volatile. This finding is consistent with studies such as Mousa (2018), Bannaga and Lezar (2024), and Kireyev (2025), which document limited productivity improvements across the GCC despite substantial investment spending. The absence of identifiable structural breaks in TFP growth further suggests that productivity dynamics have not undergone persistent regime shifts, even during periods of policy transition or major reforms.

The regression analysis reinforces this interpretation. The weak and statistically insignificant effects of trade openness, fiscal expenditure, and inflation on TFP growth indicate that short-run macroeconomic conditions play a limited role in driving productivity. Only when TFP persistence is explicitly modeled does the explanatory power of the specification improve, reflecting the slow-moving nature of efficiency gains. This contrasts with earlier findings suggesting that openness and government spending may stimulate productivity under certain conditions (e.g., Malik & Masood, 2020; Al Abri & Al Bulushi, 2022), but the present results imply that such

channels have not translated into measurable short-term effects in the Saudi context. Together, these patterns underscore the structural nature of the productivity challenge and highlight the need for reforms that influence longer-horizon drivers of efficiency—such as innovation capacity, regulatory quality, private-sector dynamism, and human-capital upgrading.

These findings carry several policy implications. First, the continued reliance on capital accumulation suggests diminishing returns unless accompanied by improvements in the efficiency with which inputs are used. Second, the muted link between macroeconomic variables and TFP growth points to deeper institutional and technological constraints rather than cyclical conditions as the main impediments to productivity. Third, the results reinforce the rationale behind Vision 2030 policies aimed at economic diversification, labor-market modernization, and investment in knowledge-intensive activities. At the same time, the analysis has limitations that open avenues for future research. The study does not incorporate sectoral heterogeneity, which may mask productivity dynamics in non-oil tradable sectors; nor does it examine forward-looking variables such as digital transformation, R&D expenditure, or innovation adoption. Extending the framework to a multi-sector growth-accounting model, or embedding the resource-adjusted TFP measure in a structural VAR or DSGE setting, would further clarify the mechanisms through which reforms translate into productivity gains.

5. CONCLUSION

This paper examined the sources of non-resource economic growth and the short-run determinants of total factor productivity (TFP) in Saudi Arabia over the period 1980–2019. By applying a resource-adjusted two-input growth accounting framework, the analysis decomposed non-resource GDP growth into the contributions of capital accumulation, labor expansion, and productivity. The results indicate that economic growth has been driven primarily by factor accumulation, particularly physical capital, while TFP growth has remained modest, volatile, and frequently close to zero. These findings are consistent with earlier evidence for Saudi Arabia and other GCC economies, where investment-led expansion has historically outweighed productivity-driven growth.

The absence of structural breaks in the TFP series suggests that productivity dynamics have not experienced sustained regime shifts, even during periods of significant economic transitions and reform initiatives. Regression results further indicate that short-run macroeconomic variables,

including trade openness, government expenditure, and inflation, exhibit limited explanatory power for TFP growth. Only when persistence is explicitly accounted for through an autoregressive specification does the model's explanatory performance improve, reinforcing the view that productivity evolves gradually and is shaped by longer-term structural forces rather than short-term macroeconomic fluctuations.

These results carry important policy implications. Enhancing productivity will require reforms that improve the efficiency of capital use, strengthen institutional frameworks, promote innovation, and foster private-sector dynamism. Investments in human capital, regulatory modernization, and technological diffusion are central to shifting the economy from an input-driven growth model toward a more sustainable, productivity-based development path. While these priorities are closely aligned with the objectives of Vision 2030, the findings underscore the importance of sustained implementation and careful monitoring of reform outcomes.

Despite its contributions, the study has limitations. It relies on aggregate data, which may obscure heterogeneity in productivity performance across different parts of the economy, and does not explicitly model forward-looking determinants such as digital infrastructure, research and development, or innovation capacity. Future research could extend the analysis by incorporating institutional and governance indicators as longer and more consistent time-series data become available for Saudi Arabia.

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