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Article

Impact of sectoral economic performance and fiscal capacity on public health expenditure in South Africa

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Abstract: This study analyses the long-run relationship between, and the direction and magnitude of impact of sectoral economic growth and fiscal capacity on government health expenditure. The study was carried out to validates the Wagner hypothesis from sectoral perspective and revenue-expenditure hypothesis for South Africa for the period 1984–2020. Fully modified least squares and dynamic least squares and canonical cointegration regression were used to achieve the objectives of the study. Empirical regression results showed that there is a negative impact of the secondary sector GDP on public health expenditure. Thus, invalidating the Wagner hypothesis and suggesting that secondary sector GDP cannot serves as an answer for public health expenditure. However, there was a positive relationship between tertiary sector GDP and public health expenditure. The study make case for unceasing provision of an enabling environment that continuously support growth of the tertiary sector.

Keywords: secondary sector; tertiary sector; government spending; health sector; revenue; Wagner hypothesis; revenue-expenditure hypothesis

1. Introduction

Globally, there are concerns relating to public healthcare expenditure and financing, two of those concerns are the escalation in healthcare cost and the underfunding in public healthcare financing (Fazal et al., 2022; Malakoane et al., 2020). Healthcare costs are rising globally due to various factors like increasing population growth specifically ageing population, advances in medical technology, epidemic and pandemics as well as increasing prevalence of chronic communicable and non-communicable diseases (Barkat et al., 2019; Espinosa et al., 2019). This increase can lead to budgetary constraints in other important sector of an economy. Public health (i.e., set of activities, including diseases surveillance, health promotion, prevention programs, and emergency preparedness) underfunding is another pressing concern in some parts of the world such as Sub-Saharan Africa and low-income economies (Meng et al., 2022; Oleribe et al., 2019). The underfunding of public health departments could lead to compromise in public healthcare system functioning, performance, resilience, and population health (Kiross et al., 2020; Malakoane et al., 2020). It is however known that the ability of a country to finance it budget and spend on the economy depends on her fiscal capacity (Murshed et al., 2022) and economic expansion. Likewise, the extent of mobilization of resources and public funding of a particular sector is influenced by the priority that is place on such sector.

Economic growth is the increase in economic activities of a geographical area,

and it is usually represented by the gross domestic product. Fiscal capacity on the other hand refers to the inherent capability of a government in a specific area to generate revenue from internal sources for the purpose of stabilizing a range of public goods and services (Martinez-Vazquez and Boex, 1997). The relationship between economic growth and government expenditure as well as fiscal capacity and government expenditure has been a topic of enduring interest and investigation among researchers and policy makers (Selvanathan et al., 2021). In terms of economic growth and government expenditure relationship, prominent theory that provided insights into these dynamics is the Wagner's theory (Wagner, 1883) while the revenue-expenditure hypothesis Friedman (1978) underpins fiscal capacity and government expenditure nexus. In the economic growth and government relationship in the concept of Wagner's law, it is postulated that a positive association between a nation's economic prosperity and its economic spending exist, in that economic expansion stimulates government spending (Wagner, 1883). It argued that the expansion is reflected in urbanization and industrialization that necessitate more government expenditure. Connecting it with this study, is can therefore be said that government health expenditure may increase because of higher demand for healthcare services, and thus the mobilization resources for funding of the health sector could come through the realized economic expansion and growth.

Generally, the Wagner's law has been widely debated, critiqued, and tested in various contexts such that while the concept holds true in some cases, exceptions and divergent findings have been observed in other case studies (Arestis et al., 2021; Ebaid and Bahari, 2019; Inchauspe et al., 2022; Onifade et al., 2020; Selvanathan et al., 2021). An identified unexplored significant complexity in validating the Wagner's law arises from the fact that different sectors contribute differently to the overall economic growth of an economy, and thus their distinct growth patterns may have varying impacts on government expenditure. In line with this fact is the crux of the study in relation to government health spending. It is put forward in this study that economic strength of different sectors can significantly impact public health financing. When certain sectors thrive economically, they contribute more to tax revenues and overall economic growth. This, in turn, provides governments with the financial resources needed for robust public health financing. Conversely, economic downturns in specific sectors may constrain government budgets, potentially affecting the availability of funds for healthcare.

This study therefore seeks to delve into the potential intricate relationship between fiscal capacity, economic growth composition and government health expenditure. This study's central concentration is to appraise the revenue-expenditure hypothesis and the Wagner theory. Therefore, the purpose of this study is to answer the following research questions: i) what is the nature of influence of fiscal capacity (whether governments spend more on health when more resources are available) and sectoral growth on public health funding in South Africa? ii) If any influence exist, does the influence align with the postulations of the revenue-expenditure hypothesis and the Wagner's theory? iii) What is the extent of their influence on government healthcare spending. This study not only contributes to the theoretical understandings of the revenue-expenditure hypothesis and the Wagner's theory but also have implications for policy makers and healthcare stake holders. By

analysing sectoral GDP, policy makers can identify key contributors to the economy, allocate resources effectively, and ensure that financing public health expenditures aligns with the economic strengths of specific sectors, promoting a sustainable and targeted approach to public healthcare funding.

2. Brief literature review

Economic growth and government expenditure: Brief empirics:

Empirically, this study acknowledges extant empirical literature relative to the economic growth and government expenditure relationships (see Arestis et al., 2021; Dudzevičiūtė et al., 2018; Ebaid and Zakaria, 2019; Nyasha and Odhiambo, 2019; Onifade et al., 2020; Sedrakyan and Varela-Candamio, 2019; Selvanathan et al., 2021). However, this section focuses on studies that have considered public health expenditure as an outcome variable and economic growth proxy by GDP as an (or one of the) independent variables. This section is further delimited by not considering studies that have used per capita GDP as an independent variable. This is so because per capita GDP represent income of individuals and it is a measure of the economic status and standard of living of the population of a country, a driver of health demand expenditure (Behera and Dash, 2019; Braendle and Colombier, 2016), which is not the interest of this study. Two strands of literature in line with the orientation of this study are identified; i) those that examined causality between health sector expenditure by government and economic growth, and ii) those that investigated long-run relationship and magnitude of impact of GDP on public heath expenditure.

In terms of causality relationship, Kaur (2023) demonstrated through Toda-Yamamoto a one-way directional causal relationship from government health expenditure to economic growth. Similarly, evidence from a granger panel ECM-based granger causal relationship estimation technique confirmed that the causal relationship between public health spending and economic growth in low-income SSA countries is unidirectional (coming from public health spending) both in the short and long run (Odhiambo, 2021). In contrast, Dincer and Yuksel (2019) use the Dumitrescu-Hurlin panel causality method to establish a unidirectional causal relationship between economic growth and public health spending for the E7 countries studied. Similar to Dincer and Yuksel (2019), Mohapatra (2017) using panel data from 16 major Indian states found that state's GDP granger cause public health expenditure in the long- and short-term whereas public health expenditure granger cause state level GDP in the long run only. A bidirectional Granger causality was found to exist between public sector health spending and economic growth in Turkey (Uzumcu and Sogut, 2020).

In terms of cointegration relationship and magnitude of relationship, Boachie et al. (2014) demonstrated through FMOLS estimation technique that real GDP positively and statistically influence public health expenditure in Ghana. Awe et al. (2020) also show that economic growth has a positive and significant impact on government health spending in the SSA region. Following the application of ARDL, FMOLS and CCR estimation techniques, Chipunza and Nhamo (2023) found that economic growth has a positive influence on PHE in both the short and long run.

This suggests that national income growth is good for PHE as it increases the availability of resources for fiscal purpose. In a study from a panel of states in India, economic growth was considered alongside other economic factors that could influence public health expenditure (Behera and Dash, 2019; Khan, 2022). The findings from the two studies aligns with Awe et al. (2020), Boachie et al. (2014), and Chipunza and Nhamo (2023), and established that GDP has a statistically significant positive impact on overall public health spending in India in the long run. In a panel data analysis study, Sagarik (2016) modelled the determinants of government health expenditure among nine ASEAN countries from 2002 to 2011 using fixed-effect model. Among the economic regressors considered, are aggregate GDP growth rate and industrial output. The study found that GDP growth rate has a negative impact on government health spending, whereas industrial sector value-added has a statistically significant positive impact on government health spending.

Espinosa et al. (2023) incorporated the share of the industry sector value-added outputs in GDP as a proxy for industrialization for Philippine in the public health expenditure estimation model. Evidence from the autoregressive distributed lag model applied by the study show that industrial output negatively influenced public health expenditure in the country under study. Specifically, per capita spending of the Philippine government on health decreases by 6.00% in the long-run as a result of 1 percent increase in industrial output. Apparently, evidence on causality relationship between economic growth and public health spending is mix so is the finding on direction of relationships and the effect of sectoral GDP on public health expenditure. This imply that some studies have validated the Wagner theory while others have not.

Fiscal capacity and government healthcare expenditure: Brief empirics:

Empirical literatures have represented fiscal capacity using various indicators including total government expenditure as a share of GDP, revenue as percentage of GDP, tax revenue as a share of GDP (Behera and Dash, 2018, 2019; Chipunza and Nhamo, 2023; Ke et al., 2011; Micah et al., 2019; Sfakianakis et al., 2021). Majority of the studies have validated the revenue-expenditure hypothesis in relation to public health expenditure. Using data for a panel of 143 countries from 1995 to 2008, Ke et al. (2011) demonstrated using a fixed effect model that regardless of country income groups the proportion of aggregate government expenditure in GDP is positive and statistically significantly associated with PHE. Behera and Dash (2019) used a panel system GMM estimation technique to study how of macro-fiscal variables including tax revenue, on public health financing among both counties in the middle- and low-income groups, respectively. The study did affirm the revenue-expenditure hypothesis by showing that tax revenue has a positive and statistically significant impact on health sector expenditure of government. A positive effect of fiscal capacity (measured by the share of general government spending in GDP) on government health spending per person was established by Micah et al. (2019) following a study on 46 Sub-Saharan Africa countries.

In a study conducted among a panel of thirty-six OECD countries for the period 2000–2017, Sfakianakis et al. (2021) found that fiscal capacity (proxy by ratio of general government expenditure to GDP and tax revenue as a share of GDP) establishes a significant positive influence on PHE. Suggesting that an increase in

each of the two will lead to an increase in public health expenditure. In a recent study conducted on Zimbabwe for the period 1980 to 2017, Chipunza and Nhamo (2023) established that fiscal capacity that was proxied by ration of tax revenue to GDP positively impacted public health expenditure. The finding was also consistent with Sfakianakis et al. (2021) suggesting that a one percent increase in fiscal capacity would lead to 0.28 percent increase in public health expenditure in the country under consideration.

3. Materials and methods

3.1. Model specification and description of variables

It is posited in this study that government healthcare expenditure (GHE) is a function of sectoral component of economic growth (specifically secondary sector and tertiary sector GDP) and fiscal capacity (FC), the functional representation of the relationship in a multivariate framework is written as follows;

$$\ln\mathrm{GHEPC}_t = \alpha_0 + \alpha_1 \ln\mathrm{SSGDP}_t + \alpha_2 \ln\mathrm{TSGDP}_t + \alpha_3 \ln\mathrm{FC}_t + e_t \quad (1)$$

lnGHEPC**:** GHEPC is government health expenditure per capita and dependent variable for this study. GHEPC was computed by dividing the national government health expenditure by total population. The variable is measured in South Africa Rand.

lnSSGDP and TSGDP: Gross domestic product is known to be a measure of total economic output of a country, including the value of all goods and services produced within its borders within a specific period. It is a broad indicator of a nation's economic prosperity. In this study, sectoral component of GDP is considered, that is the secondary sector GDP (SSGDP) and the tertiary sector GDP (TSGDP). The secondary sector comprises of manufacturing, construction, and utilities, while the tertiary sector includes economic activities like trade, transport, and services. The two sectoral components are measured in billion South Africa Rand. In line with the Wagner hypothesis, it is hypothesised in this study that both SSGDP and TSGDP would have positive impact on government healthcare expenditure.

lnFC: In this study fiscal capacity (FC) is measured by the ratio of national revenue to GDP following (Chipunza and Nhamo, 2023). It is hypothesised that FC would have a positive impact of government health expenditure according to the revenue-expenditure hypothesis and reviewed literature.

3.2. Analytical techniques

The data used for this study were analysed using both descriptive (mean, median, maximum value, minimum value, table, and graph) and inferential statistics (stationarity unit root test, cointegration test, autoregressive distributed lag (ARDL) bound test and fully modified ordinary least square (FMOLS). The statistical procedure employed to determine the stationarity of a series is called 'unit root test (Shrestha and Bhatta, 2018). Unit root test was conducted to ascertain the stationarity properties of the variables used in the study so that the acceptable stationarity property requirement is met. In this study the unit root test was conducted using the augmented Dickey Fuller (ADF) test. To determine the presence of long-run

equilibrium (cointegrating) relationship between public health expenditure and the explanatory variables of interest, the Johansen cointegration test was applied on the series. If two or more variables are linked to form an equilibrium relationship spanning the long run, these variables are said to be cointegrated. Johansen cointegration test have been argued to perform better that other cointegration test techniques such as the two-step Engle and granger (HIS Markit, 2020; Startz, 2019). Traditionally, the Johansen (1991, 1995) cointegration test typically require all variables in the VAR to be I(1) (HIS Markit, 2020; Startz, 2019;).

Fully modified OLS, introduced by Phillips and Hansen (1992) is a technique for estimating and testing single equation cointegrating relationships. FMOLS is applicable so as to eliminate problems caused by the long run correlation between the cointegrating equation and stochastic regressors innovations (HIS Markit, 2020; Startz, 2019). In other words, FMOLS is a method that is very useful in correcting issues of endogeneity and serial correlation. Furthermore, for robustness and eminence, the study uses the canonical cointegrating regression (Park, 1992), and dynamic OLS (Saikkonen, 1992; Stock and Watson, 1993) to further confirm the FMOLS results.

3.3. Data and sample period

This study uses secondary annual time-series data for the period 1984–2020. The data were obtained or extracted from the South Africa Reserve Bank (SARB) website. Data from the source are publicly available, thus no access permission is required. EViews was used to analyse the data.

4. Results

4.1. Stylised fact and descriptive statistics summary

Figures 1–4 and **Table 1** presents stylised facts on trends and summary statistics representing graph and measures of central tendency (such as mean, maximum, and median) for the variables studied. Extracts from the data show that the lowest per capita government health expenditure of R87.83 was recorded in 1984 whereas the highest (R4243.4) was recorded in 2021 was recorded in 1984. Likewise, the highest secondary sector value added of R829339 million was recorded in 2013, tertiary sector (R3003120 million) and ratio of national government revenue to GDP (31.9%) were recorded in 2019 and 2020, respectively.

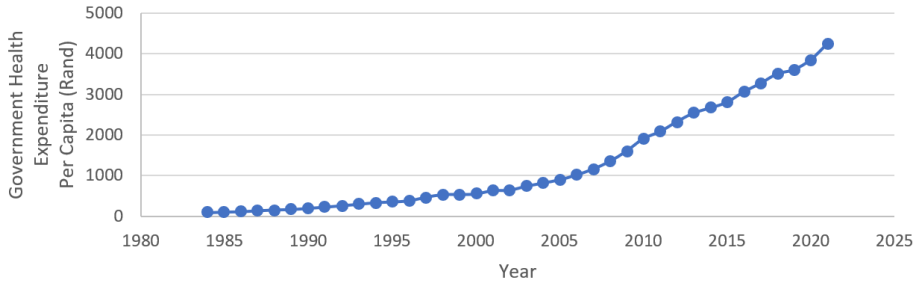

Figure 1. Trend in government health expenditure per capita.

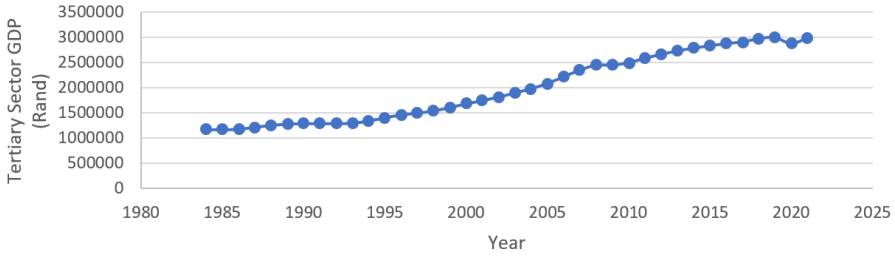

Figure 2. Trend in tertiary sector GDP.

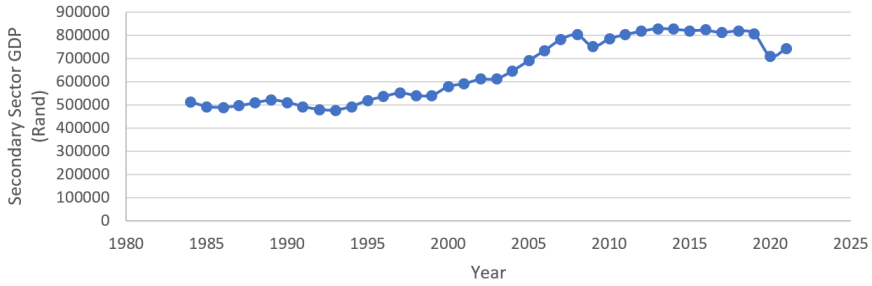

Figure 3. Trend in secondary sector GDP.

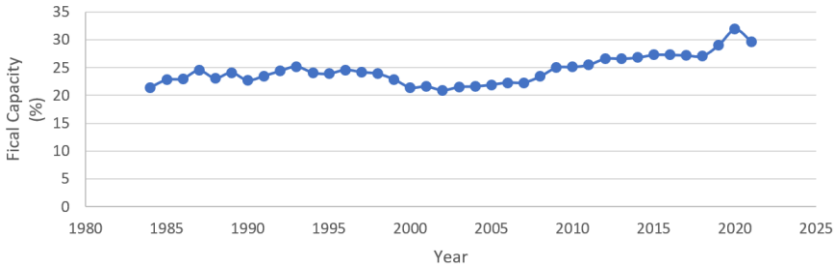

Figure 4. Trend in fiscal capacity.

Table 1. Summary statistics of series (source: computed by authors).

	GHEPC	SSECTOR	TSECTOR	FC
Mean	1305.049	645986.3	1991525.	24.48
Median	689.1899	610884.0	1856157.	24.10
Maximum	4243.483	829339.0	3003120.	31.90
Minimum	87.82904	476713.0	1166424.	20.90
Std. Dev.	1269.556	135468.7	667327.0	2.55
Observations	38	38	38	38

Unit root test: The result of the augmented Dickey-Fuller (ADF) unit root test that was conducted to ascertain order of integration of variables is presented in **Table 2**. The unit root test results show that all the variables hold non-stationarity property at level I(0). However, all the variables become stationary after taking first order difference I(1). Thus, the variables are verified to be I(1) variables.

Cointegration test: Johansen cointegration and ARDL bound testing: Having identified that the series are I(1), the test for confirmation existence of long-run relationship or otherwise is thus conducted. The tests were conducted through Johansen cointegration and ARDL bound test, respectively. The results of the Johansen tests in **Table 3** confirm the existence of a long-run relationship among the variables. Both results indicate one cointegrating equation relationships. This is also

established by the ARDL bound test, which clearly shows that the F-statistic (6.56) is higher than all critical upper limits at all the levels of significance (i.e., 1 percent, 2.5 percent, 5 percent, and 10 percent). These results validate the presence of a long-term cointegration relationship between the variables.

Table 2. Unit root test result.

Panel A: Intermediate ADF test results at level					
Variables	**Prob.**	**Lag**	**Max Lag**	**Obs.**	
LNGHEPC	0.1573	0	9	37	I(0)
LNSSGDP	0.8249	0	9	37	I(0)
LNTSGDP	0.9081	0	9	37	I(0)
LNFC	0.8230	0	9	37	I(0)
Panel B: Intermediate ADF test results at first difference					
D(LNGHEPC)	0.0004	0	8	36	I(1)
D(LNSSGDP)	0.0004	0	8	36	I(1)
D(LNTSGDP)	0.0137	0	8	36	I(1)
D(LNFC)	0.0000	0	8	36	I(1)

Table 3. Cointegration test results.

Panel A: Johansen cointegration test					
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace statistic**	**0.05 critical value**	**Prob.****	**Decision**
None *	0.570819	55.44086	54.07904	0.0376	Trace test indicates 1 cointegrating eqn. at the 0.05 level
At most 1	0.264012	24.98927	35.19275	0.4009	
At most 2	0.209954	13.95379	20.26184	0.2926	
At most 3	0.140961	5.469893	9.164546	0.2358	
Panel B: ARDL bound test					
Test statistic	**Value**	**Significance**	**I(0)**	**I(1)**	**Decision**
F-statistic	6.5551	10%	2.37	3.2	Cointegration exist
K	3	5%	2.79	3.67	
		2.5%	3.15	4.08	
		1%	3.65	4.66	

4.2. Long-run effect results: FMOLS and robustness check with (DOLS and CCR)

The results of the cointegration estimation technique (FMOLS) that was conducted on the impact of the examined independent variables on dependent variable are reported in the **Table 4**. Table show that all the independent variables except fiscal capacity exhibit statistically significant coefficient. For the statistically significant variables, the direction of relationship however differs, such that while the direction of relationship is negative for the secondary sector GDP (coef. = −2.8027; $p < 0.05$) it is positive for the tertiary sector's GDP (coef. = 4.9735; $p < 0.01$), respectively. Results from robustness check estimation techniques (DOLS and CCR) is consistent results with the FMOLS estimation result. More precisely, a

statistically significant negative (DOLS: −3.10; CCR: −2.80) association at 5% was found to exist in respect to secondary sector GDP. Whereas a corresponding increase in government health expenditure by about 5.11 percent and 4.97 percent because of 1 percent increase in tertiary sector GDP is revealed for DOLS and CCR, respectively.

Table 4. FMOLS and robustness check with (DOLS and CCR) results (source: computed by authors).

	FMOLS		**DOLS**		**CCR**	
	Coef.	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**
LNSSGDP	−2.8027	0.0018*	−3.0969	0.0223***	−2.8032	0.0028*
LNTSGDP	4.9735	0.0000*	5.1071	0.0000*	4.9732	0.0000*
LNFC	0.4429	0.3711	0.9288	0.3546	0.4380	0.3752
Constant	−29.2393	0.0000*	−28.7931	0.0001*	−29.2115	0.0000*
R-squared	0.986067		0.991282		0.986083	
Adjusted R-squared	0.984801		0.986527		0.984818	
S.E. of regression	0.140331		0.125374		0.140250	
Mean dependent var	6.656016		6.665332		6.656016	
S.D. dependent var	1.138256		1.080115		1.138256	
Sum squared resid	0.649860		0.345812		0.649114	
Jarque-Bera test for normality	0.1268		1.3143		0.1271	
Prob.	0.9386		0.5183		0.9385	

*, **, *** indicate significance at 1 percent, 5 percent, and 10 percent.

5. Discussion

The research sheds light on the intricate relationship between fiscal capacity, sectoral economic performance, and public health expenditure in South Africa. The coefficient of the secondary sector GDP is −2.8027, implying that for a 1 percent increase in the secondary sector economic activities, government spending on the health sector would reduce by about 2.8 percent. This negates the Wagner hypothesis underpinning this study that economic growth increases government expenditure. This finding is consistent with the Wagner hypothesis and related studies (Espinosa et al., 2023). Economic growth without a corresponding impact in government expenditure might occur when the growth experienced does come contribute to generated revenue. If governments have difficulty effectively taxing the profits generated by secondary sector enterprises, due to tax evasion or legal loopholes, this can lead to a loss of revenue. This deficit can impact the government's ability to adequately fund health care costs and other essential public services. Similarly, the provision of subsidies and incentives to support the growth of secondary sector due to record of unencouraging performance could have reduced the overall tax revenue generated by the sector while the growth in the sector is promoted. The coefficient for tertiary sector GDP is positive (4.97) and significant ($p < 0.05$), indicating that 1% increase in tertiary sector GDP leads to about 4.97% increase in government health expenditure when all other variables are held constant. This finding is consistent with the Wagner hypothesis and related studies (Awe et al., 2020; Behera

and Dash, 2019; Boachie et al., 2014; Chipunza and Nhamo, 2023; Dincer and Yuksel, 2019; Gatsi et al., 2019; Kyissima et al., 2017; Khan, 2022; Mohapatra, 2017) that found a positive impact of GDP on government health expenditure. This further suggest that tertiary sector is an essential sector that can enhance the revenue capacity of the government in South Africa. This is not unexpected because South Africa has transitioned from an economy that is based on the primary sector to one based on a flourishing tertiary sector (Bhorat et al., 2020). Bhorat and Rooney (2017) noted that the financial and business sector including tourism and information technology has become the main drivers of growth of the economy expanding in terms of value added and employment while the primary sector and secondary sector have collapsed.

The coefficient of fiscal capacity variable is positive (0.44) but statistically insignificant in the long-run. This indicate that 1% increase in fiscal capacity could increase government health expenditure in the health sector. The direction of impact indicate that the finding is yet consistent with the revenue-expenditure hypothesis and the findings of previous studies (Behera and Dash, 2018, 2019; Chipunza and Nhamo, 2023; Ke et al., 2011; Micah et al., 2019; Sfakianakis et al., 2021). The statistically insignificant finding may be due to inefficiencies in the allocation of fund which may weaken the impact of fiscal capacity on health spending.

6. Conclusion

This study tested the Wagner hypothesis and revenue-expenditure hypothesis, respectively by modelling the relationship sectoral component of economic growth, fiscal capacity, and public health expenditure in South Africa for the years 1984–2020. The study primarily utilized FMOLS to explore the relationship's direction and extent of impact. DOLS and CCR estimation techniques were used as a robustness check for FMOLS estimation result. The study findings invalidated the Wagner hypothesis for secondary but validated for the tertiary sector. The findings emphasize the need for policy makers to recognize that the economic strength of the different sectors can have different impacts on public health expenditure, specifically stressing the importance of enhancing economic growth in the tertiary sector and maximize its revenue generation capacity for public health financing. Investigating the specific mechanisms through which the tertiary sector positively influences public health expenditure is suggested for further research.

Author contributions: Conceptualization, ETM; methodology, ETM; software, ETM; validation, ETM; formal analysis, ETM; investigation, ETM; resources, ETM; data curation, ETM; writing—original draft preparation ETM and MFZ; writing—review and editing, ETM and MFZ; visualization, MFZ; project administration, MFZ; funding acquisition, MFZ. All authors have read and agreed to the published version of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

Notes

Primary sector GDP was excluded because its series failed the preliminary unit root test requirement.

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