ECONOMIC RESEARCH FORUM
منتدى البحوث الاقتصادية
Working Paper Series


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Roos Elizabeth, L and Adams Philip, D

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Roos Elizabeth, L[2] and Adams Philip, D[3]

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**July 2019**

Send correspondence to:
Roos Elizabeth, L
Victoria University
louise.roos@vu.edu.au

[1] The work described in this paper was carried out by the Centre of Policy Studies. The views expressed are those of the authors and do not represent the views of the organisation or members thereof.

[2] Centre of Policy Studies, Victoria University, Melbourne, Australia.

[3] Centre of Policy Studies, Victoria University, Melbourne, Australia.

First published in 2019 by
The Economic Research Forum (ERF)
21 Al-Sad Al-Aaly Street
Dokki, Giza
Egypt
www.erf.org.eg

**Abstract**

The oil price fell from around $US110 per barrel in 2014 to less than $US50per barrel at the start of 2017. This put enormous pressure on government budgets within the Gulf Cooperation Council (GCC) region, especially the budgets of oil exporting countries. The focus of GCC economic policies quickly shifted to fiscal reform. In this paper we use a dynamic CGE model to investigate the economic impact of introducing a 5 per cent Value Added Tax (VAT and a tax on business profit, with specific reference to the Kingdom of Saudi Arabia (KSA).

Our study shows that although the introduction of new taxes improves government tax revenue, markets are distorted lowering economic efficiency and production due to a tax. In all simulations, real GDP, real investment and capital stock falls in the long-run. This highlights the importance of (1) understanding the potential harm caused to economic efficiency and production due to taxes, and (2) fiscal reform includes both government expenditure reform and identifying non-oil revenue sources. This allows for the design of an optimal tax system that meets all future requirements for each of the individual Gulf States.

**Keywords:** Computable General Equilibrium (CGE) models, Saudi Arabia, Fiscal reform.

**JEL Classifications:** C68, D58, E62, O53.

# 1 Introduction

Most Gulf Cooperation Council (GCC) States[2] depend directly on exports of hydrocarbons as a source of income, wealth and employment. Low and fluctuating oil prices, as witnessed over the past five years, place severe strains on the GCC economies, with severe downward pressure on fiscal and current account positions.

Faced with these challenges, the GCC governments have responded with strategies that include programs of: (1) fiscal restructuring; (2) labour market reform; and (3) industrial diversification. While these strategies make good sense in their own right, they do overlap and hence there is a potential for conflict. For example, fiscal reforms (e.g. the introduction of new income taxes) may change the structure (and hence diversity) of the economy; diversification of the industrial structure may affect the structure of demand for skills and occupations; and both diversification and labour market reform may have significant fiscal effects.

In this paper, we focus on the largest of the GCC economies, Saudi Arabia. Using a dynamic CGE model called the General Equilibrium Model for Saudi Arabia (GEMSA) we run two experiments designed to shed light on the economic impacts of fiscal reform. In the first experiment we impose a 5 per cent VAT on the use of goods and services by households. The expected VAT revenue is SAR 35 billion. In the second experiment we introduce a tax on business profit that generates similar revenue as the VAT. In a later paper we will turn our attention to the effects of labour market reform and economic diversification, and the interplay with fiscal restructuring.

Introducing new taxes or changing existing tax rates, effectively introduce distortions by creating a wedge between the price buyers pay and the price received by producers. Such distortions reduce economic efficiency and overall production. The extent to which they reduce production can be measured using the concept of *excess burden*.[3] Because GEMSA is a dynamic single-country model, it can calculate year-on-year excess burden measures using a similar principle as Nassios et al (2019) and Dixon and Nassios (2018, 2016). Preliminary long-run results show that the business profit tax bears a larger excess burden than the VAT. In relative terms, VAT is therefore the preferred means to raise revenue.

An efficient tax system seeks to minimise excess burdens that arise from taxes. One way of doing this is to quantify and rank the excess burden caused by the different taxes. Thus far, tax reform analysis for the GCC mainly focus on identifying (i) various potential non-oil revenue sources; (ii) potential revenue raised via non-oil revenue sources (measured as a share of GDP or government income) and (iii) the potential impact on budget balances (measured as a share of GDP). To our knowledge, no study focuses on quantifying the potential distortion of tax on the economy for the GCC States.

The rest of the paper is organised as follows. Section 2 provides background information on the current economic situation in the GCC States, with particular emphasis on fiscal reform. Section 3 presents the Saudi CGE model used in this study. An overview of the data which forms the core database

[2] The Charter of the Gulf Cooperation Council was signed in May 1981, thereby officially establishing the Gulf Cooperation Council (GCC). The member states are the United Arab Emirates (UAE), Kingdom of Bahrain, Kingdom of Saudi Arabia, Sultanate of Oman, State of Qatar and the State of Kuwait.

[3] How is the excess burden determined? Pioneering work by Harberger (1962, 1964, 1966) yielded formulae and estimates of the excess burden of corporate and income taxes in the United States. These excess burden results showed that both corporate and income taxes reduce national income and therefore economic welfare. In a similar exercise for Australia, researchers at the Centre of Policy Studies developed a bottom-up, dynamic, multi-regional CGE model for Australia's states and territories in an effort to better understand the efficiency cost of the many state and federal taxes (Nassios et al., 2018, 2019; Dixon and Nassios, 2018, 2016).

is given in Section 4. Section 5 describes the simulation design. Results are presented in Section 6, and concluding remarks are in Section 7.

# 2 Tax reform in the GCC

## 2.1 The general situation

The KSA introduced personal income, corporate and capital gains taxes in 1950 on both nationals and non-Saudis. However, within 6 months the tax law was changed to exclude nationals and in 1975 income tax on foreigners were suspended (IMF, 2016b: 4-5). Kuwait introduce corporate tax in 1955. Although other GCC states soon followed, corporate tax rates were drastically reduced to promote foreign investment (IMF, 2016b: 4-5).[4]

Generally, there is limited personal income taxes levied in the GCC regions, with little or no taxes imposed on wages. Qatar and the KSA have limited income taxes and fees on non-GCC national working in these countries. In addition, Zakat is paid by nationals and is levied at 2.5 per cent of a person or companies net worth and is paid to help the poor.[5]

Taxes on profit mostly applies to foreign non-oil companies. The effective tax rate paid by foreign companies is lower due to tax relief and incentives extended to foreign companies to compensate for the loss in revenue and to promote investment.

Custom duties are unified across the GCC. In January 2003, the Common external Tariff (CET) was introduced at 5 per cent on all non-GCC products, except for those good that are exempted.

There are some very low consumption taxes. The UAE, Bahrain and Oman impose municipal taxes ranging from between 3 – 10 per cent on property rentals, hotels, entertainment and government services such as issuing passports and drivers licences. Oman imposes a 2 per cent tax on electricity while Bahrain imposes a 12 per cent sales tax on gasoline. In most GCC countries there are no property taxes(IMF, 2016b: 5).

In all GCC States, social security is paid by nationals. Employers and employees pay the social security tax. In all except the KSA, employers pay a higher share while in the KSA the share is equally split between employers and employees (IMF, 2016b: 6).

Finally, in most of the GCC States there are fees and taxes on the employment of foreign workers which is used to support and train the national labour force. The KSA and Bahrain impose monthly fees on foreign workers to train nationals. Oman has the same system but the fee is calculated as a percent of the foreign worker wage bill. The UAE imposes bi-annual work permit fees, while Kuwait imposes a tax on the annual net profits of Kuwaiti companies listed on the stock market. Qatar imposes no fees or taxes on wages earned by nationals and non-nationals (IMF, 2016b: 6).

Given the current tax-mix, there is scope to broaden tax revenue sources by introducing new taxes and/or increase existing tax rates and fees. In doing so, the Common VAT Framework Agreement between all GCC member states was finalised in 2016.[6] Under this agreement, a VAT rate of 5 per cent

[4] Corporate tax rates in the GCC were reduced: for example in Kuwait from 55 percent in 2007 to the current level of 15 percent, in the KSA from 45 per cent in 1999 to 20 per cent in 2006 and Qatar from 35 per cent in 2009 to 10 per cent in 2010. Bahrain and the UAE records no corporate tax while Oman's corporate tax rate was around 12 per cent until it was increased to 15 per cent in 2017 (Trading economics online data facility).

[5] Zakat is mandatory in the KSA, voluntary in Bahrain, Kuwait, and UAE and there is no specific government system in Oman and Qatar (Zakat by country, 2010).

[6] This agreement is available at https://www.tax.gov.ae/pdf/GCC-VAT-Agreement.pdf.

will be introduced in each Gulf state.[7] There is some discretion that allows states to determine exempted and zero-rated items.[8]

The KSA and the UAE were the first GCC countries to introduce VAT and excise taxes on cigarettes, energy and sugar drinks. The UAE and KSA introduced VAT as of 1 January 2018. Bahrain introduced excise taxes on tobacco products, energy and soft drinks in December 2017 and will introduce VAT on 1 January 2019 (Khaleej Times, 2018). Qatar, Kuwait and Oman requires more time to introduce VAT due to technical and political issues. At the earliest, Oman and Qatar could introduce VAT by middle 2019 (Taxamo, 2018; Khaleej Times, 2017a; Khaleej Times, 2017b). The IMF suggested that if the Gulf States introduce VAT separately, that they decide on a reasonable transition period (3–5 years), by the end of which VAT is uniformly introduced in the GCC States.[9]

## 2.2 The case of KSA

Figures 1 to 3 show the fiscal position of the KSA from 2008 to 2023. Figures 1 and 2 focus on government revenue and expenditure, while Figure 3 summarises the budget balance and public debt. Historical data for 2008 to 2017 is from the Saudi Arabian Monetary Authority (SAMA) while forecast data is taken from the IMF (IMF, 2018a).

Figure 1 shows government revenue from oil and non-oil revenue sources as well as the oil price per barrel. Clearly indicated in this graph is the strong correlation between the oil price (USD/bbl) and government revenue. Oil revenues comprise the largest share of revenue ranging from 92 per cent in 2011 (average oil price of 107 USD/bbl) to 63 per cent in 2017 (average oil price of 52 USD/bbl). From 2018 onward, the IMF forecasts moderate growth in total government revenue.

[7] The low rate of 5 per cent is advisable because it will encourage the design of simple and broad based taxes which are easier to manage and have little or no efficiency costs and not hinder any efforts to diversify the economy (IMF, 2016b:11).

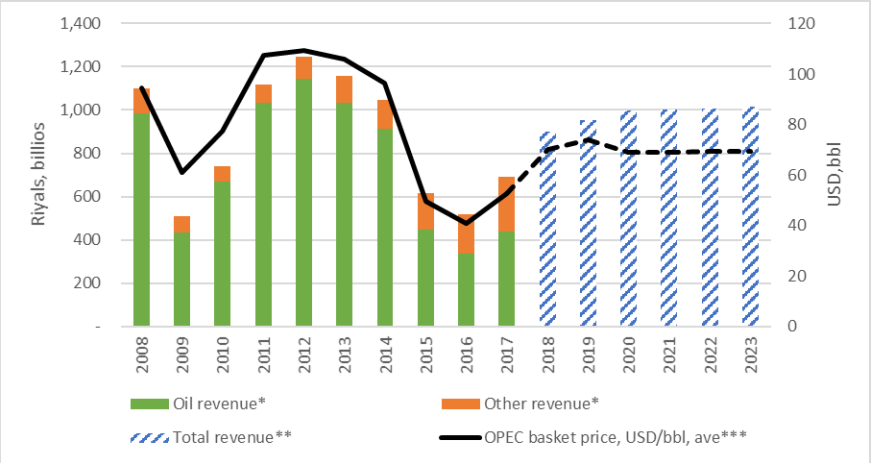
[8] Exempted supplies (Article 1(27) of the GCC VAT Agreement) include financial services, insurance, military and charitable items.

Zero-rated items implied medicine and medical equipment, good and passenger transport and other allied services and the supply of gold, silver and platinum.

Each state has the right to zero-rate items they see fit. It is likely that most of the GCC states will zero-rate similar items such as oil and oil derivatives, land and transportation (Innovate tax).

[9] Placing a timeframe on the introduction of new taxes, limits the risk to regional competitiveness. Introducing new taxes or widening of tax bases, could lead to a shift in consumption, investment and trade to other countries in the short-run. In the long-run these negative effects on competitiveness could be address through measures improving business and investment and increasing transparency of the tax system. These effort could reduce production costs and attract foreign investment (IMF, 2016b: 11).

**Figure 1. Government revenue and the oil price, 2008 – 2023 (Riyals billions, USD/bbl)**

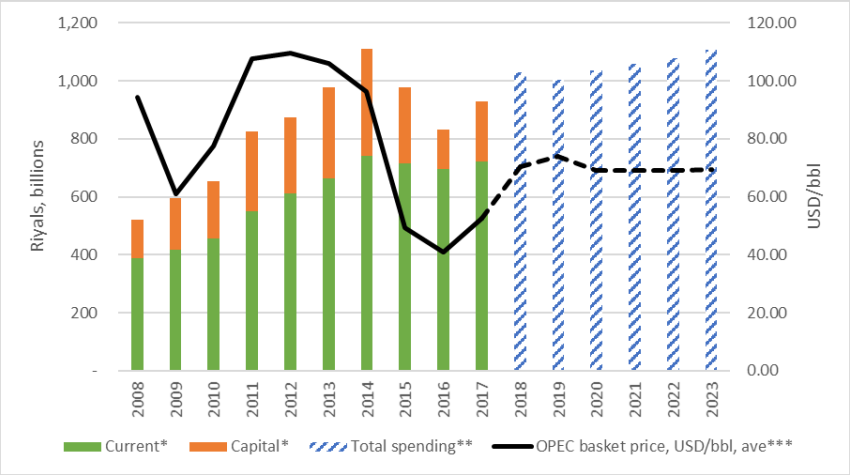



Source: * SAMA, 2017.
** IMF WEO data. Estimates start after 2017.
*** OPEC basket price, 2008 – 2017.

Since the fall in the oil price, the contribution of non-oil revenue to total revenue has increased. This increase reflects two factors. Firstly, there was an increase of investment income from SAMA. This reflects a willingness by the government to investment in assets with potentially higher-returns (Jadwa Investment, 2015; 2017; 2018). Secondly, a number of new and higher fees and taxes were introduced on tobacco products and royalties (Jadwa Investment, 2016). From 2018 onwards, it is expected that the additional VAT revenue will contribute significantly to non-oil tax revenue, with this contribution increasing as the VAT threshold is lowered. Currently, VAT applies to enterprises with an annual income of SR 1 million, but in 2019 this threshold will be lowered to include enterprises with an annual income of SR 375 thousand and above (Jadwa Investment, 2018). Other non-oil revenue sources include expat levies and excise taxes. It is projected that oil revenues as a share of total revenue will decrease to approximately 42 per cent by 2023 (Jadwa Investment, 2017).

Figure 2 shows government expenditure, historically and as forecast by the IMF through to 2023. The largest share of spending is current spending. Since 2015, growth in current spending has fallen due to lower spending on allowances which contributed to a reduced wage bill (Jadwa Investment, 2016; 2017). Capital spending is set to increase over time. This reflects the government's effort to promote private sector growth and to help achieve the objectives of Vision 2030 in areas such as housing, mining, energy, manufacturing, transport, entertainment, telecommunications and SME's (Jadwa Investment, 2017). The returns on these investments is projected to increase non-oil revenues (see Figure 2). The largest expenditure item is on military and security, which is approximately 37 per cent of expenditure, followed by education and health at approximately 25 and 13 per cent respectively. Together, the combined spending allocations is 75 per cent of total allocations. It is expected that the distribution of spending will remain unchanged in future.

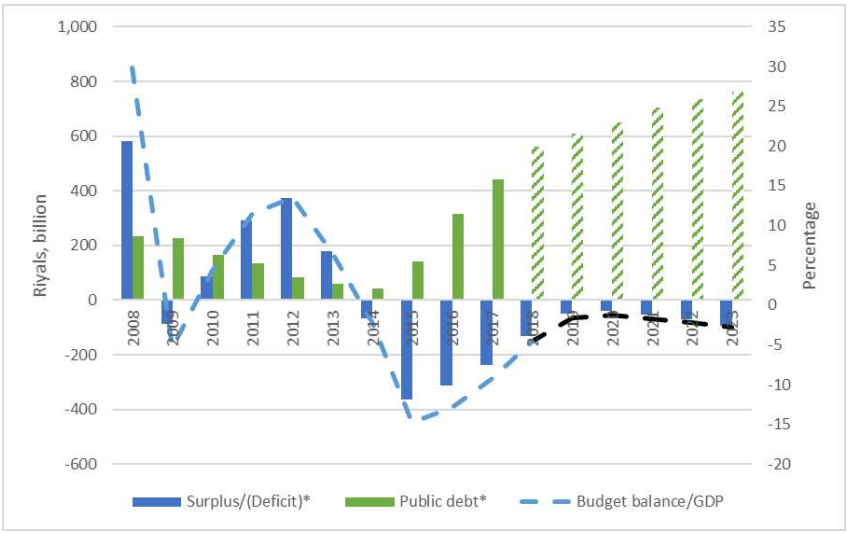
**Figure 2. Government expenditure, 2008 – 2023 (Riyals billions, USD/bbl)**




Source: * SAMA, 2017.
** IMF WEO data. Estimates start after 2017.
*** OPEC basket price, 2008 – 2017.
World Bank projections taken from Knoema online data. Estimates after 2017.

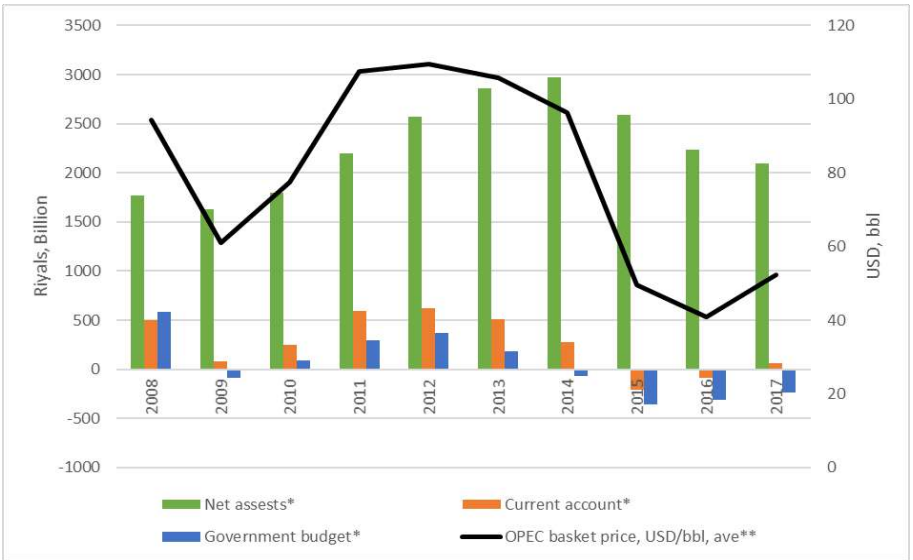
Drawing on historical data and IMF forecasts, Figure 3 shows the Riyal value of the budget balance, public sector debt as well as the budget as a share of GDP. Historically, public debt as a percentage of GDP was low. However, with the low oil price and accompanied deficit, public debt increased. Public debt totalled SR 443 billion at the end of 2017, which is approximately 17.2 per cent of GDP (SAMA, 2017). The government revised its borrowing requirement, with debt projections set to increase close to 25 per cent of GDP in 2025 (Jadwa Investment, 2018).

**Figure 3. Government budget balance and public debt, 2008 – 2023 (Riyals, billions)**




Source: * SAMA, 2017.
IMF WEO data. Estimates start after 2017.

**Figure 4. Net assets, government budget and current account balance, 2008-2017 (Riyal billion)**




Source: * SAMA, 2017.
** OPEC basket price, 2008 – 2017.

Figure 4 shows the correlation between the change in the oil price per barrel, the government budget balance, the current account balance and net foreign reserves. The KSA holds considerable net foreign assets which allowed the Kingdom to alleviate the impact of lower oil prices and finance deficits. The general trend is that if the oil price is high (lower) the current account and government balance improves (worsens). Net foreign liabilities follow the same trend. Financing deficits by drawing on net foreign assets is not sustainable in the long-run. This reinforces the need for reforms, including the diversification of non-oil revenue sources (such as VAT) that would allow the government to generate a stable and predictable revenue stream, independent of changes in the oil price.

# 3 The model

Modelling the economy-wide impact of an increase in the VAT rate on all non-zero commodities requires a detailed model that accounts for commodity-specific tax rates paid by specific users.

GEMSA models production of 57 commodities by 57 industries. Figure 5 illustrates the production structure. Each industry in GEMSA produce (supply) output using intermediate inputs, i.e., commodities from domestic or imported sources, capital, land, and labour. Labour is distinguished by 9 occupational types, nationality and gender. The production specification is managed by a series of separability assumptions illustrated by the nesting structure in Figure 7. Each nest includes demand equations derived from solving optimisation problems. For example, the bottom right hand corner of Figure 7 shows the labour-gender nest. This nest include equations, which determine industry's gender-specific labour demand that minimise labour cost subject to a constant elasticity of substitution (CES) production function. Nests for the demand for primary factors and composite intermediate commodities represent a similar optimisation problem.

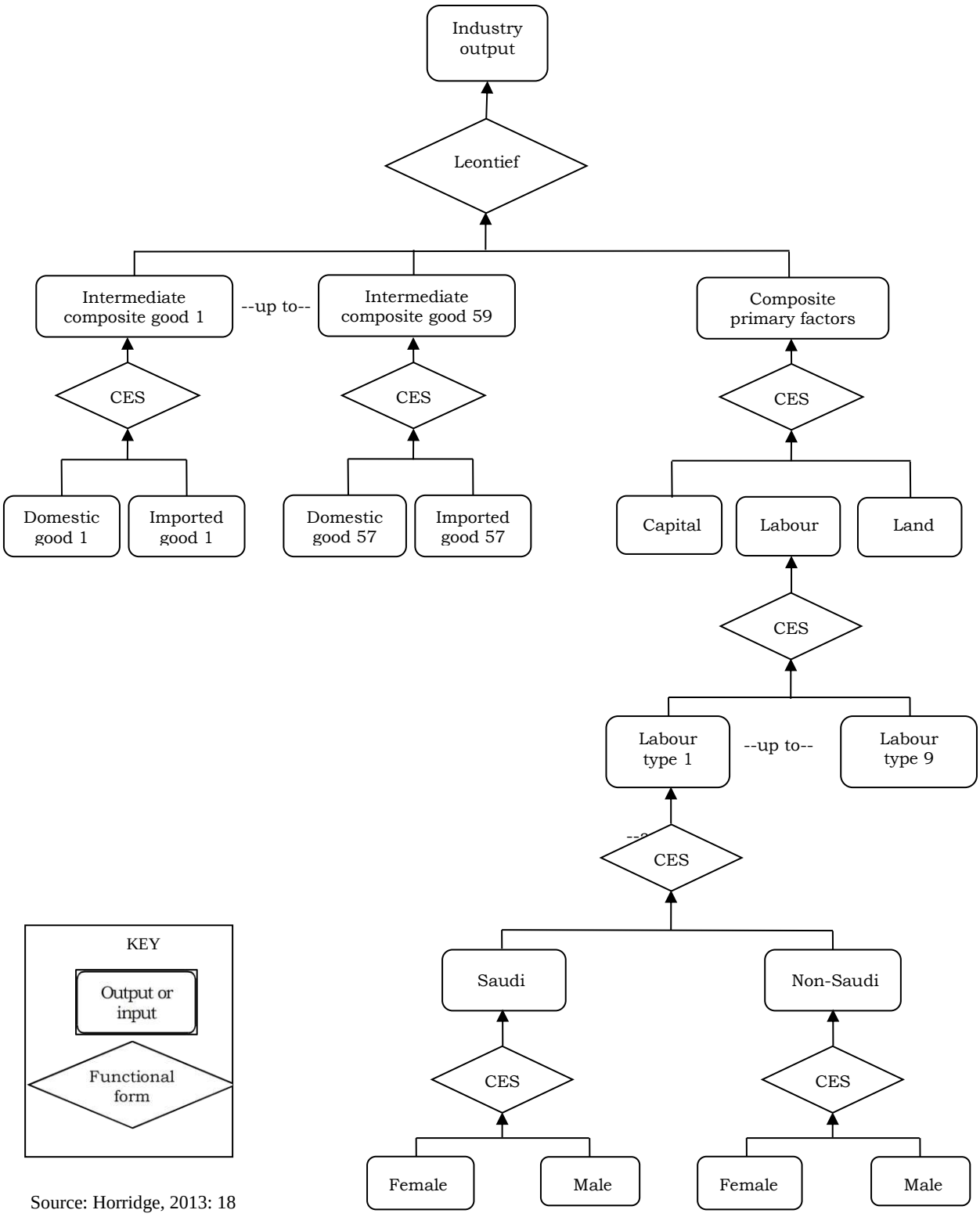
In creating capital, investors choose inputs that are cost minimising combinations of Saudi and foreign commodities. We assume that domestic and imported varieties of commodities are imperfect substitutes for each other, using constant elasticity of substitution (CES) functions. GEMSA has one representative household. This household optimisation problem is solved in two nests. In the first nest, we assume that the household chooses a combination of composite commodities to maximise utility

subject to their budget. In the second nest, the household chooses commodities from domestic or imported sources to minimise costs, subject to a CES function. The export demand equations for Saudi commodities relate export volume inversely to foreign-currency prices. GEMSA has one central government and includes equations determining the consumption of source-specific commodities by government. Government demand is either determined exogenously, or can be linked to aggregate household consumption. The model includes equations determining various tax and subsidy rates, which facilitates modelling of both indirect and direct tax collections.

GEMSA recognises three main types of dynamic adjustment: capital accumulation, a lagged adjustment mechanism in the labour market, and public debt accumulation. These dynamic relationships allow the model to trace explicitly each variable through time at annual intervals.

Each industry accumulates capital, which links to industry-specific net investment. Changes in industry-specific investment are linked to changes in industry-specific rates of return. Annual changes in the net liability position of the economy are related to the annual current account balance. GEMSA includes a mechanism that guides the labour market from a typical short-run scenario (employment adjusts while the real wage remains sticky) to a long-run scenario (real wage adjusts while employment remains unchanged from the baseline). Typically, a positive (negative) labour market outcome manifests in the short-run as an increase (decrease) in employment away from the baseline, while real wages remain sticky. In the long run, a positive (negative) outcome manifests as an increase (decrease) in the real wage away from the baseline while employment moves toward the baseline.

**Figure 5. Structure of production**




Source: Horridge, 2013: 18

In this paper we are interested in the economic impact of a VAT and a business tax. GEMSA includes various paths through which changes in commodity-specific VAT and business taxes are accounted for.

1. The VAT is treated as a consumption-sales tax paid by the final user of commodities, normally households. The direct impact is an increase in the purchase-prices of commodities used in consumption relative to their production price. Overall, when a consumption tax is introduced, consumer prices increase, raising the cost of living.
2. A business tax is imposed on capital returns and paid by the owners of capital. The business tax impacts the after-tax rate of return on capital which holds consequences for industry-specific investment, capital and output.
3. Taxes are also accounted for through changes in government revenue and, ultimately the government's budget balance. *Ceteris paribus*, raising non-oil revenue improves the government balance.
4. Increased government revenue allows for greater government spending immediately or in the future. For example, transfers can be made to households, or may be used to finance capital spending in sectors that will promote economic growth a job opportunities. This in turn impacts non-oil revenue.

See Appendix 1 for a description of a set of equations that allows us to understand how indirect and direct taxes are accounted for in the model.

# 4 The database

In its current configuration, GEMSA is calibrated to the 2010 Supply-Use Tables, updated to 2015 National accounts data (GAS, 2018). These data are complemented with data from the government budget, Saudi Arabia's account with the rest of the world and labour market statistics.[10]

The initial database for a CGE model is important because: (1) it contains information regarding the structure of the Saudi economy in the base year; (2) it is useful in the interpretation of results; and (3) in a Johansen-style CGE model, it is the initial solution to the CGE model (Roos et al., 2015). The SUT is not in the required format of the CGE database and therefore a number of steps were taken to convert the published data into the format required by GEMSA. We highlight the following characteristics of the core database.

The model requires a core database with separate matrices for basic, tax and margin flows for both domestic and imported sources of commodities sold to domestic and foreign users, as well as matrices for the factors of production, namely labour, capital and land. Commodities can be used as intermediate inputs by domestic industries, investors, a representative household, foreigners, the government or held as inventory. GEMSA includes a detailed treatment of margins. For each commodity valued at basic prices we have a corresponding margin matrix, showing the cost of margin services used to facilitate the flow of commodities from all sources to the users of these commodities.

Of special interest in this paper is the modelling of taxes. For each commodity valued at basic prices we have tax matrices showing the indirect taxes paid on the use of commodities from all sources by various users. Consistent with the published national accounts, the elements in the tax matrices in the core database are set to zero, reflecting the fact that there are no indirect taxes on the use of commodities.

[10] General Authority for Statistics, Kingdom of Saudi Arabia. National Accounts 1437/1438 (2016). Available at: https://www.stats.gov.sa/sites/default/files/national_accounts_2016_en.pdf
Saudi Arabian Monetary Authority. Annual Statistics 2017. Available at: http://www.sama.gov.sa/en-US/EconomicReports/Pages/YearlyStatistics.aspx

There are import duties, which are explicitly accounted for in the database via a satellite matrix, and are also included in the flow of imported commodities valued at basic price. This allows for the calculation of ad valorem rates as the ratio between tax revenues and the relevant basic flows of commodities on which the taxes are levied.

The database includes matrices showing the value of primary factors used by industries in current production. These matrices include inputs of three factors of production: occupation specific labour payments by industry, nationality and gender, capital rentals by industry and natural resources by industries. Natural resource use is restricted to agricultural and mining industries. Only industries pay production taxes. The database shows that labour, capital, natural resource and production taxes are only used in current production. The database includes a multi-product matrix showing the basic value of commodities produced by the various industries or stated differently, it shows the value of industry output. See Appendix 2 for a summary of the cost and sales structures captured in the database for 26 aggregated sectors.

The data suggests that the economy is largely based on, and driven by one sector namely crude oil and gas. As an industry, crude oil and gas contributes the most in terms of value added followed by the service industries. Manufacturing industries contribute the least, reinforcing the idea that the economy lacks diversification. The labour market is highly segmented. The KSA is highly dependent on foreign, temporary labour. Expatriate labour comprise 56 per cent of the number of employed. In general expatriate workers earn a lower wage than their Saudi counterparts. Expatriate workers are mostly employed in trade services, hotel and accommodation, domestic help and construction while Saudi nationals are mostly employed in the public sector. Female labour market participation rates remain low for both nationals and expatriates. A large share of wages earned by the expatriate community, are transferred abroad as remittances. Remittances as a share of GDP was 5.8 per cent of GDP in 2015.[11]

The government data shows a budget deficit which is 15.8 per cent of GDP. Oil revenue dominates government income at 72.6 per cent. Non-oil revenue contributes 27.4 per cent. Total government spending is dominated by government consumption. Capital spending is 21 per cent of total spending. The database includes values for taxes including customs, taxes on income and profit and visa taxes. Together tax revenue contributes 9.4 per cent of total revenue. This is approximately 2.3 per cent of GDP. The proposed VAT rate of 5 per cent is low compared to other countries.[12] A 5 per cent VAT rate is expected to generate SAR 35 billion, which is approximately 1.3 per cent of GDP.

# 5 Simulation design

Policy analysis with GEMSA, requires two simulations. The first simulation is the baseline forecast simulation. This simulation models the growth of the Saudi economy over time in the absence of the policy change under consideration. GEMSA is used to trace out the implications of the specialists' forecasts at a high level of sectorial detail.

The second simulation is the policy simulation. The policy simulation generates a second forecast that incorporates all of the exogenous features of the baseline forecast, plus policy-related shocks reflecting the introduction of a tax. The results of the policy simulation are typically reported as percentage deviations away from the baseline forecast. We solve the model using GEMPACK (Horridge et al., 2018).

[11] Balance of Payments data shows that remittances was SAR 141,785 million in 2015 (GAS, 2017).
[12] The standard VAT rate in Jordan is 16 per cent, Lebanon at 10 per cent (IMF, 2016b: 16).

## 5.1 Baseline simulation

The initial database represents the economy in 2015. In developing the baseline simulation we imposed on the model data for a number of variables.[13] For the current baseline we impose, for selected macroeconomic variables, forecast data from the IMF's World Economic Outlook (WEO) (IMF 2018). The forecast data extends to 2023. Thereafter we impose average growth rates based on the IMF forecast data.

Table 1 summarises the data imposed in the baseline simulation. The first three columns show the forecast values for GDP, population growth and inflation (IMF, 2018a).

The IMF does not forecast employment, only population growth. We view the growth in national employment as tied down to the growth in the labour force, determined by demographic factors and immigration policy.

In line with the IMF projections, oil prices are expected to remain subdued in the medium term compared to their level before mid- 2014 (IMF, 2016a: 7). In the forecast simulation, oil prices gradually increase over time from a record low of US$ 42 in 2016 to US$ 70 in the long run (See Figure 4 for the price of oil from 2008 to 2017).[14]

We also impose the IMF view on the government budget balance as a share of GDP (IMF, 2018a). IMF data shows that the budget balance as a share of GDP in the base year is -15.8 per cent.[15] Thereafter this share falls to a medium to long run average of -3 per cent. This is consistent with the growth path of the government budget balance as a share of GDP illustrated in Figure 3.[16]

Although the KSA is largely a tax-free environment, GEMSA includes equations describing tax revenue generation. In the baseline simulation, all commodity tax revenues apart from import duties, are forecasted to be zero. Thus, in the baseline simulation, over 70 per cent of government revenue is from the sales of crude oil. The remainder includes fees and charges, return on investments and other non-tax revenues.

[13] In a typical baseline closure the choice of exogenous variables is largely determined by the availability of independent forecasts data from reliable sources such as the Ministry of Finance or the IMF. Forecast data are usually available for naturally endogenous variables (e.g. GDP, C) in the model. To accommodate forecast data, these naturally endogenous variables are swapped with naturally exogenous variables (e.g. A, APC). For example, real private consumption (a naturally endogenous variable) is set exogenously by allowing the average propensity to consume to adjust endogenously. This allows the newly exogenous variables to be shocked with the data and allows structural variables to be determined endogenously.

[14] There is a difference in the oil price projections from the World Bank and the IMF. The World Bank projections for the average crude oil price shows a sharp increase in 2018 to US$ 70 where it remains until 2030. The IMF projections shows a gradual increase in the price of oil until 2022, which is the last year of the forecast. In our forecast, we impose the average growth rate in the price of oil from 2016 to 2030. Assuming that the average growth rate remains constant between 2023 and 2030, the forecast shows a long run oil price of US$ 70- which is consistent with the World Bank projection (Knoema Online data facility). Nevertheless, there remains much uncertainty about the future price of oil.

[15] The negative sign indicates a budget deficit while a positive sign indicates a budget surplus.

[16] The IMF reports that targeting the budget balance by 2023 is appropriate, but if oil price increase, the additional revenue should be saved. They continue to support non-oil revenue and energy price reform as well as subdued government spending (IMF, 2018b).

**Table 1. Percentage change in selected variables (2016 – 2030)**

| Year | Real GDP | Population | Inflation | Employment | Oil price | Government budget/GDP |
|---|---|---|---|---|---|---|
| 2016 | 1.67 | 2.34 | 2.03 | 2.34 | -17.64 | -12.9 |
| 2017 | -0.86 | 2.00 | -0.85 | 0.50 | 28.63 | -9.26 |
| 2018 | 2.23 | 2.00 | 2.60 | 2.00 | 34.05 | -4.55 |
| 2019 | 2.43 | 2.00 | 2.02 | 2.00 | 2.80 | -1.66 |
| 2020 | 1.91 | 2.00 | 2.20 | 2.00 | 2.80 | -1.29 |
| 2021 | 2.11 | 2.00 | 2.17 | 2.00 | 2.80 | -1.73 |
| 2022 | 2.20 | 2.00 | 2.14 | 2.00 | 2.80 | -2.19 |
| 2023 | 2.20 | 2.00 | 2.10 | 2.00 | 2.80 | -2.77 |
| 2024 | 2.20 | 2.00 | 2.10 | 2.00 | 2.80 | -3.00 |
| 2025 | 2.20 | 2.00 | 2.10 | 2.00 | 2.80 | -3.00 |
| 2026 | 2.20 | 2.00 | 2.10 | 2.00 | 2.80 | -3.00 |
| 2027 | 2.20 | 2.00 | 2.10 | 2.00 | 2.80 | -3.00 |
| 2028 | 2.20 | 2.00 | 2.10 | 2.00 | 2.80 | -3.00 |
| 2029 | 2.20 | 2.00 | 2.10 | 2.00 | 2.80 | -3.00 |
| 2030 | 2.20 | 2.00 | 2.10 | 2.00 | 2.80 | -3.00 |

As the Saudi economy grows, so does the rest of the world. In GEMSA, changes in world trading conditions occur via changes in the position of downward sloping export demand schedules and changes in foreign currency prices of imports. For our purpose it is assumed that demand from the rest of the world for non-oil Saudi products expands through the forecast period at a rate which keeps the average foreign-currency price of exports (other than oil) unchanged. The position of the foreign demand schedule for oil exports is endogenous, and moves to achieve the exogenously imposed changes in price shown in Table 1. No change is assumed for foreign-currency import prices. This, combined with the assumption for non-oil export prices, means that the economy's non-oil terms of trade is fixed. The overall terms of trade improves as a result of the growth in oil's export price (Table 1).

## 5.2 Policy simulations

We run two simulations. Both simulations generates tax revenue of SAR 35 billion via, firstly a VAT and secondly a tax on business profits.

### 5.2.1 Closure and macroeconomic assumptions[17]

The labour market is characterised by short-run stickiness of the real wage with flexible employment adjustment. GEMSA includes a mechanism that allows the labour market to transition from a short-run environment (real wage sticky ness and employment adjusts) to a long-run environment where the real wage adjusts and employment moves to its long run baseline level. In the policy simulation we assume that, if employment deviates from the baseline value initially, real wage adjustment steadily eliminates the short-run employment deviations.

Capital and investment are specific to each industry. GEMSA allows for short-run deviations in expected rates of return from their baseline levels. These cause deviations in investment, and hence capital stocks, which gradually erode the initial deviations in rates of return. Provided there are no further shocks, rates of return revert to their baseline levels in the long run.

[17] GEMSA includes a large number of equations and variables. Variables explained by equations in the model are endogenous, while variables not explained by the model are exogenous. By changing the status of endogenous and exogenous variable, different economic scenarios can be modelled.

Consumption is determined as a fixed proportion of disposable income.

Tax revenue is determined by initial effective tax rates and the change in the relevant base on which taxes are levied. In the policy closure setting for 2018, we impose a once-off increase in VAT revenue of SAR 35 billion, and allow the model to endogenously determine the required increase in the VAT rate that accommodates the imposed shock to VAT revenue. From 2019 onwards, we hold the VAT rate exogenous at the higher rate. The model then determines VAT revenue based on the higher VAT rate, and any modelled changes in the VAT base. In our policy simulation, we ensure that the tax incidence falls on households.

Non-tax revenue, fees and charges are held at their baseline projection, as is real public spending. The government's budget balance is also held at baseline values via the endogenous determination of lump sum payment to households.

The model explains changes in relative prices, but has no mechanism to determine the absolute price level. Thus, one price must be exogenous. This price is the benchmark against which all other prices are measured. In the simulations, the numeraire is the nominal exchange rate.

GEMSA contains many variables to allow for shifts in technology and household preferences. In the policy scenarios, most of these variables are exogenous and have the same values as in the baseline projection.

# 6 Results

## 6.1 VAT simulation

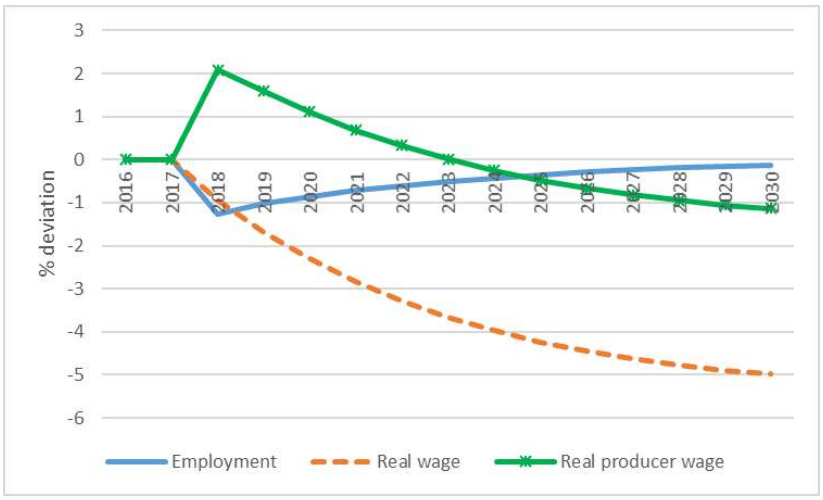
This section contains a discussion of the results of an increase in VAT. Macroeconomic impacts are dealt with first followed by industry results.

### 6.1.1 Macro results

Our explanation of the macro results begin with the impacts on the labour market. Figure 8 shows the percentage deviation in employment, the real consumer wage and the real cost of labour.[18] According to the labour market specification in the model, the real wage rate is sticky in the short run with flexible treatment of employment. Over time, the labour market moves from this short-run setting to a long-run setting where employment is fixed and real wage adjusts.

[18] The real wage is defined as the ratio of the nominal wage rate to the price of consumption. The real cost of labour is defined as the ratio of the nominal wage rate to the national price of output (measured by the factor-cost GDP deflator).

**Figure 6. Employment, real cost of labour and the real consumer wage (% deviation from baseline)**




Employment falls in the short-run because of an increase in the real cost of labour (Figure 6). The real cost of labour increases relative to the baseline because introducing VAT leads to an increase in the price of spending (for example, consumption[19]) relative to the price of production. Initially, with the real wage rate sticky, the nominal price of labour is tied to the price of consumption. Thus, if the consumption price rises relative to the price of production, the real cost of labour must increase. An increase in the real cost of labour causes producers to substitute away from labour and towards relatively cheaper alternatives, such as capital. Over time, the real wage rate falls relative to the baseline forecast, driving employment back towards its baseline value. In the short-run, with capital fixed, the fall in employment increases the capital/labour ratio.

Figure 8 shows that in the long-run the deviation in national employment is small. However, this does not mean that employment by nationality and gender at an industry level remains close the baseline level. At an economy-wide level, Saudi employment is held at the baseline level and therefore the deviation in employment is accounted for by a fall in non-Saudi employment. Our results shows that non-Saudi employment falls by 4.1 per cent in 2018. In most industries, there are permanent employment responses, especially in those industries employing a large share of expatriate workers.

Figure 7 shows the percentage deviations from the baseline in capital, investment and the rates of return. In the short-run, the increase in the capital/labour ratio leads to a fall relative to the baseline in the rates of return on capital. The fall in capital rates of return accounts for the short-run fall in investment. Over time, the capital stock therefore diminishes, driving rates of return back to baseline. This accounts for the gradual adjustment of investment throughout the simulation period.

[19] Our results show that CPI increases by 3.2 per cent. This is in-line with findings from a 2011 simulation for Kuwait which estimated the impact of the introduction of a 5 per cent VAT on inflation to not exceed 3.5-4 per cent (IMF, 2016b: 17).

**Figure 7. Investment, capital and rates of return (% deviation from baseline)**

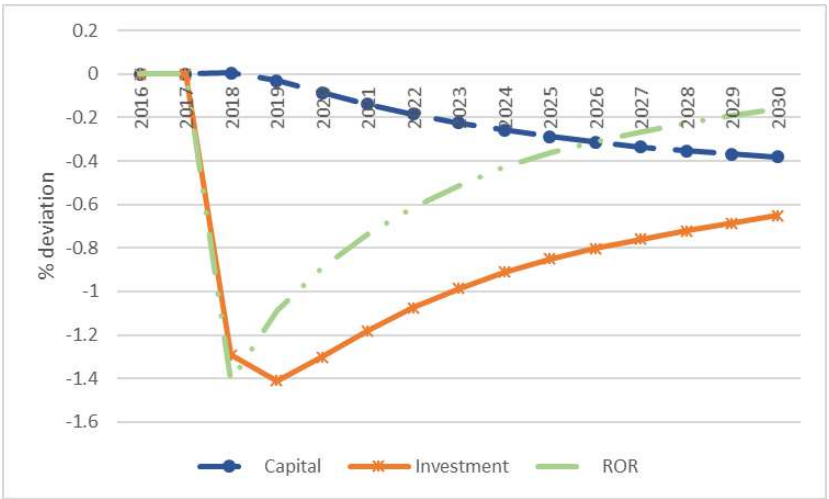



Figure 8 shows the percentage deviation in national employment, capital and GDP. GDP is calculated as the share-weighted sum of labour and capital.[20] The share of labour and capital in factor cost is 47 and 53 per cent respectively. In the short-run, with employment falling and capital unchanged, GDP falls. We see this confirmed in Figure 8. In the long-run, employment returns to the baseline while capital remains below base. [21] This accounts for the long-run negative GDP outcome.

**Figure 8. National employment, capital stock, real GDP (% deviation from baseline)**

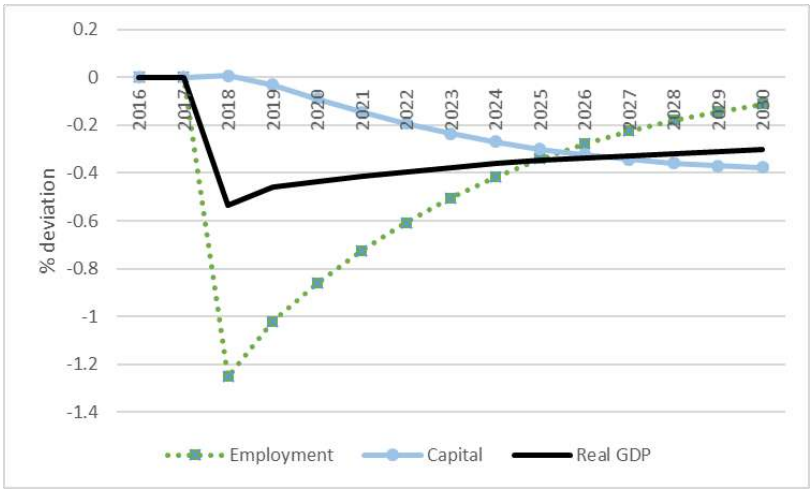


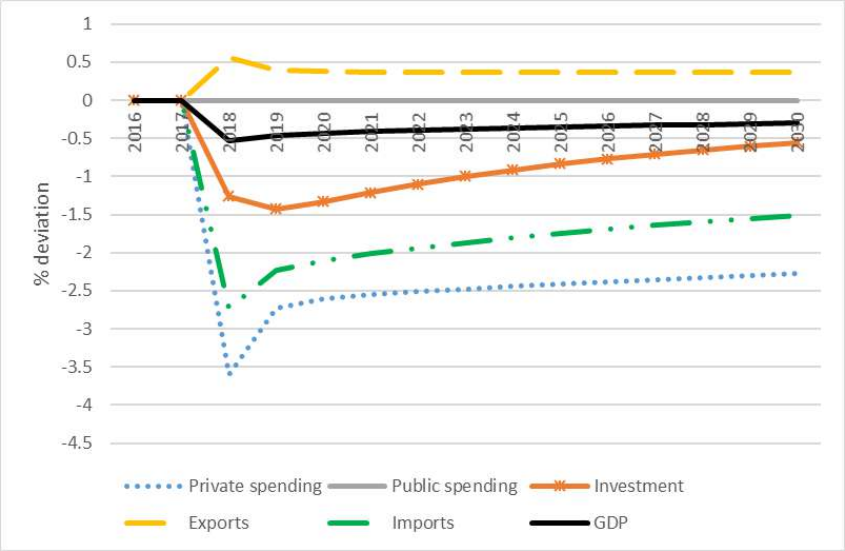

Figure 9 reports deviations in the expenditure side components of GDP. Via closure assumption, public spending is held exogenous at the baseline level. As discussed with reference to Figure 7, rates of return fall relative to baseline causing investment to fall in the short run and a fall in the long run capital stock. Consumption falls throughout the simulation period because VAT permanently raises the price of consumption (CPI). Despite investments moving toward baseline, the deviation in imports remain below the GDP deviation throughout the simulation period. This is because consumption and

[20] Note that the contributions of natural resource to the real GDP deviation are zero (because in this simulation natural resource supply does not change between policy and baseline) and are not shown.

[21] Aggregate employment moves towards its baseline level as the real wage rate falls. Our results show that that in 2030 employment is below base by 0.11 per cent. If the simulation period is extended to 2035, employment would move further towards its baseline level.

investment have a high import share[22], and therefore the negative deviation in consumption and investment drives the negative deviation in imports. Throughout the simulation period, the negative deviation in GNE (C+I+G) exceeds the deviation in GDP (Y), with the result that the net volume of trade (X-M) must improve. As shown in Figure 9 at the end of the simulation period, relative to baseline levels, the volume of exports is up by around 0.4 per cent, while the volume of imports is down by around 1.5 per cent.

**Figure 9. The expenditure components of real GDP**
**(% deviation from baseline)**




### 6.1.2 Industry results

This section focuses on the impact on industry output. For reporting, we aggregate the results for 57 industry output levels to 9 broad sectors. Figure 10 reports the output deviations of the nine broad sectors. While the output of each sector is generally depressed in both the short and long run, not all sectors are impacted in the same way when the VAT is introduced.

Real estate is the sector that performs the worst in the long run. To understand this result, we begin to consider the unique demand and supply characteristics of this sector. On the demand-side, this commodity is sold mostly to households with some services sold to industries.[23] On the supply side, over 90 per cent of this industry consists of capital. We generally assume that in the short-run capital is fixed as there is not enough time for capital to accumulate. We also assume that employment adjusts in the short run given fixed wages. Therefore in the short-run, any decrease (increase) in output must be accommodated for by a decrease (increase) in employment, holding technologies unchanged. As a consequence, capital-intensive industries have little scope to change output in the short-run. However over time capital adjusts while employment is fixed. Thus, in the long-run capital-intensive industries have considerable scope to adjust their output. With household consumption depressed due to higher consumption prices, and with the deviation in capital growth below baseline, capital-intensive sectors selling their output mostly to households underperform their peers. Similar reasoning explains the fall

[22] The initial database shows that on average 35 per cent of commodities consumed by households and 46 per cent of investments commodities are imported.

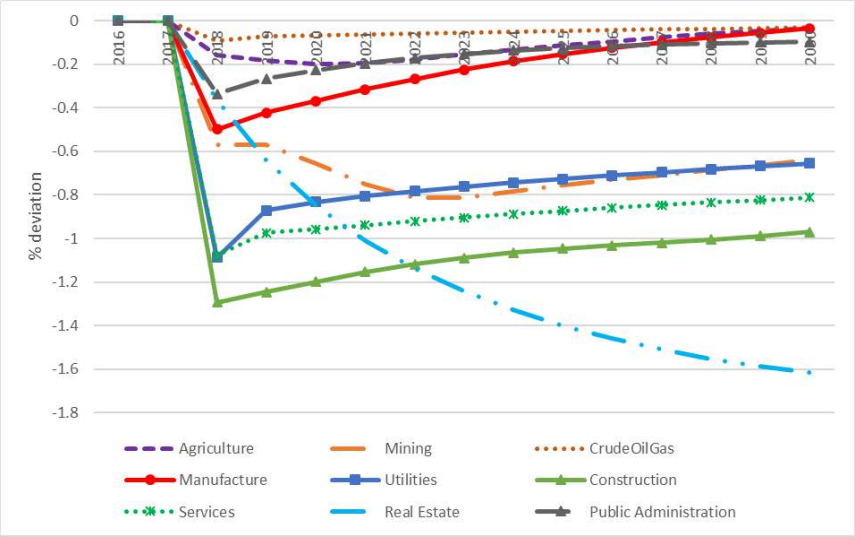
[23] Real estate includes both housing stock and real estate services. Approximately 63 per cent of real estate is sold to households with the remainder sold to industries.

in output in hotel and restaurants, some financial services (included in the services outcome in Figure 10) and leather products and tobacco (included in the manufacturing outcome).

Agriculture, crude oil and gas, manufacturing and public administration are the sectors that show the lowest negative deviation from baseline in the long-run. The deviation in the agricultural and crude oil and gas sectors reflect our assumption that inputs of natural resources and agricultural land cannot deviate from their baseline projection. The deviation in public administration illustrated in Figure 10, show that aggregate public administration is below baseline. Within the aggregate public administration sector, we include public administration, education and health services. While all public administration services are sold to the government, part of education and health services are also sold to households. It is the deviation in private consumption that accounts for the negative deviation in aggregate public consumption in Figure 10. Manufacturing is another aggregate sector that recovers in the long run. This outcome is more complex to explain as this result is driven by the individual manufacturing industries- some growing above baseline while others show negative output deviations. Industries exceeding their baseline performance share the following characteristics: (1) they sell most of their output to investment (e.g. other transport equipment, machine equipment and basic metals) or (2) as an intermediate input to industries selling their output to final demand (e.g. chemicals, metal ores and pulp and paper) and (3) have a high import share. As investment moves towards the baseline (Figure 9), the domestic demand for inputs improve. Those industries importing a high share of inputs are affected by the relative price change which favours domestically produced inputs. Those manufacturing industries performing the worst (e.g. leather products, food and beverages, textiles) sell most of their output to households and therefore the poor performance is attributed to a fall in domestic demand.

Other sectors, such as mining (excluding crude oil and gas), services and utilities, do not have concentrated direct sales to any of the final demand categories. The outputs from these industries generally serve as intermediate inputs to domestic industries. These industries include metal ores, recycling, insurance, business services, post and telecommunication. For this reason, we find these industries typically exhibit output responses that are broadly in line with the movement in real GDP. The deviation in the output of construction sector is mainly due to the negative deviation in investments, to which Construction sells 75 per cent of its output.

**Figure 10. Aggregate sectoral output (% deviation from baseline)**



## 6.2 Business profit tax simulation

The IMF suggests that business profit tax could be an alternative source of tax revenue (IMF, 2016b: 17-18). The IMF suggests that business profit tax should be simple and levied at a single, relatively low rate for all businesses. Thus, we use GEMSA to run a second policy simulation (call the Company Income Tax (CIT) simulation), in which we introduce a tax on business profit that generates SAR 35 billion (similar to the VAT revenue). We purposefully chose a value of SAR 35 billion in business profit tax as this allows us to compare the excess burden attributed to these taxes. In other words, we can determine which tax causes the most harm to the economy in the long run.

Figures 11 to 13 plot the deviation from the baseline for both the VAT and CIT simulation for three macro variables: real GDP, real capital stocks and real investment. As expected, our long run results show that a tax on business profits is more harmful to real GDP than VAT. VAT is a tax on consumption, which is paid by the final user of goods and services. Therefore, VAT increases the cost of consumption relative to production. In contrast, a tax on business profit depresses the after-tax rate of return investors earn. This damages investment and as a consequence long-run capital stocks and real GDP. Our results suggests that a business tax generating SAR 35 billion, reduce capital by 1.4 per cent in the long run, with a long run reduction in real GDP of 0.7 per cent. Our results suggests that a business profit tax that yield SAR 35 billion could contribute between 1.7 and 2.1 per cent of GDP to tax revenue.

**Figure 11. Real GDP (% deviation from baseline)**


**Figure 12. Real investment (% deviation from baseline)**

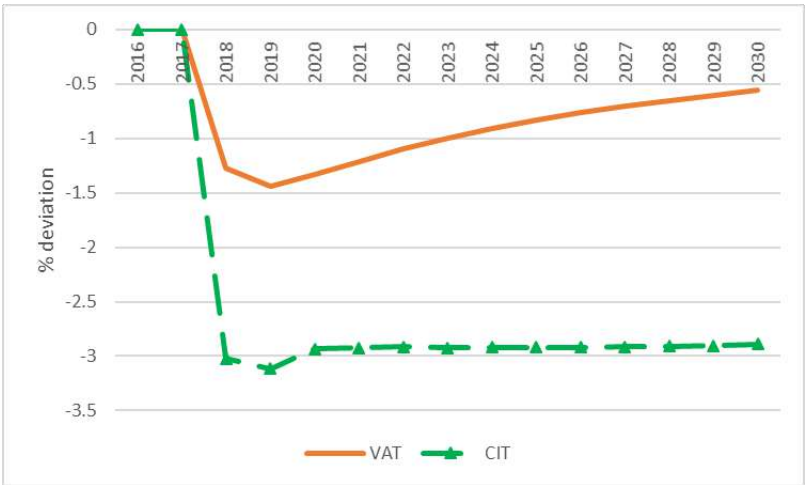
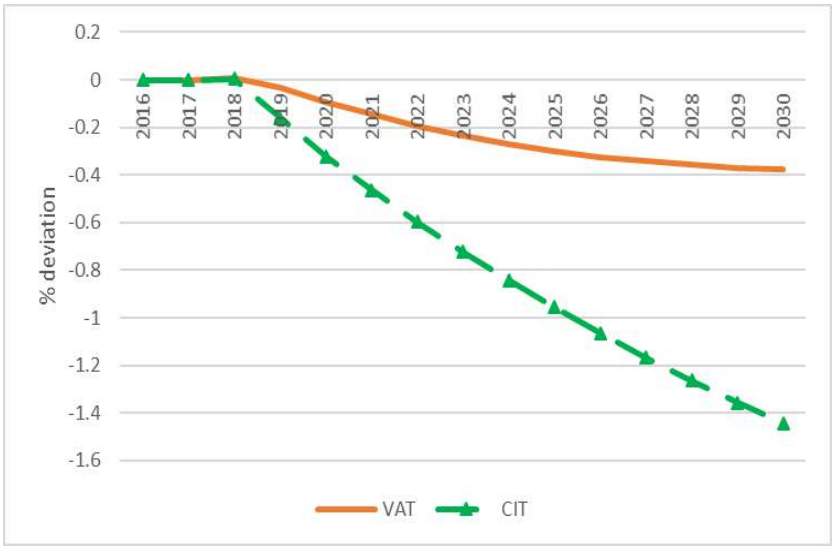


**Figure 13. Capital (% deviation from baseline)**




## 6.3 Excess burden[24]

Our discussion starts with the marginal excess burden (EB) results.[25] The excess burden is defined as a measure of the damage done to welfare (e.g national product) due to a tax.[26] We use a similar measure as in Nassios et al (2018) to calculate economy-wide excess burden (EB) as:

$$EB_{(t)} = -100\left[\frac{\Delta GNP}{\Delta LUMPSUM}\right] \qquad (E.1)$$

where $\Delta$GNP is the deviation in real gross national product (GNP) in year t expressed as the difference between the policy simulation and the baseline simulation values for GNP in year t and

$\Delta$LUMPSUM is the deviation in revenue-neutral lump sum transfer by the national government in year t. Equation (E.1) shows the change in real GNP caused by changes to national tax policy that allows the government to make a budget-neutral transfer to households. Rather than using the tax revenue generated as the denominator, we use a lump sum value. The lump sum value takes into account the revenue raised from the new tax as well as from other sources and also changes in expenditure such (price of government spending and transfers). Because GEMSA is dynamic, it calculates year-on-year excess burdens values using a similar principle.

We make several observations regarding our results. Firstly, the excess burden values are all positive and large, with the magnitudes dependent on the effective tax rate and the tax base. The tax base for

[24] Another way to measure the relative impact of these taxes was pioneered by Harberger (1962) and involves the calculation of tax-specific excess burdens. The term "excess burden" was coined by Harberger (1962) to describe the impact (in totality) of US corporate tax on US national income. Because GEMSA is dynamic, it can calculate year-on-year excess burden measures using a similar principle. In our study the preliminary results show that the business profit tax bears a larger excess burden than the VAT. In relative terms, VAT is therefore preferred means to raise revenue.

[25] Our work draws on Nassios et al., (2019). Extensive work has been completed by Jason Nassios to calculate the excess burdens of various taxes on regional and national level for Australia. See Nassios et al (2019) for a description on modelling the allocative efficiency of various state and federal taxes.

[26] By itself, the EB value of a tax is not useful. However it could be useful when a number of taxes are studied because the impact on welfare will differ depending on the tax. By ranking these welfare loss values, one can get a sense of which taxes might cause more damage to welfare.

VAT is commodity-specific household consumption and for the business tax, the base is capital rental values by industry.

Secondly, the excess burden from the VAT is high at the start of the simulation and decreases over time to a long run value of 26. The long run value can be interpreted as for every 1 Riyal tax raised the loss of welfare is 26 halala.

Thirdly, the excess burden from the business profit tax shows that the damage to welfare increases over time. This is because business profit tax negatively impacts capital formation and GDP in the long run (See Figures 11 and 13). In this simulation, the long run excess burden can be interpreted as for every 1 Riyal tax raised the loss of welfare is 32 halala.

Whether these values are plausible given the structure of the economy is not clear. To my knowledge, no study relevant to the GCC calculates the excess burden due to the introduction of new taxes or change in tax rates of existing taxes. However, these values are in-line with the excess burden analysis in Nassios et al (2019).

# 7 Conclusion

For many GCC countries, lower oil prices negatively impacted government revenue from oil sales, leading to an increase in budget deficits and a fall in foreign exchange reserves. Apart from long-term structural change, the immediate response to lower oil prices is the removal of energy subsidies and the introduction of taxes such as VAT. Using a dynamic CGE model (GEMSA) for Saudi Arabia, we simulate two policy simulations, both generating additional tax revenue of SAR 35 billion via (i) the introduction of VAT paid in full by households and (ii) a business profit tax paid in full by the owners of capital. This improves the government budget balance which allows the government to make a budget-neutral lump sum payment to households. GEMSA is useful because of its detailed representation of the linkages between different agents in the economy and its treatment of taxes and prices. We then calculate an economy-wide excess burden values to determine which tax damages welfare the most in the long run.

In the VAT simulation, our results show that real GDP is below baseline throughout the simulation period. VAT permanently increases the price of consumption relative to the price of production. With wages indexed to the CPI, the cost of labour will increase leading to a fall in employment. Over time, the real wage rate and the cost of labour move towards the baseline, forcing employment back towards its baseline value. In the short-run, the GDP outcome is explained by the fall in employment. The increase in CPI also depresses real household consumption throughout the simulation period.

In our second simulation we generate additional tax revenue of SAR 35 billion via a business tax on profit. As expected, the excess burden calculations shows that a tax on profit is more harmful than VAT, because of its long-run impact on investment, capital stock and GDP. Tax on business profit depresses the after-tax rate of return investors earn. This damages investment and as a consequence long-run capital stocks and real GDP. Therefore in relative terms, VAT is therefore preferred means to raise revenue.

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# Appendix 1. Accounting for taxes in GEMSA

## Indirect tax such as a Sales tax (VAT)

Equations (E.1) determines the purchasers' value of the use of commodity c, from source s by user u in region d, as the sum of the commodity use valued at delivered price and sales taxes levied on these commodities.

$$PUR_{(c,s,u)} = BAS_{(c,s,u)} + TAX_{(c,s,u)} + \sum_{m \in MAR}^{`} MAR_{(c,s,u,m)} \qquad (E.1)$$

for all c ∈ COM, s ∈ SRC, u ∈ USER, m ∈ MAR

where

- PUR is the purchasers' value of commodity *c*, from all sources *s* paid by user *u*;
- BAS is the basic value of commodity *c* from all sources *s* to user *u*;
- TAX is the tax (subsidy) value *t* paid by (too) user *u* for commodity *c* from all sources; and
- MAR is the value of margins *m* used to facilitate the flow of commodity *c* from source *s* to user *u*.

Tax revenue is calculated via (E.2).

$$TAX(c,s,u) = BAS(c,s,u) * TAXRATE(c,s,u) \qquad (E.2)$$

for all c ∈ COM, s ∈ SRC, u ∈ USER

where the TAXRATE is a specific tax on each commodity c from source s, used by user u. These tax rates are naturally exogenous (See E.10).

Our focus is on the sales tax term, which is defined in ordinary change below:

$$\begin{aligned} \Delta TAX(c,s,u) = {} & 0.01 * TAX(c,s,u) * \lfloor xuse(c,s,u) + puse(c,s) \rfloor \\ & + BAS(c,s,u) * \Delta TAXRATE(c,s,u) \end{aligned} \qquad (E.3)$$

for all c ∈ COM, s ∈ SRC, u ∈ USER

where

- xuse is the percentage change in the use of commodity *c*, from source *s* by user *u*;
- puse is the percentage change in the basic price of commodity *c*, from source *s* by user *u*; and
- Δ TAXRATE is the ordinary change in the tax rate on commodity *c* from source *s* paid by user *u* as determined in (E.8)

Equation (E.3) includes two percentage change variables, xuse and puse, which are the percentage change in the quantity used of commodity *c*, from source *s* by user *u* and the percentage change in the basic price of commodity *c*, from source *s*. The percentage change in the basic price is uniform over all users. The percentage change in the demand for commodity c (xuse) is derived from various optimisation problems.

The ordinary change in the respective sales tax rates in (E.3) are set equal to a number of shift variables:

$$\Delta TAXRATE(c,s,u) = \Delta TAXRATE\_u(c,s) + \Delta TAXRATE\_su(c) + \Delta TAXRATE\_s(c,u) \quad \text{(E.4)}$$

for $c \in COM$, $s \in SRC$, $u \in USER$

where

- $\Delta$TAXRATE_u is the ordinary change in the ad valorem tax rate *t* paid on commodity *c* from all sources *s*. This rate is uniform over all users *u*.
- $\Delta$TAXRATE_su is the ordinary change in the ad valorem tax rate *t* paid on commodity *c*. This rate is uniform over all users *u* and sources s.
- $\Delta$TAXRATE_s is the ordinary change in the tax rate paid on commodity c by user u. This rate is uniform over all sources.

These shift variables are naturally exogenous and unless their values change[27], the change in the tax rate remains zero.[28] By altering the respective sales tax rates, sales tax revenue change (see E.3), and ultimately the value of commodities at purchasers' price adjust (see E.1).

## Direct tax such as a business tax

Equation (E.5) determines corporate tax revenue:

$$TAXCAP = \sum_{i \in NonGov} V1CAP(i)*TAXR\_K \quad \text{(E.5)}$$

where

- V1CAP is the aggregate returns on private capital; and
- TAXR_K is the average corporate tax rate.

Equation (E.6) shows the levels from of the rates of return (ROR) as:

$$ROR(i) = \frac{V1CAP(i)}{K(i)} * (1 - TAXR\_K) * (1 - D(i)) \quad \text{(E.6)}$$

where

- V1CAP is the industry-specific returns on capital;
- K is the industry-specific capital stock;
- D is the industry-specific depreciation rates.

Equation (E.7) relates investment to the rates of return on capital.

$$I(i) = f(ROR(i)) \qquad \text{for all } i \in IND \quad \text{(E.7)}$$

[27] The shift variables' values can change by (1) directly shocking the appropriate variable and dimension to change a specific tax rate, or (2) altering the exogenous status of the appropriate variable to endogenous. The newly endogenous shift variable can then adjust to accommodate an exogenous change in tax revenue.

[28] Altering the tax rates for specific dimensions highlights the flexibility of the model and allows for various tax proposals to be modelled.

$$K(i,t+1) = K(i,t)*(1-D(i)) + I(i) \qquad \text{for all } i \in IND \qquad (E.8)$$

where

- K(i,t+1) is the industry-specific capital stock at the end of year t, which is also the capital stock at the beginning of year t+1;
- K(i,t) is the industry-specific capital stock at the beginning of year t;
- I(i) is the industry-specific investment during year t.

# Appendix 2. Summary of cost and sales structures captured in the GEMSA database

Industry-specific results are influenced by the relative change in supply and demand for that industry's output. The cost composition of an industry is important in explaining the change in supply while the sales structure and the macro closure are important in explaining changes in the demand. On the supply side we generally assume that in the short-run capital is fixed as there is not enough time for capital to accumulate. We also assume that employment adjusts in the short run given fixed wages. Therefore in the short-run, any increase (decrease) in output must be accommodated for by an increase (decrease) in employment, holding technologies unchanged. As a consequence, capital-intensive industries have little scope to change output in the short-run. However over time capital adjusts. In the long run we assume that capital adjusts while employment adjusts to return the rate of employment to its baseline level. Thus, in the long-run capital-intensive industries have considerable scope to adjust their output. On the demand side, the initial sales structure as well as the assumptions in the macro closure have an impact on industry production. For example, if public consumption is held exogenous in the macro closure, there is little scope for industries selling their output to government to change their production.

Table 1 shows the share of costs in total costs for aggregated industries in the GEMSA database. The first column shows the cost share accounted for by intermediate inputs excluding petroleum and electricity, columns 2 and 3 show petroleum and electricity as a share of the total costs, and the remaining columns show the share of primary factor costs in total costs. As previous studies have shown, the removal of energy subsidies increases production costs for industries using petroleum and electricity as intermediate inputs. Those industries benefiting the most from the subsidies will experience a larger increase in costs and decline in activity level. The initial cost structure for the aggregate sectors shows that transport sectors (Table 1, row 17) have the highest petroleum cost share. The average share of petroleum in total costs for the aggregate transport sector is approximately 5.6 per cent. Within this sector, the petroleum cost share is highest for the air transport industry (16.5 per cent), followed by land transport (9 per cent) and water transport (7.3 per cent). Other industries with high petroleum cost shares include the fishing industry (9 per cent - included in row 1), chemicals industry (4 per cent - included in row 8) and the water industry (3 per cent - row 13). Industries with the highest electricity costs are other non-metal and mineral industry at 4.8 per cent (included in row 8), electricity industry at 3.7 per cent (row 12), basic metals industry at 4.6 per cent (row 9) and motor vehicle repair at 3.5 per cent (included in row 15).

Table 2 shows the sales structure of each commodity. Commodities can either be sold on the local market to industries as intermediate input (column 1), to investment (column 2), households (column 3), the government (column 5) or held as stocks (column 6), or exported to foreign markets (column 4). Column 7 shows, for margin commodities the value of margins.

For example, the sales structure for refined petroleum (Table 2, row 7) shows that 30.6 per cent of this commodity is exported. Households and industries use (Table 2, row 7) approximately 70 per cent each (Table 2, row 7). The sales structure for electricity shows that 55 per cent of electricity is used by industries as an intermediate input followed by households at 26.4 per cent and the rest used by the government.

## Table 1. Cost shares and value added by aggregated sectors (2015)

| | Industry | Cost shares | | | | | | | | Value added share |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| | | Intermediate (excl petroleum and electricity) | Petroleum | Electricity | Labour | Capital | Natural resource | Other | Total | |
| 1 | Agriculture, hunting, forestry and fishing | 33.6 | 1.5 | 0.5 | 8.0 | 48.9 | 22.4 | -12.9 | 102 | 3.0 |
| 2 | Crude oil and gas | 1.7 | 0.1 | 0.2 | 2.5 | 54.2 | 41.3 | 0.3 | 100 | 34.1 |
| 3 | Other mining | 26.7 | 3.6 | 2.3 | 8.2 | 55.3 | 9.0 | 0.8 | 106 | 0.4 |
| 4 | Food, beverages and tobacco | 64.1 | 0.2 | 0.6 | 7.7 | 28.0 | 0.0 | 0.3 | 101 | 1.6 |
| 5 | Textiles and leather products | 63.8 | 0.3 | 0.9 | 9.0 | 25.0 | 0.0 | 2.2 | 101 | 0.3 |
| 6 | Wood and paper products including furniture | 65.0 | 0.7 | 2.7 | 12.2 | 22.1 | 0.0 | 0.7 | 103 | 0.7 |
| 7 | Petroleum | 48.3 | 0.8 | 0.0 | 3.2 | 48.1 | 0.0 | 0.0 | 101 | 2.7 |
| 8 | Other chemicals, rubber, plastic and non-metalic mineral products | 67.8 | 2.8 | 1.5 | 4.6 | 27.5 | 0.0 | 0.1 | 104 | 3.0 |
| 9 | Basic metals and fabricated metal products | 74.0 | 1.1 | 3.3 | 8.8 | 16.9 | 0.0 | 0.3 | 104 | 0.6 |
| 10 | Machinery and other equipment | 53.5 | 0.6 | 2.1 | 6.6 | 39.6 | 0.0 | 0.3 | 103 | 1.1 |
| 11 | Other manufacturing | 43.26 | 0.4 | 0.7 | 13.2 | 43.4 | 0.0 | 0.1 | 101 | 0.0 |
| 12 | Electricity and gas | 55.5 | 1.3 | 3.1 | 11.3 | 31.6 | 0.0 | 1.6 | 104 | 1.3 |
| 13 | Water | 40.2 | 2.5 | 1.5 | 10.6 | 48.3 | 0.0 | 0.9 | 104 | 0.1 |
| 14 | Construction | 60.4 | 1.0 | 0.6 | 10.6 | 28.4 | 0.0 | 0.6 | 102 | 5.1 |
| 15 | Wholesale, retail trade, motor vehicles repair | 37.6 | 0.6 | 2.9 | 13.8 | 46.4 | 0.0 | 2.2 | 104 | 8.4 |
| 16 | Hotel and restaurant services | 13.3 | 0.3 | 0.1 | 19.0 | 64.3 | 0.0 | 3.4 | 100 | 1.9 |
| 17 | Transport, supporting transport services and post | 42.6 | 9.0 | 0.5 | 15.9 | 40.6 | 0.0 | 0.8 | 109 | 3.1 |
| 18 | Telecommunication | 31.3 | 0.2 | 1.1 | 9.1 | 59.5 | 0.0 | 0.1 | 101 | 3.6 |
| 19 | Finance | 38.5 | 0.0 | 0.1 | 10.9 | 49.7 | 0.0 | 0.9 | 100 | 2.9 |
| 20 | Real estate services | 13.0 | 0.1 | 0.3 | 5.7 | 80.7 | 0.0 | 0.6 | 100 | 2.3 |
| 21 | Business services | 19.6 | 0.1 | 0.3 | 13.8 | 65.6 | 0.0 | 1.0 | 100 | 3.8 |
| 22 | Public administration and defence services | 32.0 | 0.9 | 2.2 | 62.2 | 5.7 | 0.0 | 0.0 | 103 | 8.6 |
| 23 | Education services | 22.2 | 1.4 | 1.7 | 70.1 | 7.5 | 0.0 | 0.2 | 103 | 6.8 |
| 24 | Health and social work services | 36.2 | 0.6 | 0.5 | 46.4 | 16.8 | 0.0 | 0.6 | 101 | 2.8 |
| 25 | Other community services | 44.1 | 1.3 | 1.8 | 30.0 | 25.1 | 0.0 | 0.8 | 103 | 1.2 |
| 26 | Private households with employed persons | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 | 100 | 0.5 |

Source: authors calculations based on database

## Table 2. Sales shares of aggregated commodities (2015)

| | | Sales share: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Commodity | Intermediate | Investors | Households | Exports | Government | Stocks | Margins | Total | Import share |
| 1 | Agriculture, hunting, forestry and fishing | 44.8 | 0.0 | 25.5 | 1.3 | 0.0 | 28.3 | 0.0 | 100 | 22.0 |
| 2 | Crude oil and gas | 17.7 | 0.0 | 0.7 | 81.5 | 0.0 | 0.1 | 0.0 | 100 | 0.0 |
| 3 | Other mining | 92.6 | 0.0 | 0.0 | 0.6 | 0.0 | 6.8 | 0.0 | 100 | 36.9 |
| 4 | Food, beverages and tobacco | 7.0 | 0.0 | 76.6 | 5.3 | 0.0 | 11.1 | 0.0 | 100 | 46.3 |
| 5 | Textiles and leather products | 20.6 | 1.2 | 64.0 | 4.8 | 0.0 | 9.4 | 0.0 | 100 | 59.6 |
| 6 | Wood and paper products including furniture | 49.4 | 23.0 | 13.9 | 3.3 | 0.1 | 10.2 | 0.0 | 100 | 33.9 |
| 7 | Petroleum | 29.5 | 0.0 | 39.9 | 30.6 | 0.0 | 0.0 | 0.0 | 100 | 1.4 |
| 8 | Other chemicals, rubber, plastic and non-metalic mineral products | 53.2 | 2.7 | 5.8 | 20.7 | 6.9 | 10.8 | 0.0 | 100 | 27.3 |
| 9 | Basic metals and fabricated metal products | 9.6 | 80.0 | 0.0 | 2.2 | 0.0 | 8.2 | 0.0 | 100 | 58.8 |
| 10 | Machinery and other equipment | 2.1 | 73.5 | 14.3 | 1.7 | 0.2 | 8.1 | 0.0 | 100 | 84.2 |
| 11 | Other manufacturing | 36.5 | 47.3 | 0.0 | 6.0 | 1.1 | 9.1 | 0.0 | 100 | 92.9 |
| 12 | Electricity and gas | 54.5 | 0.0 | 26.6 | 0.7 | 14.5 | 3.6 | 0.0 | 100 | 0.0 |
| 13 | Water | 17.0 | 0.0 | 77.0 | 2.0 | 0.0 | 3.9 | 0.0 | 100 | 0.0 |
| 14 | Construction | 1.7 | 75.2 | 22.6 | 0.5 | 0.0 | 0.0 | 0.0 | 100 | 7.6 |
| 15 | Wholesale, retail trade, motor vehicles repair | 63.7 | 5.7 | 23.6 | 4.0 | 0.3 | 2.5 | 0.0 | 100 | 30.3 |
| 16 | Hotel and restaurant services | 30.6 | 0.0 | 67.2 | 2.2 | 0.0 | 0.0 | 0.0 | 100 | 35.7 |
| 17 | Transport, supporting transport services and post | 50.0 | 5.8 | 21.9 | 10.1 | 10.0 | 2.1 | 0.0 | 100 | 34.8 |
| 18 | Telecommunication | 59.0 | 0.0 | 41.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 20.2 |
| 19 | Finance | 76.2 | 0.0 | 21.5 | 2.3 | 0.0 | 0.0 | 0.0 | 100 | 15.4 |
| 20 | Real estate services | 33.9 | 0.0 | 63.3 | 1.6 | 1.1 | 0.0 | 0.0 | 100 | 17.2 |
| 21 | Business services | 75.8 | 0.0 | 22.5 | 0.0 | 1.7 | 0.0 | 0.0 | 100 | 13.4 |
| 22 | Public administration and defence services | 0.9 | 0.0 | 0.1 | 0.0 | 99.0 | 0.0 | 0.0 | 100 | 15.6 |
| 23 | Education services | 10.1 | 0.0 | 8.7 | 0.0 | 81.1 | 0.0 | 0.0 | 100 | 10.9 |
| 24 | Health and social work services | 12.2 | 0.0 | 22.1 | 0.0 | 65.7 | 0.0 | 0.0 | 100 | 23.6 |
| 25 | Other community services | 15.2 | 0.0 | 10.0 | 0.1 | 74.8 | 0.0 | 0.0 | 100 | 1.6 |
| 26 | Private households with employed persons | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100 | 0.0 |

Source: authors calculations based on database