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SAUDI ARABIA

SELECTED ISSUES

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SAUDI ARABIA

SELECTED ISSUES

June 29, 2017

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CONTENTS

FISCAL ADJUSTMENT—SCOPE AND PACE[1]

This paper looks at the appropriate scope and pace of fiscal adjustment in Saudi Arabia. The analysis is based on considerations from the Fund's new framework for assessing fiscal space and is extended to account for some of the unique characteristics of oil exporting countries. In particular, the Permanent Income Hypothesis (PIH) and the structural balance approach are used to obtain additional perspectives.

A. Introduction

1. Prior to 2014, Saudi Arabia enjoyed a sustained period of fiscal and external surpluses which helped strengthen macroeconomic stability and rebuild policy buffers. Fiscal spending increased steadily for more than a decade, supported by high oil prices and oil revenues to the budget. Further, mindful of the fiscal risks from oil price fluctuations, the government paid off most of its debt and built-up large financial assets.

2. Since the large drop in oil prices in 2014, the fiscal deficit has been very large prompting the government to take a number of fiscal adjustment measures. It begun with a substantial spending cut in late 2015 and followed up with a preliminary set of reforms and a tighter budget for 2016 before announcing by mid-year its long-term Vision 2030 and five-year National Transformation Program (NTP) in which it outlined its medium-to-long term strategy for reducing the reliance of its economy and the budget on oil. In late 2016, the government announced the Fiscal Balance Program (FBP), which outlines the government's target of achieving a balanced budget by 2019. Nevertheless, the fiscal deficit has been very large, averaging over 16 percent of GDP in 2015–16, and the government net financial asset position declined by 30 percent of GDP during 2015–16 as deposits at SAMA declined and borrowing from domestic and external sources increased.

3. The economy has started to feel the impact of the fiscal adjustment. Non-oil growth has slowed substantially, while CPI inflation increased temporarily in early 2016 due to the effects of higher energy and water prices. Substantial cuts in government spending, payment arrears, and an increase in government borrowing to finance the fiscal deficit led to pressures on bank liquidity and funding.

4. This paper takes a closer look at the appropriate scope and pace of fiscal adjustment in Saudi Arabia. It uses three approaches which help assess the pace and scope of the adjustment. These are: an analysis based on considerations from the Fund's new framework for assessing fiscal space (Section B); the structural balance framework (section C); and the PIH approach (section C). Section D concludes.

[1] Prepared by Nabil Ben Ltaifa (MCD), with input from Saad A. Alshahrani (Ministry of Finance) on Box 1. Research support was provided by Meghan Greene (SPR) and Zhe Liu (MCD), and editorial support by Diana Kargbo-Sical (MCD).

B. Fiscal Space Analysis

5. The Fund's new framework for assessing fiscal space helps determine whether a country can undertake discretionary fiscal policy without endangering market access and debt sustainability. Discretionary policy can take the form of a stimulus or a slower pace of consolidation than under the baseline.[2] The analysis focuses on assessing the government debt and fiscal financing requirements in the IMF staff's baseline scenario in the staff report, which is based on the staff's judgement of the likely impact of the fiscal policy measures announced in the FBP and projections of domestic and external factors such as the international oil price.

6. The fiscal space analysis follows a three-stage approach. First, the initial state of the economy is assessed. Second, the debt and financing dynamics are assessed in the baseline and through stress tests, including a large decline in oil prices. Finally, the impact of the expansionary fiscal scenarios on growth and debt sustainability are evaluated. This dynamic perspective serves as a cross-check on the signals emanating from the second stage.

Current economic situation

7. Lower oil prices are affecting the Saudi Arabian economy. The country, however, has strong macroeconomic fundamentals, although some persistent structural weaknesses exist (Tables 1 and 2). More specifically:

- ***Growth has softened markedly since the oil price shock***. Non-oil real GDP growth slowed to near zero in 2016 and an output gap has opened up (Table 1). While non-oil growth is expected to recover somewhat this year boosted by improvements in business confidence, the restoration of civil service wage allowances, and larger investment by the Public Investment Fund, it is expected to remain well below the levels seen over the past decade.

Table 1. Saudi Arabia: Initial Macroeconomic Conditions

Output gap (percent of potential non-oil GDP)	-3.4
Gross Public Debt (percent of GDP)	13.1
Gross financing needs (GFN) for 2017 (percent of GDP)	9.4
EBA current account gap	7.7

Source: IMF staff estimates.

- ***The country remains largely dependent on oil and government spending***. The government increased significantly spending over the last decade and has continued to be the major player in the economy and the main employer of the fast-growing Saudi labor force (Figure 1). But still, youth and female unemployment remains high, while a sizable expatriate labor force works mainly in lower paying private sector jobs in the trade and services sectors. Productivity growth has been weak.

[2] International Monetary Fund, 2016, "Assessing Fiscal Space: An Initial Consistent Set of Considerations" IMF Staff Paper (Washington D.C.).

- ***Policy buffers remain strong***. The government balance sheet is strong with low public debt and considerable financial assets. Despite declining in 2015–16, government deposits at SAMA stood at about 30 percent of GDP at end-2016, while the stock of government debt was around 13 percent of GDP. However, owing to a large fiscal deficit, gross financing needs were about 18.2 percent of GDP in 2016, but are expected to decline to 9.4 percent of GDP in 2017 (and about 3 percent of GDP in 2022) (Table 1).

- ***The external position in 2016 was judged to be substantially weaker than the level consistent with desirable medium-term fiscal policy settings***. The external balance assessment (EBA) current account gap is assessed at about 7.9 percent of GDP at end-2016 (Table 1). Given the exchange rate peg, the narrowing of the current account gap over the medium-term is expected to be driven largely by the fiscal adjustment.

- ***Progress in structural reforms has remained mixed while government spending has improved infrastructure.*** Infrastructure is quite well-developed, but there are structural reform gaps that impede private sector growth (Table 2 and Appendix III of the staff report). Public infrastructure and public investment efficiency indicators are in line with emerging markets, although there remains room for improvement.

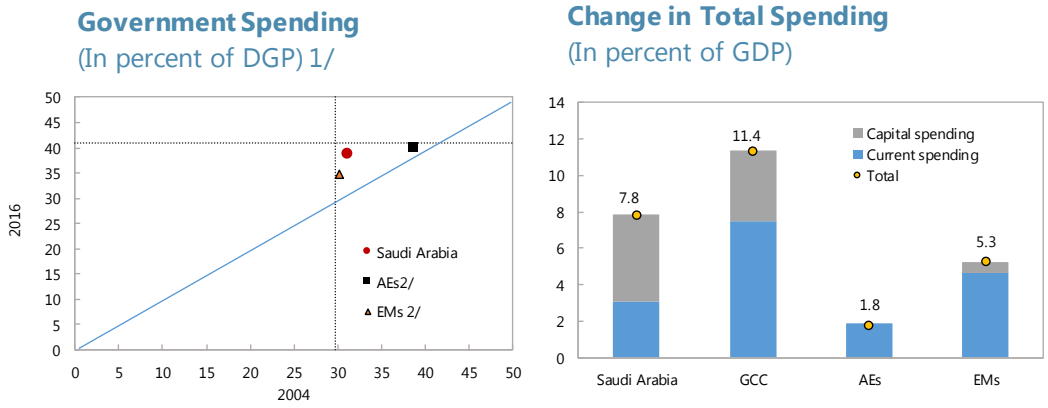
- ***The banking system remains resilient and poses little risk to macro stability***. Banks are well capitalized and in a strong position to manage any increase in NPLs (Table 2). The risks of contingent liabilities to the government from banks are low and the banks' direct exposure to the public sector is limited (6 percent of assets), although it is likely to increase over the coming years as banks buy more government debt.

Table 2. Saudi Arabia: Initial Structural Conditions

Structural reform gaps (distance to frontier) 1/	
Business regulation	56
Labor market	15
Real public capital stock per capita 2/	50,671
(distance to frontier)	41
Banking sector NPL ratio	1.4

Source: IMF staff estimates
1/ Distance measured as percentage deviation from frontier economy, with 0 being best.
2/ 2011 Thousand PPP$ per person, from IMF (2015b). Also converted to percentage deviation from frontier economy, with 0 being best.

Figure 1. Evolution in Government Spending (2004–16)



Sources: IMF FAD Expenditure Assessment Tool; IMF FAD Goverment Wage Bill and Employment Dataset; IMF Investment and Capital Stock Dataset; World Economic Outlook; World Economic Forum; and World Bank.
1/ Dashlines are the average of GCC.
2/ Data for AEs and EMs are as of 2015.

Is fiscal space available?

8. The strong government financial position makes Saudi Arabia an attractive borrower in international financial markets. External debt represents only about 1/3 of total government debt (medium risk range for emerging markets (EMs)), although total debt is very low (about 13 percent of GDP at end-2016) (Tables 1 and 3). Further, in addition to the strong financial position of the government (large deposits at the central bank), SAMA net foreign assets are high, standing at around $530 billion (about 32 months of imports) at end 2016. The government successfully accessed international financial markets twice in 2016: first through a ($10 billion) syndicated loan in April and then a $17.5 billion three-tranche debut sovereign bond in October with 5-, 10-, and 30-year maturities (in the amounts of $5.5 billion, $5.5 billion, and $6.5 billion), respectively. This issuance was the largest ever made by an emerging market country. The spreads on the three tranches were much below the benchmark of 200 bps, low risk for Emerging Markets (EMs) used in the Debt Sustainability Analysis for Market Access Country (MAC_DSA)[3] (Table 3 and Figure 2). The government also issued in April 2017 a $9 billion sukuk (split into two 5- and 10- year tranches of $4.5 billion each).

9. Debt indicators show the strong financial position of the government. Throughout the projection period (2017–22), debt remains below the threshold (70 percent of GDP for an emerging market), both under the baseline and the stress tests, and there is a low probability of breaching the threshold (Table 4).[4] Similar behavior characterizes the gross financing needs of the budget which

[3] MAC-DSA, link to IMF external website (https://www.imf.org/external/pubs/ft/dsa/mac.htm)

[4] The stress tests are based on the standard MAC-DSA shocks. They assess the implications to debt sustainability of one or a combination of the following shocks: a shortfall in the fiscal adjustment from baseline (primary balance

continue

remain below the threshold (15 percent of GDP) during the projection period. However, the debt trajectory in the staff's baseline does not stabilize in the projection period and additional consolidation would be needed to do this (Table 4).

Figure 2. International Bond Yields

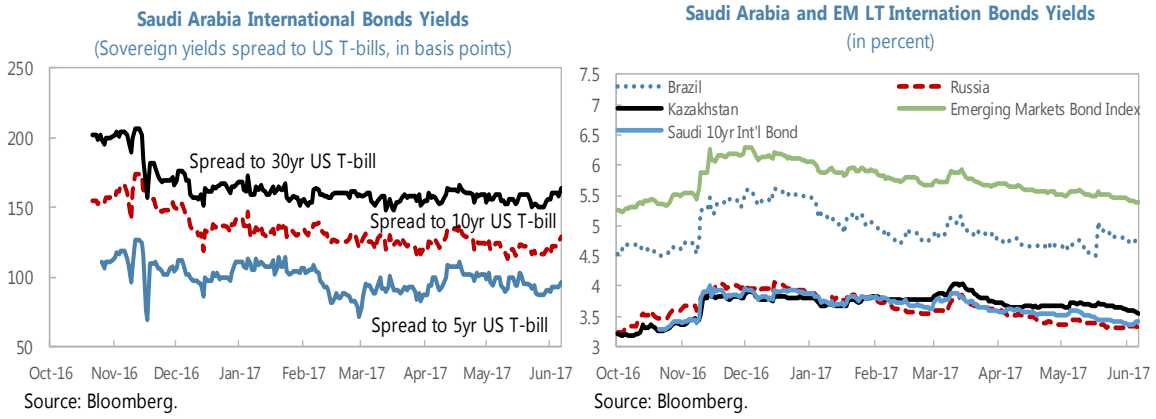


Table 3. Saudi Arabia: Financing Sources and Availability

Sovereign bond spreads 1/		
During last 12 months		123
Debt profile indicators breach benchmarks:		
Share of public debt in foreign currency 2/		32.6
Share of public debt held by non-residents 3/		32.6
Change in share of short-term debt 4/		0.0
External financing requirements (percent of GDP) 5/		9.6
Public Financial Assets (percent of GDP)		30.1

Sources: IMF staff estimates.

Notes:

1/ Benchmarks are indicative, and correspond to those used in the MAC-DSA: below 200 bps for low risk (green); between 200-600 bps for medium risk (orange); and above 600 bps for high risk (red) for EMs. The values correspond to the latest 3 month average spread.

2/ Benchmarks are indicative, and correspond to those used in the MAC-DSA: below 20 bps for low risk (green); between 20-60 bps for medium risk (orange); and above 60 bps for high risk (red).

3/ Benchmarks are indicative, and correspond to those used in the MAC-DSA: below 15 bps for low risk (green); between 15-45 bps for medium risk (orange); and above 45 bps for high risk (red) for EMs.

4/ Benchmarks are indicative, and correspond to those used in the MAC-DSA: below 0.5 (1) bps for low risk (green); between 0.5-1 (1-1.5) bps for medium risk (orange); and above 1 (1.5) bps for high risk (red) for EMs (AEs).

5/ Benchmarks are indicative, and correspond to those used in the MAC-DSA: below 5 (17) bps for low risk (green); between 5-15 (17-25) bps for medium risk (orange); and above 15 (25) bps for high risk (red) for EMs (AEs).

shock), reduced growth (real GDP shock), higher interest on debt (interest rate shock), and real exchange rate overvaluation (exchange rate shock). The stress test values reported in Table 4 show the impact of the combined shock.

Table 4. Saudi Arabia: Debt Dynamics

	Baseline		Stress tests	
		Value		Value
State of debt burden indicators				
Debt level relative to benchmark during projection period 1/ (benchmark: 70 percent of GDP)		-45.1		-26.9
Probability of breaching the benchmark 2/ at end of projection period		7		
Gross financing needs (GFN) relative to benchmark during projection period (benchmark: 15 % of GDP)		-5.6		-0.9
Does debt trajectory at least stabilize in last 2 years?		No		No
Fiscal adjustment				
Is the fiscal adjustment assumed under the baseline realistic? 3/				
Adjustment in CAPB (percentile)		1%		
Average level of CAPB (percentile)		85%		

Sources: IMF staff estimates.

Notes:

1/ Benchmarks are indicative, and correspond to those used in the MAC-DSA. For EMs, they are 70/15 percent of GDP. 'Green' means debt level (GFN) remains below the benchmark in the last year before the projections and over the projection period, 'red' means the respective benchmark is breached for at least one year in the last year before the projections or over the projection period.

2/ From IMF (2016), indicator reflects the probability that debt level exceeds the indicative debt benchmark at the end of the projection period. High risk ("red") if above 50 percent, at low risk ("green") if below 10 percent, and medium risk ("orange") otherwise.

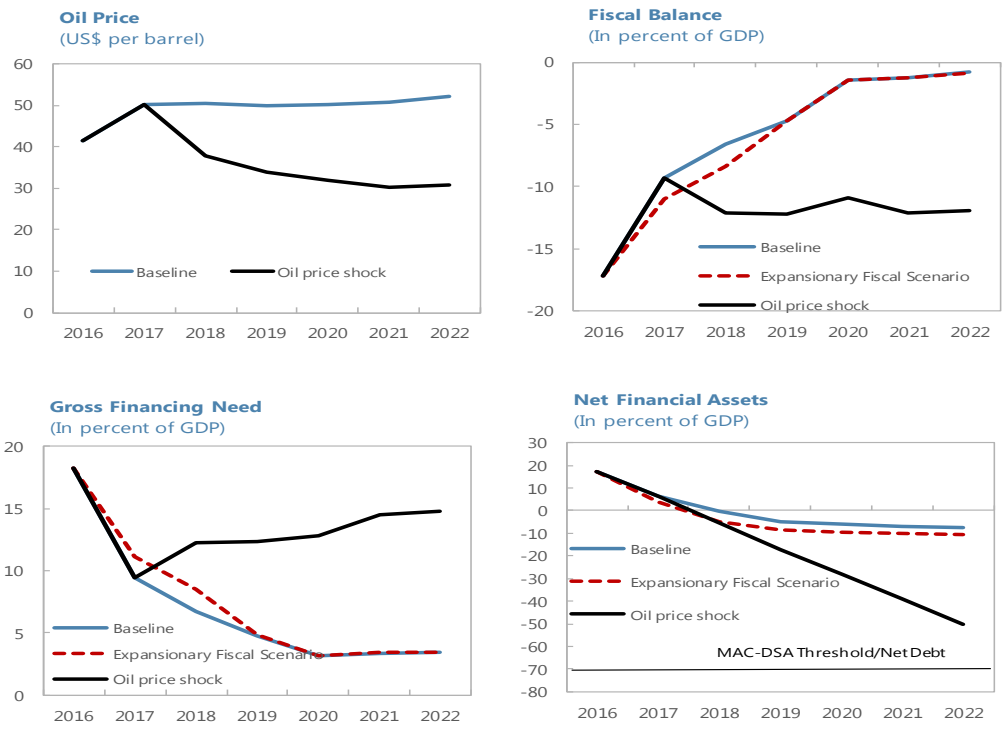
3/ Results of the MAC-DSA realism module. "Green" if 3-year CAPB adjustment (3-year average CAPB level) is less than 3 (3.5) percent, "red" otherwise. Value corresponds to the percent of countries that have achieved higher adjustment / levels of the cyclically-adjusted primary balance based on historical experience.

10. However, large oil price shocks would affect the primary source of government revenue and take up some of the available fiscal space. To assess the implications of lower oil prices, which are not captured in the stress tests discussed in paragraph 9, a scenario was considered that looks at an oil price shock starting in 2018 that reduces prices to $38 per barrel in 2018 and eventually to $31 in 2022 (lower 67 percent confidence band of the path implied in the futures market) (Figure 3). As a result of lower oil prices, the fiscal deficit by the end of the projection period (2022) widens from about 1 percent of GDP under the baseline to about 12 percent of GDP (Figure 3). The net financial asset position of the government deteriorates to -50 percent of GDP (gross debt would increase to 67percent of GDP if all additional financing needs relative to the baseline are met from borrowing rather than government deposits drawdown) from about -8 percent of GDP under the baseline. Gross financing needs (GFN) remain below the 15 percent of GDP threshold throughout the projection period (peaking at about 14.8 percent of GDP in 2022).

11. While this situation is much worse than under the baseline, it still appears broadly manageable. The net debt of the government remains 20 percent of GDP below the threshold of 70 percent of GDP. In fact, if the oil price remains low and the fiscal deficit stays at 12 percent of GDP beyond 2022, the country will not reach the debt benchmark of 70 percent of GDP until 2024.

This also does not incorporate adjustments in spending relative to the baseline that the government would likely make should oil prices decline in this fashion.

Figure 3. Baseline, Expansionary Fiscal, and Oil Price Shock Scenarios



Source: IMF staff estimates.

12. The fiscal adjustment that underlies the baseline, however, is very ambitious when compared to similar countries. The maximum three-year adjustment in the primary fiscal balance excluding oil (about 11 percent of GDP between 2016 and 2019) is larger than in 99 percent of the fiscal adjustment episodes identified by the IMF based on the cyclically adjusted primary balance (Table 4).

Expansionary fiscal scenarios

13. To gauge the impact of a fiscal expansion on the baseline fiscal path, two scenarios were considered using the IMF's G20MOD.

- The first scenario assumes a 2 percent of GDP increase in government spending for 2 years—which is allocated, 1, 0.5, and 0.5 percentage points of GDP to consumption, investment, and targeted transfers, respectively. It involves relatively higher fiscal multipliers because the expansion is expenditure-based and, also, assumes a 2-year monetary accommodation and fixed short-term interest rates.

- The second scenario assumes a 2 percent of GDP reduction in government taxes for 2 years—which is allocated 1, 0.5, and 0.5 percentage points of GDP, respectively, to consumption taxes, capital taxes, and lower income taxes.[5] It involves relatively lower fiscal multipliers because the expansion is revenue-based and assumes that there is no monetary accommodation and a rise in sovereign and term premium.

14. The fiscal expansion has limited longer-term macroeconomic impact, but would also not worsen fiscal sustainability (Table 5). The fiscal expansion boosts growth in the short-term, although the positive impact is limited by the Saudi economy's reliance on imports and expatriate labor. Fiscal spending multipliers for Saudi Arabia are estimated to be relatively low, averaging about 0.4 and 0.5-1.0 for current and capital spending, respectively. The expansion does little to raise potential growth or actual growth in the longer-term. The debt burden indicators increase somewhat in the scenario, but remain well below the EMs' thresholds for debt (Figure 3 and Table 5), indicating that the fiscal expansion does not jeopardize fiscal sustainability, although as in the baseline the government debt trajectory does not stabilize by the end of the projection period.

Table 5. Saudi Arabia: Fiscal Space Under Expansionary Fiscal Scenario

	G20MOD 1/	
	Scenario 1	Scenario 2
End of projection year: 2022	Value	Value
Macro impacts		
Change in potential GDP relative to baseline at the end of projection period (% difference)	0.10	-0.13
Change in nominal GDP relative to baseline	-0.05	0.04
Debt burden indicators		
Debt level relative to benchmark during projection period 2/ (benchmark: 70 percent of GDP)	-42.3	-42.1
Debt level at end of projection period 2/ (benchmark: 70 percent of GDP)	-42.3	-42.1
Gross financing needs (GFN) relative to benchmark 2 during projection period (benchmark: 15 of GDP)	-3.8	-3.7
Does debt trajectory at least stabilize in last 2 years?	No	No

Source: IMF staff estimates.
Notes:
1/ Illustrative scenario featuring fiscal stimulus, with two different sets of assumptions (benign and adverse) with respect to multipliers, monetary accommodation, and sovereign risk premia.
2/ Benchmarks are indicative, and correspond to those used in the MAC-DSA. For EMs, they are 70/15 percent of GDP. 'Green' means debt level (GFN) remains below the benchmark in the last year before the projections and over the projection period, 'red' means the respective benchmark is breached for at least one year in the last year before the projections or over the projection period. Value corresponds to the difference between the peak debt level (GFN) and the benchmark in percent of GDP.

15. In sum, based on the above analysis, Saudi Arabia has some fiscal space to undertake a more gradual fiscal adjustment in the next few years. Debt ratios and gross financing requirements remain below the EM thresholds in the baseline and shock scenarios, even though a sharp drop in oil prices would lead to a significant increase in gross and net debt. Using this fiscal space could help growth in the short-term which has been impacted by the fiscal adjustment over the past two years. However, the net debt does not stabilize in the baseline scenario, and further fiscal adjustment over the medium-term would be needed to achieve this. The fiscal consolidation assumed under the baseline is very large compared to the international experience with such adjustments, although it should be noted that an even larger adjustment was achieved by Saudi Arabia during the 1980s (Box 1).

[5] In the case of Saudi Arabia, given that income and capital taxes are absent and there is tax on consumption (of imported goods), this scenario is treated as an increase in labor and capital subsidies and either an increase in subsidies for goods or a reduction in some consumption taxes.

Box 1. Fiscal Adjustment Experience in the 1980s and 1990s

Saudi Arabia was faced with a large drop in oil prices in the 1980s, and oil prices remained low and volatile until the early 2000s. Oil prices declined from $38 a barrel in 1980 to $15 a barrel in 1986, and remained between $15 and $20 a barrel until 1990. In addition, oil exports were cut sharply. By 1986, oil revenues had declined by 87 percent from their peak in 1981, to their lowest level since 1973. A large fiscal surplus of 20 percent of GDP in 1980 turned into a deficit of about 25 percent of GDP in 1987.

Faced with this challenge, the government adopted in 1986 a package of fiscal policy measures. Capital spending bore the brunt of the adjustment. A large portion of the budget in the first half of the 1980s was devoted to capital spending, which peaked at 27 percent of GDP in 1981, but with the decline in oil prices, capital expenditure shrank significantly declining by 40 percent in 1986 and it eventually dropped to only about SAR 2 billion (0.5 percent of GDP) in 1994 (Figure). Current spending also declined sharply, by 17 percent, in 1986. Concurrently, growth in government employment slowed from an average of 11 percent a year in the first half of the 1980s to 2.4 percent in the first half of the 1990s, but remained positive.

These measures helped reduce the fiscal deficit, which fell to 11 percent of GDP in 1989, and while it increased again during the Gulf war in the early 1990s, it continued thereafter its downward trend to around 2.5 percent of GDP in 1997. This improvement was also helped by a strong recovery in oil revenues.

The analysis of development agency expenditures shows a shift in expenditure priorities during the 1980s and 1990s. This was manifested particularly in the decline in spending on infrastructure development from about 40 percent of the total agencies' expenditure in 1980–84 to close to 20 percent a decade later. This decline reflected in part the completion of large infrastructure projects. However, spending on human resource development and health more than doubled from about 29 percent in 1980–84 to close to 70 percent of total spending by development agencies in 1990–94. As for spending on economic resource development, it declined as the government cut back spending on some development programs.

In terms of the financing of the fiscal deficits, the government initially used its financial assets, and in 1988 it started issuing government development bonds (GDBs). The deficits, however, exhausted the financial assets the government had accumulated during the 1970s, and debt rose to 100 percent of GDP in the late 1990s.

The large fiscal adjustment had significant growth costs. Non-oil GDP declined by average of 0.6 percent per year during 1985-1989.

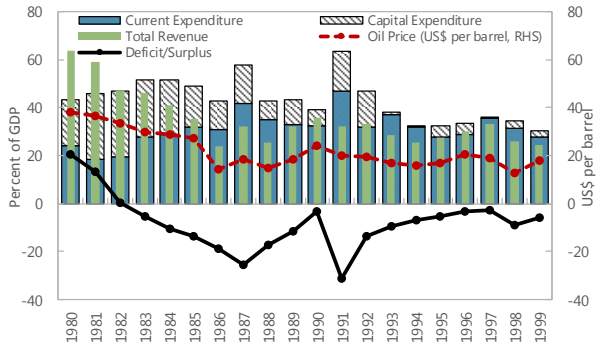
Expenditures of Development Agencies, 1980–94

	1980-1984			1985-1989			1990-1994		
	SAR Billion	Share of Total	Share of government expenditure	SAR Billion	Share of Total	Share of government expenditure	SAR Billion	Share of Total	Share of government expenditure
Economic Resources Development	192.2	30.7	15.8	71.2	20.4	8.9	34.1	10.0	3.2
Human Resources Development	115.0	18.4	9.5	115.1	33.0	14.4	164.6	48.0	15.3
Social & Health Development	61.2	9.8	5.0	61.9	17.7	7.7	68.0	20.0	6.3
Infrastructure Development	256.8	41.1	21.2	100.7	28.9	12.6	74.2	22.0	6.9
Total	625.2	100.0	51.5	348.9	100.0	43.5	340.9	100.0	31.6

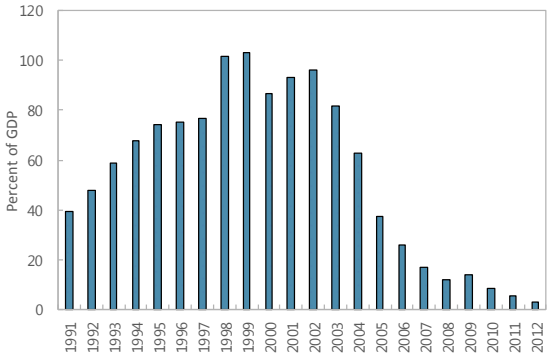
Source: Ministry of Economy and Planning of Saudi Arabia.

Box 1. Fiscal Adjustment Experience in the 1980s and 1990s (continued)

Government Expenditure and Oil Price, 1980–1999



Public Debt, 1991–2012



Sources: SAMA, and IMF staff calculations

C. Fiscal Anchors for Resource Rich Countries

16. The assessment of the fiscal stance and whether it is sustainable in the long-run is especially challenging in the case of an oil (resource) exporting country like Saudi Arabia. This challenge stems from the dependence on oil revenues, which in addition to being highly volatile, are exhaustible. Against this backdrop, alternative measures of the fiscal stance and approaches to fiscal sustainability that address these challenges are used. In this section, the structural balance and the permanent income hypothesis (PIH) approaches are applied.

The Structural Balance Approach

17. The structural balance rule provides a fiscal anchor that abstracts from the short-term volatility of oil revenues and calibrates expenditures according to longer-term trends in oil revenues. As such, it helps minimize the volatility of budget spending, thereby helping improve budget planning and implementation. Expenditures can be set in line with the expected path of structural revenues (based on an estimated/projected long term oil price/production) and a target for the structural balance.[6] If targeted spending exceeds structural revenue, there is a structural deficit. On the other hand, if targeted spending is below structural revenues, then there is a structural surplus. The target for the structural balance can be set according to the fiscal policy goals of the government.

[6] Structural revenue, which is equal to structural oil revenue plus non-oil revenue, is also referred to as structural spending. The structural balance is equal to the difference between the structural revenue and actual/projected spending.

18. The structural balance approach is applied using two alternative rules for deriving the structural oil revenues. The first is based on a 5-year backward looking moving average of the oil price; the second is based on a backward and forward looking 8-year moving average using the preceding four years, the current year, and the forthcoming three years. Both rules use a three-year backward moving average for oil export volumes. Using the above moving averages for price and volume, structural oil revenue is calculated and then accordingly a measure for structural expenditure is obtained by summing up the structural revenue and non-oil revenue in any given year. The structural fiscal balance (surplus, + and deficit, -) is then derived as the difference between structural expenditures and actual/or projected expenditures.

19. How would this structural balance rule work in practice? Assuming Saudi Arabia targets a structural balance of zero over the business cycle, and that the cycle extends from 2005 to 2015 given that the oil prices rose from $53 a barrel in 2005 to a peak of $105 a barrel in 2012 before declining to around the same level, $50 a barrel, in 2015. The estimated structural balance depends on which rule is used (Table 6 and Figure 4). Under the partial forward rule (backward and forward), a large surplus of 6.1 percent of GDP was achieved during 2005-15, while under the backward looking rule the structural budget was in broad balance. However, looking forward, the partial forward rule shows that the projected expenditure path in the staff's baseline would lead to an average structural deficit of 2.1 percent of GDP (2.9 percent of non-oil GDP) during 2016–22, while the backward-looking rule gives a structural surplus of about 1.6 percent of GDP (about 2.2 percent of non-oil GDP) over the same period (Table 6 and Figure 4).

20. In conclusion, the structural balance approach does not enable a clear assessment of the pace of the adjustment, although it is very useful in terms of reducing the cyclical behavior of spending in response to short-term swings in oil prices. In particular, the rule is sensitive to the derivation of the long-term oil price, and it is not clear how this should best be derived. Further, a choice needs to be made about the target for the structural balance.

Considering intergenerational equity

21. The PIH provides the government with a long-term view of where the fiscal balance should be to achieve an inter-generationally equitable distribution of oil revenues. The PIH considers oil in the ground as part of the government's net worth, very much like any other financial and non-financial assets it holds. As such, revenues from oil are a transformation of the oil underground (part of its wealth) into a financial asset. Against this background, the long term view the government would ideally take when deciding on its fiscal policy is to utilize for budget spending, in any given year, only the income that it can generate permanently from oil sales. Achieving sustainability under the PIH would entail adjusting government non-oil revenues and expenditures to achieve a non-oil primary deficit that is equal to the permanent income from oil. Below, permanent income is calculated from government financial assets at end-2016 and the expected present discounted revenues that will accrue to the government from oil for the next 100 years. Two measures are calculated: (i) an annuity that is constant in real terms; and (ii) another that is constant in real term and accounts for population growth.

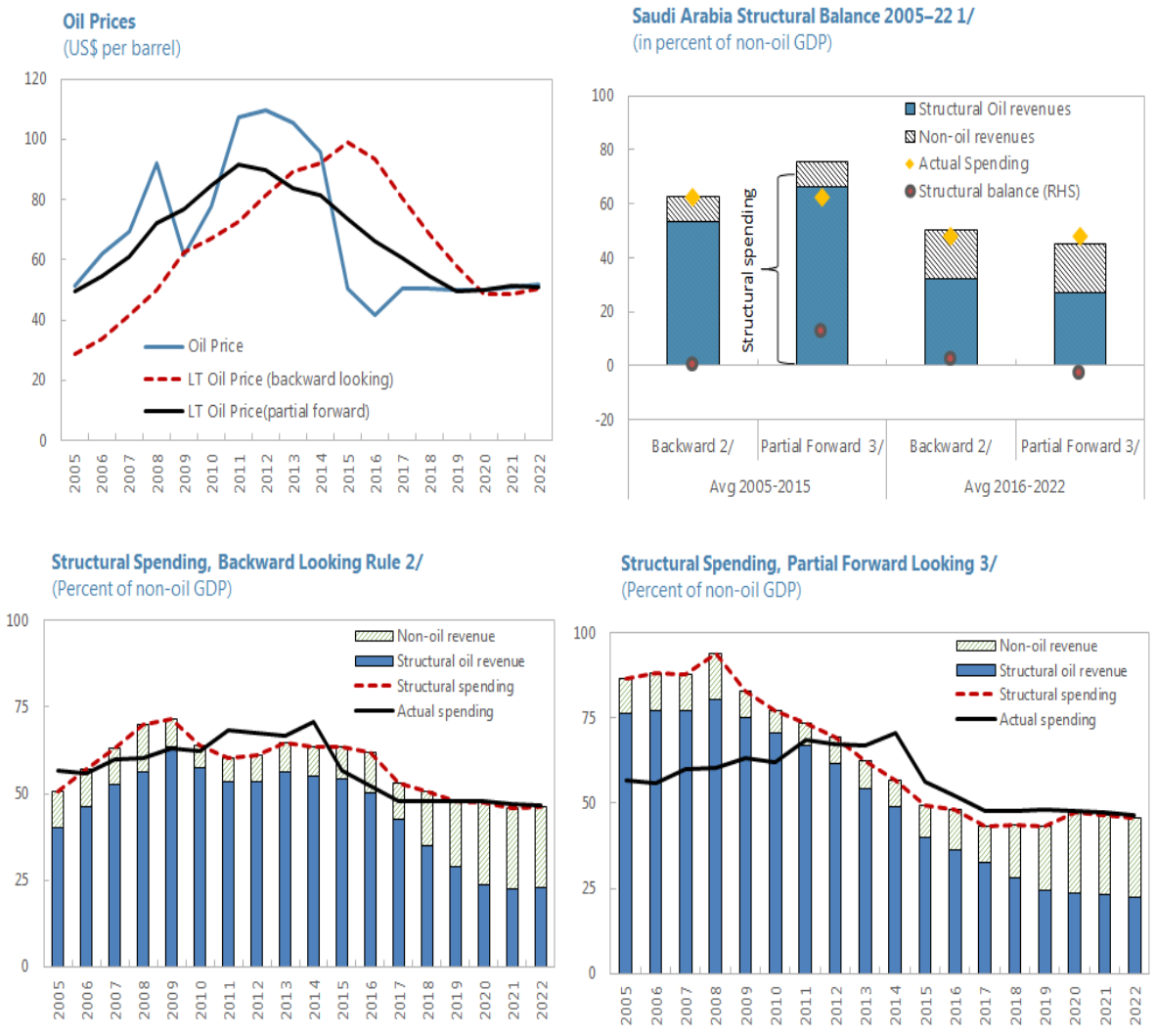
Table 6. Saudi Arabia: Overall, Non-oil, and Structural Fiscal Balances

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average 2005-15	Average 2016-2022
Overall balance															
Percent of GDP	3.6	11.1	12.0	5.8	-3.4	-15.8	-17.2	-9.3	-6.6	-4.7	-1.4	-1.2	-0.8	8.0	-5.9
Percent of non-oil GDP	6.5	22.9	24.3	10.9	-6.0	-21.9	-23.2	-12.9	-9.1	-6.4	-1.9	-1.6	-1.1	18.0	-8.0
Non-Oil Primary Balance															
Percent of GDP	-29.9	-29.8	-29.7	-31.6	-36.2	-35.9	-33.2	-28.3	-24.7	-22.4	-18.9	-18.6	-18.3	-28.5	-23.5
Percent of non-oil GDP	-54.8	-61.4	-60.1	-59.4	-63.6	-49.8	-44.7	-39.6	-34.0	-30.6	-25.6	-25.1	-24.6	-53.6	-32.0
Oil price (US$ per barrel)	77.6	107.1	109.4	105.4	95.7	50.4	41.5	50.3	50.4	49.9	50.1	50.9	52.0	80.2	49.3
Rule I: backward looking 1/															
Long-Term Oil Price	67.3	72.5	81.5	89.5	92.2	99.0	93.6	80.5	68.6	57.6	48.5	48.4	50.3	65.3	63.9
Structural balance 2/															
Percent of GDP	1.0	-4.0	-3.2	-1.2	-4.2	5.1	7.3	3.8	2.1	-0.2	-0.5	-1.0	-0.5	0.2	1.6
Percent of non-oil GDP	1.9	-8.2	-6.5	-2.4	-7.3	7.1	9.8	5.3	2.9	-0.3	-0.6	-1.3	-0.6	0.1	2.2
Structural oil Revenue															
Percent of GDP	31.4	26.0	26.3	29.9	31.4	39.1	37.2	30.6	25.5	21.0	17.5	16.8	17.1	28.6	23.7
Percent of non-oil GDP	57.4	53.4	53.4	56.3	55.2	54.2	50.1	42.7	35.1	28.7	23.7	22.7	22.9	53.5	32.3
Rule II: partial forward looking 3/															
Long-Term Oil Price	84.7	91.7	89.8	83.8	81.5	73.4	66.1	60.4	54.4	49.5	49.8	51.3	51.0	74.5	54.6
Structural balance 2/															
Percent of GDP	8.3	2.5	1.0	-2.3	-7.8	-5.2	-3.0	-3.4	-2.9	-3.4	-0.6	-0.6	-0.8	6.1	-2.1
Percent of non-oil GDP	15.2	5.2	2.0	-4.3	-13.7	-7.2	-4.1	-4.7	-4.0	-4.7	-0.8	-0.8	-1.1	12.8	-2.9
Structural oil Revenue															
Percent of GDP	38.6	32.5	30.5	28.9	27.8	28.8	26.9	23.4	20.4	17.8	17.4	17.2	16.7	34.6	20.0
Percent of non-oil GDP	70.7	66.8	61.8	54.4	48.8	40.0	36.3	32.7	28.2	24.4	23.6	23.2	22.4	66.3	27.3

Sources: Country authorities; and IMF staff estimates.

1/ Structural oil revenue is computed using the average oil price from the last 5 years and the 3-year average output.
2/ Structural balance is equal to structural revenue minus actual/projected spending; and structural revenue is equal to structural oil revenue plus non-oil revenue, which is also referred to as structural spending.
3/ Structural oil revenue is computed using the 8 year moving average oil price centered on current year and the 3-year average output (including current year).

Figure 4. Structural Balance Estimates

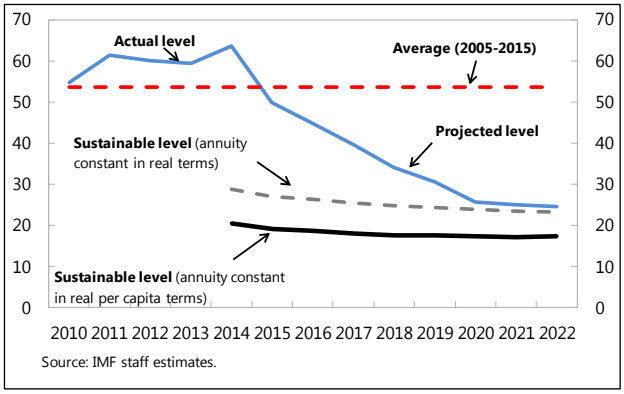


Sources: IMF staff estimates.
1/ Structural spending is equal to structural revenue or structural oil revenue plus non-oil revenue.
2/ Based on the average oil price from the last 5 years and the 3-year average output.
3/ Based on the 8 year moving average oil price centered on current year and the 3-year average output (including current year).

22. The government has reduced the gap between the actual non-oil primary deficit and the two PIH annuity measures since 2014 (Figure 5). The non-oil primary deficit declined by about 19 percent of non-oil GDP between 2014 and 2016 reflecting mostly a large reduction in capital spending. Looking forward, the staff's baseline projects a further 20 percent of non-oil GDP reduction in the non-oil primary deficit by 2022. This would reduce the gap with the constant real annuity to about 1 percent of non-oil GDP, although the non-oil primary deficit would remain about 7 percent of non-oil GDP above the real per capita annuity in 2022. To achieve intergenerational

equity on the real per capita measure, a fiscal surplus of about 4.7 percent of GDP would be needed in 2022. The average fiscal surplus needed to achieve intergenerational equity under the two annuities is 2.4 percent of GDP in 2022. Therefore, a faster pace of fiscal adjustment than in the staff's baseline scenario is needed to satisfy the PIH rule.

Figure 5. Projected and Sustainable Non-oil Primary Deficit
(As percent of non-oil GDP)



Source: IMF staff estimates.

D. Conclusions

23. Saudi Arabia has embarked on an ambitious fiscal adjustment program. This consolidation is based on a combination of additional measures to raise non-oil revenues, further energy and water price reforms, and the continued restraint of government spending. The scale of adjustment is very ambitious, although Saudi Arabia implemented a very large fiscal adjustment during the 1980s.

24. In sum, the fiscal space analysis in this paper suggests:

- **The authorities have some space to undertake a more gradual fiscal adjustment than set out in the staff's baseline in the next few years**. While a faster pace of fiscal adjustment may have advantages in terms of limiting the rundown in net assets, limiting upside risks to borrowing costs, and taking full advantage of the current pro-reform climate, it has disadvantages in terms of the larger impact on growth and employment in the near-term which may ultimately undermine the sustainability of the reforms. Saudi Arabia still has considerable fiscal buffers at its disposal to support a more gradual pace of adjustment during the next few years.

- **Nevertheless, over the medium-term some additional fiscal effort is needed.** Specifically, the baseline fiscal path does not stabilize net debt nor meet intergenerational equity considerations. Stabilizing net debt by the end of the projection period, rebuilding policy buffers, and moving closer to meeting intergenerational equity considerations would require some additional fiscal consolidation relative to the baseline over the medium-term.

- **Non-oil growth has slowed over the past year and a large output gap has opened up**. Some of the fiscal space could be used to slow the pace of fiscal adjustment in the next couple of years given the weak cyclical position of the economy.

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WHY HAS INFLATION DECLINED IN SAUDI ARABIA?[1]

Inflation has eased in Saudi Arabia since 2015 and in the first five months of 2017 was negative year-on-year. Understanding what has caused the decline in inflation is important. Domestic economic conditions have weakened as highlighted by the large negative output gap, but the exchange rate has also appreciated and imported prices have been falling. This paper uses estimates of a VEC model based on an augmented Phillips curve framework to shed light on the determinants of inflation in Saudi Arabia. The results suggest that the decline in inflation is being driven by the appreciating NEER, slower monetary growth, the decline in government spending, and weaker imported inflation. The output gap does not seem to be a key cause of the drop in inflation.

A. Introduction

1. After remaining quite stable during 2012-14, inflation started to ease in 2015 and abstracting from the impact of higher energy, water, and tobacco prices, fell further in 2016. The energy and water price reforms implemented in early 2016 saw CPI inflation rise, but after peaking in March 2016 at 4.3 percent, it has declined continuously, with average prices declining by -0.5 percent in the first five months of 2017. This is the first-time Saudi Arabia has seen a falling prices since June 2002. More generally, these recent developments suggest that Saudi Arabia may be returning to a period of lower inflation. Inflation averaged 1.4 percent from 1989-1996, prices declined by an average of 0.2 percent during 1997-2006, but the period 2007-2014 saw a higher average inflation rate of 4 percent.

2. Understanding what has caused the recent decline in inflation is important. If it has been caused by global factors—international prices and the appreciating U.S. dollar to which the Saudi Arabian riyal is pegged—the inflation path going forward is likely to be determined by how these factors develop. If, however, it has been caused by domestic factors linked to the ongoing fiscal consolidation which has seen the non-oil economy slow, a negative output gap develop, and monetary growth ease, then the lower inflation environment could be longer-lasting as fiscal consolidation continues.

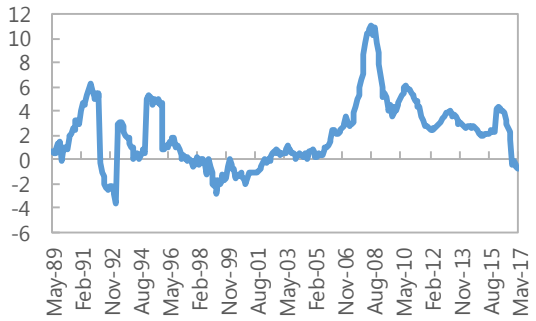
3. Housing and food have traditionally been the main components of the CPI driving inflation in Saudi Arabia. They represent 18 and 22 percent of the CPI consumption basket, respectively (Figure 1). The contribution of energy prices has been minimal. Over the past year, however, while food and housing inflation has declined, contributing to the drop in headline inflation, energy prices increased in January 2016 as energy price reforms were introduced, becoming the main contributor to headline inflation.

4. The rest of the paper is organized as follows. Section B looks at the factors influencing inflation in Saudi Arabia; section C discusses a model of the determinants of inflation in Saudi Arabia; section D reports the empirical results and projections of non-energy inflation; and section E concludes the discussion.

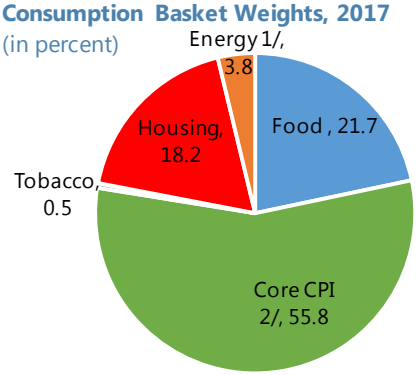
[1] Prepared by Ryadh Alkhareif (OEDSA), Moayad Al Rasasi (SAMA) and Sohaib Shahid (MCD). Research support was provided by Zhe Liu and editorial support by Diana Kargbo-Sical (both MCD).

Figure 1. Recent Inflation Developments

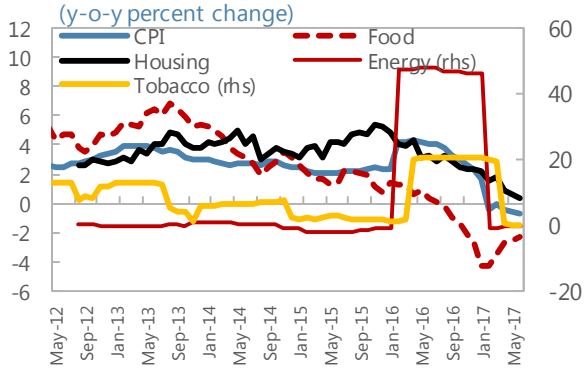
Inflation in Saudi Arabia, 1989-2017
(y-o-y percent change)



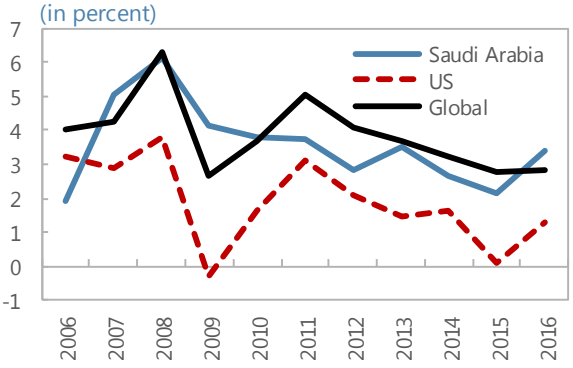
Consumption Basket Weights, 2017
(in percent)



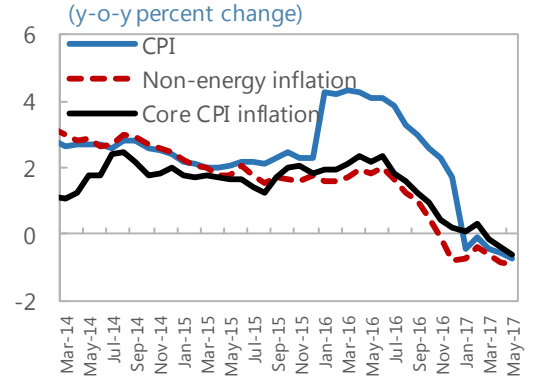
Monthly Inflation
(y-o-y percent change)



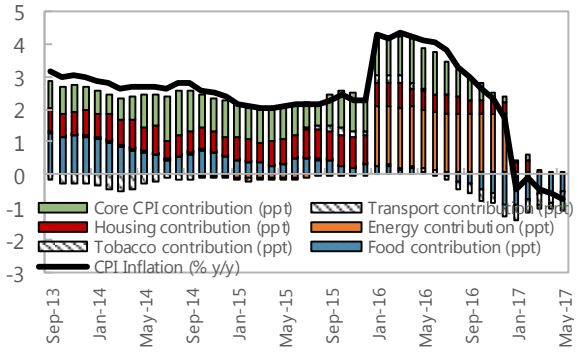
Global and Saudi Inflation, 2006-2016
(in percent)



CPI , Core and Non-energy Inflation
(y-o-y percent change)



Contribution to Inflation



Sources: Haver analytics, country authorities, and IMF staff estimates.
1/ Energy inflation includes water supply, electricity, gas and other fuels, and fuels and lubricants for transport equipment.
2/ Core CPI inflation excludes food, tobacco, housing, and energy inflation.

B. Inflation in Saudi Arabia

5. Determinants of inflation in Saudi Arabia can be classified into domestic and external factors. Domestic drivers are government spending, the output gap, and monetary growth. External drivers are the nominal effective exchange rate (NEER) and inflation in trading partners (Figure 2). Previous empirical studies show that external factors play a major role in determining inflation in Saudi Arabia. For example, Hasan and Alogeel (2008) using a Vector Error Correction Model (VECM) find that imported inflation and the exchange rate are the main drivers of inflation. Kandil and Morsy (2011), also using a VECM, find similar results for the GCC countries (see Appendix 1 for a summary of the literature in this area).

Domestic Factors

6. Growth has slowed sharply over the past two years. To look at the relationship between the domestic economic cycle and inflation, an output gap is estimated as follows:

$$Gap = \left(\frac{y_t - \bar{y}_t}{\bar{y}_t}\right) \cdot 100$$

where y_t is real output and $\bar{y}_t$ is potential output. In Saudi Arabia, there are several factors that need to be considered in estimating an output gap:

- First, the oil sector accounts for a large share (just over 40 percent) of GDP, but has little direct impact on the rest of the domestic economy (this effect comes via government spending which is reliant on oil revenues). Further, oil output is affected by decisions that have little to do with capacity constraints (for example, the recent decision to cut oil production to meet the OPEC agreement). Therefore, the oil sector is likely to have little direct influence on inflation. The non-oil output gap is likely to provide a better measure of domestic economic conditions as they affect inflation and this is what is estimated in this paper.

- Second, Saudi Arabia has a much more flexible labor market than most countries, with a very elastic supply of expatriate labor. This means that as output increases/decreases, potential output likely increases/decreases as well as the potential labor supply rises (and vice versa). So rather than translating into higher/lower wages and inflation, the positive/negative "output gap" is associated with a higher inflow/outflow of expatriate labor.

7. Bearing in mind these caveats, potential non-oil output is estimated via several different techniques—linear filter, HP filter, Band Pass filters (Baxter-King 1999 and Christiano-Fitzgerald 2003) and the production function approach. These are then used to calculate the output gap (see Appendix II for more details). The different approaches yield broadly similar results, although the current size of the estimated output gap varies across the different methodologies.[2]

[2] For 2016, the HP filter approach gives an output gap of -3.1 percent, the production function approach gives an output gap of -3.4 percent, and the linear trend approach gives an output gap of -2.8.

Using the output gap derived from the production function approach suggests a reasonably close correlation between inflation and the non-oil output gap (Figure 2).

8. Government spending and monetary growth also appear to correlate quite closely with CPI inflation (Figure 2). The public sector in Saudi Arabia has traditionally been the main driver of the economy. Higher government spending leads to higher aggregate demand, resulting in upward inflationary pressures. The correlation between government spending and inflation has increased in recent years. There is also a clear co-movement between monetary growth and inflation, although this relationship has not been as tight in recent months; monetary growth slowed considerably during the first half of 2016 as corporates struggled in the wake of government payment arrears, which pushed down bank deposits, while non-energy inflation remained more stable.

External Factors

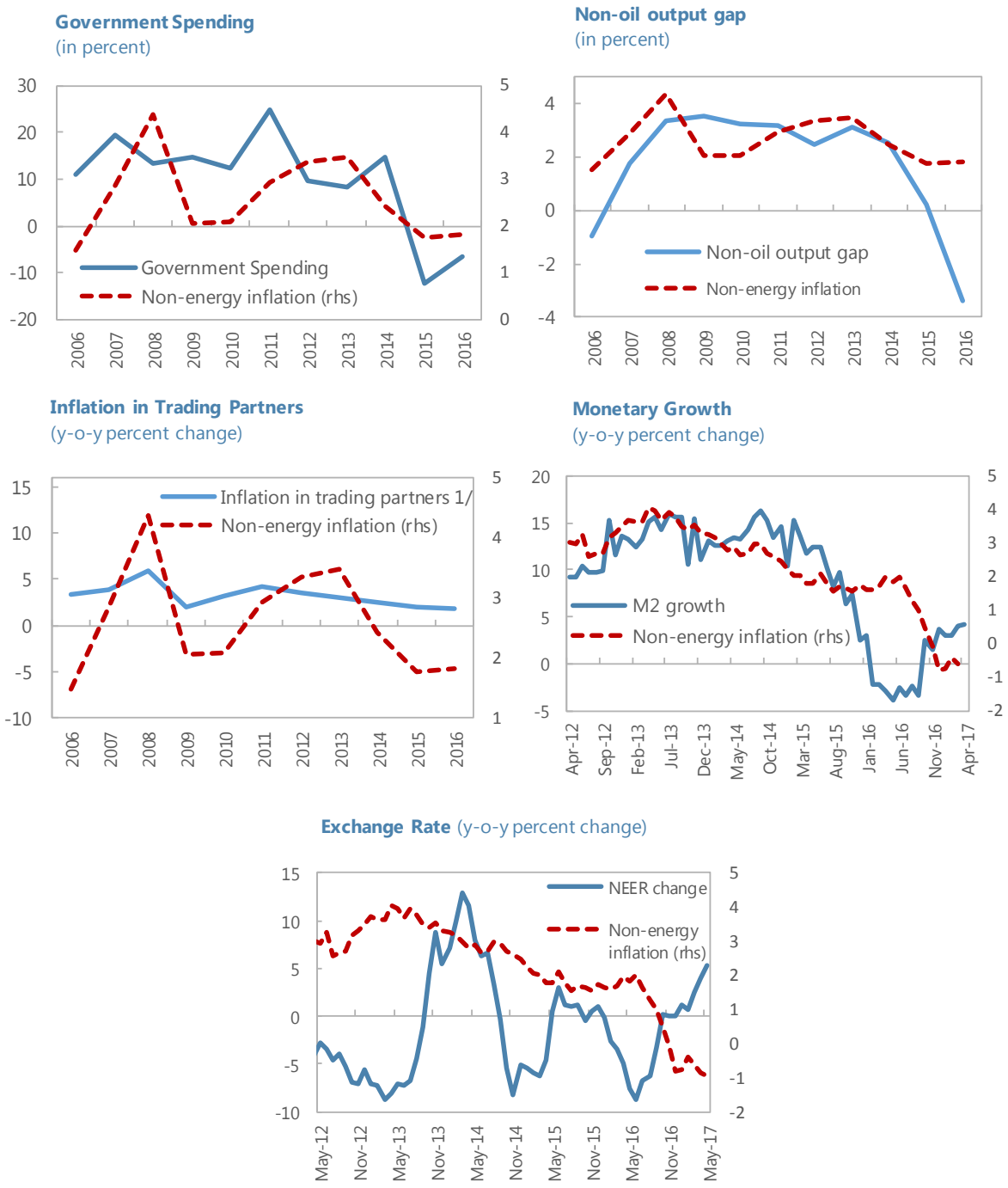
9. The NEER and global prices may explain inflation in Saudi Arabia. An appreciating NEER puts downward pressure on inflation as the country lacks a diversified domestic industrial base and depends heavily on imported goods and services. This means that higher prices in its trading partners passes through the import channel and exerts upward pressure on domestic inflation. A strong correlation between inflation in Saudi Arabia and its trading partners is evident in Figure 2.

C. Estimating the Determinants of Inflation

10. An empirical model is estimated that identifies potential domestic and external factors that influence inflation in Saudi Arabia in the short- and long-run. Using the multivariate co-integration approach proposed by Johansen (1988), a Vector Error Correction Model (VECM) is estimated based on an augmented Phillips equation framework. VECM is a type of error-correction model where the co-integrating vector will capture the long-term determinants of inflation and the short-term dynamics will trace the effects of the shocks in the following year. The results indicate the existence of one cointegrating vector.[3]

[3] The Augmented Dickey-Fuller (ADF) test for stationarity indicates that all variables are I(1).

Figure 2. Drivers of Inflation in Saudi Arabia



Sources: Haver analytics, country authorities, and IMF staff estimates.
1/World CPI weighted by imports.

11. A parsimonious model is employed in which four variables enter the long-run equation. The price level in the long run is assumed to be a function of money supply (m), exchange rate (*neer*), government spending (g), and foreign prices (p^*). To consider all factors affecting inflation in Saudi Arabia and to check for the robustness of the results, additional variables (real non-oil GDP (y) and foreign prices converted into Saudi Riyals (SAR) (p^*_sar)) (i.e., adjusting foreign prices for nominal exchange rate movements) were also added to the model sequentially (Table 1):

$$p = f(neer, m, g, p^*)$$

To combine the long-run and short-run dynamics, an error correction model is specified as follows:

$$\Delta p_t = c + \delta\left(\alpha_1 neer_{t-1} - \alpha_2 m_{t-1} - \alpha_3 g_{t-1} - \alpha_4 {p^*}_{t-1}\right)$$

$$+ \sum_{i=1}^{k} b_{1i}\Delta neer_{t-i} + \sum_{i=1}^{k} b_{2i}\Delta m_{t-i} + \sum_{i=1}^{k} b_{3i}\Delta g_{t-i} +$$

$$\sum_{i=1}^{k} b_{4i}\Delta {p^*}_{t-i} + \sum_{i=1}^{k} b_{5i}\Delta gap_{t-i}$$

Where k is the number of lags to be included and lower case letters represent the natural logarithm of the variables, gap is the output gap, and δ is the adjustment parameter.[4] gap is only included in the short-run equation since the output gap is a short-run concept i.e., the deviation of observed output from potential output is temporary. The model is estimated on annual data from 1990-2016.

D. Results

12. Results indicate that in recent years the decline in inflation in Saudi Arabia has been mainly driven by the exchange rate and government spending, while monetary growth and imported inflation have played a lesser role. NEER and monetary growth are robust across different specifications in the long-run (Table 1). Government spending and imported inflation, the change in foreign prices, are also robust in the short-run across various specifications. Since 2014, NEER and government spending have each explained on average more than 50 percent of the decline in inflation around its mean.[5] Real non-oil GDP has a positive impact on inflation, both in the short and long-run. The adjustment coefficient shows that the speed of adjustment in Saudi Arabia is low following deviations from the long-run equilibrium.[6] Looking at the impact of these variables on core inflation gives similar results, although imported inflation is not robust to different specifications when using core inflation (see Appendix III).[7] This could be because food is excluded from the core inflation measure, and is an important source of imported inflation. Column (2) in

[4] The coefficient on the error correction term captures the speed of adjustment towards equilibrium in response to short-term fluctuations.

[5] This is based on R-squared estimates of the variables for the specification in column (2). R-squared estimates for the remaining regressors were smaller than those on NEER and government spending.

[6] See Kandil and Morsy (2011) to see how the speed of adjustment in Saudi Arabia is lower than other GCC countries.

[7] Core inflation is defined as overall inflation minus food and non-alcoholic beverages, tobacco, and housing.

Table 1 is the preferred specification due to many coefficients being statistically significant – adding more variables as in column (1) reduces the statistical significance of the results.

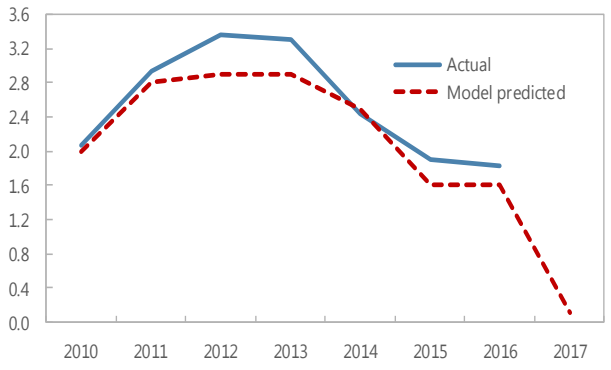
Table 1. Vector Error Correction Estimates: Determinants of Inflation
(Included observations: 26 after adjustments)

Long run equation	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
$neer(-1)$	-0.59***	-0.77***	-0.90***	-0.54***	-0.71***	
	(0.13)	(0.22)	(0.26)	(0.11)	(0.23)	
$m(-1)$	1.23***	1.95***	1.53***	0.87***	1.42***	1.91***
	(0.21)	(0.32)	(0.39)	(0.20)	(0.47)	(0.63)
$g(-1)$	0.97	-1.36***				-1.83
	(0.62)	(0.03)				(0.35)
$p^*(-1)$	0.16					
	(0.12)					
$current(-1)$			0.11			
			(0.56)			
$capital(-1)$				-0.27***		
				(0.04)		
$y(-1)$					0.63***	
					(0.07)	
$p^*\_sar(-1)$						0.84***
						(0.29)
Adjustment coefficient	-0.33***	-0.29**	-0.21***	-0.26***	-0.19**	-0.42***
	(0.08)	(0.13)	(0.05)	(0.09)	(0.08)	(0.13)
Short run dynamic						
$D(neer(-1))$	-0.26	-0.20	-0.15	-0.24	-0.35	
	(0.23)	(0.19)	(0.12)	(0.15)	(0.25)	
$D(m(-1))$	0.09	0.05	0.01*	0.03**	0.05	0.08***
	(0.08)	(0.03)	(0.00)	(0.01)	(0.04)	(0.03)
$D(g(-1))$	1.23**	1.03**				1.71***
	(0.67)	(0.47)				(0.51)
$D(p*(-1))$	0.34*	0.39**	0.45***	0.59*	0.44***	
	(0.17)	(0.16)	(0.12)	(0.30)	(0.17)	
$D(current(-1))$			0.87**			
			(0.41)			
$D(capital(-1))$				0.10***		
				(0.04)		
$D(y(-1))$					1.14***	
					(0.24)	
$D(p^*\_sar(-1))$						0.54*
						(0.20)
$D(gap(-1))$	1.24	1.69	1.56	0.96	1.57	1.85
	(3.80)	(8.24)	(2.52)	(0.84)	(0.87)	(1.12)

- An appreciation/depreciation of the NEER reduces/increases inflation in the long-term equation, but does not have a significant impact on inflation in the short-run dynamics.
- Money is an important determinant of inflation in the long-run equation, but not in the short-run dynamics. This result is in line with various studies that show a weak and unclear relationship between monetary growth and inflation in the short-run.
- In the short-run, higher government spending puts upward pressure on inflation, but it reduces inflation in the long-run. Decomposing government spending into its current and capital components suggests that the long-run negative impact on inflation could be due to capital spending (which likely reduces supply-side bottlenecks and eases capacity constraints) (see also Kandil and Morsy (2011)).
- Imported inflation is significant in the short-run, but only in the long-run equation when measured in SAR.
- The output gap is not found to have a significant impact on inflation. This is likely due to the unique labor market characteristics of Saudi Arabia. The elastic supply of available foreign labor means that when the economy is operating at capacity, more labor can be brought in to alleviate supply-side constraints without upward pressure on wages and prices.

13. The model suggests that non-energy inflation will decline further this year. The estimated model (using the specification in column (2) of Table 2) correctly picks the main trends of inflation over the past 6 years, although it has typically underestimated the inflation rate (Figure 3). In 2016, it suggested a lower average non-energy inflation of 1.6 percent while the actual non-energy inflation rate was 1.8 percent. In 2017, the model suggests that non-energy inflation will decline to 0.1. This projected decline is due to lower government spending and the lagged impact of the strong US dollar. One-off shocks in 2017, such as the excises, the second round of energy and water price reforms, and the fees on expatriate workers, however, will likely have a temporary effect on inflation. These one-off shocks are estimated to add 1.6 percentage points to inflation so the headline CPI is expected to increase by 1.7 percent in 2017.

Figure 3. Historical Fit Between Actual and Model Predicted Inflation
(In percent)



E. Conclusions

14. The decline in inflation in recent years can be explained by the appreciating exchange rate and lower government spending. Slower monetary growth and lower imported inflation have also played a role.

15. The output gap does not have much of an effect on inflation in Saudi Arabia. The Saudi economy has a unique labor market. Unlike most countries, Saudi Arabia has access to a large pool of foreign labor whose supply is highly elastic. This means that whenever the economy is operating above capacity (positive output gap), more labor is readily available to alleviate any supply side bottlenecks or capacity constraints. Having immediate access to such labor prevents an upward pressure on prices whenever the output gap is positive.

16. Going forward, inflation is likely to remain subdued, but will be hit by a series of one-off shocks. Ongoing fiscal consolidation will weigh on prices, but one-off shocks will temporarily raise inflation. These one-off shocks will include excise taxes, energy and water price reforms, higher fees on expatriate workers, and the VAT.

Appendix I. Literature Table

Citation	Sample	Method	Conclusions
Hasan and Alogeel (2008)	Annual data from 1966-2007.	Johansen and Juselius cointegration tests and the estimates of VEC models.	Imported inflation and exchange rate pass-through are the main forces driving inflation in Saudi Arabia over the long run. However, money supply shocks and demand shocks have short-term effects on inflation.
Kandil and Morsy (2011)	Annual data for GCC countries over the period of 1970-2007.	Johansen and Juselius (1988) cointegration tests and the estimates of VEC models.	Inflation is determined by both domestic and foreign factors. Imported inflation and nominal effective exchange rate are the main drivers of inflation in GCC countries over long run, including Saudi Arabia.
Nazer (2016)	Annual data 1989-2014.	Correlation, cointegration, causality analysis, and the estimation of linear model by OLS.	A significant and positive relationship exists between inflation, money supply, and import prices. Oil prices though seem to not have a significant impact on inflation in Saudi Arabia. Causality analysis indicates that changes in money supply, import prices, and oil prices are key factors in predicting inflation.
Osman et al. (2010)	Annual data for GCC countries from 1970-2006.	The linear trend model, Hodrick-Prescott filter, Band-Pass filter and the unobserved components model was used to estimate the output gap.	Parameter estimates of the Phillip curve show that output gap has explanatory power on domestic inflation in Saudi Arabia.
Ramady (2009)	Annual data from 1986-2007.	Correlation analysis and OLS estimation of a linear model.	Inflation in Saudi Arabia is determined by a combination of internal and external factors. Inflation is correlated significantly with money supply, oil prices, Saudi interest rate, and the US interest rate. Regression analysis shows that money supply, exchange rate, stock price index, and US interest rate affect inflation significantly.

Appendix II. Measuring the Output Gap

1. The output gap approximates the movement in each point in time of observed output (real non-oil GDP) from potential output. We calculate the output gap as follows:

$$Gap_t = \left(\frac{y_t - \bar{y}_t}{\bar{y}_t}\right) \cdot 100$$

Where y_t is the log of the observed real non-oil GDP in time *t* while $\bar{y}_t$is the log of the potential output in time *t*. We calculate $\bar{y}_t$ using various methods; linear trend, HP filter, Baxter-King (BP) filter, and the production function approach.

Table 1. Saudi Arabia: Various Methods Were Employed to Calculate Potential GDP

Trend	
Linear trend	A linear trend is fitted through the log of non-oil GDP. Tests were conducted for structural breaks using Chow and Quandt-Andrews tests.
Univariate filters	
HP filter	Potential output using this filter was calculated as the series that minimizes deviation of actual non-oil GDP and potential real non-oil GDP. We use a smoothness parameter of 100 which is consistent with standard practices.
BP filter	This filter, using approaches by Baxter & King (1999) and Christiano & Fitzgerald (2003) deals with business cycles using a range of frequencies to construct the cyclical component.
Multivariate	
Production function approach	Based on the approach put forward by Fuentes et al. (2007) we find the potential output using estimate of the capital stock, labor force and technological change to estimate potential output.

2. The measure for potential output we use comes from the HP filter. The rationale behind this is because the HP filter method allows us to use the complete sample (1988 – 2016). Due to data limitations (labor force data not available prior to 1999), we cannot use the complete sample when implementing the production function approach. We do not use the BP filter for our estimation due to the BP filter not providing any estimate towards the end of the sample. Though we do have the complete sample for the linear trend, we do not use it due to the HP filter providing more reliable results than the linear trend.

Appendix III. Determinants of Core Inflation

Table 1. Saudi Arabia: Vector Error Correction Estimates: Determinants of Core Inflation
(Included observations: 26 after adjustments)

Long run equation	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
$neer(-1)$	-0.64***	-0.86***	-0.84***	-0.47***	-0.69***	
	(0.17)	(0.29)	(0.34)	(0.19)	(0.18)	
$m(-1)$	1.43*	1.68***	1.48***	1.86***	1.37***	1.12***
	(0.70)	(0.32)	(0.35)	(0.24)	(0.57)	(0.38)
$g(-1)$	1.12	-1.12***				-1.68***
	(0.71)	(0.37)				(0.53)
$p^*(-1)$	0.03					
	(0.02)					
$current(-1)$			0.03*			
			(0.01)			
$capital(-1)$				-0.28**		
				(0.12)		
$y(-1)$					0.56***	
					(0.01)	
$p^*\_sar(-1)$						0.53*
						(0.26)
Adjustment coefficient	-0.39***	-0.31**	-0.28***	-0.32***	-0.40**	-0.64***
	(0.11)	(0.11)	(0.06)	(0.05)	(0.17)	(0.27)
Short run dynamic						
$D(neer(-1))$	-0.19	-0.27	-0.28	-0.28	-0.37	
	(0.27)	(0.12)	(0.24)	(0.22)	(0.31)	
$D(m(-1))$	0.01	0.00	0.03***	0.05**	0.07	0.09***
	(0.03)	(0.01)	(0.00)	(0.02)	(0.05)	(0.00)
$D(g(-1))$	1.87***	1.24**				0.59***
	(0.62)	(0.61)				(0.13)
$D(p*(-1))$	0.41*	0.52**	0.91	0.67	0.48***	
	(0.20)	(0.19)	(0.63)	(0.39)	(0.15)	
$D(current(-1))$			0.52			
			(0.38)			
$D(capital(-1))$				1.12***		
				(0.09)		
$D(y(-1))$					1.08***	
					(0.21)	
$D(p^*\_sar(-1))$						0.73***
						(0.25)
$D(gap(-1))$	1.35	1.34	1.98	2.31	1.14	1.82
	(2.34)	(3.14)	(4.12)	(1.98)	(1.91)	(1.36)

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