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Assessing Kuwaiti Energy Pricing Reforms

by

Manal R. SHEHABI

Business School, University of Western Australia
Oxford Institute for Energy Studies

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The University of Western Australia
manal.shehabi@research.uwa.edu.au
Oxford Institute for Energy Studies
manal.shehabi@oxfordenergy.org

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*** Manal Shehabi, Economics Department, Business School, The University of Western Australia. Visiting Research Fellow, Oxford Institute for Energy Studies, The University of Oxford.*

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Abstract

From mid-2014 Kuwait has experienced a substantial drop in its petroleum export price and, consequently, government revenue, causing a severe fiscal deficit and impaired economic performance. Cutting energy subsidies has become a policy priority. In the face of widespread opposition, the government raised gasoline prices in August 2016, proclaiming such reform the key to solving economic problems; yet recent policy discussions have not addressed the mechanism of pricing reforms. The paper offers a quantification and assessment of energy pricing reform in the current low petroleum price environment via a general equilibrium model of the Kuwaiti economy that embodies the structure of its economy and its labor market, its oligopolistic industries, and external flows associated with its sovereign wealth fund. Simulations clarify the required adjustments, including the seldom discussed expatriate labor exit and the decline in oligopoly rents. While necessary, subsidy reform implies tradeoffs, notably between fiscal stabilization and cost of living sustainability. The results confirm that successful implementation must be accompanied by carefully designed mitigation measures and associated microeconomic reforms.

1. Introduction

The petroleum price decline since mid-2014 has caused severe fiscal deficits among Gulf Cooperation Council (GCC) states, rendering subsidy reforms urgent. The impact in Kuwait was severe due to the economy's dependence on hydrocarbons, which in 2014 generated 92% of the Kuwaiti government's revenue and 55% of its GDP. After the oil price collapsed from US $103/barrel (bl) in January 2014 to US $30/bl in January 2016, the government announced an estimated 75% revenue drop. Despite a history of strong fiscal surpluses and substantial foreign asset accumulation in its sovereign wealth funds (SWFs), in 2016 Kuwait recorded its first budget deficit in over 16 years. Official figures anticipate a further budget deficit of US $73 billion over 2016-2019. While reliance on an inherently volatile commodity renders any petro-dependent economy susceptible to boom and bust cycles, the impact on Kuwait's economy has been exacerbated by very large fiscal commitments and rigid expenditures, including subsidies. Yet implementing reforms has proved particularly challenging. Policy discussions have been dominated by debates about the need for, rather than the mechanism of, energy price reform. The latter is the subject of this paper, which quantifies the economic impacts of subsidy reform in a low petroleum price environment using an economy-wide modeling approach.

Studies of this type in the context of Kuwait and the GCC are few. Economic theory has widely accepted that subsidies, although pervasive, are distortionary (Plante, 2014), causing inefficient resource allocation and wasteful consumption. Subsidies also are naturally inequitable; even when their objective is to expand energy access to the poor, their benefits tend to accrue to richer households due to their higher consumption levels. Nevertheless, empirical assessments of energy subsidy reform in developing countries offer inconclusive evidence; some suggest a negative impact on households' welfare (Arze Del

Grando et al., 2012; Gahvari & Taheripour, 2011), while others conclude welfare gains (Lin & Li, 2012). Hartley & Medlock III (2008) argue that national oil companies (NOCs), such as the Kuwait Petroleum Company (KPC), are on average more inefficient than private oil companies, and that their subsidizing of domestic customers increases this inefficiency. Using a micro-model, BuShehri & Wohlgenant (2012) show that reducing Kuwaiti electricity subsidies hurts welfare. By contrast, Fattouh & Mahadeva (2014) find that the alignment of residential electricity and water prices with market prices, coupled with cash transfers, encourages efficiency in consumption and generates a net welfare gain.

None of these studies examine the intermediate and macroeconomic implications of pricing reforms. Economy-wide models are best suited to offer such insights, but only a few such models of Kuwait's economy exist. Alsabah's (1985)[1] computable general equilibrium (CGE) framework of Kuwait between 1979 and 1989 and the dynamic CGE model of Khorshid (1990, 1991) analyze the role of policies in driving Kuwait's long-term growth and the effects of domestic government expenditures on relative sectoral performance. Gelan (2014) utilizes the International Food Policy Research Institute (IFPRI) standard CGE model (Lofgren et al., 2002) with Kuwaiti data from 2010, concluding that distributing cash transfers could reverse some of the contractionary effects and welfare losses engendered by electricity subsidy reduction alone. This model's high level of aggregation limits its ability to quantify distributional effects or supply-side technological changes. Collectively, these CGE assessments are dated and do not reflect recent economic features or current petroleum market conditions.

In assessing efficiency and economic policy, the omission of oligopoly from existing models of small economies like Kuwait is particularly important, since the assumption that policies directed to the advantage of one industry will have no effect on others is indefensible. It is well understood that competition induces innovation, so that short run oligopoly rent is destroyed in the long run by innovation (Schumpeter 1911, 1942).[2] This idea has become central to modern research on economic growth (Segerstrom, Anant, & Dinopoulos, 1990; Aghion & Howitt, 1992; Aghion, Akcigit, & Howitt, 2013). Oligopolies distort markets and prices and their sustained rents engender strategic behaviors that detract from growth-enhancing innovation (Grossman & Helpman, 2014). Incorporation of oligopoly behavior by Tyers (2014) suggests that the full exploitation of oligopoly market power in Australia would cause a reduction of real GDP by as much as a third in the long run. Of course, in advanced economies, this effect is moderated by pricing surveillance and price-cap regulation. Yet in resource exporters, oligopolies play an additional role: their increased rents during booms and (usually subsidized) losses during busts further impair economic performance.

[1] Unpublished doctoral dissertation.

[2] The core idea is "creative destruction," which entails that innovation is induced by competitive forces and that, while any single innovation confers rents in the short run, subsequent competitive innovations "destroy" these rents, maintaining efficiency (Schumpeter, 1942: 82-83).

This paper aims to fill existing gaps in the literature by assessing and quantifying the potential effects of subsidy pricing reform in Kuwait following declines in petroleum export revenue through economy-wide modeling. To that end, the paper employs an economy-wide CGE framework that incorporates oligopoly behavior by extending the approach of Asano & Tyers (2015) and adapting it to Kuwait's economy. Importantly, this extends conventional CGE representation by making explicit firms' profit maximization pricing rules and economies of scale. At the same time the model is designed to embody the unique features of Kuwait's economic structure, including its public sector dominance and interventions, its welfare system, capital inflows through its SWF, and particularities of its labor market that are common across GCC states. An important contribution is the construction of a model database depicting these elements. The structure adopted enables the assessment of terms of trade shocks, real exchange rate volatility, and the changes in elasticities of demand that occur as sources of demand shift in response to commodity price shocks. In the context of the current literature on the Middle Eastern and North African economies, this model offers a unique perspective on oligopolistic behavior, its regulation, and the management of both petroleum and non-petroleum oligopoly rents. It is also the first to explore the further effects of coordination between regulatory competition policies and the management of foreign labor contracts.

Section 2 offers a documentation of Kuwaiti energy pricing developments and economic features. Section 3 highlights key elements of the model database. Details of the constructed model follow in Section 4. Section 5 summarizes empirical applications of the model, quantifying the transmission mechanism to the Kuwaiti economy of petroleum price volatility, subsidy reform, and possible competition reform. Simulations clarify the required adjustments, including the seldom discussed expatriate labor exit and the decline in oligopoly rents. They also show that the expansion of non-petroleum tradables has limited but positive potential as a stabilizer of the economy. Section 6 reveals various tradeoffs, most notably between fiscal stabilization and cost of living sustainability. It concludes that, although necessary, subsidy reform alone cannot provide the solution hoped for by the government, thus requires the addition of carefully designed mitigation measures and associated microeconomic reforms.

2. Developments in Pricing Policy and Economic Features

Energy subsidies in Kuwait have been pervasive and conspicuously high, even when compared to other petrostates. A price gap approach comparison of domestic prices with their international shadow prices shows that Kuwait's subsidization rate of energy products in 2014 reached 87% (Figure 1).

[Insert Figure 1]

Until mid-2016, Kuwaiti electricity prices were less than one-twentieth of generation costs and had not changed since 1990. Water, for which the desalination techniques use local hydrocarbon resources, has

been offered at virtually no cost. Before August 2016, while many petrostates (such as Iran, Venezuela, and the GCC states) had increased local prices, local gasoline prices remained as they had been for decades and were the lowest in the world. Artificially low domestic prices contributed to excessive consumption; in 2014, Kuwait was the world's sixth highest per capita energy consumer (World Bank, 2017). Figure 2 demonstrates the resulting fiscal pressures by comparing declining petroleum and, correspondingly, government revenues with increasing welfare and subsidy expenditures.

[Insert Figure 2]

Against this backdrop, cutting energy subsidies at an accelerated pace has become a policy priority; yet reform attempts have been unsuccessful or delayed due to political opposition. Thus, in the wake of the rejection of various schemes, the National Assembly proposed 'excluding owner-occupied residences of Kuwaiti citizens' from any increase in electricity prices, effectively raising prices only for expatriates. In March-April 2016, electricity prices for residential use by expatriates were proposed to increase from US $0.007 progressively to US $0.05/kilowatt, and for commercial use from US $0.007 to US $0.082/kilowatt. Kuwait lagged behind the energy price liberalization of other GCC states, the last to reform its gasoline prices. This occurred in August 2016, by which point Kuwait had the lowest domestic gasoline prices globally and a US $15.3 billion deficit for 2016. Circumventing parliament, the government raised gasoline prices by 41–83%, differentiated by octane levels, to the international shadow price effective from September; members of the National Assembly requested a hearing about petrol price increases and challenged the energy price reform in court, citing a 1995 law prohibiting the government from raising public service charges without parliamentary approval. Tensions culminated in an executive decree to dissolve the parliament in October 2016, after which the subsidies were not reinstated, but the proposed three-month price adjustment policy was not implemented. The government insisted its pricing reform would solve fiscal pressures, economic inefficiencies, and energy over-consumption, and that any subsequent inflation would be muted. As opposition mounted, the new parliament—of which opposition members are the majority—called for a draft law to abolish energy price hikes. Beyond these binary options, the economic impact of reforms has been little debated.

Energy pricing reform in Kuwait is necessary due to its peculiar economy. Like other petrostates, government revenues are volatile owing to reliance on an inherently volatile commodity, while GDP is largely dependent on hydrocarbons with a relatively small non-petroleum production sector. The economy's relatively unique features further exacerbate the impact of price volatility, posing serious policy conundrums. The following subsections summarize the qualitative context of these features, which were factored in the construction of the model of Kuwait's economy.

2.1. Dominance of the Public Sector

The public sector is the employer of choice for Kuwaiti workers and it dominates the economy, extending to the nominally independent but publicly-owned hydrocarbon industry. In 2014, the public sector generated over 65% of GDP, compared with a private sector share that has ranged between 21% (1989) and 41% (2010). This structure dates back to early developments of modern-day Kuwait following the oil price hikes of the 1970s. It contributes to large and rigid government expenditures, impacting total welfare. As is well known in economic literature, publicly-owned firms are monitored by the government and managed so as to favor domestic consumer surplus and domestic employment (Hartley & Medlock III, 2008; Hartley & Trengove, 1986). In 2010 (under law 37/2010) the Kuwaiti government adopted its "Privatization Plan" with the aim of increasing the role of the private sector through various Five-Year Development Plans, the most recent beginning in 2015.[3] Yet there is still a discrepancy between the plan's stated objectives and economic realities, as the overall structure and size of the private sector have remained largely unchanged.

2.2. Fiscal Rigidities

Adjusting the fiscal gap between revenue and expenditure is difficult during periods of low petroleum prices due to the following factors.

Rigid government expenditure

Current expenditure constitutes 80% of government expenditure, and half of current expenditure funds the public sector wage bill. The size of this bill reflects Kuwaitis' preferences for working in secure, permanent jobs with wages exceeding those in the private sector as well as the constitutional right – which it is the duty of the government to meet – of each Kuwaiti citizen to employment.

Generous welfare transfers

In 2014, transfers and subsidies to households and firms represented more than half of the government's total spending. They span a wide range of products and services, including energy.[4] Such large commitments have reduced the scope and flexibility of other public expenditures, which are rigid in light of the opposition to any reduction of public transfers. Generous welfare payments are at the core of the Kuwaiti political economy, an arrangement deeper than the so-called petroleum era 'social contract' (i.e., the distribution of resource rents in lieu of political obedience). For some of the politically active constituency, reform contradicts the state's historic role in distributing petro-rents to the citizens, the ultimate owners of the resource. Accordingly, all official plans to reduce welfare distribution were ignored prior to the reforms following the fiscal crisis in 2016.

[3] The Ministry of Planning and Development's five-year development plans were first adopted in 1984-1985.
[4] El-Katiri, Fattouh, and Segal (2011) detail Kuwaiti welfare transfers.

Negligible tax revenue

Tax revenue constitutes an insignificant share of the revenue side of the government budget. Taxes are applied at almost negligible rates on labor income. Despite discussions of tax reform and the imposition of income tax, especially on expatriate workers, overall tax revenue represents less than 1% of government revenue. Negligible rates were also applied for decades on the profits of Kuwaiti firms. By contrast, wholly or majority-owned foreign firms, a small proportion of the total, have faced internationally comparable rates of higher company tax, in some instances as high as 55%. Yet most of them paid local rates by operating through local partnerships. Further, all publicly traded and closed Kuwaiti shareholding companies pay 1% tax as *zakat*, the almsgiving tax mandated by Islamic law. Shareholding activities pay 1% of total profits in support of scientific research undertaken by the Kuwait Foundation for the Advancement of Science. As part of fiscal reforms in 2016, the government approved the introduction of corporate taxes of 10% of profits of Kuwaiti firms and multinationals' permanent establishments (Al-Sannari, 2016). A value-added tax (VAT) of 5% is expected to be imposed in 2018, in line with a GCC-wide agreement. As another means to diversify government revenue, in 2017 the parliament proposed imposing a 5% tax on foreign remittances, which equaled 5% of GDP and 18% of government revenue in 2015 (with estimates as high as 35% in 2016) (Farouq & Moussa, 2017).

2.3. Labor Market

Although omitted from much of the associated literature, the composition of the labor market is particularly important for small economies like Kuwait, with their dependence on temporary expatriate labor. The composition of the labor market and its flexibility, particularly relating to immigration and temporary worker policies, are an essential safety valve in the face of export volatility. They also have various economic, social, and political implications for the GCC. Table 1 presents the breakdown of the Kuwaiti labor force.

[Insert Table 1]

The composition revealed by the data has important sectoral, wage, and labor mobility implications. Expatriates comprise 83% of Kuwait's labor force. Overall, 77% of Kuwaitis are employed by the bloated public sector, which has high disguised unemployment. Nonetheless, highly subsidized government-owned industries, such as electricity, employ mostly Kuwaitis. Public sector positions prioritize indigenous employment and offer salaries exceeding those in the private sector for similar levels of education and technical training (Al-Kaisi, 1993). To increase Kuwaitis' private sector participation the government offers private firms allowances to equalize Kuwaiti workers' wages with public sector wages; however, the private sector remains saturated by expatriates, who hold 95% of its jobs. Further, data from PACI imply that more than three-quarters of expatriate labor occupies low-skilled positions in construction, sales, machinery, and trades. Expatriate wages generally are lower than public-sector

Kuwaiti labor wages, constituting 70% of total wages, the majority of which are transferred abroad as remittances. It is estimated that a total of US $15 billion were transferred in 2016, mostly to India, Egypt, and the Philippines. Importantly, expatriates have flexible labor contracts tied to employer-sponsored visiting working visas through the *kafāla* system. Their employment level is thus endogenous, reacting to shocks in the economy.

2.4. Oligopoly

It is not surprising that the high levels of minimum efficient scale delivered by modern technology and the smallness of the GCC economies should lead to the emergence of oligopolies or monopolized industries, particularly in protected services. Nonetheless, it is likely that these competition imperfections are highly distortionary and, therefore, limit economic performance Using data on listed companies from the Kuwaiti Stock Exchange, Figure 3 depicts the concentration of industries' capital within a few companies.

[Insert Figure 3]

The pervasiveness of oligopolies, identified by high levels of concentration within a few industries, are evident when examining listed firms' market capitalization across industries shown in Figure 3. For instance, two out of a total of 61 financial services firms own over 50% of the total industry's listed share market value. It is not surprising that a small economy like Kuwait should have its markets supplied by monopolies and oligopolies. Kuwait has no significant agriculture, and its domestic demand is small compared with minimum efficient scale in its Manufacturing and Network Services industries, which Kuwait exports on a small scale. Nonetheless, the data imply distortions across all listed industries. Importantly, although data on capital for unlisted companies are unavailable, similar concentration trends are evident when examining revenue of an aggregate representative data of all (listed and unlisted) Kuwaiti companies across all industries. Kuwait's Ministry of Commerce and Industry has passed Law 10/2007 for the Protection of Competition, which established the Kuwaiti Competition Protection Authority to reduce imperfect competition. Despite its limited role to date, the very existence of this agency points to the prevalence of oligopoly in the economy.

2.5. Kuwait Investment Authority (KIA)

One of the most important factors in Kuwait's historical ability to weather petroleum prices falls is its foreign investments held by the country's SWFs, the KIA. SWFs are government-owned investment funds commonly established during periods of government surplus.[5] In resource-rich states, they are established to reduce the impact of volatile petroleum windfall on exchange rates. They also offer a mechanism to reinforce fiscal discipline and diversify government portfolios. The KIA was established in

[5] For further reading: Collier, Spence, van der Ploeg & Venables, 2010; van der Ploeg & Venables, 2012.

1953, 8 years prior to independence, and is the oldest country-owned fund in the world. Currently estimated at $592 billion,[6] the KIA manages two funds. One is a long-term intergenerational fund established as an alternative source of government revenue to petroleum.[7] The second, the GRF, serves a macro-stabilization objective, offering fiscal rebalancing through inflows to and from the fund. Either budget surpluses are invested in the GRF or funds are withdrawn from it to smooth out short-run governmental expenditures during deficits, thus shielding the economy from the negative impacts of petroleum price volatility. Critically, both KIA funds employ diversified investment strategies in various industries and across various geographical regions. The KIA was successful in acting as a financing alternative to revenue shortages.

3. The Social Accounting Matrix

A key component of applying the CGE framework economy-wide is the use of an appropriate database to which the model can be calibrated. An ideal framework for CGE models is a SAM depicting all sectors in an economy and the interactions between them within a given period. The constructed SAM reflects features of Kuwait's economy drawing from various official data sources for 2013 (the most recently available). Appendix A details the SAM construction. The constructed SAM aggregates official data for 57 economic sectors to 14, of which 6 are energy or energy-intensive industries. It also disaggregates factor rewards to seven primary factors: physical capital, skilled Kuwaiti labor, skilled non-Kuwaiti labor, unskilled Kuwaiti labor, unskilled non-Kuwaiti labor, arable land, and energy resources (petroleum in the ground). Factor shares and input output coefficients from this 2013 data are combined with detailed bilateral trade, transport, and trade protection data (such as tariffs), as well as country-specific data such as national accounts and balance of payments. The SAM reveals key structural elements of the Kuwaiti economy, which Table 2 depicts.

[Insert Table 2]

The data reveal dynamics pertinent to assessing impacts of oil price shocks and pricing reforms. After hydrocarbons, Other Services are the second-highest value-adding industry, employing mostly expatriate labor. The Chemicals, Other Network Services, and Transport industries generate 14% of exports, each exporting approximately one-third of its output. Data on these industries indicate that Kuwait has some existing expandable non-petroleum exportation capacity, and point to a heavy indirect effect through imported intermediate inputs (which form a large part of all intermediates).

[6] Kuwaiti Law No. 47 of 1982, Clauses 5 and 8-9, bind the KIA to nondisclosure, making data on the KIA confidential. Detailed data are provided to the Council of Ministers with strict restrictions on public access.
[7] The government is mandated to invest 25% (reduced to the pre-2012 share of 10% in the wake of the oil price collapse) of all petroleum export revenue in this fund.

Crucial to interpreting the results are factor shares of value added in each industry, shown in Table 3.

[Insert Table 3]

Oil Refining, Electricity, Chemicals, and Network Services have the highest capital intensity. The tradable Manufacturing industries and the nontradeable Other Services and Construction have the highest labor intensity. These relative intensities determine changes in factor rewards following commodity price shocks, thereby driving factor relocation and output across industries.

Per the SAM data, the reported consumption subsidies are approximately 8% of value added activities. Their value combined with government reported industry subsides in 2013 was US $8,670 million, as Table 4 details. These figures exclude the shadow price and costs of virtually free energy inputs (such as petroleum and natural gas provided to the electricity and water industries).

[Insert Table 4]

4. Modeling the Kuwaiti Economy

The model is implemented using the GEMPACK (General Equilibrium Modelling PACKage) modeling software. It is a development of that described in Shehabi (2017). The following offers an overview of the model, with details consigned to Appendix B.

4.1. Genesis and Extensions

Key motivations behind the chosen model structure are the importance of oligopolistic behavior; the potential role of pricing regulation in small economies in moderating the impact of petroleum volatility on employment and overall economic activity; and the need to compare the short and long term implications of, and interactions amongst, energy, trade, labor, and macroeconomic policies. The model incorporates core features of features of conventional CGE modeling, building on Asano and Tyers (2015). The "almost small" characterization of the modeled economy follows Harris (1984) and Dixon et al. (1982) and its openness extends to financial markets via endogenous saving and investment and open capital and current accounts. These assumptions are essential in the case of Kuwait, which has a small economy that is highly dependent on trade (including imports in markets where it is a price taker) and on international financial flows. Like that of Balistreri & Markusen (2009), the model includes the standard CGE modeling feature of Armington[8] elasticities of subnational product differentiation between home and

[8] According to Armington's (1969) theory, home and foreign goods (i.e., imports) are imperfect substitutes in the aggregate production of a given industry. Thus, tariff reduction or exchange rate appreciations will make home goods relatively less expensive, thus shifting the composition of the aggregate output towards imports. The

foreign products, with home products generally having higher elasticities of substitution than international ones. This feature implies important relationships between industry policy, the terms of trade, and the real exchange rate.

Financial flows and real exchange rate changes are endogenous, while external economic conditions, such as yields on investments abroad and global petroleum market trends, are exogenous and can be shocked in model simulations. The model adopts neoclassical features in characterizing consumption preferences and the variable costs of production, including optimizing representative agent behavior, full input substitutability, and flexible product and factor prices. It accounts for the key structural details that characterize the Kuwait economy (Ocampo, Rada, & Taylor, 2009). The unique Kuwaiti economic features captured are as follows.

Public sector

Given that KPC and the electricity company operate as large and nominally independent corporations, they are represented as separate monopoly firms with their own factor demand and output. The government is treated as the residual owner of additional rent payments (profits) after payments to fixed and variable capital and labor.

Taxes and subsidies

Fiscal rigidities are included in the model through a full representation of government accounts and expanded consumption subsidies and taxes (both direct and indirect). Although in Kuwait some of these government revenue sources are not active, the modeling includes them to enable the analysis of potential taxation reforms. The collection of petroleum export revenue appears as a quasi-tax payment, used to infer a corporate tax rate. Subsidies are represented by negative consumption and company taxes.

Flexibility of labor contracts

The model expands industries' production functions to include four labor types that are differentiated by nationality (i.e., Kuwaiti and expatriate) and by skill. Rigidities in the labor market are assumed, especially pertaining to public sector employment and low-skill wages.

Oligopolistic industries

Uniquely, in a departure from conventional CGE modeling, the model represents oligopoly with behavioral structure from Asano & Tyers (2015), which is based on earlier work done by Tyers (2014), Gunasekera & Tyers (1990), Harris (1984), Horridge (1987), and Tyers (2005). This representation emphasizes oligopoly rents in the spirit of Blanchard & Giavazzi (2003) who, in a closed-economy general equilibrium setting, found that increased competition is beneficial to an economy because it leads firms to lower their markups, in turn lowering prices and increasing output and exports economy-wide. In

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Armington specification in the model allows the economy to produce, import, and export products of the same sector.

all economic sectors, private and state-owned firms are oligopolistic in their product pricing behavior, with each colluding on prices at various levels. To incorporate in the model the realistic feature that larger firms are subject to regulation and pricing surveillance, data[9] are analyzed on industry structure, conduct, and performance to determine cost and pricing behavior, represented in the model through parameterization. Importantly, collusion and other values can be set to represent a degree of regulatory surveillance or price cap enforcement by the Kuwaiti Competition Protection Authority.

KIA

An important feature to model concerns external financial flows, primarily flows to and from the KIA. These mimic, to the extent possible, the KIA's role as a source of government funds following petroleum price shocks.

4.2. Model Structure

Two regions (Kuwait and the Rest of the World) are incorporated in a comparative static framework. As modeled, the Kuwait economy has one representative household that consumes home and imported goods, supplies indigenous and expatriate labor and skill and owns physical capital. Firms in 14 industries rent capital and hire workers, supplying products and services to meet five demand sources: final, intermediate, investment, government, and foreign demands. The government earns petroleum revenue, collects taxes and transfers subsidy and welfare payments to firms and Kuwaiti households. The model represents financial agents who manage portfolios of domestic and foreign assets. Employment contracts are flexible for each labor type (and can be fixed in model applications). Exogenous external economic conditions, such as export demand and foreign investment yields, are readily shocked in applications of the model. All in all, there are 3820 components representing 247 equation blocks, with 3606 separate endogenous variables.

4.2.1. Demand side

This model makes conventional assumptions about consumption of home products in each sector, whereby domestic products are differentiated by variety via constant elasticity of substitution (CES) nests. These local products are further differentiated also through CES nests from a given number of n of imported foreign varieties. Each local industry faces demands for its output from five sources: final demand (F), investment demand (V), government demand (G), intermediate demand (I), and export demand (X). Accordingly, the elasticity of demand (ε_i) that faces firms in a given industry i is a downward-sloping demand curve that depends on the weighted average of the elasticities of demand in

[9] Data were obtained from the Kuwaiti Central Statistical Bureau and from the Kuwaiti Stock Exchange.

these five markets, based on each demand source's elasticity multiplied by that source's share in the demand for industry *I* home products, as follows:

$$\varepsilon_i = S_i^F \varepsilon_i^F + S_i^V \varepsilon_i^V + S_i^I \varepsilon_i^I + S_i^X \varepsilon_i^X + S_i^G \varepsilon_i^G \quad \forall i \,, \tag{1}$$

where S_i^j denotes fully endogenous volume share of the home product in market *j* for each source of demand *j*. These relationships are complex and Tyers (2014) details their analytics.

The aggregate household's expenditure function is used to derive the consumer price index (CPI), which is a Cobb-Douglas-CES index of after-tax prices of both home products and imports. Collective utility is also defined as a Cobb-Douglas combination of consumption volumes by generic products, so CPI-deflated GNP is a measure of overall economic welfare.

4.2.2. Supply side and oligopolies

Production technology is Cobb-Douglas in variable factors and intermediate inputs, the latter being composites (CES nests) of home and imported products and services. The oligopolistic behavior incorporates the pricing behavior from Tyers (2014) which assumes that firms in a given industry *i* supply a differentiated product and adopt profit-maximizing pricing rules, with each carrying fixed capital and labor costs that capture unrealized economies of scale and lead to occurrence of pure (economic) profits (or losses) above market levels. Firms in *i,* therefore, face downward-sloping demand curves with elasticity ε_i (< 0) from the five demand sources, via (1). They set their price p_i relative to average variable cost v_i so as to maximize profit by applying the Lerner markup formula:

$$m_i = \frac{p_i}{v_i} = \frac{1}{1 + \frac{1}{\varepsilon_i}} \qquad \forall\, i \tag{2}$$

All firms in all economic activities have oligopoly power in product and input markets.[10] They also interact on prices, represented through calibrated conjectural variations. These parametrized values are critical because they capture the degree of price-setting collusion that occurs between the firms in a given industry. Larger firms are subject to pricing surveillance regulation.

Pure economic profits or losses:

The model calculates pure or economic profits or losses by firms as revenue net of fixed and variable costs. Net economic profit in a given industry *i* is the post-tax profit after payment of τ_i^K *net* tax rate on capital income, as follows:

$$\pi_i^N = [(p_i - v_i)Q_i - n_i(r f_i^K + w_{S_K} f_i^{S_K} + w_{S_N} f_i^{S_N}](1 - \tau_i^K) \qquad \forall i. \tag{3}$$

[10] Firms do not have oligopsony power in the markets for purchased inputs or primary factors.

where n_i denotes is the number of firms in the industry; r is the home real bond yield that captures the financing rate; f_i^K is the fixed capital requirement per firm; w_{S_K} and w_{S_N} are wages for skilled Kuwait (sub-subscript "K") and non-Kuwaiti labor (sub-subscript "N") in sector i, respectively; and $f_i^{S_K}$ and $f_i^{S_N}$ are the fixed skilled labor requirements per type per firm in industry i, respectively.

4.2.3. Domestic prices

Domestic prices are marked up over average costs. The unit variable cost is calculated as:

$$v_i = b_i r^{\alpha_i} \prod_{k=1}^{k} w_k^{\beta_{ki}} \prod_{j=1}^{N} [\hat{P}_{ji}^I]^{\gamma_{ji}} \qquad \forall i, \tag{4}$$

where the scale coefficient b_i and all the other listed exponents are calibrated from the SAM. Output elasticities are α_i for capital, β_{ki} for factors k. $\hat{P}_{ji}^I$ is a CES composite of home and imported input prices, which are weighted by the shares of the domestic and import markets of the consuming industry i., as follows:

$$\hat{P}_{ji}^I = \left[\phi_{ji}(p_j)^{(1-\sigma_j^I)} + (1-\phi_{ji})(p_j^*)^{(1-\sigma_j^I)}\right]^{\frac{1}{(1-\sigma_j^I)}}, \tag{5}$$

where ϕ_{ji} is the domestic share of inputs from industry j used by industry i. This relationship implies that domestic producer prices are simply higher by the markup, m_i: $p_i = m_i v_i, \quad \forall i$.

4.2.4. Factors of production and input demands

The model has seven primary factors mentioned above. Solving the firm's cost minimization problem with Cobb Douglas technology in variable factors and inputs yields the volumes of each intermediate demand. Thus, the unit factor demands for capital (K) and non-capital of (L) are as follows:

$$u_i^K = \frac{\alpha_i v_i}{r} \qquad \forall i, \quad \text{and} \quad u_{ki}^L = \frac{\beta_{ki} v_i}{w_k} \qquad \forall k,i\,, \tag{6}$$

Unit input demands are Leontief input-output coefficients, but they are not fixed in this model. Their values are determined by substitution behavior in response to product and input prices. Therefore, the home product inputs and the imported inputs from industry i used in the product of industry j are, respectively, the following:

$$A_{ij} = \gamma_{ij} \frac{\phi_{ij} v_j}{\hat{P}_{ij}^I} \left(\frac{p_i}{\hat{P}_{ij}^I}\right)^{-\sigma_i^I}, \quad A_{ij}^* = \gamma_{ij} \frac{(1-\phi_{ij}) v_j}{\hat{P}_{ij}^I} \left(\frac{p_i^*}{\hat{P}_{ij}^I}\right)^{-\sigma_i^I} \qquad \forall i,j\ . \tag{7}$$

4.2.5. Government

In the model, the government collects revenue from direct taxes on capital, labor income, land, resource rents, as well as from indirect taxes on trade and consumption expenditures. To account for government interventions at the firm level corporate taxes are separated from subsidies and charged through industry specific rates. The government also makes direct transfers to the collective household,

which can be set as exogenous in real terms and can be shocked, in which case one other fiscal variable must be made endogenous: the fiscal deficit, one of the tax rates, or government expenditure on goods and services. The government transfer variable is therefore exploited beyond the applications by Asano & Tyers (2015). This representation facilitates the examination of trade-offs between welfare payments and between fiscal balance and cost of living stability following local or export price changes. While ever the fiscal deficit is endogenous, the government saving varies, driving the current account deficit. The household saving rate is fixed, and firms retain net earnings at corporate savings rates that are also fixed and industry-specific.[11] To represent capital movement, home assets are differentiated from foreign assets and also offer different yields, so that private finance flows across the border to follow departures from interest parity.

4.2.6. KIA

Both KIA funds are represented as receiving payments from the government directly, rather than from the petroleum sector, but withdrawals are allowed in the form of government borrowing. The model represents funds as being available for withdrawal from abroad through KIA at a different rate, which represents the opportunity cost for withdrawing said funds for fiscal balancing.[12]

4.3. Subsidies and Tax Representation

In the standard model closure, tax revenue (or subsidy expense) and therefore the fiscal surplus or deficit, is endogenous, determined by the level of economic activity. The government raises tax revenue from both direct and indirect taxation, most rates applied being exogenous and constant (though some can be endogenized, as needed), but the revenues earned depend on levels of economic activity. Further, artificial reductions in local prices below firms' output prices are captured as consumption subsidies to households. Consumption subsidies are applied at a uniform rate of $\tau_i^C < 0$ on household final demand, approximated as the quotient of consumption subsidy expense provided to the household and their consumption value base. Thus, the total final consumption subsidy cost to the government is

$$T_C = \sum_{i=1}^{N} \tau_i^C p_i D_i + \sum_{i=1}^{N} \tau_i^C p_i^* M_i \,, \qquad (8)$$

where D_i is the local final demand of home goods in industry *i;* $M_i$is the local final demand of imported goods; I_i is the industry input of home produced goods; I_i^* is the industry input of imported products; p_i is the domestic price of home-produced goods; p_i^* is the domestic price of imported goods; and τ_i^C is the ad

[11] Financial capital, whether domestically or foreign owned, can flow into the economy in the long run. There is no endogenous distinction between FDI as green-field investment or acquisition.

[12] While in reality the macro-stabilization fund is the intended source for such withdrawals, the model does not distinguish between KIA funds, reflecting the lack of publicly available information about the composition and withdrawal practices of KIA.

valorem consumption tax rate for the products of industry i.[13] Corporate subsidies (both reported and calculated on intermediate purchases) are accounted for against total taxes paid by each industry to arrive at a net corporate tax rate τ_i^K. Initially, highly subsidized industries like electricity have a net large negative tax rate.

4.4. Short Run Macroeconomic Behavior

The long run version of the model is naturally Walrasian in that prices and interest rates all adjust to ensure that product, factor, and financial markets all clear. External flows are constrained by the balance of payments (which is implied by domestic agents satisfying their budget constraints), which drives adjustments in the real exchange rate in response to shocks. The total capital stock of the economy is endogenous, as is the level of capital use in each industry. In the short run, however, capital is fixed at the industry level, so that rates of return change in response to shocks with values differing across industries. Further details on the long and short run closures, including the implications for labor market behavior, are offered below in the Closures subsection..

In both short and long run versions of the model the open economy capital market has a market clearing identity that accounts for inward and outward financial flows.

$$I(r^{ce}, r) = S_D\left(Y_{DH}, \pi, G\right) + FI_{Inward}\left(r, r^*, \hat{e}_R^e\right) - FI_{Outward}\left(r, r^*, \hat{e}_R^e\right) , \quad (9)$$

where r^{ce} is the expected average net rate of return on installed capital; r is the home bone yield (representing the real financing rate); r^* is the foreign real post-tax yield on bonds abroad; π is accounting profit; and $\hat{e}_R^e$ is the expected proportional change in the real exchange rate. Total domestic saving S_D is the sum of saving by households S_H, corporations S_C, and government: $S_D = S_H(Y_{DH}) + S_C(\pi) + (T\text{-}G)$. This total saving depends on the fixed domestic household savings rate S_H applied to the home household disposable income Y_{DH}; the retained corporate earnings S_C; and the difference between the government tax revenue T and total government expenditure G, on goods and services and transfers (direct subsidies are deductions from revenue). Notably, S_C is assumed to remain a fixed proportion of pre-tax accounting profit at rates that are industry specific, calibrated separately for each industry.

Pertaining to capital, the expected average net rate of return on installed capital r_i^{ce} is the industry-specific expected average net rate of return on installed capital, calculated as follows:

$$r_i^{ce} = \frac{P_i^{Ye} MP_i^K}{P^K} - \delta_i , \quad (10)$$

[13] In future versions of the model, consumption subsidy will be differentiated through industry specific rates, which is critical for the adjustment of the overall price received for petroleum in the domestic market by the subsidies portion.

where P^K denotes the current price of capital goods; P_i^{Ye} is the price level of industry *i* product expected to prevail upon gestation; MP_i^K is the marginal productivity of capital in industry *i*; and δ is the depreciation rate. The economy-wide r^{ce} is calculated through weighting each industry-specific rates by the value added in its respective industry. Therefore, the economy's investment expenditure, *I*, is determined a function of the initial level of investment I_0 as follows:

$$I = P^K I_0 \left(\frac{r^{ce}}{r} \right)^{\varepsilon_V} . \tag{11}$$

In (11), r^{ce} embodies the present value of assets; the denominator *r* represents current financing costs. Thus, *I* changes in response to a change in either rate. This relationship offers a reduced form representation of either gestation costs or expectations over short run consequences of installation for the rate of return.

Inward and outward financial flows follow changes in interest rate parity, being the difference between the home and foreign real bond yields and expectations of real exchange rate. Two relationships are used in the model to allow for reversals of the direction of net flow as a response to shock and capital flows policy changes. Inward flows that have a negative elasticity ε_{FO} and are divided between home and foreign portfolio decisions. They are represented by the following equation:

$$FI_{Inward} = FI^0_{Inward} \left(\frac{\overline{r}^{ce} / \overline{\tau}_K + \hat{e}^e_R}{r*} \right)^{\varepsilon_{FI}}, \quad \varepsilon_{FI} > 0, \tag{12}$$

where FI^0_{Inward} is the initial inward inflow level; $\overline{r^{ce}}$ is the average r^{ce} on home capital weighted across industries by gross revenue; and $\overline{\tau}_K$ is the average tax rate on capital income with similar weighting. In contrast, outward flows have a positive elasticity ε_{FI} as they occur due to portfolio management decisions at home. This equation represents their form:

$$FI_{Outward} = FI^0_{Outward} \left(\frac{r / \overline{\tau}_K + \hat{e}^e_R}{r*} \right)^{\varepsilon_{FO}}, \quad \varepsilon_{FO} < 0, \tag{13}$$

where the magnitude of the elasticity ε_{FO} is larger for more liberal capital accounts. These flows are determined by the interest—or financing— rate, rather than the expected rate expressed in (10). Subsequently, the capital market clearing identity expressed in equation (9) determines the home real interest rate and the magnitude of the external financial deficit *($FI_{Outward} - FI_{Inward} = S_D - I$)*. This value equals in magnitude to the current account surplus ($X - M + N$, where *N* is net factor income from abroad[14]).

[14] As modeled, *N* comprises a fixed net private inflow of income from assets abroad and fixed aid to the government, less endogenous repatriated earnings from foreign-owned physical capital.

4.5. Capital in the Long Run

In accordance with realistic changes in the long run capital use within an economy, and consistent with Kuwait's considerable external holdings, the model's long run closures allow changes through investment flows as represented in (12) and (13). This representation necessitates determining local capital use (K^T) as well as the portion of it owned by Kuwait (K^D=K^T-K^F), calculated after subtracting foreign owned capital from K^T. Total capital use in the economy does not change with changes in K_D, unlike repatriated capital income levels which impact the real exchange rate and GNP. Capital flows are set at the level where post-tax rates of return at home equal rates internationally, while also allowing firms to generate rents consistent with oligopoly behavior. Therefore, capital use level equates post-tax capital rate of return to post-tax "market" returns, *net* of pure profits.

$$\frac{R_i/\tau_i^K}{P_K} - \delta = r^* \ , \tag{14}$$

where the home capital rental rate is $R_i = P_i^P MP_i^K$ as per (11), where MP^K is a function of total capital use, and τ_i^K is the power of the industry-specific capital income tax (net of subsidy) rate. Accordingly, drops in taxation rates of capital income (or conversely, increases in subsidies) will cause the pre-tax rate of return demanded at home to drop and capital use to, correspondingly, increase. The long-run response of the home-owned share of this capital is the following:

$$K_D = K_D^0 \left(\frac{RGNP}{RGNP_0} \right)^{\varepsilon_{KDY}} \left(\frac{K^T}{K_0^T} \right)^{\varepsilon_{KDT}} \ , 1 > \varepsilon_{KDY}, \varepsilon_{KDY} > 0 \ . \tag{15}$$

Important to the analysis, changes in real income levels at home impact long run accumulations of home-owned capital.

4.6. Closures

Closures represent assumptions as to which variables are free to change in response to shocks and which variables can adjust. They reflect policy targets and market clearance assumptions. While comparative static, the model employs two generic closures to represent the responses of the Kuwaiti economy in the short and the long runs. These closures have four sub-closures reflecting four elements, as follows.

First, labor market closures distinguish between the effects of shocks that either yield changes in real wages combined with full-employment or hold real wages fixed with changes in employment.

Second, fiscal closures determine the elements of government revenue or expenditure that are held constant and the ones that adjust.

The third is the financial capital market closure, which determines whether capital use adjusts with exogenous required rates of return or is fixed at the industry level.

And fourth, there is a market structure (oligopoly) sub-closure that either requires a fixed number of firms and endogenous profitability or allows firms entry and exit to adjust to sustain constant profitability as per Chamberlinian monopolistic competition.

In this application to Kuwait, expatriate employment of both skilled and unskilled labor is endogenous in both lengths of run, while Kuwaiti employment is fixed in both. The real expatriate skilled and unskilled production wage rates (relative to an index of *producer* prices) are held fixed, while the real Kuwaiti skilled and unskilled production wages are endogenous. This closure is set this way, first, to represent the inflexibility of the majority of Kuwaiti workers, who are likely to remain employed in the public sector, yet are sectorally mobile. Second, it accounts for the long run flexibility of expatriate worker contracts, given that the stock of expatriate workers can fall with a decline in labor demand in both the short and long runs.

The capital market closures are discussed above. In the short run physical capital use is fixed at the industry level with endogenous rates of return; in the long run, the capital stock of the entire economy is mobile so it adjusts (rises or falls) to maintain a fixed rate of return in all industries, with implications for financial flows on the balance of payments.[15] In the short-run, the default fiscal closure is to retain the governmental surplus as constant, allowing expenditures on goods and services and consumption subsidies to adjust to maintain fiscal balance. Variations on this setting allow the fiscal balance to become endogenous, to represent more realistically the changes in either the fiscal deficit and/or transfer payments that result from the fall in petroleum export revenue. Finally, the oligopoly sub-closure retains constant firm numbers and endogenous profitability in the short run. This setting is occasionally reversed in long run applications.

5. Analysis of Shocks and Reforms

The paper undertakes four types of analysis, each examined in both the short and long runs. The first concerns the drop in the petroleum price without change in any policy instruments. The second combines the first shock with a small increase in local energy prices, reflecting the kind of policy promoted by some parliamentary members. The third combines this shock with implementation of the kind of energy pricing reform intended by the Kuwaiti government (similar to that implemented in August 2016), whereby local energy prices are raised to match the international shadow price. The final investigation concerns a hypothetical microeconomic policy reform (that includes competition policy and productivity boosts),

[15] The total stock of physical capital varies in the long run and the home-owned share of it depends, as discussed earlier, on corresponding long run changes in domestic real income and on the share of wealth held abroad. The home-owned share of domestic capital is important because if affects the level of factor income outflow associated with profit repatriation.

which is implemented to assuage negative impacts of subsidy reform in a persistent low petroleum price environment.

5.1. Drop in Export Petroleum Price

To illustrate the impact of drops in petroleum export revenue in Kuwait, the export petroleum price is decreased by 5%. This scenario maintains the assumption that policies of welfare distribution and public employment remain in effect and that the fiscal surplus remains fixed. As such, both the short and long run simulations adopt the same closures for labor and fiscal variables. Both closures have fixed Kuwaiti labor employment and flexible expatriate employment. The adopted fiscal closure is exogenous fiscal deficit and welfare payments with endogenous government spending on goods and services and an endogenous consumption subsidy rate. For the capital market closure element, in the short run productive capital use in each industry is fixed with varying rates of return, while in the long run capital is sectorally and internationally mobile at fixed rates of return. The short run market structure sub-closure has fixed firms and endogenous profitability, while in the long run adopts a Chamberlinian oligopoly closure that allows free entry and exists of firms to sustain exogenous pure profits. Importantly, the model cannot find solutions when the petroleum price is reduced beyond 5% while all economic policies remain in effect, suggesting the unviability of the current economic policies at persistently low petroleum prices—a statement that echoes official assessments of the country's economic future. Although a 5% drop appears small, its effect on the economy under these circumstances is substantial. Table 5 summarizes the results. This shock contracts all economic activity. In the short run, the macroeconomic and welfare impacts include losses in real GNP and real GDP and a depreciation in the real exchange rate. These changes are magnified in the long run.

[Insert Table 5]

The results reveal important insights on the mechanisms by which the government could finance its rigid current expenditures, including the large public wage bill and welfare payments. To maintain fiscal balance, government expenditures on goods and services would have to drop by 4%, which contributes to the decline in GDP. An increase in non-petroleum government revenue is also required. As corporate and income tax rates remain fixed, a 3.3 % decrease in household consumption subsidies would be required to maintain the initial fiscal position. In practice, this decrease could be achieved through increasing energy prices, given that 10 % of households' final consumption is on energy products.

There is an increase in industries' costs that is offset by a depreciation in the real exchange rate, which is itself the result of the decrease in petroleum export revenues and the decline in investment expenditure driven by the lower rate of return on capital in the short and long runs. The depreciation renders imported final and intermediate inputs relatively more expensive. As local energy prices are

artificially set lower than the international oil price, the drop in the latter does not, in this simulation, translate to a reduction in local final costs or local industries' intermediate energy costs. A drop in consumption subsidies, as would be required to maintain a fixed fiscal deficit, would be akin to an increase in tax and, therefore, costs, maintaining the wide gap between the consumer price and the producer price. Households' welfare, measured by real disposable income deflated by the CPI, drops by 2.7% in the short run and a substantial 9% in the long run.

Two primary stabilization valves that partially absorb the negative impacts of oil price shocks are revealed. The first, obvious, channel is inflows from the SWF, which is typically shown as a large financial inflow to the government, allowing it to finance its fiscal commitments and maintain its fiscal position, thus stabilizing the economy.

The second stabilization mechanism is expatriate labor exit. The dynamics of the labor market entails different impacts of this contractionary shock on the two labor segments. Typically, as the real wages of expatriate workers are assumed to be sticky (in both the short and long runs), employment levels adjust instead. Since most Kuwaitis are employed by the public sector, where contracts are rigid, their employment is unaffected. By contrast, the flexibility of expatriate labor contracts allows affected industries to adjust their employment levels, causing a similar decline in employment levels of skilled and unskilled expatriates. The reallocation of resources following the drop in petroleum prices could, theoretically, provide additional employment opportunities in the expanding non-oil industries for the recently unemployed. In practice, however, such opportunities are limited in the short run, especially for expatriates, depending on changes in demand facing private non-oil firms and their ability to expand in the long run.

The resulting unemployment is unlike traditional unemployment in that the unemployed expatriates cannot remain in Kuwait until the advent of new expansion because their temporary residency is employer-dependent. Without employment sponsorship, they must exit (with some having mobility opportunities across the GCC states). As expatriates' wages are generally lower than those of Kuwaitis, their exit contributes to the above-described adjustments on the production side, and to potentially smaller adjustments on the consumption side. Nonetheless, in a mechanism unique to GCC states with this kind of labor market, exiting by expatriates' acts as a cushion, absorbing the shock.

Industry-wise, the performance of non-oil exporting sectors (Chemicals, Light and Heavy Manufacturing, Other Network Services, and Transportation) is boosted, owing to factor movements to them away from the contracting petroleum sector, coupled with increased competitiveness of their exports caused by the depreciating real exchange rate. Fixed capital use in the short run leads to gains by the comparatively labor-intensive production of transportation and manufacturing, with the effects differing depending on labor market structures and international labor mobility. In the long run, the mobility of capital away from petroleum and non-tradable sectors to these expanding ones enables further expansions

in non-resource exporting industries (Corden, 2012). This expansion, known as reverse *Dutch Disease* effect,[16] moderates the net effect on the economy of contraction in resource-intensive activity. Nonetheless, the potential impact of the stated effects depends on the magnitude of the real depreciation, the level of factor mobility, and the scale of revivals in other tradable industries. The simulation results suggest that reverse Dutch Disease moderation is limited in Kuwait in the current economic conditions. The expanding industries' contributions to value added in the economy do not change significantly from the initial equilibrium levels. Their contributions to export revenue rise as their output increases, but only marginally. Thus, this expansion is insufficient to cause compensatory structural change.

The effects on efficiency are minimal. Production scale in both tradable and non-tradable products is not affected. Markups decrease for all industries in the short run, though some industries manage to recover these markups in the long run as they expand. Oligopoly rents only negligibly decrease in the short and long runs and, consequently, pricing does not become more competitive. Although largely unchanged from the base scenario, markups and pure profit for the larger industries remain especially high, implying the oligopolistic firms' markups are large and that a large part of the economy's inefficiency is captured (and reduced) by distortionary oligopoly rents. The pervasiveness of subsidies keeps consumer prices artificially low, while allowing producers to sustain high mark-ups. Overall, the results of this simulation suggest the substantial implications for Kuwait of export price declines under existing policy regimes and indicate the scope for substantial reforms to energy pricing and fiscal policy that would raise aggregate welfare under these circumstances.

5.2. Petroleum Price Drop Combined with Subsidy Reform Allowing Adjustments in Fiscal Deficit and Welfare Payments

To quantify the impact of the government's plans to reduce energy subsidies in Kuwait but in a manner that would be politically palatable, the model is simulated with the previous negative shock to petroleum exports combined with an equal percentage decrease in energy subsidy whichwhich effectively increasesthe domestic price of crude and refined petroleum product paid by households and industries. While in effect this is a marginal increase in domestic energy price, it is of the magnitude promoted by some parliamentary members who accept the necessity of reducing subsidies but oppose large price hikes. Therefore, to implement the shock, the single household consumption subsidy rate is reduced by 0.5%, pro-rated based on the share of households' energy consumption in overall final demand. The corporate subsidy rate (and therefore the net corporate tax rate) is reduced also by 0.5% for all non-petroleum

[16] *Dutch Disease* refers to instances when a boom in the exports of natural resources leads to a significant appreciation of nominal (and real) exchange rates (or inflation in countries with fixed exchange rates regimes), which in turn adversely affect the non-resources tradable sectors and cause a boom in nontraded services sectors (Corden, 1984, 2012; Corden & Neary, 1982; Venables & van der Pleog, 2010).

industries, calculated on a pro-rated basis**.** This scenario relaxes the fixed fiscal deficit and fixed welfare payment assumptions to reflect realistic adjustments in the economy. To that end, the adopted fiscal closure is endogenous fiscal deficit and welfare payments with exogenous government spending on goods and services and exogenous consumption subsidy rate and corporate tax rates (both of which are shocked). The closures chosen for the remaining three elements are the same as those in the previous simulation. Table 6- column (a) summarizes the results.

Notably, the results indicate that the reduction of energy subsidies assuages many of the negative macroeconomic impacts of the petroleum price shock on the economy, simulated through a 5% drop in the petroleum export price. Real GNP drops by half of the value caused by the petroleum price shock, while real GDP decreases by more than the original drop, driven by a larger loss in investment. Government expenditures on goods and services is assumed to remain exogenously constant. Yet welfare payments to Kuwaiti citizens endogenously adjust downwards in response to the shocks, which is contrary to the government's historical practices of compensatory payments. Nevertheless, households adjust their consumption behavior of energy products, but only slightly as the conservative drop in energy prices is insufficient to cause a shift in the elasticity of final demand for local energy products.

[Insert Table 6]

The depreciation in the real exchange rate is 3.72 %, which is smaller than under scenario 1. As such, prices of imported intermediate inputs increase from the base level, but become more affordable than under scenario 1. Although local prices for industries increase with the small increase in local energy prices, import-competing industries are able to expand due to the increased competitiveness for their exports, unfettered demand by Kuwaiti households, and increased government borrowing that sees increased inflows on the capital account that sustain demand. Accordingly, these industries increase their output and employment. Additional labor demand is met by hiring additional expatriate workers, who are mobile with flexible employment contracts. The wages of Kuwaiti workers and, consequently, their welfare also increases. Overall welfare for all consumers increases in the short run and more so in the long run. Thus, the relatively low drop in subsidies could be politically palatable.

Nevertheless, this drop fails to achieve the required fiscal sustainability, for which goal the energy price increases (by reducing subsidy) were initially implemented. Withdrawals from KIA continue to be large in the short run and even larger in the long run. Further, the loss of petro-revenues exceeds the additional government savings brought about by reducing subsidies, resulting in a very large fiscal deficit in the short and long runs. In addition, the price increases are not seen to curb energy demand in the long run, as hoped for by the government.

As to economic efficiency, there is a decrease in oligopolies' pure profits as a percentage of GDP, indicating an increase in the economy's overall competitiveness. A key mechanism through which oligopoly rents affect growth performance is by reducing the cost of intermediate services during

economic contractions, depreciating the real exchange rate, and contributing to raising the economy's overall competitiveness. Here, the relative increase in the tradable input costs owing to the depreciating exchange rate coupled with the increase in locally-sourced input costs cause oligopolistic firms' average costs curves to shift upwards. Average markups decline for all industries. Specifically, average markups for non-petroleum tradables fall as their competitiveness rises with increased export share of home output due to the real exchange rate depreciation, leading to lower oligopoly rents. This drop coupled with the increase in scale both contribute to a higher efficiency in the economy. This result is consistent with observations by Menezes (2009) even if price-cap regulation is imposed. Lower rents, in turn, increase economic efficiency, competitiveness, and growth, albeit marginally, thus moderating the overall downturn impact on the economy. This mechanism confirms the argument advanced in this paper that substantial oligopoly rents play an important role in stabilizing the Kuwaiti economy during busts.

Based on the results, it may reasonably be expected that this scenario is acceptable to the parliament – slight drops in welfare payments are mitigated by overall gains in household welfare and industry performance. Nonetheless, non-petroleum output expansion and short run gains are all dwarfed by larger declines in petroleum (crude and refined) output in the long run. By not generating sufficient fiscal adjustments in government finances, the examined drop in subsidies does not provide a solution to the budgetary crisis; hence the examination of larger decreases in subsidies in the next scenario.

5.3. Subsidy Reform

This analysis quantifies the impact of energy pricing reform in current economic conditions of the type intended by the Kuwaiti government whereby local energy prices are raised to match the international shadow price. Thus, this scenario simulates the effects of a 5% drop in the petroleum export price combined with a 5% decrease in households' consumption subsidy rate and a 3.5% decrease in the corporate subsidy rate (showing effectively as an increase of 3.5% in the net corporate tax rate) of non-petroleum industries. The shocks on subsidy and tax rates are calculated based on a prorated basis to reflect a 40% increase in domestic energy prices. This scenario adopts the same closures as the previous scenario, and allows the fiscal deficit and welfare payments to adjust, while holding the government's expenditures on goods and services constant. Table 6- column (b) summarizes the results.

Overall, the results indicate that the examined fiscal adjustments achieve the government's overall fiscal sustainability goals in the short term. Fiscal improvements are largely driven by large savings obtained through a reduction in the cost of subsidy payments to both households and industries. The government increases welfare payments marginally, partially offsetting the effects of price hikes on households. The resumption of investing savings abroad in the KIA is then possible, improving the country's net asset position abroad in the short run. Other macroeconomic effects include a slight increase in real GDP and a deprecating real exchange rate as above similar in magnitude as under

scenario 1. Overall, this is a negative shock evidenced by a drop in the aggregate welfare measure real GNP, also similar in magnitude as under scenario 1.

Both final consumers and industries suffer losses. Household final consumption decrease, driven by the decrease in the real disposable income (while savings remain constant). The real disposable income is affected by an increase in CPI due to increases in real prices of locally produced goods (owing to the removal of energy subsidies) and to the relative increase in imports' prices owing to the depreciating real exchange rate. Nonetheless, these effects yield a 3.67% loss in household welfare, measured in terms of real disposable income deflated by CPI. Input costs for industries also increase, limiting the potential expansion of non-petroleum exporting industries. As such, firms are forced to cut costs, and the cost of hiring will be particularly high especially for industries that use energy as an intermediate input. Any adjustments in public sector employment impacts expatriates only due to the flexibility of their employment contracts. By contrast, Kuwaiti labor employment and real wages are not impacted. The private sector suffers employment cuts across all employees, but given that 95% of the sector's employees are non-Kuwaiti, layoffs are largely among expatriates, affecting unskilled more than skilled expatriate labor. Consequently, expatriates' real incomes drop, and their unemployment leads to their exit from the labor market in Kuwait.

Improvements in efficiency, however, partially compensate for the output losses of the affected industries. With the relative increase in imported intermediates' costs and the large increase in local energy costs, exporting non-petroleum industries are directed away from the least elastic intermediate and investment demand to the more elastic export and final demand. Consequently, their markups decline. The oligopolistic non-tradable industries, particularly Construction and Network Services, are largely consumed locally as domestic intermediates rather than as exports. Accordingly, reductions in their markups will have substantial indirect effects that accumulate economy-wide. Conversely, they will have only modest direct effects (on final product markups). Average markup changes by the affected industries are larger than those by the expanding (exporting) industries. Reductions in markups entail increasingly competitive pricing, generating an overall positive effect on economic activity and raising real GDP. Scale efficiency also expands for the expanding industries, further enlarging the reverse Dutch Disease effects on reversing losses caused by the contracting petroleum industry.

In the long run, however, assuming a continually low petroleum price, the fiscal improvement is unsustainable: the government fiscal deficit substantially worsens, necessitating large withdrawals of KIA funds to finance government expenditures. The real exchange rate further depreciates, real GNP and real GDP deteriorate, and welfare losses intensify. The non-petroleum exporting industries benefit from the movement of labor and capital and increase their output, causing additional deindustrialization in the negatively impacted industries. Capital flows out of the economy given declines in returns locally, which further hurts non-petroleum production. Industries will thus demand more labor to meet output

requirements, requiring expatriates to re-enter the economy. The overall employment level of expatriates is very similar to that in the initial equilibrium, a result that has critical implications for the labor market and its dependence on international labor mobility. Crucially, much of the short run efficiency gains are lost, with only minimal improvement in competitiveness from the initial base level.

In conclusion, the short run results of fiscal gains, economic expansion, and improvements in economic efficiency and competitiveness suggest that subsidy reform of the kind examined in this scenario will be favored by the government. Indeed, these results in the short run seem in line with some of the government's promises in September 2016. Nonetheless, the long-term impacts of these reforms are critical: not only does reform not achieve the government's goals of fiscal sustainability, it worsens welfare and competitiveness gains. It will also be costly for firms as they will have to source expatriate workers from abroad, given expatriate labor exit in the short run. This analysis confirms the unsustainability of the economy in a low petroleum price environment absent changes in its economic, labor, and oligopolistic structures. The substantial scope for fiscal adjustments and competition reform in Kuwait motivates the final analysis, which explores the possible effects of subsidy reforms combined with other reforms.

5.4. Competition Reform

The pervasiveness of oligopolies that sustain large markups and their collusive pricing in the economy both suggest that there is considerable scope for competition reform in Kuwait. This is further confirmed by Kuwait's various Five-Year Development Plans, which have the explicit goal of expanding the private sector coupled with increasing competition within the overall economy. To illustrate possible policy solutions that could be implemented in combination with energy pricing reform in a low petroleum price environment, two hypothetical competition policy reforms are introduced simultaneously: tighter pricing surveillance that reduces collusive behavior across all non-petroleum industries, simulated through a 20% reduction in the tendency for businesses to collude on prices (represented by the conjectural variations parameters); and improvements in private and services sectors' productivity of 2% in the short run and 5% in the long run. These sectors are non-tradable Construction and Other Services, and tradable Chemicals and Transport industries. Tables 6- column (c) summarizes the results.

Competition reform can yield substantial improvements in performance. In industries where large initial markups exist, like the Construction industry, which also uses energy as an input, more competitive pricing generates significant drops in markup, yielding effects on overall economic activity that largely exceed the neoclassical gains in allocative efficiency from removing price distortions due to taxes, subsidies, and regulation. Unsurprisingly, the result is expansionary for the overall economy in the short run, achieving very large gains at the macro and microeconomic levels. Fiscal improvements are substantial, similar to those achieved during high petroleum price episodes, enabling the resumption of

large investments in KIA and asset accumulation abroad. The overall expansion in the economy coupled with the substantial increase in disposable income reduces the need for large welfare payments, enabling the government to make additional budgetary savings and reducing citizens' reliance on the government. Particularly, limiting collusion slashes the large pure profits captured by oligopolies, offering gains distributed across the economy as a whole. The ensuing increased competition generates efficiency gains that are augmented by further gains stemming from the increase in productivity of the private sector and services. The gains further reduce markups and increase production scale.

The real exchange rate depreciates substantially, by approximately double the depreciation in the previous simulations in both the short and long runs. As in the previous scenarios, the depreciation is driven by the drop in petroleum exports while the decline in investments is driven by the lower rate of return on capital. Moreover, in this scenario the increase in efficiency allows firms to increase production scale gains and reduce overall costs, further depreciating the exchange rate. This depreciation renders imported intermediates and final goods more expensive, but increases the competitiveness of all non-oil exports, enabling their expansion. With capital fixed in the short run, the expanding industries demand more labor to meet their increased output, which can be met by additional expatriate labor. The increase in disposable income (and the welfare measure) encourages higher consumption of locally-produced goods, which is met with additional local output in all industries in the short run. The increased disposable income and industry expansion also leads to increased demand of imported goods, further depreciating the exchange rate. Unlike all previous scenarios, local rates of return on capital increase, driven by changes in market capital returns rather than pure profits, making this scenario beneficial for both workers and capital owners.

In the long run, the results are mixed, with overall general improvements. Table 7 summarizes long term sectoral results.

[Insert Table 7]

Much of the improvement gained over the short run is offset by the larger impairments caused by the decline of the petroleum price on the economy. Real GNP decreases and some non-tradable industries contract as well. Nonetheless, expansion owing to more competitive pricing is particularly relevant in the long run where improvements in efficiency encourage capital stock enlargement, shown as a rebalancing of Kuwait's asset portfolios away from foreign toward domestic productive assets. Yet relatively reverse Dutch Disease dynamics coupled with expansions in some non-tradable industries are sufficient to sustain improvements in the real GDP, which is not achieved under the previous scenarios. Non-petroleum exporting industries also export a higher share of their total output, diversifying the government revenue sources. Despite some non-petroleum industrial expansion, the hydrocarbon industry continues to dominate the Kuwaiti economy and governmental revenue sources, causing a large deterioration in the country's fiscal position in the long run. This result confirms that, absent intentional structural change,

fiscal unsustainability is a serious concern in a persistent low petroleum price environment. Local petroleum consumption increases in the long run, adding further downward pressures on petroleum export revenue and contributing to a deteriorating government budget. Notwithstanding such declines, welfare payments drop by a small percentage, while household welfare improves overall. With the exception of energy industries and energy-dependent transportation, industries demand additional labor in the long run, which will be mostly filled by expatriate labor. Capital mobility rebalances real rates of return on capital to a level only slightly lower than that of the base scenario. Kuwaiti labor gains in the long run, and capital owners do not endure significant losses. Sustained reductions by 5.25% in oligopolies' pure profits as a share of GDP drive increased competitiveness of the overall economy.

Importantly, like those of scenarios 2 and 3 above, the results of this simulation highlight the tradeoffs between fiscal sustainability and cost of living stability during periods of high and low petroleum prices. Figure 4 illustrates the tradeoffs associated with the three reform options examined in the three scenarios.

[Insert Figure 4]

Comparing these results suggests that subsidy reform alone cannot provide the solution hoped for by the government without the addition of mitigations measures and microeconomic reform, the combination of which offers the most gains. Thus, despite continuous fiscal deficits in the long run and the ensuing potential depletion of KIA funds, the combination of competition reform and energy pricing reform can boost output in a manner that translates to real gains for the various agents in the economy.

6. Conclusions

The energy pricing reforms of September 2016 were presented and implemented by the Kuwaiti government as the promised solution to fiscal pressures, economic inefficiencies, and local energy over-consumption. To date, results have been mixed and the reforms remain politically contentious awaiting a legal verdict. The model simulations confirm that the downsides of petroleum price collapse can be successfully managed in Kuwait through the use of its idiosyncratic safety valves: drawing down foreign assets and flexibility in the expatriate labor market. Nonetheless, the availability of these two mechanisms, coupled with petroleum riches, have in the past tended to reduce incentives for efficiency-enhancing structural changes. The government remains the preferred employer and welfare provider, the public sector dominates in most industries and investments in non-petroleum tradable sectors remain weak. Moreover, as the results indicate, these adjustment mechanisms are fiscally unsustainable if the low petroleum price persists. Model simulations actually echo statements by officials of the Central Bank of Kuwait who, in February 2017, reported to a parliamentary committee that existing SWF savings could support anticipated fiscal deficits for only five years before being depleted. The unsustainability of these adjustment mechanisms necessitates fiscal savings and a reexamination of energy pricing reform.

The results further confirm a widely-accepted view that phasing out distortionary energy subsidies can assuage long-run fiscal pressures and yield net welfare benefits. Reforms also reduce rigid government expenditures, thus generating improvements in Kuwait's budgetary and SWF positions. Nevertheless, when applied in combination with petroleum price declines, the simulations demonstrate unanticipated impacts on production, labor-energy linkages, and consumer prices. A particularly important yet under recognized area is the impact on Kuwait's labor market, which changes the economic opportunities available for both firms and workers. As shown in further model simulations, a tradeoff exists between fiscal stabilization on the one hand and industrial expansion, welfare gains, and labor market stability on the other. In the long run, energy pricing reform is unlikely to resolve the government's fiscal challenges. Large drops in energy consumption subsidies are required to curb local energy demand.

The non-petroleum exporting industries have the potential to expand in "reverse Dutch Disease" effects aided by a depreciating exchange rate, potentially moderating the negative effects of petroleum export declines. Nonetheless, such benefits depend on these industries' ability to attract labor and capital to higher-valued uses, increase their contribution to GDP, and improve their competitiveness. Based on the existing economic structure and rigidities, this ability remains very weak in the short run and is doubtful in the long term. Kuwaiti industries (including the nationally-owned energy sectors) exhibit distortionary oligopolistic (or monopolistic) behavior and earn sustained rents that detract from growth-enhancing innovation, hampering economic efficiency, competitiveness, and growth. Final simulations investigating competition reforms show that, with appropriate incentives, the reverse Dutch Disease could be considerably more effective, without becoming a panacea.

In sum, the sets of model simulations highlight the tradeoffs between fiscal sustainability and cost of living stability during periods of high and low petroleum prices. A critical implication of the analyses is that subsidy reform can be part of a larger solution that turns on the tradeoff between local consumption and exports, and between withdrawals from and investments into the SWF. The Kuwaiti economic structure has complexities that limit the potential of pure pricing reform as a universal solution. The distributional and labor market impacts of pricing reform are critically important in an economy where expatriates form 83% of the labor market and native workers prefer to remain in the public sector. Further, welfare losses juxtaposed against substantial oligopoly rents also entail distributional impacts of implementing pricing reform. Other challenges are posed by the inflexibility of local labor contracts in the public sector coupled with the economic structure and the political economy of rent distribution in Kuwait. The impacts add social and economic dimensions to subsidy reforms, necessitating extreme care in their implementation.

Therefore, successful implementation of subsidy reform ought to be accompanied by carefully designed mitigation measures and associated microeconomic reforms that address the ensuing sectoral

losses and labor effects, and target increased competitiveness in oligopolistic industries, meaningful private sector involvement, and the training and upskilling of labor. Mitigation measures, which can be designed and tested using the economy-wide model presented herein, may also include income transfers based on income levels rather than on consumption, to help the poorest who are most negatively impacted by subsidy reduction. Policies that manage competition will be of extreme relevance for achieving sustained benefits and structural changes in the long run. Importantly, these significant gains offer opportunities for economic diversification, increased efficiency, sustained growth, and private sector expansion. The accompanying employment opportunities also offer possible solutions for the bloated public sector and new Kuwaitis entering the labor market. In the electricity sector, in particular, which relies largely on hydrocarbons as input, reform should also accompany investment in energy efficiency and energy supply systems to meet increased demands more efficiently.

Tables and Figures

Table 1. Breakdown of labor force in Kuwait by nationality and sector as of January 2015

Sector	Kuwaitis		Non-Kuwaitis		Total	
	Numbers of employees	Percentage of total by sector	Numbers of employees	Percentage of the total labor force	Numbers of employees	Percentage of the total labor force
Public	326,271	70%	139,594	30%	465,865	100%
Private	93,195	5%	1,934,240	95%	2,027,435	100%
Unemployed	10,692	33%	21,255	67%	31,947	100%
Total	430,158	17%	2,095,089	83%	2,525,247	100%

Source: Author's analysis using Public Authority for Civil Information (PACI)- Population and labor force data, January 2015.

Table 2. Economic structural elements 2013

Sector/ Percentage	Share of GDP^{FC}*	Share of total exports	Export share of output	Net exports over output
1 Agriculture	0.3	0.0	1.3	-63.3
2 Mining	1.4	0.0	0.0	0.0
3 Crude oil	48.9	42.1	50.5	50.3
4 Gas and petro-services	0.9	1.3	50.5	50.3
5 Oil refining	5.4	38.6	72.6	72.2
6 Chemical	1.1	3.4	37.4	-1.7
7 Light manufacturing	0.8	0.4	4.1	-56.0
8 Heavy manufacturing	0.8	1.9	8.1	-72.0
9 Electricity	0.6	0.0	0.0	0.0
10 Other network services	4.6	4.6	32.3	31.4
11 Construction	2.2	0.0	0.0	0.0
12 Transport	3.4	5.7	38.9	14.1
13 Financial services	7.8	0.7	4.1	-1.3
14 Other services	21.7	1.2	1.8	-15.6

* GDP^{FC} is GDP at factor cost, which is the sum of value added in each industry.
Source: Model database (social accounting matrix) constructed by author for 2013.

Table 3. Factor intensity in value added per industry 2013

Industry/ Percentage	Physical capital	Kuwaiti unskilled labor	Kuwaiti skilled labor	Expatriate unskilled labor	Expatriate skilled labor	Arable land	Natural resources
1 Agriculture	35.1	0.5	0.4	5.7	2.4	41.4	14.5
2 Mining	9.3	12.8	29.8	2.8	1.9	1.1	42.3
3 Crude oil	13.1	4.2	9.9	0.4	0.3	0.1	72.0
4 Gas and petro-services	25.7	15.1	18.4	1.1	0.7	0.1	39.0
5 Oil refining	86.6	5.4	6.6	0.8	0.5	0.0	0.0
6 Chemical	76.8	4.1	4.1	9.5	5.6	0.0	0.0
7 Light manufacturing	55.4	10.0	10.0	18.4	6.1	0.0	0.0
8 Heavy manufacturing	52.6	10.7	10.7	19.6	6.5	0.0	0.0
9 Electricity	86.1	7.6	4.9	0.8	0.5	0.0	0.0
10 Other network services	65.4	6.9	4.2	4.4	3.0	16.1	0.0
11 Construction	32.2	9.5	4.1	38.0	16.3	0.0	0.0
12 Transport	52.9	10.6	3.5	28.0	4.9	0.0	0.0
13 Financial services	31.2	8.3	19.3	14.5	26.8	0.0	0.0
14 Other services	17.0	1.7	14.9	41.8	24.6	0.0	0.0

Source: Author's CGE model database (SAM) constructed for 2013.

Table 4. Reported industry and consumption subsidies 2013

Demand sector or source	Subsidies (million USD)
1 Agriculture	255.6
2 Mining	8.14
3 Crude oil	138.3
4 Gas and petro-services	1.5
5 Oil refining	731.9
6 Chemical	890.4
7 Light manufacturing	194.4
8 Heavy manufacturing	125.2
9 Electricity	439.3
10 Other network services	789
11 Construction	184.7
12 Transport	198
13 Financial services	142.4
14 Other services	1232.4
Household consumption subsidies	3,277.4
Investment and inventory consumption subsidies	61.5
TOTAL reported consumption subsidies	8,670

Source: Author's CGE model database (SAM) constructed for 2013.

Table 5. Impact of petroleum export price decline, holding fiscal balance and welfare policies fixed

Variable	Percentage change (departure from baseline) from a 5% decline in oil export revenue	
	Short run	Long run
Macroeconomic and output indicators		
Real GDP	-0.05	-9.63
Real GNP	-3.04	-12.48
Real exchange rate	-4.24	-3.90
Real rate of return on capital, gross of tax	-3.51	-4.78
Capital stock	0.00	-7.69
Non-petroleum exports/GDP	2.61	3.02
Investment expenditure/GDP	-10.2	1.59
Government		
Government expenditures on goods and services	-3.78	-32.77
Current account/GDP	8.89	-4.30
Government expenditure/GDP	-0.67	-5.86
Required change in consumption subsidies (households)	3.27	3.37
Labor market		
Unskilled expatriate labor	-1.09	-10.63
Skilled expatriate labor	-1.02	-11.91
Welfare		
Real disposable income, CPI deflated	-2.67	-9.01
Pricing and costs		
Average markup	-0.91	1.84
Fixed costs/GDP	-0.44	-1.69
Pre-tax pure profits/GDP	-0.68	0.56

Source: Simulation results.

Table 6. Impact of reform shocks combined with petroleum price declines on selected economic variables

Variable	Percentage change (departure from baseline) from a 5% decline in petroleum prices combined with reform		
	(a) Subsidy decrease: households and Firms -0.5%	(b) Subsidy reform: Household -5%; Firms -3.5%	(c) Subsidy reform; Conjectural variation -20%; productivity 2% SR/ 5% LR
Short run			
Real GDP	-0.23	0.66	18.77
Real GNP	-1.50	-3.44	23.38
Real exchange rate	-3.72	-4.27	-9.14
Real rate of return on capital, gross of tax	-2.79	-3.52	8.55
Capital stock	0.00	0.00	0.00
Unskilled expatriate labor employment	1.83	-0.54	41.84
Skilled expatriate labor employment	1.89	-0.44	35.47
Fiscal deficit/GDP	-2.05	0.36	-0.47
Welfare payments	-1.96	1.69	-13.79
Current account/GDP	5.00	10.26	-11.75
Investment expenditure/GDP	-7.76	-11.29	15.73
Household energy consumption	2.57	-2.09	0.00
Non- petroleum exports/GDP	1.92	2.77	13.09
Real disposable income, CPI deflated	0.80	-3.76	30.19
Real Kuwaiti unskilled wage, PC deflated	-0.10	-0.66	5.49
Real Kuwaiti skilled wage, PC deflated	0.01	-0.54	3.36
Real expatriate unskilled wage, PC deflated	-0.20	-0.61	0.45
Real expatriate skilled wage, PC deflated	-0.20	-0.61	0.45
Pre-tax pure profits/GDP	-0.38	-0.79	-0.05
Average markup	-0.007	-0.013	-0.20
Average markup, non-oil tradables	-0.83	-1.29	-5.30
Average markup, nontradable services	-0.55	-1.23	-30.25
Fixed costs/GDP	-0.24	-0.46	3.18
Long run			
Real GDP		-9.68	1.64
Real GNP		-14.41	-2.92
Real exchange rate		-2.71	-5.08
Real rate of return on capital, gross of tax		-6.05	-0.24
Capital stock		-9.11	-4.57
Unskilled expatriate labor employment		-0.05	13.45
Skilled expatriate labor employment		-0.04	10.74
Fiscal deficit/GDP		-8.53	-5.34
Welfare payments		3.34	-1.34
Current account/GDP		-12.83	-5.88
Investment expenditure/GDP		3.21	1.32
Household energy consumption		-5.14	3.97
Non-petroleum exports/GDP		1.75	7.73
Real disposable income, CPI deflated		-5.40	4.55
Real Kuwaiti unskilled wage, PC deflated		-11.5	9.8
Real Kuwaiti skilled wage, PC deflated		-10.8	2.4
Real expatriate unskilled wage, PC deflated		-6.0	-4.0
Real expatriate skilled wage, PC deflated		-6.0	-4.0
Pre-tax pure profits/GDP		-0.92	0.06
Average markup		0.67	-1.78
Average markup, non-oil tradables		-0.95	-2.36
Average markup, nontradable services		1.39	-2.37

Variable	Percentage change (departure from baseline) from a 5% decline in petroleum prices combined with reform		
	(a) Subsidy decrease: households and Firms -0.5%	(b) Subsidy reform: Household -5%; Firms -3.5%	(c) Subsidy reform; Conjectural variation -20%; productivity 2% SR/ 5% LR
Fixed costs/GDP		-0.37	0.22

Source: Simulation results.

Table 7. Long run sectoral effects of subsidy and competition reforms following petroleum price declines

Variable	Percentage change (departure from baseline)				
	Expatriate employment	Gross output	Markup ratios	Scale	Exports/GDP
1 Agriculture	7.24	5.82	-3.08	23.16	0.01
2 Mining	13.26	24.28	-4.45	14.76	0.69
6 Chemical	31.31	34.07	-1.84	5.70	0.88
7 Light manufacturing	12.60	7.64	-0.19	-7.68	0.06
8 Heavy manufacturing	32.69	27.76	-0.63	-4.99	0.48
9 Electricity	-20.11	7.57	-6.52	47.14	0.00
10 Other network services	7.88	9.73	-2.72	7.78	0.35
11 Construction	12.59	14.10	0.08	2.70	0.00
12 Transport	68.10	77.21	-3.97	14.18	4.87
13 Financial services	15.41	10.93	-0.84	-7.84	0.04
14 Other services	7.72	10.97	-0.55	15.86	0.34

Source: Simulation results.

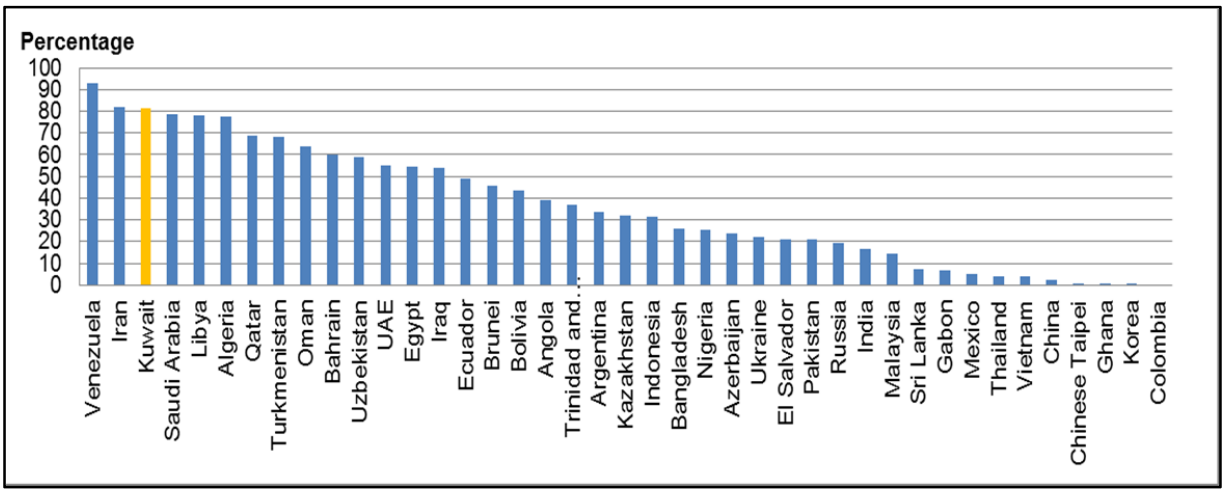

Figure 1. Average subsidization rates for 2014. *Source*: Author's analysis using U.S. Energy Information Administration data.

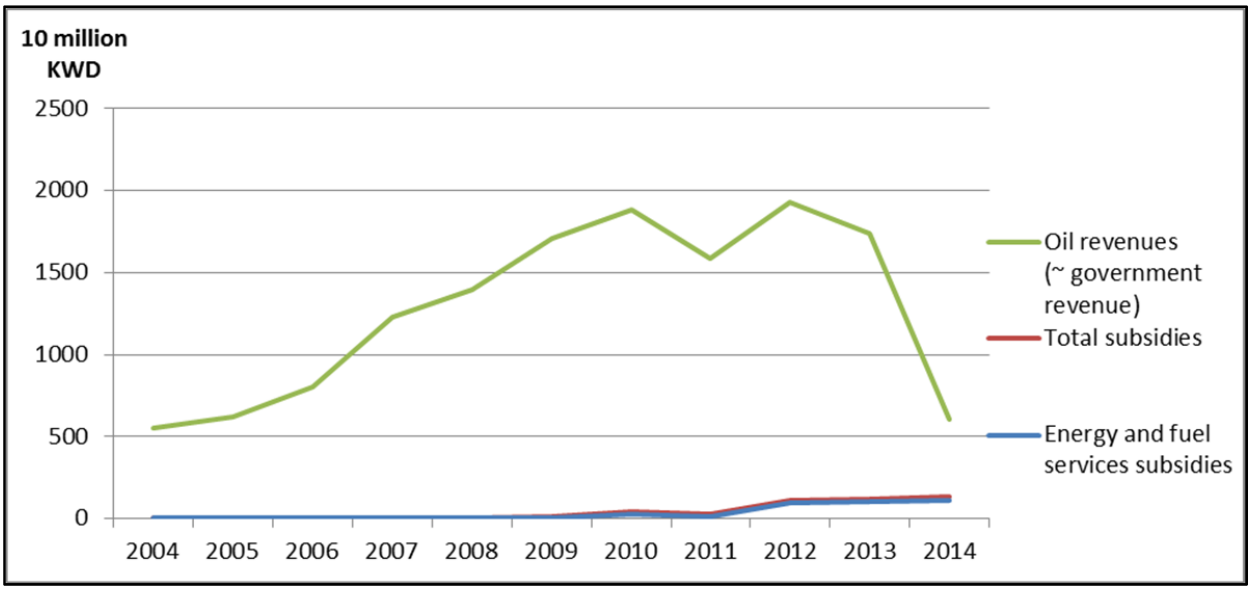

Figure 2. Subsidies in Kuwait and petroleum export revenue (as a proxy for government revenue) 2004-2014. *Source*: Author's analysis using data from the Kuwait Government Finance Statistics- Ministry of Planning.

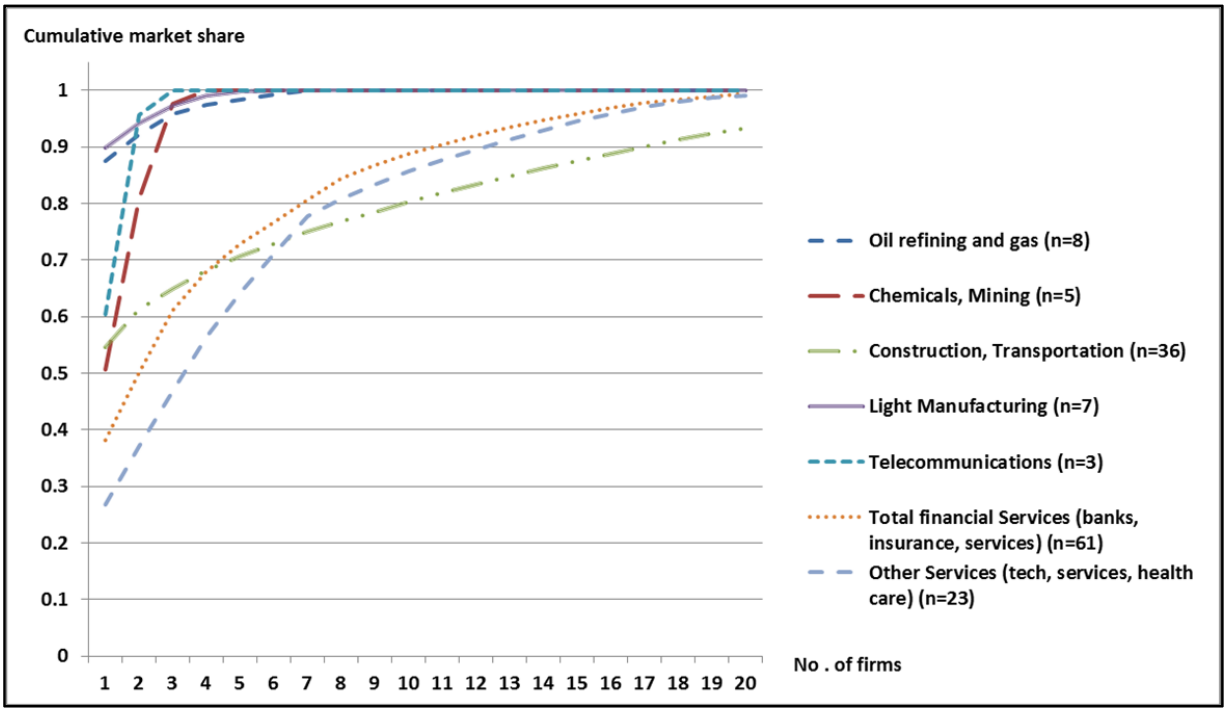

Figure 3. Cumulative Kuwaiti firm shares of industry calculated based on total industry revenue data, except for financial services which are calculated based on net profit (due to the lack of revenue data). *Source*: Author's analysis using data from the Kuwaiti Stock Exchange.
Note: The vertical axis shows the cumulative share, and the horizontal axis shows the number of total firms *n*.

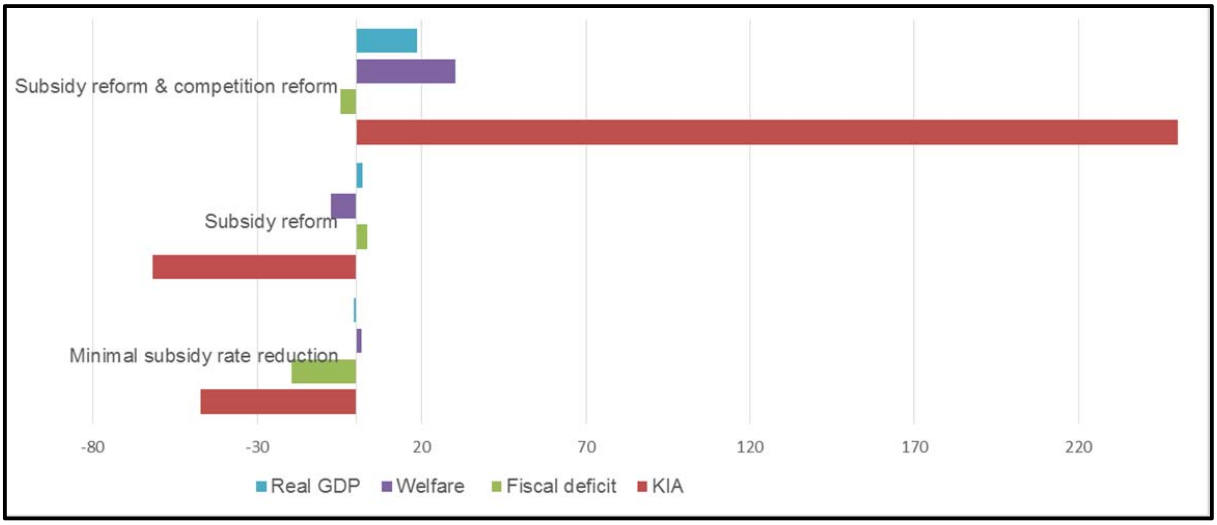

Figure 4. Comparative tradeoffs and key results of reform scenarios following oil price declines. Axis represents percentage change from baseline. *Source*: Simulation results.

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Appendix A:
The SAM and its Representation of Broad Economic Structure

The SAM is an extension of input-output models that display transactions as a circular flow of the government's incomes and expenditures. It combines detailed data characterizing economic linkages between regions using country-specific data to enable the quantification of inter-sectoral flows within and between regions.

The constructed SAM for Kuwait for 2013 drew from the following data sources for 2013 (the most recently available), obtained from the Kuwaiti government:

- *Input and Output Table 2013*, obtained from CSB;
- *Supply and Use Table 2013,* obtained from CSB;
- *Production Matrix 2013*, obtained from CSB:
- Kuwait's national accounts, obtained from Kuwait's Ministry of Planning;
- Kuwait's balance of payments, obtained from the Central Bank of Kuwait;
- Kuwait's oil production and information, publically available from KPC;
- Listed companies' sectoral market capitalization and revenue, obtained from the Kuwaiti Stock Exchange website;
- Sectoral revenue, costs, number of employees, and ownership structure, obtained from the CSB; and
- Kuwaiti labor market data, obtained from CSB and the Public Authority for Civil Information (PACI).

The database construction reflects key features of Kuwait's economy.

Government

Due to data limitations, the SAM database cannot address the public-private contrast directly; rather, it offers some representation of this contrast in the analysis.

Labor representation

An ideal representation would disaggregate labor by the private and public sectors and by nationality; however, such disaggregation could not be reliably constructed due to data limitations. The adopted disaggregation of labor in the model allows the examination of the impact of export price shocks and policy interventions on employment, wages, and the temporary worker population. The disaggregation of labor-related data between unskilled and skilled labor has been done with consideration to the International Labour Organization (ILO) classification of occupations and corroboration with sector-specific data from PACI.

Appendix B:
Key Modeling Specifications

This appendix complements the description of the model offered in the main text of the paper. It emphasizes the model's representation of demand elasticities of the various demand sources and products' prices and details the tax system built into it.

B.1. Oligopoly Markups

Oligopolistic firms operate in differentiated product markets. As such, each firm exploits its monopoly over the supply of its own product variety through selecting its price, and therefore its markup, that maximizes its profit. Within a given industry (economic sector), each firm faces an elasticity of demand that depends on the individual elasticities of the various demand sources as well as on the number of other firms and the degree of pricing collusion between them. Symmetry within each economic sector implies a common optimal unregulated markup for each firm.

B.2. Demand Elasticities

The elasticity of demand (ε_i) facing firms in a given industry *i* is a downward-sloping demand curve that depends on the weighted average of the elasticities of demand in the above-mentioned five markets. Calculating this average depends on the initial shares S_i^j of the demand facing each industry. Table B.1 calculates the shares drawing upon the SAM data.

[Insert Table B.1]

In addition, the elasticity depends on component elasticities of substitution, firm numbers (which are assumed exogenous in analysis in this paper), and the conjectural variation parameters in industry *i* (μ_i). The conjectural variation relationship allows firms to collude on price, so the overall oligopoly pricing choice is determined influence of pricing choices by any individual firm *k*, on the price set by of firm *j*.

The demand elasticities depends on the structure of the model. They are essential to the capture of oligopoly behavior since they determine the size of markup ratios via an exchange rate equation in the model (which follows a standard definition of the common currency ratio of the home and foreign GDP price levels) and investment expenditure impacted by local and foreign interest rates. These relationships are complex and Tyers (2014) details their analytics.

For example, the final demand elasticity is expressed as follows:

$$\varepsilon_i^F = -\eta_i^F + \frac{1}{n_i}\left\{(\sigma_i^F - 1)\,\delta_i^F\left(\frac{\hat{P}_{iH}}{\hat{P}_i^F}\right)^{(1-\sigma_i^F)} + (\eta_i^F - \sigma_i^F)(1+(n_i-1)\mu_i)\right\}, \qquad \text{(B.1)}$$

where η_i^F is the elasticity of substitution of final demand across home varieties in sector *i*, δ_i^F is the home share in final demand for product *i*, σ_i^F is the elasticity of substitution of final demand for good *i*

between domestic and foreign countries, n_i is the number of domestic firms in industry *i*, $\hat{P}_{iH}$ is the CES composite price of all home varieties of product *i*, and $\hat{P}_i^F$ is the CES composite of home and foreign final product prices in the domestic market, weighted by domestic consumption shares. The behavior of government consumption and the expenditure of the capital goods sector on home and foreign products are similar, except that the government pays no import duties or consumption tax and the capital goods sector pays no import duties. Table B.2 lists initial demand elasticities per sector, calculated using the model equations.

[Insert Table B.2]

B.3. Domestic Prices of Imported Goods

The formulation of these is as follows:

$$p_i^* = \frac{p_i^W(1+\tau_i^M)(1+\tau_i^C)}{e}, \quad \text{(B.2)}$$

Where p_i^W is the exogenous foreign currency price of goods imported by Kuwait and produced in the rest of the world; τ_i^M is the ad valorem tariff rate; τ_i^C is the consumption tax rate on final demand for the products of industry *i*; and *e* is the exchange rate.

B.4. Domestic Prices of Home Products

These are marked up over average variable cost. The production function is Cobb-Douglas in variable factors and inputs, with output elasticities α_i for capital, B_{ki} for factors *k* and γ_{ji} for inputs *j* and that the subaggregation of imported and domestic inputs is CES. The unit variable costs in (5) are calculated with reference to $\hat{P}_{ji}^I$, is a CES composite of home and imported input prices weighted by the domestic and imported shares specific to consuming industry *i.* It is expressed as:

$$\hat{P}_{ji}^I = \left[\phi_{ji}(p_j)^{(1-\sigma_j^I)} + (1-\phi_{ji})(p_j^*)^{(1-\sigma_j^I)}\right]^{\frac{1}{(1-\sigma_j^I)}}, \quad \text{(B.3)}$$

where ϕ_{ji} is the domestic share of inputs from industry *j* used by industry *i*. This relationship implies that domestic producer prices are simply higher by the markup, m_i: $p_i = m_i v_i, \quad \forall i$.

B.5. Prices of Home Product Exports in Foreign Markets

These prices are in foreign currency, so they depend on the home producer price, the exchange rate, the export subsidy rate S_i^X and the foreign import tariff rate, τ_i^{*M}, expressed as:

$$p_i^e = \frac{p_i e(1+\tau_i^{*M})}{(1+S_i^X)}, \quad \forall i \ . \quad \text{(B.4)}$$

B.6. Taxes and Subsidies

In the model specifications, the government raises tax revenue from both direct and indirect taxation, the rates applied to each being exogenous and constant but the revenues earned depend on levels of economic activity. Total tax revenue is then the sum of the individual components, which can be raised from each

source as expressed below. Subsidies and governmental transfers will be represented in the same way as taxes specifying the rates as a negative tax.

Direct income tax revenue

$$T_Y = \sum_{i=1}^{N} \tau_{K_i} (rK_i + \pi_i) + \tau_{U_K} w_{U_K} L_{U_K} + \tau_{S_K} w_{S_K} L_{S_K} + \tau_{U_N} w_{U_N} L_{U_N} + \tau_{S_N} w_{S_N} L_{S_N} \quad , \qquad \text{(B.5)}$$

where r is the home real financing rate (bond yield); K_i denotes total capital stock in industry i; π_i denotes total pure profit in industry i; and the subscripts "U" and "S" denote unskilled and skilled labor (production workers and the combination of professionals and para-professionals as per the ILO classification of occupations). The sub-subscripts "K" and "N" denote Kuwaiti and non-Kuwaiti labor. τ is the income tax rate applied on income earned by the respective different group of labor. To represent subsidies, government transfers and wage assistance, the model would specify $\tau < 0$.

Income tax/subsidy rates, to the extent they are applied, are approximated by flat rates deduced as the quotient of revenue and the tax base. Including tax rates even when tax rates almost negligible enables the capture and assessment of various tax policies.

Import tariff revenue

$$T_M = \sum_{i=1}^{N} \tau_i^M (M_{i+} I_i^*) \frac{p_i^w}{e} \quad , \qquad \text{(B.6)}$$

where I_i^* is foreign investments in industry i.

Export tax revenue

$$T_X = \sum_{i=1}^{N} (-s_i^X) p_i X_i \quad , \qquad \text{(B.7)}$$

where s_i^X denotes the net power of the export subsidy rate in industry i.

B.7. GNP and GDP

The model calculates national income, GNP, as the sum of payments made to domestically owned factors of production. It also accounts for the home share of any net profits (or losses) made; net income from indirect taxation; revenue from direct (income) taxation T_Y; and net inflows from abroad denoted as B. The formulation is, thus, as follows.

$$Y = rK_D + \sum_{k=1}^{K} w_k L_k + \left(\frac{K_D}{K_T} \right) \sum_{i=1}^{N} \pi_i + \left(T - T_Y \right) + \frac{B}{e} + \left(1 - \frac{K_D}{K_T} \right) \tau_K^* \left(r \left(K_T - K_D \right) + \sum_{i=1}^{N} \pi_i \right). \qquad \text{(B.8)}$$

In effect, B is the net income component of the current account and unrequited transfers.

GDP measures only income from production in the domestic economy. Therefore, in the model its calculation excludes factor payments as well as other flows to and from abroad, as follows:

$$GDP = rK_T + \sum_{k=1}^{K} w_k L_k + \sum_{i=1}^{N} \pi_i + \left(T - T_Y\right). \quad \text{(B.9)}$$

B.7. Real exchange rate

The model allows measuring variable economic variables in real terms. The real exchange rate measured the home and foreign GDP price levels expressed in a common currency. The model, thus, calculates the real exchange rate as the ratio of the home price (P_Y) of a bundle of (traded and non-traded) goods and services at home relative to that abroad (P^*_Y), as follows,

$$e_R = \frac{P_Y}{\left(\frac{P_Y^*}{E}\right)} = E\frac{P_Y}{P_Y^*}\ , \quad \text{(B.10)}$$

where e_R is the real exchange rate and *E is the* nominal exchange rate, *both* expressed according to the financial convention.

Appendices' tables

Table B.1. Demand shares per industry 2013

Industry/ Percentage	Final	Government	Investment	Intermediate	Export
1 Agriculture	87.1	3.2	0.0	0.2	9.5
2 Mining	8.5	56.2	0.0	1.0	34.2
3 Crude oil	1.7	49.3	0.0	0.9	48.2
4 Gas and petro-services	7.6	0.0	0.0	0.7	91.8
5 Oil refining	8.1	71.7	0.0	3.6	16.7
6 Chemical	8.3	55.8	0.0	15.8	20.1
7 Light manufacturing	48.4	9.5	0.0	4.0	38.1
8 Heavy manufacturing	12.6	35.6	0.0	27.9	23.9
9 Electricity	96.5	0.0	0.0	0.0	3.5
10 Other network services	41.9	33.8	0.0	0.0	24.4
11 Construction	0.0	0.0	0.0	96.1	3.9
12 Transport	44.0	36.3	0.0	0.0	19.7
13 Financial services	19.6	4.3	0.0	0.0	76.2
14 Other services	45.5	2.3	47.4	0.9	3.9

Source: Author's CGE model database (SAM) constructed for 2013.

Table B.2. Initial demand elasticities and markups per sector

Industry	Final	Government	Investment	Intermediate	Exports	Weighted average elasticity
1 Agriculture	-1.8	-4.7	-3.0	-3.0	-8.5	-2.2
2 Mining	-1.0	-3.6	-1.0	-3.0	-4.0	-3.4
3 Crude oil	-1.0	-3.5	-1.0	-12.0	-14.1	-12.8
4 Gas and petro-services	-3.6	-4.8	-2.1	-30.0	-15.0	-25.6
5 Oil refining	-7.8	-5.7	-4.7	-20.0	-12.2	-12.9
6 Chemical	-7.1	-5.4	-2.9	-8.0	-7.8	-7.0

Industry	Final	Government	Investment	Intermediate	Exports	Weighted average elasticity
7 Light manufacturing	-5.3	-12.0	-6.0	-12.0	-16.6	-8.9
8 Heavy manufacturing	-5.5	-5.4	-3.5	-12.0	-15.0	-9.9
9 Electricity	-3.8	-3.6	-1.8	-33.0	-4.7	-4.6
10 Other network services	-1.0	-2.5	-1.5	-5.0	-3.8	-2.9
11 Construction	-5.1	-5.1	-4.9	-20.0	-6.2	-5.5
12 Transport	-4.2	-5.6	-2.9	-3.0	-8.3	-5.5
13 Financial services	-6.5	-7.0	-3.5	-5.0	-8.6	-5.4
14 Other services	-5.4	-4.8	-2.0	-5.0	-12.7	-5.2

Source: Author's CGE model calculations.

Editor, UWA Economics Discussion Papers:
Sam Hak Kan Tang
University of Western Australia
35 Sterling Hwy
Crawley WA 6009
Australia

Email: ecoadmin@biz.uwa.edu.au

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