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The Welfare Effects of Oil Booms in a Prototypical Small Gulf State

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The Welfare Effects of Oil Booms in a Prototypical Small Gulf State

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This paper studies the economic consequences of booms and busts in the world oil market for a "prototypical small Gulf State economy." This economy is defined by a number of important structural characteristics: (1) it is subject to export quotas, which may be somewhat "bendable;" (2) foreign oil companies as well as the domestic government, play a central role in the primary resource (oil) sector; (3) none of the booming sector revenue passes directly to the domestic private sector, while the government relies on oil export earnings as its virtually sole source of revenue; (4) besides foreign capital and technology, the economy depends heavily on foreign guest workers. Their temporary nature provides an important mechanism for equilibrating the labor market; (5) the government provides extensive goods and services, free of charge, to nationals and non-nationals alike. The above features are shown to be critical when assessing the welfare impact of changes in world oil prices and changes in (OPEC) export quotas. The possibility that booms reduce national welfare, i.e. the so-called "Dutch Disease," is a real one.
Résumé

Ce document examine les conséquences économiques de l'alternance de phases d'expansion et de récession du marché pétrolier mondial sur un petit État typique du Golfe. Ce type d'économie se définit par un certain nombre de caractéristiques structurelles importantes: 1) il est soumis à des quotas d'exportation qui peuvent être plus ou moins souples; 2) les compagnies pétrolières étrangères ainsi que les autorités gouvernementales du pays jouent un rôle central dans le secteur primaire (pétrole); 3) les recettes générées par une phase d'expansion de ce secteur ne vont jamais directement au secteur privé national, alors que les pouvoirs publics comptent sur les revenus tirés des exportations de pétrole, qui constituent pratiquement la seule source de recettes publiques; 4) l'économie est fortement tributaire, non seulement des technologies et des capitaux étrangers, mais aussi des travailleurs immigrés temporaires; cette main-d'œuvre contribue grandement à équilibrer le marché du travail; 5) l'État fournit gratuitement un grand nombre de biens et de services, aussi bien aux nationaux qu'aux ressortissants d'autres pays. Il est montré que ces caractéristiques sont déterminantes lorsqu'il s'agit d'évaluer l'incidence des poussées soudaines des prix pétroliers mondiaux et des changements des quotas d'exportation (de l'OPEP). La possibilité que les périodes de boom aient des effets plutôt négatifs sur la croissance économique (le phénomène du "Dutch Disease") est donc bien réelle.
بحث هذه الدراسة الآثار الاقتصادية للارتفاعات والانخفاضات في أسواق البترول العالمية بالنسبة "اقتصاد دولة خليجية صغيرة". يميز هذا الاقتصاد بعدد من الخصائص الهيكلية الهامة: (1) يُخفض لنظام حجم صادرات البترول، التي قد تكون "قابلة للتعديل" إلى حد ما، (2) تقوم شركات البترول الأجنبية والحكومة المحلية بدور رئيسي في قطاع البترول، (3) لا ينتقل أي جزء من عائدات القطاع المرتفعة مباشرة إلى القطاع الخاص المحلي، بينما تعتمد الحكومة على عائدات صادرات البترول باعتبارها أهم مصادر الدخل، (4) بالإضافة إلى رؤوس الأموال والتكنولوجيا الأجنبية، يعتمد الاقتصاد بشدة على الموارد الأجانب، وتشكل طبيعة عملهم المؤقتة آلية هامة لتحقيق التوازن في سوق العمل، (5) توفر الحكومة قدراً كبيراً من السلع والخدمات عياناً للمواطنين وغير المواطنين على السواء، وتوضح الدراسة الأهمية البالغة لهذه الخصائص عند قياس أثر تطور أسعار البترول العالمية والتغيرات في حجم الصادرات (التي عندما منظمة البلدان المصدرة للنفط) على مستوى الرفاهية، وخلص إلى أن احتمال ارتفاع مستوى الرفاهية الوطنية نتيجة ارتفاع أسعار البترول، أي ما يعرف بظاهرة "المرض الهولندي"، هو احتمال حقيقي بالفعل.

٤ قد تصاحب دولة ما بآثار ضارة عندما تكتشف موارد طبيعية، أو عندما يزداد انتاج أو سعر الموارد المكتشفة، وتحمل هذه الآثار الضارة في قطعان القدرة على المنافسة في الصناعات التقليدية والبطالة، وبرامج اجتماعية يجب مواصلة عمل تكاليفها في أحيان كثيرة، وذلك نتيجة ارتفاع الأجور والمغالاة في أسعار الصرف.
The Welfare Effects of Oil Booms
in a Prototypical Small Gulf State

I. Introduction

This paper studies the economic consequences of booms and busts in the world oil market for a "prototypical small Gulf State economy." Given the predominant nature of the oil sector in such economies, the substantial literature on "booming sector economics" and the "Dutch Disease" is the obvious starting point for such an analyses. In this paper a typical Dutch Disease model is modified for a fictional country (Abu Naft) to incorporate a number of important features of the small Gulf states. The analytical issues addressed are relevant for a number of primary commodity exporters in the Persian Gulf and elsewhere.

Our small Gulf state is defined by a number of important structural characteristics not typically incorporated in Dutch Disease models:

First, it is subject to export quotas, which may or may not be rigidly binding, such as those imposed by OPEC in the post-1982 period. Some small producers have been known to exceed their OPEC quotas to a considerable extent.

Second, foreign oil companies as well as the domestic government, are heavily involved in the oil sector. None of the booming sector revenue passes directly to the domestic private sector.

Third, the government relies on oil export earnings as virtually its sole source of revenue.

Fourth, besides foreign capital and technology, the economy depends heavily on foreign guest workers. Their temporary nature provides an important mechanism for equilibrating the labor market. Oil booms lead to the inflow of foreign workers, while oil busts result in an outflow.

Fifth, the government provides extensive goods and services, free of charge, to nationals and non-nationals alike.

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The above features are potentially important when assessing the welfare impact of oil "booms", be they the result of resource discoveries, exogenous changes in world prices, or changes in OPEC export quotas. As Bhagwati and Tironi (1980), Bhagwati and Brecher (1980), Brecher and Bhagwati (1981) among others have shown, standard welfare results in trade models are often dramatically altered by the presence of foreign-owned factors of production. Shocksthat raise real income of the domestic economy, need not raise the welfare of nationals, as distinct from non-nationals.

In a different vein, van Wijnbergen (1984) has shown that resource booms can lead to reduced welfare — even in small economies where the terms of trade is exogenous — if they reduce the magnitude of certain positive externalities. In his model, learning-by doing in the industrial sector is reduced as real exchange rate appreciation draws resources into the booming and nontradeables sectors. Analogously, increases in the size of negative externalities during booms could have negative welfare effects. Often, government provision of free public goods to all workers provides an important mechanism whereby large increases in government spending, and associated externalities, can occur during booms. This is a very common public sector response to export booms. Corden (1984), in fact, argues that it is the uncontrolled increase in government spending during booms that is the true "Dutch Disease."

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2 See Bhagwati and Srinivasan (1983, Chapter 28) for a brief introduction to this literature.

3 The need to distinguish nationals and non-nationals (and temporary guest workers as opposed to permanent migrants) has been stressed in recent work on the economics of migration. See, e.g., Rivera-Batiz (1983), Ethier (1985, 1986), Lucas and Stark (1985), Stark and Bloom (1985), and Djajic (1986).

4 As is well known from the trade theory literature, these problems arise when the government does not completely offset the externality with a first-best intervention policy.

5 "...It might be argued that the true Dutch Disease in the Netherlands was not the adverse effects on manufacturing of real appreciation but rather the use of Booming Sector revenues for social service levels which are not sustainable, but which are politically difficult to reduce." (Corden, 1984, 359, fn.1)
This paper presents a small analytical model where the above structural characteristics are incorporated in a Dutch Disease framework. Our model is highly aggregative, with the usual distinction between the booming (oil) sector and other tradeables and nontradeables production. In addition, there is a sector that produces government output. Foreign ownership of capital is assumed to exist only in the oil sector. Section II describes the productive structure of the economy, including the government sector. In Section III, the demands for various goods by nationals and expatriates are derived from an underlying utility maximization framework. This facilitates our later analysis of the welfare effects of various policy changes. Section IV describes the nature of short-run equilibrium in the goods and labor markets. Sections V and VI carry out comparative static analyses of the impacts of oil price shocks and changes in OPEC quotas respectively. The focus is on the welfare of nationals as opposed to expatriates. Section VII asks whether a small Gulf state is better off asking OPEC for a higher oil price or a relaxed quota, if the impact on oil revenues is to be the same in either case. Section VIII summarizes our conclusions.

II. The Productive Structure of the Economy

This section discusses domestic production of oil, non-oil tradeables [henceforth just "tradeables"], nontradeables, and public services. The model is short-run in nature in the sense that the capital stock in each sector is fixed. Producers in all sectors are assumed to act as price takers in both the markets for their output and their variable factor inputs. The market structure in the tradeables and nontradeables sectors is assumed to be perfectly competitive. In the case of oil, OPEC-imposed export constraints are considered.

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6 That is, we take the "host country" perspective, as in Ethier (1985).
Oil Production

The situation in the oil market is complicated by the presence of OPEC. Prior to 1982, many small oil producers effectively faced a perfectly elastic demand for oil at the prevailing world price. Since that time, however, OPEC has imposed export quotas on member countries in order to stabilize prices at higher levels than would otherwise prevail.

Suppose now that the profit-maximizing oil producer faces a production quota of $Q$. It is typical in the quantity rationing literature\(^7\) to view this quota as rigidly fixed. In effect, the costs of violating it are infinite. It is well-known, however, that OPEC monitoring and enforcement of quotas is far from perfect. At times, smaller OPEC producers have exported oil in excess of their quotas. Presumably the incentives to do so increase as the gap between the unconstrained profit-maximizing level of output and the quota widens. These profit incentives to "cheat" on the quota must be weighed against the expected costs inflicted by the OPEC cartel when it detects violations, especially gross violations, of its production quotas. This "penalty" can take the form of political and economic sanctions or even military intervention. For simplicity, assume that the expected costs of exceeding the OPEC quota depend positively on the amount by which actual production $Q_e$ exceeds $Q$:

$$ C = c(Q_e - Q) \tag{1} $$

where $C_1 > 0$, $C_2 < 0$, $C_{11} > 0$, and $C_{22} < 0$.

\(^7\) This literature is reviewed in Cuddington et al. (1984).
Oil production $Q_o$ requires an intermediate input purchased from the nontradeables sector, $D_o^*$, and fixed capital, $K_o$.\(^8\)

\[ Q_o = Q_o(D_o^*; K_o). \]  

(2)

As there is typically idle capacity in the Abu Naft oil sector, both capital and labor\(^9\) are assumed to be fixed factors in the short run.

The objective of the oil sector is to maximize profits, by choosing the level of intermediate inputs, taking into account the expected costs of violating OPEC quotas:

\[ \pi_o(P_o, P_n, Q_o) = \max_{D_o^*} \left\{ P_o Q_o - P_n D_o^* - c(Q_o; D_o^*); Q_o = Q_o(D_o^*; K) \right\} \]

where $P_o$ is the prevailing world price of oil, $P_n$ is the price of nontradeable inputs.\(^10\) The notional output supply and intermediate input demand functions can be derived in the usual manner by differentiating the profit function:

\[ S_o = S_o(P_o, P_n, Q_o) \quad \text{where} \quad \frac{\partial S_o}{\partial P_o} \geq 0, \quad \frac{\partial S_o}{\partial P_n} \leq 0, \quad \text{and} \quad \frac{\partial S_o}{\partial Q_o} > 0. \]  

(3)

\(^8\) The production function is strictly concave, twice and continuously differentiable.

\(^9\) Output can be increased substantially in the short run without the need for additional labor. Hence, labor can be considered a quasi-fixed factor with idle capacity, not unlike capital. Ignoring labor input does not affect our conclusions.

\(^10\) For notational convenience in what follows, the fixed factor $K_o$ will be suppressed.
\[ D^* = D^*(P_o, P_m, Q^*) \quad \text{where} \quad \frac{\partial D^*}{\partial P_o} \geq 0, \quad \frac{\partial D^*}{\partial P_m} \leq 0, \quad \text{and} \quad \frac{\partial D^*}{\partial Q^*} > 0. \]  

(4)

The signs on the partial derivatives in (3) and (4) follow immediately from the assumed strict concavity of the production and profit functions.\(^{11}\) They state that the profit-maximizing level of output and hence the required input depend positively on the price of oil output and negatively on the cost of intermediate inputs. The partials with respect to \(Q\) are positive. In the extreme case of a completely rigid OPEC quota (where expected costs of violating it are infinite), \(\delta S_o / \delta Q^*\) equals unity and \(\delta S_o / \delta P_o = \delta S_o / \delta P_m = 0\). Thus, the specification (3)-(4) is general enough to capture the limiting cases of: (i) no OPEC quota and (ii) a completely inflexible quota.\(^{12}\)

Oil profits \(\pi_o\) flow to two recipients: the government and foreign oil companies. The division of profits is politically determined, and hence taken to be exogenous here. Specifically:

\[ \pi_o^G = \phi_o \pi_o ; \]
\[ \pi_o^S = \phi_S \pi_o ; \quad \text{and} \]
\[ \pi_o^F = (1 - \phi_o - \phi_S) \pi_o \]

(5)

where \(\phi_o\) is the government’s share, \(\phi_S\) is the Special Funds Account’s share and \((1 - \phi_o - \phi_S)\) is the share of the foreign oil companies. The government’s share in oil profits is its sole

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\(^{11}\) As usual, the profit function is increasing in \(P_o\), decreasing in \(P_m\), and convex and homogeneous of degree one in the two arguments together.

\(^{12}\) Al-Mutawa (1990) carries out comparative static exercises for the two cases separately. The results are qualitatively the same as those presented here.
source of revenue. It is reasonable to assume (see Al-Mutawa, 1990, chapter 2) that \( \pi^e \) and \( \pi^p \) are transferred out of the country.

**Tradeables Production**

Tradeables output (including agricultural and manufacturing goods) is produced using a strictly concave production technology. The profit function equals:

\[
\pi_i(P_t, W) = \max_{Q_t, L_t} \{P_t Q_t - W L_t; \quad Q_t = Q_t(L_t)\} \tag{6}
\]

where \( Q_t, L_t \) and \( K_t \) are the sector’s output, labor input and fixed capital, respectively. \( L_t \) is the only variable input in the short run. \( P_t \) is the prevailing world price of tradeables and \( W \) is the nominal wage rate.

The sector’s output supply and labor demand functions are obtained in the usual manner by differentiating (6):

\[
\frac{\partial \pi_t}{\partial P_t} = S_t(P_t, W) \tag{7}
\]

where

\[
\frac{\partial S_t}{\partial P_t} = \frac{\partial^2 \pi_t}{\partial P_t^2} > 0 \quad \text{and} \quad \frac{\partial S_t}{\partial W} = \frac{\partial^2 \pi_t}{\partial P_t \partial W} < 0
\]

and

\[
\frac{\partial \pi_t}{\partial W} = L_t(P_t, W) \tag{8}
\]

where
Nontradeables Production

Like tradeables producers, producers of nontradeable output \((Q_n)\) maximize profits by choosing labor inputs \((L_n)\), for a fixed capital stock. The resulting output supply and labor demand functions are:

\[
S_n = S_n(P_n, W) \quad \text{where} \quad \frac{\partial S_n}{\partial P_n} > 0 \quad \text{and} \quad \frac{\partial S_n}{\partial W} < 0 \quad (9)
\]

and

\[
L_n = L_n(P_n, W) \quad \text{where} \quad \frac{\partial L_n}{\partial P_n} > 0 \quad \text{and} \quad \frac{\partial L_n}{\partial W} < 0 . \quad (10)
\]

Government Services Production

One of the main features of the Abu Naft economy is the significant amount of services produced by the government. Such public services are typically distributed free of charge to both nationals and non-nationals. Given the policy-determined level of real public services per capita \((g)\), the total demand for public output depends on the (endogenous) size of the labor force \(L\):

\[
G^d = gL \quad (11)
\]

The government is assumed to produce these services using labor \((L_{G})\) and fixed capital:

Its objective is to minimize the total cost of providing the free public-sector output:
\[ G = G(L_a, \overline{F}_a) \]  

\[ E^G(W,g,L) = \min_{L_a} \{ WL_a \text{ s.t. } G^d = gL \text{ and } G = G(L_a, \overline{F}_a) \} \]  

Differentiating the cost function in (13) with respect to \( W \) yields the effective labor demand function for the government sector:

\[ L_a = L_a(g, L) \quad \text{where} \quad \frac{\partial L_a}{\partial g} > 0 \quad \text{and} \quad \frac{\partial L_a}{\partial L} > 0 \]  

It is positively related to the level of the policy-determined public output per capita and the size of the labor force.

Given government expenditure decisions and its revenue proceeds from the oil sector, a fiscal surplus or deficit may emerge:

\[ G_o = \phi_o \pi_o (P_o P_o \overline{Q}_o) - WL_o(g, L) \]  

To close the model it is assumed that any surplus (deficit) is distributed to nationals in the form of lump-sum transfers (taxes). By assumption, temporary guest workers do not share in this distribution.\(^{13}\)

III. The Demand Side of the Economy

\(^{13}\) In practice, the government increases (decreases) \( g \) in future years if persistent surpluses (deficits) occur. In truth, some of the benefits (costs) would accrue to those guest workers that happen to be working in the economy at that future date.
In order to facilitate the welfare analysis below, permanent domestic residents (i.e. nationals) and guest workers (i.e. non-nationals) are distinguished.

**Domestic Households**

The representative domestic household's utility function depends on consumption of nontradeables \(D_n\), tradeables \(D_t\) and publicly-provided government services per capita \(g\). The corresponding expenditure function equals:

\[
E(P_n, P_t, g, U) = \min_{D_n, D_t} \{ P_n D_n + P_t D_t : U(D_n, D_t, g) \geq U \}
\]

where

\[
\frac{\partial E}{\partial P_n} = D_n(P_n, P_t, g, U) ; \quad \frac{\partial E}{\partial P_t} = D_t(P_n, P_t, g, U) ; \quad \frac{\partial E}{\partial g} < 0 ; \text{ and } \frac{\partial E}{\partial U} > 0
\]

The expenditure function (16) gives the minimum expenditure on nontradeable and tradeable goods needed to achieve utility level \(U\), given the level of government services per capita and the price structure. The signs of the partial derivatives state that the domestic national's expenditure depends positively on both the prices of the goods consumed and his utility, and negatively on government-provided goods.

National households receive income from three sources: (1) wages, (2) profits generated in tradeables and nontradeables production and (3) transfers (minus taxes) from the government, \(G\). Wage income is simply the nominal wage rate \(W\) multiplied by the
fixed supply of domestic workers \( \bar{L} \).\(^4\) All profit income generated in the nontradeable and tradeable sectors \( \pi_n + \pi_t \) accrues to domestic households. Given these income sources, national households' budget constraint is:

\[
E(P_nP_tG, U) = W\bar{L} + \pi_n(P_nW) + \pi_t(P_tW) + G_s + \ldots. \tag{17}
\]

**Non-Nationals**

While employed in the domestic economy, guest workers are assumed to face the same prices and consume the same set of commodities as their domestic counterparts. In addition, the temporary migrants remit income to their home country either to support family members or their own future consumption at home.\(^5\) Hence, the utility function of the representative non-national household takes the form:

\[
u^* = u^*(d_n^*, d_t^*, r, g)\]

where \( u^* \) is the guest worker's utility, \( d_n^* \) and \( d_t^* \) are his consumption of nontradeable and tradeable goods, and \( r \) represents the real purchasing power of remittances in the homeland.\(^6\) The derivative of \( u^* \) with respect to \( r \) is positive, indicating that higher remittances increase the guest worker's utility level. The value of remittances in terms of

\(^4\) The supply of domestic workers is assumed to be fixed in the short run by demographic, social, and cultural factors.

\(^5\) In fact, remittances are often the main goal underlying decisions to migrate. Conceivable determinants of remittances include social and cultural as well as economic factors. Recently, there have been several attempts to model motivations to remit foreign earned income. See, e.g., Lucas and Stark (1985), Stark and Bloom (1985) and Djajic (1986).

\(^6\) The real purchasing power of remittances equals nominal remittances deflated by the price level, both in units of the migrant's homeland currency. This price level is exogenous in our model, so it can be set equal to one.
domestic currency is \( xr \), where \( x \) is the nominal exchange rate (the domestic currency price of one unit of foreign currency). The non-national’s expenditure function gives the minimum expenditure on the consumption of the two privately purchased goods and remittances needed to reach utility level \( u^* \), given the level of public output per capita \( (g) \) and relative prices:

\[
e^*(P_n, P, x, g, u^*) = \min \{ P_n, d_n^* + P, d_t^* + xr, u^*(d_n^*, d_t^*, r, g) \geq u^* \} \quad (18)
\]

Each guest worker is assumed to supply one unit of labor, his sole source of income. Thus, the individual’s budget constraint equals:

\[
e^*(P_n, P, x, g, u^*) = W \quad (18)
\]

In what follows, the number of guest workers \( (L_r) \) is endogenous. We are concerned only with their aggregate expenditure and the resulting demands for goods and remittances. Hence, it is convenient to specify the budget constraint for all non-nationals as:

\[
E^*(P_n, P, x, g, u^*) = WL_r \quad (19)
\]

The capital letters \( E^* \) and \( U^* \) denote the aggregates \( E^* = L_r e^* \) and \( U^* = L_r u^* \) respectively. Equation (19) can be used to obtain compensated commodity demands and remittance functions for non-nationals as a group:

The noted partial derivatives state that an increase in the provided level of government services per individual reduces expenditure required to achieve a prespecified level of aggregate utility, while raising the target level of utility necessitates higher expenditure.
IV. **Short-Run Equilibrium Conditions**

The economy’s short-run equilibrium conditions are presented for convenience in Table 1. Together they determine \( P_n, L_r, U, U^*, \) and \( G. \)

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**The Nontradeables Market**

The price of nontradeables is assumed to adjust continuously to maintain nontradeables market equilibrium:

\[
S_n(P_n, W) = D_n(P_n, P_r, x_g, U^*) + D_n^*(P_n, P_r, x_g, U^*) + D_n^*(P_n, P_r, \bar{Q}_d) .
\]

Total demand includes that of nationals and non-nationals (for consumption purposes), as well as the intermediate input demand of the oil sector.

**The Labor Market**

Aggregate labor demand can be obtained by aggregating the labor demand functions of the nontradeable sector \( (L_n) \), tradeable sector \( (L_t) \), and government services sector \( (L_o) \). For simplicity, it is assumed that foreign labor is a perfect substitute for domestic labor.

Total labor supply \( (L) \) consists of domestic residents \( (\overline{L}) \) and guest workers \( (L_g) \); \( L = \overline{L} + L_g. \) Due to large reservoirs of unemployed workers in the labor-sending countries, the supply of foreign workers is assumed to be infinitely elastic at the policy-determined
nominal wage rate \( W \). In real terms, this wage is typically well in excess of prevailing wages in the guest workers' home countries.\(^{17}\)

Since, by legislation, employment priority is given to nationals, guest workers \((L_g)\) satisfy the residual demand:

\[
L_f = L_g(P, W) + L_t(P, W) + L_c(g, L_f) - L.
\] (21)

Any shock or policy changes that increase total labor demand (e.g. a boom in the world oil market) will induce an inflow of guest workers to satisfy rising demand. Similarly, recessions reduce employment, resulting in guest workers being sent home.

In addition to the variables determined by the equations in Table 1, the model determines the level of oil exports and tradeable goods imports. In the presence of a "bendable" OPEC export quota described in Section II, oil exports \((X_o)\) are determined by the supply function in (3). Being a small open economy, net imports of (non-oil) tradeable goods equal domestic demand minus domestic supply:

\[
M = D_t(P, P_o, g, U) + D_t(P, P_o, g, U) - S_t(P, W).
\] (22)

V. \textit{The Effects of a Change in World Oil Prices}

Not surprisingly given the size of the oil sector, world oil price shocks have important consequences for small Gulf states. This section considers their effects on the

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\(^{17}\) This assumption parallels that in Ethier (1985, 1986). We also considered a specification where the Abu Naft government automatically adjusted \( W \) in response to changes in \( P_o \) or \( P_t \) in order to keep real wages constant. This greatly complicates the comparative static analysis. Because wage indexation is not always automatic in the case of Abu Naft, it seems more reasonable to discuss changes in wages as deliberate policy initiatives. This is done in Al-Mutawa (1990).
Table 1. Summary of the Model's Equilibrium Conditions

Nontradeables Market

\[ S_n(P_w, \bar{W}) = D_n(P_w, P_g, U) + D_n^2(P_w, P_g, U') + D_n^3(P_w, \bar{O}) \]  \hspace{1cm} (20)

Labor Market

\[ L_f = L_n(P_w, \bar{W}) + L_f(P_w, \bar{W}) + L_g(\bar{g}L + L_f) - \bar{L} \]  \hspace{1cm} (21)

Nationals' Budget Constraint

\[ E(P_w, P_g, U) = \pi_n(P_w, \bar{W}) + \pi_f(P_w, \bar{W}) + \bar{WL} + G_o \]  \hspace{1cm} (17)

Government Budget Surplus

\[ G_o = \phi_g \pi_n(P_w, \bar{O}) - WL_g(\bar{g}L + L_f) \]  \hspace{1cm} (15)

Guest Workers' Budget Constraint

\[ E^g(P_w, P_g, U') = WL_f \]  \hspace{1cm} (19)
relative price of nontradeables (i.e. the real exchange rate), employment of guest workers, the government budget, and the welfare of nationals.

Inspection of the equilibrium conditions in Table 1 reveals that the initial effects of a surge in world oil prices come through two channels. First, the rise in $P_o$ increases government revenues in (15), ultimately raising national households' wealth in (17) via transfers of any surplus. Hence, nationals' expenditure on both tradeables and nontradeables rises. Second, the higher oil price makes it profitable for producers to purchase more nontradeables as intermediate inputs. The boom-induced increase in nontradeables demand causes $P_o$ to rise in our model, just as it does in the standard Dutch Disease framework. This can be confirmed by total differentiation of the equations in Table 1 and solving for:

$$\frac{dP_o}{dP_o} = \frac{1}{H} \left( \frac{\partial D_a}{\partial Y} \phi \sigma_s + \frac{\partial D_s}{\partial P_o} \right) > 0$$

(23)

where $H > 0$ insures stability of the nontradeables market. The oil price boom causes the employment level of guest workers to rise via two channels as $P_o$ is bid up. First, production in the nontradeables sector will rise, thereby increasing labor demand. Second, to accommodate the resulting inflow of guest workers, the government must produce more public services. These effects can be seen by differentiating (21):

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18 That is, the boom induces an appreciation of the real exchange rate due to the "spending effect" of the boom.
where $\mu = 1/[1-(\delta L_c/\delta L)]$ is the employment multiplier associated with government production of services.

A surge in world oil prices also affects the government surplus (15). First, there is the direct wealth effect: as $P_o$ surges, government oil revenues rise (with the amount depending on the government’s profit share). Second, with the endogenous rise in $P_a$, the government will experience an increase in the intermediate input cost of producing its share of the oil output. Finally, the boom-induced inflow of guest workers increases the government’s cost of providing public services. These effects can be seen by differentiating (15):

$$dG_s = \phi_o S_o dP_o - \phi_o D_a^o dP_n - \theta dL_f$$

where:

$$\theta = W \frac{\partial L_a}{\partial L}$$

is the marginal cost of producing public output for an additional worker.

The net effect of a hike in world oil prices on the government surplus is uncertain a priori. The direct income effect of the rise in $P_o$ increases government revenue. The induced rise in $P_a$ and $L_f$, however, works in the other direction by increasing government expenditures.\(^{19}\)

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\(^{19}\) That is, the boom induces an appreciation of the real exchange rate due to the "spending effect" of the boom.
Since $G_n$ is directly linked to the national households' expenditure level via (17), determining the budgetary impact of various shocks is critical when analyzing their effects on national welfare. A monetary measure of the effect of various shocks on the welfare of nationals is found by total differentiation of (17):

$$E_d dU = dG_n + (S_n - D_n) dP_n.$$  \hspace{4cm} (26)

Equation (26) decomposes the effect on nationals' welfare into two components: (1) the budgetary impact and (2) an internal terms of trade effect.\footnote{This term should not be confused with the conventional terminology used in trade theory. There the internal terms of trade is the price of exports relative to the price of imports (inclusive of tariffs, etc.) inside the country's borders.} As discussed above, the budgetary impact of a surge in $P_0$ in (25) is uncertain.

The internal terms of trade effect operates via the shock-induced increase in the price of nontradeables. In economies with no guest workers or other foreign-owned factors of production, changes in $P_n$ have no (first-order) effect on potential welfare because income effects net to zero when $S_n - D_n = 0$.\footnote{There may, of course, be internal distributional consequences between domestic producers and consumers of nontradeable goods.} In the present context, however, increases in $P_n$ imply positive real income transfers from foreign oil companies and guest workers to nationals.

Further insight into the effect of the boom on national welfare can be obtained by substituting (25), then (24) and (23), into (26), yielding:
\[
\frac{dU}{dP_o} = \frac{1}{E_U} \left[ \phi_o S_o + \frac{F}{H} \left( \frac{\partial D_a^o}{\partial Y} \phi_o S_o + \frac{\partial D_a^o}{\partial P_o} \right) \right] > 0 \quad (27a)
\]

where

\[
F = [D^o_a + (1 - \phi_o)D^o_n] - \phi_o \frac{\partial L^o_o}{\partial P_o} > 0. \quad (27b)
\]

Equation (27) indicates that the change in the utility level of nationals as a result of the oil boom can be subdivided into the direct income gain, \( \phi_o S_o dP_o \), and an indirect effect due to higher nontradeables prices, \( \frac{F}{H} \left( \frac{\partial D_a^o}{\partial Y} \phi_o S_o + \frac{\partial D_a^o}{\partial P_o} \right) \). The sign of \( F \) may be positive or negative, implying an ambiguous effect of the endogenous rise in \( P_n \) on national welfare. On one hand, there is a welfare gain due to the favorable internal terms of trade effect. On the other hand, there is a negative welfare effect caused by increased government spending on additional guest workers. The net welfare effect of the induced rise in \( P_n \) depends on these opposing effects captured in \( F \).

In the case where \( F < 0 \), it is possible that the welfare effect of the oil boom is adverse. That is, the Dutch Disease may be a "disease" after all -- to answer Sweder van Wijnbergen's (1984) question. The virus that potentially causes the disease is the negative externality associated with the provision of public services at no charge to the additional
guest workers that enter the booming economy. Thus, government expenditure control during booms is of utmost importance. In the absence of this negative externality [i.e. Θ = 0 in (27b)], F is positive. In this case, a surge in world oil prices definitely improves national welfare in (27).

In spite of the indeterminacy in (27), equation (26) provides a simple rule-of-thumb for assessing the welfare impact of an oil price boom on nationals in small Gulf states: if the government surplus is not adversely affected, nationals' welfare must rise. That is, \(\frac{dG}{dP_o} > 0\), is a sufficient condition for a rise in nationals' utility level.

VI. The Effects of an Increase in OPEC Oil Exports Quotas

From time to time, various OPEC members argue for higher quota levels. As perusal of the equilibrium conditions in Table 1 will confirm, the economic effects of raising \(Q_o\) are qualitatively similar to the effects of an oil price boom. Again, the higher level of oil exports increases government oil revenues, and ultimately nationals' real income. Second, final consumption and intermediate input demands rise, pulling up the price of nontradeables. The rise in \(P_n\) causes labor to flow into the nontradeables sector and the government services sector. The budgetary impact of an oil (quota volume) boom is again unclear a priori. It depends on whether the direct gain in government oil revenues exceeds the induced rise in government expenditures.

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22 This argument parallels van Wijnbergen's (1984) description of the Dutch Disease. In his model, there is a positive externality associated with learning-by-doing in the tradeables sector. This externality is reduced as the boom causes real exchange rate appreciation, drawing resources out of the tradeables sector into nontradeables production. In our model, nontradeables production expands by drawing labor from abroad, not from the tradeables sector. The inflow of workers inflicts budgetary costs on the economy which are not accounted for by employers hiring these workers.
The effect on nationals' welfare of a relaxation of the OPEC quota can be derived using the equations in Table 1 in a fashion similar to that in section V:

\[ dU = \frac{1}{E_u} \left[ \phi_o \frac{P_o}{Q_o} + \frac{P_o}{H} \left( \frac{\partial D_0}{\partial Y} \phi_o + \frac{\partial D_0^*}{\partial Q_o} \right) \right] dQ_o. \]  

As before (in (26)), a non-negative budgetary impact is a sufficient condition to ensure a gain in nationals' welfare, because the internal terms of trade effect is unambiguously positive.

VII. Quota versus Price Increases

Suppose OPEC quotas are viewed as rigid rather than "bendable," implying that the price derivatives in (3) and (4) are all zero and that \( \delta S_0/\delta Q_o = 1 \). In negotiations with OPEC a small Gulf state would like to know: is it in their interest to press for an increase in world oil prices with quotas unchanged, or for an increase in their quota with no price change?

This question can be answered by comparing the welfare effect of a change in \( P_o \) in section V with the welfare effect of a change in \( Q_o \) in Section VI. To meaningfully compare these policy changes, assume that the percentage change in \( P_o \) equals the percentage change in \( Q_o \):

\[ \frac{dP_o}{Q_o} = P_o dQ_o. \]  

so that the resulting increase in oil revenues will be the same under either scenario.

The welfare effect of a change in \( P_o \) in the presence of a rigid OPEC quotas is found by setting \( S_o = Q_o \) and \( \delta D_0^*/\delta P_o = 0 \) in (27):
Given the assumption of an equal percentage change in $P_0$ or $\bar{Q}_0$, equation (30) can be written in terms of $\bar{Q}_0$ as:

$$dU = \frac{\Phi_G}{E_U} \left(1 + \frac{F \frac{\partial D_a}{\partial Y}}{H \frac{\partial Y}{\partial Y}}\right) P_0 d\bar{Q}_0 . \quad (31)$$

The welfare effect of the "price increase" policy in equation (31) can be easily compared to the welfare effect of a change in the quota in equation (28). The two equations are identical except for the additional term:

$$\frac{1}{E_U} \frac{F \frac{\partial D_a^0}{\partial Q_0}}{H \frac{\partial Q_0}{\partial Q_0}} > 0 \quad (32)$$

which appears in the case of the "quota increase" policy in (28). This term can be positive or negative depending on the sign of $F$. Take the case where $F$ is positive, so neither price booms nor quota increases will be welfare reducing. In this case, relaxation of the quota will produce a higher domestic welfare gain than an equal percentage increase in $P_0$ (in the presence of a rigid OPEC quota). If $F$ is negative, on the other hand, the above conclusion is reversed: The price increase will produce a larger welfare gain or a smaller loss in the event that welfare falls ("Dutch Disease").

The intuition behind this result is straightforward. When quotas are increased, the demand for nontradeable intermediate goods in the oil sector increases. This drives up $P_0$. 

$$E_U dU = \Phi_G \left(1 + \frac{F \frac{\partial D_a}{\partial Y}}{H \frac{\partial Y}{\partial Y}}\right) \bar{Q}_0 dP_0 . \quad (30)$$
When oil prices are increased in the presence of a rigid quota, on the other hand, there is no change in oil output or the derived demand for nontradeables. Therefore, the upward pressure on $P_n$ (i.e., the real exchange rate appreciation) is greater in the case of the quota relaxation. Thus, if $F > 0$, so that increases in $P_n$ raise national welfare, the gain will be larger when the quota is relaxed than when the world price is raised (with an unchanged rigid quota). If $F < 0$, the rise in $P_n$ is welfare-reducing. Because the policy of increasing the world oil price causes the smaller $P_n$ rise, it is preferable to quota relation in this case.

In sum, for small Gulf states like Abu Naft, oil revenues can be raised through either an increase in $P_n$ or $\bar{Q}$. In order to choose the welfare maximizing option, the authorities must have sufficient knowledge of the economy's structural characteristics to determine the sign of $F$. That is, they must be able to determine whether the net welfare impact of a boom-induced real exchange rate appreciation is positive or negative. This requires that they assess the relative importance of: (i) the favorable internal terms of trade effect and (ii) the unfavorable effect on the cost of providing public services to more guest workers.

VIII. Conclusion

This paper extends the standard three-sector Dutch Disease model to capture the main characteristics of a prototypical small Gulf state. In particular, foreign oil companies and guest workers play large roles in the economy, oil exports are restrained (to some extent) by OPEC quotas, and oil profits are the primary source of government revenue. Finally, the government has a policy of providing public services (health care, education, etc.) free of charge both to nationals and guest workers.

Using the model, the effects of various oil shocks and policy changes can be evaluated. We focused on increases in world oil prices and changes in OPEC export quotas.
The net impact of these shocks on nationals’ welfare can be decomposed into two effects. First, there is the budgetary impact. It includes the direct income effect on government oil revenues, as well as the induced increase in public expenditures for additional guest workers.

Second, there is an internal terms of trade effect, i.e. a real income gain to nationals as nontradeables prices rise. In most trade models the net supply of nontradeables to foreigners is, by definition, zero. Hence, changes in nontradeables prices have no (first-order) effect on national welfare. (Income effects net to zero, leaving only substitution effects.) In the present context where foreign-owned factors of production are extremely important, however, a rise in nontradeables prices benefits nationals. As the owners of nontradeables firms, they profit by selling nontradeables to foreigners inside the economy at higher prices. This internal terms of trade effect arises in part from selling final consumption goods to guest workers and, in part, from selling intermediate goods to foreign oil companies.

In general, the net impact of oil booms (due to higher prices or relaxed OPEC quotas) on the welfare of nationals is ambiguous. Nevertheless, a rule-of-thumb emerges: oil booms will always improve nationals’ welfare as long as they do not adversely affect the government budget. Containing government expenditure during booms is, therefore, critical. This may be difficult when there is a large inflow of guest workers in response to the boom and the government is committed to a policy of providing public services to new arrivals.

At times, small Gulf states may have the choice within the context of OPEC negotiations to press for either an increase in world prices (with OPEC quotas unchanged) or a relaxation of their quota (with prices unchanged). Our analysis shows that, assuming the revenue impact is constrained to be equal under the two scenarios, the optimal choice
depends critically on the same parameters that determine whether a boom causes Dutch Disease (i.e. a reduction in welfare). In cases where the boom results in an improvement in the budget surplus (implying that national welfare must rise), an increase in the quota level is shown to be preferable to an oil price increase.
References


