Normalization of Economic Relations

Consequences for Iran's Economy and the United States

Report prepared for the
National Foreign Trade Council
1625 K Street, NW, Suite 200
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Abstract

In the medium-term, lifting US sanctions and liberalizing Iran's economic regime would increase Iran's total trade annually by as much as $61 billion (at the 2005 world oil price of $50/bbl), adding 32 percent to Iran's GDP. In the oil-and-gas sector, output and exports would expand by 25-to-50 percent (adding 3 percent to world crude oil production). Our gravity model and alternative estimates find Iran's non-oil trade would expand by between $17 billion and $35 billion. Finally, we project that Iran would enjoy new service imports from the United States and the European Union of about $1 billion, followed by substantial foreign investment in Iran's service sector once economic policies are liberalized. The United States would also gain appreciably from normalization. Provided no offsets to production occur elsewhere in the OPEC area, increased oil production by Iran could reduce the world price of crude petroleum by 10 percent, saving the United States annually between $38 billion (at the 2005 world oil price of $50/bbl) and $76 billion (at the proximate 2008 world oil price of $100/bbl). Opening Iran's market place to foreign investment could also be a boon to competitive US multinational firms operating in a variety of manufacturing and service sectors.

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Normalization of Economic Relations: Consequences for Iran's Economy and the United States

Introduction

With the support of its allies and the UN community, the United States maintains economic sanctions against Iran in response to Iran's support for international terrorism, its pursuit of weapons of mass destruction, and more recently its practice of supplying arms to insurgents operating in Iraq. As with all economic embargoes, the efficacy of the sanctions in forcing political change is controversial. In economic terms, however, both sides lose from the geopolitical standoff.

This study quantifies the consequences for Iran's economy and trade of normalizing its economic relations with the United States and the Western Allies -- without attempting to map out policy guidelines for how normalization might be pursued. Instead, starting from the assumption that US sanctions currently enforced against Iran are lifted and, equally importantly, that Iran adopts more open policies toward foreign investment and other dimensions of its national economy, we examine the impact on Iran in two broad economic areas: the oil sector and trade in all other goods and services, emphasizing as possible the corresponding benefits to the US economy.

Our focus on the oil sector of Iran is motivated by the sector's prominence in Iran's economy. It is also motivated by the importance of marginal supplies for world prices of oil and petroleum products. Against the backdrop of the dramatic run-up of the world price for crude oil by more than 100 percent during 2008, increased production of oil by a petroleum-rich country such as Iran could appreciably reduce world prices -- measured from either the approximate average world price of crude oil during 2008 ($100/bbl) or the average world price of crude oil during 2005 ($50/bbl) upon which the present analysis is predominantly based and which the world price of crude oil appears to be approaching amid the ongoing, end-2008 downturn in the global economy.

Our analysis suggests that normalizing Iran's economic relations, both through the removal of US economic sanctions against Iran and through the liberalization of Iran's own economic policies could enable US and EU oil companies, over a period of about five years, to secure an incremental presence in Iran. We estimate the additional petroleum production from proven Iranian oil reserves -- arising in particular from the application by US and EU firms of efficient oil-lifting technologies and the unrestricted sale to Iran of modern oilfield equipment -- would expand production of crude oil in Iran by as much as 51 percent. In turn, this would raise world output by nearly 3 percent over the medium-term. By our estimates, this expansion of world output could reduce world oil prices by as much as 10 percent, trimming nearly $76 billion off the annual oil

consumption bill of the US economy at the proximate 2008 world price of $100/bbl and nearly $38 billion at the 2005 world price of $50/bbl.[1]

The impact of normalization on the non-oil merchandise trade of Iran is assessed using econometric estimates both from the Peterson Institute gravity model for merchandise trade and from applying a simpler comparative framework.[2] Finally, the analysis of non-oil trade is extended to the service sector by applying indicators of the prospective increased presence of the US and EU firms in the services trade (and possibly inward foreign direct investment) of Iran, based on the recent extent of US and EU trade in services with the Organization of Petroleum Exporting Countries (OPEC).

Iran is a prime target of current US economic sanctions, but it is also a country with an aversion to interaction with the global economy and a high degree of internal economic controls. Our analysis focuses on the impact of external and internal normalization on Iran's economy and trade. Where the analysis permits, however, the economic gains to the United States and its allies are highlighted, especially in the concluding section of our report. The expected benefits to Iran's economy and trade from normalization of economic relations with the United States and its allies will also generate substantial economic gains to US and EU firms and consumers -- directly to the extent that trade in goods and services between Iran and the Western Allies expands, and indirectly to the extent that world market conditions for crude oil and related petroleum products improve.

US Economic Sanctions and Iran's Economy

Since the Iran hostage crisis of 1979-1981, economic relations between Iran and the United States have been on a hostile footing, circumscribed by the imposition of trade and financial sanctions against Iran by the United States and, on a more limited basis, sanctions imposed by the UN Security Council. Compounding the adverse effects of these sanctions on its economy, Iran has pursued highly restrictive foreign investment and trade policies, typical of xenophobic regimes that discourage interaction with the global economy.

US Sanctions on Iran[3]

After the January 1981 release of the US hostages by Iran, the country continued to support terrorist activities, and in 1983 Iran was implicated in the bombing of the Marine Corps barracks in Beirut, Lebanon. As a result, the United States added Iran to its list of

[1] This estimate is based on total US consumption of crude petroleum in 2005 -- 20.8 million bbl/day -- reported in BP (2006), and a 10 percent reduction in the world price of crude oil. Total US consumption of crude petroleum includes both US imports and US domestic production of oil.

[2] This gravity model analysis updates previous estimates of the trade impacts of US sanctions made by the authors using an earlier gravity model and the Institute's database on economic sanctions (Hufbauer et al. 2007).

[3] This section draws mainly on Hufbauer et al. (2007).

"rogue states" that support terrorism, and imposed new restrictions on US trade with the country, targeted particularly at the Iranian oil industry. Additional US sanctions were imposed subsequently, responding to Iran's development of nuclear weapons.

In 1996, the Iran and Libya Sanctions Act (ILSA) was passed by the US Congress. The law stipulated restrictions and other financial measures, including liens on assets held in the United States, against foreign firms that undertake new oilfield investments in Iran. The ILSA sanctions led some foreign companies to defer bidding on new contracts to help develop Iranian oil and gas properties, and they must be credited with making Iran's nuclear program more costly to pursue.[4] Still, to date the ILSA sanctions have not been formally imposed by the US Government against a single foreign firm. Nor have the ILSA sanctions blunted the determination of Iran's revolutionary government to pursue a nuclear weapons program, and its corresponding designs for projecting military power in the Middle East, particularly in the Persian Gulf region.

Iran's Economy Today

After Indonesia and Nigeria, Iran is OPEC's most populous member (Table 1),[5] and, although it is not an Arab country, Iran's large geographic and economic size makes it a very influential player both economically and politically in the Middle East.

Notwithstanding its prominence, Iran is one of the least prosperous OPEC members in the Middle East. In terms of economic well-being, with per capita income of just under $3,000, the residents of Iran trail the residents of the Gulf States and some OPEC countries outside of the Middle East where per capita income levels are far higher, despite Iran's vast wealth of proven reserves of crude oil and natural gas.

As Table 1 shows, the accumulated foreign direct investment (FDI) in Iran is only 2 percent of GDP. This ratio is very low. As seen in Figure 1, Iran's FDI ratio resembles the ratios for two former rogue states, Iraq (1.3 percent) and Libya (1.4 percent), and the ratio for the Russian Federation (4.2 percent).[6] Such limited foreign direct investment is well below the norm for developing countries today, especially the outward-oriented, emerging market countries in which multinational firms are widely and favorably cited for playing a prominent role in the domestic economy and exports. Moreover, with a rating for foreign investment freedom of just 10 percent by the Heritage Foundation-Wall

[4] For a chronology of news and other reports of the diplomatic and economic costs of Iran's pursuit of its nuclear program in the face of US and EU opposition, see the case history of US economic sanctions against Iran contained in the infobase cd-rom accompanying Hufbauer et al. (2007, case history 84-1).

[5] With 221 million persons, Indonesia is substantially larger in population among OPEC members than either Nigeria (132 million) or Iran (69 million). Indonesia, however, has announced that it will not renew its membership in OPEC at the end of 2008, because it is no longer a net oil-exporting country.

[6] At just 1 percent of GDP in Figure 1, the ratio of accumulated FDI stocks in Kuwait is an unexpected "outlier."

Street Journal *Index of Economic Freedom* (Holmes et al. 2008), Iran's openness to productive foreign investment falls far below the average of 30 percent reported by the *Index of Economic Freedom* in 2008 for the major oil-producing countries shown in Figure 1.[7] Iran's condition is symptomatic of the insular, self-reliant policies that the government has pursued since the revolutionary overthrow of the Shah of Iran in 1979, and the subsequent nationalization of oil production facilities and hydrocarbon resources. Finally, the lackluster performance of Iran's economy also reflects the government's heavy regulation of the domestic economy.

With regard to Iran's performance, the US Energy Information Administration (USEIA 2007a) reports that the country produced 6 million bbl/d of crude oil in 1974, but has been unable to match that level since the 1979 revolution owing to the combination of the Iran-Iraq war (1980-1988), limited oil sector investment, US economic sanctions, and a high rate of natural decline in Iran's mature oil fields. Further, the US agency reports:

> Iran's oil fields need structural upgrades, including enhanced oil recovery efforts such as natural gas injection. Iran's fields have a natural annual decline rate estimated at 8 percent onshore and 10 percent offshore, while current Iranian recovery rates are 24-27 percent, 10 percent less than the world average. [An estimated] 400,000-500,000 bbl/d of crude production [are] lost annually to reservoir damage and decreases in existing oil deposits (USEIA 2007a, p. 3).

To promote greater exploration and upgrading of oil fields, Iran has encouraged international oil companies to participate in oil exploration and development projects by extending buyback contracts to foreign firms. These contracts are a step far short of foreign ownership (which is prohibited under the present Iranian constitution), but they do reward participating foreign firms with production-based remuneration fees over an agreed time horizon. For a number of reasons, including Iran's foreign investment climate and precarious geopolitical situation, these arrangements have not been widely pursued by foreign firms, especially not US and EU oil companies.[8]

Outside the energy sector, greater private sector participation takes place in Iran's economy, including in the service sector (which accounts for 46 percent of GDP). Still, the private sector in Iran is severely hindered by government over-regulation of the economy. Not surprisingly, the *Index of Economic Freedom 2008* (Holmes et al. 2008)

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[7] Besides Iran, among the major oil-producing countries in Figure 1, only Angola and Venezuela earned foreign investment ratings lower than 30 percent in the 2008 *Index of Economic Freedom* (both 20 percent). Within the group, Kuwait (50 percent) earned the highest foreign investment rating, followed by Algeria (40 percent).

[8] The participation rate of US and EU oil companies in producing crude oil in the OPEC countries averages 11 percent (authors' calculations based on OPEC 2006). However, the participation rate is virtually zero for all Gulf States, except the United Arab Emirates (2 percent). By contrast, the participation of US and EU oil companies in lifting crude oil is particularly high in Nigeria (98 percent), Angola (35 percent), Libya (28 percent), and Indonesia (21 percent).

rates Iran as a repressed economy.[9] The non-oil economy of Iran is also hindered by the low degree of accumulated foreign direct investment noted previously. Repression of foreign investment limits the potential of Iran's economy and the standard of living of its residents, not only with respect to energy resources but also across the whole field of economic activity and human skills. In combination with the geopolitical uncertainties of the greater Persian region, Iran's aversion to interaction with the global economy restricts the country's access to modern technologies and management techniques enjoyed by outward-oriented countries in the Middle East and other regions.

Impact of Normalizing Iran's Economic Relations

We begin our investigation of the potential impact of economic normalization by analyzing the effects of US sanctions on Iran's non-oil trade, disaggregated by major product categories. Subsequently, we consider the impact of normalization on the oil and service sectors of Iran, applying less formal analytical techniques.

Non-Oil Trade

Our analysis of the impact of US sanctions on the non-oil trade of Iran is undertaken using two methods. First we use a gravity model approach, and second we apply a simple comparative approach. The gravity model approach is suggested both by previous studies of economic sanctions and by the prominence of gravity modeling in empirical analysis of trade policies.[10] However, as discussed below, the gravity model estimates reflect the "average" experience with the impact of US sanctions targeted against a number of countries and may not reflect the unique conditions of Iran. Thus we also present alternative estimates based on a simpler, less rigorous, comparative approach based on the trade experience of other Middle East countries.

Gravity Model Analysis

Following the recent Hufbauer et al. (2007) analysis of the trade impacts of US economic sanctions in 2000, we employ the Peterson Institute gravity model to carry out a similar analysis based on international trade in 2005. The gravity model uses econometric techniques to evaluate thousands of individual observations of the dollar amount of trade between pairs of countries against the gravitational "mass" of explanatory variables that describe the characteristics of the bilateral trading partners.[11] Two familiar explanatory variables are the joint real GDP levels of partners and the distance between them.

[9] In fact, out of the 157 countries considered, the *Index of Economic Freedom 2008* ranked Iran 151st, or nearly last, in economic freedom. For further discussion, see Holmes et al. (2008).

[10] Eichengreen and Irwin (1998, pp. 33-57) dub the gravity model the "workhorse" of quantitative studies of international trade policy.

[11] The origins of the gravity model may be found in early empirical trade studies by Tinbergen (1962), Poyhonen (1963), and Linnemann (1966). For a discussion of the modern theory and application of gravity models, see Anderson and Wincoop (2004).

Essentially, the gravity model postulates that bilateral trade between countries is directly related to the product of the partner countries' GDP levels, and indirectly related to the distance between the trading partners. But other explanatory variables are specified as well, including geographic, political, and institutional factors that either augment or diminish the gravitational forces giving rise to commerce between countries.

The current Peterson Institute model identifies bilateral trade between more than 125 countries in 2005, disaggregated by the 1-digit sections of the Standard International Trade Classification (SITC) system underlying the UN COMTRADE database (DeRosa 2007). US sanctions in force during 2005 are reported in Table 2. Current US sanctions are directed against 10 countries, including Iran.[12]

Estimation Results. For the present analysis, the gravity model is estimated using ordinary least squares, a widely applied econometric technique that relates variations in the dependent variable (bilateral trade) to variations in the several postulated explanatory variables of the model (distance, joint GDP, and other variables to be identified).[13] The contribution of each explanatory variable to the variations in bilateral trade is given by an estimated linear coefficient, and the statistical significance of this coefficient is determined using the norms of an underlying standard probability distribution of possible outcomes. Overall, the explanatory power of the gravity model estimation results is given by the so-called r-squared statistic, which measures the degree to which the explanatory variables account, on a combined basis, for the sum of the observed variations in bilateral trade.[14]

The gravity model estimation results of the present study are presented in Table 3. In addition to the several "core" explanatory variables identified in the table, the explanatory variables include indicator variables for the trade of the sanctioned countries with the United States and all other countries combined. These "dummy variables" take on the value of 1 if bilateral trade (the dependent variable in the regression equation) involves either merchandise exports or imports by any country that is the target of US sanctions, and are zero otherwise.

The upper panel of Table 3 reports the gravity model estimation results in which the indicator variables refer to two-way trade (both exports and imports) by the target countries with the United States and, separately, all other trading partners. The lower

[12] The longest standing current US sanction are those against North Korea. They were first imposed in 1950 following the outbreak of the Korean War, and most are still in place under various statutes notwithstanding President Bush's recent decision to lift North Korea's designation under the Trading with the Enemy Act of 1916.

[13] For an introduction to econometrics and the method of ordinary least squares regression, see for instance Johnston and DiNardo (1997).

[14] To account for differences in economic size among the trading partners in the gravity model, selected variables in the model are first transformed to logarithmic terms: bilateral trade, distance, joint GDP, and joint land area. US dollar values of bilateral trade and GDP are converted to real terms using the US consumer price index.

panel of the table reports the estimation results when the indicator variables are differentiated by both target country exports to and target country imports from the United States and, again separately, all other trading partners.

Broadly speaking, the estimation results for the gravity model are very robust. Although the r-squared values that indicate the overall explanatory power of the regression equations are not greater than 0.40 for trade in primary goods (SITC 0 through 4) and 0.60 for trade in manufactures (SITC 5 through 8), the estimated coefficients of the "core" explanatory variables are generally statistically significant and bear the anticipated signs. For instance, the estimation results show that the distance between trading partners significantly hinders trade, while the joint level of real output in the partner countries exercises substantial "gravitational pull," promoting trade between the partners. Similarly, the results show that if the trading partners are land-locked or cover considerable land area, they tend to enjoy less bilateral trade; whereas if the trading partners share a common language, a common border, or a common colonial history, they tend to enjoy greater bilateral trade.

With respect to the influence of economic sanctions, our primary interest is in the coefficient estimates for the target country indicators, framed for emphasis by the borders in Table 3. As shown in the upper panel of the table, the influence of economic sanctions on the two-way trade of the target countries with non-US partners is predominantly negative and significant, whereas their influence on the two-way trade of target countries with the United States is negative and significant only for trade in crude materials, material manufactures, and machinery and transport equipment.[15]

In the lower panel of Table 3, the sanction indicator variables are differentiated by target country exports and target country imports. The estimation results are much as before for target country trade with non-US partners. They indicate that both target country exports and target country imports with non-US partners are predominantly negatively correlated with the US economic sanctions, except for target country exports of petroleum and other mineral fuels (SITC 3) and target country imports of fats and oils (SITC 4) and specialized manufactures (SITC 5-7).

The estimation results support the view that US sanctions are effective in limiting target country exports to the United States -- except in the important case of trade in mineral fuels (SITC 3) and in the lesser case of trade in miscellaneous manufactures (SITC 8). While US sanctions largely succeed in limiting target country exports to the United States, they appear to exert an attenuated impact on target country imports from the

[15] The strong impact of US sanctions on third-country trade with the target country may come as a surprise. However, US sanctions create a cloud of uncertainty which can dampen commerce when non-US trading partners have a choice between dealing with the target country and dealing with other countries. US financial sanctions against South Africa during the Apartheid Era are illustrative. They contributed to winding down European credit lines available to the country, impacting trade with traditional EU partners more than the United States.

United States. In many sanctions episodes, unlike the Iran case and a few others, the United States does not forbid virtually all trade with the target country (food and medicine are usually excepted, even in severe cases such as North Korea, Cuba and Iran). Moreover, in several of the less severe sanctions episodes, firms in the target country may "stock up" with US merchandise, fearing that more severe sanctions will follow the initial measures. These features may explain the attenuated impact on target country imports from the United States.

Non-Oil Trade Impacts of US Sanctions. The gravity model estimation results in Table 3 suggest that US economic sanctions in force today cause the non-oil exports and selected non-oil imports of target countries to fall short of their potential. Based on the estimation results for target country exports and for target country imports in the lower panel of Table 3, the gravity model's predictions of the ***statistically significant*** shortfalls in target country trade can be summarized as presented in Table 4.

If the "average" experience of sanctioned countries (as depicted in Table 4) applies to Iran, the actual-to-potential trade ratios imply that US economic sanctions fall more heavily on Iran's exports than imports and that the country's exports to the United States fall particularly short of their potential. For example, the ratios imply that Iran's exports of machinery and transport equipment (SITC 7) to the United States amounted to just 3 percent of their potential. In a few SITC categories, the implied shortfalls in Iran's imports are also appreciable. For example, the ratios suggest that Iran's imports of material manufactures (SITC 6) from the United States amounted to just 34 percent of the level predicted by the gravity model.[16]

In Table 5, we translate the trade impacts of US sanctions on Iran's trade in 2005 into US dollar terms. Although the impacts in the Table 5 are trade "losses" to Iran, they equally represent (with reverse signs) the potential trade gains to the country if the US sanctions were lifted. Mirroring the underlying coefficient estimates for the sanctions indicator variables in the gravity model, the overall trade impacts of the US sanctions fall more heavily on Iran's exports ($15.6 billion) than Iran's imports ($1.2 billion). On a combined basis, the impact of the US sanctions on Iran's total trade (exports plus imports) amounts to a loss of $16.8 billion, or nearly 19 percent of Iran's actual total trade in 2005 ($90.6 billion). Relative to domestic output, this total trade loss is equivalent to nearly 9 percent of Iran's gross domestic product in 2005.

Trade losses occur mainly to Iran's exports of material manufactures ($6.6 billion), foods ($3.9 billion), and machinery and transport equipment ($2.1 billion). As expected, these losses fall heavily on export shipments to the United States ($1.3 billion) and the

[16] US sanctions permit US exports to Iran of food (SITC 0) and medicine (included in SITC 5). Consistent with this, the gravity model estimation results in Table 3 indicate that US sanctions have no statistically appreciable effect on US exports of either foodstuffs or chemicals to Iran and the other target countries combined. Thus, in Table 4, the ellipses for target country imports from the United States of food and chemicals imply that Iran's imports of these goods from the United States are unimpeded by the US sanctions.

European Union ($2.8 billion). But the largest proportion of the losses are spread over export shipment to a wide number of Iran's trading partners, including its OPEC partners ($5.5 billion), the Russian Federation ($0.3 billion), and Japan ($0.1 billion).

In comparison, import losses to Iran from the US economic sanctions occur mainly to the country's imports of miscellaneous manufactures ($0.6 billion), foods ($0.3 billion), and beverages and tobacco ($0.3 billion), and they fall particularly heavily on the imports in these categories from the European Union ($0.4 billion) and the OPEC countries ($0.3 billion).[17]

Alternative Trade Analysis

In this section, we present alternative estimates of the impact of US sanctions for Iran's trade by using a less rigorous approach that draws on simple comparisons with other Middle East countries.

Our alternative analysis compares the actual-to-potential levels of Iran's trade by SITC sections with the same partners featured in Table 5. However, to assess potential trade we consider the trade of these partners with eleven Arab Middle East countries: Egypt, Iraq, Jordan, Lebanon, Syria, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE. Specifically, we relate the trade of the individual Middle East countries to their GDP levels, and then we compute what Iran's trade would have been if the United States and the other partner countries had traded with Iran at the same average "rate" that the United States and other partners trade with the group of eleven Arab Middle East countries. Finally, for each partner we computed the difference between its "potential" and actual trade with Iran in each trade category.

The trade impacts found by this method are reported in Table 6. The gravity model coefficients – estimated from the "average" experience of target countries sanctioned by the United States -- suggest a loss in Iran's total trade (exports plus imports) of about $17 billion annually. Our alternative trade analysis, however, suggests a much greater loss in the total trade of Iran, about $35 billion (of which $7 billion is lost trade with the United States). About two-thirds of the total loss – some $23 billion -- is accounted for by Iranian imports from the United States ($5 billion), the European Union ($5 billion), Japan ($3 billion) and the other partners listed in Table 6. The losses in Iranian imports are spread across the different categories of non-oil trade, with the heaviest losses concentrated in Iran's imports of machinery and transport equipment ($8 billion), foods ($5 billion), and material manufactures ($4 billion).

[17] Iran's export and import losses by its 50 top partners are reported in Appendix Tables 12 and 13. Iraq is among the top partners in terms of trade losses for Iran, probably owing more to diminished bilateral trade between the two countries following the Iran-Iraq War than to US sanctions on Iran.

The Oil Sector

The oil sector comprises about 38 percent of the domestic economy of Iran. Although the importance of the sector has declined in recent years, the sector remains a central feature of the Iranian economy. Moreover, given the country's considerable wealth of proven reserves of both petroleum and natural gas (Table 7), the vitality of the sector has important implications for the world energy market.[18]

As noted previously, the oil and natural gas sector is nationalized under the state-owned National Iranian Oil Company (NIOC), which charges low (subsidized) prices for domestically consumed petroleum and natural gas products. Foreign direct investment in the sector is prohibited, and given Iran's highly regulated economy and uncertainties surrounding the enforcement of the US economic sanctions against Iran, only limited foreign participation in Iranian oil-and-gas production and exploration takes place through buyback contracts. Together, these factors all but eliminate the participation of western oil companies in the development of Iran's energy resources, and contribute to declining productivity in the sector.

To generate significant economic gains, any normalization of Iran's economic relations must entail dramatic changes beyond the lifting of US sanctions. Iran must adopt policies that welcome foreign direct investment in its oil sector. This essential point is illustrated by the recent experiences of the energy sectors of Libya and Venezuela. The ILSA sanctions against Libya were lifted by President Bush in 2004 (USEIA 2007b). However, substantial new foreign investment by foreign oil companies, especially to develop the country's potential for expanded production of natural gas, has not yet been achieved because of Libya's antiquated infrastructure and highly regulated economy rife with corruption. In the case of Venezuela, the country is not the object of current US economic sanctions and until recently has attracted considerable direct investment from US and other foreign oil companies. These investments supported the development of Venezuela's oil fields, mainly through minority partnership arrangements with nationally-owned oil firms (now merged into the sole national oil company, Petroleos de Venezuela S.A.). Since 2005, however, the oil production and exploration rights of foreign oil companies have been sharply curtailed through a combination of new legislation, higher taxes and royalties, and new contractual arrangements (USEIA 2007c). These measures effectively expropriate foreign rights and reduce the share of foreign companies in Venezuela's oil energy sector. After this effective nationalization of considerable foreign investment in the country's energy sector, Venezuela's production of crude oil declined at an average annual rate of nearly 2 percent in both 2006 and 2007 -- though not as fast as the decline in crude oil production witnessed in Libya (minus 6.7 percent) or Indonesia (minus 2.2 percent), as seen in Table 9.[19]

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[18] In 2005, Iran accounted for about 11 percent of the world's proven reserves of crude oil, and about 15 percent of global proven reserves of natural gas (Table 1). In comparison, the country's oil refinery capacity amounted for only about 2 percent of the world total.

[19] Among the OPEC countries, production of crude oil during 2006-2007 also fell significantly in Saudi Arabia (minus 2.9 percent). This reduction in output by Saudi

To underscore the importance of foreign investment in the normalization of Iran's economic relations, we examine the apparent impact of US and EU oil companies on the production of crude oil in the OPEC countries shown in Table 7. Specifically, we consider the implied contribution of US and EU oil firms to improve the ability of the several OPEC countries to lift crude oil relative to each country's proven oil reserves. The "presence" of these Western oil firms, measured by their combined share in the production of crude oil in each OPEC country for which the statistics are available, is correlated positively and appreciably with crude oil production relative to proven reserves across the OPEC countries.[20]

We assume that normalization of Iran's economic relations with the United States and other countries results in the entry of US and EU oil companies to the oilfields of Iran, and that on a combined basis these new entrants to Iran's oilfields will account for about 5 percent of the country's total production of crude oil after a period of about five years. At 5 percent of production, this "presence" of Western oil firms is about equal to the contribution of US and EU oil companies to production annually in Algeria (about 6 percent), but below that found in other OPEC countries outside the Middle East, such as Indonesia (21 percent) and Libya (28 percent).

Within our analytical framework, raising the rate of participation of western oil firms in the production of crude oil in Iran from zero to 5 percent yields an increase of Iran's production of crude oil by 51 percent.[21] The reason we estimate such a strong impact of a mere 5 percent Western presence on Iranian production is that new equipment and technology – deployed by the National Iranian Oil Company, drawing on the experience of western oil firms -- would substantially boost the ratio between total crude production and proven reserves. This calculation, traced out in Table 8, is based on the relation between Western presence, on the one hand, and the ratio of production to reserves, on the other hand, observed elsewhere in the OPEC region (derived from the data in Table 7). Further, we assume that the ratio between Iranian exports and Iranian production remains the same as in 2005, so exports of crude oil also increase by 51 percent, or 1.2 million barrels a day. This calculation implies that Iran's own use of crude oil would also

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Arabia may reflect an effort by the country, a leading member of OPEC, to restrain OPEC's total output of oil, which in Table 9 was virtually unchanged over the period 1981-2007.

[20] The correlation coefficient is 0.25. On average, crude oil productivity (as measured by the ratio of output to proven reserves) in the OPEC countries relative to the percentage contribution of US and EU oil firms to total production is computed at 0.001. This coefficient may seem "small," but it underlies the sizable impacts of normalization of economic relations with Iran reported below in the text and in Table 8.

[21] For this analysis, we ignore the OPEC ceilings on the production and export of crude petroleum by Iran and other OPEC members. Our assumption is that an increase in Iranian production and exports would not be offset by lower production and exports by other OPEC members.

increase substantially, as crude oil production is ramped up and the Iranian economy performs better under normalized conditions.

We do not have sufficient information to determine in a like manner the impact of eliminating US sanctions on Iran's production and exports of refined products and natural gas. However, on an informal basis, we conservatively peg these related impacts at 25 percent (that is, one-half of the estimated percentage impact of normalization on crude oil production and exports). These percentage impacts are translated into quantity terms for Iranian production and exports of both petroleum and natural gas products in Table 8. Also in Table 8, we include the re-computed totals for world production and exports, to provide an indication of the prospective effects of the normalization of Iran's economic relations on supply conditions in world oil markets.[22]

Our results suggest that normalization of Iran's economic relations would appreciably strengthen the Iranian oil sector, mainly through improvements in efficiency and new technologies applied by western firms to lifting crude oil in the onshore and offshore oil fields of Iran. Increasing Iran's crude oil output and exports by 51 percent would add to world production and exports by margins of about 3 percent per annum -- margins that would be most welcome to the United States and other oil-importing countries. By comparison, our estimates of the impact of lifting sanctions on Iran's output of oil refinery products and natural gas suggest additions to world production and exports of less than 1 percent per annum. The gain is more modest, but is based on deliberately conservative assumptions.

The Service Sector

Finally, we consider the implications of normalization for Iran's service sector. The service sector of Iran is an integral part of the domestic economy and accounts for about 45 percent of the country's aggregate output. Given Iran's relatively high rates of literacy and education, the sector is important for modernization of the economy, and it is a prime candidate for catalyzing economy-wide growth in combination with policy reforms in the oil sector.

In time, the lifting of US sanctions and the liberalization of Iran's own policies that limit entry by foreign firms to the service economy should attract considerable foreign direct investment by multinational service firms headquartered in the United States and the European Union. Indeed, if foreign direct investment in proportion to the potential market opportunities presented by the Iranian economy were allowed, a number of US and other foreign banks; legal, engineering, and other service firms; and even individual professionals from abroad would likely establish operations in Iran, independently or in partnership with Iranian service firms.

[22] In the concluding section of our analysis we provide a rough estimate of the potential impact of the normalization of Iran's economic relations on the world price of crude petroleum.

In keeping with the focus of our analysis on the medium-term impact of normalization, we emphasize that Iran's service sector would first experience an expansion of cross-border trade in services with the United States and the European Union. The initial expansion of trade in services would complement the increased participation of foreign firms in the Iranian energy sector, namely, through oil and gas field technical services provided by US and Western European oil companies. Gradually, however, increased US and EU trade in services with Iran might grow in other areas. Travel services are obvious; other areas might include the provision of communications and information services or the licensing of advanced technologies, with significant (but difficult to quantify) benefits to the Iranian economy. Also gradually, US and EU service firms might develop partnership arrangements or joint ventures with Iranian service firms, but only to the extent that Iran's foreign investment laws are liberalized to permit such arrangements between foreign and domestic firms.

The prospective magnitude of cross-border trade in services with Iran following normalization of the country's economic relations can be assessed with the aid of recent statistics on US and EU cross-border exports of services to the OPEC countries and the world (Table 10). In 2005, the United States exported nearly $18 billion in services to the OPEC countries, while the European Union supplied about $27 billion (of which about $1.2 billion was supplied to Iran).[23] Without appealing to formal quantitative analysis (we know of no appropriate models), we surmise that, over a period of about five years, normalization of US-Iran economic relations should result in a doubling of the present level of Iran's services trade with the Western countries, bringing Iran's total imports of cross-border services from abroad to between $2.0 billion and $2.5 billion annually. The European Union would probably account for the bulk of this trade. However, given their international competitiveness, US service providers could gain an appreciable share after the US sanctions are lifted. A conservative estimate of the potential trade gain to US service providers is $500 million annually. However, if present US service exports to Saudi Arabia ($1.9 billion) provide a guide, prospective US exports of services to Iran could rise to as much as $1.0 billion annually. This guesstimate rests on the crucial assumption that the normalization of US-Iran economic relations is accompanied by significant liberalization of Iran's own policies in a market-oriented direction, making trade an attractive proposition for both US service providers and Iranian consumers.

[23] The principal EU exporters of services to Iran are Austria, Italy, the Netherlands, and the United Kingdom, with the total service exports of the four countries individually to Iran ranging between $200 million and $400 million each. Where reported, more detailed data suggest that EU services exports to Iran are predominantly transportation services, travel services, and "other business services" (which exclude communications; insurance; construction, financial, and information services; and royalties and licensing fees). Finally, in the data source, the European Union accounts for the bulk of Iran's total imports of services (about $1.4 billion), reported by all partner service-exporting countries.

Summing Up

What the future holds for economic relations between Iran and the United States is unclear. However, from an economic perspective, Iran bears substantial economic costs from the imposition of US and UN trade and financial sanctions that limit Iran's potential for enjoying a modern economy. This is true even if the world price of oil climbs again to the proximate average level during 2008 of $100/bbl.

Table 11 provides a summary of our estimates of the potential benefits of normalizing Iran's economic relations for both Iran and the United States, organized by the major sectors of Iran's economy. In dollar terms, we estimate that, over the medium-term (up to five years), the lifting of US sanctions would result in annual economic gains to Iran of about $61 billion (at the 2005 crude oil price of $50/bbl), or about 32 percent of the country's GDP. If the oil price rises again to $100/bbl, the Iranian economic gains would be close to $80 billion annually.[24]

In terms of additional supplies to world oil markets, our normalization scenario results in increased exports of crude oil by Iran of roughly 1.2 million barrels a day, about 3 percent of current world oil exports. Oil prices are highly sensitive to marginal changes in demand and supply, so extra supplies of 3 percent could serve to moderate world oil prices by a much larger figure. Conservatively, we estimate world oil prices would be 10 percent lower than otherwise.[25]

As might be expected, the largest economic gains for Iran originate in the oil-and-gas sector, for which we derive estimates for not only exports ($25 billion, assuming the 2005 price of $50/bbl) but also domestic output ($53 billion). Still, the potential gains to Iran's non-oil trade could also be substantial: $35 billion annually ($14 billion if only expanded trade with the US and EU is counted). Finally, our least formal estimates, those pertaining to Iran's trade in services, indicate that after the elimination of US sanctions, Iran might enjoy new imports of technical and other services from the United States and the European Union of about $1 billion annually. This modest increase in services, however, might be substantially augmented by US and EU foreign direct investment in Iran outside of the energy sector. While the potential long-term increase in services trade is difficult to estimate, most important it would require the Government of Iran to adopt

[24] This estimate makes no allowance for higher world prices of natural gas and refined petroleum products after 2005.

[25] In Appendix Table 14, we use a simple "price elasticities" model of the world oil market to calculate the range of equilibrium price impacts of a 1 percent increase in the world supply of oil, for various values of the model's price elasticities of demand and supply. The calculations suggest that a 1 percent increase in the supply of oil would cause the world price of oil to fall by 3-to-5 percent in the short-to-medium term when the price elasticity of supply would be more-to-strongly inelastic in value (relative to the parameter's long-term value). Thus, in our normalization scenario, which contemplates an increase in world production of crude oil of about 2.1 million barrels a day, or 3 percent, we would project the world price of oil to fall by between 9 percent and 15 percent.

far more open policies towards foreign direct investment and substantial reforms in the economic environment.

Our estimates in Table 11 summarize the potential economic benefits to Iran of lifting the present US and UN economic sanctions against Iran and, equally important, normalizing Iran's relations with the world economy. These estimates also indicate the potential benefits to the US economy if Iran becomes a normal country. The largest of the expected benefits is the reduced bill for US consumption of crude oil, computed at $38 billion on the basis of 2005 oil prices ($76 billion at the proximate average 2008 world price of $100/bbl). Adding possible gains in US non-oil trade and trade in services with Iran, we estimate the total benefit to the US economy at $46 billion, or about 0.4 percent of US GDP in 2005 (about 0.7 percent of US GDP at a world oil price of $100/bbl). This overall estimate, however, does not include the large (but difficult to quantify) benefits that would accrue to US oil companies and other US multinational firms from long-term investments in Iran under a scenario of true normalization.

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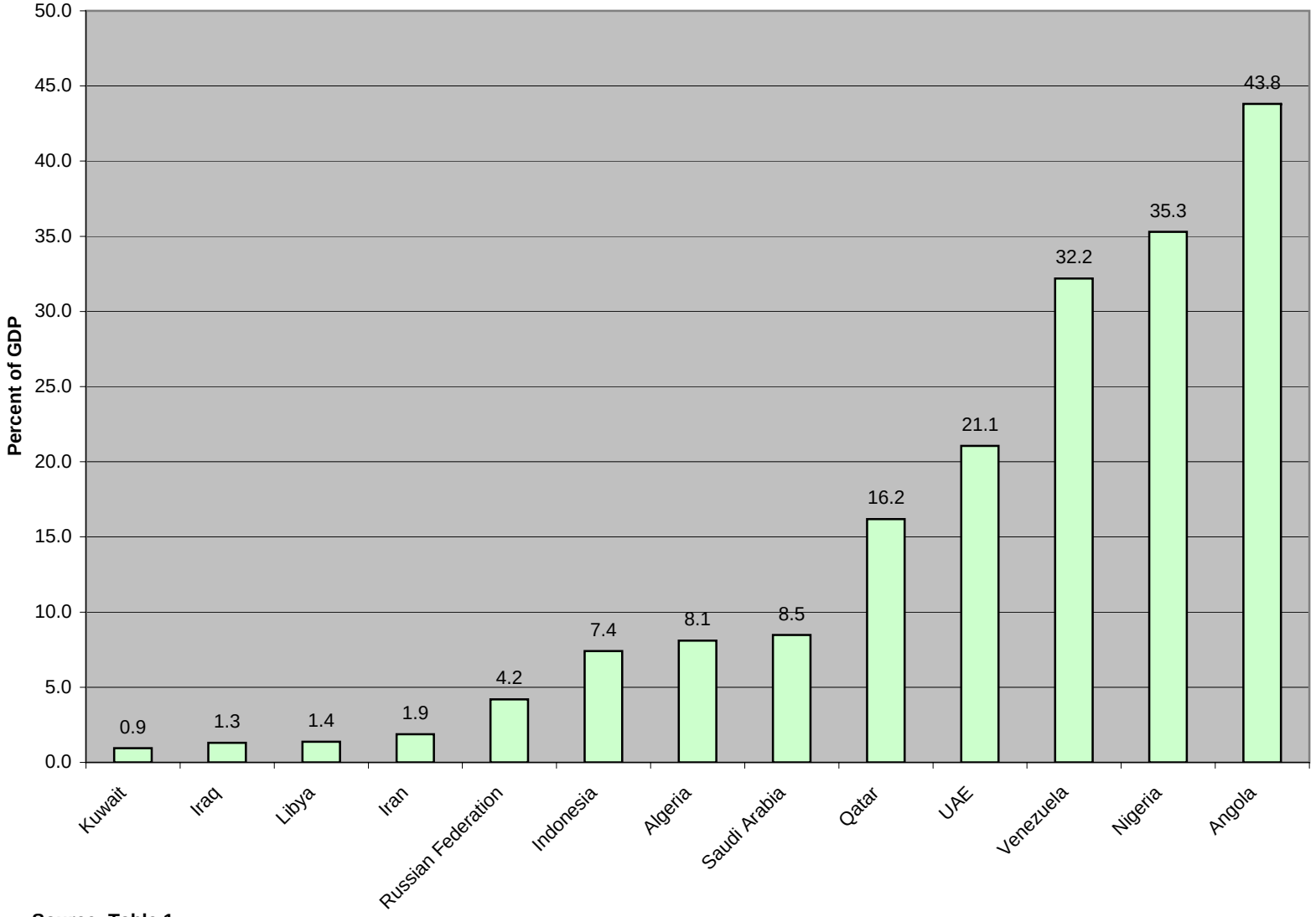
Table 1. Economic Indicators for OPEC and Other Country Groups and Regions, 2005

	National Output (GDP)							Oil and Gas Production					Trade and Foreign Investment			
				Per Capita	Structure			Production			Proven Reserves		Goods & Serv. (2004)			FDI
	Pop-ulation	Level	Per Capita	Growth 2001-05	Agr.	Ind.	Serv.	Crude Oil	Refinery Capacity	Natural Gas	Crude Oil	Natural Gas	Export	Import	Total Trade	Inward Stock
	(Mn)	($Bn)	($)	(%)	(%GDP)			(Th	(Th bbl/d)	(Mn c m)	(Mn bbl)	(Bn c m)	($Bn)		(%GDP)	
OPEC	561.8	1,484	12,165	2.7	9	55	36	31,791	9,088	506,435	913,290	89,419	598	402	89.0	14.8
Algeria	32.9	102	3,112	3.4	10	56	34	1,352	462	89,235	12,270	4,504	34	22	65.7	8.1
Angola	15.9	31	1,925	7.4	8	73	20	1,238	39	910	9,035	270	24	15	128.8	43.8
Indonesia	220.6	287	1,301	3.3	13	47	40	1,059	1,057	73,800	4,301	2,769	100	91	66.6	7.4
Iran	68.6	189	2,748	4.4	11	43	46	4,092	1,474	100,900	136,270	27,580	47	42	55.0	1.9
Iraq	28.8	33	1,160	-4.4	n.a.	n.a.	n.a.	1,853	603	2,650	115,000	3,170	n.a.	n.a.	n.a.	1.3
Kuwait	2.7	81	29,919	4.0	0	59	40	2,573	936	12,300	101,500	1,572	34	19	89.6	0.9
Libya	5.8	37	6,431	3.4	n.a.	n.a.	n.a.	1,693	380	11,300	41,464	1,491	n.a.	n.a.	n.a.	1.4
Nigeria	131.5	99	750	3.7	23	57	20	2,366	445	22,400	36,220	5,152	55	34	90.5	35.3
Qatar	0.8	42	50,874	3.4	n.a.	n.a.	n.a.	766	80	45,800	15,207	25,636	20	9	92.2	16.2
Saudi Arabia	23.1	310	13,398	1.4	4	59	37	9,353	2,091	71,240	264,211	6,900	132	62	77.5	8.5
UAE	4.5	130	28,956	1.7	3	52	45	2,378	466	47,000	97,800	6,060	94	79	165.0	21.1
Venezuela	26.6	144	5,406	1.0	5	49	46	3,067	1,054	28,900	80,012	4,315	57	29	59.6	32.2
Russian Federation	142.4	765	5,369	6.7	6	40	55	9,552	5,491	598	79,100	47,660	267	164	56.4	4.2
Developing Regions																
Europe & Central Asia	460.0	2,074	4,509	5.2	9	31	61	n.c.	n.c.	n.c.	n.c.	n.c.	663	660	78.5	21.2
East Asia & Pacific	1,899.6	3,050	1,618	7.4	13	45	42	n.c.	n.c.	n.c.	n.c.	n.c.	1,141	1,054	82.7	35.1
South Asia	1,492.5	1,017	692	4.8	20	27	53	n.c.	n.c.	n.c.	n.c.	n.c.	161	183	38.9	6.2
Latin America & Caribbean	555.9	2,539	4,625	1.2	7	31	62	n.c.	n.c.	n.c.	n.c.	n.c.	527	468	47.8	36.7
Middle East & North Africa	305.2	644	2,110	2.9	12	40	48	n.c.	n.c.	n.c.	n.c.	n.c.	245	225	73.0	36.6
Sub-Saharan Africa	770.3	631	838	2.1	15	32	53	n.c.	n.c.	n.c.	n.c.	n.c.	175	180	66.3	30.2
Major OECD Countries	740.8	26,935	36,394	1.3	2	26	72	9,430	36,888	712	36,800	8,280	5,307	5,630	40.3	16.2
EU	314.3	9,984	31,807	1.2	2	27	71	2,535	15,024	200	6,900	2,490	3,520	3,309	70.7	33.5
Japan	127.6	4,534	35,484	1.3	2	30	68	…	4,529	…	…	…	613	524	24.8	2.2
US	299.0	12,417	41,890	1.4	1	22	77	6,895	17,335	512	29,900	5,790	1,174	1,798	25.4	13.0
World	6,517.8	44,795	6,949	1.5	3	28	69	71,612	85,334	2,858,795	1,189,139	181,065	10,803	10,831	52.1	22.7

Sources: BP (2007), OPEC (2006), UNCTAD (2006, 2008), and World Bank (2008).

Notes: Oil and gas production figures are measured in barrels per day (bbl/d) and cubic meters (c m), respectively, and are not computed (n.c.) for the developing regions in the table.

Figure 1. Inward FDI Stock in Major Oil-Producing Countries, 2005



Source: Table 1.

Table 2. US Economic Sanctions in Effect in 2005

Case	Sender	Target	Start Year	Last Year	Sanction Type
50-1	US, UN	North Korea	1950	--	F,X,M
60-3	US	Cuba	1990	--	F,X,M
76-3	US	Arab League	1976	--	F,X
77-2	US	Guatemala	1977	2005	F
84-1	US	Iran	1984	--	F,X,M
86-1	US	Syria	1986	--	F,X
88-1	US, EU, Japan	Burma	1988	--	F,M
88-2	UN, US, UK	Somalia	1988	--	F,X
89-2	US	China	1989	--	F,X
89-3	US	Sudan	1989	--	F
91-2	US	China	1991	--	F,X
92-8	UN, US, Germany	Cambodia	1997	--	F
93-1	US, UN	North Korea	2002	2006	F,X
93-5	US	Sudan	1993	--	F,X,M

Source: Hufbauer et al. (2007).
Note: Types of economic sanctions are financial (F), export (X), and import (M).

Table 3. Impact of US Economic Sanctions on the Bilateral Trade of Target Countries by SITC Sections, 2005

	All Goods (SITC 0-9)	Foods, Live Animals (SITC 0)	Beverages, Tobacco (SITC 1)	Crude Materials (SITC 2)	Mineral Fuels (SITC 3)	Fats and Oils (SITC 4)	Chemicals (SITC 5)	Material Manufs. (SITC 6)	Machinery, Transport Eq. (SITC 7)	Misc. Manufs. (SITC 8)
Two-Way Target Country Trade with Non-US Partners and the United States										
Distance	-1.15 ***	-1.14 ***	-1.11 ***	-1.13 ***	-1.67 ***	-0.77 ***	-1.41 ***	-1.51 ***	-1.25 ***	-1.28 ***
Product real GDP	0.87 ***	0.73 ***	0.63 ***	0.86 ***	0.67 ***	0.47 ***	1.05 ***	1.10 ***	1.19 ***	1.16 ***
Common language	0.38 ***	0.53 ***	0.36 ***	0.07	0.19	-0.06	0.60 ***	0.45 ***	0.41 ***	0.72 ***
Common border	1.17 ***	1.27 ***	0.92 ***	1.34 ***	1.36 ***	1.42 ***	1.04 ***	1.19 ***	1.21 ***	1.27 ***
Landlocked	-0.49 ***	-0.94 ***	-0.18 ***	-0.73 ***	-1.26 ***	-0.70 ***	-0.55 ***	-0.53 ***	-0.40 ***	-0.38 ***
Product land area	-0.04 ***	0.04 ***	0.00	0.08 ***	0.12 ***	0.09 ***	-0.05 ***	-0.06 ***	-0.18 ***	-0.20 ***
Common colonizer	1.00 ***	0.79 ***	1.10 ***	1.16 ***	1.50 ***	1.16 ***	1.23 ***	1.46 ***	1.09 ***	0.82 ***
Colony	0.96 ***	1.42 ***	1.81 ***	1.13 ***	1.18 ***	0.95 ***	0.49 ***	0.45 **	0.71 ***	0.96 ***
Non US-Target Cty	-0.54 ***	-0.77 ***	-1.03 ***	-0.42 ***	0.10	-0.61 ***	-0.43 ***	-0.64 ***	-0.96 ***	-0.69 ***
US-Target Cty	-0.09	-0.36	0.29	-0.79 *	1.96 ***	1.04 *	-0.67	-1.69 ***	-1.08 **	0.50
Constant	-26.83 ***	-20.81 ***	-17.73 ***	-29.58 ***	-17.43 ***	-15.29 ***	-32.24 ***	-33.64 ***	-36.76 ***	-35.60 ***
Observations (Th.)	111	13	8	12	7	6	12	14	15	15
R-squared	0.37	0.41	0.30	0.47	0.28	0.20	0.53	0.56	0.54	0.59
F-statistic	6657.8	880.5	365.0	1025.4	282.4	139.9	1380.9	1862.5	1745.6	2119.7
Target Country Export (X) and Import (M) Trade with Non-US Partners and the United States										
Distance	-1.15 ***	-1.14 ***	-1.12 ***	-1.13 ***	-1.68 ***	-0.78 ***	-1.41 ***	-1.51 ***	-1.26 ***	-1.28 ***
Product real GDP	0.87 ***	0.73 ***	0.63 ***	0.86 ***	0.67 ***	0.46 ***	1.04 ***	1.10 ***	1.18 ***	1.15 ***
Common language	0.40 ***	0.56 ***	0.40 ***	0.09	0.14	0.00	0.62 ***	0.48 ***	0.45 ***	0.75 ***
Common border	1.17 ***	1.28 ***	0.92 ***	1.34 ***	1.36 ***	1.41 ***	1.04 ***	1.20 ***	1.20 ***	1.28 ***
Landlocked	-0.49 ***	-0.94 ***	-0.18 ***	-0.73 ***	-1.28 ***	-0.68 ***	-0.54 ***	-0.53 ***	-0.40 ***	-0.37 ***
Product land area	-0.04 ***	0.04 ***	0.00	0.08 ***	0.11 ***	0.10 ***	-0.06 ***	-0.06 ***	-0.18 ***	-0.20 ***
Common colonizer	1.00 ***	0.78 ***	1.10 ***	1.15 ***	1.49 ***	1.14 ***	1.23 ***	1.46 ***	1.10 ***	0.82 ***
Colony	0.94 ***	1.40 ***	1.77 ***	1.11 ***	1.22 ***	0.91 ***	0.48 ***	0.43 **	0.68 ***	0.95 ***
Non US-Target Cty (X)	-0.81 ***	-1.19 ***	-1.42 ***	-0.82 ***	1.15 ***	-1.38 ***	-0.55 ***	-1.08 ***	-1.66 ***	-0.76 ***
Non US-Target Cty (M)	-0.14 ***	-0.17 **	-0.49 ***	0.04	-0.91 ***	0.18	-0.08	0.04	-0.05	-0.43 ***
US-Target Cty (X)	-0.60 **	-1.48 **	-1.32	-1.89 ***	4.13 ***	0.27	-1.42 **	-2.32 ***	-3.49 ***	0.72
US-Target Cty (M)	0.36	0.67	1.51 **	0.14	0.36	1.58 **	0.04	-1.07 *	1.22 *	0.33
Constant	-26.78 ***	-20.73 ***	-17.68 ***	-29.55 ***	-17.36 ***	-15.14 ***	-32.24 ***	-33.60 ***	-36.66 ***	-35.56 ***
Observations (Th.)	111	13	8	12	7	6	12	14	15	15
R-squared	0.38	0.41	0.30	0.47	0.29	0.21	0.53	0.57	0.55	0.59
F-statistic	5573.3	743.8	308.5	863.4	247.2	122.4	1151.2	1569.7	1496.7	1766.2

Sources: Peterson Institute gravity model (DeRosa 2007) using ordinary least squares, and US economic sanctions data for 2005 (Hufbauer et al. 2007).
*, **, *** denote statistical significance at the 90, 95, and 99 percent level, respectively.

Table 4. Actual-to-Predicted Trade Ratios by SITC Sections, Based on Gravity Model Estimates of the Impacts of US Sanctions on Target Country Trade, 2005

		Target Country Exports to		Target Country Imports from	
SITC Section		Non US	US	Non US	US
0	Food	0.31	0.23	0.85	…
1	Beverages	0.24	…	0.61	…
2	Crude materials	0.44	0.15	…	…
3	Mineral fuels	…	…	…	…
4	Fats and oils	0.25	…	…	…
5	Chemicals	0.58	0.24	…	…
6	Material manufs.	0.34	0.1	…	0.34
7	Machinery	0.19	0.03	…	…
8	Misc. manufs.	0.47	…	0.65	…

Sources: Table 3 and the authors' calculations.
Notes: Ellipses (…) denote that the underlying gravity model estimates are statistically insignificant. The underlying estimates for mineral fuels are not considered.

Table 5. Gravity Model Analysis: Losses in Iranian Trade by SITC Sections Owing to US Economic Sanctions, 2005
(Millions of US Dollars)

Partner	Actual Trade, All Goods, 2005	Trade Losses (Actual Trade minus Predicted Trade)									
		All Goods (SITC 0-8)	Foods, Live Animals (SITC 0)	Beverages, Tobacco (SITC 1)	Crude Materials (SITC 2)	Mineral Fuels (SITC 3)	Fats and Oils (SITC 4)	Chemicals (SITC 5)	Material Manufs. (SITC 6)	Machinery, Trans. Eq. (SITC 7)	Misc. Manufs. (SITC 8)
						Total Trade (Exports + Imports)					
All Partners	90,580	-16,758	-4,161	-452	-1,262	0	-103	-1,108	-6,611	-2,082	-978
United States	320	-1,265	-73	0	-1	0	0	-23	-1,167	-1	0
European Union	28,525	-3,153	-894	-87	-215	0	0	-111	-1,159	-386	-301
Japan	11,496	-123	-28	0	-6	0	0	-18	-48	-1	-22
OPEC	11,262	-5,791	-1,589	-236	-81	0	-25	-317	-2,554	-615	-372
Russian Federation	1,177	-321	-147	-8	-12	0	0	-5	-17	-125	-6
						Exports					
All Partners	51,439	-15,578	-3,855	-189	-1,262	0	-103	-1,108	-6,602	-2,082	-377
United States	175	-1,257	-73	0	-1	0	0	-23	-1,158	-1	0
European Union	12,643	-2,771	-834	-8	-215	0	0	-111	-1,159	-386	-58
Japan	10,322	-102	-28	0	-6	0	0	-18	-48	-1	0
OPEC	3,421	-5,512	-1,531	-158	-81	0	-25	-317	-2,554	-615	-231
Russian Federation	125	-315	-142	-8	-12	0	0	-5	-17	-125	-4
						Imports					
All Partners	39,142	-1,180	-307	-263	0	0	0	0	-9	0	-602
United States	146	-9	0	0	0	0	0	0	-9	0	0
European Union	15,882	-382	-60	-79	0	0	0	0	0	0	-243
Japan	1,174	-21	0	0	0	0	0	0	0	0	-21
OPEC	7,840	-278	-59	-79	0	0	0	0	0	0	-141
Russian Federation	1,052	-6	-4	0	0	0	0	0	0	0	-1

Sources: Authors' calculations based on the gravity model dataset and the actual-to-potential trade ratios in Table 4.

Table 6. Alternative Trade Analysis: Losses in Iranian Trade by SITC Sections Owing to US Economic Sanctions, 2005
(Millions of US Dollars)

Partner	Actual Trade, All Goods, 2005	Trade Losses (Actual Trade minus Predicted Trade)									
		All Goods (SITC 0-8)	Foods, Live Animals (SITC 0)	Beverages, Tobacco (SITC 1)	Crude Materials (SITC 2)	Mineral Fuels (SITC 3)	Fats and Oils (SITC 4)	Chemicals (SITC 5)	Material Manufs. (SITC 6)	Machinery, Trans. Eq. (SITC 7)	Misc. Manufs. (SITC 8)
						Total Trade (Exports + Imports)					
All Partners	90,580	-34,888	-4,914	-510	-1,328	0	-161	-4,177	-6,421	-10,106	-7,272
United States	320	-7,287	-627	-41	-181	0	-33	-573	-467	-2,989	-2,378
European Union	28,525	-6,989	-889	-204	-131	0	-70	-975	-338	-2,642	-1,740
Japan	11,496	-3,007	-1	-3	-13	0	0	-153	-297	-2,464	-75
OPEC	11,262	-471	-537	-50	-211	0	-296	-346	-3	1,225	-254
Russian Federation	1,177	309	-111	-1	-11	0	-12	11	241	195	-3
						Exports					
All Partners	51,439	-11,927	-227	-187	-748	0	-265	-3,335	-2,333	-1,958	-2,874
United States	175	-2,570	-11	-4	-13	0	-5	-310	-181	-22	-2,024
European Union	12,643	-1,528	192	-25	-84	0	-65	-347	-282	-596	-321
Japan	10,322	-305	3	0	-44	0	0	-130	-128	-1	-5
OPEC	3,421	-1,919	-322	-76	-217	0	-181	-428	-140	-387	-167
Russian Federation	125	68	39	-1	7	0	0	3	0	19	1
						Imports					
All Partners	39,142	-22,961	-4,687	-324	-579	0	103	-841	-4,088	-8,147	-4,398
United States	146	-4,717	-616	-36	-168	0	-28	-263	-286	-2,967	-353
European Union	15,882	-5,461	-1,081	-179	-47	0	-5	-628	-56	-2,046	-1,419
Japan	1,174	-2,702	-4	-3	31	0	0	-23	-169	-2,463	-70
OPEC	7,840	1,447	-216	27	7	0	-114	82	137	1,612	-87
Russian Federation	1,052	241	-150	0	-18	0	-12	8	241	177	-4

Sources: Authors' calculations based on the gravity model dataset, and the difference in trade of each partner with Iran versus with eleven Arab Middle East countries on average (relative to GDP).

Table 7. World Petroleum and Natural Gas Reserves, Production, and Exports, 2005

	Petroleum						Natural Gas		
	Crude Oil				Refined Products				
		Production							
	Proven Reserves	Total	US & EU Firms	Exports	Refinery Capacity	Exports	Proven Reserves	Prod-uction	Exports
	(Mn bbl)	(Th bbl/d)	(% share)	(Th bbl/d)	(Th bbl/d)	(Th bbl/d)	(Bn c m)	(Mn c m)	(Mn c m)
OPEC	913,290	31,791	11.3	23,310	9,088	4,430	89,419	506,435	157,300
Algeria	12,270	1,352	5.7	970	462	452	4,504	89,235	64,266
Angola	9,035	1,238	35.4	947	39	14	270	910	…
Indonesia	4,301	1,059	21.0	374	1,057	142	2,769	73,800	36,300
Iran	136,270	4,092	0.0	2,395	1,474	402	27,580	100,900	4,735
Iraq	115,000	1,853	0.0	1,472	603	14	3,170	2,650	…
Kuwait	101,500	2,573	0.0	1,651	936	614	1,572	12,300	…
Libya	41,464	1,693	28.3	1,306	380	163	1,491	11,300	5,400
Nigeria	36,220	2,366	98.8	2,326	445	49	5,152	22,400	12,000
Qatar	15,207	766	0.0	677	80	77	25,636	45,800	27,100
Saudi Arabia	264,211	9,353	0.0	7,209	2,091	1,385	6,900	71,240	…
UAE	97,800	2,378	2.0	2,195	466	509	6,060	47,000	7,499
Venezuela	80,012	3,067	0.0	1,788	1,054	609	4,315	28,900	…
Major OECD Countries	36,800	9,430	…	803	36,888	2,582	8,280	711,600	103,390
EU	6,900	2,535	…	765	15,024	1,384	2,490	199,800	81,270
Japan	…	…	…	…	4,529	107	…	…	…
US	29,900	6,895	…	38	17,335	1,091	5,790	511,800	22,120
Other Ctrys: Russian Fec	79,100	9,552	…	5,374	5,491	1,702	47,660	598,000	151,280
World	1,189,139	71,612	…	42,812	85,334	20,346	181,065	2,858,795	720,740
North America	26,571	6,538	…	1,378	19,143	2,145	7,420	697,700	124,800
Latin America	118,141	10,117	…	4,751	8,147	2,136	7,312	175,700	30,950
Eastern Europe	128,597	11,083	…	7,727	9,822	1,992	58,878	833,230	163,900
Western Europe	16,716	4,904	…	3,649	15,416	5,966	5,561	293,740	160,560
Middle East	742,688	22,735	…	16,899	6,708	3,373	72,834	318,680	49,934
Africa	117,458	8,798	…	6,474	3,279	1,040	14,132	172,645	89,896
Asia and Pacific	38,969	7,437	…	1,933	22,819	3,693	14,928	367,100	100,700

Sources: BP (2006, 2007) and OPEC (2007).

Table 8. Iran and World Oil Sector Production and Exports under Normalization
(2005 levels of production and trade)

	Actual 2005			With Normalization					
				Production			Exports		
	Proven Reserves	Prod-uction	Exports	Total	Increase		Total	Increase	
Iran									
	Mn bbl	Th bbl/d	Th bbl/d	Th bbl/d	Th bbl/d	Percent	Th bbl/d	Th bbl/d	Percent
Crude Oil	136,270	4,092	2,395	6,182	2,091	51.1%	3,618	1,224	51.1%
Refined Products	…	1,474	402	1,843	369	25.0%	503	101	25.0%
	Bn c m	Mn c m	Mn c m	Mn c m	Mn c m	Percent	Mn c m	Mn c m	Percent
Natural Gas	27,580	100,900	4,735	126,125	25,225	25.0%	5,919	1,184	25.0%
World									
	Mn bbl	Th bbl/d	Th bbl/d	Th bbl/d	Th bbl/d	Percent	Th bbl/d	Th bbl/d	Percent
Crude Oil	1,189,139	71,612	42,812	73,703	2,091	2.9%	44,035	1,224	2.9%
Refined Products	…	85,334	20,346	85,702	369	0.4%	20,446	101	0.5%
	Bn c m	Mn c m	Mn c m	Mn c m	Mn c m	Percent	Mn c m	Mn c m	Percent
Natural Gas	181,065	2,858,795	720,740	2,884,020	25,225	0.9%	721,924	1,184	0.2%

Sources: Table 7 and authors' calculations.

Table 9. Average Annual Growth of Crude Oil Production in the OPEC Countries and the World, 1981-2007

	Average Annual Growth Rate (Percent)						
	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006-2007	1981-2007
Algeria	9.1	15.4	5.1	3.9	11.0	16.8	15.3
Angola	23.3	4.2	-9.5	0.1	-4.0	-0.1	3.3
Indonesia	8.7	6.9	2.7	-0.6	1.2	-2.2	5.3
Iran	8.4	7.4	2.8	0.4	2.2	-0.7	6.1
Iraq	-11.9	8.5	-19.0	30.7	-8.0	8.6	-1.1
Kuwait	-10.9	-1.7	18.5	-0.1	5.2	0.0	2.6
Libya	-6.1	2.9	1.3	2.2	2.9	-6.7	0.0
Nigeria	3.1	-4.2	-2.1	-2.3	-1.8	14.1	-0.6
Qatar	-9.3	7.0	-0.8	10.7	3.4	5.1	3.5
Saudi Arabia	-20.3	15.1	4.6	0.2	2.9	-2.9	-0.7
UAE	-9.9	11.8	4.0	0.2	1.8	3.1	2.4
Venezuela	-6.3	6.4	2.2	4.0	1.2	-1.9	1.8
World	-10.5	8.1	2.4	2.4	2.3	-0.4	1.1
OPEC	-8.2	5.5	1.9	0.7	0.6	-0.2	0.0

Source: *OPEC Annual Statistical Bulletin Online,* Table 39 (accessed September 23, 2008), and authors' calculations.

Table 10. US and EU Exports of Services to OPEC and the World, 2005
(Millions of US Dollars)

	United States	European Union
OPEC	17,842	27,246
Transportation	1,889	n.a.
Travel	2,168	n.a.
Royalties, licensing fees	504	n.a.
Other private services	5,922	n.a.
Government services	7,323	n.a.
Algeria	n.a.	3,432
Angola	n.a.	1,566
Indonesia	1,526	1,075
Iran	n.a.	1,186
Iraq	n.a.	551
Kuwait	n.a.	3,902
Libya	n.a.	1,193
Nigeria	n.a.	3,638
Qatar	n.a.	1,256
Saudi Arabia	1,879	3,324
United Arab Emirates	n.a.	4,841
Venezuela	4,134	1,284
World	377,300	1,173,874
Transportation	63,260	258,500
Travel	102,200	289,700
Communications	5,040	29,340
Construction services	4,145	25,540
Insurance	6,840	24,060
Financial services	29,320	94,800
Computer, info services	6,047	59,500
Royalties, licensing fees	57,490	47,430
Other business services	73,130	302,000
Government services	22,800	20,800

Sources: UN Services Trade Database (UNSO 2008), and US Department of Commerce (2008).
Notes: US service exports to the OPEC countries combined are estimates by the US Bureau of Economic Analysis. EU service exports include intra-EU trade.

Table 11. Normalization of Relations: Summary of Economic Benefits to Iran and the United States, 2005
(Billions of US Dollars, at 2005 Prices)

		Trade		
	Production	Exports	Imports	Total
Iran				
Non-Oil Trade 1/	…	11.9	23.0	34.9
(Based on US & EU trade only)		(4.1)	(10.2)	(14.3)
Oil Sector	52.6	24.7	…	24.7
Crude Oil	38.1	22.3	…	22.3
Refined Products	7.5	2.1	…	2.1
Natural Gas	7.0	0.3	…	0.3
Service Sector	…	…	1.2	1.2
All Sectors	52.6	36.6	24.2	60.8
Relative to GDP	28%	19%	13%	32%
(Based on US & EU trade only)	(28%)	(15%)	(6%)	(21%)
United States				
Non-Oil Trade 1/	…	4.7	2.6	7.3
Oil Sector 2/	…	…	…	38.0
Crude Oil	…	…	…	38.0
(at $100/bbl)	…	…	…	(76.0)
Service Sector	…	1.0	…	1.0
All Sectors	…	5.7	2.6	46.3
Relative to GDP	…	0.0%	0.0%	0.4%
(at $100/bbl)	…	…	…	(0.7%)

Source: Authors' calculations based on Tables 6, 8, and 10, and 2005 average world prices for crude oil ($50.64/bbl), refined products ($56.84/bbl), and natural gas ($7.58/btu), compiled from OPEC (2006) and BP (2006).
1/ Based on the alternative trade analysis results in Table 6.
2/ The figure for the US oil sector is the saving in the total US bill for consumption of crude oil in 2005, assuming US consumption at 20.8 million bbl/day and a 10 percent decline in the world price of oil resulting from the normalization of Iran's economic relations.

Appendix Table 12. Losses in Iranian Exports by 1-Digit SITC Owing to US Economic Sanctions, 2005
(Thousands of US Dollars)

	Trade Losses (Actual Trade minus Predicted Trade)									
Partner	All Goods (SITC 0-8)	Foods, Live Animals (SITC 0)	Beverages, Tobacco (SITC 1)	Crude Materials (SITC 2)	Mineral Fuels (SITC 3)	Fats and Oils (SITC 4)	Chemicals (SITC 5)	Material Manufs. (SITC 6)	Machinery, Trans. Eq. (SITC 7)	Misc. Manufs. (SITC 8)
All Partners	-15,577,512	-3,854,696	-188,936	-1,261,902	0	-103,368	-1,108,174	-6,601,908	-2,081,936	-376,591
United States	-1,256,504	-73,460	0	-1,154	0	0	-22,799	-1,158,425	-666	0
European Union	-2,770,602	-833,559	-7,846	-215,194	0	-3	-110,633	-1,159,195	-386,249	-57,922
Japan	-101,506	-28,056	-40	-6,280	0	-1	-17,689	-47,606	-1,370	-465
OPEC	-5,512,353	-1,530,761	-157,579	-81,133	0	-25,379	-316,951	-2,554,236	-615,237	-231,076
Russian Federation	-314,638	-142,332	-8,403	-11,607	0	-90	-5,489	-17,255	-125,368	-4,095
Top 50 Partners										
Iraq	-1,882,995	-540,380	-156,875	-17,448	0	-24,664	-55,459	-669,907	-322,933	-95,331
United Arab Emirates	-1,783,505	-674,574	-206	-47,137	0	-520	-109,275	-702,499	-124,183	-125,113
United States	-1,256,504	-73,460	0	-1,154	0	0	-22,799	-1,158,425	-666	0
India	-1,050,418	-178,728	0	-148,168	0	-22	-157,410	-557,205	-8,095	-791
China	-873,501	-34,813	0	-485,183	0	0	-166,376	-182,254	-4,784	-91
Kuwait	-806,621	-238,149	-179	-8,963	0	-95	-2,169	-521,848	-31,212	-4,005
Germany	-804,351	-313,276	-3,373	-91,939	0	-3	-7,618	-302,544	-72,729	-12,869
Saudi Arabia	-785,684	-54,610	-122	-1,681	0	-60	-118,165	-538,783	-67,054	-5,209
Italy	-517,094	-82,532	-2,564	-88,550	0	0	-19,430	-288,651	-29,987	-5,380
Syria	-493,019	-36,577	0	-519	0	0	-8,177	-21,740	-425,160	-845
Hong Kong	-406,831	-375,639	0	-4,743	0	-35	-5,900	-14,278	-6,209	-27
Pakistan	-375,076	-62,152	-39	-100,109	0	-174	-43,953	-110,332	-56,300	-2,019
Spain	-323,120	-147,577	-16	-6,073	0	0	-37,449	-124,917	-3,667	-3,422
Russian Federation	-314,638	-142,332	-8,403	-11,607	0	-90	-5,489	-17,255	-125,368	-4,095
France	-255,754	-62,308	-489	-7,550	0	0	-5,036	-93,947	-84,166	-2,260
Taiwan	-226,587	-23,844	0	-9,973	0	0	-47,329	-144,283	-1,111	-47
Turkmenistan	-220,692	-52,046	-302	-8,728	0	-9,659	-20,948	-73,383	-36,514	-19,111
Belgium	-218,034	-18,621	-3	-5,407	0	0	-14,530	-174,969	-3,365	-1,139

Appendix Table 12. Losses in Iranian Exports by 1-Digit SITC Owing to US Economic Sanctions, 2005
(Thousands of US Dollars)

	Trade Losses (Actual Trade minus Predicted Trade)									
Partner	All Goods (SITC 0-8)	Foods, Live Animals (SITC 0)	Beverages, Tobacco (SITC 1)	Crude Materials (SITC 2)	Mineral Fuels (SITC 3)	Fats and Oils (SITC 4)	Chemicals (SITC 5)	Material Manufs. (SITC 6)	Machinery, Trans. Eq. (SITC 7)	Misc. Manufs. (SITC 8)
Turkey	-207,180	-13,411	-4	-53,768	0	0	-35,997	-73,519	-28,274	-2,208
Tajikistan	-178,797	-69,493	-321	-5,363	0	-15,478	-15,794	-37,750	-20,713	-13,884
Netherlands	-165,142	-10,938	-122	-3,435	0	0	-19,525	-44,476	-69,375	-17,271
Korea	-152,531	-39,629	-756	-10,933	0	-54	-48,922	-41,018	-9,950	-1,270
Azerbaijan	-140,955	-19,594	-306	-8,756	0	-1,784	-4,278	-40,986	-60,739	-4,510
Armenia	-128,760	-21,305	-100	-1,326	0	-26,564	-10,999	-38,515	-26,690	-3,261
Uzbekistan	-114,943	-18,919	-75	-6,428	0	-8,921	-7,831	-49,396	-10,434	-12,938
United Kingdom	-113,823	-35,195	-231	-6,102	0	0	-2,995	-48,304	-12,659	-8,337
Japan	-101,506	-28,056	-40	-6,280	0	-1	-17,689	-47,606	-1,370	-465
Qatar	-98,387	-15,734	-198	-4,026	0	-40	-1,892	-70,616	-5,382	-500
Oman	-86,411	-25,054	-4,544	-43,990	0	-61	-472	-6,531	-5,588	-171
Sudan	-79,403	-6,467	0	-7,023	0	0	-2,557	-8,019	-52,718	-2,618
Canada	-76,856	-47,378	-269	-734	0	-1	-837	-22,220	-4,033	-1,384
Lebanon	-74,271	-36,804	-3,429	-114	0	0	-332	-27,180	-5,499	-913
Switzerland	-73,585	-5,135	-303	-3,351	0	0	-549	-41,317	-22,063	-866
Indonesia	-65,080	-2,731	0	-1,719	0	0	-28,890	-31,342	-297	-101
Thailand	-61,579	-10,995	0	-16,317	0	0	-7,218	-18,073	-7,941	-1,035
South Africa	-60,336	-1,396	-85	-183	0	-440	-888	-11,509	-44,932	-903
Venezuela	-58,398	-493	0	-74	0	0	-224	-115	-57,278	-214
Austria	-55,402	-10,489	-117	-1,064	0	0	-2,616	-13,457	-25,333	-2,326
Ireland	-51,773	-416	-7	-50	0	0	-110	-964	-49,587	-639
Singapore	-46,461	-9,472	-1	-475	0	0	-1,730	-12,358	-22,113	-314
Ukraine	-40,134	-20,744	-245	-747	0	0	-1,797	-5,616	-10,633	-351
Malaysia	-39,563	-11,238	-17	-903	0	0	-13,419	-6,617	-7,047	-322
Poland	-39,266	-35,178	-3	-345	0	0	-146	-1,324	-1,983	-288
Czech Republic	-38,544	-17,043	-267	-651	0	0	-398	-2,002	-17,210	-973
Georgia	-37,259	-2,728	0	-30	0	-9,468	-2,171	-14,852	-3,055	-4,957

Appendix Table 12. Losses in Iranian Exports by 1-Digit SITC Owing to US Economic Sanctions, 2005
(Thousands of US Dollars)

	Trade Losses (Actual Trade minus Predicted Trade)									
Partner	All Goods (SITC 0-8)	Foods, Live Animals (SITC 0)	Beverages, Tobacco (SITC 1)	Crude Materials (SITC 2)	Mineral Fuels (SITC 3)	Fats and Oils (SITC 4)	Chemicals (SITC 5)	Material Manufs. (SITC 6)	Machinery, Trans. Eq. (SITC 7)	Misc. Manufs. (SITC 8)
Kazakhstan	-35,087	-3,421	-9	-140	0	-3,224	-2,484	-6,757	-18,003	-1,049
Slovak Republic	-34,256	-32,069	0	-108	0	0	-23	-256	-1,797	-4
Greece	-33,115	-3,950	0	-1,085	0	0	-387	-27,151	-508	-32
Australia	-32,797	-13,137	-13	-123	0	0	-5,098	-10,836	-3,061	-530
Bahrain	-30,788	-6,372	-59	-18,408	0	-128	-242	-4,086	-1,330	-164

Sources: Authors' calculations based on the gravity model dataset and the actual-to-potential trade ratios in Table 4.

Appendix Table 13. Losses in Iranian Imports by 1-Digit SITC Owing to US Economic Sanctions, 2005
(Thousands of US Dollars)

	Trade Losses (Actual Trade minus Predicted Trade)									
Partner	All Goods (SITC 0-8)	Foods, Live Animals (SITC 0)	Beverages, Tobacco (SITC 1)	Crude Materials (SITC 2)	Mineral Fuels (SITC 3)	Fats and Oils (SITC 4)	Chemicals (SITC 5)	Material Manufs. (SITC 6)	Machinery, Trans. Eq. (SITC 7)	Misc. Manufs. (SITC 8)
All Partners	-1,180,323	-306,642	-263,035	0	0	0	0	-8,958	0	-601,687
United States	-8,958	0	0	0	0	0	0	-8,958	0	0
European Union	-382,158	-60,491	-78,662	0	0	0	0	0	0	-243,005
Japan	-21,272	-7	0	0	0	0	0	0	0	-21,265
OPEC	-278,436	-58,712	-78,780	0	0	0	0	0	0	-140,945
Russian Federation	-6,019	-4,465	-85	0	0	0	0	0	0	-1,469
Top 50 Partners										
United Arab Emirates	-275,055	-58,139	-77,826	0	0	0	0	0	0	-139,090
Germany	-178,570	-16,685	-71,323	0	0	0	0	0	0	-90,561
Switzerland	-102,235	-29,345	-11,211	0	0	0	0	0	0	-61,678
China	-73,771	-14,305	-1,436	0	0	0	0	0	0	-58,030
Turkey	-62,052	-2,336	-45,076	0	0	0	0	0	0	-14,640
United Kingdom	-48,152	-4,402	-4,131	0	0	0	0	0	0	-39,619
Brazil	-45,079	-40,973	-2,594	0	0	0	0	0	0	-1,512
Italy	-33,674	-300	-470	0	0	0	0	0	0	-32,903
France	-31,802	-1,645	-299	0	0	0	0	0	0	-29,858
Korea	-28,734	-767	-11,437	0	0	0	0	0	0	-16,529
Netherlands	-26,892	-15,421	-1,327	0	0	0	0	0	0	-10,144
Oman	-21,535	-38	-21,233	0	0	0	0	0	0	-264
Japan	-21,272	-7	0	0	0	0	0	0	0	-21,265
Ukraine	-19,019	-14,363	-3,589	0	0	0	0	0	0	-1,067
Austria	-17,952	-12,758	-456	0	0	0	0	0	0	-4,737
Belgium	-16,855	-2,836	-77	0	0	0	0	0	0	-13,942
Pakistan	-16,534	-16,201	-112	0	0	0	0	0	0	-221
Taiwan	-12,045	-137	0	0	0	0	0	0	0	-11,908

Appendix Table 13. Losses in Iranian Imports by 1-Digit SITC Owing to US Economic Sanctions, 2005
(Thousands of US Dollars)

	Trade Losses (Actual Trade minus Predicted Trade)									
Partner	All Goods (SITC 0-8)	Foods, Live Animals (SITC 0)	Beverages, Tobacco (SITC 1)	Crude Materials (SITC 2)	Mineral Fuels (SITC 3)	Fats and Oils (SITC 4)	Chemicals (SITC 5)	Material Manufs. (SITC 6)	Machinery, Trans. Eq. (SITC 7)	Misc. Manufs. (SITC 8)
Thailand	-11,602	-9,621	-519	0	0	0	0	0	0	-1,462
United States	-8,958	0	0	0	0	0	0	-8,958	0	0
Uruguay	-8,672	-8,553	-42	0	0	0	0	0	0	-77
India	-8,665	-3,649	-41	0	0	0	0	0	0	-4,975
Canada	-8,596	-369	0	0	0	0	0	0	0	-8,227
Vietnam	-7,475	-7,470	0	0	0	0	0	0	0	-6
Australia	-6,477	-4,875	-104	0	0	0	0	0	0	-1,499
Spain	-6,448	-379	-483	0	0	0	0	0	0	-5,586
Russian Federation	-6,019	-4,465	-85	0	0	0	0	0	0	-1,469
Sri Lanka	-5,869	-5,861	0	0	0	0	0	0	0	-8
Malaysia	-5,509	-765	-1,317	0	0	0	0	0	0	-3,427
Denmark	-5,268	-1,845	-18	0	0	0	0	0	0	-3,406
South Africa	-5,096	-4,243	-817	0	0	0	0	0	0	-36
Ireland	-4,840	-3,971	0	0	0	0	0	0	0	-869
New Zealand	-4,683	-4,615	0	0	0	0	0	0	0	-68
Hong Kong	-4,009	-7	-302	0	0	0	0	0	0	-3,700
Sweden	-3,758	-31	-1	0	0	0	0	0	0	-3,726
Kazakhstan	-3,680	-3,679	0	0	0	0	0	0	0	-2
Finland	-3,652	-1	0	0	0	0	0	0	0	-3,651
Lebanon	-3,416	-2,998	0	0	0	0	0	0	0	-418
Singapore	-2,616	-420	-9	0	0	0	0	0	0	-2,187
Jordan	-2,428	-2	-2,256	0	0	0	0	0	0	-170
Egypt	-2,328	-3	-1,866	0	0	0	0	0	0	-459
Saudi Arabia	-2,221	-504	-799	0	0	0	0	0	0	-917
Philippines	-1,839	-1,806	0	0	0	0	0	0	0	-33
Uzbekistan	-1,590	-1,589	0	0	0	0	0	0	0	0
Poland	-1,076	-4	-77	0	0	0	0	0	0	-995

Appendix Table 13. Losses in Iranian Imports by 1-Digit SITC Owing to US Economic Sanctions, 2005
(Thousands of US Dollars)

	Trade Losses (Actual Trade minus Predicted Trade)									
Partner	All Goods (SITC 0-8)	Foods, Live Animals (SITC 0)	Beverages, Tobacco (SITC 1)	Crude Materials (SITC 2)	Mineral Fuels (SITC 3)	Fats and Oils (SITC 4)	Chemicals (SITC 5)	Material Manufs. (SITC 6)	Machinery, Trans. Eq. (SITC 7)	Misc. Manufs. (SITC 8)
Ecuador	-885	-875	0	0	0	0	0	0	0	-10
Ivory Coast	-809	-809	0	0	0	0	0	0	0	0
Indonesia	-808	-68	0	0	0	0	0	0	0	-740
Bahrain	-742	-268	-7	0	0	0	0	0	0	-467
Kenya	-658	-643	0	0	0	0	0	0	0	-16

Sources: Authors' calculations based on the gravity model dataset and the actual-to-potential trade ratios in Table 4.

Appendix Table 14. Oil Price Impacts of A One Percent Increase in the World Supply of Crude Oil for Different Values of Market Price Elasticities of Demand and Supply

Market Demand	Price Elasticity: Demand	Price Elasticity: Supply	Oil Price Impact
Weakly inelastic	-0.50	0.25	-1.3%
	-0.50	0.10	-1.7%
	-0.50	0.00	-2.0%
More inelastic	-0.25	0.25	-2.0%
	-0.25	0.10	-2.9%
	-0.25	0.00	-4.0%
Strongly inelastic	-0.10	0.25	-2.9%
	-0.10	0.10	-5.0%
	-0.10	0.00	-10.0%
Average Impact by Time Horizon			
Long-term	All	0.25	-2.1%
Medium-term	All	0.10	-3.2%
Short-term	All	0.00	-5.3%

Source: Authors' calculations based on a simple demand-supply balance model of the world oil market.

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