Losing Billions

The Cost of Iran Sanctions to the U.S. Economy

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Executive Summary

- There are very few studies measuring the cost of sanctions to the *sanctioning* countries. In the case of Iran, where unprecedented U.S. and international sanctions may soon be lifted as part of a deal over Iran's disputed nuclear program, understanding the cost of the policy is particularly important since any debate over whether to exchange sanctions relief for limitations to Iran's nuclear program would be incomplete at best and misleading at worst if it did not address the cost of sanctions. This report aims to provide just that.

- The United States is by far the biggest loser of all sanctions enforcing nations. ***From 1995 to 2012, the U.S. sacrificed between $134.7 and $175.3 billion in potential export revenue to Iran.***

- These estimates reflect the loss solely from export industries, and do not include the detrimental economic effects of other externalities of Iran-targeted sanctions, such as higher global oil prices. Moreover, since sanctions have depressed the Iranian GDP, Iran's imports would have been even higher in the absence of sanctions, which further would increase the economic costs to sanctions enforcing nations due to lost exports. ***Consequently, the full cost to the U.S. economy is likely even higher.***

- There is also a human element, measured in terms of jobs needed to support higher export levels. ***On average, the lost export revenues translate into between 51,043 and 66,436 lost job opportunities each year. In 2008, the number reaches as high as 214,657-279,389 lost job opportunities.***

- Texas and California are likely the biggest losers in terms of lost employment, due to their size as well as the attractiveness of their industries to Iran's economy.

- In Europe, Germany was hit the hardest, losing between $23.1 and $73.0 billion between 2010 and 2012, with Italy and France following at $13.6-$42.8 billion and $10.9-$34.2 billion respectively.

- Between 2010 and 2012, sanctions cost the EU states more than twice as much as the United States in terms of lost trade revenue.

1. Introduction

As employment of military force has become increasingly costly, the popularity of economic sanctions as an alternative coercive foreign policy tool has increased greatly. Despite strong empirical evidence on the impotence of sanctions, the United States currently imposes sanctions on dozens of countries.[1] Even states and municipalities have begun imposing sanctions through divestment campaigns.[2] While numerous studies have been conducted to assess the cost of sanctions to the targeted country, surprisingly little attention has been given to the cost of sanctions to the *sanctioning* country. Indeed, the proliferation of sanctions may partly be tied to the almost total lack of awareness of the cost this policy tool imposes on the sanctioning entity.

A better understanding of the cost of sanctions is particularly relevant in the case of Iran – mindful of the unprecedented sanctions imposed on that country combined with the option to lift sanctions as part of a broader deal over Iran's disputed nuclear program.

Opponents of a nuclear deal with Iran argue that intensified sanctions provide a more effective route to halt Tehran's nuclear activities. They also fear that sanctions relief will give Iran a get-out-of-jail-free card and enable it to restart its nuclear program at a later stage. Proponents of sanctions argue that sanctions are far less costly than military action and maintain that sanctions influenced Iranians to elect Hassan Rouhani as president, which in turn created the current window for diplomacy.[3]

The arguments in favor of sanctions, or against a deal that entails sanctions relief, are debatable. But any debate over whether to exchange sanctions relief for limitations to Iran's nuclear program would be incomplete at best and misleading at worst if it does not address the cost of this policy. This report aims to provide just that.

Using an econometric "gravity model," we assess the trade that America as well as key EU states have lost as a result of sanctions on Iran since 1995. Based on the U.S. government's statistics on the number of job opportunities that $1 billion of trade produces, the report also assesses the number of job opportunities lost in the U.S. and EU due to the Iran sanctions. Finally, the report estimates the states in the U.S. where these job opportunities likely were lost.

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1 Robert Pape, Why Sanctions Do Not Work, *International Security*, Volume 22, Issue 2, Autumn 1997.

2 Richard N. Haass, Economic Sanctions: Too Much of a Bad Thing, Brookings Policy Brief Series, June 1998. http://www.brookings.edu/research/papers/1998/06/sanctions-haass

3 Some of these assertions are contested, see for instance *Trita Parsi, No, Sanctions Did Not Force Iran to Make a Deal, ForeignPolicy.com, May 14, 2014, http://www.foreignpolicy.com/articles/2014/05/14/sanctions_did_not_force_iran_to_make_a_deal_nuclear_enrichment,* and *National Iranian American Council, Extending Hands and Unclenching Fists, December 2013*. http://www.niacouncil.org/site/DocServer/Extending_Hands_Unclenching_Fists.pdf

2. Background on Sanctions on Iran

Sanctions targeting Iran have evolved over time – both engaging a wider range of countries and directed at a broader range of sectors. First imposed on a unilateral basis by the United States, the introduction of Iran's nuclear file to the United Nations Security Council (and the passage of a series of Security Council resolutions) paved the way for international and multilateral sanctions targeting Iran and legitimated a new wave of national sanctions in the U.S., Europe, and East Asia. These sanctions aimed at reducing Iran's major source of export revenue – its crude oil exports – and severing Iran's ties to the international financial system. Since 2010, multilateral and national sanctions have progressed with significant force, cutting into traditional trade patterns and commercial relationships and erecting a virtual stranglehold on Iran's economic lifeline.

Starting in 1995, there was a tonal change in U.S. policies towards the Islamic Republic of Iran. Long antagonists in the region's myriad conflicts, the Clinton White House – under intense pressure from Congress – exacted a comprehensive trade ban with Iran that curtailed U.S. exports to near-zero levels. This was intended in part to signal to America's European and East Asian allies that Washington was serious about the Iranian threat and expected reciprocal national sanctions from its counterparts. However, none were forthcoming, and as a result, Congress enacted the Iran Sanctions Act soon thereafter. This legislation imposed extraterritorial sanctions on foreign companies undertaking investments in Iran's energy sector. While it took more than a decade before the first sanctions were meted out to foreign companies that ignored this U.S. dictate, the Iran Sanctions Act did have an effect in limiting the extent of foreign penetration into the Iranian market and drawing down investments already made there.

Over the course of the next decade, however, the mood for a new round of sanctions was resigned. It was not until the Iranian nuclear dispute broke out into the open in 2002-2003 that the trend towards harsher and more punishing sanctions accelerated – and Iran became the trial run in which to test the influence of the U.S. market over foreign companies' investment decisions and trade relations.

This trend reached its apex in 2010 when the Security Council passed UNSC Resolution 1929, which provided a virtual safe harbor for U.S., European, and East Asian sanctions that broadly targeted Iran's energy and financial sectors. Indeed, timed in precise step with the Council's resolution, Congress enacted the Comprehensive Iran Sanctions, Accountability, and Divestment Act (CISADA), the first in a series of legislation that threatened to limit foreign banks' access to the U.S. financial system if caught facilitating certain classes of transactions with Iran and Iranian banks. The European Union, Canada, Japan, South Korea, and Australia each responded with similar national measures – all aimed at limiting Iran's access to international financial markets. By limiting Iran's ability to finance international trade, the United States and its partners impeded the continuation of pre-existing commercial relations with Iran.

Parallel to this effort at eliminating Iran's access to global financial markets, the U.S. and Europe also targeted Iran's oil revenues and, more broadly, its entire energy sector. This included a de facto ban on the purchase of Iranian crude oil overseas, as the U.S. threatened foreign banks with limited access to U.S. financial markets should there be facilitation of such purchases. Exemptions were granted to a host of countries in Asia, though the U.S. demanded significant reductions in the volume

of crude oil purchased. Revenue from these limited sales was then tied up in foreign banks, Iran unable to repatriate the funds back home. This had a significant impact on Iran's export revenue and its foreign-exchange holdings, likewise hampering its ability to purchase goods on international markets.

The European Union soon exacted its own oil embargo on Iran, thereby giving credence to U.S. efforts to cut Iran's oil revenue. Both the U.S. and EU also barred the provision of insurance services for the transport of Iranian crude oil and other products, cutting off the London insurance market from Tehran. These and other measures signaled the multiple levels at which sanctions were imposed to bleed Iran of its most important source of revenue and make a sizeable dent in government revenue. In sum, the U.S., Europeans, and East Asians pushed forth a virtual bar to all energy trade with Iran – an objective that has been accomplished with considerable success.

The cost to the Iranian economy has according to Iran's own Foreign Minister, Javad Zarif, been "crippling."[4] The cost to the sanctioning countries, however, has up until now remained unknown.

4 See for instance his video message on July 2, 2014. https://www.youtube.com/watch?v=16VIQ6LJCt8

3. Measuring the Cost of Sanctions

The Gravity Model

The gravity model of trade, as the name implies, is a social science application of Isaac Newton's law of gravitation, which states that the force of gravitational attraction between two bodies is a function of each body's mass and the distance separating them.[5] More specifically, Newton's theory states that gravitational attraction is directly correlated with mass and indirectly with distance. The gravity trade model used in this study maintains this same distance relationship, but replaces physical mass with size of economy and gravitational attraction with quantity of trade. In this version, an increase in size of economy or the distance between two trade partners corresponds to an increase or decrease in bilateral trade, respectively. In addition to size and distance, the gravity trade model incorporates a number of sociocultural variables that can affect bilateral trade, including contiguity of borders, common language, or prior colonial relationships.

Economists have used gravity trade models to examine bilateral trade relationships in studies dating back to the 1960s. It has also been used to assess the cost of sanctions – for instance, see the paper by Hufbauer, Elliott, Cyrus, and Winston for the Institute for International Economics from 1997.[6] Our report utilizes this scientific method to assess the economic cost of sanctions on Iran to the *sanctioning* countries, primarily the U.S. and key EU states. The study determines both the dollar value of trade loss and, when possible, the human cost of foregone export sector jobs. The following sections will explain the data, structure, and results of this effort.

Sources

The gravity model relies on three key pieces of data: size of economy, geographical distance, and trade. Our first step was to define what each of these meant in the context of our project. While there are several metrics that can potentially represent the size of an economy, we settled on national annual gross domestic product obtained via the World Bank's historical database as the simplest and most effective measure.[7] Second, we used a direct point-to-point kilometric measurement of the distance between capital cities to represent the geographic distance for each country pair.[8] Lastly, as we were primarily interested in the effects of sanctions on the export industry, we defined trade as the level of exports from one country to another. These we obtained from the International Monetary Fund's Direction of Trade Statistics Database.[9]

5 See "Newton's Law of Gravitation," *The American Heritage Science Dictionary* (Houghton Mifflin, 2002).

6 Gary Clyde Hufbauer et al., "U.S. Economic Sanctions: Their Impact on Trade, Jobs, and Wages" (Institute for International Economics, 1997) We considered seeking a historical pre-sanctions parallel with which to compare our model results, but part of the difficulty with estimating potential trade with Iran is the historical inconsistency of the U.S.-Iran trade relationship. In the years leading up to the 1979 Revolution, for example, Shah Mohammad Reza Pahlavi used Iran's robust oil revenues to purchase vast quantities of military equipment from the United States. U.S. exports to Iran more than doubled between 1973 and 1974, going from $772 million to $1.73 billion, eventually reaching a peak of $3.7 billion in 1978, the year before the Shah's ouster. Given the Shah's profligacy in military spending, extrapolating potential U.S. Iran trade based on these figures would be overly optimistic. Likewise, retreating further back into history, to the years before the oil boom of the 1970s, would underestimate the potential for bilateral trade by undervaluing the purchasing power of the Iranian economy.

7 World Bank, "World Bank Database," http://data.worldbank.org/indicator/NY.GDP.MKTP.CD.

8 Obtained via the CEPII website and based on a study conducted by Keith Head, Thierry Mayer, and John Ries, "The Erosion of Colonial Trade Linkages after Independence," *Journal of International Economics* 8, no. 1 (January 8, 2010): 1–14.

9 IMF Direction of Trade Statistics via "IHS Economics & Country Risk," http://www.ihs.com/products/global-insight/index.aspx?pu=1&rd=globalinsight_com.

Dataset

The study examined the export levels of 26 nations – 25 of Iran's largest trading partners over the past two decades plus Mexico, the latter due to its prominence as a United States trading partner, on an annual basis from 1995 through 2012. Conveniently, many of Iran's largest trading partners corresponded with those of the United States, which reduced the urge to expand the dataset to more countries.

The study focuses exclusively on the bilateral trade patterns between countries in the dataset. This means that for each year of the study, there are two distinct observation points for each country pair. So for the United States in 1995, there are 25 observation points, each representing U.S. export levels to other countries in the dataset for that year. There are also 25 observation points representing exports from each country to the United States for that same period. The result is a web of bilateral trade relationships that forms the basis on which we can estimate the effects of different variables on overall trade levels.

The total number of observations is represented by the equation $x=tn(n-1)$, where "n" represents the number of countries and "t" the number of time periods. With n=26 and t=18, the total number of observations for this study was 11,700.

Variables

There were three classifications of variables in this study: standard gravity model variables, sanctions-specific variables, and time series variables. The first group refers to those variables found in basic gravity trade models. In addition to the three mentioned in the section above – exports, GDP, and distance – we included variables designed to measure specific commonalities between trade partner nations such as border contiguity, shared language, colonial relationships (both for colonizer-colonized and common colonizer), and trading blocs (EU, NAFTA, MERCOSUR). We also added a variable for first purchase price of crude oil as a rough proxy to account for changes in transit costs of goods across the globe.

For sanctions-specific variables, we were able to exercise a bit more discretion, as there is no standardized method for classifying sanctions regimes. Sanctions legislation is most commonly domestically designed and implemented with loose international coordination depending on the circumstances, or, at their broadest, applied across a bloc of countries such as the European Union. Thus, they range in scope and intensity depending on the foreign policy of the enforcing nation at the time of implementation. Furthermore, they are constantly evolving, and the addition or removal of measures may fundamentally alter the efficacy of the overall sanctions program.

Our approach ordered sanctions regimes by their relative intensity by placing them into tranches of low, medium, or high classification. The low intensity group was for countries with only modest sanction measures. This variety typically targeted assets of specific individuals or companies, and were devoid of more robust methods designed to reduce or eliminate national trade levels. The medium category denotes countries with more substantial enforcement techniques aimed at reducing or eliminating large portions of bilateral trade. These include measures such as oil import bans, cancellation of insurance on shipping, or the refusal of access to regional or international financial systems.

Lastly, the high intensity sanctions category, in addition to all of the low and medium intensity measures, includes actions designed to intentionally cripple the target economy. This category was reserved exclusively for the United States, which enforced both the most intense and longest running of all Iran sanctions programs. A full breakdown of sanctions classifications and the years for which they were assigned in this study can be seen in *Table 1*. It is important to note that all sanctions regimes were classified as two-way relationships, meaning exports from sanctioning nation to sanctioned nation received identical treatment to exports from sanctioned to sanctioning in the dataset.

Table 1. Classification of Sanctions Regimes' Relative Intensity		
Low	Medium	High
• Australia (2008-12)	• European Union (2010-12)	• United States (1995-2012)
• India (2011-12)	• Austria	
• Japan (2010-12)	• Belgium	
• South Korea (2010-12)	• France	
• Switzerland (2011-12)	• Germany	
	• Great Britain	
	• Greece	
	• Italy	
	• Netherlands	
	• Spain	
	• Canada	

Lastly, we included a series of variables for each year observed in this study to account for additional global economic events not covered by the gravity model or sanctions variables that had an effect on overall bilateral trade levels. A full list of variable names and explanations is displayed in *Table 6* of the appendix.

Model Structure

This model is logarithmic-linear (log-linear), meaning that all variables are presented either in natural log form or as dummy variables that take a value of either one or zero. The regression coefficients of the logarithmic variables, including the dependent variable, trade, as well as the independent variables of GDP (both exporter and importer), distance, and crude oil prices are reported as elasticities. For example, a one percent increase in the exporter's GDP will correspond to a percent change in bilateral trade based on the regression coefficient for that variable. For dummy variables, which include indicators such as contiguity, shared language, colonial relationship, as well as all sanctions and year variables, we needed to perform one additional transformative step before assessing their effect on the dependent variable. We took the exponent of the regression coefficient for each of these variables and subtracted one to get the percent change in total exports. For example, if the exponent of a regression coefficient of a dummy variable resulted in a value of 1.60, we would interpret that as a 60% increase in exports due to that variable.[10]

Finally, it is important to point out two procedures essential for gravity modeling. First, we used the *robust* standard errors command in all regressions to correct for possible violations of the homoscedasticity assumption of OLS. One inherent weakness of the gravity model is its tendency towards endogeneity in its construction. For example, it is reasonable to think that there is codetermination in the variables on the left and right-hand sides of the equation. For example, trade may have a simultaneous effect on overall GDP levels in addition to GDP levels affecting trade. Second, we added the STATA *cluster* command to group error terms as defined by the variable of choice. This solves an important potential problem in our model, since error terms are likely to be correlated by country pair. We corrected this by specifying a method to identify country pairs that is independent of the direction of trade. For gravity models, the distance variable is a common choice.[11]

10 In equation form $\Delta\% = e^{\beta x} - 1$

11 UNESCAP, "The Gravity Model of International Trade: A User Guide" (United Nations Conference on Trade and Development, 2012)

Table 2. Regression Results – Gravity Variables				
Variable	Coef.	Robust SE	t	P>|t|
ln_gdp_x	0.8730464	0.0383774	22.75	0.000
ln_gdp_im	0.7516013	0.0374672	20.06	0.000
ln_distcap	-0.7702322	0.066151	-11.64	0.000
ln_crude_fpp	-0.0839105	0.0343534	-2.44	0.015
contig	0.4831085	0.2039097	2.37	0.018
comlang_ethno	0.6316465	0.1547416	4.08	0.000
colony	-0.1661971	0.2467409	-0.67	0.501
comcol	1.597886	0.3526033	4.53	0.000
bloc	0.1156631	0.1475736	0.78	0.434
Number of Observations: 11,582				
R-squared: 0.6744				
Root MSE: 1.1285				

Model Equation

$$\begin{aligned} ln\ (trade) = {} & \beta_0 + \beta_1 ln(GDPX) + \beta_2 ln(GDPIM) \\ & + \beta_3 ln(distcap) + \beta_4 (contig) + \beta_5 (comlang) \\ & + \beta_6 (colony) + \beta_7 (comcol) + \beta_8 (Bloc) \\ & + \beta_9 ln(crude\_fpp) + \beta_{10} (sanc\_low) + \beta_{11} (sanc\_med) \\ & + \beta_{12} (sanc\_high) + \beta_{13\text{-}30} (y_t) + \mathcal{E} \end{aligned}$$

Regression Variable Analysis

Overall, the regression yielded results that were consistent with our initial hypotheses on gravity trade modeling. These results are displayed in *Table 2*. The overall explanatory capacity of the model as explained by our R^2 variable of determination was strong. According to this metric, our dependent variables explained 67.44% of the variability in the independent variable. Taking a closer look at the individual variables on the right side of the equation, the logarithmic gravity variables performed as expected in terms of sign of the coefficient. GDPs of both exporting and importing nations were statistically associated with an increase in trade levels – .87% for every one percent of exporter GDP and .75% for every one percent of importer GDP – while a one percent increase in distance was statistically associated with a .77% decrease in exports. All three of these variables were statistically significant at the 99% level and above. Crude oil prices, which we included as a rough proxy to account for costs of international transit of goods, was also indirectly associated with exports, with a one percent increase in the price of crude oil statistically associated with a slight decrease, .08%, in exports. With a p-value of .015, this variable was statistically significant at the 95% confidence level.

The gravity dummy variables, for the most part, also performed as expected. Contiguous borders, shared language, and common colonial ancestry all were associated with an increase in trade. After taking the exponents of each variable's coefficient, we found that countries that shared a colonizing nation had the largest boost in bilateral trade, boosting their totals nearly four times over. Common language and contiguity increased export values by 62% and 88%, respectively. Of these three variables, common colonizer and common language were statistically significant at the 99% level and above, while contiguity was statistically significant at the 95% level. Only colonial relationships between colonizers and colonized and trade bloc relationships were not statistically significant.

Table 3. Regression Results – Sanctions Variables							
Variable	Coef.	95% Confidence Interval		Robust SE	t	P>|t|	Trade Effect*
sanc_low	-0.521743	0.7607	-1.804	0.65185	-0.8	0.42	N/A
sanc_med	-1.22685	-0.6526	-1.801	0.29191	-4.2	0.000	-70.60%
sanc_high	-4.117059	-3.9853	-4.117	0.06698	-61.46	0.000	-98.40%
Test for Join Significance:							
sanc_low = sanc_med = sanc_high = 0							
F = 1265.00							
Prob>F = 0.000							
*Trade effect = $e^{coef.} - 1$							

Taking a look at the coefficients on the individual year dummies showed that most were statistically significant at least at the 95% level. Generally, international trade was stronger during the 1990s and early 2000s than in recent years. The largest drop off in international trade occurred in the final three years of the study (2009 onward). This followed our expectations based on greater global macroeconomic trends given that several of the European countries observed – Greece and Spain, for example – were among those hardest hit by the European debt crisis that struck in 2009.

Measuring the Effect of Sanctions

Statistical Performance

The F-test for joint significance of the sanctions variables showed that they were statistically significant at the 99% level and above, with an F-value of 1288.38.[12]

12 Due to the clustering of standard errors based on distance between nations and the way in which we defined our sanctions variables, STATA did not run an F-test in our original regression. Instead, we tested them separately. Additional tests for multicollinearity and a further explanation of issues concerning heteroscedasticity in the model are included in the appendix, along with the regression results for all time dummy variables.

Drilling down to look at each sanction grouping individually, medium and high intensity sanctions also reported as statistically significant at the 99% level and above. The medium intensity sanctions, which included all EU nations and Canada between 2010 and 2012, resulted in decreased trade levels by 70.6% based on the regression coefficient *(*See *Table 3).* For high intensity regimes (i.e. those of the United States), sanctions resulted in decreased trade by over 98% from their theoretical levels. We also examined the regression output for the 95% confidence interval values, which gave us an estimated range for potential trade losses. The high intensity sanctions 95% confidence interval was relatively tight, remaining close to 98% for both ends of the interval. For medium level sanctions, the range was slightly larger, measuring export loss between 48% and 83%. Notably, low intensity sanctions were the only category measured as statistically insignificant, meaning that the nations enacting these kinds of sanctions, including Australia, India, Japan, and South Korea, did not statistically alter their overall trade levels through enforcement of these measures.

4. The Cost of Sanctions to the US and EU Economies

The United States was by far the biggest loser of all sanctions enforcing nations. From 1995-2012, the U.S. forfeited between $134.7 and $175.3 billion in potential export revenue to Iran.[13] Based on the coefficient estimation represented in *Table 3*, the United States lost $153.67 billion in export revenue, which was greater than the losses of all the medium intensity sanctions regimes combined. The results are displayed in graphical form in *Figure 1* below. For the purposes of graphical simplicity, we chose to use the coefficient value in this display.[14]

In Europe, the German economy was the hardest hit, losing between $23.1 and $73.0 billion between 2010 and to 2012. But comparatively, the already struggling Italian and French economies paid an even higher price, losing between $13.6-$42.8 and $10.9-34.2 billion respectively. Mindful of the economic difficulties these EU states have faced in the past years, these losses are substantial.[15] Losses throughout the rest of the European Union ranged from $145-$458 million in Greece to $4.1-$12.9 billion in Spain. Between 2010- 2012, sanctions cost the EU states over twice as much as the United States in lost trade revenue. Canada also surrendered between $650 million and $2.1 billion in export revenue. On a global scale, sanctions cost an average of $52.8 billion annually in exports to Iran from 2010 to 2012.[16]

Lost Job Opportunities

The dollar loss of foregone export revenue represents only part of the cost of sanctions enforcement; there is also a human element, measured in terms of jobs needed to support higher export levels. We estimated this value for the United States using the Department of Commerce's annual report on jobs supported per billion dollars of exports.[17] These results are presented in *Table 4*. On average, the lost export revenues translates into between 51,043 and 66,436 lost job opportunities each year. In 2008, the number reaches as high as 214,657-279,389 lost job opportunities. The low end estimates in the late 1990s – during which time there was little to no trade with Iran due to Congressional measures during the second Clinton administration – represent a potential underestimation of the actual cost in terms of human capital during this period (see following section).

13 Calculation using 95% confidence interval values.

14 For the medium and high intensity sanctions, we first translated the percentage decreases into a dollar value for opportunity cost by dividing observed trade for each country pair by the coefficient, as well as both ends of the 95% confidence interval of the respective sanctions variable to get the theoretical values for full trade. We then subtracted the observed level of trade in order to determine the amount lost due to sanctions. This was done for each individual country for each year in which sanctions were employed. In equation form:

$$Lost\ Trade_t = \left(\frac{Observed\ Trade_t}{e^{\,sanctions\ coefficient}}\right) - Observed\ Trade_t$$

15 The ranges for the medium intensity sanctions (EU and Canada) are larger than those of the high-intensity sanctions (U.S.) due to the greater standard error associated with the medium intensity sanctions in our regression estimation. The medium classification incorporates a large number of countries relative to that of high-intensity sanctions (10 vs. 1), which results in considerably more variability across the trade relationships included in this classification. This increases the uncertainty of the prediction and results in a wider range of potential outcomes.

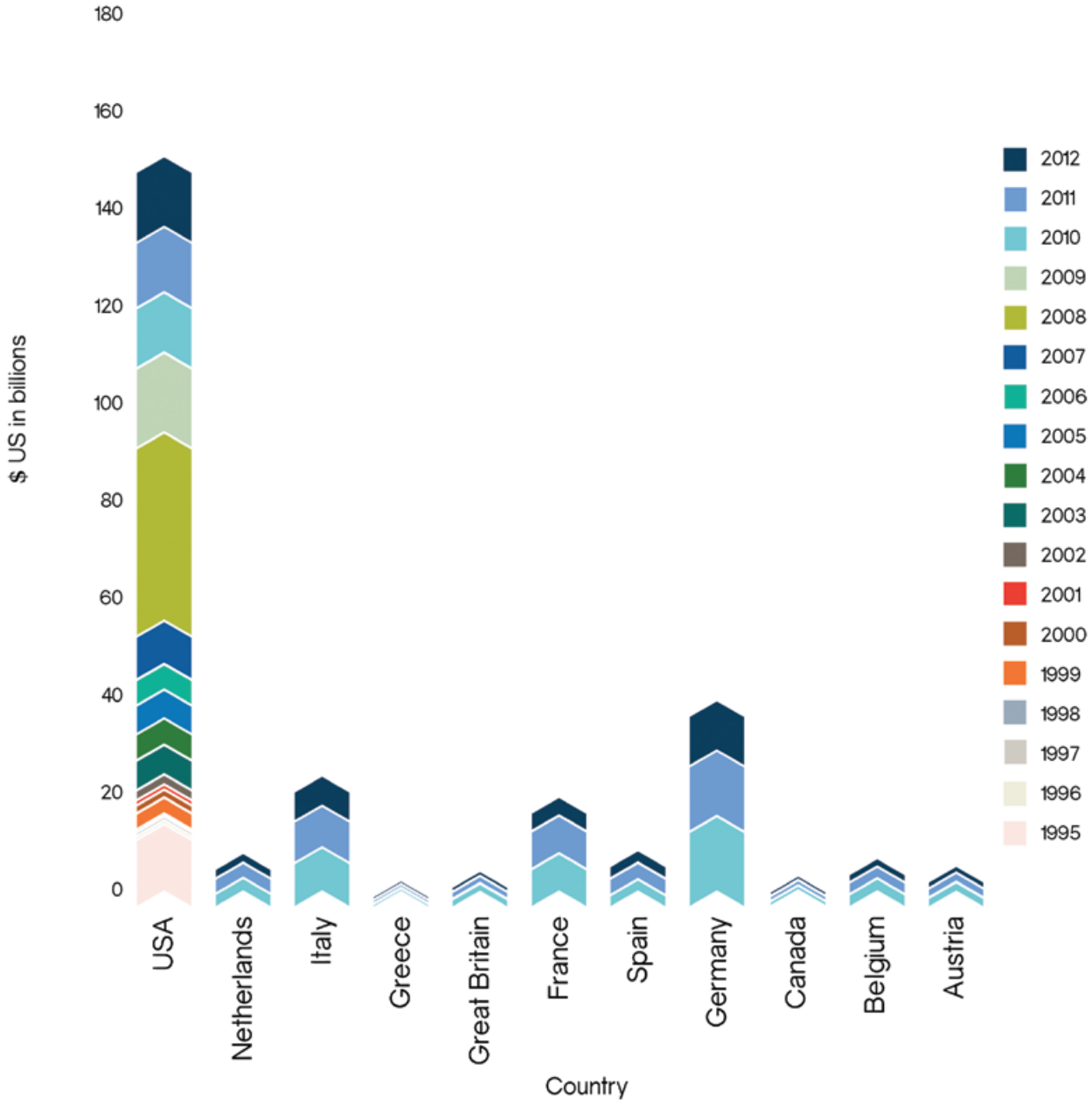
16 It is noteworthy that the cost of the Iranian nuclear program has been well over $100 billion, according to a U.S. think-tank report. Sanctions aimed at stopping the program, however, have cost the U.S. economy significantly more. See Ali Vaez and Karim Sadjadpour, Iran's Nuclear Odyssey: Costs and Risks, Carnegie Endowment, April 2, 2013.

17 Chris Rasmussen and Martin Johnson, *Jobs Supported by Exports, 1993-2011* (U.S. Department of Commerce, October 2012), http://www.trade.gov/mas/ian/build/groups/public/@tg_ian/documents/webcontent/tg_ian_003978.pdf. Martin Johnson and Chris Rasmussen, *Jobs Supported by Exports 2013: An Update* (U.S. Department of Commerce, February 24, 2014), http://www.trade.gov/mas/ian/build/groups/public/@tg_ian/documents/webcontent/tg_ian_005313.pdf.

Figure 1. Estimated Trade Loss

Exports to Iran

Medium & High Classifications



Note on U.S. Estimations

The relative magnitude of the U.S. losses compared with the rest of the world is unsurprising given that it was the only country with sanctions in place for the duration of the study, yet there are two reasons to believe that it might actually be an underestimation of the potential losses. First, the United States was the only country observed in which the beginning of sanctions enforcement predates the observed time period. The decision to begin the study in 1995 was based on the availability of certain data, but United States sanctions efforts against the Iranian government date back an additional sixteen years to the beginning of the Iranian hostage crisis in

Table 4. US Job Opportunities Lost Due to Sanctions			
Year	Jobs Supported Per Billion $ of Exports	Export Losses (billions)	Job Losses
1995	11,297	14.61421192	165,097
1996	10,835	0.018413539	200
1997	10,387	0.067516309	701
1998	10,200	0	0
1999	9,627	2.940028354	28,304
2000	9,144	1.018882477	9,317
2001	9,084	0.503303392	4,572
2002	8,477	1.66949418	14,152
2003	7,979	6.076467787	48,484
2004	7,287	5.235582851	38,152
2005	6,820	5.873918861	40,060
2006	6,487	5.217169312	33,844
2007	6,146	8.942841986	54,963
2008	5,840	41.93376558	244,893
2009	6,763	17.30258858	117,017
2010	6,177	12.79127158	79,012
2011	5,818	14.08635714	81,954
2012	5,690	15.37530486	87,485

November 1979. Had the study extended back to the beginning of sanctions enforcement, the United States losses would certainly have been greater.

Second, the gravity model, which depends on existing trade to measure theoretical levels, cannot account for years in which sanctions were so effective that they reduced U.S.-Iran trade to near zero levels. For example, pressure from a Republican-controlled Congress during the second Clinton Administration led to the implementation of new measures designed to severely curtail trade between the United States and Iran.[18] These efforts, which included a trade ban, were so effective that the IMF recorded zero total trade between the two countries in 1998. This suggests a tendency in the model towards underestimation.

Note on Iranian GDP

It is reasonable to assume that in the absence of sanctions, Iranian GDP would have been higher due to unrestricted sales of petroleum products. The 2012 European reinsurance ban on Iranian oil shipments, for example, resulted in a sharp and immediate decline in oil exports, Iran's primary source of revenue.[19] In the gravity model, GDP of both exporter and importer are positively associated with the overall level of bilateral trade, so greater Iranian GDP figures would have certainly increased the economic costs to sanctions enforcing nations.

18 Fawaz A. Gerges, "Washington's Misguided Iran Policy," *Survival* 38, no. 4 (1996): 5–15.

19 Daniel Fineren, "Insurance Relief in Iran Nuclear Deal May Lift Oil Sales," *Reuters*, November 25, 2013, http://www.reuters.com/article/2013/11/25/us-iran-nuclear-oil-idUSBRE9AN07A20131125.

5. Where are the lost American job opportunities?

The cost of Iran sanctions on the U.S. economy – a whopping $134.7 to $175.3 billion - is surprisingly high, particularly compared to the non-existing debate about the cost of this popular foreign policy tool. Congress has passed most sanctions on Iran with no more than a handful of nay votes. In 2011, the Senate even passed sanctions against Iran's Central Bank 100-0, in spite of objections from the Obama administration about the potential havoc they could cause in the oil markets. *However, in none of these debates did lawmakers raise the cost of sanctions to the U.S. economy.* This is even more surprising mindful of the ongoing efforts to reduce the U.S. unemployment rate – an objective directly undermined by the thousands of job opportunities lost due to the Iran sanctions.

But where would those jobs have been? What industries and which states have borne the brunt of these losses? To estimate that, we must first review the structure of the Iranian economy, with a particular focus on Iran's import market.

Structure of Iranian Imports

The composition and diversity of Iranian imports has been transformed over the past three decades, partly as a result of sanctions. In the 1990s, about 50% of Iranian imports were intermediate industrial products, 30% capital goods and 20% consumer goods. The largest segments were machinery (about 25%), metals (15%), chemical products (12%), vegetable oils (12%) and transportation equipment (about 8%).[20] As can be seen, Iran was a major importer of machines and metals. The specific types of both items are wide ranging. Machine imports include, but are not limited to: computers, broadcasting accessories, air pumps, construction vehicles, refrigerators, gas turbines, valves, engine parts, telephones, home appliances, and air conditioners. Metals imports range from various types of iron to aluminum to steel.

After machines and metals, Iran also imports large numbers of transportation, chemical and vegetable products. This includes cars, vehicle parts, tractors, delivery trucks, rail transport, medicine, fertilizers, antibiotics, beauty products, pesticides, corn, rice, soybeans, and sugar.

By the 2000s, Iran industrialized and reduced the importation of finished goods and started focusing on raw materials and intermediate industrial products. However, the overall growth of the economy expanded the volume of imports. As such, in the 2000s, there was a tendency towards higher imports of consumer goods to fill the gaps in the market. The total value of imports in the Iranian year 2000/2001 was $14.3 billion. It then grew to above $60 billion per annum in the second half of the 2000s, and then reached a peak of $77 billion in 2011. In 2012 and 2013, the country's import bill fell to $52 and $58 billion respectively. In 2014, the import volume will return to about $73 billion.[21] The approximate composition of Iranian imports in the 2000s is depicted in the following chart:

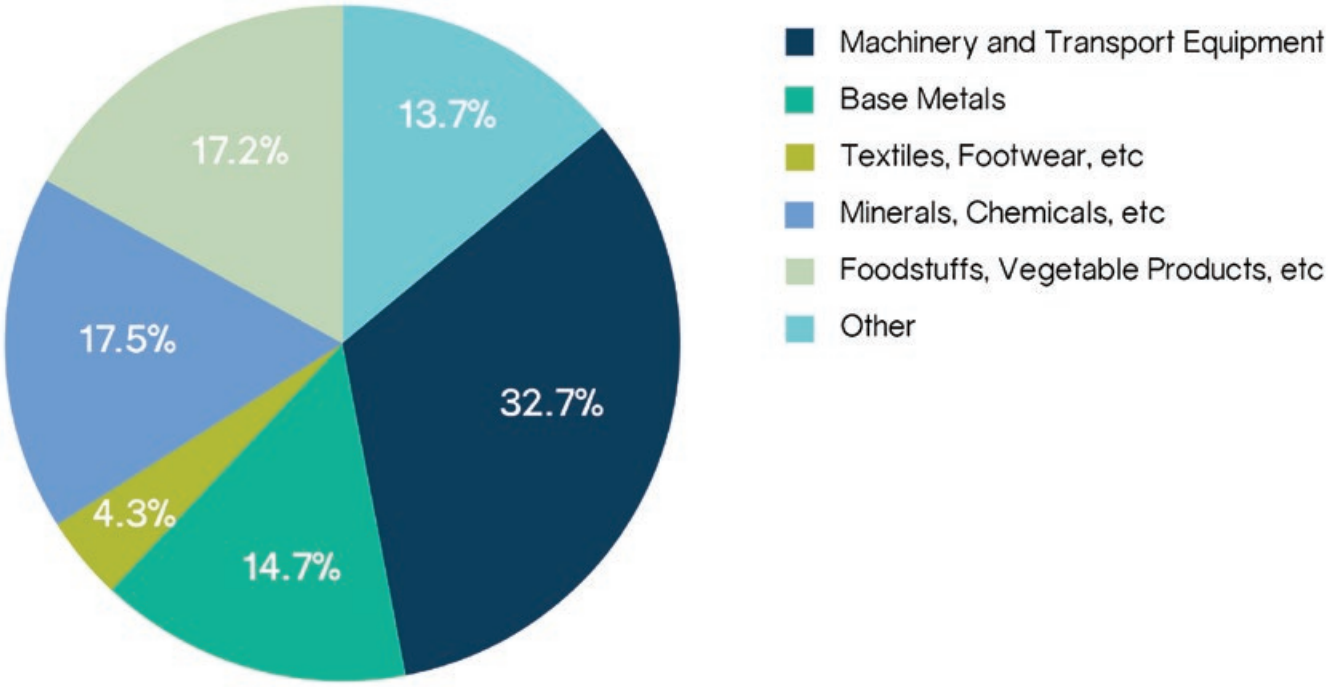
To understand the real potential of U.S. exports to Iran, it is best to take a closer look at the main exports from the European Union to Iran in the past few years, especially as the EU would be the main competitor for potential U.S. exports to Iran. *Table 5* shows the value and type of selected EU exports to Iran between 2009 and 2013.[22]

20 Source: Iran Investment Guide, Atieh Bahar Consulting, Tehran, Iran,

21 Iran Economics Magazine (Eqtessade Iran), June 2014 issue

22 Source: EU Commission statistics, http://trade.ec.europa.eu/doclib/docs/2006/september/tradoc_113392.pdf

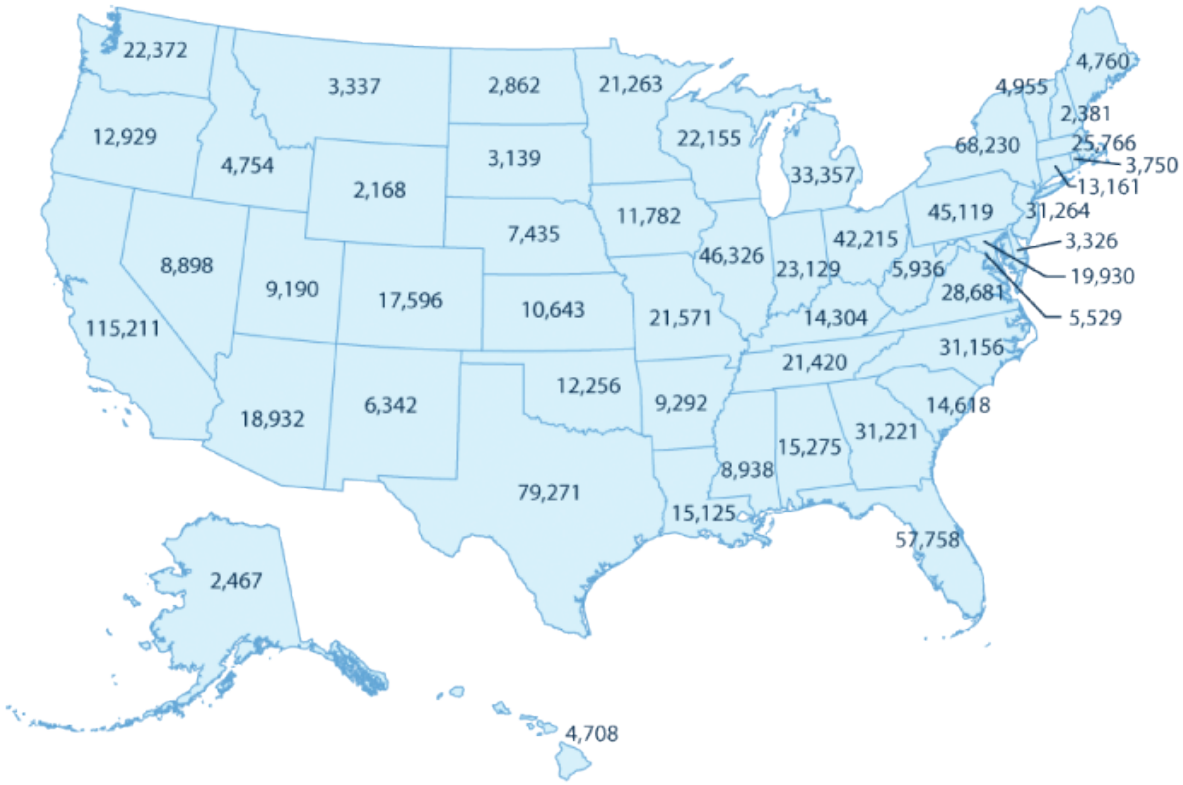
Figure 2: Composition of Iranian Imports in the 2000s



Source: Atieh International

Table 5. Selected EU Exports to Iran (in millions of Euros)					
Type / Year	2009	2010	2011	2012	2013
Machinery and Transportation Equipment	5,740	6,380	5,554	3,152	2,061
Manufactured goods classified chiefly by material	1,528	1,417	1,391	1,079	575
Chemicals and related products	1,469	1,763	1,815	1,303	1,233
Other exports	1,697	1,759	1,737	1,845	1,579
TOTAL	10,434	11,319	10,497	7,379	5,448

Figure 3. Job Opportunities Lost Per State 1995-2012



The Biggest Losers: Big states with strong export industries

Figure 3 represents the total job opportunities lost by each state between 1995 and 2012, assuming that each state was hit proportionally by the sanctions costs. We estimated these values by compiling annual employment figures for each state (plus the District of Columbia) from the Bureau of Labor Statistics using non-farm, non-seasonally adjusted numbers. We then calculated each state's employment as a percentage of the total and applied those percentages to our estimated lost jobs value for each year. We recognize that this method assumes that all job opportunities lost due to Iran sanctions would be distributed proportionally across the United States based on overall employment.

However, states with large economies containing industries most attractive to Iran would likely capture a larger share of these job opportunities than those without large export sectors. Therefore, it is likely that California and Texas may have suffered proportionally greater losses than what is displayed in this map because of their size and the strength of their export industries in the fields of energy, agriculture and communications.

6. Moving Forward: Likely Future Areas of Trade

The structure of Iranian imports provides one important insight into the lost trade between the U.S. and Iran. To understand future potential losses (or gains), it is instructive to study the Iranian government's stated areas of emphasis going forward, which include but are not limited to: energy-intensive industries; power generation; telecommunications; automobiles; aviation and shipping; roads and railways; banking and insurance; and mining. Taking both insights into account, a diverse range of sectors stand out as likely areas of future trade – or future losses, depending on whether sanctions are lifted or not.

Oil and Gas: Iran has plans to invest about $100 billion in its upstream and downstream oil and gas sectors, and American companies would be attractive prime contractors in such projects. Engineering companies and subcontractors in the oil and gas sector would also be prime candidates for collaboration. Also, Iran's growing gas production potential will push Iran to become a growing producer of gas-based products such as cement, steel and aluminum. Rouhani advisers have openly stated their desire for top of the line technology in these sectors – most of which belongs to American companies.

Automobiles: Iran has one of the most significant emerging automotive markets in the world. With a population of approximately 80 million people and a car fleet of roughly 15 million, it is clear that there will be a huge need for imports. Throughout the 1990s and early 2000s, Iran demonstrated its ability to absorb millions of cars – both imported and locally assembled through partnerships with European and Asian manufacturers. In a post-sanctions environment, struggling American car manufacturers could win a share of this lucrative market.

Telecommunications: Iran has approximately 50 million cell phone subscribers and three active mobile operators – all of whom are in need of modern technology. Because of sanctions, the infrastructure of Iran's mobile communications is based on Chinese technology. Iranian decision-makers have voiced their desire to modernize this infrastructure with top-of-the-line mobile and IT solutions as soon as sanctions are lifted. American companies are at the forefront of such technology.

Power Generation: Iran plans on investing heavily to expand its power generation capacity and ability to export electricity to the regional markets. This will require power generation technology, energy efficiency solutions and renewable energies – all areas in which U.S. companies possess the state-of-the-art technology that Iran seeks. It should be noted that the first U.S. Company to sign a preliminary investment agreement with Tehran – California's World Eco Energy – is a green energy company. If sanctions are lifted, it will invest $1.175 billion in Iran to turn rubbish and human waste into electricity. According to Agence France Presse, World Eco Energy "plans to produce 250 megawatts daily by burning trash and by processing algae and salt and waste water into power."[23]

Construction: When sanctions are lifted, top-notch construction technologies and materials will be in high demand. Sanctions have increasingly forced Iran to rely on Chinese partners that perform substandard work with frequent delays. American companies have a clear competitive advantage over their Chinese counterparts in this regard. It should also be noted that many construction engineers in Iran are U.S.-educated and familiar with American solutions.

23 U.S. company 'signs $1.175 bn Iran bio-energy deal', AFP, July 5, 2014.

Agriculture, Food & Medicine: Iran has a sizable agricultural sector (approximately 13% of the economy) and the ambition to expand it. This will require more modern agricultural equipment, which is already in demand in Iran. Some American inventions in this sector (such as irrigation technologies) are well suited for the Iranian market. It should also be noted that pharmaceutical and food companies could benefit from increased access to the Iranian market. American companies are already active in these two sectors, but their presence and market share can be expanded after sanctions are lifted.

Water: Iran has a water shortage, and has therefore charted an ambitious plan to make drinking water available to all citizens and expand its agriculture. This will require heavy investments in water consumption efficiency and waste water management. American companies have the world-class technology and know-how that their Iranian counterparts seek.

Aviation: The US aviation sector will be the initial beneficiary of significant purchase orders from Iran's aviation industry. Iran's fleet of aircraft is antiquated. The last time it received Boeing aircraft was 55 years ago. US sanctions prevented Iran from purchasing Airbus aircraft since these European aircraft contain US spare parts and technology. According to Iran's Civil Aviation Industry, out of 250 commercial aircraft that are in the Iranian fleet, 100 are not suitable for travel due to lack of spare parts. Iran's Civil Aviation Organization also estimates that Iran's four major airlines (Iran Air, Aseman Airlines, Mahan, Iran Air Tour) would need to purchase 40 aircraft every year for the next 10 years to bring its fleet up to date. Conservatively, that would mean Iran would have to spend between $10 to $20 billion dollars a year on aircraft. This does not include maintenance and spare parts that its aging aircraft still require. Boeing, General Electric, and United Technology (the latter two for aircraft engines and spare parts), could potentially be the biggest winners if Iran sanctions were lifted.

7. Conclusion

The position held by many detractors of diplomacy that a nuclear deal would be unacceptable because it forces the U.S. to "give up its sanctions" ignores that the policy also has carried significant cost to the U.S. The negative impact of sanctions to the U.S. economy has been staggering, between $134.7 and $175.3 billion, and continues to rise. The human cost has been even greater, with lost job opportunities reaching above 200,000 in some years. These are surprisingly high yet conservative estimates since neither secondary economic effects such as higher oil prices are captured by the model nor the reduction of Iranian imports as a consequence of sanctions hampering Iran's GDP.

This report does not address the debate as to whether the sanctions policy was worth the cost or not. It only seeks to ensure that the cost of sanctions is recognized as America approaches the moment when it must decide whether to exchange the sanctions for nuclear concessions or continue the economic warfare. This debate will be incomplete at best and misleading at worst if it does not acknowledge the cost of sanctions.

As U.S. diplomats negotiate a deal with Tehran over its nuclear program, some will ask whether the deal is good enough to "give up sanctions." But decision-makers must also ask themselves if the cost of sanctions to the U.S. economy is worth shouldering if other options do exist.

Appendix A. Variables List

Table 6. Description of Regression Variables	
Variable (Name in Regression)	**Definition**
Trade (ln_trade)	Natural log of exports from country A to country B on which country is listed as the exporter
GDP Exporter (ln_gdp_x)	Natural log of GDP of exporter in country pair
GDP Importer (ln_gdp_im)	Natural log of GDP of importer in country pair
Distance (ln_distcap)	Natural log of kilometric distance between two capital cities in country pair
Contiguity (contig)	Dummy variable representing country pairs with a shared land border
Common Language (eomlang_ethno)	Dummy variable representing country pairs with shared language (based off of spoken languages)
Colony (colony)	Dummy variable representing a country pair in which one country colonized the other
Common Colonizer (comcol)	Dummy variable representing a country pair in which both nations were colonized by the same nation
Crude Oil First Purchase Price (ln_crude_fpp)	Natural log of first purchase price of crude oil
Trade Bloc (Bloc)	Dummy variable representing country paris that are members of trade bloc agreements (EU, NAFTA, MERCOSUR)
Low Intensity Sanctions (sanc_low)	Dummy variable representing country pairs in which one country is enforcing low intensity sanctions on the other
Medium Intensity Sanctions (sanc_med)	Dummy variable representing country pairs in which one country is enforcing medium intensity sanctions on the other
High Intensity Sanctions (sanc_high)	Dummy variable representing country pairs in which one country is enforcing high intensity sanctions on the other
Year Variables (y_t)	Dummy variable for each year observed representing the overall effect of global economy on trade

Appendix B. List of Iran Sanctions

Table 7. U.S. National Sanctions (select)		
Sanction	**Year**	**Target**
EO 12957	1995	Energy sector
EO 12959	1995	Trade
Iran Sanctions Act	1996	Energy sector
EO 13509	1997	Trade
CISADA	2010	Trade
		Financial transactions
EO 13590	2011	Energy and petrochemical sectors
NDAA	2012	Financial transactions
		Crude oil exports
EO 13622	2012	Financial transactions
		Crude oil exports
Iran Threat Reduction Act	2012	Shipping insurance for dual-use goods
		Oil shipping insurance
		Financial messaging services
		Financial transactions
NDAA	2013	Shipping and shipbuilding sectors
		Port sector
		Precious and semi-finished metals
		Insurance services
		Financial transactions

Table 8. EU Restrictive Measures (select)		
Sanction	**Year**	**Target**
Council Common Position 2007/140/CFSP, Council Regulation 423/2007	2007	Financial transactions
Council Common Position 2010/413/CFSP, Council Regulation 961/2010	2010	Financial transactions
		Financial messaging services
		Trade
		Insurance services
		Energy sector
Council Common Position 2012/35/CFSP, Council Regulation 267/2012	2012	Financial transactions
		Raw and semi-finished metals
		Crude oil and natural gas exports
		Energy sector
		Insurance services
		Shipbuilding
		Shipping

Appendix C. Statistical Tests

Table 9. Test for Multicollinearity				
	ln_gdp_x	ln_gdp_im	ln_distcap	ln_crude_fpp
ln_gdp_x	1			
ln_gdp_im	0.0647	1		
ln_distcap	0.0113	0.0113	1	
ln_crude_fpp	0.3057	0.3057	0	1

Tests for Multicollinearity

In order to test the strength and predictive capacity of our model within the conditions of OLS regression, we ran tests to investigate the presence of multicollinearity within the independent variables. The first was a basic correlation test for non-dummy independent variables. The results are presented in *Table 9*. For the three logarithmic gravity variables – GDP exporter, GDP importer, and distance – none had a correlation higher than |0.1|. There was some correlation between the logarithmic crude oil first purchase price variable and the exporter and importer GDP, measured at .3057 for both, but this is not a surprising result given the strong link between oil prices and economic performance. Historically, an increase in world oil prices (especially sudden shocks), have had dramatic effects on global economies. While this is certainly a weakness, we did not consider this a problem for the investigative strength of this model, since the removal of this variable had very little effect on the sanctions variables we were interested in measuring.

Table 10. Tolerance Values		
Variable	VIF	1/VIF
ln_crude_fpp	3.98	0.251474
ln_distcap	1.97	0.506492
y08	1.89	0.52966
y12	1.88	0.53268
bloc	1.72	0.580496
y10	1.7	0.588721
y95	1.69	0.591337
y99	1.65	0.607878
y07	1.64	0.610639
y97	1.59	0.630557
y06	1.58	0.632048
y96	1.57	0.638859
y09	1.55	0.645226
y05	1.51	0.665738
y01	1.5	0.665738
y02	1.49	0.670278
y00	1.46	0.685887
y03	1.44	0.692579
contig	1.44	0.695351
y04	1.44	0.69554
comlang_ethno	1.3	0.769863
colony	1.18	0.849008
ln_gdp_x	1.15	0.866173
ln_gdp_im	1.15	0.86631
sanc_med	1.03	0.967939
comcol	1.03	0.97192
sanc_low	1.01	0.988486
sanc_high	1.01	0.995023
Mean VIF	1.56	

In addition to the correlation test above, we also ran a VIF test, which showed that the tolerance values for all our variables, including those of the sanctions dummies were above 0.1. The logarithmic crude first purchase price variable was again the variable of most concern, with a tolerance value of 0.25, but the remainder of the variables were all greater than 0.5. The results of this test are displayed in *Table 10*.

Table 11. Spearman Test for Correlation					
Key *rho* observations sign. level					
	ln_gdp_x	ln_gdp_im	ln_distcap	ln_crude_fpp	res
ln_gpd_x	1				
	11700				
ln_gdp_im	0.0733	1			
	11700	11700			
	0				
ln_distcap	0.313	0.0047	1		
	11700	11700	11700		
	0.6106	0.6112			
ln_crude_fpp	0.313	0.313	0	1	
	11700	11700	11700	11700	
	0	0	1		
res	0.6442	0.5645	-0.4352	0.3113	1
	11700	11700	11700	11700	11700
	0	0	0	0	

A Note on Heteroscedasticity

As noted in the Model Structure section above, there is an inherent issue of violations of the homoscedasticity assumption of OLD regression in the gravity model. Indeed, running the regression without any attempts to compensate for non-constant errors and then running a test for homoscedasticity reveals that the model violates this assumption. We have done all we can to correct for this issue by using the *robust* standard errors command when running our regressions in STATA, but we recognize that the model does suffer from some correlation between our independent variables and the error term. STATA does not accommodate traditional heteroscedasticity testing via the *hettest* command when employing *robust* errors, but we were able to run a Spearman test for correlation between our non-dummy variables and the residuals. The results of this test are displayed in *Table 11*.

Additional Regression Results

Table 12. Regression Results – Time Variables				
Variable	Coef.	Robust SE	t	P>|t|
y95	-0.0264114	0.0238838	-1.11	0.27
y96	-0.070952	0.0244779	-2.9	0.004
y97	0.0275284	0.019414	1.42	0.157
y98	Omitted because of collinearity			
y99	0.0194245	0.0177961	1.09	0.276
y00	0.1354825	0.0315324	4.3	0
y01	0.1038811	0.0260303	3.99	0
y02	0.1098563	0.0279302	3.93	0
y03	0.080449	0.0247916	3.25	0.001
y04	0.0774793	0.0258977	2.99	0.003
y05	0.0921114	0.0297841	3.09	0.002
y06	0.092337	0.0266037	3.47	0.001
y07	0.0440487	0.0238581	1.85	0.066
y08	0.0605553	0.0238666	2.54	0.012
y09	-0.1221738	0.0181199	-6.74	0
y10	-0.017406	0.0138003	-1.26	0.208
y11	Omitted because of collinearity			
y12	-0.0416233	0.0161339	-2.58	0.01

NIAC
National Iranian American Council
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Community • Democracy • Universal Rights

About NIAC

The National Iranian American Council is a nonpartisan, nonprofit organization dedicated to advancing the interests of the Iranian-American community. We accomplish our mission by supplying the resources, knowledg e and tools to enable greater civic participation by Iranian Americans and informed decision making by lawmakers.

As one of the most highly educated minority groups in the United States, Iranian Americans have achieved success on many levels – technological, scientific, academic and economic life – yet our community's impact on civil society is a less impressive story. No time was this more evident than after September 11, when the Iranian-American community was nearly silent as the United States was confronted with profound issues of national security, immigration and the character of American society. This was when NIAC emerged as a leader, addressing the difficult issues facing our community.

Since its inception in 2002, NIAC has effectively represented Iranian Americans on Capitol Hill, giving the Iranian-American community a powerful voice. NIAC has a presence on both coasts and in the American heartland. Members of Congress are now counting on hearing from NIAC and benefiting from the perspective of Iranian Americans.

NIAC is a grassroots organization supported by the Iranian-American community and prominent American foundations. NIAC does not receive funds from the Iranian government nor the United States government.

NIAC's Vision

- **Community:** NIAC promotes an active and engaged Iranian-American community in the US and celebrates the community's deep historical and cultural roots and traditions.
- **Democracy:** NIAC encourages Iranian Americans to contribute to the long tradition of American democracy by being active, informed participants and responsible, engaged citizens. NIAC also supports the Iranian-American community's aspirations for democracy in Iran.
- **Universal Rights**: NIAC works to ensure that human rights are upheld in Iran and that civil rights are protected in the US. NIAC believes that the principles of universal rights – Freedom of assembly, religion, and speech, as well as dignity, due process and freedom from violence – are the cornerstones of a civil society.

NIAC's Mission

- **Advocacy:** We advance the interests of the Iranian American Community on civic, cultural and political issues.
- **Education:** We supply the resources, knowledge and tools to enable civic participation and informed decision making.
- **Community Building:** We provide the infrastructure for bridge-building across the network of Iranian American organizations and the peoples of America and Iran.

National Iranian American Council

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