WHAT IS THE EFFECT OF U.S.-LED SANCTIONS ON A TARGET NATION'S FOREIGN CURRENCY EXCHANGE RATE?

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ABSTRACT

This study seeks to assess the relationship between United States-led sanctions and the foreign exchange rate (vis-à-vis the U.S. dollar) of targeted nations. Recent research has examined various impacts that sanctions have on a target nation, suggesting that sanctions often function as intended, reducing U.S. investment or bilateral trade. But these studies also suggest that unintended consequences can occur: U.S. investment is often replaced with other foreign investment, target nation trade with *all* partners tends to decrease, and target nations adapt to sanctions. This study explores whether U.S. sanctions affect a more wide-reaching economic indicator, the foreign exchange rate. It finds that certain types of sanctions are associated with modestly statistically significant changes in a targeted nation's long run nominal exchange rate when measured year-on-year and when using a volatility measure for exchange rates.

The research and writing of this thesis
is dedicated to God for his guidance, my wife and children for their patience, and my mother for her vision.

Many thanks,
Matthew U. Smith

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Introduction

Over the course of the 20th century, the United States increasingly used sanctions to place pressure on certain nations that, among other reasons, support terrorism, seek to produce a nuclear weapon, or hold Americans hostage. While it has been established that sanctions have an economic, and possible political, impact on target and sender nations, the question of whether sanctions are effective—that is, whether they help attain a specific policy objective—is still open for debate (see, for example, Marinov 2005, Biglaizer and Lektzian 2011 and 2012, and Hufbauer 2007).

A number of studies have evaluated the efficacy of sanctions in achieving *stated* policy goals on a target nation. For the U.S., these goals often include regime change, a change in decision-making, or the release of political prisoners, among others. But the use of sanctions often carries with it other effects on a target nation, including impacts on foreign investment, inflation, and trade.

This paper seeks to break new ground in the sanctions-related body of knowledge by isolating the relationship between sanctions and foreign exchange rates (vis-à-vis the U.S. dollar, in the case of the present paper). Such a relationship, if apparent, would provide more insight into the range of impacts that sanctions have on a target nation, especially given efforts of U.S. policymakers to specifically target a nation's ruling elite, not its working class, by using smart sanctions (Drezner 2011). Are sanctions a precision-guided policy weapon or a blunt force tool? Answering this question necessarily involves evaluating sanctions and foreign exchange rates because of the wide-ranging effects an over- or under-valued (or volatile) currency has on a nation's trade, growth, and employment.

This paper presents the findings of this research. In the follow sections, I present a short background on sanctions; summarize the sanctions and foreign exchange rate literature; discuss data and methods; present findings; and lastly conclude with policy implications and thoughts for future research.

Background On Sanctions

Scholars have noted that the use of sanctions[1] reaches back to those imposed by Ancient Athens in 436 BC against its neighbor Megara. Since the 19th century, sanctions have been used as a foreign policy tool to forestall war, alleviate public pressure on policy makers, and attempt to change the domestic and foreign policy of adversaries. For the purpose of this paper, sanctions are "the deliberate, government-inspired withdrawal, or threat of withdrawal, of customary trade or financial relations" and include the reduction of foreign financial aid and the restriction of imports and exports (Hufbauer 2007). To describe the directional manner of imposed sanctions I will use the term "sender" to denote a country that imposes sanctions on a "target" nation; the use of "sanctioner" is used by some and is analogous with "sender." In this paper I focus on sanctions that the U.S. imposes alone or leads via a coalition of states or an international organization, such as the United Nations. Sanctions are imposed in episodic form; that is, they have a beginning and an end, a start year and an end year. Senders terminate sanction episodes when a policy goal is perceived as successful (as when South Africa abandoned its nuclear weapons ambitions in the 1970s) or when the use of sanctions does not satisfy new policy goals (as in the case of Iraq following the overthrow of Saddam Hussein in the 2000s). The United States has used sanctions to further a number of policy goals.

[1] The word *sanction* originates from the word *sanctio*, a Latin word meaning "a law or decree that is sacred or inviolable, under penalty of a curse." It later evolved to its verb meaning, "to allow by law," but was not until the last century that it took on its current form, "to punish (for breaking a law)." (The Editors of American Heritage Dictionaries 2006)

A few sanctions episodes illustrate the United States' use of sanctions since World War II. Many of the U.S. sanctions episodes beginning in the 1970s and continuing today target those countries that support terrorism. Such sanctions include the Foreign Assistance Act, which restricts U.S. financial assistance to any country designated as a sponsor of terrorism; and the U.S.A PATRIOT Act, requiring the Treasury department to enforce restrictions on banks doing business with countries that are non-compliant with certain U.S. anti-terrorism laws. Other sanctions seek to further U.S. goals of reducing the proliferation of weapons of mass destruction. An example includes the Syria Accountability Act, which requires the President to impose export restrictions on dual-use items (those items that could be used for peaceful purposes but also in the production of weapons of mass destruction) to Syria (Hufbauer 2007). Some U.S. sanctions episodes have multiple purposes, such as with sanctions imposed on Iran since 1979. Initially, the Carter Administration used sanctions as a form of retaliation for the hostage taking of American diplomats following the Islamic Revolution in Iran. Since 1979, the Reagan administration along with the George H. W. Bush, Clinton, George W. Bush, and Obama administrations issued executive orders and signed legislation restricting foreign investment in the Iranian oil industry, importation of specific goods, and working with those specifically designated as instrumental to Iran's nuclear development program and terrorist support operations[2]. U.S. sanctions do not necessarily restrict Americans' activity abroad or those of the targeted country; as in the case of Iran, the U.S. has recently taken a further step of designating third party publicly- and privately-owned banks that do business with the Central Bank of Iran, which has been designated as critical to Iran's nuclear program. Indeed, the United States is in a unique position as a global leader in the financial industry to be able to impose such sanctions,

[2] See the Department of the Treasury's Office of Foreign Assets Control (OFAC) website, www.treasury.gov/ofac, for a comprehensive list of all U.S.-imposed sanctions, as well as those imposed on Iran.

which have the ability to limit activity of third parties, not just a targeted nation. America's financial position has ostensibly resulted in its increasing use of sanctions as a foreign policy tool.

Since 1900, the frequency of U.S.-led sanctions has steadily risen; from 1900 to 1969 there were 37 sanctions episodes, and from 1970 to 2000 there were 86. There are a number of reasons that sanctions are used. Among these reasons, scholars debate whether sanctions are more *expressive* or *instrumental*. On the one hand, the expressive theory states that sanctions represent another means for nations to communicate their displeasure with the actions of other nations and to pander to domestic special interest groups, who lobby for sanctions on moral or economic grounds. On the other hand, the instrumental theory argues that sanctions are economic tools meant to shape nations' actions, an important part of deterrence and the carrot-and-stick philosophy (Kaempfer and Lowenberg 1988, Drezner 1999, and Hufbauer 2007). As Hufbauer (2007) states: "In sum, the imposition of sanctions conveys a triple signal: To the target country it says the sender does not condone the target's actions; to allies it says that words will be supported with deeds; and to domestic audiences it says the sender government will act to safeguard the nation's vital interests."

Literature Review

In this section I summarize the literature on exchange rates and their determinants and on the impact of sanctions. Scholars have found sanctions to affect target nations in various ways. Research has not yet evaluated the effect that sanctions have on a target country's foreign exchange rate. Hufbauer (2007) assessed the relationship between sanctions and trade. Hufbauer found that comprehensive U.S. sanctions have a statistically significant and negative impact on a target nation's trade with all of its trading partners. This is important because it

signifies that trade involving these target nations not only is reduced with the U.S. but with other nations as well, even when not explicitly restricted in U.S. sanctions law. The effect of sanctions on foreign direct investment (FDI) has also been studied. In a recent study, which assessed the impact of U.S. sanctions on FDI in target nations, Biglaizer and Lektzian (2011) found that U.S. investment falls significantly in the presence of U.S.-imposed sanctions. In a follow-up study, Biglaizer and Lektzian (2012) evaluated the relationship between U.S. sanctions and global (non-U.S.) FDI in target countries and generally found that there is "strong evidence that when U.S. firms disinvest during U.S. sanctions, global FDI significantly increases, providing the target country with a reliable source of capital replacement."

The current study broadens the sanctions body of knowledge by assessing U.S. sanctions' impact on exchange rates, a macroeconomic measure that has potentially further-reaching effects on a country's economic well-being than trade or investment alone. As can be expected, many things may affect exchange rates, and over the past three decades there has been considerable effort to establish the determinants of exchange rate fluctuations. A well-known study by Dornbusch (1976) established that artificial increases in currency to the market (or monetary expansion) result in exchange rate depreciation and increased inflation causes appreciation. Dornbusch also noted that when "real output is fixed, a monetary expansion will…cause the exchange rate to overshoot its long-run depreciation." Further, when output responds to demand the exchange rate will depreciate but perhaps not as much, in the short run. This idea is important in the context of sanctions given Hufbauer's finding that international trade is impacted more by comprehensive sanctions than financial or trade sanctions alone; perhaps when U.S.-imposed sanctions cause a change in output, a corresponding change in the exchange rate is observed. Furthermore, a target country's attempts at blunting the effect of sanctions may likely

include stimulative monetary policy, such as injecting domestic currency into the economy through one-time tax rebates or subsidies or by shoring up stable foreign currencies, such as the dollar and euro, and gold.

Meese and Rogoff (1988) found that real interest rates are a statistically insignificant and poor predictor of real exchange rates. However, they concede that "this finding appears to conflict with the predictions of most monetary and portfolio balance models of exchange rate determination."

As of 2013, the literature has mostly suggested that economic models have poorly explained, if at all, the historical change in foreign exchange rates.[3] In fact, most have shown that random walk models have been better predictors of exchange rate changes in the short run.[4] In spite of this, Rossi (2006) set out to explain how better specified models using dynamic economic parameters could explain exchange rate changes. Rossi found that when accounting for parameter instability, other forecast models were better predictors of exchange rates than the random walk models.

So far, the research has yielded more questions than answers. As Blomberg (2001) states, "One of the great disappointments of exchange rates economics is the failure of two decades of intensive research to identify the fundamental determinant of observed exchange rate dynamics." And while the debate over exchange rate determinants still continues, this study treads lightly into the discussion within the context of empirically testing the relationship between sanctions and exchange rates, not in exhaustively searching the effects of exchange rate fluctuations.

[3] For more on the various models used to test exchange rate volatility, see the influential work by Meese and Rogoff (1983).
[4] If exchange rate movements are characterized by a random walk, then the likelihood that the rate would increase or decrease at any point in time is random.

Tying together trade and investment to exchange rate *volatility*, Arize (2000) concluded that among a set of less developed countries there is a negative and statistically significant relationship between export flows and exchange rate volatility; Amadou (2007) found that investment is hampered by high exchange rate volatility. These findings are important because if U.S. sanctions are effective at reducing a target country's bilateral trade and foreign investment then further effects on the stability of a target country's exchange rate would likely compound an already difficult economic situation.

Conceptual Framework

When it comes to foreign exchange rates, it is thought that, as per some of the literature noted above, long-term rates are influenced by a country's gross domestic product (GDP), inflation, interest rate, trade balance, government debt, and foreign currency reserves held by its central bank. Some aspects of sanctions have a direct impact on these influences since countries are often limited to trade and financial sanctions. It is logically expected that given trade sanctions, a target nation's exports and/or imports would decrease; and with the imposition of financial sanctions, a target nation's GDP, inflation rate and government debt might be impacted negatively. A number of factors are believed to result in a successful sanctions episode: realistic policy goals, relative size of target and sender nations, the health of internal political and economic conditions in target nations, and interconnectedness of the target nation with the global economy (Hufbauer 2007).

That the relationship between sanctions and foreign exchange rates has not been empirically studied is noteworthy because of the impact that a sufficiently devalued or highly unstable currency can have on an economy. Exchange rates impact a country's ability to trade, affect its citizens' ability to buy common goods (inflation often moves with wide exchange rate

movements), and as a result affect the rate of growth of an economy. The impact of exchange rate movements on an economy is complicated; it may be desirable to have a currency that is worth less relative to key trading partners but decreases or increases over short periods of time could introduce volatility that is undesirable (a volatile exchange rate is associated with reduced international trade (Arize 2000).

It is expected that the imposition of sanctions will have an impact on exchange rate movements because of the types of sanctions that are often imposed. The U.S. has used import, export, and financial sanctions over the past few decades, relying mostly on financial or a combination of all three. Trade and financial sanctions are thought to directly impact certain fundamental economic indicators that influence the exchange rate. I posit that measures of trade, economic size, inflation rates, and foreign currency reserves have some explanatory power on exchange rates. Also, the existence of military conflict within or between target nations and other countries is likely to impact exchange rates and whether the U.S. chooses to use sanctions as a foreign policy tool.

I hypothesize that the imposition by the United States of sanctions has a limited but significant impact on a target nation's exchange rate vis-à-vis the U.S. dollar, causing it to devalue on average when compared to periods when there are no sanctions. I also hypothesize that when comprehensive sanctions (those including restrictions on foreign aid, imports, and exports) are imposed, the impact to the exchange rate will be larger than when only one or two types of sanction are imposed but still only modestly. Lastly, I expect sanctions to have a short but significant impact on a target nation's exchange rate stability; thus, when more sanctions are applied, an exchange rate is more volatile (but over a short period of time as investors and business people adjust to the sanctions).

Data

For this study I leverage the often-utilized and often-cited Hufbauer-Schott-Elliott (HSE) dataset, which includes data for 204 international sanctions episodes from 1917 to 2000.[5] I use the data representing instances in which the U.S. led unilateral or multilateral sanctions from 1976 to 2000; in all, this equates to 75 sanctions episodes imposed on 52 countries. Of these 52 countries I excluded the following: Cameroon, Grenada, Ivory Coast, Kampuchea (Cambodia), Niger, Serbia, Yugoslavia, and Zaire because of insufficient exchange rate data; North Korea because of insufficient economic data; Panama because it was pegged to the dollar from at least 1975 to 2000; Taiwan because of insufficient economic data; and the Union of Soviet Socialist Republics (USSR) because of the drastic territorial changes it underwent following the end of the Cold War to become present-day Russia. I collected economic data on the remaining 40 countries.

Dependent Variable

To test the relationship between foreign exchange rate and sanctions, I have gathered average yearly nominal exchange rate data on 40 countries from 1976 to 2000.[6] I evaluate nominal exchange rates per USD for each of the target countries using annual data from

[5] The HSE database does not include all instances where economic pressure has been used to further a foreign policy goal. As Hufbauer notes in *Economic Sanctions Reconsidered* (2007): "To focus our analysis on the use of sanctions to achieve foreign policy goals, we have taken care both to distinguish economic sanctions from other economic instruments and to separate foreign policy goals from other objectives of economic leverage… We define economic sanctions to mean the deliberate, government-inspired withdrawal, or threat of withdrawal, of customary trade or financial relations. "Customary" does not mean "contractual"; it simply means levels of trade and financial activity that would probably have occurred in the absence of sanctions. We do not systematically cover cases in which positive economic incentives (e.g., new aid or credits) are used to achieve foreign policy goals. However, when such incentives are closely paired with economic sanctions in a "carrot-and-stick" approach, they are covered in our case histories and analysis (note that "carrots" often take the form of lifting prior sanctions)."

[6] The year 1976 was chosen as the start date because of the availability of key economic data as well as the point at which the floating exchange rate system had taken full effect for major world currencies. By 1973 major currencies were unpegged from the dollar and were allowed to float, this marked the end of the Bretton Woods system. To read more on the history of the Bretton Woods system see Bordo (1993). The year 2000 was chosen as the end date because this is the last year that sanctions data was recorded in the HSE database.

the Global Financial Data (GFD) database. I use three types of exchange rate measures: the nominal exchange rate value per USD; the year-on-year percent change of the nominal exchange rate; and a volatility measure for the nominal exchange rate throughout each year. This volatility measure is calculated as follows:

$$ERv_{i,t} = STDEV\ [Log(ER_{i,t})-Log(ER_{i,t-1})]$$

where ERv is the exchange rate volatility for a certain country, STDEV is standard deviation, and ER is the average monthly value of a country's nominal exchange rate. The resulting value is the exchange rate volatility for a given year using the GFD database's monthly exchange rate values.

Independent Variables

The primary independent variable is the sanctions data obtained in the HSE database and for this I have created a variable for sanction types and sanction episodes. Target countries in the sample are under zero, one or two episodes of U.S. sanctions during any given year (but not during all 25 years); thus, when the U.S. has imposed five years of sanctions on country A from 1990 to 1994 and three years of sanctions from 1992 to 1994, country A's sanction episode value would be "2" for years 1992 through 1994. There are no instances where a target is under more than 2 separate U.S. sanction episodes during any year. I also create sanction type dummy variables to identify which types and combinations of sanctions have the most impact, if any, on exchange rate movements. These dummy variables indicate the following types of sanction for U.S. sanction episodes in the sample: financial, trade, and sanction threat..

Control Variables

The following variables are thought to have some explanatory power on the dependent variable, exchange rates, and the key independent variable, the imposition of sanctions on a target country. Relevant country financial indicators, including GDP, trade balance (using current account balance), foreign currency reserves (minus gold), and inflation rates, are gathered from the World Bank. U.S. decision makers are thought to be more apt to using sanctions against those countries that have relatively smaller economies than the United States; GDP has also been identified as a determinant of foreign exchange rate movement. In a similar light, a country's trade balance and foreign currency reserves are seen as determinants of sanctions imposition (even if marginally) as well as exchange rates. Inflation rates are associated more with exchange rate movements but are not believed to have as strong a relationship to the imposition of sanctions; I include inflation rate to have a more explanatory regression model. The GDP data is expressed in current USD on a yearly basis, the trade balance data is expressed as an annual percentage of GDP in current USD, a country's foreign currency reserves is defined as the total amount of reserves in current USD per year minus gold, and inflation rates are in percent values.

I also will use conflict data on inter-, intra-, and extra-state war, from the Correlates of War (COW) database. It is likely that U.S. decision makers are inclined to impose sanctions on a target before or during a military conflict; such was the case with Iraq and other countries where the policy goal was to prevent nuclear proliferation, terrorism, and military activity. Additionally, I posit that such military conflict is likely to have a negative impact on a country's economic condition, including its exchange rate. I create an indicator variable signifying what type of conflict a target country is currently engaged in. These types of wars fall within the following groups, as defined by the COW: wars between countries (inter-state), wars occurring

within a countries borders but not involving an additional country (intra-state), and wars between state and non-state groups outside the borders of the state (extra-state). In the case of inter-state wars that involve two target countries, each country will receive a "1" for the corresponding war type variable for each year they are involved in the conflict. Intra-state and extra-state wars that involve groups that originate from within a target country are not accounted for in the data; only those states that are involved in conflict will receive a "1" for each year they are involved in the war. Some wars begin and end then begin again a year or more after their initial ending; these wars are accounted for in the data. And finally, some countries are in engaged in multiple wars for a given year.

Table 1: Description of variables

Variable	Description	Source
Nominal Exchange Rate *(Variable Name: exrate, exrate_perdiff, exrate_vol)*	Nominal exchange rate, year/year percent difference of average annual nominal exchange rate, and yearly exchange rate volatility measure.	Global Financial Data (2013)
Sanction years *(sanction_episodes)*	The number of sanction episodes imposed on a target nation by the U.S.	Peterson Institute of International Economics (HSE Database 2007)
Sanction type *(sanction_fin, sanction_trade, sanction_threat)*	These are indicators variables that indicate the type of sanction or combination of sanctions imposed by the US on a target country.	Peterson Institute of International Economics (HSE Database 2007)
Current account balance *(tradebalance)*	The sum of net exports of goods, services, net income, and net current transfers. Data are annual and in current U.S. dollars. (World Bank).	World Bank (2013)
GDP per capita *(gdppercap)*	The gross domestic product per capita of a target country in USD on an annual basis. (World Bank).	World Bank (2013)
Total reserves minus gold *(total_reserve)*	Total reserves minus gold comprise special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities. Gold holdings are excluded. Data are annual and in current U.S. dollars. (World Bank)	World Bank (2013)
Inflation rate (inflation)	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. (World Bank)	World Bank (2013)
War Type (*war_type1, war_type2, war_type3, war_type4, war_type5*)	These are indicator variables that denote the type of war a target country is engaged in during a given year.	Correlates of War (version 4.0) (2010)

Method

This paper evaluates the relationship between sanctions and exchange rates. The hypotheses that I will be testing are:

H1: The imposition of sanctions is associated with changes in a target nation's exchange rate that are non-zero.

H2: Exchange rate volatility is greater during sanction episodes than when a target nation is not under sanctions.

H3: The imposition of comprehensive sanctions is associated with a more volatile exchange rate than singe sanction episodes.

The paper uses fixed effects regression with panel data for 40 countries over 25 years. This regression method allows me to control for country-fixed effects, such as characteristics that are similar amongst U.S.-sanctioned countries (as well as time-fixed effects), without explicitly including them within the model. Additionally, fixed effects regression allows me to identify country-specific effects by including in the model each target country as a dummy variable.

As discussed in the literature review, above, economic conditions are believed to contribute to exchange rate changes, although they have not yet been found to explain such movement in a statistically significant way. There are a number of economic indicators that may be correlated with the imposition of sanctions. The size of a target country's economy is a good example. Hufbauer argues that relatively big countries (when compared to the U.S. economy) are less likely to be sanctioned by the U.S. Thus, the regression model will generally be specified in the following manner, which includes the key independent variables and control variables along with time- and country-fixed effects:

Sanction Type model

$$\textbf{\textit{Exchange rate}}_{it} = \beta_1 * \textbf{\textit{sanction type}}_{it} + \beta_2 * \textbf{\textit{GDP}}_{it} + \beta_3 * \textbf{\textit{trade balance}}_{it} + \beta_4 * \textbf{\textit{foreign reserve}}_{it} + \beta_5 * \textbf{\textit{inflation rate}}_{it} + \beta_6 * \textbf{\textit{war type}}_{it} + \beta_7 * \textit{timedummies} + \boldsymbol{\alpha} + \mu$$

Sanction Episode model

$$\textbf{\textit{Exchange rate}}_{it} = \beta_1 * \textbf{\textit{sanction episodes}}_{it} + \beta_2 * \textbf{\textit{GDP}}_{it} + \beta_3 * \textbf{\textit{tradebalance}}_{it} + \beta_4 * \textbf{\textit{foreign reserve}}_{it} + \beta_5 * \textbf{\textit{inflation rate}}_{it} + \beta_6 * \textbf{\textit{war type}}_{it} + \beta_7 * \textit{timedummies} + \boldsymbol{\alpha} + \mu$$

The *exchange rate* variable is continuous and the estimators on each independent variable can be readily interpreted. To test sensitivity, I conduct two separate regressions that omit certain countries that are seen as outliers. A key assumption of the fixed effects regression method is that outliers are not included in the sample. Such outliers would exhibit exchange rate movements that are much more extreme than others. To illustrate, from 1989 to 1990 Iraq experienced the devaluing of its exchange rate vis-à-vis the USD by about 44,649 percent.

Descriptive Statistics

The data is composed of 40 countries over 25 years. The population that I am evaluating is the set of targeted countries that have sanctions imposed on them by the U.S. alone or by the U.S. along with another country or international organization. I am evaluating the percent changes on a year-on-year basis of targeted countries' nominal exchange rate due to the imposition of U.S. sanctions. Of the countries in the sample, the mean is 131.42 percent y/y change with a maximum of 46,449 percent (see table 2). The type of sanctions the U.S. imposes on these targeted nations often involves financial restrictions. Out of the 75 sanctions episodes in the sample, 59 included financial type sanctions. The average number of years targeted nations in this sample experience U.S. imposed sanctions is 0.445 with a maximum of two years,

which accounts for 7.2 percent of all sanction episodes in the sample. The average GDP per capita for the sample is $1,489.74. Many, but not all, of the targeted countries were involved in a military conflict between 1976 and 2000. The average amount of conflict (or war) years for this sample is 0.3 (meaning that the average country in the sample is engaged in at least one war about every three years), with the maximum amount of conflict years being three.

Table 2: Summary Statistics

Name	Source	Obs.	Mean	Standard Deviation	Min	Max
Dependent Variable						
Exchange rate *(average annual nominal value, local currency per USD)*	Global Financial Data (2013)	990	366.66	1537.38	3.89e-12	24970
Exchange rate *(percent y/y average annual, nominal local currency per USD)*	Global Financial Data (2013)	990	131.42	1540.32	-26.98	46449
Exchange rate *(volatility measured in standard deviations)*	Global Financial Data (2013)	990	0.035	0.154	0	1.747
Independent Variables						
Sanction episodes *(number in a given year per target country)*	HSE Database (2007)	1000	0.445	0.626	0	2
Sanction type	HSE Database (2007)	These dummy variables indicate each kind of sanction imposed on a target during a given year. See Table 1.				
Financial		1000	0.33	0.471	0	1
Trade		1000	0.246	0.431	0	1
Threat		1000	0.003	0.055	0	1
Control Variables						
Gross domestic product per capita *(annual, current USD)*	World Bank (2013)	863	1518.08	1706.70	120.94	12249.17
Total current reserves minus gold *(annual, current USD) (in millions)*	World Bank (2013)	923	4868.95	13614.35	0.59	168278
Current account balance *(percentage of GDP)*	World Bank (2013)	788	-3.45	7.19	-42.89	43.40
Inflation rate, consumer price (percent)	World Bank (2013)	822	95.52	574.27	-16.12	11749.64
War Type	Correlates of War (version 4.0)	These are indicator variables for each type of war a target is involved in during a given year.				
Inter		1000	0.053	0.224	0	1
Colonial		1000	0.015	0.122	0	1
Imperial		1000	0.124	0.330	0	1
Intra, civil		1000	0.069	0.254	0	1
Intra, local issues		1000	0.186	0.389	0	1

Source: Global Financial Data (2013). *The Global Financial Data database compiles data from a number of sources, such as the World Bank, the IMF, and central banks around the world, among other sources.*
Source: World Bank (2013). *This table contains various economic data on targeted nations during the period 1976 to 2000.*
Source: Correlates of War dataset version 4 (2010)

Regression Results

Exchange Rate Percent Difference

Table 3 reports the results of the fixed-effects cross-sectional regression estimations using the Stata command *xtregar* to reduce the effect of serial correlation.[7] I have included five different models[8] in the table: the first model is the fully specified base model including all control variables; the second model omits the war variables; the third model leaves only the dependent variable regressed on the independent variable; the fourth model shows the dependent variable regressed on sanction years; and the last model shows the impact of accounting for sanction threats on foreign exchange rate movements.

When controlling for economic and war variables, the effect of sanctions on foreign exchange rate movements is statistically insignificant. Conducting a second regression and omitting the war variables results in statistical significance, with 90 percent confidence, for the sanction variable. The financial and the interacted financial-trade term are significant and are associated with negative year/year changes in the nominal exchange rate. The magnitudes of the financial and interacted sanction estimators appear large; double or triple digit percentage point increases would be characterized as drastic movements in any country's currency, let alone a sanctioned country. The direction of the estimators is surprising; if accepted at face value, the model suggests that financial or comprehensive sanctions are associated with increases in the nominal exchange rate.

[7] I conducted a number of tests to evaluate the appropriateness of using fixed-effects regressions. First, I conducted a Breush-Pagan Lagrange multiplier (LM) test to determine whether random-effects or Ordinary Least Squares (OLS) regression was more appropriate. I was able to establish that the variances across the entities are non-zero and that a random-effects regression is more appropriate than OLS. To determine whether to use fixed- or random-effects I used the Hausman test. The result suggested that the estimators on the fixed-effects regression were not statistically different from the random-effect regression; thus, I have chosen to use fixed-effects.

[8] Autocorrelation is a common issue when evaluating the impact on economic variables, such as foreign exchange rates. I have conducted a test developed by Drukker (2003) to determine if the models in question exhibit an autoregressive nature.

When not controlling for economic or war variables, the sanction type is statistically insignificant. This is likely due to omitted variable bias. The first three models illustrate the impact of including variables that have explanatory power on the dependent and independent variables and including variables that are not correlated with either. Indeed, there appears to be no relationship between whether and what type of war a country is engaged in and its foreign exchange rate, at least in the way that I have specified in this model. It appears, however, that there is a strong relationship between the four economic variables (GDP per capita, inflation rate, total reserves, and trade balance) and foreign exchange rate movements (as well as the imposition of sanctions). Comparing models 2 and 3, both statistical significance and magnitude change considerably. I conclude that including economic variables and excluding war variables are important to reducing omitted variable bias and specifying the model more accurately.

I conducted an additional regression (model 4) to evaluate the quantitative, not qualitative, effect of sanctions on foreign exchange rates. The variable for sanction years includes instances where the United States simply threatened the imposition of sanctions on a target nation. Because of the war variables' lack of omitted variable bias effect, I only controlled for economic variables when regressing foreign exchange rate changes on sanction years. The result is a statistically significant (with 95 percent confidence) estimator for sanction years that has a direction that is similar to sanction type but a magnitude that is somewhat different. Since the data only contains instances in which a target experiences up to two sanction episodes in a given year, model 4 estimates that a country exposed to two sanctions on averages experiences a 112 percentage point increase in its foreign exchange rate, holding economic controls constant. Again, this is a surprising change in exchange rates, in magnitude and direction.

With the final model (5), I sought to evaluate the impact that including sanction threats might have. The answer appears to be very little, as the magnitude, direction, and statistical significance on the other variables, including the other sanction types, did not change dramatically. The threat of sanctions had occurred in only three instances and is statistically insignificant, when controlling for economic effects.

Table 3: The effect of sanctions on target countries' foreign exchange rates (percent change y/y)

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Sanction Type[9]					
Financial	-82.94 (51.49)	-86.58 (51.10)*	-24.04 (214.63)		-87.72 (51.11)*
Trade	23.46 (124.51)	-6.44 (116.85)	-46.40 (398.01)		-6.46 (116.75)
Financial*Trade	-67.75 (43.44)	-74.15 (42.31)*	20.07 (162.26)		-74.49 (42.28)*
Threat					-116.30 (149.72)
Sanction Episodes				-56.43 (26.67)**	
GDP per capita (log)	88.33 (47.35)*	77.53 (45.71)*		80.13 (46.72)*	78.20 (45.68)*
Total Foreign Reserves (log)	13.17 (18.49)	16.40 (18.02)		17.29 (18.46)	16.32 (18.02)
Trade Balance	9.17 (2.23)***	9.08 (2.22)***		9.03 (2.32)***	9.18 (2.23)***
Trade Balance (squared)	0.792 (0.106)***	0.795 (0.106)***		0.797 (0.106)***	0.795 (0.106)***
Inflation (log)	182.19 (12.53)***	180.71 (12.43)***		181.76 (12.49)***	181.00 (12.43)***
War Type					
Inter-state	51.63 (76.45)			48.86 (74.67)	
Colonial	42.66 (139.09)			52.13 (138.65)	
Imperial	-29.74 (139.97)			-20.06 (138.39)	
Civil war for intra-state control	-75.16 (122.56)			-63.39 (120.02)	
Civil war over local issues	7.08 (128.49)			-5.03 (126.69)	
Constant	-1296.82 (261.22)***	-1288.43 (255.98)***	132.58 (68.75)*	-1324.80 (261.62)***	-1291.08 (256.51)***
Observations	625	625	952	625	625
YEAR DUMMY[10]	No	No	No	No	Yes

*(Notes. ***p<0.01, **p<.05, *p<0.1; standard error in parentheses)*

[9] The three-way interaction between financial sanctions, trade sanctions, and sanctions threats yielded essentially a two-way interaction, since there were no instances where financial or trade sanctions also existed where there were sanctions threats. Thus, this table only shows one interaction (between financial and trade sanctions), when in fact a three-way interaction was conducted as in Model 5.

[10] Using the Stata 12 command *testparm*, I conducted a joint test of the year dummy variables to evaluate whether to include them or not. The resulting test showed that, with 95 percent confidence, the time fixed-effects were **not needed** since they are not jointly equal to zero. But they are jointly equal to zero with a 90 percent confidence. I include them here in Model 5 to illustrate sensitivity.

Exchange Rate Volatility

Table 4 presents the results of fixed effects regressions with robust standard errors of the exchange rate volatility measure regressed on the sanction and control variables. These regressions help to answer a similar question to that posed using exchange rate year/year changes. The exchange rate volatility measure that I use here, however, is thought to be a better measure of change and has been used by researchers to evaluate the effect of such volatility on trade and investment (Arize 2003, Amadou 2008).

The five regressions that I have noted in Table 4 are structured as in Table 3; the key difference is that the estimators signify standard deviations instead of percent changes. The key difference between the first regression (exchange rate percent changes) and this regression (exchange rate volatility) is that trade sanctions are statistically significant and have an expected direction of effect; that is, when target countries are under U.S. trade sanctions, their exchange rate becomes more volatile. Additionally, model 4 suggests that the number of sanctions (sanction episodes) is not statistically significant and suggests that the there is a difference in exchange rate volatility due to certain sanction types. It should be noted that the only control variable that is consistently statistically significant is the inflation measure; this could be an area for further improvement.

Table 4: The effect of sanctions on target countries' foreign exchange rates (volatility measure, standard deviation)

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Sanction Type[11]					
Financial	0.008 (0.033)	0.011 (0.036)	-0.008 (0.029)		0.011 (0.036)
Trade	0.025 (0.014)*	0.031 (0.015)**	-0.021 (0.028)		0.031 (0.015)**
Financial*Trade	-0.024 (0.014)*	-0.022 (0.014)	-0.009 (0.009)		-0.023 (0.014)
Threat					-0.048 (0.041)
Sanction Episodes				-0.013 (0.011)	
GDP per capita (log)	0.033 (0.020)	0.029 (0.019)		0.033 (0.019)*	0.029 (0.019)
Total Foreign Reserves (log)	0.002 (0.009)	0.002 (0.008)		0.002 (0.008)	0.002 (0.008)
Trade Balance	0.0001 (0.001)	0.0001 (0.001)		0.0001 (0.001)	0.0001 (0.001)
Trade Balance (squared)	-0.0001 (0.0001)	-0.0001 (0.0001)		-0.0001 (0.0001)	-0.0001 (0.0001)
Inflation (log)	0.033 (0.009)***	0.034 (0.009)***		0.034 (0.009)***	0.034 (0.009)***
War Type					
Inter-state	-0.009 (0.0113)			-0.018 (0.011)	
Colonial	0.009 (0.015)			0.013 (0.018)	
Imperial	0.033 (0.038)			0.042 (0.039)	
Civil war for intra-state control	-0.002 (0.015)			0.005 (0.014)	
Civil war over local issues	-0.009 (0.017)			-0.016 (0.016)	
Constant	-0.327 (0.213)	-0.309 (0.198)	0.039 (0.004)***	-0.323 (0.207)	-0.302 (-0.198)
Observations	659	659	990	659	659
YEAR DUMMY[12]	Yes	Yes	Yes	Yes	Yes

*(Notes. ***p<0.01, **p<.05, *p<0.1; standard error in parentheses)*

Nominal Exchange Rate

[11] The three-way interaction between financial sanctions, trade sanctions, and sanctions threats yielded essentially a two-way interaction, since there were no instances where financial or trade sanctions also existed where there were sanctions threats. Thus, this table only shows one interaction (between financial and trade sanctions), when in fact a three-way interaction was conducted as in Model 5.

[12] Using the Stata 12 command *testparm*, I conducted a joint test of the year dummy variables to evaluate whether to include them or not. The resulting test showed that, with 95 percent confidence, the time fixed-effects were **needed** since they are jointly equal to zero.

Table 5 reports the results of the fixed-effects cross-sectional regression estimations using the Stata command *xtregar, used* to reduce the effect of serial correlation due to nominal exchange rates. The results are spurious: no estimators on either of the sanctions variables are statistically significant except for sanction threats. In fact, there exists only three instances of sanctions threats in the sample and statistical significance could be merely coincidental. Additionally, the value of the estimator on the sanction threat variable seems very large. The direction of the estimator, however, appears in line with my conceptual framework; that is, when sanctions are imposed, a target country's exchange rate would be devalued.

Table 5: The effect of sanctions on target countries' foreign exchange rates (nominal value per USD)

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Sanction Type[13]					
Financial	-16.36 (177.97)	-17.04 (177.05)	-7.06 (118.49)		-14.95 (168.38)
Trade	-5.75 (504.54)	-6.68 (501.90)	-4.97 (276.45)		-7.17 (477.26)
Financial*Trade	-169.37 (167.37)	173.08 (164.61)	-88.47 (111.64)		-171.20 (156.56)
Threat					3148.83 (380.06)***
Sanction Episodes				-83.00 (101.36)	
GDP per capita (log)	-269.94 (183.52)	-272.52 (181.92)		-267.86 (183.19)	-285.77 (173.77)*
Total Foreign Reserves (log)	43.92 (67.51)	43.96 (66.91)		42.61 (67.25)	48.22 (63.76)
Trade Balance	8.89 (6.38)	8.91 (6.34)		8.82 (6.37)	8.02 (6.03)
Trade Balance (squared)	-0.025 (0.253)	-0.023 (0.252)		-0.024 (0.252)	-0.024 (0.239)
Inflation (log)	67.67 (46.17)	67.18 (45.83)		67.49 (46.11)	60.52 (43.60)
War Type					
Inter-state	4.07 (215.10)			-2.15 (214.40)	
Colonial	27.90 (448.86)			25.30 (447.90)	
Imperial	4.46 (423.32)			19.04 (421.97)	
Civil war for intra-state control	-48.69 (376.07)			-52.22 (375.45)	
Civil war over local issues	-10.83 (363.66)			-23.77 (362.56)	
Constant	1527.83 (1661.19)	1543.38 (1649.55)	651.47 (229.46)***	1541.66 (1656.66)	1537.02 (1575.41)
Observations	659	659	990	659	659
YEAR DUMMY[14]	No	No	No	No	No

*(Notes. ***p<0.01, **p<.05, *p<0.1; standard error in parentheses)*

[13] The three-way interaction between financial sanctions, trade sanctions, and sanctions threats yielded essentially a two-way interaction, since there were no instances where financial or trade sanctions also existed where there were sanctions threats. Thus, this table only shows one interaction (between financial and trade sanctions), when in fact a three-way interaction was conducted as in Model 5.

[14] Using the Stata 12 command *testparm*, I conducted a joint test of the year dummy variables to evaluate whether to include them or not. The resulting test showed that, with 95 percent confidence, the time fixed-effects were **not needed** since they are not jointly equal to zero.

Summary And Conclusions

This study of exchange rates and sanctions, if limited, builds on the body of knowledge of the effects of U.S.-imposed sanctions on target countries. Here, sanctions are associated with a positive and modestly statistically significant change in exchange rates in the long run, when controlling for various economic and war variables. This makes sense, as investors, foreign exchange speculators, and trade partners are likely to disinvest in a country where a large amount of economic uncertainty possibly begins to affect investment rate of return and profit margins. This analysis suggests that exchange rates of U.S.-targeted countries become modestly volatile when trade sanctions are imposed. When evaluated along with other sanctions research, especially those establishing a relationship between trade, investment, and sanctions, this paper on exchange rates begins to partially complete a picture of tangible economic effects caused by U.S.-imposed sanctions. Whether these effects are intended is inconsequential; economic sanctions appear to have at least some impact on a country's economic well-being in the short-run. This must be qualified by the type of sanctions one is evaluating; this paper aggregated all trade sanctions, for instance, regardless of the direction of trade or type of good. This analysis has a number of challenges, primarily due to the lack of granular data. There are other challenges occurring.

Firstly, there appears to be an omitted variable bias on the independent variable, sanction type. It may be the case that the magnitudes of the estimators on sanction type are too large and as a result they could be biased downward (in other words, more negative than in a fully specified model). Further, the range of foreign exchange rate percent differences in this sample is from -26.98 to 46449 percent, with an average of 131.89 percent. This illustrates that U.S.-targeted countries' nominal exchange rates tend to, but not always, rise (decrease in value) more

than fall (increase). An additional concern is the existence of outliers. The one country that accounts for the year-on-year change of 46449 percent is Iraq and Stata excludes this country when the regression is run because of missing data. There may be additional outliers that give us imprecise estimators that are not accounted for here.

Additionally, using *annual* data to evaluate exchange rate movements is challenging since the nature of foreign exchange rate movements is similar to that of the stock market; there tends to be an long-term trend upward but often that trend is characterized by short- to medium-term effects, causing it to fluctuate many times in a day, month, or quarter. Evaluating such changes over a year, instead of a month, tends to distort market reactions to events such as sanctions (perhaps the market absorbs or reacts to sanctions over a shorter period of time than an entire year). Additionally, investors, who very likely do not have full access to necessary information as events occur, could influence changes in foreign exchanges rates. For example, GDP and other lagging economic indicators are reported on a quarterly basis. It is likely that foreign exchange rates are set based on investors' evaluation of past economic performance. As a result, many of the variables included in the models here would be lagged in a shorter-term evaluation but because this paper evaluates rates on an annual basis it is likely that no such lag exists in the long-term. Also, evaluating exchange rate movements during the first and last years of a sanction episode shed light on how the market responds to certain types of sanctions. Furthermore, I would expect for exchange rates to be more volatile during such years of a sanction episode.

An area of encouragement is the functional forms of the economic variables and the overall specification of the model. In each of the models, many of the economic variables, especially the inflation rate measure, are consistently highly statistically significant and change

very little from model to model. On the other hand, it does not appear that war variables help to explain the relationship between foreign exchange rates and sanctions.

More work must be done to further find a causal relationship between various types of sanctions and exchange rates, and to explain the movements that sanctions place on exchange rates. A few case studies, when exposed to further research, could provide the needed detail that is missed when evaluating multiple countries over a long time span. For instance, the Iraq example, not withstanding two wars and an oppressive ruler, might help shed light on how sanctions play a part in a country's economic well being, to include its regional bi-lateral trade, foreign investment, and ability to manage its exchange rate (Oskarsson 2012). Iran could also be evaluated as a present-day case in which 33 years (from 1979 to 2012) of sanctions are thought to have a small effect on its economy (as well as the regime's decision making) until an organized international coalition imposed what many would characterize as broad-based, comprehensive sanctions and its currency took a drastic 50 percent decrease within a year (Gladstone 2013). In fact, this actual occurrence was the motivation for this study, but fully evaluating this was not feasible at the time of this paper because of a lack of good economic data, up-to-date sanctions data, and shorter time-period data. When, or if, such data is available, Iran represents a good example of U.S. policy makers' increasing use of an economic tool to solve a foreign policy dilemma.

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