Coups, Corporations, and Classified Information

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Abstract

We estimate the impact of top-secret coup authorizations on asset prices of partially nationalized multinational companies that stood to benefit from US backed coups. The average abnormal return to a coup authorization is 1.5% over 4 days, rising to more than 3% over thirteen days. Pre-coup authorizations account for a larger share of stock price increases than the actual coup events themselves. There is no effect in the case of the widely publicized, poorly executed Bay of Pigs invasion, consistent with abnormal returns to coup authorizations reflecting credible private information. We also introduce two new intuitive and easy to implement nonparametric tests that do not rely on asymptotic sample size approximations.

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1 Introduction

Covert operations conducted by intelligence agencies were a key component of superpower foreign policy during the Cold War. For the U.S., many of these operations had the express goal of replacing an "unfriendly" regime - often one that had expropriated U.S. corporate property - and were planned under extreme secrecy. Since corporate property was restored after succesful regime change, these operations were potentially profitable to nationalized companies. This paper shows that not only were U.S-supported coups valuable to partially nationalized multinationals, but that asset traders arbitraged supposedly "top-secret" information concerning plans to overthrow foreign governments.

Specifically, we estimate the effect of secret United States decisions to overthrow foreign governments on the stock market prices of companies that stood to benefit from regime change. Using official timelines reconstructed from CIA documents, we find statistically and economically significant effects on stock prices both from the regime change itself and from "top secret" authorizations. Besides testing for CIA information leaks, we interpret our results as providing an estimate of the value of the coups to potential corporate beneficiaries. Net total price rises from coup authorizations are three times larger in magnitude than price changes from the coups themselves. Total stock price increases from coup authorizations and the coups themselves range between 10% and 16%. We thus show that there were substantial economic incentives for firms to lobby for these operations. While we are unable to discern whether these influences were decisive for U.S. policymakers (versus, say, political ideology), we show that regime changes led to significant economic gains for corporations that stood to benefit from U.S. interventions in developing countries.

Our findings complement other evidence in empirical political economy that large, politically connected firms benefit from favorable political regimes (Faccio, 2006; Fisman, 2001; Jayachandran, 2006; Knight, 2006; Snowberg *et al.*, 2007). However, we show that firms benefit not only from publicly announced events but also from top-

secret events, suggesting information flows from covert operations into markets. Our results are consistent with recent papers that have used asset price data to show that companies can profit from conflict (DellaVigna and La Ferrara, 2007; Guidolin and La Ferrara, 2007). We also provide evidence that private information leaks into asset prices slowly over time. This is consistent with both private information theories of asset price determination (Allen *et al.*, 2006) and the empirical literature on insider trading (Meulbroek, 1992).

The theoretical literature on coups in economics has emphasized the role of domestic elites (Acemoglu and Robinson, 2006). However, anti-democratic political transitions have often been instigated, planned and even partially executed from abroad, most notably by the U.S. and the Soviet Union during the Cold War. Operating under the threat of nuclear war, direct conflict between the two superpowers was replaced by covert and proxy operations to install supporting regimes (Kinzer, 2006). According to Easterly *et al.* (2008), 24 country leaders were installed by the CIA and 16 by the KGB since the end of the Second World War.

Our paper also makes an econometric contribution to hypothesis testing in event studies. The structure of our event study allows us to improve on existing nonparametric tests. Nonparametric tests used in event studies do not use exact small sample distributions but rather tests with faster asymptotic convergence to a normal distribution (Campbell *et al.,* 1997; Corrado and Zivney, 1992). We introduce two new small sample tests that are valid without asymptotic approximations based upon the number of events.

Section 2 of this paper discusses the history of U.S. covert interventions, with backgrounds on each of the coups in our sample. Section 3 describes the data and our selection of companies and events. Section 4 outlines our estimation strategies and Section 5 reports our main results along with a number of robustness checks. Section 6 provides an interpretation of our main results; we decompose the total value of a coup to a multinational into public and private components. We also calibrate a simple asset pricing equation and back out the implied changes in the stock market's

assessments of the probability of a future coup. We conclude in section 7.

2 Background and History: The CIA

The Central Intelligence Agency was created in 1947 under the National Security Act of July 26. The act allowed for "functions and duties related to intelligence affecting the national security", in addition to intelligence gathering (Weiner, 2007). Initially, the scope of the CIA was relegated to intelligence, though a substantial and vocal group advocated for a more active role for the agency. This culminated in National Security Council Directive No. 4, which ordered the CIA to undertake covert actions against communism.

In the United States, covert operations designed to overthrow foreign governments were usually first approved by the director of the CIA and then subsequently by the President of the United States. A 1978 executive order described covert actions as "operations conducted abroad in support of national foreign policy objectives which are designed to further official United States programs and policies abroad and which are planned and executed so that the role of the United States government is not apparent or acknowledged publicly" (Johnson, 1989).

After Eisenhower's election in 1952, Allen Dulles was appointed director of the agency. Under Dulles, the CIA expanded its role to include planning and executing overthrows of foreign governments using military force. All but eight of the CIA operations in Table I, including 3 of the 4 studied in this paper, began during Dulles' reign as CIA director under the Eisenhower administration. Allen Dulles was supported by his brother, John Foster Dulles, who was the contemporaneous Secretary of State. The Dulles brothers together wielded substantial influence over American foreign policy from 1952 to 1960.

In 1974, partly due to public outcry over the U.S. involvement in the military coup in Chile, the Hughes-Ryan Act increased congressional oversight of CIA covert operations. In 1975, the U.S. legislature formed subcommittees to investigate American

covert action. Thus, the intensity and scope of U.S. covert actions fell substantially (Johnson, 1989). The height of covert CIA activity lasted slightly more than twenty years encompassing the period from 1952 to 1974.

Our sample of coups includes four such covert attempts. The first one occurred in Iran in August, 1953, when the CIA, joint with the UK MI6, engineered a toppling of Prime Minister Mohammed Mossadegh. Mossadegh had nationalized the oil fields and refinery at Abadan, which were the property of the Anglo-Iranian oil company, itself a partially nationally owned company of the UK government. In Guatemala, the CIA overthrow of Jacobo Arbenz Guzman in June, 1954 occurred after the Arbenz government had nationalized most of United Fruit's assets in Guatemala. In Cuba, the Castro government nationalized all US property in 1960, one year before the failed Bay of Pigs coup attempt in April, 1961. Finally, the Chilean nationalization of copper and other foreign owned assets began under the Frei government but proposed compensation was substantially lower after the Allende government came to power in late 1970. Allende was in office less than 3 years before he died in a coup on September 11, 1973. In appendix A, we provide a more detailed synopsis of each coup, focusing on the nature of the pre-coup regime, the motivations behind the expropriations, the American response, and the resolution of the coup.

The qualitative evidence suggesting links between the private and public sectors. Much of the CIA leadership was recruited from Wall Street. Additionally, at the time of the coup planning against Arbenz, three high ranking members of the executive branch of government had strong connections to the United Fruit Company. Alan Dulles, a former member of the board of directors of the United Fruit Company, was Director of the CIA. John Foster Dulles, who had worked for the United Fruit Company as an attorney while employed by the prominent Wall Street firm Sullivan and Cromwell, was Secretary of State. John Moors Cabot, who was Assistant Secretary of State for InterAmerican Affairs, was also the brother of the former President of the United Fruit Company. In the United Kingdom, in 1913, First Lord of the Admiralty Winston Churchill was the main force behind the partial nationalization of what later

came to be called the Anglo Iranian Oil Company. Winston Churchill was also the British Prime Minister who authorized the coup against Mossadeq. While ties of the government to private interests are suggestuve, we have no evidence on whether the source of trading was from within the public sector or the private sector.

3 Data

3.1 Coup Selection

We selected our sample of coups on the following basis: (1.) a coup timeline exists, either directly declassified from the CIA or constructed by secondary sources based on declassified original CIA documents, (2.) the coup contained secret planning events including at least one covert authorization of a coup attempt by a national intelligence agency and/or a head of state, and (3.) the coup authorization was against a government which nationalized property of at least one exposed multinational firm with publicly traded shares[1]. Table I shows a full list of covert CIA operations from Prados (2006). The highlighted operations are those that met our criteria, which limited us to 4 coup attempts. Operation Ajax in Iran in 1953 led to the overthrow of Muhammed Mossadegh. Operations PBFortune and PBSuccess in Guatemala in 1952 and 1954 respectively culminated in the overthrow Jacobo Arbenz Guzman. The US unsuccessfully attempted to overthrow the Fidel Castro government in Operation Zapata in 1961. Finally, Operation FU/Belt in Chile, which began in 1970 with a failed assassination attempt of Salvador Allende, contributed to Allende's overthrow in the 1973 coup.

[1]It turns out that the third criterion is redundant. All covert coups with available planning documents had at least one publicly listed multinational company with nationalized property.

3.2 Company Selection

We select our treatment companies based upon exposure to nationalization. We follow a four stage procedure. We first examine all the nationalizations in the timelines. If companies are mentioned by name, we include them. Second, we augment this list with lists of nationalized companies from Congressional testimony[2]. Third, we use only publicly listed companies. We obtain lists of publicly listed companies from CRSP for companies listed in US stock exchanges and from the New York Times for companies listed on foreign exchanges[3]. Lastly, we only include companies with accessible exposure data. We compute exposure as the value of assets in the foreign country divided by value of outstanding shares. We use data on value of expropriated nationalized assets where available and gross investments where not available.

We calculate asset exposures using a variety of sources. For Iran, there is only one company. We use compensation amounts reported in Bamberg (2000). For Guatemala, there is also only one company. We make use of asset holdings recorded in United Fruit shareholders reports from 1953 and 1954 and augment them with compensation amounts reported in Gliejses (1991). For Cuba, we use compensation claims reported Baklanoff (1975). For Chilean companies, we obtain expropriation amounts listed in Baklanoff (1975) together with estimates of investment compiled by NACLA (1975). Details are in Appendix B.

For each company, we collect a time series consisting of the closing price, a value weighted index of the New York Stock Exchange, and the three digit SIC industry code. We also extract the closing prices of all companies in the same three digit industry as the treatment company which were listed continuously starting three years before the nationalizing regime caem to power and ending with the coup.

[2]The US Congress held hearings on Chilean and Cuban nationalizations of assets held by US based multinationals in 1974.

[3]The Anglo-Iranian Oil Company is listed on the London Stock Exchange.

3.3 Event Selection

Our sources for events are declassified timelines written by official CIA historians or reconstructed directly from declassified CIA sources by official historians. A timeline for Operation Ajax in Iran was constructed by the New York Times on the basis of the internal CIA history of the Iran operation written by Wilber (1954)[4] and declassified in 2000[5]. In the case of Guatemala, William Cullather, an official CIA historian, himself did an internal timeline of the operation, which we used[6]. The Bay of Pigs timeline[7] comes from the National Security Archives, housed at George Washington University, which has filed virtually all of the Freedom of Information Act (declassification) requests regarding Cuba and the CIA. For FU/Belt in Chile, we use the timeline constructed by the Church Committee, which was a committee set up in 1975 by the US Senate to investigate foreign intelligence operations[8]. The Church Committee Report, which was recently declassified, includes a timeline of events based upon top-secret CIA documents for Chile.

We first extract all of the authorization events from the official timelines. These are restricted to events where either a coup was explicitly approved by the head of a government (the President of the United States or the Prime Minister of the United Kingdom) or the head of an intelligence agency (the CIA or MI6) or where US $1 million or more was allocated to the overthrow of a foreign government. Authorization events are coded as "good"(+1) or "bad"(-1) depending on whether they increase or decrease the likelihood of a coup. Our selection and coding of authorization events is presented in Table III.

We also extract public events from the official timelines for use as controls in some specifications. Public events are restricted to dates where company assets are nationalized or regime transitions and consolidations occur. The public events are coded as

[4] Available at http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB28/

[5] Available at http://www.nytimes.com/library/world/mideast/041600iran-cia-index.html

[6] Available at http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB4/

[7] Available at http://www.gwu.edu/~nsarchiv/bayofpigs/chron.html

[8] Available at http://foia.state.gov/Reports/ChurchReport.asp

"good"(+1) or "bad"(-1), where "good" events are those which are likely to increase the stock price and "bad" events are ones which are likely to cause a decline in the stock price[9]. The public events and their coding are listed in Table IV; Table V lists the dates of the regime changes themselves.

4 Methodology

Our main conjecture is that authorization events should result in an increase and deauthorizations a decrease in the stock price of the affected company over the days following the event. In contrast to public events, we expect stock price reactions to top-secret events to diffuse slowly. There are multiple reasons for slow and steady stock price reactions to private information. First, the information may itself slowly take time to diffuse. Second, there may be secondary trading or momentum; traders may update based upon previous price increases. Third, traders may be cautious and wait to see if other investors are trading on the private information (Allen *et al.,* 2006). For this reason we look at windows of different lengths around the authorization events. Our benchmark specification is a 4 day window starting at the event date.

In this paper, we employ two different estimation strategies. The first, which we call the "regression method," includes the contemporaneous market return as a control along with dummies for contemporaneous authorization events in a single specification where the dependent variable is the raw stock return. This is estimated using data from the period starting one year before the nationalizing regime comes to power. Our second approach, which we use later in the paper, is the event-study methodology originally developed by Fama, Fisher, Jensen and Roll (Campbell *et al.,* 1997; Fama *et al.*, 1969). We first estimate company covariances with the market. We then compute abnormal returns as the difference between actual returns and returns pre-

[9]The authorization events are coded as "good" or "bad" for the coup because we want to test whether what was good for the coup was good for the company. In contrast, the public controls are coded as "good" or "bad" for the company to control for events which could be correlated with stock price rises or falls.

dicted from estimated market covariances. Finally, we compute the mean cumulative abnormal return for a number of days following each event, and test to see if it is significantly different from 0. We refer to the second approach as the "out of sample method", referring to the fact that the abnormal returns around the events, and their standard errors, are calculated using a sample of stock market returns from before the authorization events. We also introduce two new small sample tests which we use in combination with the "out of sample" method.

4.1 Regression Method

For the regression method we estimate the following equation with OLS:

$$R_{ft} = \alpha_f + \beta_f R_{mt} + \gamma_k D_{ft}(k) + \epsilon_{ft} \tag{1}$$

R_{ft} is the one day raw stock return for firm f between date $t-1$ and date t, R_{mt} is the one day New York Stock Exchange index return between date $t-1$ and date t and $D_{ft}(k)$ is a k-day dummy variable which takes on a value of one on an authorization day and for the $k-1$ days following an authorization day. The average daily abnormal return over the k days after an event (inclusive) is γ_k. The cumulative abnormal return is $k{\gamma_k}$[10], the average abnormal return times the event window length. We consider values of k ranging from 1 to 16. The regressions are estimated using all days in what we call the "event sample." This sample consists of the time period starting exactly one year before the nationalizing regime comes to power until the day before the beginning of the coup. The standard error for the cumulative abnormal return is given by the standard error on the regression coefficient multiplied by the length of the window. Except where noted, our standard errors are clustered by day.

Our benchmark regressions weight observations by company asset exposure. First, we compute the total asset exposure of each company as the ratio of nationalized assets at the time of the coup to the average value of outstanding shares in the year

[10] Note that this is a standard approximation to $(1+\gamma_k)^k - 1$

prior to the nationalizing regime's rise to power. We describe the computation of the asset exposures in Appendix B. We then normalize asset exposure so that the weight given to each country is the same. We do this by weighting by relative exposure of each company within each country. For each country c, we compute total exposure across companies f:

$$e_c = \sum_f e_{fc}$$

The weight for company f in country c is then:

$$w_{fc} = \frac{e_{fc}}{e_c}$$

These weights account for several factors. First, the returns from authorization events for a particular company are likely to be proportional to the extent of their exposure– i.e, the ratio of expropriated value to total value of the company. Secondly, our population of interest is firms that were expropriated, thus weighting makes the sample more representative, adjusting both means and standard errors to reflect the importance of exposed firms. Thirdly, since the nature of each country's authorization events are different, we are weighting by exposure only within countries. This is similar to constructing a "country portfolio" of abnormal returns which is common in canonical event studies, and a method we employ when we utilize the "out of sample" method[11].

We also present a secondary set of unweighted regressions with the most exposed company in each country as our sample. We refer to this as the "Top Company" specification.

[11] We have also report country portfolio results in the robustness table, which we discuss in the next section of the paper.

4.2 Out of Sample Method

The out of sample method first estimates, for each company, a market model in an "estimation window" that is prior to any coup-related events. The coefficients from the regression are used to define abnormal returns around events days, and to estimate the standard error of the average abnormal returns for a set of events. In this section, we focus on our benchmark specification of four day returns. To purge our estimation window of potential contamination from forthcoming political change, our estimation window is one calendar year in length and begins 2 years before the nationalizing regime comes to power. We use the same estimation window for all events within a country.[12] For each firm, we estimate:

$$R_{ft} = \alpha_f + \beta_f R_{mt} + \epsilon_{ft} \tag{2}$$

Using the estimated coefficients α_f and $\beta_f$from (2), we calculate the abnormal returns around our authorization events as the difference between the actual and predicted returns for a given date:

$$\widehat{AR}_{ft} = R_{ft} - \hat{a}_f - \hat{\beta}_f R_{mt} \tag{3}$$

The four day cumulative abnormal return for an event at date t for company f is defined as:

$$\widehat{CAR}_{ft} = \sum_{\tau=t}^{t+3} \widehat{AR}_{f\tau}$$

For countries with multiple companies, we construct a country portfolio of abnormal returns. We denote as F_c the number of companies in country c. The cumulative

[12]The number of trading days differ in the estimation window. Chile has 235 days; Cuba has 250 days; Guatemala has 282 days; and Iran has 260 days. Guatemala has more trading days because the NYSE was open on Saturdays until September 29, 1952. Also since more trading holidays have been added over time, the number of trading days per year has decreased over time. Lastly, Anglo-Iranian traded on the London Stock Exchange during the period in question, which accounts for the lower number of trading days in comparison with Guatemala. We opted to use exactly one year for the estimation window rather than a fixed number of trading days. We experimented with both pre- and post event window data of various lengths, and the choice of estimation window does not impact our results.

abnormal return for an event is just the exposure-weighted sum of the cumulative abnormal returns (CARS) of the exoised companies in the country:

$$\widehat{CAR}_{ct} = \sum_{f=1}^{F_c} w_{fc} \widehat{CAR}_{ft}$$

We can now define the cumulative abnormal return for a country portfolio overall by averaging across events in country c. We define E_c as the set of events in country c and $|E_c|$ as the number of events in that country (i.e., the cardinality of the set).

$$\widehat{CAR}_c = \frac{1}{|E_c|} \sum_{t \in E_c} \widehat{CAR}_{ct}$$

Finally, we can compute the average cumulative abnormal return across a set C of countries. Defining $|C|$ as the number of countries in the set, the average CAR across countries and events, $\widehat{CAR}$ is defined as:

$$\widehat{CAR} = \frac{1}{|C|} \sum_{c \in C} \widehat{CAR}_c$$

Under the assumption that, conditional on the broad market return, individual company returns are independently distributed over time, the standard error for the cumulative abnormal return for an individual event at date t for firm f in country c is the estimated standard deviation from the estimation window multiplied by the square root of the length of the CAR period (i.e., 4 in our case):

$$\widehat{\sigma_{AR_{fct}}} \sqrt{4}$$

The standard error for the 4-day CAR of a country portfolio is given by:

$$\sum_{f=1}^{|F_c|} w_{fc} \widehat{\sigma_{AR_{fct}}} \sqrt{4}$$

Analagously, the standard error for the 4-day CAR for a set C of countries is:

$$\frac{\sum_{c \in C} \sum_{f=1}^{|F_c|} w_{fc} \widehat{\sigma_{AR_{fct}}} \sqrt{4}}{|C|}$$

4.3 Small Sample Distribution Tests

Inference using the standard errors from the previous section relies on asymptotic justifications which assume normality of the return distribution. However, distributions of returns are often non-normal. In small samples, this can distort test size. Instead of the canonical t-tests, common alternatives in finance include the nonparametric sign and rank tests (Corrado and Zivney, 1992). Both tests depend on the percentile of the cumulative abnormal return from an event, rather than the mean and thus perform better in the presence of non-normal error term distributions.

Guidolin and La Ferrara (2007) provides a more detailed summary of the sign and rank tests. The sign test assigns events +1 or -1 depending upon whether the cumulative abnormal returns after an event are above or below the median. The sign test divides the sum of the event signs by the estimated standard deviation of the sum from the estimation window. The resulting test statistic is asymptotically distributed according to a unit normal, but simulations have shown it to have faster small sample convergence properties to the normal in comparison with standard t-tests.

While the sign test is a definite improvement over t-tests in small samples, it still relies on asymptotic justifications. The small sample convergence properties of the sign test are only verified through simulations and thus the speed of convergence may depend upon the distribution of returns. However, our framework allows us to implement a test with correct size in small samples. When testing the impact of a single event on multiple companies, it is sensible to control for intra-day correlation

in returns across companies. When each event occurs on a completely different day, this is not necessary. Since we construct country portfolios, and all of our events therefore occur on different days, we do not need to take intra-day correlation in returns across companies into account. This allows us to construct small sample tests from the exact distribution of signs and ranks which do not depend on any asymptotic approximations to sample size.

4.3.1 Binomial Sign Test

We devise a test based upon the Binomial distribution to supplant the sign test. First, we generalize the sign test by considering not only the distribution of the number of events above the median estimation window return but the number of events above any given percentile p of estimation window returns. We define:

$$G_{ct}(p) = \begin{cases} = 1 & \text{if} \quad \widehat{CAR}_{ct} - CAR_c^p > 0 \\ = 0 & \text{if} \quad \widehat{CAR}_{ct} - CAR_c^p \leq 0 \end{cases}$$

where $\widehat{CAR}_{ct}$ is the 4-day return of country portfolio c starting at date t and CAR_c^p is the p^{th} percentile of 4-day abnormal return in the estimation window.

When events are distributed identically and independently of one another, the probability of observing at least m cumulative abnormal returns of k-day length above percentile p is given by: the Binomial Distribution:

$$1 - \sum_{i=m}^{M} \binom{M}{i} p^i \left(1-p\right)^{M-i} \tag{4}$$

where M is the total number of events. Without loss of generality, we assume that $p \geq .5$. Then, due to the symmetry of the Binomial distribution, the two-sided probability of getting m or more abnormal returns above the $1 - p^{th}$ percentile or below the p^{th}

percentile is given by

$$2\left(1-\sum_{i=m}^{M}\binom{M}{i}p^{i}\left(1-p\right)^{M-i}\right)$$

This is the p-value of the two-sided Binomial sign test.

When we perform this test using the formula above, we assume that we observe the true p^{th} percentile return of the underlying distribution. However, the p^{th} percentile return is estimated based on a finite (and variable) estimation window. Moreover, all event returns within a given country are estimated using the same estimation window returns, inducing correlation in estimated percentiles within countries. These factors may distort test size.[13] Therefore, we compute our p-values in two different ways. In addition to calculating the p-value analytically using equation (4), we also simulate our test statistic.

First we draw T_c returns and then $|E_c|$ additional returns from a uniform distribution, where $|T_c|$ is the estimation window sample size of four day returns for country c and $|E_c|$ is the number of events in the country as defined before. We use the uniform distribution because percentile is uniformly distributed independent of the underlying probability distribution as long as it is positive and finite over its domain.[14] We then estimate the percentile return for each of the additional $|E_c|$ relative to the T_c other draws. Next, we count $m_c(p)$, the number of event returns in country c above the p^{th} percentile of estimation window returns. We do this for all countries and then compute the average number of event returns above the p^{th} percentile:

$$\frac{\sum_{c\in C} m_c(p)}{M}$$

where M, the total number of events, is equal to $\sum_{c\in C}|E_c| = M$. We replicate this procedure 10,000 times, simulating the empirical distribution of the probability of observing at least m events higher than the estimated p^{th} percentile under the null

[13] The differing estimation window sizes come from the differences in number of trading days over time and between the U.S. and the U.K.

[14] The Binomial test can be shown to be independent of the distribution of the return draws. A proof of this is available from the authors upon request.

hypothesis.

4.3.2 Uniform Rank Test

The rank test assigns each event a rank based on its cumulative abnormal return relative to the cumulative abnormal returns in the firm's estimation window. The rank test uses more information than the sign test, in that it considers the full distribution of ranks of cumulative abnormal returns, and not just a count of how many ranks exceed a particular cutoff. Under the null hypothesis that return rank is identically and independently distributed across events, the rank test divides the mean rank for event abnormal returns by the standard deviation of the mean rank across countries over estimation windows. Again, this ratio is asymptotically unit normally distributed with rapid small sample convergence properties.

Parallel with the Binomial test developed above, we construct an analogue of the rank test exploiting the independence of events in our country portfolio sample to obtain exact inference. Following the standard rank test (Corrado, 1989; Campbell *et al.*, 1997), we rank each of our events relative to the distribution of abnormal returns in the estimation window. We then convert the rank into a percentile. Noting that, for i.i.d. variables, percentile is uniformly distributed, we compute the CDF for the sum of the percentiles of M independently and uniformly distributed random variables over the interval $[0, 1]$[15]. The probability, given M events, that the mean percentile is below m is given by (Mood, Graybill and Boes, 1974):

$$F_M(m) = \sum_{f=0}^{M} \left(\frac{(-1)^f \, (m-f)^M \mathbf{1}(m \geq f)}{f!(M-f)!} \right) \tag{5}$$

Without loss of generality, we assume that $m \geq .5$. Given symmetry of the cumulative distribution function, the p-value of getting a percentile rank greater than m or less

[15] This test was suggested, but not pursued, by Corrado, 1989.

than $1 - m$ is then

$$2\left(1 - \sum_{f=0}^{M}\left(\frac{(-1)^f (m-f)^M \mathbf{1}(m \geq f)}{f!(M-f)!}\right)\right)$$

We derive test statistics using the analytical equation from (5). However, similar to the Binomial sign test, the ranks are estimated using a finite, variable and common window for events within the same country, which may distort the size of the test. Therefore, we also simulate the distribution of average rank under the null to account for this potential bias. For each country, we draw T_c returns and then $|E_c|$ additional returns. The returns are drawn from a continuous uniform distribution[16] for each country. We compute the average ranks of the additional $|E_c|$ returns relative to the common (within country) T_c estimation sample returns. We repeat this 10,000 times to form the empirical distribution of the average rank under the null hypothesis, accounting for the common estimation sample within each country. We then use this simulated distribution to compute the p-values for our event ranks.

5 Results

5.1 Baseline Results

In Table VII, we report the cumulative abnormal returns for authorization events using window lengths ranging from 1 to 16 days. We use $(0, k-1)$ to denote the k-day window beginning with the day of the event. We find clear evidence that stock prices react positively to authorization events. Row 1 of Table VII shows that, in the weighted sample of all companies, the average four day stock price return for an authorization event is 1.5% with a standard error of 0.5%. For the all company sample, the cumulative abnormal returns are always significant at the 10% level for returns between 4 and 16 days after the event; usually they are significant at the 5%

[16] The Uniform Rank test can also be shown to be independent of the distribution of the return draws. A proof of this is available from the authors upon request.

or 1% level. The cumulative abnormal returns increase monotonically between days 4 and 16 after the event, with most of the gains occurring by day 13.This pattern is consistent with the hypothesis that private information is incorporated into asset prices with a delay. We then restrict attention to the most exposed ("top") company in each country, we get an average four-day stock price return of 1.89%, with a standard error of 0.6%, increasing to 3.7% after 16 days. Our top company sample has consistently higher estimated abnormal returns with higher levels of significance, unsurprisingly suggesting greater sensitivity to coup planning. For the top company sample, the cumulative abnormal returns are significant from four day through sixteen day at least at the 5% level of significance and often at a 1% level, depending upon the length of the window.

We next restrict attention to the set of three successful coups, where the corresponding estimates are consistently larger. Using exposure-weighted regression, we obtain a four day cumulative abnormal return of 2.0% with a standard error of 0.6%, increasing to 4.0% after 16 days. For the three country sample with the most exposed company in each successful coup, we find a four day cumulative abnormal return of 2.3% (with a standard error of 0.7%); this increases to 4.4% after 16 days.

Figure I provides graphical evidences on abnormal returns around an authorization event, with 95% confidence intervals shown. We compute cumulative abnormal returns using the weighted regression method aggregated across events for each of the 22 days following an event and each of the 22 days prior to an event. For the 22 days prior to the event, we aggregate backwards in time starting at the event date. Cumulative abnormal returns become significant at a 5% level on the 4th day after an event and generally remain significant until day 17. The rise over this period is monotonic with the exception of only two days. Moreover, the gains seem to be permanent, although not statistically distinguishable from 0 after 17 days. Going backwards in time from the event date, however, the cumulative abnormal returns show no trends and are never significant. We conclude that there is no pre-existing trend in the stock price prior to an event, suggesting that the CIA did not authorize coups in response

to drops in the value of connected companies.

We also break down our estimates separately by country. The effects for Iran and Guatemala are consistently the strongest. In both cases, the average cumulative abnormal return after four days is around 2.4% and significant at a 1% level of significance. The Chile estimates are smaller in magnitude, particularly when using the exposure-weighted full sample of companies, and with larger standard errors. However, the four day top company sample would be significant at the 5% level for Chile if the standard errors were as low as in Iran or Guatemala.

We do not find an effect within the Cuba subsample. There is no detectable change in the stock prices of affected companies following a decision to invade Cuba, whether made by the CIA or the President. This is true using either the exposure-weighted full sample of companies or just the most exposed company (American Sugar) sample. We suggest three possible reasons for the absence of an effect in Cuba: (1.) The decision remained top-secret. We find this to be an unlikely explanation given the large number of public blunders which were made related to and well before the invasion. (2.) Due to the high degree of public aggression from the United States towards Cuba, including numerous bombing missions, the coup was already commonly believed to be in planning and thus leaked top-secret authorizations were not "news" [17]. (3.)Traders widely believed that the coup would fail. Substantial errors in the Bay of Pigs planning and implementation may have made investors rightfully skeptical about the likely success of the operation.

5.2 Additional Specifications

We perform a number of additional specifications. All are estimated both in the pooled sample, the set of successful coups, and separately by country. We compute cumulative abnormal returns over a 4 day period following an authorization event. All specifications are estimated using the exposure-weighted regressions.

[17] "Kennedy reads the [NYT] story he exclaims that Castro doesn't need spies in the United States; all he has to do is read the newspaper" (Wyden, 1979)

5.2.1 Public Events and Media Coverage

Top-secret decisions to overthrow foreign governments may have coincided with publicly known events in the targeted countries. This could bias our estimates, reflecting the effect of public news rather than private information. We deal with this potential confound in several ways. First, we control for the number of articles in the NY Times mentioning the country by name, to capture whether these events were occurring at times with unusually high media attention. Second, we control for other public events; these are nationalizations of foreign owned property as well as electoral transitions and consolidations which are also listed in the declassified timelines. We list these dates in Table IV. Third, as a more stringent test, we restrict our sample to days with no NY Times articles written about that country (this is similar to the approach in Meulbroek, 1992). Since most days have at least one article mentioning any given one of our countries, we lose a large part of our sample in this specification. In a fourth specification, we restrict the sample to days with no public events. Lastly, we control simultaneously for both the incidence of public events and the number of NY Times articles.

Table VIII reports 4-day cumulative abnormal returns for the exposure-weighted sample of all companies. We find that controlling for public events and New York Times articles does not affect our results. The average aggregate effect for a 4-day period in the pooled sample is around 1.5% and significant at the 1% level, depending on the specification. This is true even when we restrict to days with no New York Times articles about the relevant country. When we restrict attention to the successful coups, the effect rises to between 1.9 and 2.0%. The coefficients are significant at the 1% level across all of the different public information specifications, except when we restrict attention to the small number of days without any NY Times stories. With two exceptions, our results by country are largely similar to those from the baseline specifications. The first exception is that the no New York Times mentions specification where the estimate for Chile rises to a significant 3.5% and Cuba rises to 0.8%, but remains insignificant. This is perhaps indicative that top-secret events had

a larger impact when they were surprising, i.e. not already anticipated and leaked by the press. The second exception is that there were no authorization days without New York Times mentions for the country of Iran. In fact, there were only 15 days in the entire $2\frac{1}{4}$ year event window for Iran without New York Times mentions.

5.2.2 Robustness

To show that the positive abnormal returns reflect significant changes in company-specific returns, we consider a number of robustness specifications.

First, we consider raw returns of the weighted, unadjusted by a market return, re-assuring us that our cumulative abnormal return effects are due to increases in the treatment company stock prices rather than drops in the market. Column 1 of Table IX shows a 4-day cumulative abnormal return of 1.71%, slightly higher than in our benchmark specification[18].

In the second column, we estimate our baseline specification on the full sample of companies, but omit the exposure-weighting. The resulting coefficient estimate is close to 0 and insignificant. This is consistent with our expectation that only the highly exposed companies react significantly to private coup-planning events.

Next, we use Newey-West standard errors to control for potential serial correlation in returns. The coefficient remains significant at the 5% level. Looking across samples, the standard error is slightly larger relative to our benchmark (the four day return from Table VII) in the Chile and Cuba subsamples, but smaller in Guatemala, Iran, and the set of successful coups[19].

We control for industry returns by first constructing an equal-weighted basket of returns for all companies in the same 3-digit industry as our treatment companies. We exclude the treatment companies themselves, and otherwise restrict the basket to

[18] We also ran unweighted specifications including an interaction between $D_{ft}(k)$ and the exposure w_{fc} which generates qualitatively similar results; the coefficient on the interaction term 0.007 and is significant at the 1% level. We omit the full set of results for space reasons.

[19] In a prior version of the paper, standard errors were clustered by month rather than by day. Our results were essentially identical to the benchmark.

companies which were listed in CRSP for the entire event window period for the treatment company in question. We then regress the returns of the treatment company on the company dummies interacted with NYSE index returns, the authorization events, and company dummies interacted with equal weighted industry index returns. The fourth column of Table IX shows the estimates from this specification; the effect is virtually identical, at 1.4%, and still significant at the 5% level.

One potential explanation for our findings is pre-existing market momentum. We include a dummy that is equal to 1 in a 20 day window around each authorization event. This specification tests whether the abnormal returns are higher in the 4 days right after an authorization than in the average of the 20 day period surrounding each authorization event. Column 5 of Table IX shows that the four-day abnormal return is 1.6% and is significant at the 5% level, slightly higher than in our benchmark. Pre-existing price trends do not explain our results.

We also consider two placebos, reported in the last two columns of Table IX. We regress NYSE index returns on our event dummies. We regress our equal-weighted baskets of industry returns on company-specific NYSE index returns and the authorization event dummies. The 4 day abnormal returns are small and insignificant in all of the samples except Cuba, both with the NYSE returns as the dependent variable and with the industry returns as the dependent variable. In the case of Cuba, the NYSE abnormal returns are significantly positive at the 5% level in the days following authorization events, while the industry return is significantly negative (at the 10% level), reinforcing the interpretation of the null Cuba effect as due to public leaks of information surrounding the Bay of Pigs planning.

5.3 Time-Shifted Placebos

As additional evidence that our effects are not an artifact of the data, we rerun our main specification on placebo dates. We take our 4 day cumulative abnormal returns and shift our authorization events forward as well as backward by 5, 10, 15, 20, 25,

30, 35, and 40 days. We also look at full year (258 trading days)[20] shifts forward and backward. For a k day shift, we estimate:

$$R_{ft} = \alpha_f + \beta_f R_{mt} + \gamma_k D_{ft+k} + \epsilon_{ft} \tag{6}$$

We exclude all days with other private events, public events, or that occur during the coup itself.

Figure 2 shows the results. Out of the 19 time-shifted regressions, γ_k is only significant for $k = 0$, our benchmark specification with cumulative abnormal return of 1.45% which is significant at the 1% level. The cumulative abnormal returns 5 days or 10 days before an authorization event are close to zero and insignificant.

The placebo estimates reinforce that our baseline estimates are not due to local serial correlation in returns. The pattern of no abnormal returns before a decision, sizeable abnormal returns just after a decision, and smaller possible abnormal returns in the medium run after a decision is consistent with our hypothesis of secret authorization events causing a slow increase in the stock price.

5.4 Coup Effects

We now estimate abnormal returns for coup attempts using exposure-weighted regressions. We do this for two reasons. First, we want to show that these companies were affected by the coup attempts themselves, confirming that companies were benefitting from the anticipated regime change. Second, we want to compare the direct effect of the coup itself to the total net rise due to pre-coup authorizations.

We look at three specifications: abnormal returns on the first day of the coup, abnormal returns on the first day of the new regime, and abnormal returns during the coup window. We define the coup window as the period between the first day of the

[20] Since shifting by one calendar year can lead to event dates getting shifted to the weekend, we shift by a fixed number of trading dates. We compute the average number of trading dates in a year over our sample. This is 258 days. We then shift our events dates both backward and forward by this amount.

coup (inclusive) to the first day of the new regime (inclusive). For Cuba, which was unsuccessful, the coup window is the duration of the Bay of Pigs operation, as given in the CIA timeline. These dates are listed in Table V.

Column 1 of Table X presents cumulative abnormal returns over the coup window for each country. We multiply the coup window cumulative abnormal return by -1 in the case of Cuba in order to make the pooled coup effect comparable across successful and unsuccessful coups. Note, however, that for the country specific results, we report the actual returns around the coup date for Cuba.) Our results are large and significant. Using the exposure-weighted full sample of companies, the average cumulative return across countries is 2.8% over the duration of the coup. The result is virtually identical at 2.7% when we restrict attention to the successful coups, reflecting the fact that negative cumulative abnormal return experienced by the Cuba-exposed companies during Bay of Pigs Operation is very similar to the positive cumulative abnormal return experienced by exposed companies experiencing successful coups. This contradicts the idea that the coup in Cuba was widely expected to fail and thus reinforces the idea that the null Cuba effect was due, at least in part, to the coup being commonly expected.

The individual country average abnormal returns vary from United Fruit in Guatemala which had zero rise on average during the coup window to companies in Chile which experienced an exposure-weighted 3.1% average increase in their stock prices. The Chilean companies' large increase was partially due to the fact that the coup happened quickly and was consolidated essentially immediately; this is different from our 3 other coups where it took longer for the overthrow to succeed or fail. Cuba's abnormal returns were negative because the coup failed. As mentioned above, this suggests that the possibility of a coup against the Castro regime in Cuba had already been priced into the stock of the exposed companies. Anglo-Iranian oil has a large increase over the coup window. It is 5.7% and significant at the 10% level. The insignificant, slightly negative estimate for Guatemala is perhaps due to the high degree of political uncertainty following the coup. When the Arbenz government finally

resigned on June 28, 1954, there was still speculation about whether the coup would be successful. Also, in the 11 days after the fall of the Arbenz regime, 5 separate juntas gained control of the government (Gleijeses, 1991).

The next two columns of Table X show two other measures of the effect of the coup: the abnormal return on the first trading day of the coup and the abnormal return on the first trading day of the new regime. Using the exposure-weighted sample of all companies, we get that the average annual abnormal return on the first day of the coup is 2.0%, while the average abnormal return on the first day of the new regime (last day of the coup) is 3.1%, both significant at the 1% level. In both Chile and Cuba, the returns are significant at the 1% level, though the returns from the (failed) coup in Cuba are negative. The abnormal returns on the first day following the coup attempt (whether or not it was successful) are large for all companies (in magnitude), with an average abnormal return of 3.2%, falling to 3.0% for the successful coups, as the companies exposed to Cuba experience a large drop of 3.7% on the last day of the Bay of Pigs Invasion. United Fruit and the companies exposed in Chile both experience a significant and greater than 3% increase on the last day, while Anglo-Iranian has an insignificant 2% cumulative abnormal return on the last day of the Iranian coup.

Overall, we take the evidence to show that there were clear increases in stock prices of exposed companies after successful coups, and reduction in the price after the failed coup in Cuba. However, the exact timing of the increase varied across countries, likely reflecting the particualr ways in which uncertainty about the success of these coups was resolved over time.

5.5 Out of Sample Results and Small Sample Tests

In Table XI, we present the 4 day CARs, and the associated standard errors, using this out-of-sample method. Similar to our regression method, inference using these conventional standard errors rely on asymptotic justifications. However, later panels

in Table XI provide inference based on non-parametric tests (the Binomial Sign Test and the Uniform Rank Test) that relax distributional and large sample assumptions.

The four day weighted CAR is 1.6%, slightly higher than in our benchmark specification and significant at the 1% level using conventional standard errors. When we restrict attention to successful coups, the four day return of 2.2% and is also significant at the 1% level.

The second panel of Table XI uses the Binomial Sign Test for statistical inference. First, out of our 14 events, 10 are above the median. The two-sided probability of having 10 events or more out of 14 above the median or 10 or more below the median is approximately 18.0%. The simulated probability, accounting for the estimated nature of the median return, is 19.9%. In the 3 countries with successful coups, 11 out of 14 are above the median which gives a p-value of 7.7%. Besides the median, however, it is also instructive to evaluate the probability of obtaining returns above other percentiles. In figure III, we show the p-values at different percentiles for both the full sample as well as the succesful coups sample. By the 60^{th} percentile, the number of unusually high returns in our results are significant at a 5% level of significance. By the 80th percentile, these numbers drop below a 1% level of significance. There are 6 returns out of 14 in the full sample, and 6 out of 11 in the succesful coups sample, that are above the 90^{th} percentile return. The associated two-sided probabilities for the 90^{th} percentile are 0.3% for the full sample and less than 0.1% in the succseful coups sample. There does not seem to be substantial reaction to about half of the events. However, when there are reactions, the reactions are very strong. This is consistent with leakages occurring following some authorization events leakages and not following others.

While the Binomial (Sign) Test provides the odds of obtaining returns above specific percentiles, it does not allow us to aggregate these results across percentiles. The Uniform Rank Test solves this problem by considering the average percentile rank of all the events, and doing inference based on this mean. The third panel of Table XI shows the results from the Uniform Rank test. Our mean percentile rank for

the four country sample is 0.70 and 0.77 for the succesful coups sample. Again, we provide both the analytical probability-values using the uniform distribution of ranks ignoring the estimated nature of the ranks, and simulated probability-values that take the estimated nature of ranks into account. The two sided p-value for the 4 country sample is 0.7%. For the successful coups sample, the p-values range from 0.001 to 0.002 depending on whether we use the analytical or the simulated method for computing p-values. Consistent with our findings using the regression method, the ranks associated with the four day returns from both Guatemala and Chile are significant at the 2% level and Guatemala at the 1% level.

Our small sample and non-parametric tests confirm that the significance of our results is not an artifact of asymptotic standard errors. Also, they show us that there were reactions to some events and not to others. However, when markets reacted to events, the reaction was strong and unmistakeable.

6 Interpretations

In the previous sections, we presented estimates of the average impact of coup authorizations on stock market returns. In this section, we interpret the estimated magnitudes in two ways. First, we compare the magnitude of the total percentage change in the stock price due to authorization events with the percentage change from the coup itself. Second, we fit a simple model of asset price determination with our estimated impact of coup authorizations and back out implied changes in prior market probabilities of the coup attributable to authorization events. The latter helps quantify the information content of possible leaked decisions to asset traders.

6.1 Decomposition

We use our estimates of authorization events and coup effects to calculate an overall value of the coup to our treatment companies. This incorporates both the changes in

the asset prices during the actual coup as well as due to authorization events. If we only look at the stock returns over the coup window, we ignore the capitalization of the coup probability already embedded in the stock price. Therefore, the change in the value of the company over the coup window is likely to be an underestimate of the value of the coup to the company. We compute the value of the coup to a company by multiplying one plus the returns to the authorization events and one plus the return to the coup. We use the country-specific 13 day cumulative abnormal returns in order to compute the value per authorization for each country. The longer window is used in order to capture the full asset price change due to a leaked authorization event. The total rise in the stock price due to authorizations is then just one plus the average return to an authorization event, raised to the power of the net number of events[21] multiplied by one plus the return on the first day of the new government:

$$(1 + R_{c,Auth})^M (1 + R_{Coup}) \tag{7}$$

where $R_{c,Auth}$ is the thirteen day[22] cumulative abnormal return in country c, M is the net number of authorization events, and R_{Coup} is the cumulative abnormal return in country c on the first day of the new regime. We use the return on the first day of the new government because, due to the length of the coup in Guatemala and the ensuing political instability after the end of the Arbenz regime, there is no net positive change in the stock price over the exact coup window. If we use either of the alternative two definitions of the effect of the coup, our estimates for the relative gain from authorization events are even greater.

The results are listed in Table XII. In the full country sample, the average total gain from authorizations is 9.4%, and the mean return on the first day of the post-coup regime is 3.2%. The majority of the gains from coups, 74.9% in the succesful coup

[21] In Guatemala, one of the events is a deauthorization or a negative event. Therefore, the total number of net events in Guatemala is the number of positive events, 3, minus the negative event, which results in 2 net events.

[22] We also tried decomposing the aggregated coup returns using 4-day returns as well as 7-day returns. Even using 4-day returns, net stock price changes from pre-coup authorizations were greater in magnitude than coup events themselves in all countries except for Cuba.

sample, occurred solely as returns to ex-ante authorization events. By country, the total gain from authorizations alone ranges from 7.0% in Guatemala to 13.4% in Iran. The return from the coup itself ranges from 2.1% in Iran to 3.7% in Guatemala. The total gain from the coup ranges from 11.0% for Cuba (note that this is the reduction in prices from a failed coup) to 16.0% in Iran. We find that the relative percentage benefit of the coup attributable to ex-ante authorization events ranges from 65.3% in Guatemala to 86.6% in Iran. In other words, estimating the benefit of the coup simply from looking at the change in the stock price during the coup window leads to a large underestimation of the value to the companies of the coup.

6.2 Model Simulations

6.2.1 Model Setup

Whereas the total abnormal returns from coup authorizations are larger than the total returns from the actual coup events, both may represent only a small fraction of coup-related stock price changes. This would be the case if publicly known events affecting the probability of a coup (as opposed to the classified events we consider) account for most of the stock price increases in the period leading up to the coup. In this section, we construct and calibrate a simple model to estimate how informative these classified authorization events were in terms of moving asset traders' priors on the probability of a coup. We model the determination of stock prices for firms with nationalized assets, and allow for a time varying probability of a coup. We then use this model in conjunction with asset price changes in response to authorization events to back out the implied changes in the market's subjective probability of a future coup from information leaks.

We assume that investors are risk-neutral, know the exact date of the coup, and share common beliefs at all times about the probability of a successful coup. We consider the asset price of a stock at date $-\tau$: τ days before the coup attempt. The date of the coup is normalized to date zero. At date j, the coup is believed to be successful

with probability p_j. The rate of time discount is β. At date $t_{-\tau}$, the dividend is $(1-\xi)\,d$ where d is the dividend and $\xi \in (0,1]$ is the fraction of the asset which has been nationalized. The dividend grows at rate γ per period. In the absence of asset expropriation, the firm issues dividends of $d\,(1+\gamma)^{t+\tau+1}$[23].

If the coup is successful, the expropriated asset gets restored forever. The dividend in period t if the coup is successful is then $d\,(1+\gamma)^{t+\tau+1}$. If the coup is unsuccessful then the dividend is just $(1-\xi)\,d\,(1+\gamma)^{t+\tau+1}$. Whether the coup is successful or unsuccessful, we assume that the effects are permanent. If the coup succeeds, the dividends are restored in perpetuity and if the coup fails, the dividends permanently remain at the expropriated level.

The value of the stock at date $-\tau$ then is the discounted sum of dividends before the coup plus the probability of a successful coup times the discounted sum of dividends given a successful coup from the coup date onwards plus one minus the probability of a successful coup multiplied by the discounted sum of dividends given an unsuccessful coup:

$$\begin{aligned} S_\tau &= (1-\xi)\sum_{t=-\tau}^{-1}\beta^{t+\tau+1}d\,(1+\gamma)^{t+\tau+1} + \\ &\quad p_{-\tau}\sum_{t=0}^{\infty}\beta^{t+\tau+1}d\,(1+\gamma)^{t+\tau+1} + (1-\xi)\,(1-p_{-\tau})\sum_{t=0}^{\infty}\beta^{t+\tau+1}d\,(1+\gamma)^{t+\tau+1} \end{aligned}$$

We can now derive an expression for the percentage change in the stock price:

$$\frac{S_{-\tau+1}-S_{-\tau}}{S_{-\tau}} = \frac{\xi\left[\beta\,(1+\gamma)\right]^{\tau-1}\left[p_{-\tau+1}-p_{-\tau}\beta\,(1+\gamma)\right]+\gamma}{1+p_{-\tau}\xi\left[\beta\,(1+\gamma)\right]^{\tau}} \tag{8}$$

Solving for the change in the probability of the coup between dates $-\tau$ and $-\tau+1$, we get:

$$p_{-\tau+1}-p_{-\tau} = \frac{1}{\xi\left[\beta\,(1+\gamma)\right]^{\tau-1}}\left[\frac{S_{-\tau+1}-S_{-\tau}}{S_{-\tau}}-\gamma\right]-p_{-\tau}[1-\beta\,(1+\gamma)\,(1+\Delta S)] \tag{9}$$

[23] The fact that the change in the imputed probability is larger when the date of the coup is farther in the future is a consequence of stationarity of the discounted dividend stream (i.e. $\beta\,(1+\gamma)<1$).

The intuition for this expression can be captured by the following approximation (which is exact when $\beta(1+\gamma)(1+\Delta S)=1$ or when $p_{-\tau}=0$):

$$p_{-\tau+1}-p_{-\tau}\approx\frac{1}{\xi\left[\beta(1+\gamma)\right]^{\tau-1}}\left[\frac{S_{-\tau+1}-S_{-\tau}}{S_{-\tau}}-\gamma\right] \tag{10}$$

The change in the probability of the coup can be backed out from the abnormal stock return which is given by the term in brackets: the difference between the stock price change and the normal rate of return. Therefore, from equation (10) , we can interpret the change in the probability of a coup as an exposure adjusted and discounted abnormal return. The full expression (9) is then the exposure adjusted and discounted abnormal return adjusted by the initial prior.

6.2.2 Numerical Evaluation

Table XIII presents numerical simulations of the model. We back out implicit changes in probabilities of a successful coup from an average authorization event for a company. We assume that $p_{-\tau}$ is close to zero[24]. $\frac{S_{-\tau+1}-S_{-\tau}}{S_{-\tau}}-\gamma$ is just the estimated abnormal return which we take from Table VII. For the sake of consistency, we choose the the estimated abnormal return over a thirteen day horizon. We compute $\tau-1$ as the average number of days before the coup for a private authorization event. Since both Chile and Guatemala had failed coup attempts prior to the eventually successful coup, we incorporate the days before the expected coup date in each event. We assume β to be 0.95 annually; however, since some of the events occur shortly before the coup, we do our computations in days rather than years and so we compute a daily equivalent for an annual β. γ is computed as the average daily rate of return for the market (New York stock exchange index return) in the estimation window. Finally, ξ is the exposure of a company, as defined in the data section and Appendix 2.

[24]This assumption does not have a large effect on our calibration. Note that if we assume that $p_{-]\tau}\approx 0\%$, then our simple formula holds. However, if we assume $p_{-\tau}\approx 100\%$, then imputed probabilites change by at most 4%.

For Chile, the imputed change in probability from a coup authorization is small, averaging at 3%. The implied average change in probability from an authorization/deauthorization in Guatemala is approximately 12%. For Iran, the change in the market probability is somewhat smaller at 7%. Guatemala's high imputed probability changes are due to the large cumulative abnormal returns after an authorization event, the short window between the authorizations and the coup, and the relatively low exposure. Chile's low returns are influenced by a high average distance to the coup date and a somewhat lower estimated abnormal return. Finally, with Cuba, even though the mean abnormal return is positive, the exposure is so high and the gap between authorization date and coup date so large that there is no noticeable impact on probabilities.

7 Conclusion

Covert operations organized and abetted by superpowers during the Cold War left lasting political and economic impacts in developing countries around the world. Given the secrecy surrounding their planning and execution, little is known about the domestic political economy of Cold War foreign interventions. This paper uses stock prices and declassified CIA documents to estimate not only the economic incidence of these clandestine regime changes, but also the access financial markets had to "top secret" foreknowledge of the operations.

We look at CIA-backed coups against governments which had nationalized foreign assets. Using an event-study methodology, we find that private information regarding coup authorizations and planning by the U.S. government increased the stock prices of expropriated multinationals that stood to benefit from the regime change. The presence of these abnormal returns suggests that not only were the coups profitable to the affected companies, but also that there were leaks of classified information to asset traders. Consistent with theories of asset price determination under private information, this information took some time to be fully reflected in the stock price.

We find that coup authorizations, on net, contributed three times more to stock price rises of highly exposed companies than the coup events themselves. These price changes reflect sizeable shifts in beliefs about the probability of coup occurrence. This suggests that most of the value of the coup to the affected companies had already been anticipated and incorporated into the asset price before the operation was undertaken.

Our results are robust across all successful coups, as well as to a variety of controls for alternate sources of information, including public events and newspaper articles. The anomalous result for Cuba suggests that the information leaks and inadequate organization that surrounded the ultimately failed coup attempt eroded the information value of coup authorizations. Our results are consistent with evidence in political science that business interests exert disproportionate influence on foreign policy (Jacobs and Page, 2005), as well as historical accounts which suggest that protecting foreign investments was a motivation for undertaking regime change (Kinzer, 2004). Our results also suggest that future theoretical work on non-democratic political transitions take foreign involvement and the interests of foreign constituencies seriously. Finally, whether or not economic factors were actually pivotal in the U.S. government's decision to covertly overthrow foreign governments remains a subject for further research.

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Appendix A: Historical Background on each Coup

Iran 1953

> "Anglo-Iranian Rises on News of Mossadegh's Fall" - August 20, 1953 New York Times Headline.

In 1951, Muhammed Mossadegh campaigned for prime minister on a platform of ending British ownership of Iranian oil. The Iranian parliament (the Majlis) had passed a measure supporting nationalization on March 25, 1951. Mossadegh was elected Prime Minister by the Majlis on April 28, 1951. His assumption of power on April 28 was followed quickly by a nationalization of Anglo-Iranian oil assets on May 1, 1951. Initially commanding a great deal of popular support, Mossadegh threatened the power of the Shah. The Shah dismissed Mossadegh on July 18th, 1952, only to reinstate him 5 days later after a barrage of popular protest. However, support for Mossadegh fell by the middle of 1953. The Truman administration had attempted to broker a deal between the British and the Iranian government. With the advent of the Eisenhower administration, however, the U.S. government's interests in overthrowing Mossadegh increased. In late 1952, the British MI6 found an ear receptive to the idea of overthrowing Mossadegh in Allen Dulles, and final coup plans were jointly approved by the CIA and MI6 on June 18, 1953.

Churchill approved the coup plan on July 1, 1953, with Eisenhower's endorsement following 10 days later. The United States and the United Kingdom spent hundreds of thousands of dollars on lobbying politicians and hiring crowds of demonstrators (Gasiorowski and Byrne, 2004). They also convinced the Shah to dismiss Mossadegh and assume power directly. On August 16th, the coup began, but failed owing to logistical and planning problems. However, anti-Mossadegh protests and violence over the next few days culminated in Mossadegh's overthrow on August 19, 1953.

Guatemala 1954

> "The overthrow of the Communist-dominated government of Guatemala, while causing a cessation of shipments from that country for period of about 3 weeks, was a decidedly favorable development which will have far-reaching effects in the future."- 1954 United Fruit Shareholder's Report

Guatemala has been historically marked by a high degree of political and economic inequality (Mahoney 2002, Dunkerley 1985). The center-left Arevalo regime that came to power in 1945, following the first free elections in the country, immediately provoked the anger of the coffee planters by striking down the most repressive of the labor regulations. The 1951 successor government, led by Jacobo Arbenz, had a policy platform centered around a comprehensive land reform and modernization plan. The leftist government thus threatened both the domestic coffee landlords as well as the United Fruit company, which owned over 40% of Guatemala's land, along with all the banana processing plants, virtually all of the shipping ports, and most of the railroads in the country (Gleijeses, 1991).

On June 17, 1952, the agrarian reform bill was passed, and redistribution began on August 7 of the same year. The land reform bill also encouraged peasant land occupations, which were violently suppressed by landowners. On December 12, 1952, workers at the Tiquisate plantation filed for 55,000 acres to be expropriated from United Fruit under the agrarian reform bill. United Fruit petitioned the Supreme Court, which demanded a stay on all land confiscation and redistribution. In response, the Arbenz-dominated congress voted to impeach the Supreme Court. On February 25, 1953, the Guatemalan government nationalized 234,000 more acres from United Fruit, and subsequently another 173,000 acres in the following year.

The United States foreign policy establishment, prodded by United Fruit's intense public relations and lobbying effort, reacted to the 1952 implementation of the Arbenz land reform as evidence that the country was becoming communist. Allen Dulles, then Deputy Director of the CIA, promoted the coup vigorously to Director of Central

Intelligence (DCI) Walter Bedell Smith and President Harry Truman (Schlesinger and Kinzer, 2005). On August 18, 1952, Operation PBFortune was approved by Bedell Smith, only to be halted on October 8, 1952, as potential leaks of the coup plot were discovered. However, with the advent of the Eisenhower government, Allen Dulles was promoted to DCI, and approved a new plan to overthrow Arbenz on December 9, 1953, and full approval was given by Eisenhower given on April 19th, 1954.

The coup was launched on June 19, 1954 when US-backed Castillo Armas and his force of 150 troops invaded Guatemala from Honduras. At first the coup was unsuccessful. After 9 days, on June 28, 1954, the Arbenz government capitulated (Immerman, 1983).

Cuba 1961

> "Stock prices, like bond prices, advanced at first in sympathy, and then declined with disagreement over the unsuccessful invasion attempt. For instance, on the big board, Cuban American Sugar, largely American owned, and with some diversification in this country, rose $4\frac{3}{8}$ points to $23\frac{3}{4}$, a new high for the year, but closed on Friday at $19\frac{3}{4}$." - April 23, 1961 New York Times article.

On January 1, 1959, the Cuban dictator, Fulgencio Batista, fled Cuba to the Dominican Republic. On January 3rd, the new government was set up and on January 8 of 1959, Fidel Castro's march through Havana signalled that the Cuban revolution was a *fait accompli*.

Following an initially lukewarm reaction from the United States, and a friendly U.S. tour by Castro in April of the same year, relations chilled quickly when Castro obtained 100 advisors from the USSR and expropriated all foreign (largely U.S.) landholdings in May, 1959. Covert plans to overthrow Castro began in the fall of 1959, modelled on the Guatemalan intervention and with many of the same CIA officers involved. On March 17, 1960, Eisenhower gave presidential approval to the CIA's plan,

and later authorized 13 million dollars towards the overthrow of the Castro regime. The date of the coup was set for August 19, 1960. The plan involved a small group of trained Cuban exiles who would invade, establish a beachhead, and draw support in the countryside, eventually deposing Castro. Publicly, the U.S. responded to the increased closeness of the Castro government with the Soviet Union by progressively increasing economic sanctions and diplomatically ostracizing the new Cuban government. In retaliation, the Cuban government nationalized U.S. held assets in Cuba starting on August 5, 1960, and continuing in October of the same year.

When Kennedy assumed power in January 1961, he authorized continuation of the CIA plan on January 30, 1961, after extensive deliberation with advisors. The Bay of Pigs invasion failed to overthrow the Cuban government, generating ample speculation as to why. Firstly, there were regular leaks of the plans to the press. The CIA had also falsely predicted a popular anti-Castro uprising following the invasion. In addition, the U.S. operation against Cuba was characterized by a large number of miscommunications and logistical errors (Gleijeses, 1995; Weiner, 2007; Prados, 2006), culminating in Kennedy's decision not to provide air support to the exile invasion force (Kornbluh, 1998; Vandenbroucke, 1984). After 3 days of fighting, the last of the invaders were captured by the Cuban military. Relations between Cuba and the United States further deteriorated, with the CIA conspiring regularly to assassinate Castro in the decades following the coup attempt.

Chile 1971-73

> "Anaconda was one of those on the plus side, rising $\frac{7}{8}$ to $22\frac{7}{8}$. Its strength was attributed partly to the revolt yesterday in Chile against the Marxist government, which, in 1971, expropriated the holdings of Anaconda and other U.S. companies.".- September 12, 1973 quote from the Wall Street Journal

The Allende government that narrowly won elections on September 4, 1970 had al-

ready overcome a long series of U.S. and domestic obstacles, beginning in 1958 with Allende's first run for president. Through the Alliance for Progress program, the United States had been heavily involved with Chilean domestic politics, trying to deflate the left-wing FRAP alliance (Sigmund, 1977) and more generally create a positive example of a free-market, democratic economy in Latin America. The Christian Democrats, backed by the U.S., handily won the 1964 municipal elections, as well as the 1965 senate elections. The September 4, 1970 elections were sufficiently close that Allende's ratification as president required a congressional vote on October 24, 1970, a fact that the first U.S. plan tried to exploit.

Copper was by far the most important industry in Chile. Within 2 months of assuming office, Allende had proposed nationalizing the mines, and on July 11, 1971, the Chilean legislature approved nationalization. While domestic pressure for "Chileanization" of the large copper mines was omnipresent, the Christian Democrats favored a majority shareholder stake for the government, together with generous compensation, and retention of both foreign management and rights of control. This was in contrast to the position of Allende's FRAP, which demanded outright nationalization and a much smaller compensation package. In particular, on September 28, 1971, the government declared that the copper multinationals had been making "excess profits" since 1946, and deducted this from the compensation package.

The U.S. began plotting for a coup even before Allende formally assumed power, with Nixon authorizing an anti-Allende plan on September 15, 1970. Coup planning and funding authorization after this was delegated to the 40 Committee, which was set up in the wake of the Bay of Pigs failure in order to operate as the mediating body between the upper eschelons of the executive branch of the US government and the CIA. The CIA and the State Department began two tracks in the fall of 1970; Track 1, which involved public political support for Allende's domestic opponents, and Track 2 which involved covert political operations against the government. Track 1 ended with Allende's ratification by the legislature, but "Track 2 never really ended"[25].

[25] CIA officer Tom Karamessines, cited in (Weiner, pg. 315).

On January 28, 1971, the 40 committee appropriated $1.2 million for the overthrow of the Allende regime. This was followed by an additional $1.4 million on October 26, 1972. Finally, on August 21, 1973, a few months after Allende managed to strengthen his electoral support in the March 4, 1973 municipal elections, the 40 committee allocated $1 million to overthrow Allende. While the true extent of CIA participation in the 1973 coup that deposed Allende is unknown, it is known that they supported and had knowledge of Pinochet's coup plan (Kornbluh, 2003). On September 11, 1973, the Allende government was toppled in a military coup.

Appendix B: Data Appendix on Company Exposures

In Appendix B, we compute exposure ratios of multinational corporate assets to nationalization by foreign governments. We use the value of outstanding shares in the estimation window as the value of the company. We also compute the value of exposed assets for each company which satisfies our selection criterion. In later years, compensation requests were made by companies to the US government. Where this data is available, we use it. In the case of Iran and Guatemala, we reconstruct asset exposures using available valuations of sub-assets held by the multinational in the country.

Iranian Companies (Anglo-Iranian Oil Company)

After the coup, the Anglo-Iranian Oil Company (AIOC) received 40% of Iran's oil assets; the rest went to a consortium of French and American companies. While we do not know exactly how much the oil assets are worth, we can calculate the expected compensation from what AIOC asked from the consortium. Bamberg (1982, pg. 501) writes that Fraser, the negotiator for AIOC vis-a-vis the British and American governments, asked for 530 million pounds directly from Iran together with 280 million

pounds from the consortium (for the AIOC assets that the consortium was getting), a total of 810 million pounds in compensation.

To compute the total value of the Anglo-Iranian Oil Company, we use 143.7 pounds sterling, the mean share price from January to May of 1950. Unfortunately, the New York Times historical records from "Bonds and Shares on the London Market" does not contain the number of shares outstanding. Nevertheless, we obtain annual share volumes from Howarth *et al.* (2007), which reports 20,137,500 shares outstanding for Anglo-Iranian from 1930 to 1953. Concomitant with the change to British Petroleum, the company split the stock by a factor of 5. This generates a market value of 2.89 billion pounds sterling.

Guatemalan Companies (United Fruit Company)

United Fruit experienced 3 episodes of land expropriation under Decree 900 of the Arbenz government. The first, in March 1953, was the only one for which compensation was formally demanded via the State department. United Fruit asked for "more than 15 million"[26], which Gleijeses found was 19.35 million, in compensation for roughly 234,000 acres[27] valued at \$83.3 each. The Guatemalan government instead offered \$610,000 in agrarian bonds, paying 3% interest over 25 years, which equals \$1.3 million in total. The total land owned by UFCO in Guatemala was 550,000 acres, including improved and unimproved lands. Assuming a constant per-acre valuation, we can calculate the value of all of United Fruits land, which we calculate to be \$550,000 $\times$ 83.3= \$45.8 million.

The other major asset of United Fruit in Guatemala was their ownership of railroads, which was also threatened by the Arbenz government, even though no railroads were nationalized. Part of the threat came from modernization projects (e.g. an Atlantic highway) that threatened the profitability of the railroad as a monopoly on long-distance transit. The 1954 shareholders report for United fruit lists that the total

[26] UFCO 1954 shareholders report

[27] FRUS:Foreign Relations, 1952-1954, vol. IV, pp. 1056-1057 (Document 13).

value of railways and tramways was US $29.5 million. United Fruit had 185.17 miles of railways in Guatemala, out of 1,486.31 miles total, and 43.78 miles of tramways out of 181.49 total. Thus, the fraction of their railways in Guatemala is 0.124, and the fraction of tramways is 0.241; the total combined rail and tramway fraction in Guatemala is 0.137. Assuming a constant value of rail and tram across countries, we get that the value of rail and tram assets in Guatemala is 29.5 million dollars. Putting these two pieces of information together, we get that the total exposure of United Fruit in Guatemala was US $45.8 million plus US $29.5 million, totalling $75.3 million dollars.

Chilean Companies

We calculate the exposure of the Chilean copper companies from Baklanoff (1975), who reports the amounts claimed by each of the copper companies. Baklanoff also reports the amount claimed by ITT (200 million), and the amount that had been insured under OPIC (92.5 million). For the other companies reported as nationalized, we use the NACLA "New Chile" book, which gives the value of investment in 1970 for most foreign companies and US parent percentage equity, to calculate exposure. The NACLA numbers are obtained from a variety of sources. NACLA lists both the business press (e.g. Forbes) and official Department of Commerce publications, among others. While the investment numbers may overstate the amount expropriated, the amounts are an order of magnitude smaller than the copper companies or ITT.

Cuban Companies

We obtain the value of expropriated assets from Baklanoff (1975), who provides a table of the top 10 claims filed by Cuban companies to Congress in 1972, obtained from Congressional records. In order to account for inflation, we calculate the mean inflation rate between 1959 and 1972, 3% from the BLS CPI-U index, and used it to calculate the value of the assets in 1959.

Table I
Coup Selection

Project	Country	Year	Planning Docs Declassified	Description	Coup	Exprop.
Ajax	Iran	1953	Yes	Coup against Mossadeq	Yes	Yes
FU/Belt	Chile	1970-73	Yes	Coup against Allende	Yes	Yes
Bloodstone	Germany	1946	No	Recruitment of Nazis	No	No
Brushfire	US	1955	Yes	Propaganda at Universities	No	No
Camelot	Chile	1960s	No	Funded Anthro. Research	No	NA
ST/Circus	Tibet	1955	No	Trained Tibetan Rebels	Yes	No
Democracy	Nicaragua	1985	No	Anti-Sandinista Operations	No	Yes
IA/Feature	Angola	1975	No	Supported Savimbi	No	Yes
Fiend	Albania	1949	No	Insurgency	Yes	No
Fortune/PB/Success	Guatemala	1952-54	Yes	Coup Against Arbenz	Yes	Yes
PM/Forget	All over	1950s	No	Pro-U.S. Media Distortion	No	NA
Haik	Indonesia	1956/57	No	Military Support for Rebels	Yes	Yes
HardNose	Vietnam	1965	No	Disrupt Viet Cong Supplies	No	No
Momentum	Laos	1959	No	Trained Hmong in Laos	No	No
Mongoose	Cuba	1961	Yes	Post-Bay of Pigs Operations	No	Yes
Opera	France	1951	No	Electoral Manipulations	No	No
Paper	China	1951	No	Invasion from Burma	No	No
Stole	N. Korea	1950/51	No	Sabotage	No	No
Tiger	Syria	1956	Yes	Assassination Attempts	No	No
Washtub	Guatemala	1954	Yes	Anti-Arbenz Propaganda	No	Yes
Wizard	Congo	1960	No	Lumumba Assassination	Yes	Yes
Zapata	Cuba	1960-61	Yes	Bay of Pigs	Yes	Yes

Notes: (1.) Project is the name of the operation, (2.) Country is the target country of the operation, (3.) Year is the year when the operation was carried out, (4.) Planning documents records yes if the planning documents are publicly available, (5.) Description is a description of the operation, (6.) Coup is recorded as yes if a coup was planned as part of the operation and no otherwise, and (7.) Exprop. refers to whether or not the regime nationalized (or expropriated) property from multinational firms operating within the country.

Table II
Company Selection

Company Name	Coup Country	Expropriation Description	Source	Exprop. Value	Total Value	Exposure Ratio
Anglo-Iranian Co.	Iran	Oil	Bamberg	810	2,607	0.310
United Fruit Co.	Guatemala	Land	Gleijses	75	441	0.147
American Sugar Refining Co.	Cuba	Land	Baklanoff	55	58	0.945
International Tel & Teleg.	Cuba	Tel./Radio	Baklanoff	89	540	0.165
Texas Co.	Cuba	Oil	Baklanoff	38	4,732	0.008
United Fruit Co.	Cuba	Land	Baklanoff	59	303	0.194
Anaconda Co.	Chile	Mines	Baklanoff	320	480	0.667
General Motors Corp.	Chile	Car Factory	Nacla	8.00	20,608	0.000
General Tire & Rubber Co.	Chile	Rubber Plant	Nacla	12.00	329	0.037
International Tel & Teleg.	Chile	Tel./Radio	Baklanoff	107	2,567	0.042
Kennecott Copper Corp.	Chile	Mines	Baklanoff	217	1,329	0.163

Notes I: (1.) Company name refers to the name of the company at the time of the coup, (2.) Coup country is the country where the coup or coup attempt was made, (3.) Expropriation description lists the types of assets expropriated, (4.) Source lists the source of information on the expropriations, (4.) Baklanoff, Bamburg, Gleijses, and Nacla are authors of books which list exporpropriations, (5.) Exprop. value list the nominal amount of the value of the expropriation in currency units of the estimation window year, (6.) All monetary values are expressed in US dollars with the exception of the Anglo Iranian Oil Company which is expressed in pounds, (6.) Total value lists the average stock price for the company in current currency units during the estimation window, (7.) Exposure ratio is the ratio of the value of expropriated assets to the total market value of the company.

Notes II: Many companies have changed their names. Anglo-Iranian is now called British Petroleum. The United Fruit Company is now called Chiquita Brands International. The Standard Oil Company of New Jersey is now called ExxonMobil. Texas Company is now called Texaco. International Telephone and Telegraph Corporation is now called ITT Corporation. American Sugar Refining Co. is now called Domino Foods, Inc.

Table III
Authorization Event Selection

Date	Country	Description	Good
June 18, 1953	Iran	CIA/British Intelligence Both Approve Coup	Y
July 1, 1953	Iran	British Prime Minister Approves Coup	Y
July 11, 1953	Iran	President Eisenhower Appoves Coup	Y
August 18, 1952	Guatemala	DCIA Approves PBFortune (Coup to Overthrow Arbenz)	Y
October 8, 1952	Guatemala	PBFortune Halted	N
December 9, 1953	Guatemala	DCIA Approves PBSuccess (Coup to Overthrow Arbenz)	Y
April 19, 1954	Guatemala	Full Approval Given to PBSuccess	Y
March 17, 1960	Cuba	Eisenhower Approves Plan to Overthrow Castro	Y
August 18, 1960	Cuba	Eisenhower Approves $13 Million to Overthrow Castro	Y
January 30, 1961	Cuba	Kennedy Authorizes Continuing Bay of Pigs Op	Y
September 15, 1970	Chile	Nixon Authorizes Anti-Allende Plan (Incl. Poss. Coup)	Y
January 28, 1971	Chile	40 Committee Appropriates $1.2 Million	Y
October 26, 1972	Chile	40 Committee Appropriates $1.4 Million	Y
August 21, 1973	Chile	40 Committee Appropriates $1 Million	Y

Notes: (1.) Date is the date of the event, (2.) Country is the target country of the coup attempt, (3.) Description gives a brief description of the event, (4.) Good is coded as Y if the event should raise the share value of the company and N if the event should lower the share value of the company.

Table IV
Public Event Selection

Date	Country	Description	Good
March 25, 1951	Iran	Iranian Parliament Backs Oil Nationalization	N
April 28, 1951	Iran	Prime Minister of Iran Quits and Mossadeq Elected	N
July 18, 1952	Iran	Ghavam Replaces Mossadeq as Prime Minister	Y
July 23, 1952	Iran	Mossadeq Comes Back As Prime Minister	N
August 4, 1953	Iran	Mossadeq Asks For Parliament to be Dissolved	N
November 11, 1950	Guatemala	Arbenz Elected	N
June 17, 1952	Guatemala	Arbenz Enacts Agrarian Reform Bill	N
August 7, 1952	Guatemala	Distribution of Land Under Agraian Reform Bill Begins	N
December 12, 1952	Guatemala	Workers File for Expropriation of 55,000 Acres From UF	N
February 5, 1953	Guatemala	Congress Impeaches Court to Fasten Reform	N
February 24, 1954	Guatemala	Guatemala Confiscates 234,000 Acres	N
January 1, 1959	Cuba	Castro Comes to Power in Cuban Revolution	N
August 5, 1960	Cuba	Cuba Nationalizes Electricity, Oil, Telephone, Sugar	N
October 12, 1960	Cuba	Cuba Nationalizes Sugar, Beer, Liquor, Soap	N
October 24, 1960	Cuba	Cuba Nationalizes 166 More Businesses	N
September 4, 1970	Chile	Allende Wins Election	N
October 24, 1970	Chile	Legislature Votes for Allende	N
December 21, 1970	Chile	Allende Proposes Mine Nationalization	N
July 11, 1971	Chile	Ammendment Allowing Nationalization of Copper	N
September 28, 1971	Chile	Excess Profits Subtracted From Nationalization Comp.	N
September 29, 1971	Chile	Chitelco (owned by ITT) Nationalized	N
May 12, 1972	Chile	ITT Expropriation Requested by Allende	N
March 4, 1973	Chile	Allende's Party Get 43% of Vote in Elections	N

Notes: (1.) Date is the date of the event, (2.) Country is the target country of the coup attempt, (3.) Description gives a brief description of the event, (4.) Good is coded as Y if the event should raise the share value of the company and N if the event should lower the share value of the company.

Table V
Coup Dates

	Date	Country	Successful
Begin	August 15, 1953	Iran	Yes
End	August 20, 1953		
Begin	June 19, 1954	Guatemala	Yes
End	June 28, 1954		
Begin	April 15, 1961	Cuba	No
End	April 20, 1961		
Begin	September 11, 1973	Chile	Yes
End	September 11, 1973		

Notes: (1.) Date lists the begin and end dates of coups, (2.) Country lists the country where the coup or coup attempt took place, (3.) Successful records whether or not the coup achieved its objectives in overthrowing the government in question.

Table VI
Summary Statistics

Country and Company		Variable								
Chile		Exposure	Abnormal Returns	Raw Returns	Market Returns	Industry Returns	Authoriz. Dummy	Public Dummy	NYT Counts	
Anaconda	Mean	0.6666	0.0008	0.0000	0.0001	0.0002	0.0256	0.0079	1.9857	N=1016
	Std-dev.	(0.0000)	(0.0195)	(0.0214)	(0.0076)	(0.0117)	(0.158)	(0.0694)	(1.7986)	
General Tire and Rubber Co.	Mean	0.0365	0.0001	0.0002	0.0001	0.0002	0.0256	0.0079	1.9857	N=1016
	Std-dev.	(0.0000)	(0.0161)	(0.0179)	(0.0076)	(0.0117)	(0.158)	(0.0694)	(1.7986)	
General Motors	Mean	0.0004	-0.0003	0.0000	0.0000	0.0002	0.0256	0.0079	1.9832	N=1015
	Std-dev.	(0.0000)	(0.0097)	(0.012)	(0.0075)	(0.0118)	(0.1581)	(0.0694)	(1.7977)	
Int. Telephone and Telegraph	Mean	0.0417	-0.0005	-0.0004	0.0001	0.0002	0.0246	0.0048	1.9867	N=1015
	Std-dev.	(0.0000)	(0.0153)	(0.0185)	(0.0076)	(0.0118)	(0.1551)	(0.0694)	(1.7992)	
Kennecott Copper Company	Mean	0.1633	0.0001	0.0000	0.0001	0.0002	0.0256	0.0079	1.9857	N=1016
	Std-dev.	(0.0000)	(0.0167)	(0.0189)	(0.0076)	(0.0117)	(0.158)	(0.0694)	(1.7986)	
Cuba										
American Sugar	Mean	0.9452	-0.0016	0.0004	0.0007	0.0001	0.0496	0.0048	4.7861	N=827
	Std-dev.	(0.0000)	(0.0161)	(0.0163)	(0.0057)	(0.0077)	(0.2172)	(0.0694)	(3.024)	
Int. Telephone and Telegraph	Mean	0.1649	0.0006	0.0018	0.0007	0.0001	0.0496	0.0079	4.7799	N=827
	Std-dev.	(0.0000)	(0.0151)	(0.0172)	(0.0057)	(0.0077)	(0.2172)	(0.0694)	(3.0116)	
Texas Company (Texaco)	Mean	0.0081	-0.0007	0.0007	0.0007	0.0001	0.0495	0.0048	4.7892	N=829
	Std-dev.	(0.0000)	(0.011)	(0.0125)	(0.0057)	(0.0077)	(0.217)	(0.0694)	(3.0207)	
United Fruit	Mean	0.1941	-0.0013	-0.0005	0.0007	0.0001	0.0495	0.0048	4.794	N=828
	Std-dev.	(0.0000)	(0.0176)	(0.0181)	(0.0057)	(0.0077)	(0.2171)	(0.0694)	(3.0196)	
Guatemala										
United Fruit	Mean	0.1475	0.0007	0.0000	0.0004	0.0004	0.0178	0.00486	1.3925	N=1234
	Std-dev.	(0.0000)	(0.0106)	(0.0116)	(0.0058)	(0.0131)	(0.0696)	(0.5044)	(1.534)	
Iran										
Anglo-Iranian Oil Company	Mean	0.3103	-0.0099	0.0003	0.0003	0.0009	0.0084	0.0012	4.2235	N=834
	Std-dev.	(0.0000)	(0.0169)	(0.0161)	(0.0063)	(0.0099)	(0.0913)	(0.0600)	(2.4518)	

Notes: (1.) Summary statistics by country and company are shown over the event window, (2.) N gives the number of observations for the majority of listed variables for a given company in a given country; in some cases, particular variables are missing for a few days for a given company/country, (3.) Exposure is the ratio of nationalized to total assets for the company/country, (4.) Abnormal returns are at the daily level, are computed in an out of sample window, and are corrected for the NYSE index, (5.) Raw returns are at the daily level, (6.) Market returns are daily averages of the returns on the NYSE index, (7.) Industry returns are daily returns for an equal weighted basket of returns for other firms in the company's 3 digit industry, (8.) Authorization and public dummies are variables which take on the value 1 for coup authorizations and -1 for coup deauthorizations, (9.) Public dummies are variables which take on a value -1 for nationalizations and political transitions/consolidations which benefit the companies and 1 for ones which hurt the companies, (10.) NYT Counts are daily counts of a country's mentions in the New York Times.

Table VII
Main Effects - Cumulative Abnormal Returns

		(0,0)	(0,3)	(0,6)	(0,9)	(0,12)	(0,15)
All Coups	Weighted Regression	0.0019	0.0145	0.0163	0.0240	0.0304	0.0325
		(0.0019)	(0.0053)***	(0.0085)*	(0.0105)**	(0.0109)***	(0.0145)**
		N=10426	N=10426	N=10426	N=10426	N=10426	N=10426
	Top Company	0.0026	0.0189	0.0213	0.0276	0.0333	0.0369
		(0.0023)	(0.0060)***	(0.0094)**	(0.0117)**	(0.0119)***	(0.0160)**
		N=3886	N=3886	N=3886	N=3886	N=3886	N=3886
Successful Coups	Weighted Regression	0.0022	0.0195	0.0208	0.0253	0.0322	0.0398
		(0.0024)	(0.0063)***	(0.0094)**	(0.0119)**	(0.0120)***	(0.0163)**
		N=7118	N=7118	N=7118	N=7118	N=7118	N=7118
	Top Company	0.0027	0.0228	0.0249	0.0282	0.0354	0.0443
		(0.0026)	(0.0069)***	(0.0101)**	(0.0130)**	(0.0129)***	(0.0175)**
		N=3059	N=3059	N=3059	N=3059	N=3059	N=3059
Chile	Weighted Regression	-0.0039	0.0103	0.0013	0.0149	0.0189	0.0142
		(0.0032)	(0.0144)	(0.0190)	(0.0265)	(0.0278)	(0.0334)
		N=5075	N=5075	N=5075	N=5075	N=5075	N=5075
	Top Company	-0.0045	0.0183	0.0085	0.0213	0.0263	0.0236
		(0.0051)	(0.0197)	(0.0252)	(0.0354)	(0.0370)	(0.0438)
		N=1016	N=1016	N=1016	N=1016	N=1016	N=1016
Cuba	Weighted Regression	0.0010	-0.0038	-0.0002	0.0189	0.0229	0.0014
		(0.0027)	(0.0071)	(0.0192)	(0.0225)	(0.0257)	(0.0316)
		N=3308	N=3308	N=3308	N=3308	N=3308	N=3308
	Top Company	0.002	0.0008	0.0043	0.0248	0.0224	-0.0035
		(0.0044)	(0.0090)	(0.0243)	(0.0265)	(0.0316)	(0.0398)
		N=827	N=827	N=827	N=827	N=827	N=827
Guatemala	Both Samples	0.0074	0.0255	0.0324	0.0240	0.0345	0.0339
		(0.0030)**	(0.0081)***	(0.0132)**	(0.0167)	(0.0188)*	(0.0244)
		N=1234	N=1234	N=1234	N=1234	N=1234	N=1234
Iran	Both Samples	0.0035	0.0236	0.0307	0.0398	0.0427	0.0661
		(0.0034)	(0.0064)***	(0.0140)**	(0.0147)***	(0.0133)***	(0.0271)**
		N=809	N=809	N=809	N=809	N=809	N=809

Notes: (1.) All multi-country regressions control for an interaction of a companyXcountry dummy with the NYSE, (2.) Single country regressions control for an interaction of a company dummy with the NYSE, (3.) All dates where a company changed its name or changed its outstanding shares by more than 5% were dropped, (4.) Weighted regressions weight asset exposure, (5.) Top company specification restricts the sample to the most exposed company in each country, (6.) Successful coups excludes Cuba, (7.) Column numbers at the top in parentheses denote the number of days before and after the authorizations which are included as part of the dummy variable for the authorization event, e.g., (0,3) refers to the return between the event date and three days after the event date, (8.) Robust standard errors clustered on date reported in parentheses, (9.) Statistical significance at 10%, 5% and 1% levels is denoted by *,**, and *** respectively.

Table VIII
Public Information Controls

	Public Info	NY Times	No NY Times	No Public Info	Public and NY Times
All Coups	0.0145	0.0148	0.0152	0.0146	0.0148
	(0.0053)***	(0.0053)***	(0.0077)**	(0.0054)***	(0.0053)***
	N=10426	N=10128	N=1586	N=10361	N=10128
Successful Coups	0.0195	0.0197	0.0193	0.0196	0.0197
	(0.0063)***	(0.0063)***	(0.0104)*	(0.0063)***	(0.0063)***
	N=7118	N=7003	N=1422	N=7069	N=7003
Chile	0.0103	0.0098	0.0346	0.0101	0.0095
	(0.0144)	(0.0145)	(0.0142)**	(0.0144)	(0.0145)
	N=5075	N=5000	N=1010	N=5035	N=5000
Cuba	-0.0038	-0.0031	0.0084	-0.004	-0.0032
	(0.0071)	(0.0069)	(0.0105)	(0.0071)	(0.007)
	N=3308	N=3125	N=164	N=3292	N=3125
Guatemala	0.0255	0.0259	0.0118	0.0255	0.0259
	(0.0081)***	(0.0081)***	(0.0122)	(0.008)***	(0.0081)***
	N=1234	N=1223	N=396	N=1228	N=1223
Iran	0.0236	0.0231	X	0.0241	0.0232
	(0.0064)***	(0.0066)***	X	(0.0064)***	(0.0066)***
	N=809	N=780	N=16	N=806	N=780

Notes: (1.) All multi-country regressions control for an interaction of a companyXcountry dummy with the NYSE, (2.) Single country regressions control for an interaction of a company dummy with the NYSE, (3.) All dates where a company changed its name or changed its outstanding shares by more than 5% were dropped, (4.) All regressions weight by asset exposure, (5.) Top company restricts the sample to the most exposed company in each country, (6.) Successful coups excludes Cuba, (7.) Public info regressions control for a four day dummy variable for time periods starting with public information days.

(8.) NY Times regressions control for number of NY Times articles mentioning the country on that day, (9.) No Public Info and No NY Times regressions drop all observations with a positive public information dummy, or days with NY Times articles mentioning the country, respectively, (10.) Iran only had 16 days with no mentions in the NYTimes, none of which fell on authorization days, (11.) Public and NY Times regressions control for tthe public information dummy and the number of NY Times articles. (12.) Robust standard errors clustered on date reported in parentheses, (13.) Statistical significance at 10%, 5% and 1% levels is denoted by *,**, and *** respectively.

Table IX
Robustness

	Raw Returns	Country Portfolios	Unweighted	Newey-West	Industry Controls	Trend Controls	Market Placebo	Industry Placebo
All Coups	0.0171	0.0146	0.0022	0.0145	0.0136	0.0157	0.0033	0.0005
	(0.0065)***	(0.0054)***	(0.0036)	(0.0062)**	(0.0054)**	(0.0066)**	(0.0026)	(0.0048)
	N=10451	N=3882	N=10426	N=10426	N=10426	N=10426	N=10426	N=10426
Successful	0.0210	0.0195	0.0056	0.0195	0.0189	0.0197	0.0015	0.0062
Coups	(0.0079)***	(0.0063)***	(0.0045)	(0.0069)***	(0.0064)***	(0.0077)**	(0.0030)	(0.0054)
	N=7143	N=3056	N=7118	N=7118	N=7118	N=7118	N=7118	N=7118
Chile	0.0187	0.0104	-0.0012	0.0103	0.0085	0.0124	0.0071	0.0082
	(0.019)	(0.0144)	(0.0055)	(0.0173)	(0.0146)	(0.0168)	(0.0065)	(0.0079)
	N=5075	N=1013	N=5075	N=5075	N=5075	N=5075	N=5075	N=5075
Cuba	0.0029	-0.0038	-0.0054	-0.0038	-0.0060	0.0005	0.0097	-0.0053
	(0.0083)	(0.0071)	(0.0054)	(0.01)	(0.0073)	(0.0110)	(0.0048)**	(0.0030)*
	N=3308	N=826	N=3308	N=3308	N=3308	N=3308	N=3308	N=3308
Guatemala	0.0206	0.0255	0.0255	0.0255	0.0255	0.0277	-0.0055	-0.0004
	(0.0093)**	(0.0081)***	(0.0081)***	(0.0064)***	(0.0081)***	(0.0093)***	(0.0034)	(0.0112)
	N=1234	N=1234	N=1234	N=1234	N=1234	N=1234	N=1234	N=1234
Iran	0.0243	0.0236	0.0236	0.0236	0.0236	0.0138	0.0040	0.0006
	(0.0063)***	(0.0064)***	(0.0064)***	(0.0033)***	(0.0064)***	(0.0097)	(0.0046)	(0.0045)
	N=834	N=809	N=809	N=809	N=809	N=809	N=809	N=809

Notes: (1.) Estimates are on (0,3) returns, (2.) Except for the raw returns specifications, regressions control for an interaction of a companyXcountry dummy with the NYSE, (3.) Except for the unweighted specifications, observations are weighted by the ratio of nationalized firm assets to total firm assets, (4.) Dates where a company changed its name or changed its outstanding shares by more than 5% were dropped, (5.) Raw returns do not control for the NYSE, (6.) Unweighted regression runs the benchmark regression without weighting (7.) Country Portfolios report regressions using returns of exposure-weighted country portfolios, (8.) Newey-West report Newey-West standard errors, (9.) Industry controls control for 3-digit industry returns, (10.) Trend controls control for trends by creating an additional dummy in an 20 day symmetric window around each authorization date, (11.) NYSE and Industry Placebos replace company returns with the NYSE index and the industry index respectively. (12.) Robust standard errors clustered on date reported in parentheses, (13.) Statistical significance at 10%, 5% and 1% levels is denoted by *,**, and *** respectively.

Table X
Coup Effect

	Coup Window	First Day of Coup	First Day of New Govt.
All Coups	0.0279	0.0200	0.0315
	(0.0091)***	(0.0047)***	(0.0047)***
	N=10457	N=10437	N=10443
Successful Coups	0.0274	0.0156	0.0297
	(0.011)**	(0.0057)***	(0.0057)***
	N=7133	N=7125	N=7127
Chile	0.0313	0.0313	0.0313
	(0.0084)***	(0.0084)***	(0.0084)***
	N=5080	N=5080	N=5080
Cuba	-0.0295	-0.0331	-0.0368
	(0.0163)*	(0.0081)***	(0.0081)***
	N=3324	N=3312	N=3316
Guatemala	-0.0058	-0.001	0.0373
	(0.0257)	(0.0104)	(0.0104)***
	N=1240	N=1235	N=1236
Iran	0.0566	0.0167	0.0206
	(0.0325)*	(0.0162)	(0.0162)
	N=813	N=810	N=811

Notes: (1.) All multi-country regressions control for an interaction of a companyXcountry dummy with the NYSE, (2.) Single country regressions control for an interaction of a company dummy with the NYSE, (3.) All dates where a company changed its name or changed its outstanding shares by more than 5% were dropped, (4.) Coup window estimates are obtained from regressions of returns on a dummy variable which takes on a value of one during the coup window; coefficients are then multipled by the length of the coup window, (5.) First day of coup regressions are regressions of returns an a dummy variable for the first day of the coup, (6.) First day of new government regressions are regressions of returns on a dummy variable for the first day of the new regime after the end of the coup. In the case of Cuba this is the first day after the end of the invasion, (7.) Since Cuba's coup was unssuccesful, it's dummy takes on a value of -1 in multi-country regressions, (8.) Robust standard errors clustered on date reported in parentheses, (9.) Statistical significance at 10%, 5% and 1% levels is denoted by *,**, and *** respectively.

Table XI
Out-Of-Sample Results: Asymptotic and Small-Sample Tests

		4 Country	Successful Coups	Chile	Cuba	Guatemala	Iran
Number of Events		14	11	4	3	4	3
4 Day CAR		0.0160	0.0221	0.0159	-0.0064	0.0243	0.0274
Standard Error		(0.0060)***	(0.0069)***	(0.0321)	(0.0304)	(0.0174)	(0.0263)
Number of Observations		56	44	16	12	16	12
Binomial Sign Test	Number Above Median	10	9	2	1	4	3
	P-Value: Analytical	0.1796	0.0654*	1.0000	1.0000	0.1250	0.2500
	P-Value: Simulated	0.1988	0.0772*	1.0000	1.0000	0.1404	0.2714
	Number Above 90th Percentile	6	6	2	0	2	2
	P-Value: Analytical	0.003***	0.0006***	0.1046	1.0000	0.1046	0.0560*
	P-Value: Simulated	0.0031***	0.0006***	0.1404	1.0000	0.1294	0.0616*
Uniform Rank Test	Mean Raw Rank	N/A	N/A	48.25	73.33	18.75	13.67
	Total Number of Dates	N/A	N/A	118	127	141	127
	Mean Percentile Rank	0.70	0.77	0.59	0.42	0.87	0.89
	P-Value: Analytical	0.0067***	0.0013***	0.5566	1.0000	0.0067***	0.0138**
	P-Value: Simulated	0.0068***	0.0021***	0.5557	1.0000	0.0070***	0.0122**

Notes I: (1.) This table reports 4 Day Cumulative Abnormal Returns using the "out of sample" method; (2) Standard error is computed using standard deviations of the out of sample 4 day returns, and *, **, and *** denote statistical significance using asymptotic inference at the 10%, 5% and 1% levels, respectively, (3) Successful coups excludes Cuba.

Notes II (For the Binomial Sign Test): (1.) Number above the median (and 90th percentile) reports the number of 4-day events above the median (and 90th percentile) of the abnormal return distribution in the estimation window, (2.) P-Value: Analytical reports the associated P-Value using the Binomial Distribution to give the probability of having at least X number of events above the cutoff (median or 90th percentile) or Y-X below the cutoff out of Y total events, (3.) P-Value: Simulated reports the p-value for a simulated distribution of having at least X number of events above or below the cutoff (median or 90th percentile) out of Y total events, accounting for the cutoff value being estimated using the actual number of days in the estimation sample.

Notes III (For the Uniform Rank Test): (1) Total number of dates refers to the number of 4-day return observations in the estimation window , (2.) Mean raw rank refers to the average raw rank of abnormal returns for events relative to the estimation window in the country or group of countries, (3.) Mean percentile rank is the average percentage rank of abnormal returns for events relative to the estimation window. (4.) P-Value: Analytical uses the Uniform distribution to calculate the probability of having an average rank greater than or equal to max(M,1-M) or less than or equal to min(M,1-M), (5.) P-Value: Simulated reports the p-value for a simulated distribution of having an average rank greater than or equal to max(M,1-M) or less than or equal to min(M,1-M), accounting for the ranks being estimated using the actual number of days in the estimation sample.

Table XII

Relative Gains From Coup and Authorization Events

	Per Event Authorization Event Gain	Total Gain from Authorization Events	Gain From Coup Event	Total Gain from Coup	Relative Gain From Auth. Events
All	0.0304	0.0940	0.0315	0.1285	0.7490
Top 3	0.0322	0.0997	0.0297	0.1324	0.7704
Chile	0.0189	0.0778	0.0313	0.1115	0.7130
Cuba	0.0229	0.0703	0.0369	0.1098	0.6557
Guatemala	0.0345	0.0702	0.0373	0.1101	0.6530
Iran	0.0427	0.1336	0.0206	0.1570	0.8664

Notes: (1.) Per event authorization event gain is the cumulative abnormal return over a thirteen day period for a company in a country estimated individually, (2.) Total gains from authorization events is one plus the abnormal return to the power of the number of net events; in the case of Guatemala, the number of net events is 2 out of total 4 events since one event was a coup abortion and thus counted as negative, (3.) The gain from the coup event is the estimated abnormal returns from the first day of the new government after the end of the coup except in the case of Cuba where we report the loss frmo the first day of the new government, (4.) The total gain from the coup is the cumulative gain from the authorization events plus the gain from the coup itself, (5.) The relative gain from authorization events is the share of the total gain from the coup (including pre-coup stock market rises) due to authorization events.

Table XIII
Calibration

Country	Good for Coup	Days Before Coup	Discount Rate	Stock Growth Rate	Exposure	Event Effect	Prob. Change	Cum-ulative Prob.
Chile	Y	37	0.9999	0.0005	0.52	0.019	0.01	0.01
Chile	Y	957	0.9999	0.0005	0.52	0.019	0.00	0.01
Chile	Y	320	0.9999	0.0005	0.52	0.019	0.00	0.02
Chile	Y	21	0.9999	0.0005	0.52	0.019	0.02	**0.03**
					Mean		**0.01**	
Cuba	Y	394	0.9999	0.0005	0.73	0.023	0.00	0.00
Cuba	Y	239	0.9999	0.0005	0.73	0.023	0.00	0.00
Cuba	Y	75	0.9999	0.0005	0.73	0.023	0.01	**0.01**
					Mean		**0.00**	
Guat.	Y	92	0.9999	0.0005	0.15	0.035	0.12	0.12
Guat.	N	56	0.9999	0.0005	0.15	0.035	-0.14	-0.03
Guat.	Y	192	0.9999	0.0005	0.15	0.035	0.06	0.04
Guat.	Y	61	0.9999	0.0005	0.15	0.035	0.14	**0.18**
					Mean		**0.12**	
Iran	Y	58	0.9999	0.0005	0.31	0.043	0.07	0.07
Iran	Y	45	0.9999	0.0005	0.31	0.043	0.07	0.14
Iran	Y	35	0.9999	0.0005	0.31	0.043	0.08	**0.22**
					Mean		**0.07**	

Notes: (1.) This table shows the inputs and outputs of a calibrated model of asset price determination, (2.) Country is the country where the coup attempt took place, (3.) Good for Coup is Y for authorizations and N for deauthorizations, (4.) Days before coup is the number of trading days before the planned coup; in Guatemala and Chile, this entails using two different dates for two coup plans each, (5.) Discount rates are 12-day equivalents based upon an annual rate of 0.95, (6.) Stock growth rate is the average daily growth rate of the stock in the 3 year period during and prior to the estimation window, (7.) Exposure is the percentage of company assets in the coup country, (8.) Event effect is the estimate of the impact of the authorization event window with the highest t-stat for each country, (9.) Probability change is the calibrated change in probability due to an authorization event; cumulative prob. is the cumulative net change in probability in the country, and (10.) Mean effect is the mean calibrated change in probability across events in a country, (11.) Events are listed in chronological order but days before coup sometimes increases due to failed coup attempts.

Figure I: Cumulative Abnormal Returns
Forwards and Backwards in Time
(In-Sample method)

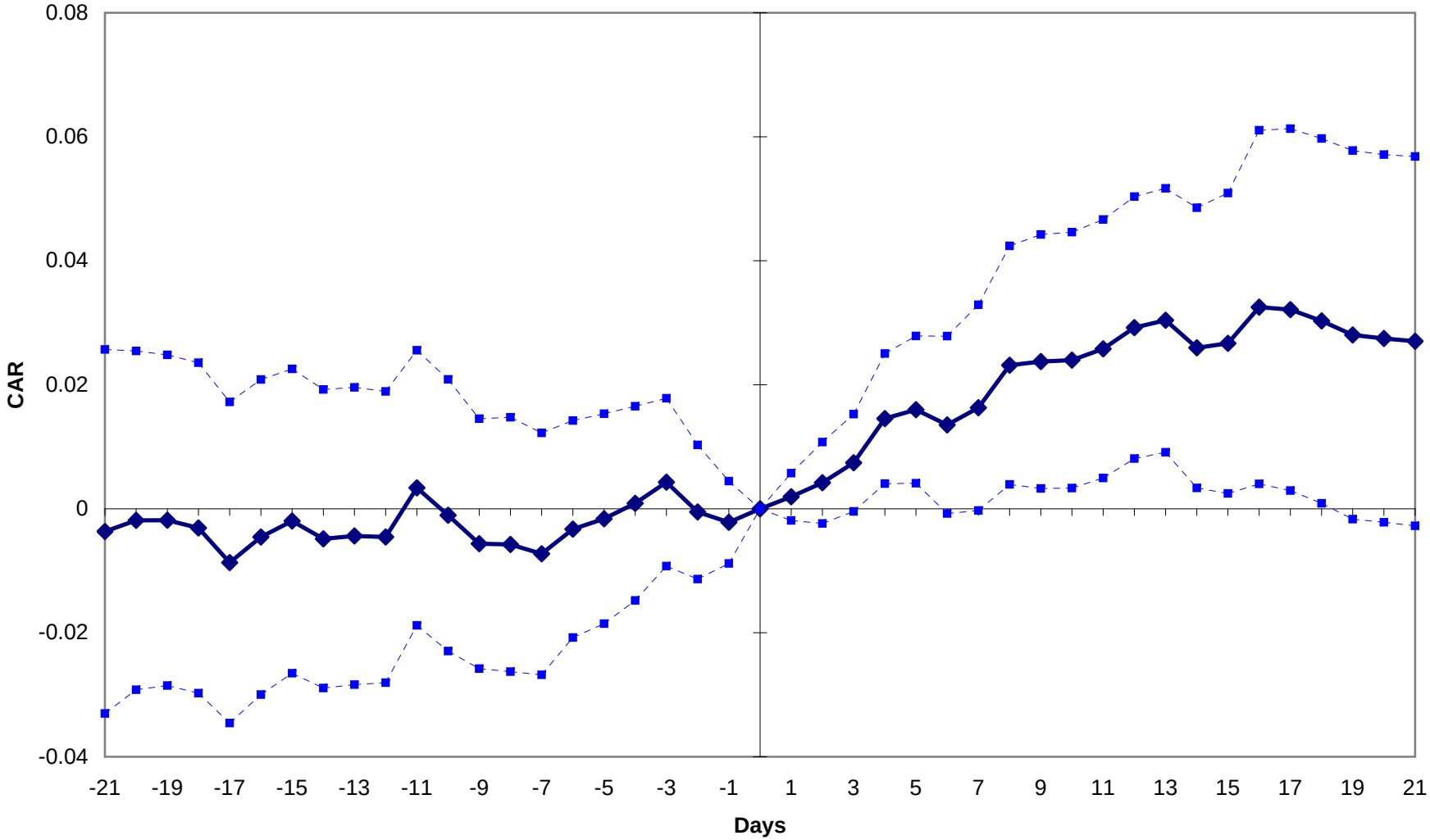


Figure II:
Time-Shifted Placebos

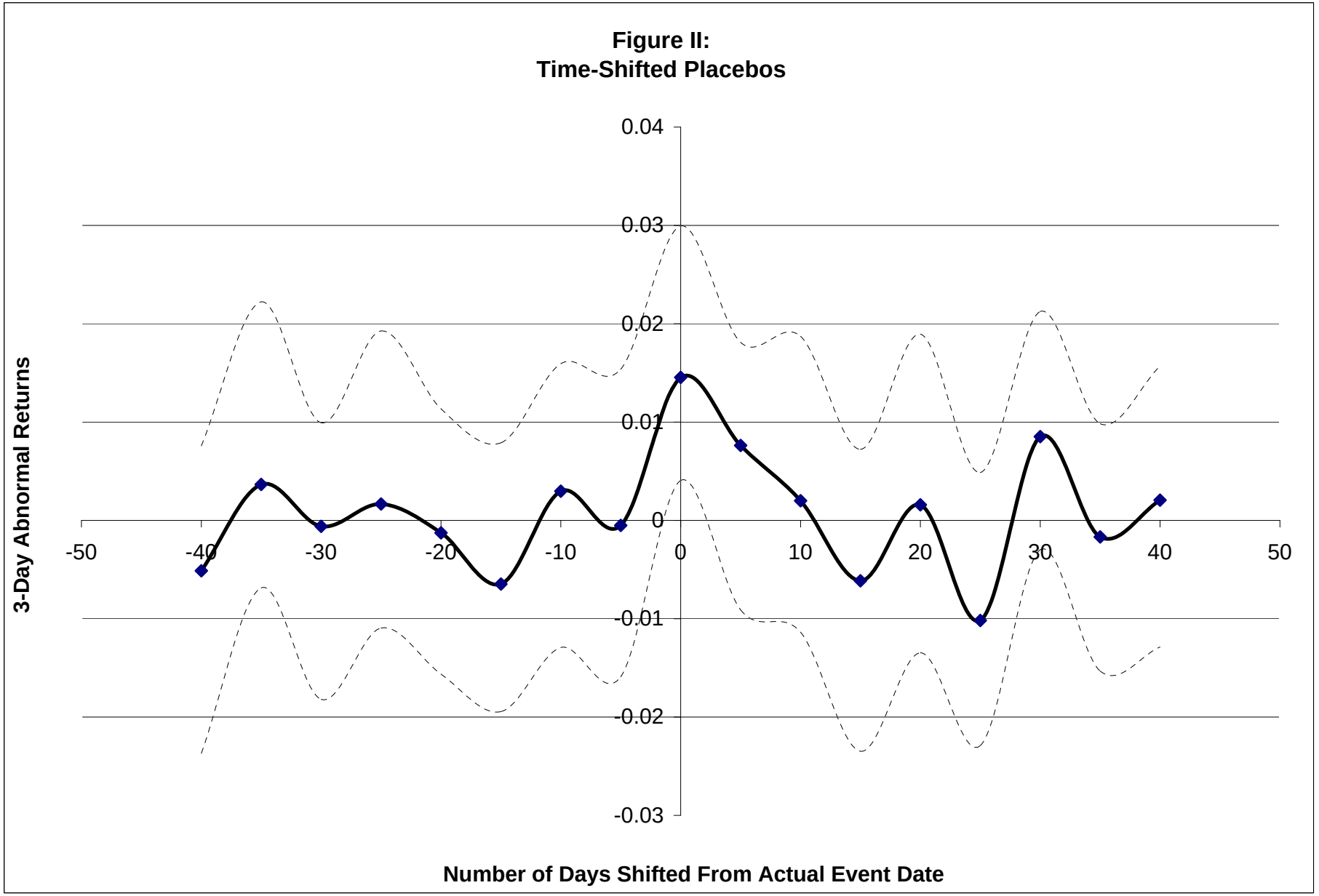
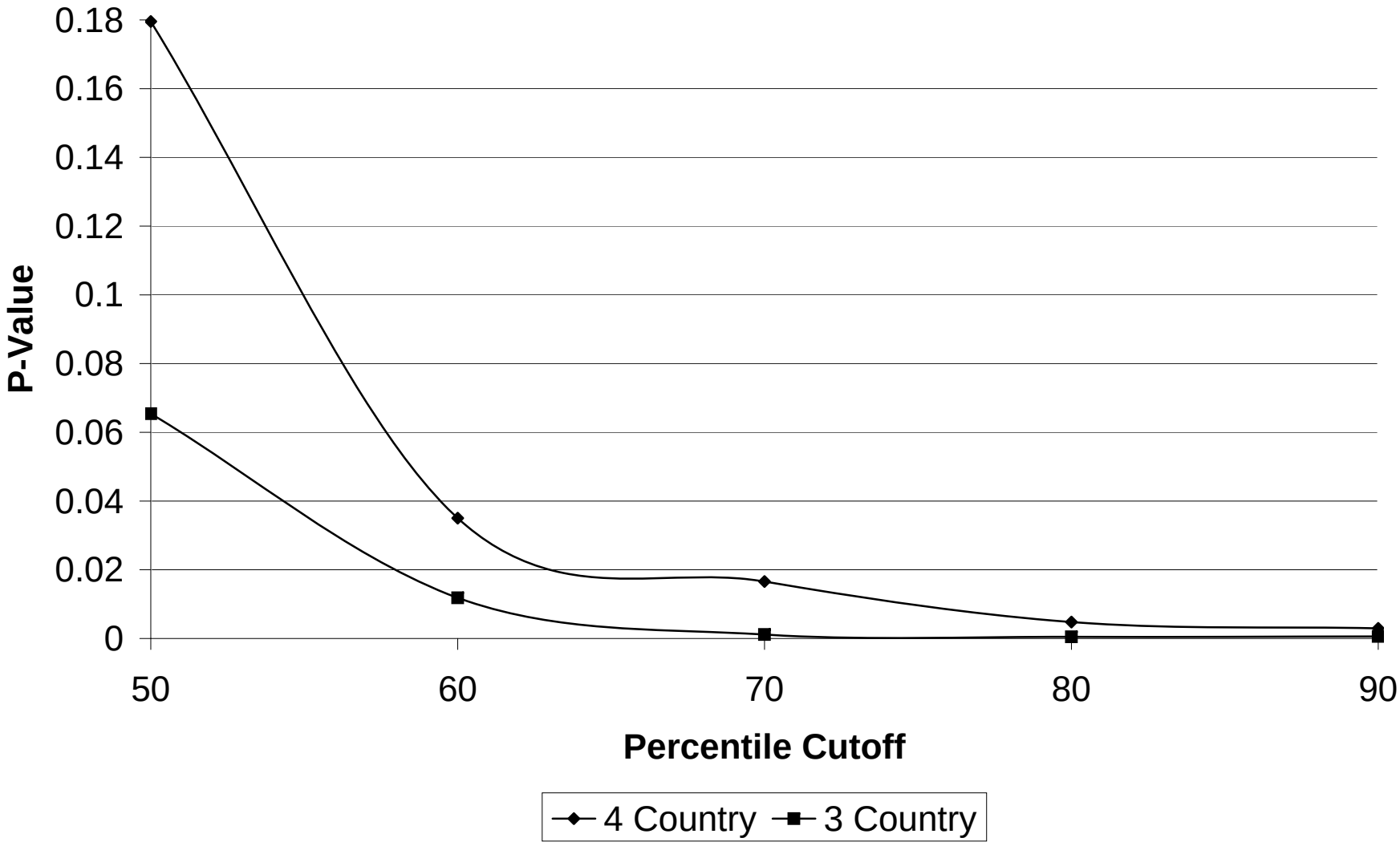


Figure III: P-Values for Binomial Tests



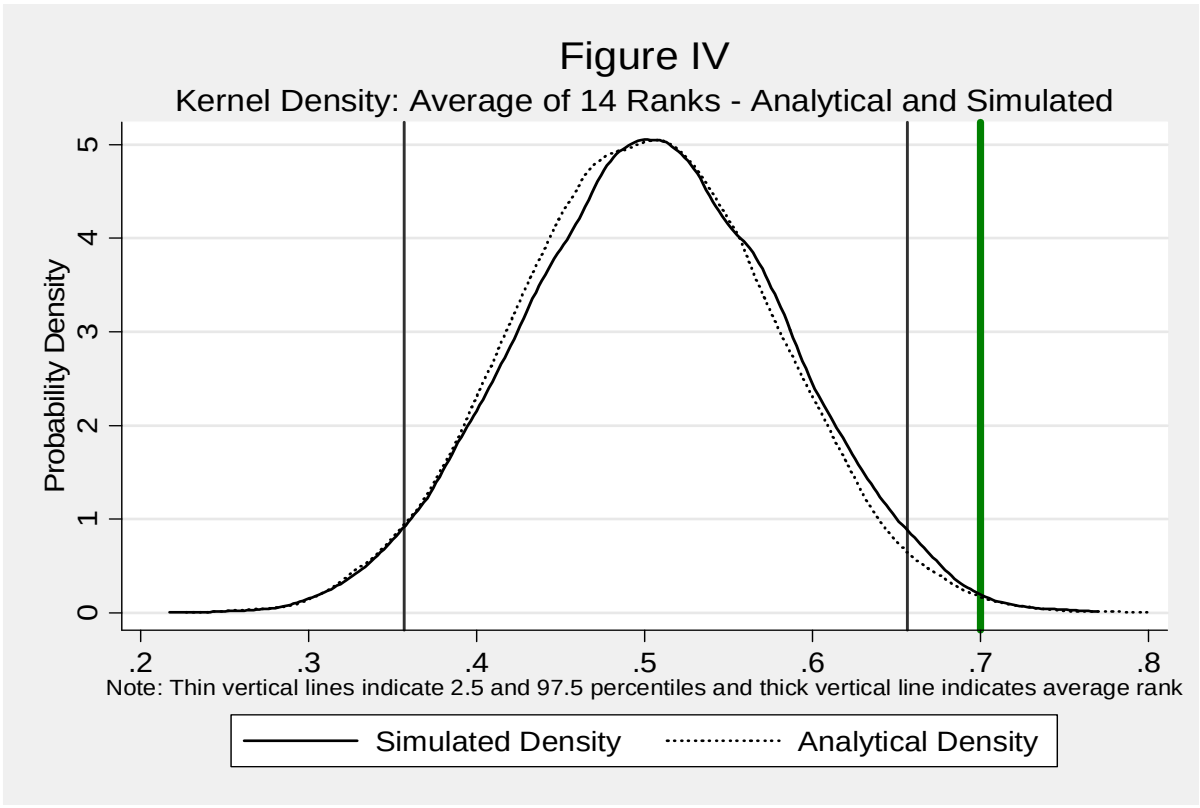


Figure IV
Kernel Density: Average of 14 Ranks - Analytical and Simulated
Probability Density
0
1
2
3
4
5
.2
.3
.4
.5
.6
.7
.8
Note: Thin vertical lines indicate 2.5 and 97.5 percentiles and thick vertical line indicates average rank
Simulated Density
Analytical Density