UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

THREE ESSAYS IN CORPORATE FINACE: EXAMINING THE INFLUENCE OF GOVERNMENT OWNERSHIP AND EVALUATING CRUDE OIL ARBITRAGE

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

Degree of

DOCTOR OF PHILOSOPHY

By

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Norman, Oklahoma
2013

THREE ESSAYS IN CORPORATE FINANCE: EXAMINING THE INFLUENCE OF GOVERNMENT INVOLVEMENT AND EVALUATING CRUDE OIL ARBITRAGE

A DISSERTATION APPROVED FOR THE
MICHAEL F. PRICE COLLEGE OF BUSINESS

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I dedicate this work to my mother, Hanna Nosova, and my children, Nathan and Eric. I appreciate the support of people who are like family to me – Rex, Sharon and Florence McKee and family, Anatoliy Popov and family, Inna Cheterener-Giguere and family, Kate Vasilishina and family, and Lyudmila Adjigitova. Finally, this would not be possible without the support of my wonderful friends, especially Veljko Fotak, as well as Victoria Gutman, Dalia Maraulaite, Inna Popko and Temur Akhmedov and all my other great friends, who have helped me during my doctorate studies.

Acknowledgements

I thank my two wonderful co-chairs: Louis Ederington for his wisdom and guidance and William Megginson for his support and mentoring. I am grateful to Ginka Borisova, Chitru Fernando, Veljko Fotak, and Scott Linn for their suggestions and the opportunity to work together. I am thankful for the helpful comments from Pradeep Yadav, Evgenia Golubeva, Georgia Kosmopoulou, Bernardo Bortolotti, and Vikas Raman.

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Abstract

The aim of this dissertation is twofold: first, to evaluate how governments influence firms in which they invest (chapters one and two), and second, to examine arbitrage in the crude oil market by investigating the relationship between crude oil inventories, physical prices, and financial prices (chapter three). In the first chapter (The Wealth Effects of Government Investment in Publicly Traded Firms), I study how government share ownership affects shareholder wealth. I find that government investments with higher likelihood of political interference have a negative influence on shareholder wealth, while the opposite is true for government investments with economic objectives. In the second chapter (Government Ownership and the Cost of Debt: Evidence form Government Investment in Publicly Traded Firms), I investigate how government share ownership affects the cost of debt of publicly traded firms. I find that government ownership generally leads to a higher cost of debt, except for times of economic and firm distress, when the value of the implicit government guarantee is associated with a reduction in the cost of debt. In the third chapter (Financial Trading, Spot Oil Prices, and Inventory: Evidence from the U.S. Crude Oil Market), I confirm the existence of an active cash and carry market in crude oil in Cushing, OK, the main U.S. crude oil futures settlement location. In other words, crude oil inventories in Cushing, but not in any other U.S. crude oil storage locations, are explained by the spread between the financial and the physical price of oil in addition to operational factors.

Chapter 1: The Wealth Effects of Government Investment in Publicly Traded Firms

Since the early 1980s, governments around the world have received US$3.1 trillion from the sale of business assets through privatizations, but they have also simultaneously invested US$2.9 trillion, as they acquired stakes in private sector firms.[1] While governments are becoming an increasing important class of investors, little is known about different types of government investors. Prior literature has focused on privatizations and, as those are mainly administered by central governments, has not studied how other government owners, such as local governments, government financial institutions and state owned enterprises (SOEs) influence firms under their control. This paper provides a first look at foreign and domestic *investments* by various government entities in publicly traded companies and assesses the shareholder announcement reaction to these acquisitions.

Government investment vehicles might be affected by political pressures, thus leading them to pursue goals other than wealth-maximization. The imposition of those other goals on firms is likely to reduce profitability.[2] That is, governments might actively impact the companies in which they invest, but have goals that differ from those of other shareholders: governments don't simply go for 'shareholder value maximization', but might want to maximize employment, favor domestic investments, acquire foreign technologies and, as Shleifer (1998) suggests, pursue political goals

[1] Government investment and divestment totals are from the Thomson Reuters SDC Platinum M&A database. Since 1988 it documents 18,494 government investments worth over $2.9 trillion and 2,088 of these deals worth $892 billion are government investments in publicly traded firms.

[2] Related evidence can be found in the stakeholder literature (Jensen, 2002) which finds that shareholder value suffers when multiple, possibly conflicting goals are imposed on corporations.

and increase government officials' personal income. An interesting legalistic analysis is put forth by Kahan and Rock (2010): governments can impose their own goals on a firm more easily than private controlling shareholders; in their words "*when the Treasury is the controlling shareholder, the legal basis for challenging conduct that would normally constitute a clear breach of the duty of loyalty or care is very weak.*"[3] Such negative effects of government ownership should lead to a negative reaction to announcements of government investment. I will refer to this effect as the '*political interference hypothesis*.'

Alternatively, government investments can lead to 'preferential access' to financing, state contracts, and regulatory lobbying. I will refer to this as the '*preferential access hypothesis*.' Several studies show that firms benefit from political connection. Faccio (2006) shows that firm stock prices react around announcements that their officers or large shareholders are entering politics. Examples of 'preferential access' to financing are provided by Borisova, Fotak, Holland, and Megginson (2012), who show that firms with government ownership enjoy a lower cost of debt during distress times; Kotter and Lel (2011), who note that governments often act as lenders of last resort; Faccio, Masulis, and McConnel (2006) and Duchin and Sosyura (2012), who show that politically connected firms are more likely to receive funding and bailouts; and Houston, Jiang, Lin, and Ma (2011), who confirm that US firms' political connections reduce borrowing costs and increase firm value.

[3] Kahan and Rock (2010) cite a recent clear-cut case in which government priorities trump shareholder-wealth concerns: *"The Treasury's political considerations have led it to block profitable actions by controlled firms. For example, at Fannie Mae, the Treasury vetoed a sale of $3 billion in tax credits to Goldman Sachs and Berkshire Hathaway. Although these tax credits were worthless to Fannie Mae, the Treasury would have lost tax revenues had they been sold to an entity that could use the credits to offset its taxes."*

Examples of 'preferential access' to contracts, with no otherwise planned changes to firms' infrastructure, management or even head office locations, are illustrated by two recent investments by Chinese state-owned enterprises.[4] China's Bright Foods Group, after the May 2012 acquisition of the U.K. cereal maker Weetabix, intends to offer Weetabix products in China, thus providing access to a large and difficult-to enter market. Similarly, after being acquired by China's National Offshore Oil Corporation in July 2012, the Canadian energy firm Nexen was allowed access to China's untouched shale reserves. These effects along with cheaper financing should be associated with an increase in shareholder wealth and a positive announcement reaction around government investments.

Between the negative impact of 'political interference' and the positive effect of 'preferential access', the net impact of government ownership on shareholder value is a matter of empirical investigation. I examine this impact around the government investment announcements in order to evaluate changes in shareholder wealth. I study government investments in 68 countries, involving 1,809 transactions in 1,477 unique target firms between 1988 and 2011. Using event-study methodology, I find that overall stock price reactions to government investments are positive around the acquisition announcement. However, the results are largely dependent on the perceived level of political interference from government-owned investors. In my tests I evaluate situations where the influence of either the negative political interference or the beneficial effect of government ownership is more likely. In particular, I differentiate first between domestic and foreign government investments, second

[4] Burkitt, Laurie "Chinese Food Company Eats English Breakfast." *Wall Street Journal*, May 3, 2012
"Canucks, meet CNOOC," *The Economist***,** July 28, 2012

between investments by political, economic and financial arms of governments, third between investments from government with varying levels of economic freedom and finally between majority and minority government investments.

First, I distinguish between domestic and foreign government investments. Extant literature suggests that foreign investors are less likely to impose conflicting goals on a firm and more likely to increase shareholder wealth (Djankov and Murrell, 2002; Ferreira and Matos, 2008; Estrin, Hanousek, Kocenda and Svejnar, 2009). However, domestic government investors could also benefit target shareholders, by providing better financing terms and, possibly, by favorably altering domestic regulation and taxation. I find that stock price reactions are positive for foreign government investments but negative for domestic ones, after controlling for firm and deal characteristics. This is consistent with the notion that foreign government investors provide access to foreign markets, while domestic government investors tend to impose political priorities.

Second, I classify government entities according to their main objectives – political (for example, national and local governments), financial (government financial institutions and sovereign wealth funds) and economic (state owned enterprises, SOE). In a multivariate regression setting, I document negative stock reactions to investments by political arms of government and positive stock reactions to investments by governments' economic arms, while reactions to the government's financial arms are not significant.

Third, I examine economic freedom characteristics of investing governments by considering their likelihood of expropriation, as well as their left- or right-wing

political orientation. Governments with lower levels of economic freedom, such as government with higher likelihood of expropriation and left-wing governments, are associated with higher levels of political interference and therefore I expect their purchases to have a more negative effect on shareholder wealth. I find that markets react negatively to purchases by governments where the expropriation risk is high and by left-wing governments, while markets react positively where the opposite is true, in other words, to purchases by governments where the expropriation risk is low and by right-wing governments.

Finally, I distinguish between government minority and majority stake purchases, where the expectations regarding political interference are mixed. Extant research shows that large institutional investors improve shareholder wealth through activism. Similarly, large government investments could benefit equity holders, as governments could actively distribute a larger volume of contracts, provide cheaper financing and favorably affect regulation for firms in which they have high ownership. These positive effects of large government holdings could be reversed by higher levels of political interference, as government investors pursue political goals and majority ownership would allow them to impose such objectives. I find that majority stake purchases by governments are associated with a positive stock price reaction, while minority stake purchases are associated with a negative stock price reaction. The results are robust to the inclusion of the offer premium and evaluation of majority purchases between 50% and 10% and minority purchases of below 10%.

In summary, the above results suggest that government investments associated with higher levels of political interference have a negative influence on shareholder

wealth, while the opposite is true for government investments which are motivated by economic objectives. These empirical findings are closely related to the theoretical predictions found in the literature on government policy uncertainty and stock prices. Pastor and Veronesi (2011, 2012) develop a general equilibrium model of government policy choice and model stock price response to political news. The authors note that governments are motivated by two sets of objectives – economic objectives, such as maximizing investors' welfare, and noneconomic objectives, such as maximizing political benefits for the government. In their model the government policy choice is uncertain, as investors do not know which policy governments will choose to adopt. The main source of this uncertainly is political cost.[5] Pastor and Veronesi (2011, 2012) theorize that stock prices should rise at the announcement of government policy change which is perceived to benefit profitability; I show that firms react positively to government investment that is more likely to benefit firm profitability. Also, Pastor and Veronesi (2011, 2012) predict a stock prices decline for government policy changes accompanied by higher levels of uncertainty related to profitability, due to political cost. This is similar to my finding that firms react negatively to government investment associated with higher likelihood of political interference, which conflicts with shareholder profit maximization goals.

Extant evidence from the privatization literature points to the superiority of private ownership, motivated by profit maximization goals, over government ownership. Numerous studies have documented positive effects of privatizations on

[5] Pastor and Veronesi (2011) show that stock prices respond to policy change and are impacted by economic and political shocks and despite being unrelated to each other (orthogonal) political shocks command a political risk premium. When governments step in and provide a type of put protection or implied guarantee, especially during weak economic climate, such protection reduces the equity risk premium. On the other hand, political uncertainty and political costs increase the equity risk premium.

firm profitability, efficiency, dividend payout, leverage, and better alignment of shareholder and manager goals.[6] Yet, the differences between various government investors and their effects on shareholder wealth have not been fully examined in extant literature.[7] The privatization literature is unable to disentangle the difference between government entities, as privatizations are mainly directed by central governments. The privatization literature further suffers from the innate disadvantage of studying wealth effects at very peculiar times, as firms are often reorganized and legal systems are contemporaneously restructured, thus obfuscating the impact of a simply ownership change.[8] However, the ability to compare different types of government investors is important, as past research documents significant investment style and shareholder value differences among institutional investors (Chen, Harford, and Li, 2007; Ferreira and Matos, 2008). My findings reveal that governmental investors, just like other institutional investors, differ in terms of their objectives and influence their investment targets in fundamentally different ways.

[6] Megginson, Nash and Randenborgh (1994), Eckel, Eckel, and Singal (1997), D'Souza and Megginson (1999), Megginson and Netter (2001), Gupta (2005), Estrin, Hanousek, Kocenda, and Svejnar (2009), Brown, Earle, and Telegdy (2010), Dinç and Gupta (2011), Boubakri, Cosset, Guedhami, and Saffar (2011), Julio and Yook (2012).

[7] Borisova, Fotak, Holland, and Megginson (2012) examine the influence of various government entities on the cost of debt of firms in which they own a stake. My study is different as it evaluates the impact of different government investors on shareholder wealth.

[8] Dinç and Gupta (2011) show that profitable firms are more likely to be privatized early and Dewenter and Malatesta (2001) indicate that governments effectively restructure some of the firms before privatization and find little evidence of later profitability enhancements. It warrants to be noted that both government divestment and investment could suffer from selection biases. While governments privatize more profitable, 'healthier' and 'easier' firms (Megginson and Netter, 2011; Dinç and Gupta, 2011), governments might also be likely to purchase failing enterprises in nations' vital industries. These rescues could obscure the true relationship between government ownership and shareholder wealth. Accordingly I perform my tests controlling for the firm's prior performance, as well as differentiate between crises periods, when government rescues are more likely, and non-crises. I plan to introduce a two-stage selection and instrumental variables models to ensure the robustness of my results.

My study unifies and puts into perspective the findings of the segmented government investment literature (sovereign wealth funds are examined by Bortolotti, Fotak, and Megginson, 2012; Kotter and Lel, 2011; Dewenter, Han, and Malatesta, 2010; government cross-border deals are studied in Karolyi and Liao, 2010). Boardman, Freedman and Eckel (1986) is one of first studies of government investment and examines a single nationalization event – the 1981 takeover of Domtar, a private Canadian corporation, into government ownership – the authors document a 25% loss in shareholder value due to the anticipated pursuit of non-profit objectives. Karolyi and Liao (2010) examine general reactions only to cross-border government acquisitions and show that targets react positively to the news of government acquisitions, as do targets of private sector cross-border share acquisitions. These findings differ from those of Boardman, Freedman and Eckel (1986). Additionally, Karolyi and Liao (2010) document that foreign sovereign wealth fund (SWF) purchases earn significantly lower target reactions than do purchases by other types of foreign government acquirers, though studies of SWF investments (Bortolotti, Fotak, and Megginson, 2012; Kotter and Lel, 2011; Dewenter, Han, and Malatesta 2010) generally document significant positive short term target reactions. All these conflicting results highlight a need, addressed by this paper, to separately consider the effects of government investments involving different types of government investors and different levels of ownership, as well as, to pay special attention to the nature and legal context of acquiring governments – in particular whether they are domestic or foreign and whether these governments have high or low levels of involvement in the economy.

This study also extends the literature examining the relationship between shareholder wealth and political connections (Faccio, 2006; Faccio, Masulis, and McConnel, 2006; Duchin and Sosyura, 2012; Houston, Jiang, Lin, and Ma, 2011; Chansog, Christos, and Jung, 2012). This paper contributes to the broader economic debate on the role of governments in the spirit of Friedman, Stiglitz and Shleifer. It also adds to the stream of corporate governance literature dealing with government ownership of business assets and control of economic activity. Moreover, the study adds to the literature on ownership and blockholding that highlights the importance of understanding the difference between various investor classes (Ferreira and Matos, 2008; Woitdke, 2002; Giannetti and Laeven, 2009; Klein and Zur, 2009; Chen, Harford and Li, 2007) by evaluating governments as an investor class and uncovering the influence of government investors according to their perceived levels of political interference.

The rest of the paper is structured as follows. Section 1 outlines the empirical design. Section 2 describes event study results, Section 3 provides regression results, and Section 4 includes robustness checks. Section 5 concludes.

1. Empirical Design

1.1. Dataset

I collect all announcements of government purchases from the Thomson Reuters Securities Data Company (SDC) Platinum Mergers and Acquisitions database with buyside government involvement over the 1981-2011 period. This includes transactions where either the ‘acquirer’ or the ‘acquirer immediate parent’ or the

'acquirer ultimate parent,' are identified with a 'government' status. According to SDC, 'government' status identifies all firms and institutions in which a government owns, directly or indirectly, at least a 50% stake. 'Parents' and 'ultimate parents' are shareholders who own 50% or more in a firm. I do not include transactions where a government entity is a part of an investor group. I restrict the sample to completed and withdrawn deals, thus excluding rumors, and only to publicly traded targets. These filters lead to a sample of 2,088 acquisitions worth about US$893 billion.

I use SDC to collect additional information about the deal, including the announcement date, the proportion of shares acquired and held by the acquirer after the deal, the status of the deal (completed or withdrawn), and the associated payment method (stock, cash or mixed). I also gather SDC information about the acquirer, acquirer parent and the target, including names, nations, 'Standard Industrial Classification (SIC)' codes, other 'macro' and 'industry' level SDC classifications and 'public status' (government, publicly traded, privately held, subsidiary, joint venture) and 'SWF flag'. Daily total return indices, adjusted for dividends and splits, in US$, along with their related total return local market indexes are obtained from Datastream. I exclude securities with a large number of missing, zero or extreme returns around the time windows of interest. I further restrict the sample to cover the 1988-2011 period due to a small number of government purchases and irregularities in Datastream prior to 1988. Contemporaneous investments involving the target on the same day are removed from the sample. I further require all sample firms to be present in Worldscope, which is the source of accounting data for my sample. Economic freedom variables are collected from the WorldBank Database of Political

Institutions, the Economic Freedom of the World publication, and the PRS Group's ICRG databases. Descriptions of variables and their sources are provided in Table 1. All data are winsorized at the top and bottom 1%. The final sample used for event study analysis consists of 1,809 transactions (133 of which are eventually withdrawn) in which a government acquirer purchases an equity stake in 1,474 unique target firms. The next sections explain how I categorize different government investments.

1.2. Foreign Versus Domestic

Foreign governments' investments could differ from domestic, as foreign governments are likely to invest following the goals of profit maximization rather than pursuing a political agenda. Ferreira and Matos (2008), Arnold and Javorcik (2009), and Aitken and Harrison (1999) point to the superiority of foreign institutional investor ownership, as it is associated with higher firm valuation and productivity. While no studies examine the difference between overall foreign and domestic government investments, several evaluate subsets of such investments. Karolyi and Liao (2010) examine only government cross-border acquisitions, but not government domestic purchases. They show that targets react positively to the news of foreign government investment. Dewenter, Han, and Malatesta (2010), Kotter and Lel (2011) and Bortolotti, Fotak, and Megginson (2012) examine SWFs – government entities that tend to invest in cross-border deals – and find positive target stock reactions to SWF acquisition announcements. All these studies suggest that foreign government investors are more likely to benefit target shareholders as they are more likely to follow profit maximization goals and not impose political agenda.

On the other hand, Borisova, Fotak, Holland, and Megginson (2012) also show that acquisitions by foreign governments are associated with a higher cost of debt, while those by domestic governments are associated with a lower cost of debt. Therefore, it is also possible that domestic government investors have a more positive influence on target's shareholder wealth, as they are more likely to provide cheaper financing. In order to examine these effects, government investments are classified as ***foreign***, if the nation of the acquiring government is different from the nation of target's headquarter location, and as ***domestic*** otherwise. The acquirers are evaluated at the 'parent' level, as the ultimate parent owns 51% or more of the acquirer. Accordingly, the nation of the acquirer ultimate parent is considered the nation of the acquiring government.

1.3. Political, Financial and Economic Investors

In order to further examine the effects of political interference I differentiate between various government investors – financial, economic and political. Within the political group I include national entities (governments, the Treasury, economic and finance ministries, the central bank, regulatory boards) and local governments (regional, city and municipal branches of government), as well as national pension funds. The economic group contains SOEs, which are further broken down into industry specializations – energy, materials, industrial, telecom and technology, media, and consumer. The financial category includes commercial and development banks, real estate, other financial institutions, SWFs and supranationals.

These political, financial and economic types of government acquirers pursue different objectives and could influence the targets of their investment in different ways. I expect certain government entities, such as the political subgroup, which includes national and local governments, to be more likely to pursue political objectives which conflict with profit maximization goals and therefore to be more deleterious to shareholder wealth. On the other hand, the political group could also benefit shareholders as it is also the most capable of offering explicit or implicit guarantees, which as Borisova, Fotak, Holland and Megginson (2012) show can lead to cheaper financing. Categorizing government investors helps uncover otherwise hidden interactions.

Woidtke (2002) explains the importance of disaggregating investors into categories to enhance the evaluation of underlying relationships. She breaks pension funds into private and public and confirms the positive relationship between private pension fund ownership and firm value documented in prior literature, but also shows that the relationship between firm value and public or government pension funds is negative. Giannetti and Laeven (2009) further show, in their evaluation of Swedish pension funds, that funds whose objectives are not likely to conflict with shareholder value maximization and monitoring are associated with higher firm value. Woidtke (2002) suggests that future research pay particular attention to the mix of investor groups instead of evaluating them as one monolithic entity. While Karolyi and Liao (2012) separate their cross-border investments into two categories, those by SWF and those by other government acquirers, Borisova, Fotak, Holland, and Megginson (2012) differentiate between more than two different types of government entities and

find that different government entities vary in their influence on the firms' cost of debt. My paper is different as it evaluates the impact of different government investors on shareholder wealth. While my classification is similar to Borisova, Fotak, Holland, Megginson (2012), it provides both more generalized results based on the three wide categories – political, financial, and economic – and more specific results based on various industrial subcategories within the SOE group.

I follow a combination of SDC 'public status' and 'macro industry' identifications to classify government investors into various government investor type categories. ***Political government investors*** must be in the 'Government and Agencies' SDC 'macro industry' description on both the acquirer and the acquirer parent level. Within the political group I identify *political national government* investors when both the acquirer and the acquirer parent fall into the 'National Agency' or 'National Government' SDC industry categories. All other entities, except for 'Supranational' under the 'Government and Agencies' 'macro industry' are classified as *political local government* investors and include city agencies, city governments, public administration, regional agencies and regional governments. I complete the political group by including government *pension funds* and identify those by manually searching and evaluating the deal and acquirer descriptions for words like 'social security,' 'pension fund,' 'public employees,' etc.

Financial government investors must be in the 'Financials' SDC 'macro industry' on both the acquirer and acquirer parent level. Additionally, I include all the acquirers categorized as *real estate investors, SWFs* and *supranationals* into my financial government investor group given the financial nature of their investments. I

differentiate between *government banks* and *development banks*, while both are included in the government financial investor category. Development banks are identified by searching and evaluating the deal and acquirer descriptions for words such as 'development bank,' 'development fund,' 'commonwealth development,' 'de Development,' 'development finance,' etc. The remaining entities in the financial government investor category are classified as *other financial investors* and include alternative financial investment firms, asset managers, brokerages, credit institutions, diversified financials, insurance and some government sponsored enterprises.

The final large group includes ***economic government investors*** which are represented by SOEs in various fields and are predominantly industrial players who develop non-financial products and services. *SOE_Energy* government economic investor group contains acquirers or acquirer parents that are a part of the 'Energy and Power' SDC 'macro industry' group and includes alternative energy sources, oil and gas, petrochemicals, pipelines, power, as well as water and waste management. *SOE_Industrial* group comprises of all acquirers classified by SDC as 'Industrials' and includes aerospace and defense, automobiles and components, building construction and engineering, machinery, transportation and infrastructure and other industrials. *SOE_Materials* group consists of all acquirers that fall into SDC 'Materials' macro industry classification and includes chemicals, construction materials, metals and mining, paper and forest products and other materials. *SOE_TelecomTech* group includes acquirers from 'Telecommunications' and 'High Technology' SDC macro level industries and contains space and satellites, telecommunication equipment and services, computers and peripherals, electronics, internet services, IT consulting,

semiconductors and software. *SOE_Media* group consists of government acquirers that belong to the SDC 'Media and Entertainment' and 'Consumer Services' SDC 'macro industry' groups and includes broadcasting, cable, motion pictures, publishing, professional, travel and educational services. Finally, the *SOE_Consumer* group contains government acquirers from the following SDC macro industry groups: 'Consumer Staples,' 'Healthcare,' and 'Retail' and includes household and personal products, textiles and apparel, tobacco, livestock and agriculture products, healthcare services, pharmaceuticals, automotive and food/beverage retailing.

1.4. Economic Freedom

Firm in countries with lower levels of economic freedom, such as those with governments that are more autocratic, left-wing, more likely to expropriate, and those with low property rights protection, are more likely to experience government interference and political goal imposition. Economic freedom factors have been shown to affect shareholder wealth (La Porta, Lopez-de-Silanes, Shleifer, and Vishny 1997, 1998, 2000). Ben-Nasr, Boubakri, and Cosset (2012) hypothesize that a higher cost of equity will be associated with the higher residual government post-privatization ownership by left-wing governments, with holdings by more autocratic / less democratic governments, with holdings by less stable governments and for countries with a higher perceived risk of government expropriation. Therefore, the literature points to a positive relationship between high levels of economic freedom and shareholder wealth. Accordingly, investments by governments with high levels of economic freedom would carry less political interference and would be more likely to

increase shareholder wealth. On the other hand, nations with lower levels of economic freedom, which accordingly have higher levels of government interference, could be more likely to provide favorable regulation and cheaper financing terms which would benefit target shareholders.

In order to evaluate whether economic freedom factors play a role in target stock price reaction around government investment announcements I examine the levels of expropriation expected of the acquiring government. The expropriation index is provided by the PRS Group's International Country Risk Guild (ICRG) and is based on contract expropriation, profits repatriation, and payment delays. In robustness checks I also examine economic freedom factors pertaining to the level of the acquiring government's autocracy / democracy, stability and size. Additionally, I examine the influence of the acquiring government's left-wing or right-wing political orientation, as it also proxies for the level of economic freedom. Bortolotti, Fantini, Siniscalco (2003) show that left-wing governments are often associated with more state intervention. Accordingly, left-wing governments would proxy for lower levels of economic freedom. I collect these variables from the World Bank database of Political Institutions.

1.5. Minority Versus Majority Ownership

Borisova and Megginson (2011) show a non-monotonic relationship between the size of the stake owned by governments and the cost of debt. In the case of government acquisitions, targets can exhibit a positive reaction to large stake government purchases in the company if that provides access to new contracts and

regulatory easement for the firm. Also, majority government investment could benefit target firm shareholders as higher ownership levels could overcome collective action problems associated with widely dispersed shareholdings. Alternatively, government acquisition targets might react negatively to majority acquisitions, as such acquisitions increase the likelihood of managerial changes in favor of government officials and of goal deviation from shareholder wealth to other government goals, which in turn would lead to higher inefficiency and lower profitability. To uncover target stock price reactions to different sizes of government investment I differentiate between majority purchases of stakes exceeding 50%, majority purchases between 50% and 10% and minority government investments of below 10%. This minority investor definition is adopted from Faccio (2006) and Bortolotti and Faccio (2009), who define large shareholders as anyone with 10% or more of control rights.

1.6. Descriptive Statistics

The description of the sample is provided in multiple panels of Table 2, which present the overall number and value of deals and various categorizations of the total. The number of deals is further broken down by foreign and domestic acquisitions, as well as by the economic, political, or financial type of government acquirer. Panel A breaks down government purchases by year. The sample of 1,809 government purchases has a total value of over US$ 501 billion. About 569 transactions (30% of total count) cover the crisis years of 2008-2010, which allows for a comparison of government investments during and outside the 2008 financial crisis. Cross-border deals represent a third (659 deals, 36% of the sample) of the sample and on average

account for about 40% of deals done in any given year, with the exception of the crisis years of 2008 and 2009 when the proportion of cross-border deals declines. Different types of government acquirers are well represented, with 698 observations (39%) by economic, 347 observations (19%) by political and 764 (42%) by financial arms of government.

Panel B breaks down government purchases by *ex post* ownership stake. Governments assume minority stake (<10%) ownership in 521 observations (29% of the sample). Their large representation in this category hints to the changing nature of government investment, as they switch from ownership block purchases to smaller stakes. The tendency to purchase non-controlling stakes is common for both foreign and domestic government acquirers, considering their proportional investment. The most common government ownership stake in my sample is between 10% and 50% in 710 deals (39%) worth US$143 billion (29%). Akin to minority deals, the proportion of both foreign and domestic government investment for the stake between 10% and 50% is similar. Interestingly, it is predominantly the economic and financial arms of the government that prefer this level of ownership, while political arms favor minority investments below 10%. There are 401 observations (22%) worth about US$200 billion (40%) where governments maintain majority ownership of 51% or higher. Government economic acquirers are most active in deals involving majority control (219 observations; 55% of majority purchases), followed by government financial acquirers (143 observation; 36% of majority purchases) and a very few (39 observations) majority purchases by government political acquirers.

Panel C describes government investment by target nation. US$ 403 billion (80%) is invested by governments in the top 15 target nations, according to investment value, led by the investments in the United States (274 observations, 15% of the sample by count, for US$83 billion, 17% by value). Overall, the sample contains 68 target nations. Other countries attracting large government investments include the United Kingdom (15% by value), Germany (8%), Switzerland (5%), and Austria (5%).

Panel D lists government acquirers' domicile nations. US$ 412 (82%) is spent by the governments of the top 15 acquirer nations, out of 69 total, according to investment value. China is the largest government acquirer with 387 investments (21%) totaling over US$76 billion (15%). It is followed by France (11% by value), United Arab Emirates (9%), the United States (8%), and the United Kingdom (7%). It is interesting to note that a lot of small value deals occur in China, while a few large deals dominate government purchases in the United Kingdom.

Panel E presents target firms' industry classifications by 1-digit SIC code. The largest number of government acquisitions is in the financial sector (SIC 6) with 575 observations (32%) worth over US$197 billion (39%). This is followed by transportation and utilities (SIC 4), with 347 deals (19%) worth over US$122 billion (25%); mining (SIC 1), with 200 deals (11%) worth US$96 (19%); and manufacturing (SIC 2 and SIC 3) with 487 deals (27%) worth US$60 billion (12%).

Finally, Panel F provides a more detailed industry description, based on the 4-digit SIC code, of the largest government investment. US$ 240 billion (48%) of government purchases occur in just three main industries – the financial sector (depository institutions), crude oil and natural gas, and electric and telephone services

sectors. The financial sector is further represented by commercial bank (5%), investment advisory (4%), life insurance (2%) and personal credit segments (3%).

1.7. Variables

Table 3 provides descriptive statistics for continuous variables in Panel A, for pre-event target firm performance in Panel B, binary variables in Panel C, and correlations between variables in Panel D. Panel A describes government ownership and target firm characteristics and lists means, standard deviations, medians and 25th and 75th percentiles. Government investors purchase a 24% stake on average (12% median) and hold on average a 32% stake (18% median) in a firm after the acquisition. Economic freedom indicator variables are presented next and I expect government investors with low levels of economic freedom and, accordingly, a higher likelihood of political interference to have a more negative influence on shareholder wealth and thus expect a negative reaction for acquisition announcements involving such acquirers. *Expropriation* measures the likelihood of government expropriation, where 0 denotes low risk and 12 denotes high risk. Acquiring governments have, on average, a low level of expropriation with a 3.35 index average. The following alternative economic freedom indicators are evaluated for robustness: *Government Size* (with a mean of 5.47), which measure the degree to which a country relies on markets rather than government budgets and where higher values mean lower government involvement on a scale from 0 to 10; *Autocracy/Democracy* (with a mean of -3.75), which measures how autocratic or democratic a government is on a scale from -10 to 10, where -10 denotes highly democratic and 10 denotes highly autocratic

governments; and *Government Stability* (with a mean of 5.18), measuring the number of years the current government has been in power.

The following standard firm level controls are included in the main regression: *Size* (computed as a natural logarithm of $US current dollar total assets, with a mean of 13.5), *Leverage* (computed as a ratio of debt-to-assets, with a mean of 64%), Return on Assets, or *ROA* (with a mean of 1% and median of 3%); and *Tobin's Q* (computed as [(market value + total assets – book value of equity)/total assets] and with a mean of 1.44). Bates and Lemmon (2003) show that target shareholders gain less when target firm is larger. Accordingly, I expect larger firms to have lower gains around the news of government investment. I also expect less leveraged and more profitable firms, in other words firms with sufficient resources, to evaluate any government interference as intruding and to react more negatively to government acquisition announcements.

Measures for firm performance six month and one year periods preceding the government's investment are presented in Panel B, which provides mean and median market adjusted buy-and-hold returns. I expect weaker firms to have a more positive reaction around government acquisition announcement and therefore expect a negative relationship between announcement reactions and prior performance. Prior performance should proxy for firm-specific distress, when governments are likely to step in and provide bail-outs. Market adjusted buy-and-hold returns of firms in my sample are on average positive, with 8% over the six months before and 16% over the year before the date of government stock acquisitions, which seems to indicate that government are not, in the majority of cases, investing to rescue distressed firms.

However, the difference between the mean and median results is indicative of skewness, which in turn indicates that a few firms with large positive pre-investment performance are present.

Panel C presents descriptive statistics for binary variables and provides information regarding deal features, consideration offered, and payment made, as well as government acquirer information. While it is important to control for the firm's prior performance as a proxy for firm-specific distress, special attention also needs to be paid to periods of economic uncertainty, as government ownership could be associated with a more pronounced certification effect of firm's vitality during those times. Pastor and Veronesi (2011, 2012) show that stock price reaction to government policy changes maybe be different during weak economic climates. *Bank Crises* (410 deals, 23%) and *2008 Crisis* (492 deals, 27%) are both binary variables that take value of 1 during periods of economy-wide distress. While the *2008 Crisis* corresponds to the 2008-2010 years, *Banking Crises* is a binary variable equal to one if the investment takes place during a year that is identified as a 'banking crisis' year for the nation in which the target is headquartered. Banking crises are defined by Laeven and Valencia (2010). Controls for banking crises and the years associated with the financial crisis are present in all regressions. In robustness regressions I also control for capital inflows – where the state investor purchases newly-issued shares, resulting in a capital infusing for the issuing company – as these are more likely to be provided to firms in times of distress and in need of cash. I identify capital inflows by searching the deal synopsis for phrases like 'capital injection' and 'capital inflow' and also flag all deals where the firm issues new shares. I identify 156 capital inflow deals (9%), though the

estimate is conservative, as the data are provided sporadically thus increasing both Type 1 and Type 2 errors.

I evaluate the likelihood of political goal imposition following government investment by examining 659 (36%) foreign and 1150 (64%) domestic government investments. I acknowledge the transfers of control between different government branches with a *Government-to-Government (Gov.-to-Gov. Deal)* variable, where both the acquirer and the target are flagged with a 'government' status. While only one such deal exists, there are 282 deals (16%) where the government-to-government pairs follow a wider SDC definition and besides the target and acquirer also include their 'parent' firms, who according to SDC own at least a 51% of the direct acquirer or target. When checking for robustness I also control for deals completed in the same industry, as those are more likely to be based on economic goals and not pursuant to political agenda. Accordingly, I expect same industry deals to have a more positive relationship with target stock price announcement reaction. 629 deals (35%) are done within the same 2-digit SIC group between the acquirer and the target, including their 'parent' firm industries. Further, about 47% of the sample consists of deals in the same industry, when considering an even wider industry group classification by evaluating deals in the same 1-digit SIC group and including the 'parent.'

Panel C shows that the most typical way that governments invest is by buying common stock (1587 deals, 88%), but they also attain stakes through warrants (186 deals, 10%) – which are mainly connected with the 2008 US Troubled Asset Repurchase Program (TARP) – and to a much lesser extent through convertible debt (31 deals, 2%). Further, I control for factors that have been shown in the literature to

affect the acquisition premium and returns. Loughran and Vijh (1997) show that target shareholders in stock-merger deals do not earn significantly positive returns, while those of cash-mergers do. Bates and Lemmon (2003) show that US target acquisition announcement returns are negatively associated with stock deals and withdrawn offers. Accordingly, I expect a negative association between target stock reaction to the announcement of government investment and withdrawn deals (133 deal, 7%), as well as stock deals (1190 deals, 66%). But I expect cash deals (588 deals, 33%) to be associated with higher target equity returns around government investment announcements.

Panel C also provides information about government investors. I categorize government investors into three major groups based on their nature and objectives – political (347 deals, 19%), financial (764 deals, 42%) and economic (698 deals, 39%). The political group consists of national governments (264 deals, 15%), local governments (58 deals, 3%), and pension funds (25 deals, 1%). The financial group consists of banks with government ownership (108 deals, 6%), development banks (49 deals, 3%), government real estate investment arms (42 deals, 2%), supranationals (23 deals, 1%), such as the IMF, and SWFs (164 deals, 9%) and finally other financial institutions with government ownership (378 deals, 21%). I also control for the legal origin of the acquiring government as LLSV (1997, 2000) show that legal origin influences capital market development and dividend payout. 690 deals (38%) are completed by acquirers (parents) from common law countries, which offer higher investor protection, with the remaining 1,119 coming from civil law origin nations. I evaluate the political orientation of the acquiring government, as it proxies for

economic freedom and the likelihood of political goal imposition and in about half the sample (892 deals, 49%) acquisitions are done by left-wing governments.

Correlations among variables are presented in Panel D of Table 3. It is interesting to note that most government investments that received warrants in the sample are from TARP deals, as they are 92% correlated and they were in a large part (63% correlation) issued by the political arms of the U.S. federal government. The correlation table also confirms that acquirer and acquirer parent nations are typically the same and hence are highly correlated on their common law status (84% correlation).

2. Event Study Results

I use a standard event-study methodology to calculate targets' cumulative abnormal returns (CARs) around the announcement of government acquisitions. Market adjusted returns are described below, while market model returns are only presented to confirm consistency with the market adjusted returns. To estimate returns I use the Datastream *daily country specific* U.S. dollar denominated total return index which is adjusted for dividends and stock splits. Market model parameters are estimated over days (-230,-30), where day (0) is the day of announcement of government investment. Only firms with trading data for a minimum of 100 days are included. I evaluate several event windows – (0,+1), (-2,+2), (-5,+5), (-10, +10) – around the announcement, as well as pre-event (-30,-10) and post-event (+10,+30) windows to check for any information leakages prior to or after the announcement. I follow the existing literature which uses international data and pay particular attention

to the 5-day event window surrounding the announcement of government investment, (-2+2) CAR.

Table 4 shows targets' stock price reactions to government investment and breaks it down by foreign and domestic government investment. In general, targets exhibit a significant positive reaction with a mean (median) of 2.48% (0.46%) for the (0,+1) window and 2.81% (0.91%) for the (-2,+2) window. The result is similar for both foreign and domestic government investment, but the scale is much larger for foreign investments with the significant returns of 5.05% (1.33%) for the (0,+1) window and 6.28% (2.25%) for the (-2,+2) window as compared to smaller but still significant stock reaction to domestic investments of 1.01% (0.22%) for the (0,+1) window and 0.82% (0.30%) for the (-2,+2) window. Target performance shortly after the event, for the (+10,+30) window, is significantly negative at -1.60% (-1.26%) for all deals and similar for both foreign and domestic acquisitions. Prior to government acquisition (-10, -30) the performance of domestic targets is negative at -1.31% (-0.76%), but it is positive for foreign, at 3.11% (1.13%). Overall, the results in Table 4 clearly document that targets exhibit a stock reaction to government investment. These results also reveal that foreign government investment is met with much more positive reaction than domestic government investment. This finding supports the view that foreign government investors are less likely to impose political agenda and are more likely to benefit their target firms.

Target equity reactions to investments by different arms of government – political, financial and economic – are presented in Table 5 and highlight the heterogeneous reactions to investment by these different government entities. For the

(-2,+2) and other short term windows the reaction is significantly negative for government investors from the political group at -2.92% (-0.64%) but significantly positive for those from the financial group at 2.23% (-0.48%), and overwhelmingly so for those from the economic group at 6.30% (2.36%). These results suggest that the conflict generated by political and profit maximization goals hurts shareholder wealth, as investors respond negatively to investments that would increase such conflict – such as investments by the political arms of the government. On the other hand, shareholders welcome investments by economically oriented groups, in particular the economic group that is comprised of SOEs. The reaction to government financial investments is positive overall, but this group encompasses diverse government investors. Some of these, such as development banks, are more likely to follow economic goals, while others, such as other banks with government ownership or government real estate investors, might pursue a political agenda.

Table 6 breaks down target equity reaction according to different economic freedom levels of acquirers. In particular it presents acquirers with high or low levels of government expropriation, as well as those from left- or right-wing governments. When government investors are from countries with low levels of expropriation likelihood, target announcement reaction is more positive, at 4.63% (1.74%) for the (-2,+2) window, as compared to that of high expropriation governments, at 1% (0.22%). Target performance shortly after the event, for the (+10,+30) window, is more negative for investments by acquirers from nations with high expropriation levels, at -2.26% (-1.73%), as compared to those with low expropriation levels at -0.85% (-0.87%). These results show that target shareholders welcome investment that carries

low levels of political interference, but are more cautious when investment originates from a nation with high expropriation risk and therefore high political interference tendencies and low levels of commitment to economic freedom. Table 6 also examines if target equity reaction differs between investments from left- and right-wing governments. Target pre-event performance in (-30,-10) window differs, with 1.69% (0.65%) for left-wing and -1.05% (-0.75%) for right-wing government investments, but no other significant difference are found, as the short-term reaction is positive in both cases.

Table 7 disaggregates target equity reaction according majority and minority government investment. Following Faccio (2006) and Bortolotti and Faccio (2009), I classify minority government ownership as that below 10%. In general, for firms with large shareholdings, where several blockholders own over 10%, the majority owner is the one with ownership of 51% or larger. Accordingly, I differentiate between majority purchases of over 50% and those between 50% and 10%. The target equity reaction to majority (over 50%) government investments is significantly positive at 5.87% (2.84%) for the (-2,+2) window and keeps growing to 8.14% (5.5%) for the (-10,+10) window. Opposite results are documented for minority government purchases, as the target equity reaction is negative and keeps getting more negative till -2.94% (-1.65%) for (-10,+10) window. Differences also exist in target performance shortly before the event in window (-30,-10) as government majority investments exhibit a positive performance of 0.69% (0.68%), but those of government minority investments produce a negative return of -1.59% (-1.59%). Also, while shortly after the performance in window (+10,+30), the performance of government minority

investments remains negative, that of government majority investments is positive, though insignificant. Overall, Table 7 indicates that minority government investment destroys target shareholder wealth, perhaps by exacerbating the conflict between political and profit maximization goals without the beneficial effects of government ownership – such as cheaper financing and favorable regulation – which reveal themselves only at higher levels of ownership.

Finally, Table 8 provides target reactions to the news of increased government ownership during and outside of periods of economic uncertainty, by examining banking crises and the 2008 financial crisis. The average target equity reaction to government investment during banking crises is significantly negative: starting at -1.76% for the (-2,+2) window and declining to -4.82% (-2.49%) for the (-10,+10) window. On the other hand, the reaction to government investment outside of banking crises is positive, at 4.15% (1.15%) for the (-2,+2) window. In the case of banking crises, target firm investors seem to worry that governments are likely to impose the same ideas that put the country into a banking crisis onto them and to reduce shareholder wealth through tunneling. On the other hand, the average target equity reactions to government investment during the 2008-2010 financial crisis is significantly positive at 1.37% (1.04%) for the (-2,+2) window. Though it is still smaller than the stock reaction to government investment for periods outside of the 2008-2010 crisis, when the average target reaction is 3.48% (0.84%) for the (-2,+2) window. Therefore, the certification effect and other benefits provided by government ownership during the 2008-2010 financial crisis must have outweighed other negative

effects. Overall, Table 8 results signify the importance of controlling for periods of economy-wide distress.

Event study results suggest that in general stock price reactions of government investment targets are positive around the acquisition announcement. But while stock price reactions are positive for investments by foreign governments, by those governments' economic and financial arms, and those for majority control, they are negative for investments by domestic governments, by government political arms and for minority stake purchases. Also, firms react more positively to purchases by governments where the expropriation risk is low. These results indicate that government investment associated with a higher level of political interference, that is likely to exacerbate the conflict between political and profit maximization goals, has a negative influence on shareholder wealth, while the opposite is true for government investment where this conflict is outweighed by benefits such as preferential access to financing and contracts. The panel regressions in the next section allow for a closer examination of government investor attributes and their perceived political goal imposition by examining target stock reaction around acquisition announcements while controlling for firms and deal characteristics.

3. Regression Results

I further examine the relationship between government investment and target stock price announcement reaction in multivariate Ordinary Least Squares (OLS) regression analysis where I control for target- and deal-specific characteristics and include year fixed effects. All regressions employ controls for industry of the target

firm and for the nations of the target and the acquirer parent. I employ Newey-West standard errors adjusted for heteroskedasticity and autocorrelation. In all the regressions my dependent variable is the market adjusted target stock reaction over a five-day window (-2,+2) around the government investment announcement. My variables of interest aim to uncover the circumstances under which governments are more likely to hurt target shareholders by the imposition of political goals and those under which governments are more likely to benefit the targets of their investment through preferential access to financing, additional contracts or regulatory lobbying. These variables of interest examine foreign and domestic government investment, investment by political, financial and economic arms of government, investment by governments with different levels of economic freedom, proxied by expropriation likelihood and the left- or right-wing nature of the investing government, and also investments for minority and majority stakes.

Results for the influence of foreign and domestic government investors on target equity announcement returns are presented in Table 9. Model 1 includes all deals in the sample; Model 2 pertains only to foreign, and Model 3 only to domestic deals. Model 1 shows that foreign government investments are associated with significant target shareholder gains. The effect is economically significant, as target shareholders gain 3.09% when the government investor is foreign. Model 1 reveals other factors that influence target equity reactions to government investment, in particular, a strong positive relationship with overall government ownership both regarding the shares acquired and previously owned. Further, as expected, deals involving stock payments, primarily by publically listed SOEs reduce target

shareholder wealth by -3.78% , compared to mixed stock-and-cash payment deals. Finally, larger and more valuable (in terms of Tobin's Q) firms react more negatively to the news of government investment.

Since Model 1 shows that target equity reaction differs between foreign and domestic government investors, I further investigate this difference by separately evaluating foreign and domestic government acquirers in Models 2 and 3 in Table 9 respectively. Target shareholder reaction is positively related to the size of the stake acquired for both foreign and domestic government investments. Several significant differences between foreign and domestic government investments also emerge. First, the average target equity announcement reaction is significantly negative for stock-swap mergers (-9.36%), but only for foreign government investments. However, only in the case of domestic government investments are target equity announcement returns a significant negative function of target size (-0.67%) and value (-0.58%), meaning that larger, more profitable firms suffer from the escalated negative political interference the most. Larger firms are typically diversified and already carry a diversification discount due to the multitude of intra firm goals (Laeven and Levine, 2007). Large firm shareholders are likely to have a more adverse reaction to domestic government investment as they anticipate the imposition of additional political goals, which could create conflict with profit maximization objectives and possibly make the difference amount existing goals more apparent. A negative relationship (-4.48%) between target equity announcement returns and domestic eventually-withdrawn deals suggests that either domestic withdrawals are somewhat expected, possibly due the higher media coverage involving controversial government investments that require

regulatory approval, or that governments are more likely to withdraw their domestic investments if the initial reaction is negative. Finally, only for domestic investments government-to-government deals command a higher premium (by 2.53%), perhaps because governments within the same country tend to overpay for their investments in other government entities or maybe the imposition of a political agenda is not going to increase given that an target firm is already influenced by government.

Overall, Table 9 results suggest that foreign government investors are more likely to be associated with the beneficial effects of government investment rather than the conflict amplified by a political agenda, as target shareholders earn a 3.09% return in deals involving foreign government investors. Also, foreign and domestic government investments differ in terms of other important factors that influence target announcement reactions.

Results for different government investing entities are presented in Table 10 where the binary variables for political and financial government investors are included in the main regressions and contrasted with the economic government investor groups. Model 1 includes all deals. Models 2 and 3 include only foreign and only domestic deals respectively. Model 4 includes only investments by political arms of government; Model 5 by financial and Model 6 by economic arms of government. Political government investors are associated with significant negative target equity announcement returns of -3.02% overall. Moreover, this relationship is only significant for domestic political government investors, as they are linked with a -3.64% loss in target shareholder wealth. It is important to notice that political government investors are associated with target shareholder losses even after

controlling for domestic government investors. These results highlight the deleterious effect of government investment when a conflict between political and profit maximization goals is created. Political arms of government, as expected, are more likely than other government investors to impose a political agenda on target firms, which conflicts with profit maximization and destroys shareholder wealth.

Models 4-6 allow target stock announcement reactions to vary given a political, financial or economic government investor. Target announcement reactions are negatively associated with the higher percentage of shares purchased by political arms of government (-0.14%), but it is positively linked to higher share purchases by financial (0.14%) and economic (0.10%) arms of government. Several similarities exist between different government investors, as all of the deals paid for with stock are associated with a negative target reaction and also larger firms react more negatively to the news of investment by political and economic arms of government. Intriguingly, government-to-government deals earn a 8.79% higher target stock announcement reaction only for purchases by government political investors. This again could be due either to with-in system overpayment or a lower expectation of political goal imposition due to already existing government involvement in the target firm. Another interesting relationship is a positive (negative) association between political (economic) government investors and eventually-withdrawn deals. Government economic arms might be more likely to withdraw deals with a negative announcement reaction. Alternatively, shareholders might have better information on the likelihood of eventual withdrawal of controversial government investments with high media coverage and welcome the eventual withdrawal of government investors who impose a

political agenda but lament the loss of beneficial effects of government investment from economic arms of government.

To further examine the influence of political, financial and economic government investors on target equity announcement reactions I evaluate subgroups that make up each government investor category in Table 11. Subgroup descriptions are provided in section 1.1.2. Since there are three main government investor groups – political, financial and economic – I can evaluate any two of them against one left out group. I choose to always include the subgroup members of the political group, while I alternate the financial and economic groups as the left out category, in order to present results for all three groups. Accordingly, Model 1(a) includes political and financial government investors and Model 1(b) political and economic government investors. Models 2(a, b) replicate Models 1 (a, b) respectively but considering only foreign government investors. Similarly, Models 3 (a, b) replicate Models 1 (a, b) respectively but considering only domestic government investors. Results for political government investors echo those of Table 11, as branches included in the political category are associated with a decline in shareholder wealth. More specifically, targets react most negatively to pension funds (-4.57%), followed by national government (-3.46%). A further breakdown into foreign and domestic deals shows that while foreign target shareholders are not significantly affected by any government investors, domestic shareholders tend to lose the most from an investment by national governments (-4.41%, average of 3(a,b)), followed by local governments (-4.13%, average of 3(a,b)) and finally by pension funds (-3.58%). Results for groups that

comprise the financial and economic government investors differ by group but are not significant.

Results for the economic freedom of the acquiring government are presented in Table 12 and 13. The variable of interest in Table 12 is *Gov. Expropriation,* and in Table 13 *Left*. Model 1 includes all deals; Models 2 and 3 show foreign and domestic deals; Model 4 presents investments by political arms of government; Model 5 by financial and Model 6 by economic arms of government. Higher levels of government expropriation and left-wing governments are associated with increased levels of political interference, which intensifies the conflict with profit maximization.

Table 12 shows that investments from governments with higher levels of expropriation are met with negative target shareholder announcement reaction of -0.54%. This relationship is significant only for domestic deals as target shareholders are likely to expect lower levels of interference in their operations by foreign governments, regardless of the economic freedom policy of these investors. This highlights higher benefits associated with foreign government investors who strive to avoid the imposition of conflicting political goals to their foreign investors, while they still create this conflict in their domestic investments. While target shareholders exhibit a -0.82% more negative reaction to investments by economic arms of government that are more likely to expropriate assets, target shareholders, interestingly, exhibit a 0.85% more positive reaction to investment by governments with high levels of expropriation when the investment is completed by the political arms of government. Perhaps the latter reaction could be explained by shareholders

being glad to receive at least some compensation in a situation where an outright asset expropriation is likely.

Likewise, Table 13 shows that investments by left-wing governments are met with negative target shareholder announcement reaction of -2.14%. While target reaction is negative to left-wing government investment in both foreign and domestic deals, the relationship is only significant is case of domestic deals (-2.5%). A further breakdown into government investor types shows that the significance of this relationship is primarily driven by political arms of government, as targets have a -6.31% negative reaction to the news of investment by the political arms of left-wing governments. Overall, both Tables 12 and 13 show that higher likelihood of the negative political interference is met with a more negative target shareholder equity reaction. When this conflict is proxied by measures of economic freedom of the acquiring government, this negative reaction is again specific to domestic deals.

I further examine how the political-profit maximization goal conflict influences shareholder wealth given not only different types of government investors but also considering whether they purchased majority or minority stakes in the target firm. These results are presented in Table 14. Faccio (2006) and Bortolotti and Faccio (2009) treat government ownership in excess of 10% as majority ownership. Accordingly, I differentiate between majority ownership above 50%, ownership between 50%-10% and minority ownership lower than 10%. Model 1 includes all deals and the main variables of interest in it are: *Majority Ownership (>50%)* and *Majority Ownership (50%-10%)*, while the left out group is *Minority Ownership (<10%)*. Models 2 only includes deals where government ownership represents a

majority control holding of 50% or more, while Model 3 includes those with majority ownership between 50% and 10%, and Model 4 contains deals involving minority purchases lower than 10%. Overall, target equity announcement reaction is positively related to government investment above 50% (7.27%) and also between 10% and 50% (2.20%). While governments may impose political agenda which conflicts with profit maximization at all levels of ownership, at the higher levels of ownership benefits associated with government investment outweigh the negative effects of political agenda.

Model 1 in Table 14 also points to the deleterious effects of political investors on shareholder wealth, as target equity announcement reaction associated with that type of investors is a negative -4.04%. But the classification of government investments according to the ex-post ownership in Models 2-4 reveals several important relationships. First, that political investors have a negative influence of -5.91% on shareholder wealth for acquisitions of 50% to 10% interest and only domestically, as foreign government investment is linked with a 5.05% positive shareholder reaction at that investment level. This supports prior results which linked foreign government ownership to a positive target shareholder reaction. Second, the disaggregated results reveal that target shareholders exhibit a -3.37% negative stock reaction to the news of minority (below 10%) foreign government investment. Interestingly, this negative reaction is mitigated through investments by foreign political and financial arms of government, as target shareholders respond with a 3.57% and 2.69% positive reaction respectively. Target shareholder wealth increases when foreign political and financial arms of government acquire minority stakes of

below 10% by 6.94% and 6.06% respectively. Third, Model 2 indicates that target shareholders react positively to majority government investments regardless of the government investor-type or foreign and domestic nature of government investment, as neither the foreign deal nor the political or financial investor indicators are significant.

4. Robustness Checks

In this section I check the robustness of the results from the prior sections to alternative specifications. These alternatives include controlling for offer premium and estimating models over periods of economic distress and outside of it. All models are also robust to the inclusion of additional controls for same industry deals, deals where the direct acquirer, as opposed to both the acquirer and its parent, has a 'government' status, and capital inflow controls (these results are not presented but available upon request). The results involving alternative specifications confirm the hypothesis that the imposition of political goals, which conflict with profit maximization goals, is detrimental to shareholder wealth.

The inclusion of the offer premium is especially important in addressing concerns dealing with overpayment and surrounding majority purchases. While it is typical in M&A studies to examine both target and bidder announcement reactions in order to trace overpayment, this is not possible for government investors, as most of them are not publically traded. I am able to calculate government investor announcement reactions for 46 out of 1,809 deals and they are not significant (these results are not presented but available upon request). However, the inclusion of the

offer premium is a direct way to address concerns about results being driven by payment amounts. Offer premium is the 'PREM4WK' variable from the SDC Platinum database, which they define as a "*premium of offer price to target closing stock price 4 weeks prior to the original announcement date, expressed as a percentage*." The variable is scarcely populated and due to this reason is presented only as a robustness check.

The inclusion of the offer premium also helps address concerns that findings for majority purchases are driven by the premium offered and not by the beneficial effects of government investors at the higher levels of ownership. Generally, acquisitions of majority control are done at a premium and therefore associated with a positive target reaction. However, government investors are different from other acquirer and can choose to offer a premium when they increase their ownership above 50% or pay a suboptimal price as they expropriate the firm from private control. Vivid examples are presented by the recent 2012 re-expropriation by President Kirchner of the Argentina's oil firm YPF from Spanish Repsol and by President Putin's depletion of shareholder wealth during the scandalous renationalization of Russian Yukos in 2003. Also, the concern that target equity reaction to majority government investment is driven by premium is partially addressed by examining two types of majority government investments – those above 50% and those between 10% and 50% - and showing that target equity reaction is positively associated with both. But a more direct test that the inclusion of the offer premium allows is justified.

Besides including offer premium, the relationship between government investment with various levels of political interference and target equity reaction is

examined during and outside of periods of financial distress. Financial distress is proxied by banking crises and the 2008-2009 financial crisis. Pastor and Veronesi (2011) model the relationship between political uncertainty during policy changes and equity risk premium. They conclude that government policy changes should have a positive effect on stock prices in a weak economy, as new policy changes are perceived to be profitability enhancing when compared to the policy being replaced, but during more typical conditions stock prices should fall at government policy change announcements. Given the importance of economic distress when evaluating the effects of political uncertainty, I examine the relationship between government investment with various levels of political interference and target equity reaction during and outside of periods of economic uncertainty.

Robustness checks are presented in Table 15. The main variables of interest are those that define a government investor type, foreign or domestic nature of government investment and the percentage acquired by governments. In general, the setting of Table 15 is similar to that of Table 10 but additional specifications are considered. Model 1 controls for the offer premium, while Models 2 includes deal that do not have data on offer premium in order to examine the robustness of the relationship between political interference and shareholder wealth around government investment announcement. Models 3 and 4 present results during and outside of the banking crises. Similarly, Model 5 estimates for the 2008-2009 financial crisis and Model 6 for the period outside of the 2008-2009 financial crisis.

Model 1 in Table 15 shows that even after controlling for offer premium investment by the political arms of government is associated with a negative

shareholder reaction of -6.63%. Investments by the financial arms of government are linked to a negative reaction of -3.31%. Foreign government investments are associated with a positive target reaction but insignificantly. Also, target equity reaction remains a positive significant function of the amount of shares acquired. In other words, when governments purchase larger stakes in companies, target shareholders react positively, even after controlling for the offer premium. Model 1 involves all deals, but the results (unreported but available on request) also hold for regressions with offer premium when separately considering foreign and domestic government investments, investments by those governments' political, financial and economic arms, investments by left wing governments and government majority and minority investments. Model 1 also confirms that deals financed with stock are associated with a -8.97% negative target equity reaction. The relationship between shareholder equity reaction and the announcement of government-to-government investment remains positive even after controlling for the offer premium, perhaps emphasizing the synergies gained through such deals. Another interesting result presented in Model 1 is that target shareholders react negatively (-3.74%) to government investment during banking crises. It is possible that during banking crises firms are particularly worried about governments imposing political agenda and disregarding shareholder interests.

The relationship between political government investors and shareholder reactions during the investment announcement remains negative (-2.44%) for deals that do not have data on the offer premium in Model 2. Model 2 also shows that target equity reaction to government investment is a positive function of shares acquired.

Foreign government investments are associated with a positive reaction of 2.3% as they are less likely to impose political agenda. Target equity reaction is 0.1% higher for each additional % increase in government stake investment. Additionally, larger and more profitable firms, as measured by ROA and Tobin's Q, react negatively to the news of government investment. In general, Models 1 and 2 from Table 15 confirm the findings that political agenda imposition by government investors has negative consequences for shareholder wealth, as investments by the political arms of government are met with a negative reaction even after controlling for the offer premium.

Models 3-6 estimate during and outside of periods of financial distress and consider banking crises and the 2008-2009 financial crisis. Their results echo the findings from other tables. Model 3 shows that during banking crises target shareholders exhibit a -4.99% negative reaction to the news of investment by government political arms and, interestingly, there is no significant relationship between the percentage of shares acquired by governments and target equity reaction. Also, larger and less leveraged firms react negatively to the news of government investment during banking crises. These results show that during banking crises firms are especially worried about the imposition of political goals that government investment may inflict. This political agenda imposition is specific to domestic government investments, as target shareholders welcome foreign government investment (4.34%) during banking crises. Model 4 presents results outside of banking crises and they largely parallel those during the banking crises, except that the

relationship between target equity reactions and the percentage of government investment becomes positive and significant, as it is in all models, except Model 3.

Results for the 2008-2009 financial crisis, presented in Model 5, show that this period of financial distress is different from other crises, as governments stepped up to rescue a variety of firms, especially those in the financial industry, and provided them with financing to meet their obligations. Target equity reaction to the investment by government's political and financial arms during the 2008-2009 financial crisis is still negative, but not significant. Also, prior year performance is negatively (-2.71%) related to target stock reaction, meaning that firms with worse performance in the prior year had a more positive reaction to government investment during the crisis, highlighting the government's role as a lender of last resort. Like for the banking crises, larger and more profitable firms had negative reactions to government investment during the financial crisis, probably fearing the divergence of their firms resources to support political agenda. Also, because most government invested domestically during the 2008-2009 financial crisis, in order to support their local economy, foreign government investment has no significant relation with target equity reaction over that period. Model 6 presents results outside of the 2008-2009 financial crisis and shows that target shareholders react negatively to the investment by political (-3.82%) and financial (-2.16%) arms of government but target equity reaction is positive for foreign government investment (2.51%) and increases by 0.13% for each additional percentage of government investment.

In general, the finding that government investment influences shareholder wealth and that the imposition of political goals associated with government

investment hurts target shareholders is robust to the inclusion of the offer premium and when estimating models during and outside of periods of financial distress.

5. Conclusions

Despite common misperceptions, governments are a large and growing class of investors. I examine government investment in publicly traded companies in order to evaluate target shareholders' reactions to different types of government investors. Government investment could benefit the target firm through 'preferential access' to financing, additional contracts and regulatory lobbying. On the other hand, as the privatization literature points out, government ownership is likely to lead to lower profitability and efficiency due to the conflict between political and profit maximization goals. I show that not all government investors are alike. Government investors with high perceived levels of political interference, in particular those that are political, domestic, left-wing and those more likely to expropriate are associated with a negative target stock price announcement reactions. But other government investors, in particular foreign, those from economic arms of the government, those from right-wing governments and those less likely to expropriate, benefit their target firms, as the positive effects of their ownership outweigh any additional conflict between the goals of politics and profit maximization. I also show that the benefits associated with government investment are more likely to reveal themselves at higher ownership levels, while the negative effects of political arms of government on shareholder wealth are stronger with minority stake investments.

Investments by various government entities have not been previously examined in the literature and this paper provides a first look at them. The paper aims to uncover the likelihood of political goal imposition by these different government investors and the related shareholder wealth effects are examined around government investment announcements. It leaves a multitude of unanswered questions dealing with government investment for future research involving not only identification but also the evaluation of long term effects of government investments and the comparison of shareholder wealth effects between government and public investments. It would be particularly interesting to identify not only why governments invest in general and whether they invest around specific events, such as elections, but also to provide a more careful identification of the political interference channel that is associated with government investment.

Chapter 2: Government Ownership and the Cost of Debt: Evidence from Government Investment in Publicly Traded Firms[9]

Contrary to public perceptions and despite the worldwide success of state privatizations, over the past decade governments have acquired more assets through stock purchases (US$ 969 billion) than they have sold through share issue privatizations and direct sales (US$ 765 billion).[10] In fact, governments and state-owned entities have been such active stock-market investors that they now own approximately one-fifth of global stock-market capitalization (The Economist, 2010). We investigate the impact of this novel and growing form of government ownership on the cost of publicly traded debt of the firms in which governments invest.

The rise in "state capitalism" that this phenomenon of government stock purchases both reflects and encompasses has been deeply controversial, especially when it involves share purchases by foreign state-owned investors such as sovereign wealth funds (SWFs – see Bortolotti, Fotak, and Megginson, 2010; Dewenter, Han, and Malatesta, 2010; Kotter and Lel, 2009) or state-owned enterprises (SOEs – see Karolyi and Liao, 2010; Karolyi and Taboada, 2011).[11] In addition, the mass of published research examining the effectiveness of governments versus private investors as owners of business enterprises points to the superiority of the latter, and

[9] This chapter is based on collaborative work with Ginka Borisova, Veljko Fotak, and William Megginson.

[10] Based on data from the Thomson Reuters SDC Platinum M&A database.

[11] Politicians and analysts have often referred to the possibility that foreign governments could gain control of vital assets through their investments, thus constituting a security risk. For example, the attempted acquisition of six US port-management businesses by Dubai Ports World, a state-owned enterprise, was stalled by the US Congress in 2006 on the basis of security concerns. A second often-cited risk is that of a foreign government acquiring technology which could constitute a threat to national security.

empirical evidence overwhelmingly documents that when governments privatize SOEs, performance tends to improve – often dramatically.[12] All this suggests that states should be reducing their ownership of corporate equity, rather than increasing it. Yet, this evidence is mostly based on an analysis of stock-price and operating performance. The effect of government ownership on the value of firm debt is largely unexplored.

Despite governments resembling other large institutional investors, they often have different goals. While private investors are generally concerned with wealth maximization, several possible rationales for state ownership of listed equity have been put forth. Governments can purchase equity stakes to influence companies to pursue socially-desirable objectives, such as maintaining high levels of employment, or to subsidize industries considered vital to the nation's political and military goals. These motivations suggest that governments are reluctant to allow companies in which they purchase stock to fail. Accordingly, investors come to expect that governments will prevent struggling government-owned firms from defaulting, thus providing a form of implicit debt guarantee (Faccio, Masulis, and McConnell, 2006; Brown and Dinç, 2011; Borisova and Megginson, 2011). Such a guarantee is likely to lower the

[12] The relative effectiveness of state versus private ownership is examined in Eckel and Vermaelen (1986), Boardman and Vining (1989), Kole and Mulherin (1997), Shleifer (1998), Chhibber and Majumdar (1999), Shirley and Walsh (2000), La Porta, López-de-Silanes, and Shleifer (2001), Sapienza (2004), Dinç (2005), Caprio, Laeven, and Levine (2007), Chen, Firth, Xin, and Xu (2008), Chernykh (2008), Lin and Su (2008), Wolf (2009), Firth, Lin, and Zou (2010), Morck, Yavuz, and Yeung (2011), and Lin, Ma, Malatesta, and Xuan (2011). Early privatization empirical studies are summarized in Megginson and Netter (2001) and Djankov and Murrell (2002), while more recent research includes Sun and Tong (2003), Megginson, Nash, Netter, and Poulsen (2004), Boubakri, Cosset, and Guedhami (2005), D'Souza, Megginson, and Nash (2005), Gupta (2005), Brown, Earle, Telegdy (2006, 2010), Wolf and Pollitt (2008), Estrin, Hanousek, Kočenda, and Svejnar (2009), Boubakri, Cosset, Guedhami, and Saffar (2011), and Denisova, Eller, Frye, and Zhuravskaya (2011).

perceived risk of default, which in turn reduces the risk premiums required by investors and, hence, lowers the cost of debt for the issuing firm.

On the other hand, Stiglitz, Jaramillo-Vallejo, and Park (1993) warn that this reluctance of governments to allow firms (especially financial institutions) to fail can increase managerial moral hazard, as shareholders and managers enjoy the benefits of strong firm performance, while the government and, ultimately, the taxpayers share the costs of insolvency. Such moral hazard can increase the cost of borrowing (Lin, Ma, Malatesta, and Xuan, 2011) and is further strengthened by a lower risk of managerial replacement, as government-owned firms are less likely to be acquired in a takeover or be allowed to go bankrupt. For example, when German skin-care company Beiersdorf was targeted by U.S.-based Proctor & Gamble in 2003, the city of Hamburg purchased a stake in the company to prevent the takeover and maintain local employment. The moral hazard problem is also exacerbated by a monitoring gap associated with government ownership, as shown, for example, by Bortolotti, Fotak, and Megginson (2010) for SWF investments: governments typically provide lower levels of monitoring than other private shareholders, and the implicit guarantees they offer remove monitoring incentives for other stakeholders. In addition, the imposition of social and political priorities on investment targets, despite the best intentions of governments to maintain the firm's viability, could result in deviations from purely economic shareholder value maximization. Such deviations could negatively impact firm performance and firm value, which in turn leads to a higher probability of default and a higher cost of debt. In other words, the implicit debt guarantee has a direct effect on the cost of debt – by lowering the perceived risk of default, it lowers the required

risk premium – but it also has an indirect effect of increasing moral hazard and agency costs, which could lead to a higher risk of default.

The net effect of government ownership on the firm-level cost of debt is thus a matter for empirical investigation. While the potentially countervailing effects of government shareholdings need not be mutually exclusive, our analysis aims at determining which effect dominates on average and in specific circumstances – for example, we recognize that debt guarantees could be stronger in times of economic distress. Thus, we examine the link between government ownership and spreads (above benchmark yields) on publicly traded corporate bonds issued by firms in which governments and other state-owned investors purchase equity ownership stakes. We manually collect and extensively verify stock ownership data to identify government ownership stakes for a sample of firms for each year between 1991 and 2010, as an accurate metric of government ownership is crucial to our study. Our sample consists of 5,048 credit spreads from 1,278 bonds issued by 214 companies from 43 countries over 1991-2010. The main analysis relies on panel regressions in which we model the spread on corporate bonds as a function of government ownership after controlling for other factors (both security- and firm-specific) which have been found in previous research to affect the cost of debt. Our initial results indicate that, in our overall sample, the presence of a government shareholder is linked to an increase in the cost of debt, but that the cost of debt decreases in the size of the stake owned by the government. A binary variable related to the presence of government investors is associated with a 40 basis points (bp) increase in the cost of debt, while each percentage point of government ownership is associated with a corresponding 0.6 bp

decrease. We conjecture that government shareholding induces moral hazard and deviations from shareholder wealth maximization, but implicit government guarantees become more credible as government-owned stakes increase.

We further note that a government guarantee on the debt of investment targets is likely to be more valuable during times of economic hardship as defaults are, all else equal, more probable during crises or recessions (Ivashina and Scharfstein, 2010; Puri, Rocholl, and Steffen, 2011; Santos, 2011). We therefore distinguish between the recent financial crisis and previous 'non-crisis' years. During non-crisis years, controlling for relevant firm and bond characteristics, we find that firms with one or more government entities as a shareholder display significantly higher bond spreads, with an average increase of 61 bp. During the recent financial crisis, however, government presence is associated with lower spreads, by 18 bp, and each percentage point increase in government stake ownership translates into a 1 bp decrease in the cost of debt. Likewise, government ownership is associated with a lower cost of debt, by 9 bp, during banking crises identified by Laeven and Valencia (2010) but with a higher cost of debt, by 38 bp, outside of the banking crises. We interpret this as further evidence of the value of implicit government guarantees on the cost of debt of investment targets as, during times of distress, government ownership in any amount is associated with a decrease in the cost of debt.

We recognize that government investments are not random – rather, governments invest selectively, which could lead to a non-causal relation between government ownership and cost of debt. For example, during the recent financial crisis, governments have acquired stakes in failing institutions, which could obscure

the relation between government ownership and cost of debt. Accordingly, we perform the majority of our tests with samples that exclude observations related to the 2007-2008 wave of bailouts. Our results are also not affected by other investment selection biases. First, in regression analysis, we use lagged (previous-year) government ownership. Further, in two-stage selection models, we control for factors influencing the decision of the state to take ownership positions in investment targets and find our core results to be robust. Similarly, an instrumental variable approach confirms our findings.

The above results gathered from economy-wide distress periods suggest that, as expected, government guarantees are more valuable, the more likely the firm is to default. In additional analysis, we focus on firm-specific measures of distress by investigating the effect of government ownership on the cost of debt for a sample of firms issuing high-risk (non-investment-grade) bonds and for a sample of high-leverage firms. In the sample of non-investment-grade bonds, we observe patterns similar to our main results – government ownership during crisis (non-crisis) years is associated with a lower (higher) cost of debt. We find the same relation when looking at firm-years with leverage values above the median. For highly-levered firms during non-crisis years, government ownership is linked to a 50 bp increase in the cost of debt, while during the recent financial crisis, government ownership is linked to an 89 bp decrease (or to a 2 bp decrease for each percentage point of ownership). Generally, we document that credit spread reductions are stronger when considering firm distress, consistent with the heightened value of state guarantees.

Past research has also documented that not all institutional investors are good monitors and that the monitoring is mostly – perhaps uniquely – provided by independent, long-term investors (Borokhovich, Brunarski, Harman, and Parrino, 2006; Chen, Harford, and Li, 2007; Ferreira and Matos, 2008; Brav, Jiang, Partnoy, and Thomas, 2008; Cronqvist and Fahlenbrach, 2009; Klein and Zur, 2009; Aggarwal, Erel, Ferreira, and Matos, 2011; Chung and Zhang, 2011). Similarly, different government-owned entities vary in terms of objectives and *modus operandi*. For example, government entities such as SOEs are often more closely involved in the management of investment targets than are pure state actors, such as the central government or local/regional governments (Sapienza, 2004; Dinç, 2005; Brown and Dinç, 2005; Fan, Wong, and Zhang, 2007). State-owned investment vehicles such as pension funds and SWFs monitor target firm management differently than do pure government entities or state-owned operating companies (Woidtke, 2002; Giannetti and Laeven, 2009; Jiang, Lee, and Yue, 2010). Bortolotti, Fotak, and Megginson (2010) show evidence that SWFs are very poor monitors, especially when the investment target is a foreign firm. An activist stance by acquiring state entities could, therefore, either mitigate or amplify the adverse impact of government-induced moral hazard depending on the goals of the government entity. Further, implicit government guarantees should be mainly provided by the central and local governments, as well as by central banks and by SOEs in strategic industries – entities that act as 'protectors' – and not by the more financially-oriented government entities, such as SWFs and pension funds. Our study is the first to provide a detailed breakdown of government investors into groups – central government, local government, SOEs, mixed SOEs,

central/development banks, SWFs, and public pension funds. We find that ownership by SWFs and pension funds is associated with an increase in the cost of debt, while ownership by central and local governments is linked to a decrease in the cost of debt. Fully and partially government-owned SOEs generally lead to an increase in the cost of debt outside of crises and a decrease in the cost of debt during the recent financial crisis. Overall, our evidence is consistent with the idea that more direct government involvement provides the strongest implicit debt guarantees due to political goals (often inconsistent with firm default) and 'deep pockets', thereby helping lower the cost of debt during crisis periods. Conversely, the increase in the cost of debt is primarily linked to financial arms of the government (e.g., SWFs, pension funds), whose investing objectives are often commercial and, as such, do not lead to a similar implied debt guarantee.

We further note that implicit government guarantees should be strongest for domestic targets, as the default of a foreign investment target is less likely to carry the political stigma associated with failures of domestic state-owned companies. For example, social and political goals are less likely to be imposed on foreign targets, as employment maximization is not typically a goal sought by a foreign government owner. Additionally, recent empirical studies show that local investors are better able to overcome informational asymmetries than are more distant investors (Baik, Kang, and Kim, 2010; Almazan, de Motta, Titman, and Uysal, 2010), thus enabling domestic owners to exercise more informed monitoring. On the other hand, even more empirical evidence points to the superiority of foreign institutional and corporate investors as monitors of investee-firm management, which could lead to higher firm valuations and

thus a reduced cost of debt (Djankov and Murrell, 2002; Brown, Earle, and Telegdy, 2006 and 2010; Ferreira and Matos, 2008). Clearly, we should expect different types of government entities to impact the cost of debt of target firms in materially different ways. By separately analyzing the effect of domestic and foreign government ownership, we find that the implicit debt guarantee documented during the recent financial crisis is specific to domestic government presence, and we estimate the effect to be of approximately 70 bp. Foreign government ownership over the full twenty-year sample period, however, is associated with an increase in the cost of debt of about 56 bp.

On balance, these results suggest private investors believe that stock ownership by most domestic government categories can improve the creditworthiness of corporate bond issuers by providing an implicit debt guarantee that becomes especially valuable during a financial crisis. However, a higher cost of debt is associated with state ownership during relatively healthier economic times, as well as with holdings of foreign government entities and more commercially-oriented state investment vehicles. In these scenarios, the negative effects of government ownership (i.e., moral hazard, poor monitoring, political goals) outweigh the strong backing provided by these state investors.

Evidence on the impact of government ownership on the cost of debt has been investigated recently by Borisova and Megginson (2011). Our research differs in several ways, most importantly in that Borisova and Megginson examine residual state ownership following privatization – the reduction of state control in firms, often concomitant with regulatory changes and firm reorganization – while we look at the

government as an investor in publicly traded firms. Our analysis further indicates that the relation between government ownership and cost of corporate debt is dramatically affected by firm-specific and economy-wide distress, differences between types of government acquirers and, finally, by the distinction between domestic and foreign government ownership. Our sample spans 43 countries, and includes firms from North America and Asia, while Borisova and Megginson (2011) focus solely on domestic government ownership of European firms.

This study is structured as follows. Section 2 develops the hypotheses. Section 3 describes data sources, sample construction, and variable definitions and offers descriptive statistics and univariate tests. Section 4 discusses the methodology, panel regressions, and the associated model estimation results. Section 5 concludes.

1. Hypotheses Development

Governments, as acquirers, differ from private entities in multiple ways. Most importantly, government ownership carries an implicit guarantee on the debt of the firm, as it is not probable that a firm with state ownership will fail. This unwillingness of governments to allow firms to default is due to three main reasons. First of all, governments pursue political goals, such as low unemployment, which are not consistent with the loss of jobs frequently associated with firm default. Second, government ownership is often motivated by the desire to maintain key industries providing crucial services to the country; accordingly, governments are not keen on allowing such strategic holdings to default. Finally, politicians do not wish to be associated with a failed investment and would thus pressure or steer the government to

rescue an insolvent government-owned firm. Consistent with this reasoning, Faccio, Masulis, and McConnell (2006) find that politically connected firms are more often the recipients of government bailouts, while Brown and Dinç (2005) show evidence that defaults of government-owned banks are less common than defaults of privately-owned banks. Consequently, debt holders could perceive a reduced probability of default as governments would either back the debt of the defaulting firm or prevent the default altogether. Therefore, we expect that state ownership would lower the debt pricing for target firms.[13]

However, Borisova and Megginson (2011) show that state influence on debt pricing can be non-monotonic, and several factors resulting from state presence could raise the firms' cost of debt financing. First, as discussed by Stiglitz, Jaramillo-Vallejo, and Park (1993), the implicit government guarantee allows shareholders and managers to benefit from strong firm performance, while public funds are used to keep firms afloat during difficult periods. Consequently – as Gropp, Hakenes, and Schnabel (2011) find for state-owned banks – we expect managers to increase levels of risk taking, which in turn will increase the cost of debt of the government-owned firm.

Second, the moral hazard problem can be reinforced by a monitoring gap that occurs because the government is unable, or unwilling, to supervise management.

[13] The implicit assumption in our model, based on the cited literature, is that government ownership affects the probability of default of the firm itself. Another possible channel of state influence on credit spreads lies in the impact of government backing on bondholder recovery rates in the case of default. This relation could be found in cases where explicit state guarantees exist for corporate bonds. In our sample, however, the instances of direct government guarantees on firm debt are rare and affect 0.71% of the total number of observations. In particular, we find the following bond collateral types, controlled for in our regression analysis, that imply a direct government guarantee: "FDIC Guaranteed" (2 obs), "Govt Guaranteed" (2 obs), and "Govt Liquid Guaranteed" (32 obs). Accordingly, we focus on the effect implicit government guarantees can have on the probability of default, rather than on recovery rates.

Since debtholders expect governments to monitor and rescue distressed firms, their own incentives to supervise the actions of management decrease (OECD, 1998). However, government employees could simply not have the skills or technical knowledge necessary for proper monitoring, due to political appointments and other inefficiencies in the government employment sector. Borisova, Brockman, Salas, and Zagorchev (2012) find a lower quality of corporate governance in publicly traded firms partially owned by the government when compared to firms free from state ownership. Governments could be reluctant to actively impact the governance of firms in which they invest for fear of public opposition and backlash by media and regulators, especially if the investment target is located abroad. Bortolotti, Fotak, and Megginson (2010) propose the "Constrained Foreign Government Investor Hypothesis" and show evidence that SWFs create a 'governance gap' that leads to value destruction, largely due to their desire not to stir opposition. Eckel and Vermaelen (1986) also point to the fact that government ownership can decrease the probability of a takeover, hence reducing the disciplining effect associated with the market for corporate control.

Third, government investment vehicles may pursue goals other than wealth maximization. State entities could want to maximize employment, favor domestic investments, or acquire foreign technologies. Well-known cases of government ownership directing the benefits to their political supporters or simply appeasing the groups that have power to overthrow the existing government highlight inefficiencies

in state ownership.[14] Outside of the state's goal to keep its investment targets in operation, the above-mentioned political factors could lower the risk-adjusted performance of government-owned firms, and as Crabbe and Fabozzi (2002) document, firm profitability is closely linked to the firm's ability to repay borrowed funds.

Between implicit debt guarantees, moral hazard, ineffective monitoring, and political goals linked to state owners, the net impact of government ownership on the cost of debt of target firms is a matter of empirical investigation. While we recognize that government ownership could impact the cost of debt in multiple ways, our focus is on the *net* effect. First, we believe that the overall effect is of ultimate interest to the debate on optimal government ownership; second, we realize the empirical difficulty in measuring the relative contribution of the different effects. Therefore, we simply hypothesize that government ownership has an influence on the cost of debt of investment targets, positing:

H1: Government ownership impacts the cost of debt of investment targets.

We test the above hypothesis by investigating whether the cost of debt of firms with government entities amongst their shareholders is different from the cost of debt of a sample containing the same firms during years without government ownership. We further note that the impact that government ownership has on firm behavior could plausibly be conditioned by the size of the government-owned stake. Governments could be more protective of firms in which they own larger stakes, thus reinforcing the

[14] Refer to Shleifer (1998) for examples. Some instances include post-World War II British government sponsoring of coal mines due to the miners' union power to overthrow the current government and the Philippines running a state-owned power utility that stops providing electricity to some parts of the nation for seven hours a day.

implicit debt guarantee previously mentioned. Similarly, state owners can have a stronger effect on the governance and behavior of firms in which they hold larger stakes, in virtue of greater control and the ability to influence board-of-director appointments, for example. Therefore, we also examine the relation between firms' cost of debt and the size of the stake owned by government investors.

The value of a government guarantee is roughly equal to the perceived probability of distress times the perceived probability of government intervention (in case of distress). In normal economic times, the probability of default of a firm could be viewed by bondholders as remote, so that the probability of government bailout or other intervention would not have a meaningful impact on the cost of debt. As economic conditions deteriorate and the probability of default increases, the value of a government guarantee increases, possibly leading to a substantial effect on the cost of debt. Hence, we hypothesize that:

H2: The effect of government ownership on the cost of debt of investment targets differs during recessions and periods of market-wide financial distress.

As a first test of the above hypothesis, we make use of the recent financial crisis (spanning the years 2008, 2009, and 2010). This event, engulfing as it has virtually the entire global economy, is an appropriate testing ground as it constitutes an exogenous shock in most domestic economies. Using both interaction variables and data subsets, we investigate whether the impact of government ownership on the cost of firms' debt differs during this financial crisis. For robustness, we replicate our analysis by focusing on a broader set of financial crises – the banking crises described by Laeven and Valencia (2010).

Using similar reasoning, we investigate whether government guarantees would also be more valuable in the presence of firm-specific distress. We thus examine the influence of government ownership on the cost of non-investment-grade bonds and highly-levered firms, which we use as proxies for firm-specific distress, and theorize the following:

H3: The effect of government ownership on the cost of debt of investment targets differs for high-risk firms.

Government-owned entities can vary substantially in their goals and operations. Some classes of government entities are more likely to be involved in the management and monitoring of their acquisition targets. A more active approach to corporate governance by government shareholders could help reduce or exacerbate the costs of moral hazard associated with state ownership, depending on the government entity's agenda. Similarly, the strength of the implicit debt guarantee differs according to the nature of the government entity holding the investment stake, in turn leading to different impacts on the cost of debt. SWFs and state-run pension funds have "deep pockets" like other government shareholders but are more likely to adjust their portfolios than, for example, a local government investing to prevent a foreign takeover. Hence, we hypothesize:

H4: The effect of government ownership on the cost of debt of investment targets differs according to the type of government investment vehicle.

Accordingly, we investigate whether different classes of government-owned acquirers (central government, local government, SOEs, mixed SOEs, government banks, SWFs, and public pension funds) have different effects on the cost

of debt of investment targets. In particular, we expect government acquirers that are more closely associated with political goals (such as central governments) to take on the role of 'protectors' and to provide the strongest debt guarantees. Entities with a more independent nature (such as government-owned pension funds and SWFs), which we deem 'investors', should more closely follow the behavior of other institutional investors. They should suffer less from the political distortions that lead to government support of distressed firms and be less able to rescue defaulting portfolio holdings.

Government guarantees should be most relevant when governments invest in a local target, since foreign state investors will not have the same national concerns. A lower cost of debt could be linked to domestic government investments due to greater debt guarantees and the greater monitoring role of local governments. Also, active foreign government involvement in a domestic target is usually met with significant public opposition, so governments sometimes choose to be passive investors, especially in their foreign holdings (Bortolotti, Fotak, and Megginson, 2010). This reduced monitoring can lead to increased risk taking, reduced firm efficiency and, therefore, a higher cost of debt when foreign state holdings predominate. On the other hand, government involvement could lead to a higher cost of debt for domestic entities as those investments typically pursue not only shareholder value maximization, but also other political and social goals. Thus, we hypothesize:

H5: The effect of government ownership on the cost of debt of investment targets differs for domestic firms.

2. Sample Description

We collect a sample of government investments from the Securities Data Company (SDC) Platinum Mergers and Acquisitions database. As an initial screen, we include all investments by entities whose ultimate parent is flagged as 'government' over the years 1980-2010. This initial search yields 12,112 completed transactions worth $1.66 trillion. After restricting the sample to government investments in publicly traded firms, so that we can obtain audited accounting data for the investment targets, we have 2,512 transactions worth $749 billion in 1,953 unique publically target firms. We further rely on SDC to collect additional information about the deals, such as completion dates, the proportion of shares acquired for each deal, the proportion of shares held by the acquirer after the deal, the nation of the acquirer, and the nation and primary SIC code of the target.

We use the SDC New Issues database to identify target firms based on CUSIP identifiers with publicly traded 'plain vanilla' bonds outstanding over the period 1991-2010.[15] Following Borisova and Megginson (2011), we only use straight bonds with fixed coupons as the spreads of debt securities with additional features are more sensitive to sovereign bond yield fluctuations (Duffee, 1998). Based on the 1,953 unique CUSIPs from our government investment sample, SDC returns 7,804 straight bonds from 388 issuers. The retrieval of bond spread and rating data requires bond ISINs, and SDC provides ISINs for 2,977 bonds. Of the remaining bonds without

[15] Our main sample period starts in 1991, as bond credit spreads are not widely available before this time. However, we track government investments starting in 1980 when these data are available, as the earlier starting date allows us to capture a greater number of state investments and more accurately track government shareholding during the period of interest.

identifiers, we record ISINs for 945 additional securities manually found in Datastream, yielding a combined total of 3,922 bonds.

Data for these bonds are obtained from Datastream. We retrieve the bond spread as the difference between the yield of the corporate bond and the yield of a benchmark government bond that is matched by currency and maturity (using linear interpolation), as defined by Datastream. We also use this database to retrieve time-varying Standard and Poor's (S&P) ratings for the bond issues. Bond yield data and historical credit ratings are recorded as of the Wednesday closer to November 15 of each year (i.e., the third Wednesday of each November). We use data as of Wednesday to avoid end-of-week or beginning-of-week distortions in market data. For similar reasons, we use a target date of November 15 to avoid end-of-year effects. We retrieve 10,124 bond-year spreads for our sample, and 6,854 of these (from 1,554 bonds and 278 firms) are found with accompanying yearly S&P ratings. To eliminate outliers in the credit spread data, we truncate the top and bottom 1% of spreads. It is worth noting that our use of a November sampling point means that spread observations for 2008 are all after the collapse of Lehman Brothers on September 14, and thus after the 2008 financial crisis truly began.

Crucial to our analysis are accurate, time-varying values of government ownership, both in the aggregate and for various categories of state investing entities. Therefore, we further augment our dataset by using numerous sources to verify and track lagged government ownership over time in the targets. For each of our target firms, we manually collect ownership as of each year end between 1990 and 2009. SDC provides the starting point for this collection via the investments that form our

sample, as well as sales by the same acquirer-target pair in order to capture decreases in stakes. We then locate our sample firms in the Thomson ONE Banker ownership module, track holdings of all institutional shareholders across our sample period as of the end of the calendar year, and classify each reported shareholder into various government investing categories (or as a non-government investor). When not available in this database, ownership amounts and investor identifications are found using company annual reports, filings, and business descriptions. These data are provided by Thomson ONE Banker; entities' websites; press releases; the Securities and Exchange Commission's Electronic Data-Gathering, Analysis, and Retrieval system (EDGAR); the Canadian Securities Administrators' System for Electronic Document Analysis and Retrieval (SEDAR); Privatization Barometer; the World Bank privatization database; and Lexis-Nexis.

To perform our analysis, historical accounting data for sample firms are also required. We search for relevant financial data using Worldscope and track acquired/merged firms through the new entity, as in Bortolotti and Faccio (2009) and Borisova and Megginson (2011). We are able to collect necessary measures for a final dataset of 214 publicly traded firms, which provide the sample bond-years with and without the presence of state ownership. These firms are targets of 288 government purchases, and have 1,278 sample bonds outstanding that meet our selection criteria, thus yielding 5,048 bond-year observations. Description of variables and their sources are provided in Table 16.

2.1. Descriptive Statistics

Core descriptive information regarding our sample is presented in multiple panels in Table 17. Panel A includes observation counts by year for both the entire sample, including 5,048 bond-year observations, and for a subset including only observations for firm-years with government shareholding greater than zero, including 3,111 observations. Approximately 1,819 bond-year observations (36% of the total count) span the crisis years 2008-2010, allowing for a balanced comparison between the recent financial crisis and previous years. For the subsample of firm-years with government participation, 1,256 observations (40%) span the crisis years, ensuring that the subsample and the overall sample are indeed comparable.

Panel B presents bond-year observation counts by country of origin of the government owner. In cases where multiple government stakes are present in the same target firm-year, we tabulate the country of origin of the largest government shareholder. Overall, our sample contains government owners from forty different countries, and the top ten investing states include nations from North America, Europe, and Asia. Nineteen percent of our sample is represented by bond-years of firms purchased by the Canadian government. The list of other government acquirers leading our sample includes France (13% of the sample), the United States (10%), the United Kingdom (7%), Spain (6%), and Singapore (5%).

Panel C lists bond-year observations by nation of the sample firms' headquarters. The top nation is the United States, with 1,574 observations (31% of the sample). Other well-represented nations include Canada (877 observations, 17% of the

sample), the United Kingdom (570 observations, 11% of the sample), and France (459 observations, 9% of the sample).

Panel D presents bond-year counts by industrial sector, classified by one-digit SIC code of the sample firms. The leading industry is SIC code 6, the financial sector, with 2,337 observations (46% of the sample). The sample contains also a large number of observations (1,582, or 31% of the sample) related to transportation and utilities (SIC code 4). SIC codes 2 and 3, both related to manufacturing, account for 655 observations (13% of the sample).

Panel E presents descriptive statistics for our main binary variables.. The presence and level of government investment in target firms serve as our primary explanatory factors of interest. *Govt presence* is a binary variable taking a value of 1 if there is any government ownership in the firm during a specific calendar year, and 0 otherwise. We also collect levels of state ownership represented as a percentage of a firm's shares. As presented in Panel E of Table 17, out of a total of 5,048 bond-years, 3,111 (62%) involve the presence of government. To further explore how government involvement can affect debt pricing, we disaggregate state ownership into different investing entities. Specifically, government owners are split into seven categories: *Central govt* (comprising 562 bond-year observations and 18% of the sample with government ownership), *Local/regional govt* (69 observations; 2% of the state ownership sample), *SOE full* (894 observations; 29% of the state ownership sample), *SOE mixed* (1,625 observations; 52% of the state ownership sample), *Govt bank* (212 observations; 7% of the state ownership sample), *SWF* (893 observations; 29% of the

state ownership sample), and *Pension fund* (783 observations; 25% of the state ownership sample). [16]

Our sample also includes transactions related to government bailouts, and we account for these rescues in an attempt to isolate their effect on bond spreads. Bailouts are identified using SDC deal synopses, as well as reports from the press and company financial statements. We identify 480 bond-year observations (9.5% of our sample) from 27 firms related to bailouts for the full sample, with almost all of these occurring during the 2008-2010 period (472 bond-years of 26 firms). We also account for foreign governments investing in our target firms, as this type of state ownership could yield different effects on the cost of debt of target firms. Foreign government ownership is present in 1,339 observations, which is 27% of the overall sample and 43% of the sample with state ownership. Since we hypothesize that the presence of government shareholders could have a different impact during times of economic crisis, we include a financial crisis indicator taking a value of one when credit spreads are measured in the period 2008-2010. We also use a binary variable representing country-years experiencing banking crises, as identified by Laeven and Valencia (2010), and these observations comprise approximately 26% of the sample.

[16] The classification is based on the identity of the government-owned shareholder (the investor). The 'central government' group is comprised of non-independent branches of the central (national) government, such as ministries of finance and national treasuries. 'Local/regional government' refers to non-independent branches of sub-national governments (e.g., municipalities and townships). The 'SOE full' category includes all enterprises fully owned by the government, while 'SOE mixed' includes all enterprises in which the government retains partial ownership or some level of control/connectedness (for example, through 'golden shares'). 'Government banks' includes financial institutions owned by governments and consists primarily of central and development banks. For 'Sovereign Wealth Funds' we follow the descriptions given by Thomson ONE Banker and the SWF Institute, while 'Pension funds' refers to government-owned pension funds.

Banks and other financial institutions are often treated separately in empirical analysis, as their capital structures are typically different from those of other firms. We define an indicator variable identifying banking firms based on the firm's industry classification, name, and business description, and we expect this variable to be negatively associated with firms' cost of debt. About one-fourth of all target firm observations (1,284 of 5,048 total bond-year observations) relate to investments in banks.

Panel F provides descriptive statistics for our continuous ownership, bond, and firm variables, presenting mean, median, standard deviation, 25^{th} and 75^{th} percentiles. Our dependent variable – credit spread – has an average value of 216 bp and a median value of 136 bp, and as we highlight further in our analysis, these large values are driven by the financial crisis period beginning in 2008. The mean government ownership stake is 13.5% for the overall sample and 21.9% for the sample of bond-years in which government is present as a shareholder.

As a control variable in our main analysis, we include S&P credit ratings obtained from Datastream. We form an ordinal scale with the best credit quality assigned the highest number, and we use the natural logarithm of credit rating to account for possible nonlinearity. The expected sign of the coefficient on the credit rating is negative, as we expect a higher rating to be associated with a lower spread. Table 17, Panel F, shows that the median credit rating in our sample corresponds to an S&P rating of "A-". The number of days to maturity is also included in our models, with an expected positive coefficient due to more uncertainty over the lifetime of the bond. Average time to maturity in our sample is about 2829 days, or 7.75 years. We

also control for the bond's age, defined as the number of days between the issue date and the date on which the spread was collected; average bond age in our sample is 1650 days, or approximately 4.5 years. Houweling, Mentink, and Vorst (2005) document the age of the bond as one of the most important determinants of bond market liquidity. We expect a negative relation between bond age and credit spreads, as in Borisova and Megginson (2011), since as the bond's maturity date approaches there is less uncertainty associated with its coupon and par value payments.

We further include controls for firm leverage (computed as total assets minus equity, divided by equity) to serve as a proxy for the probability of default. Including firm leverage as a control variable also allows us to account for the impact of deleveraging associated with capital injections. We expect firms with higher leverage to have a higher cost of debt, as in Collin-Dufresne, Goldstein, and Martin (2001) and Krishnan, Ritchken, and Thomson (2005). We also include the market-to-book ratio (with an average of 1.86) and size (proxied by the natural logarithm of total assets, with a mean of 10.9), as Fama and French (1993) show these factors to explain variation in bond returns. Market-to-book is generally viewed as a proxy for the growth prospects of the company, so we expect higher growth opportunities to be associated with more ease of debt repayment, and, hence, a lower cost of debt. Larger firms are generally considered safer, at least partially due to increased asset diversification, and we expect a negative relation between firm size and cost of debt. Finally, we include return-on-equity (with a mean of 7.49%), which Crabbe and Fabozzi (2002) document being associated with the ability to meet debt obligations. Thus, we expect return-on-equity to be negatively associated with the cost of debt.

Further, we obtain collateral/instrument types from Bloomberg, as those could also have an impact on bond pricing. We consider twenty-six different collateral/instrument types (see Borisova and Megginson, 2011, for examples).

2.2. Differences in Means

Before presenting our main, panel-based analysis, we offer a first look at the data though tests for differences in means presented in Table 18. Given that each firm in our sample can have multiple bond observations, the distribution of spreads is possibly clustered at the firm level. As discussed by Petersen (2009), clustering of observations can lead to problems in the estimation of standard errors. Accordingly, we employ a standard error estimation methodology adjusted for clustering (at the firm level) as described by Skinner, Holt, and Smith (1989). We then employ the clustered standard-error estimates to compute two-sample t-tests for mean differences between data subsets.

For the earlier years of the sample period (1991-2007), bond spreads of firms with government ownership are significantly higher than those without government ownership (168 bp vs. 119 bp). However, during the 2008-2010 financial crisis we find significantly lower spreads in bond-years with government presence (with a mean spread of 312 bp) than in those without government presence (393 bp). We interpret these univariate results as indicative of the importance of the implicit government guarantee during times of financial distress.

When results are broken down by the different types of government investors, we find strong heterogeneity across groups. Fully-government-owned SOEs, mixed SOEs, and government banks are associated with a significantly lower cost of debt in

the crisis period. Government banks, SWFs, and government pension funds are associated with a significantly higher cost of debt during non-crisis years.

Next, we differentiate between foreign and domestic government ownership. Target firms are grouped based on whether the majority of their government ownership is held by a domestic state entity or a foreign one. Firms with a majority of domestic government ownership have a lower mean spread (147 bp) than firms with a majority of foreign government ownership (271 bp) over the period 1991-2007. But during the 2008-2010 crisis, the cost of debt for firms with domestic government ownership (326 bp) is not statistically different from that for firms with foreign government ownership (366 bp).

The univariate analysis suggests that government ownership, while generally associated with a higher cost of debt, leads to a reduction in cost of debt during times of economic distress (i.e., during the recent financial crisis). These results are consistent with the increased value of an implicit government debt guarantee when default is unconditionally more likely. Yet, we find substantial heterogeneity across different types of government owners, with SOEs most consistently associated with a lower cost of debt. State-owned pension funds, SWFs, and foreign government ownership, however, are associated with a higher cost of debt. Our panel regressions in the next section allow us to further examine the association between government ownership and debt pricing and to clarify which economic conditions and state entities have the strongest effect on the cost of debt.

3. Panel Regressions

3.1. Methodology

We employ regression analysis to test the effect of government ownership on a target company's cost of debt, measured by its bonds' credit spreads. To control for heteroskedasticity and account for time-series dependence, firm-clustered standard errors are employed, as suggested by Petersen (2009). Year fixed effects are also used in all regressions. Similar to Borisova and Megginson (2011), the preliminary model is as follows:

$$y_{it} = \varsigma + \beta X_{it} + \gamma r_{it} + \nu_t + \varepsilon_{it}, \quad (1)$$

where y_{it} represents the credit spread, ς is an intercept term, β is a set of coefficients, and X_{it} is a matrix of right-hand side variables. γ is a scalar coefficient, r_{it} is the credit rating, ν_t (t = 1...20) represents the yearly fixed effects, and ε_{it} is a classical error term. The indices *i* and *t* refer, respectively, to bonds and years.

The right-hand side variables include control factors, as described in Section 2.1, and variables of interest related to government ownership. Depending on the specific model being tested, we employ binary variables identifying bond-years with government shareholders, continuous variables measuring the size of the stake owned by the government (expressed as a percentage), or both variables together. Further, to allow for the different effect of government ownership on the cost of debt during times of distress, we add interactions between the government-ownership variables and the financial crisis or banking crisis variables. In additional specifications, we identify the presence or stake owned by specific categories of government shareholders.

To alleviate endogeneity concerns, we evaluate the cost of debt for the same firm in years with and without government ownership, and we also lag government ownership values (e.g., December 2006 ownership is matched with bond spreads in November 2007), as in Borisova, Brockman, Salas, and Zagorchev (2012). Since government rescues could reverse the causality between state ownership and credit spreads, we also perform tests with and without the observations associated with bailouts. As a more formal method of accounting for endogeneity, Heckman treatment effect (Heckman, 1979; Heckman and Robb, 1986) and two-stage least-squares instrumental variable models are also used. In the Heckman two-stage models, an initial selection equation is fit using probit models describing the characteristics associated with firm-years where government ownership is present. The probit models include firm-specific variables present in the second-stage outcome equation, as well as variables that predict the presence of government ownership and are exogenous to the credit spread outcome we intend to model (i.e., *Privatized target firm*, *Govt size*, and *Political leadership: Left*, all defined in Table 16). In regards to these instruments, we expect firms that were once SOEs and are now privatized to have more connections to the state and to be more common targets for government investment and ownership. Lower values of the *Govt size* ranking indicate more pervasive government intervention in a given country, and greater state holdings are generally predicted in these cases. Finally, left-wing states are often associated with more state intervention and share ownership (Bortolotti, Fantini, and Siniscalco, 2003). Results from the selection equations are presented in Table 28 and are used to calculate a selectivity correction – the inverse Mills ratio (*Lambda*) – included in our credit

spread models to account for unobserved factors related to government presence in a firm and potentially to the cost of debt. The two-stage least-squares models use the same exogenous factors as the treatment effects models to instrument the amount, rather than the presence, of government ownership. First-stage results for these instrumental variable models are included as Table 29.

All models in the analysis use an orthogonalized value of credit rating to account for the effect that other independent variables could have on its assigned value. Liu and Thakor (1984) discuss the residual transformation procedure in depth, and it has also been used in more recent work (Datta, Iskandar-Datta, and Patel, 1999; Klock, Mansi, and Maxwell, 2005; Borisova and Megginson, 2011). The models also include fixed effects for bond collateral/instrument type and bond currency to account for these security-level characteristics. Firm country fixed effects capture nationwide factors that could affect bond spreads and are used in all models except those that incorporate the country-level banking crisis variable and those that investigate country-level factors expressed as differences between domestic and foreign government investors.

3.2. Government Ownership and the Cost of Debt

We apply the model described in the previous section and present results regarding the effect of government ownership on the cost of debt in Table 19. In Model 1, our main explanatory variable of interest, government ownership, is expressed as a binary variable equal to 1 if a firm has a government or government-owned entity as a shareholder in that year. We find government ownership to be

significantly linked to spreads that are 33 bp higher for the full period, consistent with the moral hazard and social/political goals imposed by state owners. In Model 2, the explanatory variable of interest is the size of the stake held by all government-owned shareholders in a firm at year end. Parameter estimates for the effect of stake size on cost of debt are negative but not statistically significant at conventional levels when considering the full sample period. In Model 3, we include both the binary variable indicating government presence as a shareholder and the continuous variable measuring the size of the government-owned stake. The coefficient associated with government presence is positive (approximately 40 bp), while the coefficient estimate associated with the government stake is negative, indicating a decrease in the cost of debt of approximately 0.6 bp for each additional percentage point of government shareholding. This model highlights the non-monotonic relation of state ownership to credit spreads, as in Borisova and Megginson (2011). Government presence generally leads to higher spreads, but at high levels of state ownership, government guarantees become strong enough to lower debt pricing. The estimated point of inflection is about 60% government ownership.

Since bailouts are widely publicized and often involve other state-imposed conditions or guarantees (irrespective of the shares procured by the government), their presence could be partially masking the relation between the size of state ownership stakes and the cost of debt. We replicate the analyses of the first three models in Models 4 through 6 of Table 19 without observations specifically associated with government rescues. The results for state presence remain similar, but the effect linked to the size of the stake owned by the government becomes larger and gains a higher

level of statistical significance in Models 5 and 6. Once we exclude bailouts, government ownership leads to a drop in the cost of debt once it exceeds the 40% threshold. Since the relation between government ownership and the cost of debt could be impacted by other selection biases in government shareholding, we estimate two-stage models which control for endogeneity in the state ownership decision. Model 7 reports the second-stage results from a treatment effects model. The coefficient estimate for government presence is almost identical (32 bp) to what it is in Model 1, as the private information related to state ownership contained in *Lambda* cannot be significantly tied to bond spreads. Model 8 of Table 19 shows the second-stage outcome of a two-stage least-squares model where the percentage of government ownership is instrumented. The effect of state ownership on debt pricing appears strong and statistically significant in this model: each extra percentage point of state ownership is linked to a bond spread decrease of roughly 1.6 bp. These endogeneity controls suggest that our results are not driven by sample-selection biases.

3.3. Financial Crises

In Table 20, we continue to evaluate the data over the full 1991-2010 period and add a variable identifying the 2008-2010 financial crisis period. Interactions between this crisis binary variable and the government ownership metrics enhance the evaluation of the relation between government ownership and spreads across diverse economic periods. By focusing on the years 2008-2010, during which most worldwide markets were affected by a global financial crisis, we make use of this exogenous shock to firms, allowing us to measure the differential impact of government ownership with limited concerns of reverse causality.

The results in Model 1 of Table 20 indicate that government ownership presence is associated with a 61 bp increase in the cost of debt during non-crisis years and an 18 bp decrease in the cost of debt during the financial crisis.[17] Model 2 shows that government ownership stake does not appear to impact the cost of debt in a statistically significant manner prior to the 2008 crisis, but each extra percentage point of government ownership is related to a 1.3 bp decrease in the cost of debt during the financial crisis. Models 3 and 4 repeat the first two models without bailout observations, and the results remain very similar. The treatment effects regression in Model 5 also echoes the conclusions of Models 1 and 3, without finding a significant link between the private information associated with state ownership decisions (*Lambda*) and credit spreads. Coefficient estimates in Model 5 show that government presence is associated with a 49 bp increase in the cost of debt outside of the crisis and a 33 bp decrease during the crisis. Model 6 shows the results from a two-stage least squares model that instruments the level of state ownership. Greater government stakes are associated with higher spreads in normal economic periods and lower spreads during times of crisis – roughly 8.9 bp lower for each additional percentage point of government ownership. The sample-selection controls in Models 5 and 6 indicate that the estimated value of government guarantees is larger once we account for selection biases. These results are consistent with the idea that government shareholding increases the cost of debt during regular, non-crisis years but decreases the cost of debt of portfolio holdings during the recent financial crisis. This finding is

[17] During the recent financial crisis, government ownership presence is associated with a negative estimated coefficient representing 79 bp. Summing this result with the 61 bp increase linked to state ownership during the entire period indicates that state ownership during the crisis is associated with a decrease in the cost of debt of approximately 18 bp.

largely consistent with governments introducing inefficiencies and the pernicious effects of moral hazard but offering, at the same time, implicit debt guarantees that become extremely valuable during times of distress.

In Model 7 of Table 20, we adopt a broader definition of 'crisis' by focusing on a wide sample of banking crises identified by Laeven and Valencia (2010).[18] The authors identify country-years in which banking crises occur across the world from 1970 to 2009 based on two conditions: "(1) Significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and bank liquidations); and (2) Significant banking policy intervention measures in response to significant losses in the banking system" (Laeven and Valencia, 2010). In Model 7, we find that government shareholding is associated with a 38 bp increase in the cost of debt of outside of the banking crises and a reduction of about 9 bp during the banking crises. In the context of the higher spreads experienced by all firms during a banking crisis, we note that the cost of debt for non-government-owned firms in our sample increases by 57 bp, but the increase for government-owned firms during a banking crisis is much lower, about 9 bp. This robustness test using banking crises confirms our general findings that government ownership is associated with a higher cost of debt during normal economic periods but with a lower cost of debt during periods of distress. The two-stage treatment Model 8 confirms our findings.

[18] Luc Laeven's dataset identifying banking crises is available at: http://www.luclaeven.com/Data.htm.

3.4. Distressed Firms

We further investigate the influence of government ownership on the cost of debt when firms are in financial distress. Noting that the value of debt guarantees should increase as default becomes more likely, we have focused on testing whether government ownership affects the cost of debt differently during a financial crisis in Section 4.3. We further analyze the effect of government shareholding on the cost of debt around firm-specific distress. To identify a sample for which distress is more probable, we focus on firms that issue non-investment-grade (junk) bonds.

Table 21 details the effect of government ownership on the cost of debt of firms that issue non-investment-grade bonds. Our main explanatory variable of interest – government ownership – is expressed as presence (i.e., a binary variable) in Models 1, 3, and 5 and as a stake (i.e., a percentage) in Models 2, 4, and 6. Moreover, given the importance of financial crises to debt pricing as shown in the previous subsection, we investigate whether the influence of government ownership on the cost of debt of distressed firms differs during an economy-wide financial crisis. Therefore, besides analyzing the influence of government ownership on the cost of debt of distressed firms over our full 1991-2010 period (Models 1 and 2), we also examine that influence for the pre-crisis period of 1991-2007 (Models 3 and 4) and the 2008-2010 financial crisis period (Models 5 and 6). This allows us to evaluate whether the implicit government guarantee influences the cost of capital for distressed firms in general and also when combined with economy-wide distress. Because of the potentially confounding effects of state investments from bailout transactions, we filter out these observations whenever performing regression analyses for the crisis period or the full

period, as it contains the crisis years. All subsequent tables in the analysis follow this general structure.

Table 21, Models 1 and 2 show that the spreads of non-investment-grade bonds are a function of government ownership for the overall 1991-2010 period. Government presence is linked to higher spreads, by approximately 81 bp, while the variable measuring the size of the stake owned is not statistically significant. Models 3 and 5 show that the results for state presence are driven by increased debt pricing associated with government presence during the pre-crisis years (98 bp). In Model 6, we do find a lower cost of debt tied to increased government stakes during the crisis period (4 bp decrease for each percentage point increase in state ownership) when state guarantees should be most valuable. The magnitude of these effects is stronger for junk bond spreads than for our full sample shown in Tables 19 and 20, emphasizing the importance of government objectives and guarantees for firms issuing these riskier instruments.

As a robustness check for our distressed firm models in Table 21, Table 22 features similar tests using a subsample of firm-years with leverage above the sample median. Although we show previously that government ownership can help lower the cost of debt during the crisis, it could also aid highly-levered firms facing debt problems that are more firm-specific than macroeconomic. In this subset, we find that the cost of debt is higher for state-owned, highly-levered firms during the pre-crisis period (50 bp) but drops significantly for this group during the crisis period by 89 bp. The size of the stake owned by governments does not have a statistically significant impact during pre-crisis years, but leads to a 2 bp decrease for each percentage point

of ownership during the financial crisis. These results comply with our analysis of non-investment-grade bond issuers by showing how government guarantees are more valuable to firms facing distress. One difference is that during the crisis, the *size* of the state ownership stake is more important for non-investment-grade bond issuers, while the mere presence of the government is linked to lower spreads for firms with higher leverage levels. This result could emerge from the relatively greater distress of firms issuing non-investment-grade bonds (14% of the sample) compared to firms with above-median leverage (by definition, about half of the sample). Although we find that the mere presence of the state can affect the cost of debt, we expect that more distressed firms benefit especially from stronger government guarantees realized as the percentage of the firm owned by the state climbs.

Overall, the results in Tables 21 and 22 support our previous findings, as well as our third hypothesis pertaining to government ownership's influence on the cost of debt during firm-specific distress. Our interpretation of these results is that the implicit government guarantee is important for the cost of debt capital during a variety of distress periods – whether economy-wide or firm-specific.

3.5. Government Ownership and Cost of Debt by Government Investor Categories

In this section we consider how different government investing entities influence debt pricing. Table 23 presents the effects of government ownership when broken down into the following government acquirer types: central governments, local and regional governments, fully state-owned enterprises (*SOE full*), mixed state-owned enterprises (*SOE mixed*), government banks, SWFs, and government-owned

pension funds. These models allow us to compare firm-years with ownership of each government entity to non-government-owned firm-years, while controlling for the effects of other government owners.

Considering the results in all six models of Table 23, we find central governments are associated with a lower cost of debt during the crisis years: government presence reduces the cost of debt by 77 bp, while the stake owned leads to a decrease of 1.5 bp for each additional percentage point of ownership. Over the full period, the estimated effect is negative (a lower cost of debt) and statistically significant when measured by the size of the stake owned. This result is consistent with the powerful government guarantees supplied by this most direct agent of state involvement. During the crisis years, local/regional government ownership is associated with a significant reduction in credit spreads based on the size of the stake. Fully-government-owned SOEs are associated with a higher cost of debt during pre-crisis years (the estimated impact of their presence is 30 bp) and with a lower cost of debt during the crisis (a 3 bp decrease per percentage point of ownership). Mixed SOEs yield results similar to those for fully SOEs, but the estimated effect is stronger. They lower the cost of debt the most during the crisis period (their presence is associated with a 79 bp reduction and stake owned with a 2.7 bp decrease per percentage point of ownership), although their presence is also linked to higher spreads (40 bp) during the pre-crisis period. This result suggests that, even for state entities predisposed to provide guarantees which lower spreads, other factors (such as moral hazard) could dominate during normal economic periods. Moreover, central and development bank ownership is linked to higher spreads during the full and pre-crisis

periods but also during the crisis period, indicating that policy objectives could be mitigating the effect of state guarantees. The results are strong from both a statistical and economic perspective: the presence variable indicates an increase in the cost of debt of 120 bp pre-crisis and 128 bp during the crisis, and the shares owned variable is associated with increases of 10 bp pre-crisis and 22 bp during the crisis (per percentage point of government ownership). Similarly, shareholdings by SWFs are associated with significantly higher spreads, consistent with a monitoring gap encouraged by these state investors: each percentage point of ownership by SWFs leads to an increase in the cost of debt by 6.2 bp (3.5 bp) during the pre-crisis (crisis) years. Finally, the stake owned by government pension funds is associated with a lower cost of debt (6.6 bp per percentage point) during the pre-crisis period. During the crisis period, however, the cost of debt increases by about 100 bp in the presence of government pension funds and by 5.6 bp for each percentage point of their ownership. This latter result emphasizes the conflicting effects of different government vehicles, and how a more profit-oriented state investing entity, such as a pension fund, could govern the target efficiently during normal economic times but offer little in the way of government guarantees during a financial crisis.

Table 24 presents similar models for the subsample of non-investment-grade bonds, and the results clearly show, once more, the differences between various types of state investors. Regardless of the ownership measure, central governments help lower the cost of debt for junk-bond issuers, although results are not statistically significant during the crisis. Local government presence emerges as significantly linked to lower spreads in both subperiods. Greater shareholdings by fully-owned

SOEs are associated with higher spreads during the pre-crisis period and lower spreads during the crisis. All other state entities are linked to higher spreads when estimates are statistically significant. These results are consistent with the notion that certain government actors have more of a 'protector' function, investing primarily to prevent firms from defaulting or to keep nationally-important companies viable. Entities of this nature, such as central/local governments and SOEs, are those more concerned with social and political objectives when investing. Entities such as SWFs and state-run pension funds are more similar to pure investing vehicles, less likely to have imposing social objectives in their investments but also less equipped to offer the implicit state guarantees that seem critical to firms in distress.

To confirm these conjectures, we aggregate state entities into two categories: *Govt protector*, which consists of central and local governments, fully and mixed SOEs, and government banks; and *Govt investor*, which consists of SWFs and government-run pension funds. Results using these state ownership categories are presented in Table 25.

In the overall sample, we find that the size of the stake owned by a *Govt protector* is linked to a statistically significant decrease in the cost of debt, as expected, equivalent to approximately 1.1 bp per additional percentage owned. The presence of this type of government entity is not significantly associated with credit spreads over the full period, yet these results mask important differences across subperiods. During the pre-crisis years, we find the presence of a *Govt protector* associated with an increase in the cost of debt (50 bp), while during the crisis years, the relation is negative (an 83 bp decrease based on presence or approximately 2.3 bp

per each additional percentage of shares owned). On the other hand, the *Govt investor* category is associated with an increase in the cost of debt, and the results are mainly driven by the crisis period, with an increase in the cost of debt of 57 bp based on presence or 4.3 bp per additional percentage owned.[19]

Our analysis highlights the significant differences between these two different groups of government owners. During more stable economic periods, the overall effect of state entities not primarily designed for investment purposes is to increase the cost of debt, as moral hazard and non-economic goals interfere with firm operations. But during the crisis, these government vehicles provide implicit guarantees that fortify the solvency of target firms. In sum, the results of Table 25 are consistent with the 'investor' nature of SWFs and pension funds – motivated by economic objectives in their investments – and the 'protector' nature of the central/local governments and SOEs, more likely to pursue economy-wide stabilization goals, especially during crisis times. To further investigate the plausibility of implicit debt guarantees provided by different state entities, we investigate distinctions between domestic and foreign government ownership in the following section.

3.6. Domestic Versus Foreign Government Ownership

We hypothesize that domestic and foreign government investments are motivated by different sets of priorities. Our expectation is that the desire to maintain

[19] We group central and state development banks into the *Govt protector* category due to their stabilization role, particularly in domestic transactions. In some countries, however, central banks and their subsidiaries can be more investment-oriented. If we run the models in Table 25 shifting government banks to the *Govt investor* category, the coefficient estimates have equivalent signs as those reported and are slightly larger in magnitude.

high levels of employment and political concerns about market failures will strengthen the implicit debt guarantees offered by government shareholders on their domestic portfolio holdings. We also expect a weaker implicit debt guarantee to be provided by foreign government ownership since government influence in foreign markets should be more passive. Additionally, investments by foreign governments are more often commercially-oriented (i.e., motivated by profit-seeking) and thus are less likely to involve the creation of implicit debt guarantees. We expect the domestic government guarantee to play a larger and more beneficial role in influencing the cost of debt of government-owned firms, especially during the financial crisis.

Results for the effect of domestic versus foreign government ownership on the cost of debt are presented in Table 26. Domestic government shareholders significantly decrease the cost of debt by approximately 70 bp during the recent financial crisis. We do not find a statistically significant link between the size of the stake owned by the domestic government and credit spreads, nor between domestic government ownership and credit spreads during the pre-crisis years, although all estimated coefficients are negative. Foreign government ownership, on the other hand, is strongly linked to an increase in the cost of debt. In the overall sample, foreign government presence is significantly positively related to the cost of debt during the full period (56 bp), and each percentage point increase in foreign government ownership is linked to an increase in the cost of debt by 2.5 bp. The effect is stronger during non-crisis years (with the coefficients on government presence and stake being 74 bp and 3.8 bp, respectively) than during the crisis years (51 bp and 1.6 bp), yet the

estimated impact of foreign government ownership is consistently positive and statistically significant.

Finally, Table 27 presents results for the influence of domestic and foreign government owners on the cost of debt of firms that issue non-investment-grade bonds. Domestic government ownership lowers the cost of debt by approximately 2 bp per additional percent owned during the 2008-2010 crisis period. On the other hand, the cost of debt is positively and significantly associated with the presence of foreign government ownership in all models, with estimates ranging from 164 bp during the pre-crisis period (Model 3) to 103 bp during 2008-2010 (Model 5). Further, spreads increase in the size of the foreign government stake by 4 bp (2.3 bp) per each additional percentage point of ownership during the pre-crisis (crisis) years.

Overall, the distinction between domestic and foreign government ownership and between crisis and non-crisis years reveals that the effect of government ownership on the cost of debt can vary and that a pooled analysis risks obfuscating important nuances. In particular, our more detailed analysis indicates that domestic government ownership decreases the cost of debt of firms during crisis years, while foreign government ownership increases the cost of debt during both subperiods. Times of distress reveal the dominance of an implicit debt guarantee, especially valuable when default is more likely and specifically when the investor is a domestic government. Conversely, ownership by foreign governments yields ineffective monitoring and creates incentive distortions that prove particularly deleterious.

4. Conclusions

Our research examines how government ownership affects firms' cost of debt. As documented by Faccio, Masulis, and McConnell (2006) and Brown and Dinç (2005), governments are generally reluctant to allow state-owned firms to default. Consequently, government ownership could provide an implicit debt guarantee reducing the chance of default and, hence, the cost of corporate debt. On the other hand, the implicit debt guarantee could induce moral hazard for managers, by reducing the probability of disciplinary replacement, by eliminating takeover threats, and by minimizing the risk of bankruptcy. Such an increase in moral hazard could lead to higher risk taking and, thus, to a higher cost of debt. Also, government ownership could increase the cost of debt by imposing social and political goals that reduce corporate profitability and increase default risk. Given these conflicting (yet not mutually exclusive) effects of government ownership on the cost of debt, the resulting impact is a matter deserving empirical investigation.

In panel regressions, we analyze 5,048 yield spreads for a sample of 1,278 bonds issued by 214 publicly traded firms subject to changes in government share ownership from 43 countries over 1991-2010. We initially find that the presence of a government shareholder is linked to a higher cost of debt compared to firm-years without government ownership, in the range of 30-40 bp, suggesting the investment distortions fostered by state owners. We also find that the effect of government ownership on cost of debt differs according to the size of the stake acquired. When considered together, our results indicate that the presence of a government shareholder increases the cost of debt by approximately 40 bp, but that the cost of debt decreases

by about 0.6 bp for each additional percentage point of state ownership. We conjecture that such a result is explained by the fact that a larger stake indicates a higher level of commitment and increases the likelihood of government support for firm-level debt issues, eventually outweighing the deleterious effects of state influence.

We note that a government guarantee on the debt of investment targets can be more valuable during times of economic hardship as defaults are, all else equal, more likely during recessions. Focusing on the recent financial crisis, we find that government ownership affects the cost of debt differently in crisis versus non-crisis years. During non-crisis years, firms with the government as a shareholder display a 61 bp increase in bond spreads. On the other hand, during the recent financial crisis, government presence is associated with an 18 bp decrease in spreads. We find similar results when adopting a broader definition of 'financial crisis' and consider the banking crises identified by Laeven and Valencia (2010).

Since the value of a debt guarantee is greater the higher the likelihood of default, we further investigate the effects of government ownership focusing on firm-specific distress, particularly on firms that issue non-investment-grade bonds and firms with high leverage. In both cases, we find results in line with the overall findings, but of greater magnitude. Government ownership for both firms issuing non-investment-grade bonds and for highly-levered firms is associated with a higher cost of debt in non-crisis years and with a lower cost of debt during the financial crisis beginning in 2008.

To account for the non-random nature of government investments, we control for possible sample-selection biases with both two-stage (Heckman) sample-selection

models and an instrumental-variable approach. Our core results are robust to these endogeneity controls. We also perform tests using lagged values of government ownership and excluding ownership stakes linked to bailout transactions to alleviate concerns of reverse causality.

Different government-owned entities vary in terms of objectives and *modus operandi*, and we show that their diverse goals impact the cost of debt differently. Generally, we find that government-owned investment entities (i.e., SWFs and state-run pension funds) are associated with a higher cost of debt, while central and local government owners are associated with a lower cost of debt. Results are mixed for government-owned SOEs and highlight the problems fostered by state control (i.e., moral hazard) but also the value of government guarantees during times of distress. Overall, our evidence is consistent with the idea that certain government investors act as protectors, favoring political goals (typically inconsistent with firm default) and providing the strongest implicit debt guarantees. Increases in the cost of debt are mostly specific to financial arms of the government, whose objectives are more similar to those of other institutional investors (i.e., often commercial) and, as such, do not lead to a similar implied debt guarantee.

We finally note that government guarantees should be strongest for domestic targets. Correspondingly, we find that the implicit debt guarantee documented during the recent financial crisis is specific to domestic government presence, which is associated with spreads that are 70 bp lower, on average. Conversely, foreign government ownership is associated with an increase in the cost of debt of about 56 bp for the full sample period. On balance, these results suggest that stock ownership by

domestic governments improves the perceived creditworthiness of corporate bond issuers by providing an implicit bond payment guarantee. This guarantee becomes especially valuable during a financial crisis or in the presence of firm-specific distress factors.

In the aggregate, our results are consistent with the view that government ownership influences firm behavior through financial and governance channels, including debt guarantees and moral hazard. The magnitude and direction of the effects of state ownership depend on market-wide and firm-level distress factors, as well as the type of government acquirer and whether it is based locally or in another nation. In general, government ownership lowers the cost of debt during periods of economy-wide and firm-specific distress and particularly if the state investor is domestic or more closely related to the central government. But state ownership increases the cost of debt outside of periods of distress and especially if the government investor is foreign or more profit-oriented (e.g., SWFs). Our evidence is robust and accounts for sample-selection, indicating that government ownership is indeed a relevant factor for the cost of debt.

We do not address the question whether this is a desirable outcome or a pernicious market distortion, which is better explored within a macroeconomic perspective, as our focus centers on the corporate finance issues. For instance, lower debt pricing driven by government stakes in bailed-out firms can come at the expense of other stakeholders, such as taxpayers. Also, while we indicate that the impact of government ownership is nuanced, depending on economy-wide and firm conditions and the type of investing government entity, we do not investigate further whether

specific government factors have different effects. We believe our study highlights the importance of fully investigating the impact of government ownership on the so far largely unexplored pricing of corporate debt, as we indicate that the effect is both statistically and economically significant. In broader terms, we contribute to the literature on bond pricing and indicate that the identity of shareholders is an important factor.

Chapter 3: Financial Trading, Spot Oil Prices, and Inventory: Evidence from the U.S. Crude Oil Market[20]

While there has been considerable focus, especially in the aftermath of the 2007-08 oil price spike, on the role of financial speculators in influencing oil prices,[21] a question that lies at the heart of this debate -- how oil futures trading is related to spot oil prices – remains unresolved. A financial speculator who expects future oil prices to rise and wants to take a speculative position based on this expectation would typically go long in financial futures contracts. An index investor who wants to invest in oil will take a similar long position in futures contracts, which would be rolled over periodically.[22] If such speculative or investment activity increases the futures price sufficiently relative to the prevailing spot price,[23] a rational market response would be for arbitrageurs to step in to buy oil in the spot market and store it while simultaneously selling futures.[24] This "cash and carry" (C&C) arbitrage provides the mechanism that links oil futures and spot markets, since the withdrawal of oil from the market by arbitrageurs will cause spot prices to also increase.[25] Accordingly, a number

[20] This chapter is based on collaborative work with Louis Ederington, Chitru Fernando and Thomas Lee.

[21] See, for example, U.S. Senate Permanent Subcommittee on Investigations (2006), Masters (2008), Einloth (2009), Kaufmann and Ullman (2009), Sornette, Woodard, and Zhou (2009), Phillips and Yu (2010), Parsons (2010), and Singleton (2011).

[22] See, for example, Masters (2008).

[23] Singleton (2011) provides evidence of a significant effect of such investor flows on futures prices during the 2006-2010 period.

[24] This argument stems from standard financial market theory (reviewed in section 2) -- arbitrageurs have an incentive to simultaneously sell futures and buy oil in the spot market and put it in storage when the futures price exceeds the spot price by enough to cover net carrying costs (storage plus financing costs minus convenience yield), resulting in a riskless profit.

of studies argue that if financial speculators or index investors drive up futures prices that, in turn, elevates spot oil prices above the level dictated by supply-demand fundamentals, such an elevation in the oil price should be accompanied by a build-up in oil inventories.[26]

However, the available evidence of such an inventory build-up during the sharp 2007-08 oil price increase is mixed at best. Studies by the International Energy Agency (IEA) (2008), International Monetary Fund (IMF) (2008), and Organization for Economic Co-operation and Development (OECD) Working Party on Agricultural Policies and Markets (2010) find no evidence of a speculative increase in crude oil inventories in 2007-2008. The Interagency Task Force on Commodity Markets (ITFCM) (2008) argues that oil inventories were near historical levels in 2006-2008, while Hamilton (2009) concludes "in late 2007 and the first half of 2008, when the [oil] price increases were most dramatic, inventories were significantly below normal." Krugman (2008) makes the same point regarding the 2008 price run-up but does believe speculation contributed to higher prices in 2009 (Krugman, 2009). On the other hand, the U.S. Senate Permanent Subcommittee on Investigations (2006) argues that the behavior of inventories was consistent with speculation impacting cash prices and Einloth (2009) argues in support of a speculative build-up of inventory that accompanied the 2008 increase of oil prices from $100 to $140 a barrel but not during the preceding period.

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[25] Of course, in theory, financial speculators betting on a price run-up could also directly accumulate crude oil inventories, which would also increase spot oil prices. In practice, the higher financial leverage and lower transactions costs of trading futures relative to physical oil makes it much more likely that pure financial speculators will employ futures.

[26] See, for example, ITFCM (2008), IMF (2008), IEA (2008), Krugman (2008), Hamilton (2009), Irwin, Sanders, and Merrin (2009), Smith (2009), and Kilian and Murphy (2010).

The prerequisite for an inventory build-up as predicted above is a viable and active C&C market in crude oil. The existence of such a market cannot be simply assumed since there are many limits to arbitrage that would impede the functioning of such a market, such as the unavailability of non-operational storage (i.e., storage that is not reserved for operating purposes), pipeline and other transportation constraints, and financing barriers.[27] To our knowledge, there has been no in-depth research on the existence and functioning of a C&C market in oil, i.e., how oil inventories respond to changes in the futures-spot price spread, which should be the mechanism connecting financial market speculation and spot oil prices.

This study focuses on the causal relationships between oil spot prices, futures prices and storage, specifically how storage is impacted by contango versus normal backwardation in oil futures prices. In other words, the study examines the relation between oil inventories and the spread between crude oil futures contracts.[28] Gaining an in-depth knowledge of this relationship is an important topic for academics, energy companies and traders, policymakers, regulators, as well as the general public, since it can deepen our understanding of the factors that move oil prices. No direct connection exists between the financial futures and physical spot prices of crude oil as contracts are rarely settled through delivery (Smith, 2009; IEA, 2008). The physical crude oil market is a highly competitive market in which prices are set by supply and demand.

[27] See, for example, Shleifer and Vishny (1997), Etula (2010), and Acharya, Lochstoer, Ramadorai (2011).

[28] From here on out when we refer to spread, we mean the spread between two crude oil contracts of different maturity. Typically, we will be referring to the spread between the two- and the one-month crude future contracts. The reasoning for this selection is provided in Section 3.2.1. The results of the study hold with other spread specifications also; in particular, the spread between the one-month future and the spot price, as well as the spread between the three- and one-month crude future contracts.

Thus, if crude oil futures trading impacts physical prices, it must do so by impacting either the physical supply or the physical demand. This puzzle of showing how financial futures influence physical spot prices is highlighted by Hamilton (2009), who notes that "The key intellectual challenge for such an explanation [of how future prices influence the associated spot commodity] is to reconcile…the price path with what is happening to the physical quantities of petroleum demanded and supplied." Thus, the financial futures market influences the physical spot prices by altering either the real physical demand or supply of crude oil. This study tests whether this influence can be traced through inventories. Smith (2009) advocates that, "The only avenue by which speculative trading might raise spot prices is if it incites participants in the physical market to hold oil off the market – either by amassing large inventories or by shutting in production." This paper tests if crude oil inventories increase (decrease) when the futures spread is positive (negative).

While the relation between futures spreads and inventory is not his primary focus, Singleton (2011) provides preliminary evidence of an active U.S. C&C market by graphing the relationship between the spread across two- and four-month futures prices and the level of U.S. crude oil inventories, which suggests a tendency throughout the 2004-2009 period for inventories to increase when the futures market is in contango.[29] He notes also that this graphical pattern is even stronger when inventory levels from Cushing or Petroleum Administration for Defense District 2 (PADD2), the district which includes Cushing, are used. However, while he includes inventory

[29] Singleton's (2011) focus is on explaining returns in crude oil futures markets, which he shows were significantly affected by investor flows (specifically index investors and managed-money accounts) into the oil futures markets around the time of the 2008 oil price spike.

changes as a conditioning variable in his formal analysis, he finds that the explanatory power is weak.

Einloth (2009) evaluates the relationship between spreads and inventories in his study of the role of speculation in the 2008 oil price behavior. However, he does not use inventories directly but rather the convenience yield as a proxy for inventories, derived from the prices of Brent crude oil futures. Additionally, in using the pricing of Brent futures to predict U.S. crude oil inventories, Einloth (2009) assumes a frictionless global oil market that, as our results suggest, may not be valid even within the continental U.S. In contrast, we minimize the effect of basis issues in our study by using the West Texas Intermediate (WTI) futures spreads to predict U.S. crude oil inventories, while carefully accounting for international oil flows that link the U.S. market with the global market. Doing so also minimizes the effect of storage measurement errors highlighted by Einloth (2009) and Singleton (2011). Additionally, we include controls that impact inventory levels and prices, such as supply and demand shocks, and other factors that influence inventories directly. We also perform a comprehensive analysis of which futures prices matter and which inventories are impacted, and investigate whether inventory levels adjust immediately to predicted levels or do so with a time lag. We therefore extend the current literature on inventories, spreads and the arbitrage role of inventories.

We find that over the 2004-2011 period crude oil inventories at Cushing were a significant positive function of the spread between the two- and one-month New York Mercantile Exchange West Texas Intermediate (NYMEX WTI) crude oil futures with a lag. We also find that over the 1992-2004 period (before the Cushing inventories

were reported separately), total U.S. non-Strategic Petroleum Reserve (SPR) inventories and PADD2 inventories were positive functions of lagged spreads. However, over the 2004-2011 period, neither total U.S. non-SPR inventories nor PADD2 inventories are significant functions of the spread once Cushing inventories are removed. None of the other four PADD inventories are significantly related to the spread over either period. Current crude oil inventories appear to be influenced by spreads over the last eight weeks or so. Our interpretation of this finding is that current spreads likely lead to contracts for forward delivery which do not result in a change in actual stock levels until delivery occurs sometime in the future. We observe basically the same results whether examining inventory levels or changes, and these results remain robust when we use different measures of the spread. We further find evidence that total U.S and most individual PADD inventories (but not at Cushing) are a negative (positive) function of the change in current (next week) refinery inputs and a positive (negative) function of the current (next week) imports. These results indicate that storage operators are able to partially anticipate crude oil shortages and surpluses and adjust their inventories accordingly. These findings establish, to our knowledge, the first tangible evidence documented in the literature of a causal link between oil futures and spot markets via inventory changes resulting from arbitrage, and raise several important questions for future research. In particular, our findings suggest that it would be fruitful for researchers looking to understand the impact of financial traders on the spot markets, especially the twin questions of (a) whether financial traders exacerbate or attenuate spot price volatility, and (b) whether they

systematically affect the spot oil price level, to study the behavior of the C&C market over time.

We review the theoretical foundations of our study and discuss their empirical implications in the next section. We discuss our data in Section 2 and specification issues in Section 3. We present our estimation of the crude oil inventory adjustment lag structure in Section 4. Our main results are presented in Section 5 and our robustness checks are in Section 6. Section 7 concludes.

1. The Theoretical Link between Inventories and the Futures-Spot Spread, and Empirical Implications

Inventories are connected to the spread through what is known as cash-and-carry (C&C) arbitrage. If the current (time t) futures price for delivery at time t+s, F(t,t+s), exceeds the current spot price, S(t), by more than the cost of storing oil from t to t+s (including transaction costs and net of any convenience yield) plus interest, SC(t, t+s), arbitrageurs can make a riskless profit by buying oil in the spot market for S(t), simultaneously shorting the futures contract at price F(t,t+s), and storing the oil. At time t+s, they can deliver on the futures contract collecting F(t, t+s).[30] Their time t+s profits adjusting for interest costs on the time t expenses are $F(t,t+s) - [S(t)+SC(t,t+s)](1+r)^s$.[31] For example, if crude oil spot price is \$90, the one month futures price is \$100 and the cost of storage is \$6; it would make sense to sell the futures contract, purchase spot crude oil and store it for a month and then deliver on

[30] Due to convergence at maturity, actual delivery on the futures contract is not necessary. Arbitrage profits are approximately the same if the arbitrageur longs the futures contract at time t+s and sells in the spot market.

[31] This specification assumes the storage costs are paid at time t.

their futures contract, at a profit of about $4 per trade. Such arbitrage is profitable and oil inventories would be expected to rise at time t and fall at time t+s when

$$F(t,t+s) > [S(t)+SC(t,t+s)](1+r)^s.$$

This issue is important because it is the nexus between oil futures trading and physical oil prices. If we accept that physical energy prices, e.g., gasoline at the pump or oil at the wellhead, are determined by supply and demand, then C&C arbitrage is the mechanism through which futures market speculation could impact physical or spot prices.[32] If futures speculation pushes the futures price up enough to set off the arbitrage described in the previous paragraph, then the demand for oil and the spot price will tend to rise at time t when arbitrageurs buy oil to put into storage, and fall at time t+s when the oil comes out of storage thereby increasing the supply on the spot market.

While we have discussed C&C arbitrage from the point of view of a pure arbitrageur, a similar relationship holds for oil companies, pipelines, and others in the oil industry. When $F(t,t+s) > [S(t)+SC(t,t+s)](1+r)^s$, oil companies and others have an incentive to store and sell oil forward rather than sell in the spot market. Likewise, if $F(t,t+s)$ is far below $[S(t)+SC(t,t+s)](1+r)^s$ they have an incentive to draw down inventories by selling at time t. As noted above, SC(t, t+s) is net of any convenience yield, which is more important for oil firms. Producers, refiners, and marketers hold working inventories as buffers against supply interruptions and fluctuations in demand. When inventory levels are low, they run the risk of a stop-out or shortage. Thus there is an advantage or convenience yield to holding inventory. As inventories

[32] Futures prices could also influence long-run supply by impacting drilling activity today or long-run demand by impacting conservation decisions but C&C arbitrage is the main short-run connection.

are reduced, the risk of a stop-out rises, raising the convenience yield and lowering SC(t,t+s). When inventories increase, the risk of a stop-out falls, lowering the convenience yield and raising SC(t,t+s). Thus, as Einloth (2009) and others point out, SC(t,t+s) varies positively with the inventory level and an ever-increasing difference between the futures price and the cash price is required to induce continued cash-and carry arbitrage when $F(t,t+s) > [S(t)+SC(t,t+s)](1+r)^{s}$.[33]

Speculative inventory levels should be related to past as well as current futures-spot price spreads. If the time t futures price for delivery at time t+s, F(t,t+s), exceeds the time t futures price for delivery at time t+v, F(t,t+v), where s > v, by more than the cost of storage from v to s, SC(t+v, t+s), plus interest, arbitrageurs can make a riskless profit by simultaneously (at time t) longing the t+v futures contact at price F(t, t+v) and shorting the t+s futures contract at price F(t,t+s). At time t+v, they would take delivery on the t+v contract paying F(t, t+v) and store. At time t+s, they would deliver on the t+s contract receiving F(t, t+s). Their time t+s profits adjusting for the interest or opportunity costs of the time t expenses would be $F(t,t+s) – [F(t,t+v)+SC(t+v,t+s)](1+r)^{s-v}$. Thus such arbitrage is profitable and oil inventories would be expected to rise at time t+v and fall at time t+s when

$$F(t,t+s) > [F(t, t+v)+SC(t+v,t+s)](1+r)^{s-v}.$$

Note that in this case, there is no immediate change in inventories. Also, in this case physical prices tend to be pushed up at future time t+v when the oil is taken off

[33] During prolonged contango markets additional crude storage facilities can be constructed which would decrease SC(t,t+s) allowing the futures-spot spread to remain at lower levels in order to achieve profitable C&C arbitrage.

the market and placed in storage and pushed downward at time t+s when the oil comes out of storage and back on the market.

Considerable anecdotal evidence indicates that C&C arbitrage occurs. For instance, several newspaper articles published in 2007 described increasing and decreasing levels of inventory at Cushing, OK, the NYMEX delivery point for the WTI contract, and related the activity to the C&C type arbitrage.[34] The time-series relation between the futures spread and Cushing inventories is graphed in Figure 1. Note that Cushing inventories are positively correlated with the futures spread as predicted by C&C arbitrage. Note also the sharp increase in storage capacity between 2004 and 2011, which some reports tie to building additional capacity for C&C arbitrage.[35]

As noted by the IEA (2008) and others, given the central role that inventories play in the futures price - cash price nexus and the significant interest in the question of how much, if at all, speculation impacts physical oil prices, it is surprising how little research has been done on the relation between the futures-spot spread, $F(t,t+s)-S(t)(1+r)^s$, or for simplicity $F(t,t+s)-S(t)$, and inventories. While some studies have noted simple correlations between inventories and $F(t,t+s)-S(t)$, a careful multivariate approach is needed for several reasons. First, without controlling for other factors that impact inventories, simple correlations do not establish that inventory levels are responding to the futures-spot spread. Suppose, for instance, that demand falls unexpectedly. In that case, inventories would rise and S(t) would tend to fall raising

[34] Davis, Ann "Where Has All the Oil Gone?" *Wall Street Journal*, October 6, 2007.

[35] While we do not have direct data on Cushing, OK storage capacity, the amount of crude oil stored in Cushing between April 9, 2004 and April 8, 2011 increased by 259%, from 11,677 to 41,896 thousand barrels.

F(t,t+s)-S(t). Thus inventory levels and F(t,t+s)-S(t) would move together but not because inventories are responding to F(t,t+s)-S(t), and their correlation would not constitute evidence that futures speculation impacts cash prices through inventory behavior. Studies that carefully examine how oil futures prices impact spot prices through inventory and production controlling for other changes in supply and demand appear warranted. Second, as explained above, current inventory levels and changes should be a function of past, as well as current, futures and spot spreads. Third, most crude oil inventories are held for operational purposes, rather than for speculation or arbitrage, so controlling for factors that influence operational inventory levels should enable better estimates of the impact of the futures spread.

2. Data

In order to estimate the relationship between the spread and crude oil inventories, we obtain weekly ending inventories of crude oil for: 1) U.S., excluding the SPR, the five PADD districts, and Cushing from the Energy Information Administration (EIA) website from 9/11/1992 (4/09/2004 for Cushing) through 7/08/2011. We also obtain weekly data on U.S. oil production levels, imports, refinery inputs, NYMEX WTI future contracts for the first four months, and Cushing WTI spot prices. The variables used are described in Table 30; their descriptive statistics are in Table 31, while the correlations between different variables are in Table 32.

Crude oil is traded on both the spot and the futures market. In the U.S., crude oil futures trade primarily on the NYMEX. The main crude oil futures contract is for the WTI grade of crude oil and it settles at Cushing, OK. While a variety of spot

locations are priced, their prices are typically perceived in terms of the basis to the NYMEX WTI crude oil price. A variety of crude oil counterparties, both producers and users, need to buy and sell crude oil physically in the spot market. However, if they need to hedge their exposure forward they need to participate in the futures market. Trading in the WTI crude oil contract ceases on the third business day prior to the 25th calendar day of the prior month. For example, trading in the August contract ceases near the end of July. Thus traders who do not wish to make or take delivery of WTI crude oil at Cushing must reverse their positions prior to this date. If they do not reverse, physical delivery of settled crude oil occurs at Cushing, OK, over the full length of the contract month, i.e., August in our example.

Cushing, OK is a special location for crude oil contracts because physical settlement of the future market transactions occurs there. The other crude oil districts in the U.S., which are the five Petroleum Administration for Defense Districts (PADD's) that the entire U.S. territory is broken into, are equally important especially from the standpoint of product supply and distribution.[36] PADD 1 covers the East coast, PADD 2 the Midwest, including Cushing, PADD 3 the Gulf Coast, PADD 4 the Rocky Mountains and PADD 5 the West Coast.[37] Given that the futures crude oil contract settles at Cushing, OK, the traders involved in C&C arbitrage have an incentive (as discussed below) to locate their storage facilities there. While operational drivers of crude oil inventory are important in all PADDs, the spread and its influence on inventory via C&C arbitrage should be most observable in Cushing.

[36] The PADD's were originally created during World War II for gasoline rationing.

[37] PADD 3 is home to the U.S. Strategic Petroleum Reserve (SPR) which is a large reserve created for national security purposes. The data used in this study excludes crude used for SPR inventories due to the nature of these reserves.

We have contacted several pipeline and storage operators at Cushing, OK, concerning common institutional arrangements, such as delivery mechanisms and contracts, and speculative strategies. Of the major operators in Cushing, we have interviewed representatives from Plains All American Pipeline, Magellan and Enterprise. All of the above firms lease out storage to customers mainly via longer-term full tank leases or capacity leases. The tank leases are typically done for five year periods. Capacity leases allow several customers to have common stream crude oil in the tank. The main customers for storage leases are refineries, but Exploration and Production (E&P) firms, large physical oil trading firms, as well as trading arms of different banks also lease storage. The operators also said that crude oil deliveries are scheduled months ahead and trading in the spot market occurs in emergency situations. This influenced our choice of the spread for this study.

The data series on crude oil inventory levels exhibit unit roots, which may be due in part to persistent time trends in the data. To avoid issues with unit roots in crude oil inventory levels, we use changes in inventory (first difference) in all our analysis reported here.[38]

3. Specification Issues

In specifying the model to estimate the relationship between crude oil inventories and spread, we face four issues. First, since there are numerous futures contracts with different maturities, it is important to address the question of which of

[38] We have replicated the analysis reported in this paper using inventory levels data that is detrended and seasonally adjust using a process available from the authors. The results using the detrended levels data, which largely support the conclusions from the change data, are available upon request.

these contracts should be used to measure the spread -- the nearby contract, the futures contact maturing in two months or in three months, etc. Second, what is the appropriate lag and lag structure? In other words, does a change in the futures-spot spread impact inventory levels quickly or does it take some time? Third, what inventory data should we focus on? Fourth, how should spurious correlation or endogeneity be controlled for? As described below, unexpected shifts in supply and demand should impact both spot oil prices (and hence the futures-spot spread) and oil inventory levels. Thus, if not controlled for, the estimation might pick up this spurious correlation instead of the impact of the spread on inventories. We next discuss our thoughts on and approach to each of these.

3.1. Futures-Spot and Futures-Futures Spreads

Most of the time, prices of the nearby futures contract and the Cushing WTI spot price are approximately the same except during the roll period; therefore, the spread between them is of little use for our analysis. Spreads between the spot price and the price of any other futures contract, and between prices of different maturity futures, could conceivably set off C&C arbitrage. For example, if the third month futures exceeds the spot by more than storage and transaction costs, that could also set off C&C arbitrage and an increase in inventory levels. Or if the third month futures exceeds the second month futures by more than storage plus transaction costs, arbitrageurs could contract to take delivery in the second month and deliver in the third, so inventories would increase a month in the future. Similarly, if the two-month ahead futures price exceeds the one-month ahead futures price by more than storage

plus transaction costs, C&C arbitrage could take place as arbitrageurs contract to take delivery in the next month and deliver a month after next. Hence in our view, the question of the best spread to use is an empirical one.

As it turns out the market is normally in continuous backwardation or contango over the first few months so that the different spreads are highly correlated. For instance, the correlation of the spread between the second month contract and the spot and the spread between the third month contract and the spot is 0.982. The correlation between the third-month-spot spread and the fourth-month-spot spread is 0.995. Hence it makes little difference which spread we use; any one spread tends to pick up the effect of all on inventory levels. Storage operators in Cushing explained during our conversations that only emergency trading is done in the spot market and most crude oil deliveries are scheduled a month ahead. Therefore, we chose to use the spread between the two- and the one-month crude oil future contracts. This spread also has fewer outliers than the two-month ahead to spot spread while the correlation between the two is 0.942. The correlation between the actual spot price and the one-month ahead future contract is 0.9999. Therefore, most of the changes in the spot price are reflected in the one-month futures with the exception of those that are very temporary in nature and are not expected to persist past the current month. Here we report results for the spread defined as the difference between the two- and the one-month crude oil future contracts but the results are virtually the same using the two-month to spot spread, three-month to spot and three-month to one-month spread.

3.2. Lag Structure

In estimating the relationship between the futures spread and crude oil inventories, one issue is what lags to expect between the spread and inventories and how to specify the lag structure. As explained earlier, we expect today's inventory levels to depend on past spreads since current changes in inventories may be due to contracts signed weeks or months ago. As noted previously, we have also reached out to major storage operators at Cushing to ascertain common delivery arrangements and representative storage and transaction costs.

As we see it, if today's spread is sufficient to set off C&C arbitrage, it may be weeks or days before inventories increase since we only observe actual physical changes in inventories, not the contracts being executed for future delivery. For example, on July 5, 2011 the Cushing spot price was $96.89 and NYMEX futures prices were: $96.89 for August 2011, $97.38 for September; and $97.87 for October 2011. While we are seeking hard data on storage costs, a fairly common rough estimate is about $0.40 a barrel per month which would place the July 5 futures price structure above the breakeven point for profitable C&C arbitrage. July crude oil deliveries were scheduled at the end of June, so if traders want to take non-emergency delivery of crude oil they have to purchase the August contract. If we assume for the moment that storage and transaction costs for the August contract were about $0.40 per month so that C&C arbitrage would be profitable, arbitrageurs might purchase oil for delivery in August and simultaneously short the September futures. In this case inventories would rise over the month of August, meaning anytime between one to

eight weeks from today.[39] The October-September spread is also fairly large so another alternative is that today arbitrageurs might long the September contract, while shorting the October contract, and subsequently take delivery on the September contract in September, and make delivery on the October contract in October. In this case, inventories would not rise until September even though the contracts are set in July. Thus, lags of several weeks or even months are quite likely, but beyond that it is hard to say what the lag relationship is. Our interviews with storage operators suggest that in general, the lag could be anywhere from one to nine weeks but do not provide more specificity beyond that. Thus we turn to the data to see what the lags look like.

3.3. Choice of Inventory Locations

While C&C arbitrage is possible utilizing storage at any location, storage at Cushing offers the arbitrageur significant advantages. Suppose that at time t, an arbitrageur buys and stores the oil at location X and shorts the futures contract maturing at time t+s. At time t+s, she transports the oil to Cushing and delivers on the futures contract. In order to be profitable, the futures contract must exceed the location spot price by more than the cost of storage plus the cost of transporting the oil. In addition to arranging storage the arbitrageur must arrange transportation as well.

[39] Trading in the WTI crude contract ceases on the third business day prior to the 25th calendar day of the prior month. For example, August 2011 contract would have stop trading and settled physically on July 20, 2011 and then delivery would get scheduled between August 1 and August 31. So, if an August 2011 crude future is purchased on July 5th, it can get delivered anytime between August 1 and August 31. That implies a waiting time between the trade and actual inventory increase in Cushing of four to eight weeks. However, if the August 2011 crude future was purchased on July19, 2011 then the waiting time between the trade and actual inventory increase in Cushing would be between one and a half and six and a half weeks.

Instead of delivering the oil to Cushing, the arbitrageur may buy, store, and sell the oil at location X. In this arbitrage, she shorts the futures at the beginning of the arbitrage and longs the same futures contract shortly before trading ceases. As long as the basis or differential between the price at location X and Cushing is constant, this strategy is profitable if and only if the futures-spot or futures-futures spread exceeds the cost of storage (at location X). However, if the basis changes over time, then the profitability is uncertain. In other words, C&C arbitrage utilizing storage and delivery at non-Cushing locations involves a basis risk which is not present if the storage and delivery are at Cushing.[40] For this reason, we focus particular attention on Cushing inventories but also examine the impact of the spread on storage away from Cushing.

3.4. Controlling for Spurious Correlation

A fourth issue in estimating the relationship between the spread and crude oil inventories is how to correct for the spurious correlation caused by unforeseen shifts in supply and demand. For instance, if there is an unforeseen increase in demand, this would tend to lead to a fall in crude oil inventories and at the same time an increase in spot prices, which would mean a fall in the spread. Hence a positive correlation between changes in the spread and changes in inventories would be observed but due to the impact of the demand shift on both prices and inventories - not to C&C arbitrage. Likewise a sudden unforeseen increase in supply would tend to cause a simultaneous increase in crude oil inventories and in the spread. To control for this to the extent possible, we include the changes over the current week in: 1) U.S. crude oil

[40] On the other hand, storage may be less expensive away from Cushing.

production levels, 2) imports (overall net and by PADD), and 3) refinery inputs (overall and by PADD) between weeks t-1 and t. Consider the change in refinery inputs. The change from the previous week consists of a planned or expected change plus the unplanned or unexpected change. If refinery production increases unexpectedly, this would lead to an unexpected decline in crude oil inventories. Thus to the extent part of the change in refinery inputs is unexpected, we expect it to be negatively correlated with the change in crude oil inventories. Similarly, to the extent changes in U.S. crude oil production and imports are unexpected, we expect them to be positively correlated with changes in crude oil inventories. In addition, we include the change in the spot WTI price as an additional variable separate from the spread. If an unexpected change in demand or supply is viewed as temporary, it will tend to impact the spot price but not the futures price. Thus this variable should have a negative coefficient and pick up additional unforeseen shifts in supply and demand which impact both the spread and crude oil inventories. Note that if the shift is seen as permanent so that both spot and futures prices change, there is no spurious correlation problem.

While including current week changes in refinery inputs, imports, and production as independent variables helps control for correlation between changes in the spread and changes in inventory induced by unforeseen shifts in supply and demand, coefficients of these variables must be interpreted with caution. We cannot distinguish between expected and unexpected changes in these variables. By definition, if the data is perfect, the change in inventories this week is equal to the level of imports plus the level of production minus the level of refinery inputs. Since

the levels of imports, production, and refinery inputs are by definition equal to the sum of all current and past changes in these variables, there is a small built-in positive correlation between current changes in imports and production and the change in inventories, and a small built-in negative correlation between change in refinery inputs and the change in inventories. Thus positive coefficients for current week changes in production and imports and negative coefficients for refinery inputs need not necessarily indicate an effect of unforeseen changes in supply and demand on inventories.

We also seek to control for other factors that impact desired inventories at time t. Of course, operational inventories are held to bridge any gap or mismatch between supply and demand. Specifically, refineries hold inventories to bridge mismatches between their crude oil supplies and refinery needs. If refinery draws are expected to be larger next week than the combined production and imports supply, then there would be a tendency to hold large current inventories in order to "stock up" for next week. Likewise, if next week's production and imports are expected to be higher than refinery needs, current inventory levels should be smaller. While we cannot observe expected future imports, production, and refinery imports we can observe *ex post* levels and changes. Viewing the actual change as proxies for expected changes, we add lead measures of the changes in refinery inputs, U.S. crude oil production and imports over the week from t to t+1 to our set of independent variables. Note that the expected signs for these lead variables are opposite to those for the current week. We expect a negative coefficient for the current week change in refinery inputs and a positive coefficient for the change next week. We expect positive coefficients for

current week's changes in imports and production and negative for the changes next week. The rationale for the current week variables is to pick up the effect of unexpected changes on actual inventories; the rationale for the lead variables is to pick up the effect of expected future changes in these variables on desired inventories.

4. Polynomial Distributed Lag Estimation of the Spread on Crude Oil Inventory

We examine the influence of the change in the spread on the change in inventories. Expecting some seasonality in inventory patterns, we control for this with dummy independent variables. Since 52 separate weekly dummy variables are neither feasible nor appropriate, we assume that any seasonality can be captured by a polynomial form. First, we define weekly dummy variables as follows: $w_1 = 1$ if the observation is the first week in January and 0 otherwise, $w_2 = 1$ if the observation is for the second week in January and 0 otherwise, and so forth through $w_{52} = 1$ the last week in December and 0 otherwise. We then specify five dummy variables z_k where z_1 is a zero-degree polynomial of the w_i's, z_2 is a first degree polynomial, z_3 is a second degree polynomial, z_4 is a third degree polynomial, and z_5 a fourth degree polynomial. The graph of storage pattern from the z variables is presented in Figure 2 for Cushing and Figure 3 for the U.S. and the z variables are defined in the following manner:

$$z_1 = w_1 + w_2 + w_3 + \cdots + w_{52} \text{ (picked up by the intercept)}$$
$$z_2 = w_1 + 2w_2 + 3w_3 + \cdots + 52w_{52}$$
$$z_3 = w_1 + 2^2 w_2 + 3^2 w_3 + \cdots + 52^2 w_{52}$$
$$z_4 = w_1 + 2^3 w_2 + 3^3 w_3 + \cdots + 52^3 w_{52}$$
$$z_5 = w_1 + 2^4 w_2 + 3^4 w_3 + \cdots + 52^4 w_{52}$$

We estimate the impact of the change in spreads up to twelve weeks ago on the change in current inventory using the following model:

$$\Delta STOCK_{i,t} = \beta_{0,i} + \sum_{k=1}^{4} \beta_{i,k} Z_{k,t} + \sum_{j=5}^{16} \beta_{i,j} \Delta SPREAD_{j,t} + \sum_{j=17}^{J} \beta_{i,j} \Delta Y_{i,j,t} \quad (1)$$

where ΔSTOCKi,t is the change in inventories between weeks t-1 and t at one of the following locations i: U.S., Cushing, PADD1-PADD5, as well as U.S. without Cushing and PADD 2 without Cushing. $Z_{k,t}$ variables control for seasonality and are created as described above, ΔSPREAD j,t is the change in the spread between the two- and one-month WTI crude oil future contracts and its lags going back twelve weeks, and ΔYj,i,t represents other possible factors j impacting inventories in region i, including current and lead changes in imports, production, and refinery inputs. In addition, but not shown in Equation (1), autoregressive and moving average lagged error terms are included as needed to remove autocorrelation in the residuals.

As discussed above, in the absence of measurement error, the change in inventories for the U.S. (including SPR) would equal imports plus production minus refinery inputs. Thus including flow *levels* of these variables would result in built-in correlation. Instead of flow levels, we include *changes* in import, production, and refinery input flows in ΔYj,i,t to capture changes in inventories. These variables smooth out temporary mismatches between (a) crude oil additions plus production and imports, and (b) crude oil withdrawals minus the refinery intake. Not only current but also coming week changes in these variables are included. Next week, or lead, variables are utilized as proxies for expected changes in crude oil additions and

withdrawals. We anticipate that the change in inventories should be a positive function of the changes in imports and U.S. production over the current week and a negative function of the changes in these two variables over the coming week. The change in inventories should be a negative function of the change in refinery inputs this week and a positive function of the change in refinery inputs next week.

In order to impose some structure on the spread coefficients and improve the efficiency with which they are estimated, we condense the twelve lagged spread variables in Equation (1) to four. Accordingly, we estimate a polynomial distributed lag (PDL) model in which the coefficients of the lagged spreads follow a fourth degree polynomial. PDL_j is a j-1 degree polynomial of the twelve lagged spread. In other words, PDL_1 is a zero degree polynomial, PDL_2 a first degree polynomial, etc. Details of the structure are available in Appendix 1. Therefore, our final model is:

$$\Delta STOCK_{i,t} = \beta_{0,i} + \sum_{k=1}^{4} \beta_{i,k} Z_{k,t} + \sum_{j=5}^{8} \beta_{i,j} \Delta PDL_{j,t} + \sum_{j=9}^{J} \beta_{i,j} \Delta Y_{i,j,t} \quad (2)$$

5. Results

The weekly change in Cushing inventory is a positive function of the change in the current and past spreads but changes in other PADDs' inventory are not. Changes in PADD 2 inventories, which include Cushing, are a significant function of change in the spread when the inventory figures include Cushing, but not when Cushing inventories are excluded. Similarly, changes in overall U.S. (non-SPR) inventories are a positive function of spread 1992-2004 but not for the 2004-2011 period. The

implication is that, at least since 2004, C&C arbitrage is largely concentrated at Cushing.

5.1. Cushing Results

Estimation results for Equation (2) are presented in Tables 33, 34, 35 and 36 for weekly changes in inventories at Cushing, U.S. non-SPR, PADD 2, and PADDs 1, 3, 4, 5, respectively. The Cushing equation is estimated from 4/16/2004, when the Cushing data is first available, to 7/8/2011. Equations for other areas are estimated over various periods including 1992-2011. ΔPDL coefficients shown in Panel A of the tables are for the polynomial variables calculated from the spread changes over the current and twelve past weeks. Their joint significance is tested with the Wald p-values shown at the bottom of Panel A of the tables. Panel B of the tables shows the implied coefficients for the twelve lagged spread differences calculated from the ΔPDL coefficients in the top of the tables. Thus, in Table 33 Panel B, the coefficient for the current spread is 282.03, the coefficient for last week's spread is 324.29, and the coefficient for the week before that is 333.20. Above we argued that due to delivery arrangements, there may be a considerable delay between the arbitrage trades in response to the spread and the actual change in crude oil inventories since we observe actual inventories but not contracts for future delivery. The estimated coefficient pattern in the bottom part of Table 33 is certainly consistent with this. Indeed, coefficients for the spreads two, three and four weeks ago are actually higher than the coefficient for the current week.

The lag pattern shown in Panel B of Table 33 shows that we observe positive inventory changes through at least the first eight weeks. The largest increases are observed over the first four weeks or so. Then the increases start declining. Cushing results in Table 33 imply that a one- time $0.10 increase in the spread leads to a positive change in inventories of about 28,203 barrels the first week, approximately 153,241 barrels after four weeks, and 211,142 barrels after nine weeks.

Cushing data is only available from 2004-2011 and the Cushing results reported in Table 33 pertain to this period. Model 1 evaluates actual changes in Cushing inventories, while Model 2 pertains to a modified version where Cushing inventory changes are winsorized at the 1% level to control for outliers. Cushing inventory changes are mainly explained by the spread. No operational variables, other than U.S. oil production, significantly influence Cushing inventory changes. The removal of the PDL spread lags from the regressions drops the adjusted R^2 for Cushing models by 55% from 15% to 7%. However, the same removal for overall U.S. (non-SPR), PADD 1, 3, 4, and 5, and PADD2 non-Cushing inventories decreases the adjusted R^2 only slightly, if at all. The overall results are similar when the change in Cushing inventories is winsorized. Table 33 also shows evidence of a seasonal pattern in Cushing inventories as reflected in the z variable coefficients.

The graph of the Cushing seasonal pattern in inventories as implied by the z variables is presented in Figure 2. The pattern of inventory levels shows a short period of crude oil withdrawal from storage at the beginning of the year (weeks 1-3) after which inventory additions begin (week 4) and last through May (week 20), at which point withdrawals resume and continue through autumn, with additions to storage

resuming in late autumn (week 40) and persisting through the end of the year. Figure 2(a) also shows that inventory levels in Cushing have grown significantly over 2004-2011 as more storage facilities have been built. The average annual inventory increase is shown by the difference in the starting and ending points of the inventory "level" series. Figure 2(b) adjusts for this capacity increase by normalizing the graph scale in Figure 2(a) to start and end at the same level, and shows the seasonal pattern on this adjusted scale.

5.2. Results for Total U.S. Above-Ground, On-Shore Storage

Results for the U.S. (non-SPR) change in inventories are presented in Table 34. In Model 1, we present estimations of Equation (2) for the full 1992-2011 period and, in Model 1-winsorized, we use the same data as in Model 1 but winsorize the dependent variable—the change in U.S. inventories--at the 1% level. In Table 34 Model 2 we estimate the equation for the 1992-2004 period, over which separate Cushing storage data is unavailable. In Model 3, Equation (2) is estimated over the 2004-2011 period, including Cushing storage inventories and in Model 4, over 2004-2011, excluding Cushing. The changes in the spread are significant in explaining U.S. inventory changes in Models 1-2 for the 1992-2011 and 1992-2004 periods respectively, but not in Models 3-4 which cover the 2004-2011 period. However, over 2004-2011, the change in spread is the main significant explanatory variable for Cushing inventory changes, as shown in Table 33. This indicates that the seeming relationship between the U.S. (non-SPR) change in inventories and the spread is largely driven by Cushing inventories.

As shown in Table 34, the spread is not significant in explaining overall U.S. (non-SPR) inventories over 2004-2011, whether or not Cushing inventories are included in the total. Consistent with this, as reported in Table 36, none of the PADD 1, 3, 4 or 5 district inventories appear influenced by the spread. Combined with the findings from Table 3 that Cushing inventories are a significant positive function of the spread over 2004-2011, this indicates to us that most C&C arbitrage in recent years has been confined to Cushing. However, it bears noting that the inventory figures include above-ground on-shore inventories only. We cannot rule out C&C arbitrage involving off-shore storage in tankers, or producers opting to leave oil in the ground in response to the futures spread.

The insignificant result in Model 3 of Table 34 could be due to the largely operational role of inventories outside Cushing since the operating parameters are very significant). Model 3 of Table 34 reports U.S. results over 2004-2011 with Cushing included but shows that the spread is not significant in explaining inventory. In contrast, Model 3 of Table 35 reports PADD2 results over 2004-2011 with Cushing included and shows that spread is significant. The implication here is that when Cushing is included in overall U.S. numbers, it loses power to explain overall U.S. inventory changes especially since the explanatory power of operating variables in all other PADDs increases.

While we found little impact of the operational variables on inventories at Cushing, they are important in explaining total U.S. inventories. Moreover, the explanatory power of operational variables grows overtime, as the R^2 over 2004-2011 (69%) is much higher than the R^2 over 1992-2004 (21%). As expected, we find a

significant positive relation between inventory changes and changes in both imports and U.S oil production over the current week and a negative relation between the change in inventories and the change in refinery inputs. Also, as expected, the signs are reversed for changes in imports, U.S. production, and refinery inputs over the coming week, though the coefficient for the coming change in U.S. production is not significant. The results for the lead variables indicate that if refinery inputs are expected to be higher (lower) next week than imports and production, then storage operators tend to increase (decrease) current inventories in anticipation. There is also evidence of a seasonal pattern as reflected in the z variable coefficients.

The graph of the U.S. (non-SPR) seasonal pattern in inventories as implied by the z variables is presented in Figure 3. In Figure 3(a) we presents the changes and levels of U.S. crude oil inventories as predicted by the z pattern over the 1992-2011 period; in Figure 3(b) over the 1992-2004 period; and in Figure 3(c) over the 2004-2011 period. The pattern of crude oil inventory levels shows that crude oil additions to storage start in early autumn (around weeks 36-38), followed by a quick period of crude oil withdrawals over the last couple of weeks of the year, after which additions resume at the start of the new year and continue through May (around week 20). Then in May crude oil starts being withdrawn as inventories decrease. Crude oil withdrawals last over the summer and early autumn months, till the end of September (around week 35). Figure 3(b) shows that overall U.S. crude oil storage capacity did not increase significantly over 1992-2004, as the line graphing inventory levels converges to its starting point. This differs from Figure 3(c) which shows that capacity

increased over the 2004-2011 period. This capacity increase is partially attributed to Cushing, as can be seen from Figure 2.[41]

5.3. PADD 2 Results

Results for PADD 2 crude oil inventories are presented in Table 35. We present PADD2 results separately from other PADD district because it physically includes Cushing. In Model 1, we present Equation (2) estimations for the full 1992-2011 period and, in Model 1-winsorized, we use the same data as in Model 1 but winsorize the dependent variable—the change in PADD 2 inventories--at the 1% level. In Model 2 we estimate the equation for the 1992-2004 period, over which separate Cushing storage data is unavailable. In Model 3, Equation (2) is estimated over the 2004-2011 period, including Cushing storage inventories and in Model 4, over 2004-2011, excluding Cushing. The changes in the spread are significant in explaining inventory changes in Models 1-3 but not in Model 4 which excludes Cushing over the 2004-2011 period. So, unlike total U.S. (non-SPR) and PADD 1, 3, 4, and 5 inventories, PADD 2 inventories are a significant function of the spread over 2004-2011 until we exclude Cushing. Furthermore, if we remove all spread lags from the list of independent regression variables, the adjusted R^2 declines for PADD 2 inventory changes when Cushing is included from 17% to 12%, but it remains at 5% when Cushing is excluded from PADD 2 inventories. This shows that Cushing inventories are driving the explanatory power of spread for PADD 2 inventories. We

[41] While we do not have capacity data, we can partly infer capacity from levels since level will not exceed capacity. The overall U.S. (non-SPR) weekly crude levels did not change a lot (unlike Cushing) – from around 333,494 (October 30, 1992) to 355,456 (July 8, 2011) thousand barrels. In Cushing there was over a 250% increase in levels, which is unlikely to have been accomplished without capacity increases.

conclude that there is little evidence of above-ground C&C arbitrage in PADD 2 outside of Cushing.

Changes in PADD 2 inventories are partially explained by current, but not lead, operational variables. PADD 2 inventories are a positive function of current week imports and production and a negative function of refinery inputs. This is in line with the results for overall U.S. inventories, where the operational variables also explain inventory changes, but different from the results for Cushing, where the operational variables are insignificant. Evidence of a seasonal pattern, as reflected by the z variables, also exists in PADD 2 as in all the other areas.

5.4. Results for Other PADD Districts

Results for the other individual PADD districts, excluding PADD 2, are presented in Table 36. There is no evidence that changes in the spread impact inventory changes in these regions, as the PDL lags of the spread are neither jointly nor individually significant. However, inventory changes in most PADD districts are a positive function of recent changes in imports and a negative function of imports over the coming week. They are a negative function of recent changes in refinery inputs and a positive function of the change in refinery inputs over the coming week.

Overall, our results from Tables 33-36 suggest that over the 2004-2011 period the spread is significant in explaining inventories mainly at Cushing indicating that above-ground on-shore C&C arbitrage in the U.S. currently takes place largely in Cushing.

6. Robustness Checks

In this section we carry out check of robustness of the results reported in the previous section to alternative specifications. In results that are available from the authors, we have repeated our analysis where the dependent variables are levels, rather than the changes, in inventories. Results largely parallel those in section 5. Several alternative specifications for Cushing are presented in Table 37 and for the total U.S. (no-SPR) in Table 38, as well as for both in Tables 39-41. These alternatives include adding lagged control variables, evaluating the percentage instead of the barrel change in inventories and examining the role of cross-PADD imports. We also estimate our models without the PDL structure for the spreads and using month dummies instead of the z weekly variables to adjust for seasonality. Finally, we present our results using two different measures of the spread, instead of the original difference between the two- and one-month NYMEX WTI futures, we use the difference between the two-month future and the spot WTI prices, as well as the difference between the tree- and two-month NYMEX WTI futures.

We include the percentage change in inventories as an alternative specification to partially control for the large growth in capacity, especially at Cushing, over the evaluation period. We also consider the possibility that Cushing inventories might be influenced by the inflows and outflows of crude oil from other PADDs. While imports are not significant in explaining the Cushing inventory changes, our imports measure does not contain imports from other PADDs. After studying the correlations for storage and imports for different PADDs and consulting EIA data we establish that the largest exchange of crude oil occurs between PADD 2 and PADD 3. We therefore

include changes in PADD 3 storage and imports as controls in Cushing regressions. These alterations do not change the significant role of the spread in explaining Cushing inventories.

We add lagged control variables for several reasons, of which the first is to reduce the influence of asynchronous data reporting for inventories and the above mentioned controls. In this case, we expect the signs on the lagged coefficients to be the same as for the ones for the current week—negative for refinery inputs and positive for production and imports. The second reason to add lagged control terms deals with "reaction adjustment" in the following manner: if refinery inputs were higher than expected last week, this week there could be a tendency to restock inventory and if production and imports were higher than expected last week, this week there could be a tendency to "drain down" inventory. In this case, we would expect the lagged control coefficients to be of a different sign than the ones for the current week—positive for lagged refinery inputs and negative for lagged production and imports. However, like the current week imports, production, and refinery input variables, the lags of these variables may be correlated with the change in inventories due to their correlation with the levels of these variables. This additional specification again does not alter our main results.

We also we want to explore whether our PDL structure for the twelve spread lags is responsible for our results, i.e., to see if the main results are robust to including the twelve individual spreads. The same issue applies to using the four seasonal z variables. We are also interested in whether these specifications result in more efficient estimates of the spread and seasonal patterns.

Finally, we want to evaluate the relationship between crude oil inventories and the spread using different measures of the spread to ensure that our results are not driven my our chosen spread measure—the difference between the two- and the one-month NYMEX WTI futures. We present two alternative spread measures—the difference between the two-month future and the spot WTI prices, as well as the difference between the three- and one-month WTI futures. The correlation between different spread levels is high, over 94%. But we use spread changes, not levels, in our models and while the correlation between our main spread measure, the difference between the two- and one-month WTI futures, and one of the alternatives, the difference between the three- and one-month WTI futures, remains high at 96%. The correlation between our main spread measure and another alternative, the difference between the two-month futures and the spot WTI prices, is only 64%.

Alternative models for Cushing over the 2004-2011 period are presented in Table 37. In Model 1, we use an alternative dependent variable—instead of the barrel change we use the percentage change in inventories. In Model 2, we add lagged control variables for crude oil refinery inputs, production and imports. In Model 3, we add controls for possible transfers of crude oil from PADD3 into PADD2, where Cushing is located. Cushing changes in inventory remain a positive significant function of the spread in all specifications in Table 37.

Model 1 results in Table 37, in which the percentage change in inventories replaces the barrel change as the dependent variable, echo the Table 33 results in that changes in the Cushing inventory are again a significant positive function of the spread. The change in production is the only operational control variable that explains

Cushing inventory changes. There is again evidence of a seasonal pattern as reflected in the z variable coefficients.

The implied coefficient pattern for the twelve lags of the change in spread in Table 37, Model 1, Panel B is similar to that of Table 3 Panel B, as it again shows that spread influences inventories with a lag. Table 37 Panel B shows that inventory increases over about the first eight weeks. A one-time $0.10 increase in the spread leads to 1.25% increase in Cushing inventories over the first week, approximately 6.23% increase over four weeks and 8.34% increase after nine weeks.

Model 2 in Table 37 adds lagged control variables. Cushing inventory changes are still a significant positive function of the change in spread. Again none of the control variables, except the current production changes and the lagged refinery inputs change, are significant in explaining Cushing inventory changes. The lagged refinery inputs change is positively related with current Cushing inventory changes. This is inconsistent with our non-synchronous data interpretation but in line with but with "reaction adjustment" interpretation—if the refinery draws were higher than expected last week then there would be a tendency to restock this week.

Results in Model 3 in Table 37, in which PADD 3 imports and inventories are included as explanatory variables for Cushing inventories, are interesting. Changes in Cushing inventories are still a significant positive function of the spread. But also changes in PADD 3 imports are significant in explaining Cushing inventory changes, while PADD 3 inventory changes are not. No other control variables, not even production, which exhibited explanatory power in all other models, are significant in explaining Cushing inventory changes. PADD 3 imports may matter because a part of

crude oil coming into PADD 3, which includes the largest U.S. crude oil port in Louisiana, might eventually be destined for PADD 2. However, that crude oil is temporarily stored in PADD 3 before transfer to PADD 2, so is not originally reported as a PADD 2 import in the data. These results suggest that a future study that takes imports between different PADDs into account could be interesting.

Alternative models for the changes in overall U.S. (non-SPR) inventories are presented in Table 38. Models 1 and 3 evaluate the full sample period from 1992-2011 and Models 2 and 4 evaluate the 2004-2011 period. In Models 1 and 2 we present estimations using an alternative dependent variable. Instead of the change in barrels we use the percentage change in inventories. In Models 3 and 4 we add lagged control variables for crude oil refinery inputs, production and imports. Results are consistent with our main results that total U.S. (non-SPR) inventory changes are a positive function of the change in spread over the full sample period from 1992-2011 but not over the 2004-2011 timeframe. Again the results indicate that since 2004 most on-shore and above-ground C&C arbitrage apparently occurs at Cushing.

Models 1 and 2 in Table 38 where we use the percentage change in total U.S. (non-SPR) inventories as a dependent variable are very similar to Models 1 and 3 in Table 4 where the dependent variable is the barrel change. Otherwise the model specifications for models in Tables 38 and 34 are the same. Consistent with the previous results, the percentage change in total U.S. (non-SPR) inventories is a positive function of the spread in Model 1 from 1992-2011, but the spread is insignificant in Model 2 from 2004-2011. Also consistent with the Table 34 results,

operational controls and seasonal variables remain significant in explaining U.S. (non-SPR) inventories in both time periods and in both Models 1 and 2 in Table 38.

The results from Models 3 and 4 in Table 38 in which we add lagged control variables for refinery inputs, production and imports are consistent with the results from Models 1 and 2 from Table 38, as well as models in Table 34. As before, the change in total U.S. (non-SPR) inventories is a positive function of the change in spread over the 1992-2011 period, but not over the 2004-2011 period.

On the other hand, all operating variables--current, lag, and most lead changes are significant in explaining total U.S. (non-SPR) inventory changes. We did not include lag control variable changes past one week back because we reasoned that longer dated lags would bring our models to an approximate tautology.[42]

In general, Tables 37 and 38 indicate that results dealing with the influence of the spread on Cushing and total U.S. crude oil inventories remain consistent with alternative specifications. Spread mainly explains Cushing inventory changes, while operational variables largely explain inventory changes in other areas. The influence of spread on inventories occurs with a lag. The implied coefficient pattern for the twelve lagged spreads calculated from the ΔPDL coefficients in the models again confirms that when the spread rises inventories in both Cushing and the overall U.S. increase most, not in the current week, but two to four weeks out. In other words

[42] With perfect data, the change in inventories equals imports plus production minus refinery inputs for that week. So, a regression of inventory changes on import, production, and refinery input levels would be estimating a tautology. Since lagged inventory changes going back many weeks proxy for the current inventory levels, models that include long-dated lags of imports, production and refinery inputs estimate an approximate tautology. An inclusion of just one lag increases the adjusted R^2 by 9% between Models 1 and 3 and by and 15% between Models 2 and 4 in Table 38.

spreads two to four weeks out have a stronger influence on the change in inventories than the current spreads.

Table 39 presents regressions for both Cushing and the U.S. using the twelve individual spread change lags instead of imposing the PDL structure on the lagged spreads and monthly dummy variables instead of using weekly dummy variables structured in a polynomial form. In Model 1, we estimate the relations for Cushing from 2004-2011, in Model 2, for the U.S. from 1992-2011 and, in Model 3, for the U.S. from 2004-2011. Again our results hold using parsimonious specifications. Cushing inventory changes are a positive function of the change in spread, as confirmed by the Wald test (p-value of 0.000) for the joint significance of all twelve spread lags. U.S inventory changes are a positive function of the change in spread over 1992-2011, but not over 2004-2011. As compared with the PDL specification, the coefficient pattern for the lagged spread changes jumps around. Also, the standard errors of the coefficients of the lagged spread terms (*not shown but available upon request*) for the non-PDL models are considerably higher, so the PDL specification does (as expected) provide more efficient estimations. Standard errors are also higher when monthly dummies, instead of the polynomial specification of weekly dummies, are used to adjust for seasonality. Therefore, models with polynomial specifications have several advantages—they are more efficient and they provide us with a smoother coefficient pattern for seasonality and for the influence of the change in spread on inventory changes.

Tables 40 and 41 present regressions for both Cushing and the U.S. using alternative measures of the spread. In Model 1, we estimate the relations for Cushing

from 2004-2011, in Model 2, for the U.S. from 1992-2011 and, in Model 3, for the U.S. from 2004-2011. The main measure of the spread used in the paper is the difference between the two- and one-month NYMEX WTI futures and the reasoning for this choice is described in section 4.1. In Table 41 we follow Equation (2) but regress crude oil inventory changes on the spread defined as the difference between the two-month futures and the spot WTI prices, while in Table 41 the spread is defined as the difference between the three- and one-month NYMEX WTI futures. Again our results hold using different measures of spread. Cushing inventory changes are a positive function of the different spread measures over 2004-2011. U.S. inventory changes are a positive function of different spread measures over 1992-2011, but not over 2004-2011. None of the operational variables, except for production changes, are significant in explaining Cushing inventory changes. On the other hand, all current and lead operational variables, except lead production, are significant in explaining U.S. inventory changes. The patterns of spread coefficients available in Panel B are similar to all our other models as they show that spreads influence crude inventories with a lag.

7. Conclusions

From regressions of crude oil inventory changes on current and lagged spreads, we find that crude oil inventories at Cushing are a strong positive function of current and lagged futures spreads. We find that current crude oil inventories are influenced not only by current spreads but by spreads over the last eight weeks. Indeed we find that current inventories are a stronger function of spreads several weeks ago

than of current spreads. Our interpretation of this is that current spreads likely lead to contracts for forward delivery which do not result in a change in actual stock levels until delivery occurs sometime in the future. For instance, if in July the price of the September futures contract exceeds the price of the August contract by more than the cost of storage, an arbitrageur may long the August futures contract and short the September contract. He would then take delivery on the August contract and make delivery on the September contract so we would observe inventories rising in August and falling in September due to the July spread. Thus, the influence of the spread on storage is not immediate. We find no convincing evidence that the futures spread materially impacts inventories outside Cushing. Total U.S. inventories and PADD 2 inventories over the 1992-2004 period, i.e. before Cushing inventories were reported separately, are significant positive functions of the spread. However, when Cushing inventories are subtracted from PADD 2 figures over the 2004-2011 period, the spread terms are insignificant. Similarly, the spread is insignificant in explaining total U.S. inventory changes over 2004-2011. The spread variables are also insignificant in regressions for all the other PADD districts.

It has been hypothesized that the futures spread impacts inventories held by refiners, pipelines, and other oil companies as well as arbitrageurs. In other words, if the spot price is far enough above the futures price, refiners and pipelines will draw down current inventories (thus risking a stock-out) and replenish later at lower prices, and they will build up inventories when the spot price is low relative to the futures price. The fact that we find little evidence that inventories outside Cushing are impacted by the futures spread indicates that if this activity occurs at all it is too small

for us to detect with aggregate data. However, our inventory data includes above ground, on-shore inventories only. We cannot rule out the possibility that the futures spread may impact producers' decisions whether to pump the oil or leave it in the ground. Nor can we shed light on the impact of the spread on tanker storage in the Gulf or elsewhere.

We further find evidence that total U.S. and most PADD district inventories, except for Cushing, are partially explained by operational variables, particularly current and future changes in imports, U.S. oil production, and refinery inputs. These results indicate that refiners and storage operators increase inventories when they foresee future refinery needs exceeding future imports plus U.S. crude oil production, and reduce inventories when they foresee a surplus of imports and domestic production over refinery needs. We do not find these variables having much impact on Cushing inventories, further indicating that inventories there are mostly held for arbitrage (and possibly speculative) purposes.

To our knowledge, this study provides the first comprehensive analysis of the causal relationships between oil spot prices, futures prices and inventories, including the C&C arbitrage relation between oil inventories and the futures spread, and how inventories are impacted by contango versus normal backwardation in oil futures prices. Our findings establish, to our knowledge, the first tangible evidence documented in the literature of a causal link between oil futures and spot markets via inventory changes resulting from arbitrage. These findings provide an important foundation for future research on the impact of financial traders on the spot markets,

especially the twin questions of whether financial traders (a) exacerbate or attenuate spot price volatility, and (b) whether they systematically affect the spot oil price level.

Table 1: Variable Definitions, Chapter 1

Table 1 defines variables used in the analysis in Chapter 1. Deal level data, including ownership, was obtained from Thomson Reuters SDC Platinum M&A database. Firm variables, stock prices and local indexes are from the Worldscope/DataStream databases. Numbers in parentheses pertain to the actual Worldscope data item number.

Variable	Definition
Dependent Variable	
(-2,+2) MAR	Market adjusted abnormal 5 day (-2, +2) return, where 0 is government investment announcement day.
Government Ownership Variables	
Gov. Prior Ownership (%)	Government percentage ownership, if any, before the investment
Gov. Shares Acquired (%)	Percentage government investment into a target firm.
Gov. Ex Post Ownership (%)	Percentage government ownership after the investment into a target firm.
Government Investor Colors	
Foreign Deal	Dummy=1 if the target and acquirer parent nations are not the same.
Domestic Deal	Dummy=1 if the target and acquirer parent nations are the same.
Political Gov. Investor	Dummy=1 if the acquirer has political objectives and is a local or a national government, or a government pension fund.
Financial Gov. Investor	Dummy=1 if the acquirer has financial objectives and is a SWF, government owned bank, development bank, government real estate investor, supranational or other financial government entity.
Economic Gov. Investor	Dummy=1 if the acquirer has economic objectives and is an SOE, including energy, consumer, industrial, materials, media and telecom-technology SOEs.
Gov. Expropriation	Index evaluating contract expropriation, profits repatriation, payment delays, ranges from 0 to 12 with the higher values meanings higher expropriation risk; obtained from ICRG.
Left-wing Gov.	Dummy=1 if the acquirer government is left-winged. Data is obtained from the WorldBank database of Political Institutions (updated 2010).
Maj. Own. (>50%)	Dummy=1 if the acquirer purchases 51% or more of a firm.
Maj. Own.(50%-10%)	Dummy=1 if the acquirer purchases between 50%-10% of a firm.
Min. Own. (<10%)	Dummy=1 if the acquirer purchases less than 10% of a firm.
Deal Variables	
Gov.-to-Gov. Deal	Dummy=1 when a 'government' flagged entity is involved on the acquirer and target side. The acquirer side includes acquirers and acquirer parents; the target side targets and target parents.
Same Industry Deal (2-digit SIC)	Dummy=1 if either target or target parent and acquirer or acquirer parent are within the same 2-digit SIC code.
Withdrawn Deal	Dummy=1 for eventually withdrawn deals.
Government Acquirer	Dummy=1 if the acquirer, as opposed to acquirer parent, if flagged with government status.
Cash Deal	Dummy=1 if 98% of the payment was in cash.
Stock Deal	Dummy=1 if 98% of the payment was in stock.

Table 1(Continued). Variable Definitions, Chapter 1

Variable	Definition
Mixed Deal	Dummy=1 if the deal was paid for with a mix of cash and stock or the payment was unknown.
Bank Crises	Dummy=1 if the deal occurs during banking crises defined by Laeven and Valencia (2010).
2008 Crisis	Dummy=1 if deal occurs during the 2008-2009 Financial crisis.
Capital Inflow	Dummy=1 if either new shares were issued for the investment or SDC deal synopsis specified an investment as a 'capital injection.'
Common Law (acquirer p.)	Dummy=1 if the acquirer parent nation is common law from Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2002): "Courts: the Lex Mundi Project," NBER 8890.
Firm Variables	
Size	The natural logarithm of total assets (# 02999).
Leverage	(Total Assets - Book Value of Equity) / Total Assets (# 02999 and # 03501).
ROA	Net Income / Last Year's Total Asets (# 08326).
Tobin's Q	(Market Value + Total Assets - Book Value of Equity) / Total Assets (# 08001, # 02999 and # 03501).
Other Variables	
Last Year Performance	Target's buy-and-hold abnormal market adjusted return (-250, -26).

Table 2: Descriptive Statistics, Chapter 1

The table summarizes 1809 government investments. The sample covers the 1988-2011 period and presents the number, value and respective proportion of government investments, as well as the number of investments by foreign, domestic, political, financial and economic government entities. Government investment is broken down by year of transaction announcement in Panel A, by the percentage of government ownership in Panel B, by country of the target in Panel C, by country of acquirer in Panel D, by target's 1 digit SIC in Panel E and full SIC in Panel F.

Panel A. Government Investment by Transaction Year (announced)

Year	Deal Count	Deal Value USD (mil)	Proportion of Total (Count)	Proportion of Total (Value)	Foreign	Domestic	Political	Economic	Financial
1988	4	991	0%	0%	3	1	1	3	0
1989	15	4,686	1%	1%	11	4	1	8	6
1990	22	1,751	1%	0%	16	6	3	12	7
1991	46	3,731	3%	1%	22	24	9	17	20
1992	39	1,633	2%	0%	15	24	3	12	24
1993	68	3,529	4%	1%	33	35	8	28	32
1994	52	6,589	3%	1%	22	30	6	13	33
1995	37	6,167	2%	1%	11	26	6	10	21
1996	35	7,571	2%	2%	16	19	3	16	16
1997	61	7,061	3%	1%	33	28	6	26	29
1998	45	23,246	2%	5%	20	25	5	21	19
1999	70	8,888	4%	2%	22	48	11	34	25
2000	99	16,235	5%	3%	43	56	12	53	34
2001	61	19,749	3%	4%	25	36	5	26	30
2002	70	7,915	4%	2%	26	44	1	37	32
2003	92	6,219	5%	1%	26	66	6	45	41
2004	88	11,713	5%	2%	28	60	2	40	46
2005	100	31,801	6%	6%	34	66	8	41	51
2006	93	12,276	5%	2%	37	56	9	37	47
2007	116	74,850	6%	15%	46	70	9	49	58
2008	231	113,695	13%	23%	50	181	113	66	52
2009	261	102,727	14%	20%	75	186	106	77	78
2010	77	20,416	4%	4%	32	45	10	17	50
2011	27	8,438	1%	2%	13	14	4	10	13
Total	**1809**	**501,876**	**100%**	**100%**	**659**	**1150**	**347**	**698**	**764**

Table 2(Continued). Descriptive Statistics, Chapter 1

Panel B. Government Investment by Percentage Ownership

Stake Acquired	Deal Count	Deal Value USD(mil)	Proportion of Total (Count)	Proportion of Total (Value)	Foreign	Domestic	Political	Economic	Financial
No data	177	75,445	10%	15%	67	110	39	74	64
<10%	521	83,164	29%	17%	187	334	181	97	243
10%-50%	710	143,204	39%	29%	256	454	88	308	314
>50%	401	200,063	22%	40%	149	252	39	219	143
Total	**1809**	**501,876**	**100%**	**100%**	**659**	**1150**	**347**	**698**	**764**

Panel C. Government Investment by Target Nation (top 15 by value)

Rank	Target Nation	Deal Count	Deal Value USD(mil)	Proportion of Total (Count)	Proportion of Total (Value)	Foreign	Domestic	Political	Economic	Financial
1	United States	274	83,169	15%	17%	68	206	208	43	23
2	United Kingdom	58	76,313	3%	15%	51	7	11	25	22
3	Germany	58	40,780	3%	8%	30	28	10	25	23
4	Switzerland	14	26,008	1%	5%	9	5	2	5	7
5	Australia	92	23,595	5%	5%	66	26	0	52	40
6	Spain	45	19,910	2%	4%	22	23	3	26	16
7	Italy	13	19,699	1%	4%	3	10	0	9	4
8	Russian Fed	78	17,773	4%	4%	2	76	8	52	18
9	Canada	89	16,999	5%	3%	34	55	3	31	55
10	Hong Kong	117	14,813	6%	3%	117	0	2	53	62
11	Malaysia	81	13,284	4%	3%	15	66	20	19	42
12	Belgium	23	12,776	1%	3%	9	14	2	12	9
13	Brazil	29	12,747	2%	3%	13	16	2	14	13
14	Singapore	24	12,610	1%	3%	10	14	0	6	18
15	Norway	24	12,118	1%	2%	10	14	2	11	11
	Total	**1019**	**402,594**	56%	80%	**459**	**560**	**273**	**383**	**363**
	Others	**790**	**99,282**	44%	20%	**200**	**590**	**74**	**315**	**401**
	Overall	**1809**	**501,876**	**100%**	**100%**	**659**	**1150**	**347**	**698**	**764**

Table 2(Continued). Descriptive Statistics, Chapter 1

Panel D. Government Investment by Acquirer (parent) Nation (top 15 by value)

Rank	Target Nation	Deal Count	Deal Value USD(mil)	Proportion of Total (Count)	Proportion of Total (Value)	Foreign	Domestic	Political	Economic	Financial
1	China	387	76,180	21%	15%	175	212	5	236	146
2	France	173	56,393	10%	11%	82	91	13	79	81
3	United Arab Em.	48	46,472	3%	9%	46	2	0	7	41
4	United States	240	38,020	13%	8%	34	206	204	7	29
5	United Kingdom	13	37,617	1%	7%	6	7	5	2	6
6	Singapore	99	31,364	5%	6%	85	14	7	3	89
7	Germany	41	23,778	2%	5%	13	28	11	11	19
8	Russian Fed	89	19,981	5%	4%	13	76	9	59	21
9	Qatar	18	15,436	1%	3%	15	3	0	1	17
10	Switzerland	9	13,934	0%	3%	4	5	2	6	1
11	Malaysia	76	12,280	4%	2%	10	66	21	20	35
12	Belgium	20	11,383	1%	2%	6	14	2	12	6
13	South Korea	29	10,422	2%	2%	4	25	3	7	19
14	Italy	20	10,162	1%	2%	10	10	0	13	7
15	Sweden	36	8,768	2%	2%	20	16	0	23	13
	Total	**1298**	**412,189**	72%	82%	**523**	**775**	**282**	**486**	**530**
	Others	**511**	**89,687**	28%	18%	**136**	**375**	**65**	**212**	**234**
	Overall	**1809**	**501,876**	**100%**	**100%**	**659**	**1150**	**347**	**698**	**764**

Table 2(Continued). Descriptive Statistics, Chapter 1

Panel E. Government Investment by 1-digit SIC

SIC 1-digit code	SIC Category	Deal Count	Deal Value USD(mil)	Proportion of Total (Count)	Proportion of Total (Value)	Foreign	Domestic	Political	Economic	Financial
0	Agriculture, forestry, fishing	17	3,949	1%	1%	6	11	2	4	11
1	Mining, construction	200	96,133	11%	19%	130	70	8	125	67
2	Manufacturing (food, fabric, wood, chemical)	203	20,804	11%	4%	63	140	12	101	90
3	Manufacturing (rubber, plastic, glass, metal; boat, rail, air equipment)	284	39,525	16%	8%	88	196	29	133	122
4	Transportation, communications, electric, gas, and sanitary service	347	122,980	19%	25%	141	206	35	224	88
5	Trade (wholesale, retail)	57	4,013	3%	1%	16	41	7	22	28
6	Finance, insurance, and real estate	575	197,526	32%	39%	163	412	241	46	288
7	Services (hotel, beauty, funeral, computer, car rental & repair, movie)	103	9,485	6%	2%	44	59	10	39	54
8	Services (doctor's offices, legal, schools [elementary, secondary, colleges], religious, accounting)	23	7,462	1%	1%	8	15	3	4	16
	Overall	**1809**	**501,876**	**100%**	**100%**	**659**	**1150**	**347**	**698**	**764**

Table 2(Continued). Descriptive Statistics, Chapter 1

Panel F. Government Investment by SIC (top 10 by value)

Rank	SIC Category	Deal Count	Deal Value USD(mil)	Proportion of Total (Count)	Proportion of Total (Value)	Foreign	Domestic	Political	Economic	Financial
1	Depository institutions	153	79,924	8%	16%	58	95	28	5	120
2	Crude petroleum and natural gas	69	67,543	4%	13%	42	27	2	51	16
3	Electric services	119	55,345	7%	11%	35	84	3	99	17
4	Telephone communications	51	36,750	3%	7%	27	24	10	30	11
5	National commercial banks	112	26,776	6%	5%	2	110	110	0	2
6	Investment advice	20	18,270	1%	4%	8	12	4	0	16
7	Personal credit institutions	9	14,955	0%	3%	2	7	3	0	6
8	Life insurance	21	11,630	1%	2%	12	9	4	1	16
9	Semiconductors and related devices	17	11,560	1%	2%	11	6	0	6	11
10	Land subdividers and developers	61	10,163	3%	2%	22	39	6	12	43
	Total	**632**	**332,916**	**35%**	**66%**	**219**	**413**	**170**	**204**	**258**
	Others	**1177**	**168,960**	**65%**	**34%**	**440**	**737**	**177**	**494**	**506**
	Overall	**1809**	**501,876**	**100%**	**100%**	**659**	**1150**	**347**	**698**	**764**

Table 3: Description of Variables, Chapter 1

This table present variables used in the evaluation of government investment. Variables are defined in Table 1. Continuous variables are presented in Panel A and the table describes the number, mean, standard deviation, median, 25th and 75th percentile for each. Target firm's prior performance is shown in Panel B. Binary variables are presented in Panel C. Variable correlations are available in Panel D. The sample consists of 1,809 government investments in publically traded firm form 1988 through 2011. Variables are winsorized at the top and bottom 1%.

Panel A. Continuous variables

Continuous Variables	Count	Mean	Std. Dev.	Median	25th percentile	75th percentile
Government Variables						
Gov. Prior Ownership (%)	1,809	7%	18%	0%	0%	0%
Gov. Shares Acquired (%)	1,600	24%	27%	12%	6%	30%
Gov. Ex Post Ownership (%)	1,632	32%	31%	18%	8%	50%
Gov. Expropriation	1,806	3.35	1.98	3.85	1.33	4.58
Gov. Size	1,776	5.47	1.49	5.55	4.50	6.78
Gov. Autoc./Democ.	1,807	-3.75	7.43	-9.00	-10.00	7.00
Gov. Stability	1,389	5.18	5.13	3.00	2.00	8.00
Firm Variables						
Size [ln(Total Assets)]	1,541	13.5	2.32	13.38	11.99	14.91
Total Assets	1,541	21,172,870	125,855,521	646,217	161,058	2,982,103
Leverage (Debt-to-Assets)	1,524	64%	0.29	66%	46%	89%
ROA	1,410	1%	0.15	3%	0%	6%
Tobin's Q	1,453	1.44	1.38	1.04	0.92	1.48
Market Value	1,482	1,832,383	6,655,736	146,433	12,498	675,911
Book Value of Equity	1,525	1,511,096	5,467,537	158,719	47,945	737,107
MTBV	1,505	2.27	3.66	1.39	0.81	2.40
Debt	1,524	19,902,627	122,159,122	368,051	73,417	2,133,354
Cash Over Total Assets	1,049	34%	0.27	27%	13%	50%
Long Term Debt-to-Equity	1,494	83%	2.04	29%	1%	93%
Debt-to-Equity	1,525	163%	4.25	66%	17%	165%
Dividend Yield	1,430	2%	0.03	1%	0%	4%
Quick Ratio	1,071	2.61	8.24	0.89	0.55	1.49

Panel B. Pre-Announcement Performance Using Country Specific Indices (6 and 12 months back)

Buy-and-Hold Returns	N	Positive : Negative	Mean Compound AR	Patell Z p-value	Median CAR	Signed Rank p-value
BHAR (-150,-26)	1,754	902:852	8%	<.0001	1%	0.013
BHAR (-250,-26)	1,694	814:880	16%	<.0001	-2%	0.781

Table 3 (Continued): Description of Variables, Chapter 1

Panel C. Binary Variables			
	Count	Yes (1)	Yes(%)
Deal Variables	1809		
Bank Crises		410	23%
2008 Crisis		492	27%
Capital Inflow		156	9%
Foreign		659	36%
Gov-to-Gov Deal (direct)		1	0%
Gov-to-Gov Deal		282	16%
Common Law (Target)		896	50%
Same Industry Deal (2-digit SIC)		629	35%
Consideration Offered Variables	1809		
Warrants		186	10%
Convertible Debt		38	2%
Stock		1587	88%
Variables that influence acquisition premium	1809		
Withdrawn		133	7%
Cash Deal		588	33%
Stock Deal		31	2%
Mixed Deal		1190	66%
Government Investor Variables	1809		
Political Gov. Investor		347	19%
Political_Gov_National		264	15%
Political_Gov_Local		58	3%
Political_Pension_Fund		25	1%
Financial Gov. Investor		764	42%
Financial_Bank		108	6%
Financial_Development_Bank		49	3%
Financial_Real_Estate		42	2%
Fianncial_Supranational		23	1%
Financial_SWF		164	9%
Financial_Other		378	21%
Economic Gov. Investor		698	39%
SOE_Energy		269	15%
SOE_Industrial		119	7%
SOE_Materials		114	6%
SOE_TelecomTech		99	5%
SOE_Media		40	2%
SOE_Consumer		57	3%
Government Acquirer (direct)		881	49%
Common Law (Acquirer)		796	44%
Common Law (Acquirer Parent)		690	38%
Left-wing Gov.		892	49%

Table 3 (Continued): Description of Variables, Chapter 1

Panel D: Correlation Table

	Leverage	*Dividend Yield*	*Quick Ratio*	*ROA*	*Tobin's Q*	*Size*	*Foreign*	*Capital Inflow*	*Same Industry*	*Warrants*	*Convertible Debt*	*Stock*	*Gov-to-Gov*	*Gov. Acquirer*	*Bank Crises*	*2008 Crisis*	*TARP*	*Common Law (T)*	*Common Law (A)*	*Common Law (AP)*	*Acquired(%)*	*Ex Post Own. (%)*	*Prior Own. (%)*	*Cash deal*	*Stock deal*	*Mixed deal*	*Left*	*Gov. Exprop.*	*Gov. Size*	*Political*	*Financial*	*Economic*
Leverage (debt-to-assets)	1																															
Dividend Yield	0.05	1																														
Quick Ratio	-0.31	-0.09	1																													
ROA	-0.12	0.24	-0.11	1																												
Tobin's Q	-0.04	-0.15	-0.07	-0.12	1																											
Size (log total assets)	0.38	0.24	-0.2	0.27	-0.29	1																										
Foreign Deal	-0.15	-0.07	0.1	-0.05	0.04	-0.02	1																									
Capital Inflow	-0.01	-0.08	0.11	-0.11	0.07	-0.01	0.12	1																								
Same Industry (2-digit SIC)	-0.14	0.01	-0.04	0.11	0	0.02	0.13	-0.06	1																							
Warrants	0.33	0.2	-0.01	-0.04	-0.11	0.13	-0.24	-0.1	-0.24	1																						
Convertible Debt	0.02	-0.01	0	-0.02	-0.01	0.1	0.07	-0.02	-0.03	-0.02	1																					
Stock	-0.31	-0.18	0	0.05	0.1	-0.17	0.19	0.1	0.23	-0.91	-0.39	1																				
Gov-to-Gov Deal	-0.09	0.02	-0.02	0.07	-0.03	0.01	-0.08	-0.03	0.17	-0.07	-0.01	0.08	1																			
Government Acquirer	0.15	0.09	-0.02	0	-0.03	0.13	-0.21	-0.06	-0.3	0.33	-0.01	-0.29	0.13	1																		
Bank Crises	0.28	0.09	-0.01	0	-0.2	0.27	-0.19	-0.07	-0.18	0.57	-0.04	-0.51	-0.05	0.25	1																	
2008 Crisis	0.17	0.1	0.15	-0.02	-0.15	0.18	-0.14	0.02	-0.16	0.51	0	-0.48	-0.07	0.18	0.58	1																
TARP	0.32	0.19	.	0	-0.12	0.14	-0.24	-0.1	-0.24	0.92	-0.05	-0.83	-0.08	0.33	0.59	0.53	1															
Common Law (target)	-0.02	0.11	0.15	-0.09	0	-0.09	0.23	0.05	-0.2	0.33	0.03	-0.32	-0.02	0.18	0.11	0.14	0.32	1														
Common Law (acquirer)	0.05	0.13	0.08	-0.04	-0.04	-0.02	0.05	0.01	-0.22	0.36	-0.01	-0.33	-0.02	0.16	0.16	0.13	0.37	0.73	1													
Common Law (acquirer p.)	0.13	0.15	0.01	-0.02	-0.03	0.05	-0.08	-0.04	-0.27	0.41	0	-0.38	-0.01	0.27	0.2	0.15	0.41	0.65	0.84	1												
Gov. Shares Acquired (%)	-0.08	0.02	0.02	0.05	0.04	-0.11	0.03	-0.04	0.26	-0.2	0.02	0.18	0.14	-0.19	-0.14	-0.09	-0.2	-0.08	-0.14	-0.17	1											
Gov. Ex Post Ownership (%)	-0.09	0.03	-0.01	0.09	0.02	-0.08	0.01	-0.05	0.36	-0.25	0	0.23	0.17	-0.2	-0.16	-0.11	-0.25	-0.13	-0.17	-0.2	0.82	1										
Gov.Prior Ownership (%)	-0.05	0.04	-0.05	0.08	-0.03	0.01	-0.04	-0.03	0.24	-0.14	-0.02	0.14	0.07	-0.07	-0.09	-0.07	-0.13	-0.11	-0.09	-0.08	-0.05	0.51	1									
Cash deal	0.01	-0.01	0.06	0	-0.02	-0.02	0.05	0.01	-0.03	0.13	0.01	-0.13	0	0.03	0	0.07	0.13	0.18	0.16	0.13	0.02	0.07	0.09	1								
Stock deal	-0.05	0.08	-0.01	0.03	-0.01	-0.02	-0.01	0.07	0.11	-0.04	0.04	0.02	0	-0.1	-0.07	-0.06	-0.04	-0.01	0.01	-0.02	0.2	0.18	0.04	-0.09	1							
Mixed deal	0.01	-0.01	-0.06	0	0.02	0.03	-0.04	-0.02	0	-0.12	-0.02	0.12	0	-0.01	0.02	-0.05	-0.12	-0.18	-0.17	-0.12	-0.08	-0.12	-0.1	-0.96	-0.18	1						
Left-wing Gov.	-0.02	-0.04	-0.02	-0.03	0.04	-0.17	0.03	0.04	0.07	-0.03	-0.04	0.04	-0.03	-0.08	-0.19	-0.07	-0.01	-0.05	-0.14	-0.27	0.04	0	-0.05	0	-0.02	0.01	1					
Gov. Exprop.	-0.15	-0.07	0.05	0	0.06	-0.05	0.16	0.08	0.07	-0.19	0.06	0.15	-0.04	-0.12	-0.07	0.07	-0.2	-0.08	-0.1	-0.06	0.04	0.1	0.1	-0.04	0	0.04	-0.11	1				
Gov. Size	0.08	0.09	0.02	0.04	-0.04	0.14	-0.06	-0.02	-0.19	0.27	0.05	-0.27	0	0.18	0.27	0.27	0.27	0.35	0.5	0.65	-0.14	-0.15	-0.06	0.08	-0.07	-0.06	-0.48	0.18	1			
Political Gov. Investor	0.29	0.16	-0.02	0.02	-0.12	0.24	-0.29	-0.05	-0.33	0.63	-0.06	-0.56	0.02	0.48	0.48	0.39	0.67	0.25	0.3	0.35	-0.17	-0.19	-0.08	0.08	-0.06	-0.07	-0.1	-0.2	0.25	1		
Financial Gov. Investor	-0.01	-0.03	0	-0.04	-0.01	0.01	0.08	0.02	-0.16	-0.26	0.11	0.2	-0.03	-0.1	-0.19	-0.2	-0.28	-0.02	0.06	0.1	-0.11	-0.1	-0.02	-0.07	-0.03	0.07	-0.09	0.04	0.12	-0.42	1	
Economic Gov. Investor	-0.24	-0.11	0.01	0.02	0.11	-0.2	0.15	0.02	0.43	-0.25	-0.06	0.25	0.02	-0.29	-0.2	-0.12	-0.26	-0.18	-0.3	-0.38	0.24	0.26	0.08	0	0.08	-0.02	0.17	0.12	-0.32	-0.39	-0.68	1

Table 4: Event Study Results for All, Foreign and Domestic Deals

Target stock price changes at the announcement of increased government ownership for the entire sample and the subsets of foreign and domestic deals. Foreign and domestic deals are defined in Table 1. Market adjusted returns are calculated as the difference between the firm's total return index and the corresponding local total return index, as defined by Datastream. Market Model parameters are estimated over days (-230,-30), where day 0 is the day of the announcement. Firms with a minimum of 100 daily returns are included in the study. Mean and median returns, as well as the p-values of the associated significance tests are presented. P-values at and below the 10% significance level are grayed out.

	All						Foreign						Domestic				
Event Window	N	Positive: Negative	Mean CAR	Patell Z p-value	Median CAR	Signed Rank p-value	N	Positive: Negative	Mean CAR	Patell Z p-value	Median CAR	Signed Rank p-value	N	Positive: Negative	Mean CAR	Patell Z p-value	Median CAR	Signed Rank p-value
Market Adjusted (using country specific indices)																	
(0,+1)	1809	1024:778	2.48%	<.0001	0.46%	<.0001	659	407:250	5.05%	<.0001	1.33%	<.0001	1150	617:528	1.01%	<.0001	0.22%	<.0001
(-2,+2)	1809	1021:787	2.81%	<.0001	0.91%	<.0001	659	418:241	6.28%	<.0001	2.25%	<.0001	1150	603:546	0.82%	<.0001	0.30%	0.0009
(-5,+5)	1809	1005:804	2.50%	<.0001	1.03%	<.0001	659	416:243	6.70%	<.0001	2.49%	<.0001	1150	589:561	0.09%	0.0079	0.20%	0.1149
(-10,+10)	1809	937:872	1.85%	<.0001	0.51%	0.0007	659	385:274	6.73%	<.0001	2.22%	<.0001	1150	552:598	-0.95%	0.8209	-0.33%	0.6443
(-30,-10)	1809	910:899	0.30%	0.148	0.05%	0.7841	659	371:288	3.11%	<.0001	1.13%	0.0001	1150	539:611	-1.31%	0.0351	-0.76%	0.0073
(+10,+30)	1809	786:1023	-1.60%	<.0001	-1.26%	<.0001	659	288:371	-1.03%	0.0155	-1.15%	0.0038	1150	498:652	-1.93%	<.0001	-1.30%	<.0001
Market Model (using country specific indices)																	
(0,+1)	1809	1061:748	2.55%	<.0001	0.55%	<.0001	659	421:238	5.18%	<.0001	1.36%	<.0001	1150	640:510	1.05%	<.0001	0.28%	<.0001
(-2,+2)	1809	1048:761	2.93%	<.0001	0.99%	<.0001	659	432:227	6.40%	<.0001	2.19%	<.0001	1150	616:534	0.94%	<.0001	0.43%	0.0003
(-5,+5)	1809	1025:784	3.00%	<.0001	1.18%	<.0001	659	419:240	7.10%	<.0001	2.51%	<.0001	1150	606:544	0.65%	0.362	0.47%	0.0109
(-10,+10)	1809	998:811	3.05%	3E-04	1.28%	<.0001	659	400:259	7.61%	<.0001	3.19%	<.0001	1150	598:552	0.44%	0.9823	0.49%	0.0725
(-30,-10)	1809	926:883	1.28%	<.0001	0.28%	0.0174	659	368:291	3.85%	0.0101	1.50%	<.0001	1150	558:592	-0.19%	<.0001	-0.25%	0.4809
(+10,+30)	1809	840:969	-0.74%	0.43	-0.65%	0.0082	659	300:359	-0.29%	<.0001	-0.70%	0.1275	1150	540:610	-1.01%	<.0001	-0.60%	0.0306

Table 5: Event Study Results for Different Types of Government Acquirers

Target stock price changes at the announcement of government investment by political, financial and economic arms. Political, financial and economic government investors are defined in Table 1. Market adjusted returns are calculated as the difference between the firm's total return index and the corresponding local total return index, as defined by Datastream. Market Model parameters are estimated over days (-230,-30), where day 0 is the day of the announcement. Firms with a minimum of 100 daily returns are included in the study. Mean and median returns, as well as the p-values of the associated significance tests are presented. P-values at and below the 10% significance level are grayed out.

	Political						Financial						Economic (SOE)					
Event Window	N	Positive: Negative	Mean CAR	Patell Z p-value	Median CAR	Signed Rank p-value	N	Positive: Negative	Mean CAR	Patell Z p-value	Median CAR	Signed Rank p-value	N	Positive: Negative	Mean CAR	Patell Z p-value	Median CAR	Signed Rank p-value
Market Adjusted (using country specific indices)																		
(0,+1)	347	160:187	-1.16%	<.0001	-0.31%	0.3162	764	410:349	2.03%	<.0001	0.32%	<.0001	698	454:242	4.78%	<.0001	1.19%	<.0001
(-2,+2)	347	161:186	-2.92%	<.0001	-0.64%	0.0302	764	413:350	2.23%	<.0001	0.48%	<.0001	698	447:251	6.30%	<.0001	2.36%	<.0001
(-5,+5)	347	152:195	-4.36%	<.0001	-1.73%	0.0005	764	409:355	2.18%	<.0001	0.63%	0.0011	698	444:254	6.26%	<.0001	2.76%	<.0001
(-10,+10)	347	142:205	-6.43%	<.0001	-3.57%	<.0001	764	384:380	0.99%	0.0004	0.03%	0.2432	698	411:287	6.90%	<.0001	2.97%	<.0001
(-30,-10)	347	139:208	-5.60%	<.0001	-3.97%	<.0001	764	390:374	0.53%	0.4299	0.10%	0.6119	698	381:317	2.98%	<.0001	1.24%	<.0001
(+10,+30)	347	147:200	-3.61%	<.0001	-2.69%	0.0006	764	332:432	-1.36%	0.008	-1.08%	0.0012	698	307:391	-0.86%	0.0652	-1.17%	0.0195
Market Model (using country specific indices)																		
(0,+1)	347	173:174	-1.26%	<.0001	-0.03%	0.2826	764	430:334	2.18%	<.0001	0.45%	<.0001	698	458:240	4.87%	<.0001	1.08%	<.0001
(-2,+2)	347	162:185	-2.99%	<.0001	-0.56%	0.0061	764	442:322	2.42%	<.0001	0.85%	<.0001	698	444:254	6.44%	<.0001	2.29%	<.0001
(-5,+5)	347	159:188	-3.47%	<.0001	-0.89%	0.0039	764	421:343	2.60%	<.0001	0.87%	<.0001	698	445:253	6.66%	<.0001	2.94%	<.0001
(-10,+10)	347	153:194	-3.77%	<.0001	-1.65%	0.0047	764	408:356	1.82%	0.78	0.77%	0.0179	698	437:261	7.80%	<.0001	3.79%	<.0001
(-30,-10)	347	147:200	-3.26%	0.019	-2.16%	0.0025	764	398:366	1.12%	<.0001	0.40%	0.1498	698	381:317	3.73%	0.7064	1.31%	<.0001
(+10,+30)	347	157:190	-2.63%	<.0001	-2.11%	0.0167	764	349:415	-0.55%	<.0001	-0.63%	0.0526	698	334:364	-0.02%	0.2312	-0.35%	0.6395

Table 6: Event Study Results for Different Levels of Government Expropriation

This table presents target reaction to the news of increased government ownership. The results are broken down by the level of expropriation risk and left- or right-wing nature of the acquirer parent nation government. Market adjusted returns are calculated as the difference between the firm's total return index and the corresponding local total return index, as defined by Datastream. Market Model parameters are estimated over days (-230,-30), where day 0 is the day of the announcement. Firms with a minimum of 100 daily returns are included in the study. Mean and median returns, as well as the p-values of the associated significance tests are presented. P-values at and below the 10% significance level are grayed out.

		Expropriation Risk High						Expropriation Risk Low				
Event Window	N	Positive: Negative	Mean CAR	Patell Z p-value	Median CAR	Signed Rank p-value	N	Positive: Negative	Mean CAR	Patell Z p-value	Median CAR	Signed Rank p-value
Market Adjusted (using country specific indices)												
(0,+1)	915	491:419	1.59%	<.0001	0.18%	0.0004	891	531:358	3.35%	<.0001	0.93%	<.0001
(-2,+2)	915	477:437	1.00%	<.0001	0.22%	0.0164	891	542:349	4.63%	<.0001	1.74%	<.0001
(-5,+5)	915	468:447	0.33%	0.1428	0.16%	0.3449	891	535:356	4.52%	<.0001	2.02%	<.0001
(-10,+10)	915	431:484	-0.65%	0.5106	-0.73%	0.2387	891	503:388	4.21%	<.0001	2.09%	<.0001
(-30,-10)	915	449:466	-0.32%	0.2523	-0.28%	0.2441	891	460:431	0.93%	0.4325	0.28%	0.1179
(+10,+30)	915	378:537	-2.26%	<.0001	-1.73%	<.0001	891	407:484	-0.85%	0.0484	-0.87%	0.0179
Market Model (using country specific indices)												
(0,+1)	915	516:399	1.66%	<.0001	0.31%	<.0001	891	543:348	3.42%	<.0001	0.83%	<.0001
(-2,+2)	915	485:430	1.16%	<.0001	0.42%	0.005	891	561:330	4.71%	<.0001	1.80%	<.0001
(-5,+5)	915	477:438	1.05%	0.524	0.42%	0.0294	891	546:345	4.79%	<.0001	1.81%	<.0001
(-10,+10)	915	461:454	1.06%	0.5883	0.10%	0.2358	891	534:357	4.89%	<.0001	2.63%	<.0001
(-30,-10)	915	470:445	0.94%	0.0005	0.31%	0.2591	891	454:437	1.63%	<.0001	0.22%	0.0244
(+10,+30)	915	410:505	-1.44%	<.0001	-1.01%	0.0019	891	429:462	0.05%	<.0001	-0.41%	0.6034

Table 6 (Continued): Event Study Results for Different Levels of Government Expropriation

	Left-Winged Government						Right-Winged (or other) Government					
Market Adjusted (using country specific indices)												
(0,+1)	892	515:374	3.01%	<.0001	0.53%	<.0001	916	508:404	1.96%	<.0001	0.42%	<.0001
(-2,+2)	892	520:372	3.75%	<.0001	1.15%	<.0001	916	500:415	1.90%	<.0001	0.70%	<.0001
(-5,+5)	892	524:368	4.21%	<.0001	1.65%	<.0001	916	481:435	0.85%	0.001	0.47%	0.0245
(-10,+10)	892	489:403	3.97%	<.0001	1.18%	<.0001	916	447:469	-0.22%	0.4304	-0.31%	0.9375
(-30,-10)	892	477:415	1.69%	<.0001	0.65%	0.0049	916	433:483	-1.05%	0.0348	-0.75%	0.0144
(+10,+30)	892	400:492	-0.95%	0.0342	-1.07%	0.0177	916	385:531	-2.24%	<.0001	-1.53%	<.0001
Market Model (using country specific indices)												
(0,+1)	892	532:360	3.05%	<.0001	0.53%	<.0001	916	528:388	2.07%	<.0001	0.55%	<.0001
(-2,+2)	892	520:372	3.88%	<.0001	1.15%	<.0001	916	527:389	2.02%	<.0001	0.90%	<.0001
(-5,+5)	892	524:368	4.67%	<.0001	1.68%	<.0001	916	501:415	1.38%	<.0001	0.74%	0.0009
(-10,+10)	892	519:373	5.08%	0.0103	1.82%	<.0001	916	478:438	1.08%	0.0092	0.59%	0.0346
(-30,-10)	892	480:412	2.64%	0.1112	0.92%	<.0001	916	446:470	-0.03%	<.0001	-0.30%	0.4842
(+10,+30)	892	428:464	-0.16%	0.0062	-0.36%	0.4292	916	411:505	-1.32%	0.0001	-1.00%	0.0031

Table 7: Event Study Results for Different Government Ownership Stakes

Target stock price changes at the announcement of majority and minority government investment. Market adjusted returns are calculated as the difference between the firm's total return index and the corresponding local total return index, as defined by Datastream. Market Model parameters are estimated over days (-230,-30), where day 0 is the day of the announcement. Firms with a minimum of 100 daily returns are included in the study. Mean and median returns, as well as the p-values of the associated significance tests are presented. P-values at and below the 10% significance level are grayed out.

		Government Ownership 50% or above						Government Ownership below 10%				
Event Window	N	Positive: Negative	Mean CAR	Patell Z p-value	Median CAR	Signed Rank p-value	N	Positive: Negative	Mean CAR	Patell Z p-value	Median CAR	Signed Rank p-value
Market Adjusted (using country specific indices)												
(0,+1)	408	256:149	5.11%	<.0001	1.29%	<.0001	515	270:245	0.41%	0.021	0.16%	0.1608
(-2,+2)	408	264:143	5.87%	<.0001	2.84%	<.0001	515	268:247	-0.02%	0.2627	0.39%	0.3502
(-5,+5)	408	267:141	7.26%	<.0001	3.60%	<.0001	515	237:278	-1.41%	0.0034	-0.94%	0.0606
(-10,+10)	408	263:145	8.14%	<.0001	5.50%	<.0001	515	224:291	-2.94%	<.0001	-1.65%	0.0007
(-30,-10)	408	220:188	0.69%	0.0496	0.68%	0.1153	515	224:291	-1.59%	0.0408	-1.59%	0.0021
(+10,+30)	408	192:216	0.15%	0.4339	-0.64%	0.7452	515	198:317	-3.10%	<.0001	-2.13%	<.0001
Market Model (using country specific indices)												
(0,+1)	408	261:147	5.29%	<.0001	1.07%	<.0001	515	278:237	0.41%	<.0001	0.23%	0.0731
(-2,+2)	408	273:135	6.27%	<.0001	2.70%	<.0001	515	268:247	-0.16%	<.0001	0.25%	0.7315
(-5,+5)	408	272:136	7.77%	<.0001	4.04%	<.0001	515	237:278	-1.29%	0.159	-0.60%	0.074
(-10,+10)	408	283:125	9.14%	<.0001	5.59%	<.0001	515	238:277	-2.20%	<.0001	-1.24%	0.0107
(-30,-10)	408	224:184	1.80%	<.0001	0.97%	0.0088	515	228:287	-0.85%	<.0001	-1.25%	0.0762
(+10,+30)	408	215:193	1.28%	0.0144	0.45%	0.1942	515	200:315	-3.33%	<.0001	-2.59%	<.0001

Table 8: Event Study Results During Banking and Financial Crises

Target stock price changes at the announcement of increased government ownership during and outside of banking crises and the 2008-2010 financial crisis. Banking crises, as defined by Laeven and Valencia (2010), cover country specific years when those nations are under a banking crisis. The 2008-2010 Financial Crisis covers deals announced between 2008-2010, while the sample outside of this crisis covers the 1988-2007 period. Market adjusted returns are calculated as the difference between the firm's total return index and the corresponding local total return index, as defined by Datastream. Market Model parameters are estimated over days (-230,-30), where day 0 is the day of the announcement. Firms with a minimum of 100 daily returns are included in the study. Mean and median returns, as well as the p-values of the associated significance tests are presented. P-values at and below the 10% significance level are grayed out.

		Banking Crises						Outside of Banking Crises				
Event Window	N	Positive: Negative	Mean CAR	Patell Z p-value	Median CAR	Signed Rank p-value	N	Positive: Negative	Mean CAR	Patell Z p-value	Median CAR	Signed Rank p-value
Market Adjusted (using country specific indices)												
(0,+1)	410	209:200	-0.03%	0.9712	0.07%	0.3351	1399	815:578	3.22%	<.0001	0.54%	<.0001
(-2,+2)	410	208:202	-1.76%	<.0001	0.17%	0.7218	1399	813:585	4.15%	<.0001	1.15%	<.0001
(-5,+5)	410	198:212	-3.18%	<.0001	-0.47%	0.1835	1399	807:592	4.16%	<.0001	1.34%	<.0001
(-10,+10)	410	181:229	-4.82%	<.0001	-2.49%	0.0019	1399	756:643	3.80%	<.0001	0.96%	<.0001
(-30,-10)	410	167:243	-4.30%	<.0001	-3.61%	<.0001	1399	743:656	1.65%	<.0001	0.51%	0.0011
(+10,+30)	410	163:247	-5.11%	<.0001	-2.88%	<.0001	1399	623:776	-0.57%	0.0454	-1.02%	0.0017
Market Model (using country specific indices)												
(0,+1)	410	226:184	0.03%	0.6481	0.26%	0.2938	1399	835:564	3.30%	<.0001	0.62%	<.0001
(-2,+2)	410	214:196	-1.65%	<.0001	0.37%	0.5679	1399	834:565	4.28%	<.0001	1.19%	<.0001
(-5,+5)	410	209:201	-2.03%	<.0001	0.22%	0.6653	1399	816:583	4.47%	<.0001	1.42%	<.0001
(-10,+10)	410	200:210	-1.74%	<.0001	-0.69%	0.5907	1399	798:601	4.46%	<.0001	1.55%	<.0001
(-30,-10)	410	182:228	-1.50%	0.0013	-1.67%	0.0615	1399	744:655	2.10%	<.0001	0.81%	0.0001
(+10,+30)	410	173:237	-3.40%	<.0001	-2.76%	0.0013	1399	667:732	0.03%	<.0001	-0.41%	0.272

Table 8 (Continued): Event Study Results During Banking and Financial Crises

	2008-2010 Financial Crisis					Excluding the 2008-2010 Financial Crisis (1988-2007)					
Market Adjusted (using country specific indices)											
(0,+1)	569	309:259	1.72%	<.0001	0.51%	0.0001	1213	696:511	2.76%	<.0001	0.43%	<.0001
(-2,+2)	569	317:252	1.37%	0.0002	1.04%	0.0018	1213	688:524	3.48%	<.0001	0.84%	<.0001
(-5,+5)	569	305:264	0.63%	0.8322	1.13%	0.0477	1213	687:526	3.31%	<.0001	0.99%	<.0001
(-10,+10)	569	278:291	-0.16%	0.4878	-0.58%	0.9676	1213	644:569	2.73%	<.0001	0.71%	<.0001
(-30,-10)	569	264:305	-1.90%	0.0004	-0.96%	0.0165	1213	631:582	1.27%	<.0001	0.36%	0.0471
(+10,+30)	569	245:324	-3.75%	<.0001	-2.38%	<.0001	1213	531:682	-0.52%	0.0142	-1.06%	0.001
Market Model (using country specific indices)												
(0,+1)	569	324:245	1.78%	<.0001	0.53%	0.0001	1213	719:494	2.84%	<.0001	0.53%	<.0001
(-2,+2)	569	319:250	1.48%	<.0001	0.93%	0.0031	1213	711:502	3.61%	<.0001	0.99%	<.0001
(-5,+5)	569	319:250	1.50%	0.7338	1.40%	0.004	1213	691:522	3.63%	<.0001	1.10%	<.0001
(-10,+10)	569	302:267	2.25%	<.0001	1.32%	0.0154	1213	681:532	3.39%	<.0001	1.26%	<.0001
(-30,-10)	569	274:295	0.12%	<.0001	-0.38%	0.9561	1213	638:575	1.78%	0.441	0.66%	0.0035
(+10,+30)	569	255:314	-2.31%	0.9589	-1.61%	0.0284	1213	577:636	0.10%	0.481	-0.49%	0.1701

Table 9: Target Stock Price Reaction to Government Investment Announcements

The dependent variable is the market adjusted cumulative abnormal 5 day (-2, +2) return, as in Table 4. Variables are defined in Table 1. Model 1 includes all deals; Model 2 foreign and Model 3 domestic deals. The regression parameters are estimated via OLS (Ordinary Least Squares) with the Newey-West adjustment. Year, SIC, target nation, and acquirer nation fixed effects (FE) are included where indicated. Coefficients significant at and below the 10% level are in boldface and t-statistics are listed underneath in parentheses.

	(1) All	(2) Foreign	(3) Domestic
Foreign Deal	**0.0309**		
	(2.50)		
Gov. Shares Acquired (%)	**0.0012**	**0.0021**	**0.0006**
	(5.63)	*(5.20)*	*(2.69)*
Gov. Prior Ownership (%)	**0.0008**	0.0002	**0.0008**
	(3.33)	*(0.46)*	*(2.72)*
Gov.-to-Gov. Deal	**0.0215**	0.0567	**0.0253**
	(1.68)	*(1.44)*	*(1.86)*
Withdrawn Deal	-0.0396	0.0029	**-0.0448**
	(-1.53)	*(0.07)*	*(-1.89)*
Last Year Performance	0.0014	-0.0095	0.0059
	(0.19)	*(-0.61)*	*(0.72)*
Cash Deal	0.0089	0.0005	0.0150
	(1.09)	*(0.02)*	*(1.51)*
Stock Deal	**-0.0378**	**-0.0936**	-0.0196
	(-1.67)	*(-1.85)*	*(-0.96)*
Bank Crises Dummy	-0.0151	-0.0054	-0.0134
	(-0.98)	*(-0.21)*	*(-0.60)*
Size	**-0.0061**	-0.0051	**-0.0067**
	(-2.71)	*(-1.09)*	*(-2.47)*
Leverage	0.0000	0.0000	0.0000
	(-0.69)	*(-0.55)*	*(-0.15)*
ROA	-0.0001	-0.0004	-0.0001
	(-0.38)	*(-0.59)*	*(-0.28)*
Tobin's Q	**-0.0058**	-0.0022	**-0.0058**
	(-1.81)	*(-0.37)*	*(-1.70)*
Intercept	0.0465	0.1819	0.0048
	(0.84)	*(1.38)*	*(0.09)*
Year FE	Yes	Yes	Yes
SIC FE	Yes	Yes	Yes
Target Nation FE	Yes	Yes	Yes
Acquirer P. Nation FE	Yes	Yes	
Observations	1160	412	748
R-squared	0.229	0.360	0.184
Adjusted R-squared	0.152	0.155	0.097

Table 10: Target Stock Price Reaction to Investment by Different Types of Government Investor

The dependent variable is the market adjusted cumulative abnormal 5 day (-2, +2) return, as in Table 4. Variables are defined in Table 1. Model 1 includes all deals, Model 2 shows foreign and Model 3 domestic deals. Model 4 includes investments by political, Model 5 by economic, and Model 6 financial arms of government. The regression parameters are estimated via OLS (Ordinary Least Squares) with the Newey-West adjustment. Year, SIC, target nation, and acquirer nation fixed effects (FE) are included where indicated. Coefficients significant at and below the 10% level are in boldface and t-statistics are listed underneath in parentheses.

	(1) All	(2) Foreign	(3) Domestic	(4) Political	(5) Financial	(6) Economic
Political Gov. Investor	**-0.0302**	-0.0134	**-0.0364**			
	(-2.23)	*(-0.29)*	*(-2.45)*			
Financial Gov. Investor	-0.0025	-0.0001	-0.0052			
	(-0.23)	*(-0.00)*	*(-0.44)*			
Foreign Deal	**0.0232**			0.0681	-0.0019	0.0176
	(1.82)			*(1.35)*	*(-0.13)*	*(0.90)*
Gov. Shares Acquired (%)	**0.0012**	**0.0021**	**0.0006**	**-0.0014**	**0.0014**	**0.0010**
	(5.40)	*(5.07)*	*(2.45)*	*(-2.34)*	*(3.64)*	*(3.70)*
Gov. Prior Ownership (%)	**0.0008**	0.0002	**0.0008**	0.0009	**0.0008**	**0.0006**
	(3.24)	*(0.45)*	*(2.66)*	*(1.10)*	*(2.09)*	*(1.64)*
Gov.-to-Gov. Deal	**0.0223**	0.0576	**0.0263**	**0.0879**	-0.0009	0.0041
	(1.75)	*(1.45)*	*(1.94)*	*(2.78)*	*(-0.04)*	*(0.21)*
Withdrawn Deal	-0.0404	0.0012	**-0.0448**	**0.1148**	0.0659	**-0.0697**
	(-1.56)	*(0.03)*	*(-1.86)*	*(2.20)*	*(1.19)*	*(-2.58)*
Last Year Performance	0.0013	-0.0096	0.0057	0.0015	-0.0007	0.0047
	(0.18)	*(-0.62)*	*(0.72)*	*(0.10)*	*(-0.07)*	*(0.41)*
Cash Deal	0.0083	0.0008	0.0129	0.0198	0.0015	0.0031
	(1.02)	*(0.04)*	*(1.30)*	*(1.18)*	*(0.09)*	*(0.20)*
Stock Deal	**-0.0416**	**-0.0954**	-0.0263		**-0.0892**	**-0.0555**
	(-1.84)	*(-1.90)*	*(-1.25)*		*(-1.67)*	*(-1.92)*
Bank Crises Dummy	-0.0144	-0.0054	-0.0146	0.0039	-0.0132	-0.0301
	(-0.94)	*(-0.21)*	*(-0.66)*	*(0.11)*	*(-0.59)*	*(-1.13)*
Size	**-0.0055**	-0.0050	**-0.0057**	**-0.0072**	-0.0020	**-0.0075**
	(-2.46)	*(-1.07)*	*(-2.14)*	*(-1.77)*	*(-0.62)*	*(-1.99)*
Leverage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(-0.65)	*(-0.52)*	*(-0.11)*	*(0.58)*	*(-0.63)*	*(-0.40)*
ROA	-0.0001	-0.0004	-0.0001	-0.0007	-0.0001	0.0000
	(-0.32)	*(-0.59)*	*(-0.24)*	*(-0.43)*	*(-0.19)*	*(-0.00)*

Table 10 (Continued): Target Stock Price Reaction to Investment by Different Types of Government Investor

	(1) All	(2) Foreign	(3) Domestic	(4) Political	(5) Financial	(6) Economic
Tobin's Q	**-0.0054**	-0.0021	-0.0052	0.0138	-0.0011	**-0.0132**
	(-1.66)	*(-0.34)*	*(-1.50)*	*(1.20)*	*(-0.30)*	*(-2.97)*
Intercept	0.0504	0.1780	0.0095	0.0536	0.0065	0.1503
	(0.93)	*(1.35)*	*(0.19)*	*(0.69)*	*(0.10)*	*(1.57)*
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
SIC FE	Yes	Yes	Yes	Yes	Yes	Yes
Target Nation FE	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer P. Nation FE	Yes	Yes		Yes	Yes	Yes
Observations	1160	412	748	252	455	453
R-squared	0.232	0.361	0.191	0.167	0.233	0.278
Adjusted R-squared	0.154	0.149	0.102	0.032	0.107	0.163

Table 11: Target Stock Price Reaction to Investment by Different Types of Government Investor

The dependent variable is the market adjusted cumulative abnormal 5 day (-2, +2) return, as in Table 4. Variables are defined in Table 1. Model 1 (a,b) includes all deals, Model 2 (a,b) shows foreign and Model 3 (a,b) domestic deals. The regression parameters are estimated via OLS (Ordinary Least Squares) with the Newey-West adjustment. Year, SIC, target nation, and acquirer nation fixed effects (FE) are included where indicated. Coefficients significant at and below the 10% level are in boldface and t-statistics are listed underneath in parentheses.

	(1a) All	(1b) All	(2a) Foreign	(2b) Foreign	(3a) Domestic	(3b) Domestic
Political_Gov_Local	-0.0301	-0.0254	-0.0217	-0.0076	**-0.0422**	**-0.0404**
	(-1.60)	*(-1.28)*	*(-0.47)*	*(-0.14)*	*(-2.08)*	*(-1.89)*
Political_Gov_National	**-0.0346**	**-0.0302**	0.0296	0.0303	**-0.0454**	**-0.0427**
	(-1.88)	*(-1.68)*	*(0.55)*	*(0.59)*	*(-2.70)*	*(-2.59)*
Political_Pension_Fund	**-0.0457**	**-0.0349**	-0.0035	0.0088	**-0.0358**	-0.0330
	(-2.26)	*(-1.81)*	*(-0.04)*	*(0.11)*	*(-1.64)*	*(-1.56)*
Finanacial_SWF	-0.0216		0.0165		0.0021	
	(-1.02)		*(0.56)*		*(0.06)*	
Financial_Restate	-0.0010		0.0177		-0.0255	
	(-0.02)		*(0.27)*		*(-1.12)*	
Financial_Bank	-0.0034		0.0014		-0.0090	
	(-0.20)		*(0.04)*		*(-0.40)*	
Financial_Develop_Bank	0.0077		-0.0684		0.0163	
	(0.28)		*(-1.04)*		*(0.58)*	
Financial_Other	-0.0053		-0.0183		-0.0020	
	(-0.44)		*(-0.67)*		*(-0.14)*	
Financial_Supranational	0.0229		-0.0123			
	(0.43)		*(-0.21)*			
SOE_Energy		-0.0102		-0.0366		0.0079
		(-0.73)		*(-1.30)*		*(0.52)*
SOE_Consumer		0.0151		0.0460		0.0068
		(0.62)		*(0.70)*		*(0.29)*
SOE_Industrial		0.0147		0.0628		-0.0182
		(0.91)		*(1.61)*		*(-0.97)*
SOE_Materials		-0.0052		-0.0077		0.0020
		(-0.23)		*(-0.20)*		*(0.08)*
SOE_Media		-0.0116		-0.0099		-0.0119
		(-0.50)		*(-0.25)*		*(-0.42)*
SOE_Telecomtech		0.0322		0.0343		0.0293
		(1.51)		*(0.82)*		*(1.58)*

Table 11 (Continued): Target Stock Price Reaction to Investment by Different Types of Government Investor

	(1a) All	(1b) All	(2a) Foreign	(2b) Foreign	(3a) Domestic	(3b) Domestic
Foreign Deal	**0.0222**	**0.0223**				
	(1.78)	*(1.87)*				
Gov. Shares Acquired (%)	**0.0011**	**0.0011**	**0.0020**	**0.0019**	**0.0006**	**0.0006**
	(5.20)	*(5.16)*	*(4.68)*	*(4.63)*	*(2.64)*	*(2.49)*
Gov. Prior Ownership (%)	**0.0007**	**0.0007**	0.0002	0.0001	**0.0008**	**0.0008**
	(2.91)	*(2.81)*	*(0.49)*	*(0.31)*	*(2.79)*	*(2.81)*
Gov.-to-Gov. Deal	**0.0258**	**0.0249**	0.0451	0.0324	**0.0276**	**0.0298**
	(2.00)	*(1.94)*	*(1.41)*	*(1.13)*	*(2.08)*	*(2.26)*
Withdrawn Deal	-0.0399	-0.0399	-0.0608	-0.0701	-0.0315	-0.0265
	(-1.56)	*(-1.51)*	*(-0.87)*	*(-1.03)*	*(-1.07)*	*(-0.88)*
Last Year Performance	0.0014	0.0009	-0.0102	-0.0080	0.0069	0.0064
	(0.20)	*(0.12)*	*(-0.80)*	*(-0.67)*	*(0.92)*	*(0.84)*
Cash Deal	0.0077	0.0077	0.0021	0.0012	0.0114	0.0131
	(0.95)	*(0.94)*	*(0.12)*	*(0.07)*	*(1.19)*	*(1.35)*
Stock Deal	**-0.0467**	**-0.0532**	**-0.0967**	**-0.1235**	**-0.0365**	**-0.0394**
	(-2.05)	*(-2.30)*	*(-2.05)*	*(-2.93)*	*(-1.97)*	*(-2.00)*
Bank Crises Dummy	-0.0181	-0.0181	0.0027	0.0009	-0.0250	-0.0271
	(-1.19)	*(-1.21)*	*(0.12)*	*(0.04)*	*(-1.36)*	*(-1.52)*
Size	**-0.0058**	**-0.0061**	-0.0043	-0.0022	**-0.0062**	**-0.0065**
	(-2.50)	*(-2.64)*	*(-1.14)*	*(-0.61)*	*(-2.29)*	*(-2.41)*
Leverage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(-0.44)	*(-0.55)*	*(-1.05)*	*(-1.24)*	*(-0.19)*	*(-0.05)*
ROA	-0.0001	-0.0001	-0.0005	-0.0005	0.0000	0.0000
	(-0.28)	*(-0.36)*	*(-0.83)*	*(-0.93)*	*(-0.05)*	*(-0.09)*
Tobin's Q	**-0.0055**	**-0.0058**	-0.0020	-0.0025	**-0.0057**	**-0.0068**
	(-1.71)	*(-1.67)*	*(-0.37)*	*(-0.46)*	*(-1.64)*	*(-1.91)*
Intercept	0.0564	0.0564	0.1515	0.0959	0.0257	0.0211
	(1.06)	*(1.07)*	*(1.63)*	*(1.00)*	*(0.56)*	*(0.46)*
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
SIC FE	Yes	Yes	Yes	Yes	Yes	Yes
Target Nation FE	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer P. Nation FE	Yes	Yes	Yes	Yes		
Observations	1160	1160	412	412	748	748
R-squared	0.221	0.225	0.292	0.311	0.170	0.173
Adjusted R-squared	0.145	0.149	0.154	0.177	0.093	0.096

Table 12: Target Stock Price Reaction to Investment by Governments with the High Risk of Expropriation

The dependent variable is the market adjusted cumulative abnormal 5 day (-2, +2) return, as in Table 4. Variables are defined in Table 1. Model 1 includes all deals, Model 2 shows foreign and Model 3 domestic deals. Model 4 includes investments by political, Model 5 by economic, and Model 6 financial arms of government. The regression parameters are estimated via OLS (Ordinary Least Squares) with the Newey-West adjustment. Year, SIC, target nation, and acquirer nation fixed effects (FE) are included where indicated. Coefficients significant at and below the 10% level are in boldface and t-statistics are listed underneath in parentheses.

	(1) All	(2) Foreign	(3) Domestic	(4) Political	(5) Financial	(6) Economic
Gov. Expropriation	**-0.0054**	-0.0079	**-0.0066**	**0.0085**	-0.0038	**-0.0082**
	(-1.98)	*(-1.22)*	*(-2.23)*	*(1.68)*	*(-0.95)*	*(-1.65)*
Political Gov. Investor	**-0.0285**	-0.0182	**-0.0395**			
	(-2.10)	*(-0.39)*	*(-2.78)*			
Financial Gov. Investor	-0.0017	0.0033	-0.0022			
	(-0.15)	*(0.11)*	*(-0.19)*			
Foreign Deal	**0.0218**			0.0748	-0.0055	0.0125
	(1.71)			*(1.56)*	*(-0.40)*	*(0.60)*
Gov. Shares Acquired (%)	**0.0012**	**0.0021**	**0.0006**	**-0.0013**	**0.0014**	**0.0010**
	(5.38)	*(5.08)*	*(2.56)*	*(-2.21)*	*(3.67)*	*(3.60)*
Gov. Prior Ownership (%)	**0.0008**	0.0002	**0.0008**	0.0011	**0.0008**	**0.0006**
	(3.22)	*(0.46)*	*(2.77)*	*(1.30)*	*(2.10)*	*(1.68)*
Gov.-to-Gov. Deal	**0.0234**	0.0526	**0.0291**	**0.0858**	-0.0001	0.0079
	(1.84)	*(1.31)*	*(2.21)*	*(2.67)*	*(-0.00)*	*(0.39)*
Withdrawn Deal	-0.0386	0.0025	**-0.0333**	**0.0995**	0.0667	**-0.0684**
	(-1.52)	*(0.06)*	*(-1.16)*	*(1.87)*	*(1.20)*	*(-2.53)*
Last Year Performance	0.0009	-0.0092	0.0059	0.0013	-0.0010	0.0031
	(0.12)	*(-0.59)*	*(0.76)*	*(0.09)*	*(-0.11)*	*(0.26)*
Cash Deal	0.0088	0.0001	0.0125	0.0208	0.0023	0.0013
	(1.09)	*(0.00)*	*(1.32)*	*(1.24)*	*(0.15)*	*(0.08)*
Stock Deal	**-0.0430**	**-0.1056**	**-0.0398**		**-0.0899**	**-0.0640**
	(-1.89)	*(-1.99)*	*(-2.03)*		*(-1.66)*	*(-2.11)*
Bank Crises Dummy	-0.0101	0.0025	-0.0217	0.0083	-0.0111	-0.0255
	(-0.66)	*(0.09)*	*(-1.16)*	*(0.24)*	*(-0.49)*	*(-0.96)*
Size	**-0.0054**	-0.0049	**-0.0067**	**-0.0062**	-0.0022	**-0.0073**
	(-2.47)	*(-1.07)*	*(-2.58)*	*(-1.49)*	*(-0.67)*	*(-1.92)*
Leverage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(-0.76)	*(-0.55)*	*(-0.31)*	*(0.23)*	*(-0.70)*	*(-0.47)*

Table 12 (Continued): Target Stock Price Reaction to Investment by Governments with High Risk of Expropriation

	(1) All	(2) Foreign	(3) Domestic	(4) Political	(5) Financial	(6) Economic
ROA	-0.0002	-0.0004	-0.0001	-0.0009	-0.0001	-0.0001
	(-0.47)	*(-0.61)*	*(-0.18)*	*(-0.55)*	*(-0.28)*	*(-0.15)*
Tobin's Q	-0.0051	-0.0022	-0.0054	0.0178	-0.0007	**-0.0133**
	(-1.56)	*(-0.37)*	*(-1.56)*	*(1.53)*	*(-0.19)*	*(-3.03)*
Intercept	0.0664	0.1867	0.0572	0.0078	0.0205	**0.1754**
	(1.20)	*(1.41)*	*(1.27)*	*(0.09)*	*(0.33)*	*(1.83)*
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
SIC FE	Yes	Yes	Yes	Yes	Yes	Yes
Target Nation FE	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer P. Nation FE	Yes	Yes		Yes	Yes	Yes
Observations	1159	411	748	252	455	452
R-squared	0.234	0.363	0.174	0.173	0.234	0.283
Adjusted R-squared	0.156	0.149	0.103	0.035	0.106	0.167

Table 13: Target Stock Price Reaction to Investment by Left-Wing Governments

The dependent variable is the market adjusted cumulative abnormal 5 day (-2, +2) return, as in Table 4. Variables are defined in Table 1. Model 1 includes all deals, Model 2 shows foreign and Model 3 domestic deals. Model 4 includes investments by political, Model 5 by economic, and Model 6 financial arms of government. The regression parameters are estimated via OLS (Ordinary Least Squares) with the Newey-West adjustment. Year, SIC, target nation, and acquirer nation fixed effects (FE) are included where indicated. Coefficients significant at and below the 10% level are in boldface and t-statistics are listed underneath in parentheses.

	(1) All	(2) Foreign	(3) Domestic	(4) Political	(5) Financial	(6) Economic
Left-wing Gov.	**-0.0214**	-0.0391	**-0.0250**	**-0.0631**	0.0097	-0.0276
	(-1.77)	*(-1.61)*	*(-2.11)*	*(-2.63)*	*(0.62)*	*(-1.30)*
Political Gov. Investor	**-0.0316**	-0.0156	**-0.0393**			
	(-2.35)	*(-0.34)*	*(-3.02)*			
Financial Gov. Investor	-0.0032	0.0002	-0.0033			
	(-0.29)	*(0.00)*	*(-0.28)*			
Foreign Deal	**0.0231**			0.0593	-0.0008	0.0154
	(1.81)			*(1.19)*	*(-0.05)*	*(0.78)*
Gov. Shares Acquired (%)	**0.0012**	**0.0021**	**0.0006**	**-0.0013**	**0.0014**	**0.0010**
	(5.42)	*(5.05)*	*(2.52)*	*(-2.28)*	*(3.66)*	*(3.68)*
Gov. Prior Ownership (%)	**0.0008**	0.0002	**0.0008**	0.0007	**0.0007**	0.0005
	(3.24)	*(0.44)*	*(2.81)*	*(0.85)*	*(2.07)*	*(1.60)*
Gov.-to-Gov. Deal	**0.0212**	0.0559	**0.0242**	**0.0845**	-0.0001	0.0021
	(1.66)	*(1.39)*	*(1.82)*	*(2.97)*	*(-0.00)*	*(0.10)*
Withdrawn Deal	-0.0400	-0.0020	-0.0308	**0.1233**	0.0645	**-0.0683**
	(-1.54)	*(-0.04)*	*(-1.05)*	*(2.49)*	*(1.16)*	*(-2.57)*
Last Year Performance	0.0012	-0.0084	0.0054	-0.0060	-0.0006	0.0034
	(0.16)	*(-0.54)*	*(0.69)*	*(-0.43)*	*(-0.06)*	*(0.29)*
Cash Deal	0.0082	0.0002	0.0116	0.0147	0.0013	0.0044
	(1.01)	*(0.00)*	*(1.23)*	*(0.88)*	*(0.08)*	*(0.29)*
Stock Deal	**-0.0437**	**-0.0965**	**-0.0418**		-0.0862	**-0.0555**
	(-1.99)	*(-1.98)*	*(-2.20)*		*(-1.59)*	*(-2.02)*
Bank Crises Dummy	-0.0176	-0.0081	**-0.0286**	-0.0056	-0.0117	-0.0293
	(-1.14)	*(-0.30)*	*(-1.75)*	*(-0.16)*	*(-0.53)*	*(-1.11)*
Size	**-0.0054**	-0.0047	**-0.0065**	**-0.0069**	-0.0020	**-0.0079**
	(-2.43)	*(-1.00)*	*(-2.51)*	*(-1.69)*	*(-0.60)*	*(-2.08)*
Leverage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(-0.62)	*(-0.52)*	*(-0.24)*	*(0.43)*	*(-0.64)*	*(-0.32)*

Table 13 (Continued): Target Stock Price Reaction to Investment by Left-Wing Governments

	(1) All	(2) Foreign	(3) Domestic	(4) Political	(5) Financial	(6) Economic
ROA	-0.0001	-0.0003	0.0001	-0.0005	-0.0001	0.0000
	(-0.19)	*(-0.49)*	*(0.16)*	*(-0.36)*	*(-0.25)*	*(0.06)*
Tobin's Q	-0.0052	-0.0024	**-0.0058**	0.0164	-0.0011	**-0.0136**
	(-1.61)	*(-0.40)*	*(-1.72)*	*(1.46)*	*(-0.29)*	*(-3.03)*
Intercept	0.0551	0.1926	0.0445	0.0815	0.0008	**0.1679**
	(1.02)	*(1.48)*	*(0.99)*	*(1.10)*	*(0.01)*	*(1.76)*
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
SIC FE	Yes	Yes	Yes	Yes	Yes	Yes
Target Nation FE	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer P. Nation FE	Yes	Yes		Yes	Yes	Yes
Observations	1159	411	748	252	455	452
R-squared	0.234	0.364	0.172	0.189	0.233	0.280
Adjusted R-squared	0.155	0.151	0.101	0.053	0.105	0.164

Table 14: Target Stock Price Reaction to Majority and Minority Government Stake Investment
The dependent variable is the market adjusted cumulative abnormal 5 day (-2, +2) return, as in Table 4. Variables are defined in Table 1. Model 1 includes all deals. Model 2 shows deals with majority stake purchases of above 50%; Model 3 with stake acquisitions of below 50% and above 10%; Model 4 with minority stake investments of below 10%. The regression parameters are estimated via OLS (Ordinary Least Squares) with the Newey-West adjustment. Year, SIC, target nation, and acquirer nation fixed effects (FE) are included where indicated. Coefficients significant at and below the 10% level are in boldface and t-statistics are listed underneath in parentheses.

	(1) All	(2) Maj. Own (>=50%)	(3) 50% > Maj. Own >= 10%	(4) Min. Own. (<10%)
Majority Ownership (>50%)	**0.0727**			
	(5.47)			
Majority Ownership (50%-10%)	**0.0220**			
	(2.71)			
Political	**-0.0404**	-0.0382	**-0.0591**	-0.0166
	(-2.82)	*(-0.74)*	*(-3.11)*	*(-0.74)*
Financial	-0.0094	0.0162	-0.0200	-0.0135
	(-0.82)	*(0.48)*	*(-1.11)*	*(-0.76)*
*Political * Foreign*	0.0076	0.2239	0.0622	**0.0694**
	(0.19)	*(1.53)*	*(0.90)*	*(2.11)*
*Financial * Foreign*	-0.0004	0.0350	-0.0386	**0.0606**
	(-0.01)	*(0.48)*	*(-1.23)*	*(2.44)*
Foreign Deal	0.0255	-0.0272	**0.0505**	**-0.0337**
	(1.43)	*(-0.65)*	*(1.77)*	*(-1.64)*
Gov.-to-Gov. Deal	**0.0250**	**0.0536**	0.0153	0.0005
	(1.83)	*(2.17)*	*(0.70)*	*(0.02)*
Withdrawn Deal	0.0106	**-0.0682**	**0.0720**	-0.0668
	(0.42)	*(-1.83)*	*(1.91)*	*(-1.32)*
Last Year Performance	0.0010	0.0303	-0.0073	0.0000
	(0.14)	*(1.30)*	*(-0.78)*	*(-0.00)*
Cash Deal	0.0112	0.0085	0.0078	0.0054
	(1.34)	*(0.32)*	*(0.55)*	*(0.46)*
Stock Deal	-0.0366	-0.0498	-0.0350	
	(-1.54)	*(-1.28)*	*(-0.95)*	
Bank Crises Dummy	-0.0193	**-0.0973**	-0.0112	0.0101
	(-1.26)	*(-2.01)*	*(-0.50)*	*(0.65)*
Size	**-0.0054**	-0.0032	**-0.0095**	0.0002
	(-2.45)	*(-0.47)*	*(-2.45)*	*(0.06)*
Leverage	0.0000	0.0000	0.0000	**-0.000004**
	(-0.66)	*(-0.04)*	*(-0.72)*	*(-1.95)*
ROA	-0.0001	-0.0018	-0.0007	0.0001
	(-0.27)	*(-1.45)*	*(-1.60)*	*(0.31)*
Tobin's Q	-0.0045	**-0.0215**	-0.0006	0.0026
	(-1.40)	*(-3.20)*	*(-0.11)*	*(0.82)*
Intercept	0.0430	0.0038	**0.1961**	0.0581
	(0.77)	*(0.02)*	*(2.58)*	*(0.86)*
Year FE	Yes	Yes	Yes	Yes
SIC FE	Yes	Yes	Yes	Yes
Target Nation FE	Yes	Yes	Yes	Yes
Acquirer P. Nation FE	Yes	Yes	Yes	Yes
Observations	1183	275	509	399
R-squared	0.226	0.456	0.230	0.154
Adjusted R-squared	0.147	0.258	0.091	0.052

Table 15: Robustness Checks for Target Stock Price Reaction to Investment by Different Types of Government Investor

The dependent variable is the market adjusted cumulative abnormal 5 day (-2, +2) return, as in Table 4. The independent variables are described in Table 1. Model 1 includes offer premium, Model 2 examines deals with no offer premium data. Model 3 estimates during banking crises; Model 4 outside of banking crises; Model 5 during the 2008-2009 financial crisis and Model 6 outside of the 2008-2009 financial crisis. The regression parameters are estimated via OLS (Ordinary Least Squares) with the Newey-West adjustment. Year, SIC, target nation, and acquirer nation fixed effects (FE) are included where indicated. Coefficients significant at the 10% level are in boldface and t-statistics is listed below in parentheses.

	(1) With Offer Premium	(2) Without Offer Premium	(3) Bank Crises	(4) Outside Bank Crises	(5) 08-09 Financial Crisis	(6) Outside 08-09 Financial Crisis
Offer Premium	**0.0648**					
	(3.16)					
Political Gov. Investor	**-0.0663**	**-0.0244**	**-0.0499**	**-0.0261**	-0.0357	**-0.0382**
	(-2.59)	*(-1.64)*	*(-1.74)*	*(-1.70)*	*(-1.12)*	*(-2.90)*
Financial Gov. Investor	**-0.0331**	0.0051	-0.0343	0.0003	-0.0065	**-0.0216**
	(-1.85)	*(0.39)*	*(-1.21)*	*(0.02)*	*(-0.24)*	*(-2.03)*
Foreign Deal	0.0209	**0.0230**	**0.0434**	0.0201	0.0127	**0.0251**
	(1.24)	*(1.89)*	*(1.65)*	*(1.49)*	*(0.48)*	*(2.88)*
Gov. Shares Acquired (%)	**0.0009**	**0.0010**	0.0000	**0.0013**	**0.0011**	**0.0013**
	(2.87)	*(3.26)*	*(0.01)*	*(5.92)*	*(2.13)*	*(5.32)*
Gov. Prior Ownership (%)	0.0006	0.0001	-0.0003	**0.0009**	0.0001	**0.0008**
	(1.42)	*(0.55)*	*(-0.46)*	*(3.40)*	*(0.14)*	*(3.13)*
Gov.-to-Gov. Deal	**0.0462**	0.0017	0.0419	0.0184	0.0358	0.0133
	(2.37)	*(0.12)*	*(1.23)*	*(1.31)*	*(1.05)*	*(1.05)*
Withdrawn Deal	-0.0256	-0.0314		**-0.0437**	-0.0058	-0.0425
	(-0.49)	*(-1.27)*		*(-1.69)*	*(-0.16)*	*(-1.54)*
Last Year Performance	-0.0042	0.0064	-0.0200	0.0063	**-0.0271**	0.0015
	(-0.35)	*(0.83)*	*(-1.54)*	*(0.73)*	*(-1.66)*	*(0.21)*
Cash Deal	0.0113	-0.0039	0.0124	0.0073	0.0117	0.0130
	(1.00)	*(-0.33)*	*(0.79)*	*(0.77)*	*(0.84)*	*(1.44)*
Stock Deal	**-0.0897**	0.0071		**-0.0497**	-0.0053	**-0.0649**
	(-3.09)	*(0.31)*		*(-2.21)*	*(-0.11)*	*(-2.94)*
Bank Crises Dummy	**-0.0374**	-0.0078			-0.0254	-0.0118
	(-1.65)	*(-0.53)*			*(-1.15)*	*(-0.76)*

Table 15 (Continued): Robustness Checks for Target Stock Price Reaction to Investment by Different Types of Government Investor

	(1) With Offer Premium	(2) Without Offer Premium	(3) Bank Crises	(4) Outside Bank Crises	(5) 08-09 Financial Crisis	(6) Outside 08-09 Financial Crisis
Size	-0.0025	**-0.0065**	**-0.0076**	-0.0041	**-0.0070**	-0.0037
	(-0.79)	*(-2.39)*	*(-2.36)*	*(-1.45)*	*(-2.03)*	*(-1.61)*
Leverage	0.0000	0.0000	**0.0000**	0.0000	**0.0000**	0.0000
	(-0.27)	*(-1.48)*	*(-1.67)*	*(-0.24)*	*(-1.72)*	*(-0.19)*
ROA	0.0002	**-0.0008**	-0.0005	-0.0001	0.0000	-0.0003
	(0.55)	*(-1.69)*	*(-0.37)*	*(-0.23)*	*(-0.06)*	*(-0.79)*
Tobin's Q	-0.0031	**-0.0082**	-0.0043	-0.0052	**-0.0098**	**-0.0064**
	(-0.57)	*(-2.79)*	*(-0.15)*	*(-1.47)*	*(-2.03)*	*(-1.87)*
Intercept	-0.0014	**0.1036**	**0.1980**	0.0340	0.1010	0.0507
	(-0.01)	*(1.73)*	*(2.62)*	*(0.57)*	*(1.80)*	*(0.93)*
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
SIC FE	Yes	Yes		Yes		Yes
Target Nation FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	506	654	278	882	356	804
R-squared	0.320	0.178	0.119	0.255	0.184	0.180
Adjusted R-squared	0.252	0.084	0.062	0.153	0.125	0.134

Table 16: Variable Definitions, Chapter 2

Ownership data are from the following sources: SDC Platinum; Thomson ONE Banker; entities' websites; press releases; the Securities and Exchange Commission's Electronic Data-Gathering, Analysis, and Retrieval system (EDGAR); the Canadian Securities Administrators' System for Electronic Document Analysis and Retrieval (SEDAR); Privatization Barometer; the World Bank privatization database; and Lexis-Nexis. Bond data are obtained from Bloomberg and DataStream. Financial data are obtained from the Worldscope database.

Variable	Definition
Government Ownership Variables	
Govt presence	Takes a value of 1 if the company currently has some government ownership, and 0 otherwise.
Govt stake (%)	Percentage of the company owned by the government.
Bailed out	Takes a value of 1 once a company has been publicly rescued by the government, and 0 otherwise
Government Investor Types	
Central govt	Takes a value of 1 if the investing entity is a central government, treasury, or ministry, and 0 otherwise.
Local/regional govt	Takes a value of 1 if the investing entity is a government representing a state, city, or region, and 0 otherwise.
SOE full	Takes a value of 1 if the investing entity is a 100% state-owned enterprise, and 0 otherwise.
SOE mixed	Takes a value of 1 if the investing entity is a government-controlled enterprise that is now at least partially owned by non-government investors, and 0 otherwise.
Govt bank	Takes a value of 1 if the investing entity is government-owned financial institution (e.g., a Central Bank or government development bank), and 0 otherwise.
SWF	Takes a value of 1 if the investing entity is a sovereign wealth fund, and 0 otherwise.
Pension fund	Takes a value of 1 if the investing entity is a government-owned public pension fund, and 0 otherwise.
Macroeconomic Variables	
Fin. crisis	Takes a value of 1 for the years 2008, 2009, and 2010, and 0 otherwise.
Banking crisis	Takes a value of 1 for the years defined as a banking crisis by Laeven and Valencia (2010), and 0 otherwise.
Govt size	Score between 0 to 10 based on the amount of government involvement in a nation's economy. Higher scores indicate less government involvement. Based on the Economic Freedom of the World Index (Gwartney, Hall, and Lawson, 2010).
Political leadership: Left	Takes a value of 1 if the chief executive of a nation is part of a left-wing political party, and 0 otherwise. Based on Beck et al. (2001); database updated December 2010.
Bond Variables	
Rating	The natural log of Standard and Poor's bond rating, after conversion to an ordinal scale. (AAA = 22, AA+ = 21, etc.)
Age	The time since the issue date, in days.
Maturity	The time till maturity, in days.
Firm Variables	
Leverage	(Total assets – Stockholders equity) / Stockholders equity
Market-to-book	(Total shares * Closing share price) / Stockholders equity
Size	The natural log of total assets.
ROE	Net income / Stockholders equity
Bank	Takes a value of 1 if the target company is a bank, and 0 otherwise.
Privatized target firm	Takes a value of 1 if the target company is a formerly state-owned company, and 0 otherwise.

Table 17: Descriptive Statistics, Chapter 2

The sample consists of 5,048 yearly observations from 1,278 bonds issued by 214 firms over 1991-2010. 3,111 observations relate to firm-years with government ownership. Panel A includes observation counts for the entire sample and for the subsample including only firm-years with state ownership. Panel B shows observation counts grouped by the nation of the government owner with the largest stake for each firm-year. Panels C and D include observation counts by the headquarter nation of sample firms and industrial sectors based on one-digit SIC codes, respectively. Panel E lists the distributions of binary variables, while Panel F lists the count, mean, median, standard deviation, 25th, and 75th percentiles of continuous variables. Variable definitions are provided in Table 16. Credit spreads in the top and bottom 1% of all observations are dropped. Bond-years can be associated with more than one state investment vehicle type listed in Panel E.

Panel A. Credit spread observations by year

Year	All Firms		Firms with Government Ownership	
	N	Proportion	N	Proportion
1991	2	0.04%		
1992	5	0.1%		
1993	17	0.3%	10	0.3%
1994	20	0.4%	10	0.3%
1995	25	0.5%	12	0.4%
1996	34	0.7%	18	0.6%
1997	41	0.8%	18	0.6%
1998	60	1.2%	29	0.9%
1999	129	2.6%	79	2.5%
2000	161	3.2%	105	3.4%
2001	264	5.2%	163	5.2%
2002	260	5.2%	158	5.1%
2003	333	6.6%	186	6.0%
2004	401	7.9%	236	7.6%
2005	443	8.8%	265	8.5%
2006	509	10.1%	317	10.2%
2007	525	10.4%	249	8.0%
2008	536	10.6%	300	9.6%
2009	630	12.5%	377	12.1%
2010	653	12.9%	579	18.6%
Totals	**5,048**	**100%**	**3,111**	**100%**

Table 17 (Continued): Descriptive Statistics, Chapter 2

Panel B. Nationalities of government owners			
Rank	Acquirer Nation	Firms with Government Ownership	
		N	Proportion
1	Canada	576	19%
2	France	414	13%
3	United States	310	10%
4	United Kingdom	206	7%
5	Spain	196	6%
6	Singapore	140	5%
7	Germany	134	4%
8	Belgium	131	4%
9	Norway	116	4%
10	Malaysia	108	3%
	OTHER	780	25%
	Totals	**3,111**	**100%**

Panel C. Nationalities of sample firms			
Rank	Target Nation	N	Proportion
1	United States	1574	31%
2	Canada	877	17%
3	United Kingdom	570	11%
4	France	459	9%
5	Germany	151	3%
6	Spain	143	3%
7	Netherlands	111	2%
8	Malasya	100	2%
9	Australia	98	2%
10	Hong Kong	86	2%
	OTHER	879	17%
	Totals	**5,048**	**100%**

Table 17 (Continued): Descriptive Statistics, Chapter 2

Panel D. Industries of sample firms			
Target SIC	Description of Target SIC	N	Proportion
0	Agriculture, forestry, and fishing	13	0.3%
1	Mining, construction	233	5%
2	Manufacturing (food, fabric, wood, chemical)	401	8%
3	Manufacturing (rubber, plastic, glass, metal; boat, rail, air equipment)	254	5%
4	Transportation, communications, electric, gas, and sanitary service	1,582	31%
5	Trade (wholesale, retail)	192	4%
6	Finance, insurance, and real estate	2,337	46%
7	Services (hotel, beauty, funeral, computer, car rental & repair, movie)	27	0.5%
8	Services (doctor's offices, legal, schools, religious, accounting)	9	0.2%
	Totals	**5,048**	**100%**

Panel E. Binary Variables			
Binary Variables	N	Yes (1)	No (0)
Government Variables			
Govt presence	5,048	3,111	1,937
Central govt	5,048	562	4,486
Local/regional govt	5,048	69	4,979
SOE full	5,048	894	4,154
SOE mixed	5,048	1,625	3,423
Govt bank	5,048	212	4,836
SWF	5,048	893	4,155
Pension fund	5,048	783	4,265
Bailed out	5,048	480	4,568
Foreign govt investor	5,048	1,339	3,709
Macroeconomic Variables			
Fin. crisis	5,048	1,819	3,229
Banking crisis	5,048	1,307	3,741
Firm Variables			
Bank	5,048	1,284	3,764

Table 17 (Continued): Descriptive Statistics, Chapter 2

Panel F. Continuous variables						
Continuous Variables	Count	Mean	Median	Standard deviation	25th percentile	75th percentile
Credit spread	5,048	215.5	135.8	235.1	68.6	273.2
Government Variables						
Govt ownership	5,048	13.50%	2.29%	22.20%	0	14.50%
Govt ownership > 0	3,111	21.90%	10.70%	24.80%	3.63%	31.90%
Bond Variables						
Rating	5,048	15.8	16	3.18	14	18
Age (days)	5,048	1650	1317	1376	604	2316
Maturity (days)	5,048	2829	1886	3204	971	3266
Firm Variables						
Leverage	5,048	11.2	3.6	13.2	1.62	19.3
M_B	5,048	1.86	1.62	1.34	1.09	2.24
Size	5,048	10.9	10.6	2.45	9.24	13.2
ROE	5,048	7.49%	11.20%	34.00%	5.48%	16.90%

Table 18: Mean Difference Tests, Chapter 2

The following table presents Credit spread means and two-sample t-tests for differences in means. The sample covers the period 1991–2010. The p-value shows the significance level of the two-tailed difference in means tests, with standard errors clustered at the firm level (as in Skinner, Holt, and Smith, 1989). For the comparison of foreign and domestic government ownership, firms are grouped based on whether the majority of their government ownership is held by a domestic state entity or a foreign one.

Sample	All	Govt presence	No Govt presence	*p*-value	Count
Full	215.51	225.95	198.74	0.351	5,048
1991-2007	146.97	167.49	119.26	0.02	3,229
2008-2010	337.18	312.3	392.71	0.1	1,819
2008-2010, without bailouts	357.72	343.1	395.43	0.406	1,346
Junk bonds: 1991-2007	400.17	431.18	313.2	0.009	449
Junk bonds: 2008-2010, without bailouts	666.35	655.73	696	0.614	254

Sample	All	Govt-category presence	No Govt-category presence	*p*-value	Count
Central govt: 1991-2007	146.97	167.72	145.33	0.578	3,229
Central govt: 2008-2010, without bailouts	357.72	293.41	362.49	0.33	1,346
Local/regional govt: 1991-2007	146.97	161.99	146.78	0.654	3,229
Local/regional govt: 2008-2010, without bailouts	357.72	319.72	358.5	0.693	1,346
SOE full: 1991-2007	146.97	136.51	149.05	0.647	3,229
SOE full: 2008-2010, without bailouts	357.72	282.94	382.5	0.04	1,346
SOE mixed: 1991-2007	146.97	163.86	138.71	0.293	3,229
SOE mixed: 2008-2010, without bailouts	357.72	294.14	388.39	0.036	1,346
Govt bank: 1991-2007	146.97	280.89	143.22	0	3,229
Govt bank: 2008-2010, without bailouts	357.72	241.89	369.47	0.015	1,346
SWF: 1991-2007	146.97	229.41	141.29	0.099	3,229
SWF: 2008-2010, without bailouts	357.72	327.09	373.78	0.361	1,346
Pension fund: 1991-2007	146.97	198.81	135.64	0.088	3,229
Pension fund: 2008-2010, without bailouts	357.72	411.18	348.17	0.273	1,346

Sample	All Govt	Foreign Govt	Domestic Govt	*p*-value	Count
1991-2007	167.49	271.06	147.11	0.032	1,855
2008-2010, without bailouts	343.1	365.86	326.51	0.525	970

Table 19: Government Ownership and the Cost of Debt

Year fixed effects (v_t) regression analysis with heteroskedasticity-robust and firm-clustered standard errors is performed on the following model: $y_{it} = \alpha + \theta X_{it} + \gamma \hat{\zeta}_{it} + v_t + \eta_{it}$. The dependent variable, credit spread (y_{it}), is the difference between the corporate bond's current yield to maturity and that of the government bond most closely matched by maturity. α represents the intercept, and η_{it} is the error term. Orthogonalized values of the log of the bond's rating after conversion to an ordinal scale, ***Rating*** ($\hat{\zeta}_{it}$), are used. The variables included in X_{it} are described in Table 16. ***Bank * Leverage*** is an interaction of the variables described in Table 16. Observations from bailed-out firms are removed in Models 4-6. Model 7 shows the second-stage results of a treatment effects regression, where the first stage is the probit Model 1 in Table 28 and ***Lambda*** represents the inverse Mills ratio. Model 8 shows the second-stage results of a two-stage least squares instrumental variables regression where ***Govt stake (%)*** is instrumented, and the first stage model is Model 1 in Table 29. The data are annual and cover the period 1991-2010. The models control for bond collateral/instrument type, bond currency, and the nation of the firm. Coefficients are listed below, with t-statistics in parentheses. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

	All observations			Bailouts removed			Heckman	IV
	Presence	Stake (%)	Both	Presence	Stake (%)	Both	Presence	Stake (%)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Govt presence	32.60**		39.58***	30.33**		39.72***	32.34**	
	(2.384)		*(2.875)*	*(2.011)*		*(2.657)*	*(2.232)*	
Govt stake (%)		-0.257	-0.625*		-0.680*	-1.002***		-1.568**
		(-0.769)	*(-1.850)*		*(-1.859)*	*(-2.761)*		*(-2.301)*
Rating	-425.0***	-425.0***	-423.9***	-413.2***	-410.8***	-410.7***	-425.0***	-425.0***
	(-6.496)	*(-6.383)*	*(-6.494)*	*(-6.196)*	*(-6.057)*	*(-6.186)*	*(-35.684)*	*(-35.470)*
Age	0.00211	0.00197	0.00247	0.00189	0.00185	0.00239	0.0021	0.00258
	(0.67)	*(0.65)*	*(0.78)*	*(0.565)*	*(0.585)*	*(0.714)*	*(1.166)*	*(1.4)*
Maturity	0.00358***	0.00339***	0.00362***	0.00455***	0.00438***	0.00458***	0.00358***	0.00340***
	(4.062)	*(3.954)*	*(4.096)*	*(4.817)*	*(4.814)*	*(4.794)*	*(4.547)*	*(.279)*
Leverage	0.95	0.945	1.057	0.705	0.668	0.8	0.953***	1.151***
	(1.466)	*(1.394)*	*(1.612)*	*(1.101)*	*(1.015)*	*(1.259)*	*(2.626)*	*(3.23)*
Bank	45.32*	42.68*	47.95**	4.628	-4.464	5.579	45.29***	46.64***
	(1.921)	*(1.704)*	*(2.023)*	*(0.214)*	*(-0.200)*	*(0.266)*	*(3.405)*	*(.636)*
*Bank * Leverage*	-3.040***	-2.739**	-3.106***	-1.377	-0.633	-1.271	-3.039***	-2.742***
	(-2.854)	*(-2.430)*	*(-2.929)*	*(-1.343)*	*(-0.620)*	*(-1.327)*	*(-4.433)*	*(-4.638)*
Market-to-book	-14.78***	-14.07***	-15.20***	-12.79***	-11.73**	-13.06***	-14.83***	-14.63***
	(-3.004)	*(-2.790)*	*(-3.073)*	*(-2.639)*	*(-2.371)*	*(-2.690)*	*(-6.574)*	*(-6.565)*
Size	-12.43***	-13.79***	-12.73***	-9.292**	-11.21***	-10.02**	-12.45***	-14.93***
	(-2.995)	*(-3.233)*	*(-3.072)*	*(-2.281)*	*(-2.612)*	*(-2.466)*	*(-6.927)*	*(-8.110)*

Table 19 (Continued): Government Ownership and the Cost of Debt

	All observations			Bailouts removed			Heckman	IV
	Presence	Stake (%)	Both	Presence	Stake (%)	Both	Presence	Stake (%)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ROE	-44.27*	-51.27**	-44.08*	-37.80*	-47.23**	-38.89*	-44.27***	-53.79***
	(-1.898)	*(-2.370)*	*(-1.891)*	*(-1.786)*	*(-2.388)*	*(-1.838)*	*(-5.646)*	*(-7.146)*
Lambda							-0.008	
							(-0.001)	
Constant	259.6***	268.9***	261.2***	217.3***	238.1***	227.2***	375.5***	477.1***
	(4.139)	*(4.23)*	*(4.158)*	*(3.458)*	*(3.646)*	*(3.604)*	*(3.282)*	*(3.94)*
Observations	5048	5048	5048	4568	4568	4568	5042	5042
R-squared	0.542	0.539	0.543	0.548	0.545	0.549		0.6
Wald χ^2							8474.4	

Table 20: Government Ownership, Financial Crises and the Cost of Debt

Year fixed effects (v_t) regression analysis with heteroskedasticity-robust and firm-clustered standard errors is performed on the following model: $y_{it} = \alpha + \theta X_{it} + \gamma \hat{\zeta}_{it} + v_t + \eta_{it}$. The dependent variable, credit spread (y_{it}), is the difference between the corporate bond's current yield to maturity and that of the government bond most closely matched by maturity. α represents the intercept, and η_{it} is the error term. Orthogonalized values of the log of the bond's rating after conversion to an ordinal scale, ***Rating*** ($\hat{\zeta}_{it}$), are used. The variables included in X_{it} are described in Table 16. ***Bank * Leverage*** is an interaction of the variables described in Table 16. The data are annual and cover the period 1991-2010. ***Govt ownership*** represents the presence of a state owner expressed as a binary variable in Models 1, 3, 5, and 7-8; it represents the percentage owned by the state in Models 2, 4, and 6. Observations from bailed-out firms are removed in Models 3 and 4. Models 5 and 8 show the second-stage results of a treatment effects regression, where the first stage regressions are probit Models 2 and 3, respectively, in Table 28, and ***Lambda*** represents the inverse Mills ratio. Model 6 shows the second-stage results of a two-stage least squares instrumental variables regression where ***Govt stake (%)*** and ***Govt stake (%) * Fin. crisis*** are instrumented, and the first stage models are Models 2 and 3 in Table 29. Models 7 and 8 use a banking crisis indicator based on Laeven and Valencia (2010). The models control for bond collateral/instrument type, bond currency, and the nation of the firm, except for Models 7 and 8 where country fixed effects are not used in lieu of the country-level banking crisis variable. Coefficients are listed below, with t-statistics in parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level.

	Financial Crisis						Banking Crises	
	All observations		Bailouts removed		Heckman	IV	All	Heckman
	Presence	Stake (%)	Presence	Stake (%)	Presence	Stake (%)	Presence	Presence
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Govt ownership	61.10***	0.289	52.04***	-0.234	49.17***	2.121	37.90***	36.54***
	(4.196)	*(0.722)*	*(3.302)*	*(-0.576)*	*(3.395)*	*(1.548)*	*(3.361)*	*(2.869)*
*Govt ownership * Fin. crisis*	-79.42***	-1.270**	-69.74**	-1.184*	-82.03***	-8.939***		
	(-2.850)	*(-2.246)*	*(-2.007)*	*(-1.888)*	*(-7.798)*	*(-3.220)*		
Fin. crisis	431.5***	439.7***	412.8***	420.8***	152.6	292.5**		
	(3.578)	*(5.192)*	*(0.878)*	*(3.297)*	*(1.419)*	*(2.266)*		
*Govt ownership * Banking crisis*							-47.25*	-47.13***
							(-1.705)	*(-4.414)*
Banking crisis							56.63**	56.79***
							(2.386)	*(5.716)*
Rating	-422.9***	-422.6***	-412.2***	-408.6***	-424.0***	-422.3***	-447.3***	-445.8***
	(-6.523)	*(-6.337)*	*(-6.228)*	*(-6.015)*	*(-35.739)*	*(-31.600)*	*(-7.120)*	*(-38.462)*
Age	0.00118	0.00206	0.000849	0.0019	0.00111	0.00316	-0.000106	-0.000131
	(0.373)	*(0.697)*	*(0.253)*	*(0.618)*	*(0.617)*	*(1.534)*	*(-0.033)*	*(-0.073)*
Maturity	0.00357***	0.00345***	0.00455***	0.00443***	0.00358***	0.00388***	0.00148*	0.00147*
	(4.099)	*(-4.11)*	*(4.965)*	*(5.107)*	*(-4.57)*	*(4.328)*	*(1.732)*	*(1.937)*

Table 20 (Continued): Government Ownership, Financial Crises and the Cost of Debt

	Financial Crisis						Banking Crises	
	All observations		Bailouts removed		Heckman	IV	All	Heckman
	Presence	Stake (%)	Presence	Stake (%)	Presence	Stake (%)	Presence	Presence
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Leverage	1.351**	0.984	0.978	0.634	1.244***	1.473***	1.219**	1.182***
	(2.123)	*(-1.44)*	*(1.513)*	*(-0.97)*	*(3.456)*	*(3.597)*	*(1.988)*	*(3.443)*
Bank	50.74**	45.76*	13.08	-1.204	46.85***	69.05***	69.74***	69.00***
	(2.153)	*(1.806)*	*(0.627)*	*(-0.054)*	*(3.552)*	*(4.342)*	*(2.982)*	*(5.578)*
*Bank * Leverage*	-3.643***	-3.011**	-1.786*	-0.777	-3.332***	-4.676***	-3.991***	-3.927***
	(-3.349)	*(-2.555)*	*(-1.701)*	*(-0.746)*	*(-4.909)*	*(-5.245)*	*(-3.884)*	*(-6.551)*
Market-to-book	-15.16***	-13.46***	-13.03***	-11.01**	-14.57***	-10.61***	-15.96***	-15.42***
	(-3.129)	*(-2.702)*	*(-2.701)*	*(-2.267)*	*(-6.348)*	*(-3.821)*	*(-3.392)*	*(-7.380)*
Size	-12.90***	-13.57***	-9.766**	-11.08***	-13.38***	-13.50***	-15.94***	-15.85***
	(-3.154)	*(-3.223)*	*(-2.446)*	*(-2.621)*	*(-7.420)*	*(-6.438)*	*(-4.521)*	*(-9.905)*
ROE	-41.67*	-49.30**	-38.00*	-46.71**	-43.75***	-39.49***	-34.98*	-36.64***
	(-1.860)	*(-2.241)*	*(-1.822)*	*(-2.316)*	*(-5.644)*	*(-4.162)*	*(-1.770)*	*(-4.731)*
Lambda					8.51			0.695
	0	*0*	*0*	*0*	*(0.951)*	*0*	*0*	*(0.085)*
Constant	263.6***	260.0***	224.5***	231.8***	391.0***	482.4***	250.6***	250.4**
	(4.276)	*(4.119)*	*(3.584)*	*(3.562)*	*(3.435)*	*(3.577)*	*(5.260)*	*(2.187)*
Observations	5048	5048	4568	4568	5042	5042	5048	5042
R-squared	0.546	0.541	0.551	0.546	0	0.503	0.59	0
Wald χ^2					8621.7			7840.7

Table 21: Government Ownership and the Cost of Debt: Non-Investment-Grade Bonds

Year fixed effects (v_t) regression analysis with heteroskedasticity-robust and firm-clustered standard errors is performed on the following model: $y_{it} = \alpha + \theta X_{it} + \gamma \hat{\varsigma}_{it} + v_t + \eta_{it}$. The dependent variable, credit spread (y_{it}), is the difference between the corporate bond's current yield to maturity and that of the government bond most closely matched by maturity. α represents the intercept, and η_{it} is the error term. Orthogonalized values of the log of the bond's rating after conversion to an ordinal scale, ***Rating*** ($\hat{\varsigma}_{it}$), are used. The variables included in X_{it} are described in Table 16. ***Bank * Leverage*** is an interaction of the variables described in Table 16. The data are annual and cover the period 1991-2010 in Models 1 and 2, the years before the 2008 Financial Crisis in Models 3 and 4, and 2008-2010 in Models 5 and 6. Only observations using non-investment-grade bonds are used in this table. ***Govt ownership*** represents the presence of a state owner expressed as a binary variable in Models 1, 3, and 5; it represents the percentage owned by the state in Models 2, 4, and 6. Observations from bailed-out firms are removed in periods that cover the 2008 Financial Crisis (Models 1-2 and 5-6). The models control for bond collateral/instrument type, bond currency, and the nation of the firm. Coefficients are listed below, with t-statistics in parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level.

	1991-2010 Presence (1)	1991-2010 Stake (%) (2)	1991-2007 Presence (3)	1991-2007 Stake (%) (4)	2008-2010 Presence (5)	2008-2010 Stake (%) (6)
Govt ownership	81.10**	-0.121	98.09***	1.111	12.88	-4.187**
	(2.574)	*(-0.153)*	*(2.886)*	*(1.109)*	*(0.229)*	*(-2.421)*
Rating	-287.0**	-282.3**	-328.3***	-318.3***	-348.5**	-288.5**
	(-2.500)	*(-2.434)*	*(-2.938)*	*(-2.737)*	*(-2.519)*	*(-2.025)*
Age	0.00872	0.00681	0.015	0.0174	0.0107	0.00675
	(0.781)	*(0.587)*	*(1.088)*	*(1.178)*	*(0.671)*	*(0.439)*
Maturity	0.0031	0.00121	0.00153	-0.000967	0.0104	0.0104
	(-0.7)	*(0.249)*	*(0.265)*	*(-0.149)*	*(1.289)*	*(1.256)*
Leverage	8.110***	8.646**	11.18***	12.01***	0.136	-1.553
	(2.664)	*(-2.54)*	*(3.235)*	*(3.074)*	*(0.011)*	*(-0.137)*
Bank	-37.34	-139.2	-88.72	-200.9	633.7**	557.6*
	(-0.317)	*(-1.003)*	*(-0.829)*	*(-1.569)*	*(2.272)*	*(1.992)*
*Bank * Leverage*	-8.989	-5.054	-8.583	-4.643	-104.4***	-99.59***
	(-0.887)	*(-0.464)*	*(-0.791)*	*(-0.379)*	*(-2.813)*	*(-2.745)*
Market-to-book	-45.14***	-45.69***	-66.81***	-68.27***	-37	-34.68
	(-3.007)	*(-2.890)*	*(-3.429)*	*(-3.370)*	*(-0.949)*	*(-0.867)*
Size	-13.34	-15.26	-8.863	-13.67	-16.44	-5.101
	(-1.342)	*(-1.599)*	*(-0.940)*	*(-1.312)*	*(-0.580)*	*(-0.180)*
ROE	-61.07	-58.65	-102.2	-102.5	81.94	63.89
	(-1.273)	*(-1.150)*	*(-1.647)*	*(-1.524)*	*(0.447)*	*(0.373)*
Constant	628.3***	757.5***	643.7***	232.8	1470***	1524**
	(3.109)	*(3.474)*	*(3.449)*	*(1.089)*	*(2.808)*	*(2.337)*
Observations	699	699	449	449	254	254
R-squared	0.476	0.467	0.428	0.408	0.43	0.444

Table 22: Government Ownership and the Cost of Debt: Highly-Levered Firms

Year fixed effects (v_t) regression analysis with heteroskedasticity-robust and firm-clustered standard errors is performed on the following model: $y_{it} = \alpha + \theta X_{it} + \gamma \hat{\zeta}_{it} + v_t + \eta_{it}$. The dependent variable, credit spread (y_{it}), is the difference between the corporate bond's current yield to maturity and that of the government bond most closely matched by maturity. α represents the intercept, and η_{it} is the error term. Orthogonalized values of the log of the bond's rating after conversion to an ordinal scale, ***Rating*** ($\hat{\zeta}_{it}$), are used. The variables included in X_{it} are described in Table 16. ***Bank * Leverage*** is an interaction of the variables described in Table 16. The data are annual and cover the period 1991-2010 in Models 1 and 2, the years before the 2008 Financial Crisis in Models 3 and 4, and 2008-2010 in Models 5 and 6. Only observations from firm-years with leverage values above the sample median are used in this table. ***Govt ownership*** represents the presence of a state owner expressed as a binary variable in Models 1, 3, and 5; it represents the percentage owned by the state in Models 2, 4, and 6. Observations from bailed-out firms are removed in periods that cover the 2008 Financial Crisis (Models 1-2 and 5-6). The models control for bond collateral/instrument type, bond currency, and the nation of the firm. Coefficients are listed below, with t-statistics in parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level.

	1991-2010 Presence	1991-2010 Stake (%)	1991-2007 Presence	1991-2007 Stake (%)	2008-2010 Presence	2008-2010 Stake (%)
	(1)	(2)	(3)	(4)	(5)	(6)
Govt ownership	20.5	-1.410***	49.85**	-0.285	-89.24*	-1.930**
	(0.787)	*(-2.728)*	*(2.335)*	*(-0.395)*	*(-1.831)*	*(-2.102)*
Rating	-483.4***	-478.0***	-483.7***	-490.8***	-455.9***	-449.5**
	(-4.986)	*(-4.921)*	*(-5.448)*	*(-5.135)*	*(-2.658)*	*(-2.644)*
Age	-0.00359	-0.00268	0.000764	0.00195	-0.00488	-0.00443
	(-0.647)	*(-0.494)*	*(0.144)*	*(0.364)*	*(-0.637)*	*(-0.529)*
Maturity	0.00316	0.00294	0.0105***	0.0101***	-0.0147***	-0.0142***
	(-1.43)	*(1.364)*	*(5.028)*	*(4.787)*	*(-3.711)*	*(-3.488)*
Leverage	-0.933	-1.059	-0.305	-0.81	2.097	0.885
	(-0.928)	*(-1.103)*	*(-0.399)*	*(-0.974)*	*(0.716)*	*(0.292)*
Bank	-37.07	-49.95	-44.2	-65.31**	98.25	98.22
	(-1.131)	*(-1.545)*	*(-1.632)*	*(-2.154)*	*(1.479)*	*(1.255)*
*Bank * Leverage*	-0.554	0.238	-0.0336	1.13	-7.261*	-6.677
	(-0.472)	*(0.196)*	*(-0.038)*	*(1.089)*	*(-1.908)*	*(-1.626)*
Market-to-book	-14.71*	-14.64*	-11.16	-12.26	-17.97	-17.26
	(-1.980)	*(-1.881)*	*(-1.516)*	*(-1.603)*	*(-1.082)*	*(-0.995)*
Size	-11.90*	-14.99**	-16.66***	-18.98***	-4.4	-1.847
	(-1.848)	*(-2.299)*	*(-3.351)*	*(-3.614)*	*(-0.307)*	*(-0.122)*
ROE	-63.90**	-72.12***	-144.6***	-148.3***	-12.83	-12.59
	(-2.211)	*(-2.787)*	*(-3.254)*	*(-3.498)*	*(-0.299)*	*(-0.287)*
Constant	298.4***	332.3***	380.6***	391.1***	258.8	242
	(3.463)	*(3.955)*	*(5.749)*	*(5.636)*	*(1.226)*	*(1.111)*
Observations	2064	2064	1518	1518	553	553
R-squared	0.607	0.609	0.529	0.525	0.57	0.565

Table 23: Ownership by Different Government Entities and the Cost of Debt

Year fixed effects (v_t) regression analysis with heteroskedasticity-robust and firm-clustered standard errors is performed on the following model: $y_{it} = \alpha + \theta X_{it} + \gamma \hat{\zeta}_{it} + v_t + \eta_{it}$. The dependent variable, credit spread (y_{it}), is the difference between the corporate bond's current yield to maturity and that of the government bond most closely matched by maturity. α represents the intercept, and η_{it} is the error term. Orthogonalized values of the log of the bond's rating after conversion to an ordinal scale, ***Rating*** ($\hat{\zeta}_{it}$), are used. The variables included in X_{it} are described in Table 16. ***Bank * Leverage*** is an interaction of the variables described in Table 16. The data are annual and cover the period 1991-2010 in Models 1 and 2, the years before the 2008 Financial Crisis in Models 3 and 4, and 2008-2010 in Models 5 and 6. The models compare the effects of government ownership presence (Models 1, 3, and 5) and amounts (Models 2, 4, and 6) among different state entities. Observations from bailed-out firms are removed in periods that cover the 2008 Financial Crisis (Models 1-2 and 5-6). The models control for bond collateral/instrument type, bond currency, and the nation of the firm. Coefficients are listed below, with t-statistics in parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level.

	1991-2010 Presence	1991-2010 Stake (%)	1991-2007 Presence	1991-2007 Stake (%)	2008-2010 Presence	2008-2010 Stake (%)
	(1)	(2)	(3)	(4)	(5)	(6)
Central govt	-26.7	-1.268**	-6.32	-0.705	-76.67**	-1.544***
	(-0.971)	*(-2.050)*	*(-0.226)*	*(-1.111)*	*(-2.354)*	*(-3.501)*
Local/regional govt	24.79	-0.771	18.15	0.199	-57.21	-1.332*
	(-1.05)	*(-1.173)*	*(0.601)*	*(0.283)*	*(-1.427)*	*(-1.676)*
SOE full	5.162	-1.829**	30.39*	1.132	-4.187	-3.197**
	(0.302)	*(-2.092)*	*(1.745)*	*(1.015)*	*(-0.190)*	*(-2.587)*
SOE mixed	18.26	-1.227**	40.01**	-0.291	-78.84**	-2.663***
	(0.932)	*(-2.414)*	*(2.456)*	*(-0.631)*	*(-2.432)*	*(-3.366)*
Govt bank	51.32	16.54***	119.6**	9.697**	128.1***	21.61***
	(1.545)	*(6.638)*	*(2.023)*	*(2.075)*	*(3.185)*	*(5.137)*
SWF	46.71*	4.704***	82.74	6.202*	26.11	3.483**
	(1.749)	*(3.953)*	*(1.522)*	*(1.968)*	*(1.238)*	*(2.025)*
Pension fund	61.12***	2.818	20.42	-6.591*	103.4***	5.637***
	(3.668)	*(1.243)*	*(1.218)*	*(-1.890)*	*(3.214)*	*(4.503)*
Rating	-406.2***	-398.8***	-350.4***	-351.3***	-527.3***	-518.6***
	(-6.190)	*(-5.960)*	*(-4.814)*	*(-4.607)*	*(-5.506)*	*(-5.389)*
Age	0.00342	0.00368	0.00397	0.00389	0.00252	0.00123
	(1.023)	*(1.198)*	*(1.034)*	*(1.053)*	*(0.672)*	*(0.341)*
Maturity	0.00462***	0.00460***	0.00724***	0.00711***	0.000731	0.000815
	(4.972)	*(5.394)*	*(7.784)*	*(8.096)*	*(0.444)*	*(0.508)*
Leverage	0.598	0.631	1.202*	1.081*	2.964	4.313
	(0.937)	*(0.941)*	*(1.949)*	*(1.699)*	*(1.186)*	*(1.642)*
Bank	-1.137	-11.02	-7.776	-15.98	124.4**	130.0**
	(-0.055)	*(-0.518)*	*(-0.369)*	*(-0.745)*	*(2.332)*	*(2.262)*
*Bank * Leverage*	-1.253	-0.344	-0.725	0.111	-10.16***	-10.16***
	(-1.276)	*(-0.353)*	*(-0.721)*	*(0.118)*	*(-2.836)*	*(-2.775)*
Market-to-book	-11.61**	-13.77***	-7.986	-8.999*	-21.00**	-26.57**
	(-2.338)	*(-2.756)*	*(-1.582)*	*(-1.778)*	*(-2.142)*	*(-2.450)*
Size	-9.656**	-13.19***	-10.94***	-13.11***	-8.125	-12.98*
	(-2.445)	*(-3.204)*	*(-3.203)*	*(-3.503)*	*(-1.104)*	*(-1.737)*
ROE	-36.44*	-36.66*	-94.99**	-96.12**	43.78	62.57
	(-1.749)	*(-1.742)*	*(-2.547)*	*(-2.409)*	*(1.045)*	*(1.424)*
Constant	232.5***	259.5***	302.5***	303.5***	-122.7	-111.9
	(-3.48)	*(3.928)*	*(4.836)*	*(5.623)*	*(-0.800)*	*(-0.705)*
Observations	4568	4568	3229	3229	1346	1346
R-squared	0.552	0.554	0.45	0.442	0.552	0.554

Table 24: Ownership by Different Government Entities and the Cost of Debt: Non-Investment-Grade Bonds

Year fixed effects (v_t) regression analysis with heteroskedasticity-robust and firm-clustered standard errors is performed on the following model: $y_{it} = \alpha + \theta X_{it} + \gamma \hat{\zeta}_{it} + v_t + \eta_{it}$. The dependent variable, credit spread (y_{it}), is the difference between the corporate bond's current yield to maturity and that of the government bond most closely matched by maturity. α represents the intercept, and η_{it} is the error term. Orthogonalized values of the log of the bond's rating after conversion to an ordinal scale, ***Rating*** ($\hat{\zeta}_{it}$), are used. The variables included in X_{it} are described in Table 16. ***Bank * Leverage*** is an interaction of the variables described in Table 16. The data are annual and cover the period 1991-2010 in Models 1 and 2, the years before the 2008 Financial Crisis in Models 3 and 4, and 2008-2010 in Models 5 and 6. Only observations using non-investment-grade bonds are used in this table. The models compare the effects of government ownership presence (Models 1, 3, and 5) and amounts (Models 2, 4, and 6) among different state entities. Observations from bailed-out firms are removed in periods that cover the 2008 Financial Crisis (Models 1-2 and 5-6). The models control for bond collateral/instrument type, bond currency, and the nation of the firm. Coefficients are listed below, with t-statistics in parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level.

	1991-2010 Presence (1)	1991-2010 Stake (%) (2)	1991-2007 Presence (3)	1991-2007 Stake (%) (4)	2008-2010 Presence (5)	2008-2010 Stake (%) (6)
Central govt	-181.1***	-3.831***	-238.7***	-4.515***	-33.36	23.75
	(-4.548)	*(-4.035)*	*(-4.743)*	*(-3.228)*	*(-0.437)*	*(1.262)*
Local/regional govt	-94.1	13.84	-180.0**	-7.932	-493.2***	-6.863
	(-0.855)	*(0.796)*	*(-2.089)*	*(-0.391)*	*(-4.320)*	*(-0.227)*
SOE full	22.61	-2.915**	36.56	3.440**	-1.904	-7.012***
	(0.427)	*(-2.517)*	*(0.717)*	*(2.323)*	*(-0.019)*	*(-2.835)*
SOE mixed	67.41*	1.441	56.65**	1.524	52.22	-6.261
	(1.985)	*(1.342)*	*(2.145)*	*(1.505)*	*(-0.58)*	*(-1.279)*
Govt bank	240.7*	26.76	249.4*	43.63**	877.1***	-10.71
	(1.807)	*(-1.25)*	*(1.883)*	*(2.158)*	*(3.426)*	*(-0.263)*
SWF	156.0**	2.216	459.9***	83.99**	-8.205	-7.547
	(2.125)	*(0.831)*	*(-5.17)*	*(2.318)*	*(-0.118)*	*(-1.204)*
Pension fund	79.24**	-0.264	121.3***	0.0975	130.5	-0.711
	(2.128)	*(-0.161)*	*(-3.14)*	*(0.017)*	*(1.319)*	*(-0.326)*
Rating	-302.5**	-276.8**	-379.9***	-356.8**	-246.0*	-324.3**
	(-2.447)	*(-2.291)*	*(-3.347)*	*(-2.617)*	*(-1.921)*	*(-2.195)*
Age	0.00778	0.00167	0.00954	0.0119	0.0139	0.00546
	(0.727)	*(0.157)*	*(0.749)*	*(0.845)*	*(0.834)*	*(0.352)*
Maturity	0.00341	0.00248	0.0017	-0.00153	0.0115	0.0102
	(0.784)	*(0.529)*	*(0.297)*	*(-0.241)*	*(1.388)*	*(1.231)*
Leverage	8.375***	8.983**	9.951***	11.34***	-5.443	-4.806
	(2.741)	*(2.556)*	*(3.985)*	*(3.538)*	*(-0.393)*	*(-0.399)*
Bank	44.79	-129.5	39.26	-73.87	619.4**	497.9*
	(0.422)	*(-0.944)*	*(-0.41)*	*(-0.614)*	*(2.096)*	*(1.748)*
*Bank * Leverage*	-14.45	-6.774	-10.8	-11.34	-96.33**	-95.17**
	(-1.457)	*(-0.611)*	*(-1.171)*	*(-0.978)*	*(-2.475)*	*(-2.537)*
Market-to-book	-47.68***	-49.67***	-63.05***	-68.87***	-23.33	-24.18
	(-3.496)	*(-2.996)*	*(-4.028)*	*(-3.814)*	*(-0.613)*	*(-0.553)*
Size	-8.964	-11.8	0.852	-9.069	-23.71	-14.13
	(-0.844)	*(-1.216)*	*(0.089)*	*(-0.844)*	*(-0.731)*	*(-0.469)*
ROE	-59.44	-62.78	-68.42	-87.38	-16.57	24.76
	(-1.265)	*(-1.218)*	*(-1.333)*	*(-1.406)*	*(-0.085)*	*(0.139)*
Constant	854.9***	925.2***	273.1*	783.4***	1889***	1807***
	(4.155)	*(4.253)*	*(1.828)*	*(4.436)*	*(3.866)*	*(3.833)*
Observations	699	699	449	449	254	254
R-squared	0.498	0.477	0.526	0.465	0.559	0.459

Table 25: Ownership by Government Entity Categories and the Cost of Debt: 'Protectors' and 'Investors'

Year fixed effects (v_t) regression analysis with heteroskedasticity-robust and firm-clustered standard errors is performed on the following model: $y_{it} = \alpha + \theta X_{it} + \gamma \hat{\zeta}_{it} + v_t + \eta_{it}$. The dependent variable, credit spread (y_{it}), is the difference between the corporate bond's current yield to maturity and that of the government bond most closely matched by maturity. α represents the intercept, and η_{it} is the error term. Orthogonalized values of the log of the bond's rating after conversion to an ordinal scale, ***Rating*** ($\hat{\zeta}_{it}$), are used. The variables included in X_{it} are described in Table 16. ***Bank * Leverage*** is an interaction of the variables described in Table 16. The data are annual and cover the period 1991-2010 in Models 1 and 2, the years before the 2008 Financial Crisis in Models 3 and 4, and 2008-2010 in Models 5 and 6. The models compare the effects of government ownership presence (Models 1, 3, and 5) and amounts (Models 2, 4, and 6) among two categories of state entities: ***Govt protector***, which consists of central and local governments, full and mixed SOEs, and government-owned banks; and ***Govt investor***, which consists of SWFs and government-run pension funds. Observations from bailed-out firms are removed in periods that cover the 2008 Financial Crisis (Models 1-2 and 5-6). The models control for bond collateral/instrument type, bond currency, and the nation of the firm. Coefficients are listed below, with t-statistics in parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level.

	1991-2010 Presence (1)	1991-2010 Stake (%) (2)	1991-2007 Presence (3)	1991-2007 Stake (%) (4)	2008-2010 Presence (5)	2008-2010 Stake (%) (6)
Govt protector	3.843	-1.097***	49.56***	-0.115	-82.86**	-2.282***
	(0.209)	*(-2.869)*	*(-2.81)*	*(-0.264)*	*(-2.418)*	*(-4.190)*
Govt investor	54.74***	3.884***	41.45	0.246	57.11***	4.347***
	(-3.52)	*(3.371)*	*(1.645)*	*(0.131)*	*(2.993)*	*(3.959)*
Rating	-408.0***	-402.6***	-353.7***	-357.3***	-525.4***	-512.9***
	(-6.228)	*(-6.003)*	*(-4.935)*	*(-4.704)*	*(-5.698)*	*(-5.371)*
Age	0.00291	0.00282	0.00305	0.00378	0.000453	0.00118
	(0.869)	*(0.857)*	*(0.784)*	*(0.992)*	*(0.118)*	*(0.322)*
Maturity	0.00462***	0.00427***	0.00731***	0.00725***	-0.000661	0.000040
	(-4.9)	*(-4.51)*	*(7.957)*	*(8.107)*	*(-0.402)*	*(0.024)*
Leverage	0.539	0.655	1.302**	1.024	3.988	4.721*
	(0.852)	*(0.985)*	*(2.144)*	*(1.624)*	*(1.586)*	*(1.821)*
Bank	-5.58	-8.42	-3.112	-12.89	122.9**	122.8**
	(-0.268)	*(-0.390)*	*(-0.162)*	*(-0.616)*	*(2.193)*	*(2.061)*
*Bank * Leverage*	-0.828	-0.352	-1.054	-0.186	-8.811**	-9.701***
	(-0.834)	*(-0.353)*	*(-1.110)*	*(-0.193)*	*(-2.515)*	*(-2.615)*
Market-to-book	-11.80**	-13.43***	-9.278*	-8.25	-25.37**	-28.92***
	(-2.427)	*(-2.729)*	*(-1.861)*	*(-1.653)*	*(-2.508)*	*(-2.745)*
Size	-10.09**	-12.28***	-9.656***	-10.54***	-12.05*	-13.81*
	(-2.519)	*(-2.828)*	*(-3.033)*	*(-2.889)*	*(-1.702)*	*(-1.773)*
ROE	-34.87	-38.56*	-97.03**	-100.2**	65.49	68.89
	(-1.641)	*(-1.834)*	*(-2.581)*	*(-2.503)*	*(1.591)*	*(1.592)*
Constant	238.3***	247.6***	280.4***	270.4***	-66.15	-81.39
	(3.678)	*(3.782)*	*(5.529)*	*(5.294)*	*(-0.427)*	*(-0.513)*
Observations	4568	4568	3229	3229	1346	1346
R-squared	0.55	0.549	0.45	0.437	0.544	0.545

Table 26: Domestic and Foreign Government Ownership and the Cost of Debt

Year fixed effects (v_t) regression analysis with heteroskedasticity-robust and firm-clustered standard errors is performed on the following model: $y_{it} = \alpha + \theta X_{it} + \gamma \hat{\zeta}_{it} + v_t + \eta_{it}$. The dependent variable, credit spread (y_{it}), is the difference between the corporate bond's current yield to maturity and that of the government bond most closely matched by maturity. α represents the intercept, and η_{it} is the error term. Orthogonalized values of the log of the bond's rating after conversion to an ordinal scale, ***Rating*** ($\hat{\zeta}_{it}$), are used. The variables included in X_{it} are described in Table 16. ***Bank * Leverage*** is an interaction of the variables described in Table 16. The data are annual and cover the period 1991-2010 in Models 1 and 2, the years before the 2008 Financial Crisis in Models 3 and 4, and 2008-2010 in Models 5 and 6. ***Domestic (Foreign) govt*** represents the presence of a domestic (foreign) state owner expressed as a binary variable in Models 1, 3, and 5; it represents the percentage owned by the domestic (foreign) state in Models 2, 4, and 6. Observations from bailed-out firms are removed in periods that cover the 2008 Financial Crisis (Models 1-2 and 5-6). The models control for bond collateral/instrument type and bond currency. Coefficients are listed below, with t-statistics in parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level.

	1991-2010 Presence	1991-2010 Stake (%)	1991-2007 Presence	1991-2007 Stake (%)	2008-2010 Presence	2008-2010 Stake (%)
	(1)	(2)	(3)	(4)	(5)	(6)
Domestic govt	-13.41	-0.34	-5.498	-0.101	-70.46***	-0.708
	(-1.065)	*(-1.388)*	*(-0.443)*	*(-0.343)*	*(-2.660)*	*(-1.466)*
Foreign govt	55.84***	2.532***	73.58***	3.775***	50.84**	1.591**
	(3.194)	*(3.314)*	*(3.113)*	*(3.123)*	*(2.124)*	*(2.405)*
Rating	-430.2***	-426.3***	-386.9***	-379.4***	-551.9***	-557.4***
	(-6.812)	*(-6.775)*	*(-5.543)*	*(-5.499)*	*(-5.551)*	*(-5.491)*
Age	0.00009	0.000471	0.00303	0.00275	-0.00294	-0.000913
	(0.028)	*(0.147)*	*(-0.79)*	*(0.737)*	*(-0.751)*	*(-0.232)*
Maturity	0.00249***	0.00255***	0.00646***	0.00627***	-0.0055***	-0.0055***
	(2.956)	*(-2.93)*	*(7.971)*	*(7.174)*	*(-3.387)*	*(-3.347)*
Leverage	0.556	0.444	0.712	0.389	5.039**	5.282**
	(0.793)	*(0.676)*	*(1.239)*	*(0.743)*	*(2.111)*	*(2.078)*
Bank	17.95	6.72	5.863	-8.933	199.6***	191.9***
	(0.773)	*(0.325)*	*(0.252)*	*(-0.459)*	*(3.815)*	*(4.186)*
*Bank * Leverage*	-1.406	-0.988	-0.702	-0.121	-12.24***	-12.00***
	(-1.269)	*(-1.012)*	*(-0.634)*	*(-0.136)*	*(-4.174)*	*(-3.865)*
Market-to-book	-13.41***	-13.12***	-10.70**	-9.559**	-20.12**	-22.57**
	(-2.670)	*(-2.626)*	*(-2.224)*	*(-2.040)*	*(-2.000)*	*(-2.134)*
Size	-16.23***	-13.59***	-13.59***	-10.67***	-27.05***	-19.41***
	(-4.608)	*(-4.065)*	*(-3.524)*	*(-3.378)*	*(-4.103)*	*(-2.725)*
ROE	-30.72	-36.34*	-88.75**	-89.08**	70.24*	63.02
	(-1.530)	*(-1.853)*	*(-2.327)*	*(-2.331)*	*(1.677)*	*(1.407)*
Constant	257.9***	220.6***	256.2***	210.3***	96.09	-9.249
	(-5.42)	*(4.774)*	*(-5.3)*	*(5.491)*	*(0.905)*	*(-0.096)*
Observations	4568	4568	3229	3229	1346	1346
R-squared	0.597	0.601	0.515	0.527	0.583	0.578

Table 27: Domestic and Foreign Government Ownership and the Cost of Debt: Non-Investment-Grade Bonds

Year fixed effects (v_t) regression analysis with heteroskedasticity-robust and firm-clustered standard errors is performed on the following model: $y_{it} = \alpha + \theta X_{it} + \gamma \hat{\zeta}_{it} + v_t + \eta_{it}$. The dependent variable, credit spread (y_{it}), is the difference between the corporate bond's current yield to maturity and that of the government bond most closely matched by maturity. α represents the intercept, and η_{it} is the error term. Orthogonalized values of the log of the bond's rating after conversion to an ordinal scale, ***Rating*** ($\hat{\zeta}_{it}$), are used. The variables included in X_{it} are described in Table 16 1. ***Bank * Leverage*** is an interaction of the variables described in Table 16. The data are annual and cover the period 1991-2010 in Models 1 and 2, the years before the 2008 Financial Crisis in Models 3 and 4, and 2008-2010 in Models 5 and 6. Only observations using non-investment-grade bonds are used in this table. ***Domestic (Foreign) govt*** represents the presence of a domestic (foreign) state owner expressed as a binary variable in Models 1, 3, and 5; it represents the percentage owned by the domestic (foreign) state in Models 2, 4, and 6. Observations from bailed-out firms are removed in periods that cover the 2008 Financial Crisis (Models 1-2 and 5-6). The models control for bond collateral/instrument type and bond currency. Coefficients are listed below, with t-statistics in parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level.

	1991-2010 Presence	1991-2010 Stake (%)	1991-2007 Presence	1991-2007 Stake (%)	2008-2010 Presence	2008-2010 Stake (%)
	(1)	(2)	(3)	(4)	(5)	(6)
Domestic govt	-45.5	-1.174	-56.84	-0.0913	-96.16	-2.087**
	(-1.219)	*(-1.600)*	*(-1.647)*	*(-0.099)*	*(-1.469)*	*(-2.226)*
Foreign govt	138.1***	3.414***	164.3***	3.999***	102.7**	2.287***
	(3.708)	*(3.746)*	*(4.133)*	*(3.049)*	*(2.269)*	*(3.028)*
Rating	-223.9**	-245.3***	-199.3**	-241.7**	-317.9***	-307.4***
	(-2.524)	*(-2.706)*	*(-2.017)*	*(-2.463)*	*(-2.996)*	*(-2.702)*
Age	-0.00405	-0.00424	0.0146	0.0154	-0.0225	-0.0159
	(-0.330)	*(-0.346)*	*(0.864)*	*(0.876)*	*(-1.259)*	*(-0.975)*
Maturity	-0.000849	-0.000873	-0.00522	-0.00412	0.00702	0.00617
	(-0.169)	*(-0.167)*	*(-0.862)*	*(-0.637)*	*(0.739)*	*(0.618)*
Leverage	4.264	5.006	6.448**	8.186**	-3.019	-9.955
	(1.547)	*(1.567)*	*(2.635)*	*(2.648)*	*(-0.222)*	*(-0.799)*
Bank	-132.0*	-170.6***	-227.5**	-278.4***	835.3***	779.3***
	(-1.805)	*(-3.155)*	*(-2.227)*	*(-2.757)*	*(2.914)*	*(2.755)*
*Bank * Leverage*	3.494	5.435	7.958	10.57	-100.5**	-87.05**
	(0.735)	*(1.043)*	*(0.909)*	*(1.107)*	*(-2.486)*	*(-2.306)*
Market-to-book	-36.64***	-32.69**	-52.54***	-49.50***	-8.884	4.08
	(-3.041)	*(-2.565)*	*(-3.679)*	*(-3.053)*	*(-0.346)*	*(0.199)*
Size	-31.52***	-23.96***	-14.58*	-7.833	-74.56***	-62.64**
	(-4.069)	*(-3.262)*	*(-1.842)*	*(-0.909)*	*(-2.860)*	*(-2.313)*
ROE	-82.51*	-81.54	-114.4*	-102.9*	-61.83	-131.9
	(-1.870)	*(-1.655)*	*(-1.994)*	*(-1.688)*	*(-0.403)*	*(-0.840)*
Constant	1948***	1851***	1610***	1532***	3666***	2247***
	(7.686)	*(0.074)*	*(0.722)*	*(0.898)*	*(7.896)*	*(6.722)*
Observations	699	699	449	449	254	254
R-squared	0.502	0.499	0.5	0.482	0.414	0.417

Table 28: Factors Associated with Government Presence in a Firm Year: First-Stage Models for Treatment Effects Regressions

The following table shows probit regression results from models describing factors associated with the presence of government ownership in a given firm-year. The dependent variable is ***Govt presence***, as defined in Table 16. The probit model shown as Model 1 serves as the first-stage regression for the treatment effects model (Model 7) in Table 19; Models 2 and 3 do the same for the treatment effects models (Models 5 and 8, respectively) in Table 20. The firm- and country-level variables pertain to the target firms in our sample. The right-hand side variables are described in Table 16. ***Bank * Leverage*** is an interaction of the variables described in Table 16. The data are annual and cover the period 1991-2010.

	(1)	(2)	(3)
Leverage	-0.0231***	-0.0237***	-0.0227***
	(-8.432)	*(-8.541)*	*(-8.221)*
Bank	-1.331***	-1.306***	-1.326***
	(-13.184)	*(-12.959)*	*(-13.098)*
*Bank * Leverage*	0.0825***	0.0820***	0.0822***
	(8.111)	*(8.041)*	*(7.969)*
Market-to-book	0.131***	0.181***	0.127***
	(6.785)	*(8.831)*	*(6.368)*
Size	-0.149***	-0.160***	-0.148***
	(-11.203)	*(-11.854)*	*(-10.935)*
ROE	-0.572***	-0.545***	-0.579***
	(-8.705)	*(-8.225)*	*(-8.748)*
Privatized target firm	0.724***	0.742***	0.720***
	(4.181)	*(4.456)*	*(4.048)*
Govt size	-0.382***	-0.320***	-0.393***
	(-13.621)	*(-11.292)*	*(-12.902)*
Political leadership: Left	0.958***	0.948***	0.968***
	(1.603)	*(1.269)*	*(1.151)*
Fin. crisis		0.382***	
		(8.081)	
Banking crisis			-0.0496
			(-0.891)
Constant	4.354***	3.734***	4.431***
	(16.69)	*(14.12)*	*(6.069)*
Observations	5042	5042	5042
Pseudo R-squared	0.23	0.24	0.231

Table 29: Factors Associated with Government Stakes in a Firm-Year: First-Stage Models for Instrumental Variable Regressions

The following table shows OLS regression results from models describing factors associated with the percentage of shares owned by the government in a given firm-year. The dependent variables are ***Govt stake (%)*** for Models 1 and 2, and ***Govt stake (%) * Fin. Crisis*** for Model 3. Variables are defined in Table 16. The OLS model shown as Model 1 serves as the first-stage regression for the instrumental variable model (Model 8) in Table 19; Models 2 and 3 do the same for the instrumental variable model (Model 6) in Table 20. The firm- and country-level variables pertain to the target firms in our sample. ***Bank * Leverage*** is an interaction of the variables described in Table 16. The data are annual and cover the period 1991-2010.

	(1)	(2)	(3)
Rating	1.079	1.081	0.267
	(1.056)	*(1.058)*	*(0.297)*
Age	0.000400***	0.000400***	0.000239*
	(2.595)	*(2.595)*	*(1.767)*
Maturity	-0.00004	-0.00004	-0.00003
	(-0.548)	*(-0.549)*	*(0.569)*
Leverage	0.238***	0.238***	0.130***
	(8.133)	*(8.133)*	*(5.068)*
Bank	-0.675	-0.674	2.259**
	(-0.615)	*(-0.615)*	*(2.344)*
*Bank * Leverage*	-0.00355	-0.00354	-0.207***
	(-0.071)	*(-0.071)*	*(-4.692)*
Market-to-book	-0.658***	-0.658***	0.149
	(-3.492)	*(-3.493)*	*(-0.9)*
Size	-1.430***	-1.430***	-0.443***
	(-9.415)	*(-9.415)*	*(-3.317)*
ROE	-1.445**	-1.445**	0.895
	(-2.295)	*(-2.295)*	*(1.618)*
Privatized target firm	10.16***	10.16***	4.058***
	(6.478)	*(6.478)*	*(7.491)*
Govt size	0.292	0.295	3.355***
	(0.416)	*(-0.42)*	*(5.435)*
Political leadership: Left	2.094***	2.094***	1.348***
	(4.448)	*(4.449)*	*(-3.26)*
Fin. crisis		10.02	17.67**
	0	*(1.086)*	*(-2.18)*
Constant	51.47***	51.46***	10.64
	(5.115)	*(5.114)*	*(1.203)*
Observations	5042	5042	5042
R-squared	0.684	0.684	0.512

Table 30: Variable Definitions, Chapter 3

The data comes from the "EIA WEEKLY PETROLEUM STATUS REPORTS" or is created based on variables from the report http://www.eia.gov/oil_gas/petroleum/data_publications/weekly_petroleum _status_report/wpsr.html Below are the descriptions of variable levels. In our analysis we mainly use changes in these variables. Δ(variable name) means a change in that variable over the last week calculated via first difference. (variable name)(+1) denotes a lead, or the next period value, and (variable name)(-1) denotes a lag, for that specific variable. Years from which the data is available and used in the analysis, as well as, units of measure are also presented. The data is weekly and the study ends on 7/8/20011.

Variable	Description	From	Units
ΔPDL_1-ΔPDL_4	Polynomial distributed lag (PDL) change in spread lags between the two- and one-month WTI crude futures for spread2_1. Robustness tests include the PDL change in spread lags between the two month future and spot WTI for spread2_spot (Table 40) and between three- and one-month WTI crude futures for spread 3_1 (Table 41).	9/11/1992	
SpreadX_Y	The spread between the X and Y month out future NYMEX WTI crude contract (X,Y = 1,2,3,4). Typically, spread2_1, which is the spread between the two- and one-month WTI crude futures.	9/11/1992	Dollars per Barrel
ΔSpread2_1	The change in spread between the two- and the one-month WTI crude futures.	9/11/1992	Dollars per Barrel
Spot_WTI	Cushing, OK NYMEX WTI crude oil spot price FOB	9/11/1992	Dollars per Barrel
Future_WTI_X	Cushing, OK WTI NYMEX crude oil future contract X (X = 1,2,3,4)	9/11/1992	Dollars per Barrel
Stock_US	Weekly U.S. crude oil inventories (stocks) excluding the Strategic Petroleum Reserve (SPR)	9/11/1992	Thousand Barrels
Stock_X	Weekly crude oil inventories (stocks) excluding SPR for PADD_X (X=1, 2, 3, 4, or 5)	9/11/1992	Thousand Barrels
Stock_Cushing	Weekly Cushing, OK crude oil inventories (stocks) excluding SPR	4/9/2004	Thousand Barrels
Stock_US_non Cushing	Weekly U.S. crude oil inventories (stocks) excluding SPR and excluding Cushing	4/9/2004	Thousand Barrels
Stock_2_non Cushing	Weekly crude oil inventories (stocks) for PADD2 excluding SPR and excluding Cushing	4/9/2004	Thousand Barrels
Prod_US	Weekly U.S. field production of crude oil	9/11/1992	Thousand Barrels/Day
Imports_US	Weekly Net Inflows (Imports Excluding SPR - Exports)	9/11/1992	Thousand Barrels/Day
ImportsX	Weekly crude oil imports excluding SPR for PADD_X (X=1, 2, 3, 4, or 5)	9/11/1992	Thousand Barrels/Day
RefinerInputUS	Weekly U.S. refiner net input of crude oil (balance between crude oil supply and disposition)	9/11/1992	Thousand Barrels/Day
RefinerInputX	Weekly refiner net input of crude oil for PADD_X (X=1, 2, 3, 4, or 5)	9/11/1992	Thousand Barrels/Day
Jan-Nov	Monthly dummies	9/11/1992	1 or 0
Z1-Z5	Weekly dummies (Z1 is 1, Z2 is level, Z3 is squared, Z4 is cubed, Z5 is to the forth power) that remove seasonality in inventory	9/11/1992	

PADD 1 -- East Coast; PADD 2 -- Midwest; PADD 3 -- Gulf Coast; PADD 4 -- Rocky Mountains; PADD 5 -- West Coast.

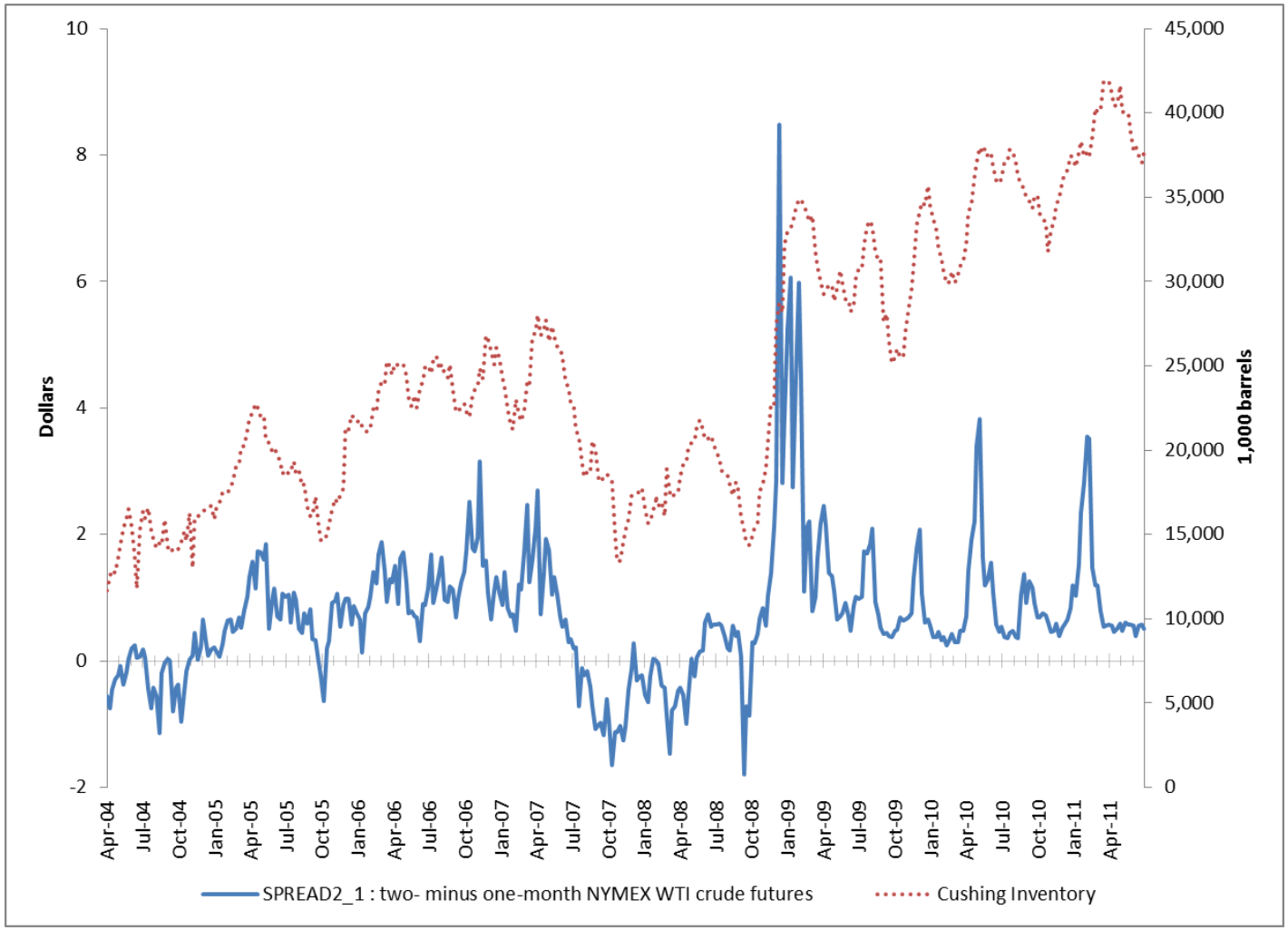

Figure 1: Cushing Crude Inventory and the Spread Between the Two- and One-Month NYMEX WTI Crude Futures

This figure plots crude oil inventories in Cushing, OK and the spread between the two- and one-month WTI crude futures between April 9, 2004 and July 8, 2011.

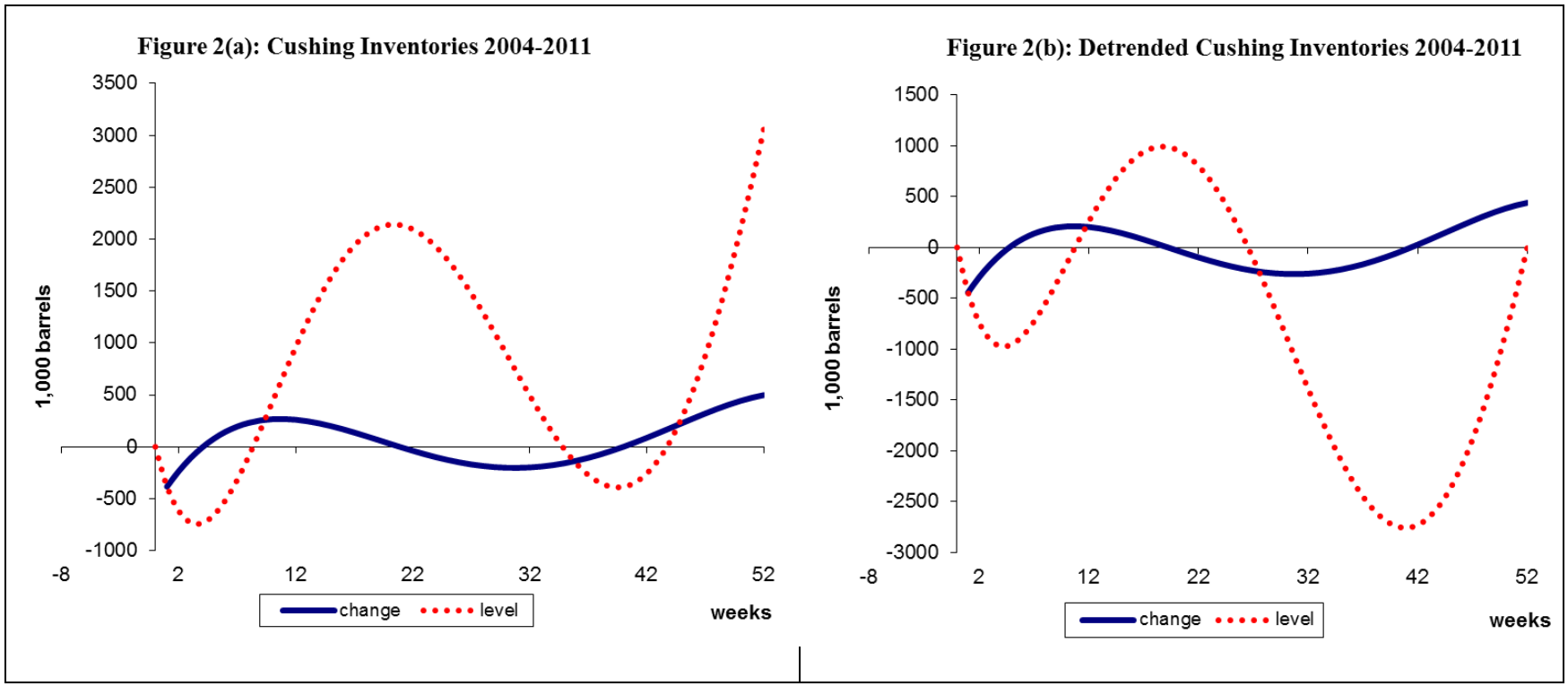

Figure 2: Cushing Crude Oil Inventory Levels and Changes as Predicted by the Seasonal Adjustment from the Z Variables

This figure plots seasonal pattern at Cushing, OK crude oil inventories as implied by the weekly seasonal Z variables. Variable definitions are in Table 30. Both inventory levels and changes are presented over the 2004-2011 period. Figure 2(a) shows unadjusted inventory levels in Cushing. There has been a significant increase in capacity in Cushing, OK over 2004-2011as shown by the difference in the starting and ending points of the inventory "level" series. Figure 2(b) adjusts for this capacity increase by normalizing the graph scale in Figure 2(a) to start and end at the same level, and shows the seasonal pattern on this adjusted scale.

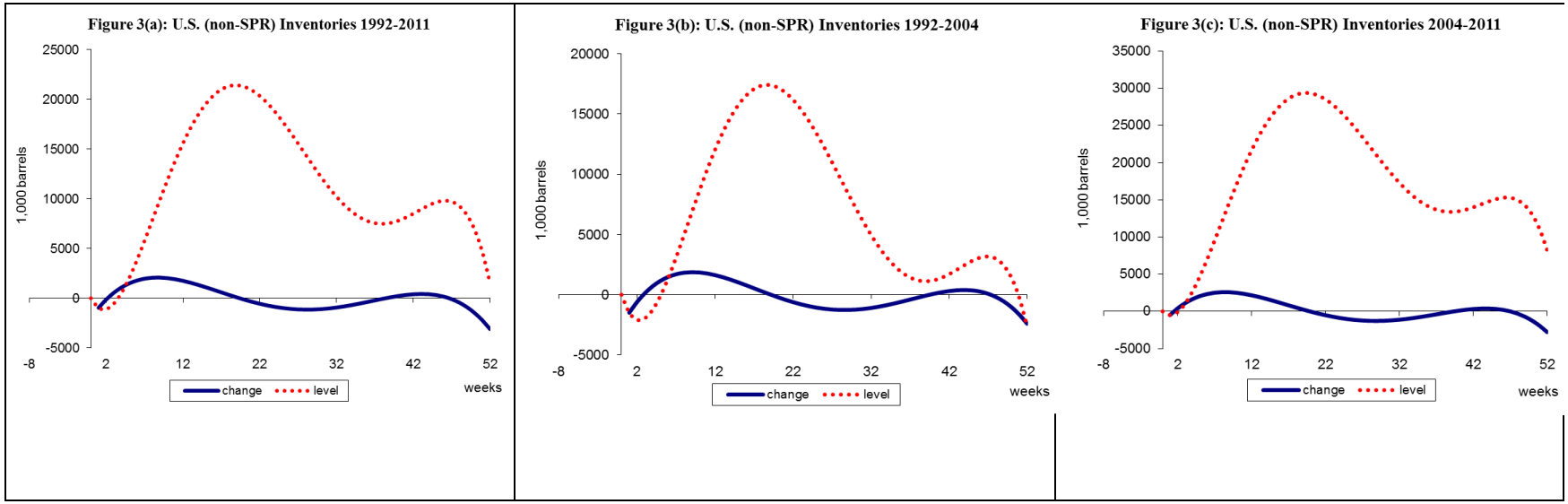

Figure 3: U. S. (non-SPR) Crude Oil Inventory Levels and Changes as Predicted by the Seasonal Adjustment from the Z Variables

This figure plots the U.S. (non-SPR) seasonal pattern in inventories as implied by the weekly seasonal Z variables. Variable definitions are available in Table 30. Both inventory levels and changes are presented. Figure 3(a) covers the 1992-2011 period; Figure 3(b) the 1992-2004 period; and Figure 3(c) the 2004-2011 period. Figure 3(b) shows that overall U.S. crude oil storage capacity did not increase significantly over 1992-2004, as the line graphing inventory levels converges to its starting point. This differs from Figure 3(c) which shows that capacity increased over the 2004-2011 period. This capacity increase is partially attributed to Cushing, as can be seen from Figure 2.

Table 31: Description of Variables in Levels and Changes (1st Difference), Chapter 3

The table describes the number, mean, median and standard deviation (and autocorrelation for changes) for levels and changes (1st difference) of the variables used in the analysis. Years for which the data is available and used in the analysis are also presented. Variable definitions are in Table 30.

			LEVELS			CHANGES (1st Difference)				
Variables	N	Years	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	AC 1st order	AC p-value
STOCK_US	983	1992-2011	319,097.20	320,634.00	23,355.21	27.56	132.50	3,912.40	0.045	0.161
STOCK_CUSHING	379	2004-2011	24,741.52	23,157.00	7,866.80	68.71	56.00	979.94	0.100	0.051
STOCK_US_nonCUSHING	379	2004-2011	304,012.90	304,584.00	17,244.58	90.24	317.00	3,365.87	0.351	0.000
STOCK2	983	1992-2011	70,007.28	68,376.00	10,320.64	33.49	8.50	1,287.79	0.085	0.007
STOCK2_nonCUSHING	379	2004-2011	49,980.12	48,074.00	5,370.63	36.87	68.00	1,102.75	-0.054	0.293
STOCK1	983	1992-2011	14,650.79	14,764.00	1,523.02	-3.19	40.50	1,115.03	-0.362	0.000
STOCK3	983	1992-2011	162,503.00	162,172.00	13,808.29	9.98	29.50	3,198.50	0.008	0.791
STOCK4	983	1992-2011	12,989.03	12,680.00	1,609.29	3.73	-1.50	311.82	-0.085	0.007
STOCK5	983	1992-2011	58,947.08	56,518.00	7,943.24	-16.46	-1.00	2,030.22	-0.281	0.000
SPREAD2_SPOTWTI	983	1992-2011	0.19	0.11	1.08	0.00	0.00	0.67	-0.344	0.000
SPREAD2_1	983	1992-2011	0.16	0.10	0.92	0.00	0.01	0.47	-0.261	0.000
SPOT_WTI	983	1992-2011	41.42	28.86	27.92	0.08	0.10	2.57	-0.022	0.487
PROD_US	983	1992-2011	5,850.92	5,808.00	615.73	-1.40	1.00	107.50	-0.201	0.000
REFINERINPUTUS	983	1992-2011	14,708.67	14,793.00	752.25	1.38	15.00	282.95	-0.001	0.978
REFINERINPUT1	983	1992-2011	1,446.55	1,477.00	181.78	-0.06	-1.00	72.65	-0.101	0.002
REFINERINPUT2	983	1992-2011	3,253.51	3,260.00	163.98	-0.02	2.00	94.39	-0.064	0.046
REFINERINPUT3	983	1992-2011	6,976.75	7,076.00	518.09	1.45	9.00	231.14	-0.053	0.097
REFINERINPUT4	983	1992-2011	508.52	511.00	48.41	0.08	0.00	22.53	-0.151	0.000
REFINERINPUT5	983	1992-2011	2,523.34	2,538.00	148.75	-0.08	2.00	85.57	-0.160	0.000
IMPORTS_US	983	1992-2011	8,685.16	8,876.00	1,307.88	2.79	-20.00	779.04	-0.534	0.000
IMPORTS1	983	1992-2011	1,421.93	1,415.00	272.57	-0.20	-6.00	346.94	-0.568	0.000
IMPORTS2	983	1992-2011	975.69	979.00	208.23	0.54	4.00	160.72	-0.501	0.000
IMPORTS3	983	1992-2011	5,400.42	5,502.00	802.97	0.92	-21.00	708.78	-0.488	0.000
IMPORTS4	983	1992-2011	203.83	205.00	87.65	0.19	0.00	51.94	-0.573	0.000
IMPORTS5	983	1992-2011	747.10	742.00	370.68	1.27	0.00	253.44	-0.588	0.000

Table 32: Correlation between Variables, Chapter 3

This table describes correlations between variable changes (1st difference). Variable definitions are in Table 30. Data involving Cushing covers the 2004-2011 period, data for all other variables is for 1992-2011.

	Δ(STOCK_US)	Δ(STOCK_CUSHING)	Δ(STOCK_US_nonCUSHING)	Δ(STOCK2)	Δ(STOCK2_nonCUSHING)	Δ(STOCK1)	Δ(STOCK3)	Δ(STOCK4)	Δ(STOCK5)	Δ(SPREAD 2_1)	Δ(SPOT_WTI)	Δ(PROD_US)	Δ(REFINERINPUTUS)	Δ(REFINERINPUT1)	Δ(REFINERINPUT2)	Δ(REFINERINPUT3)	Δ(REFINERINPUT4)	Δ(REFINERINPUT5)	Δ(IMPORTS_NET_NOSPR)	Δ(IMPORTS1)	Δ(IMPORTS2)	Δ(IMPORTS3)	Δ(IMPORTS4)	Δ(IMPORTS5)
Δ(STOCK_US)	**1**																							
Δ(STOCK_CUSHING)	.17	**1**																						
Δ(STOCK_US_nonCUSHING	.96	-.12	**1**																					
Δ(STOCK2)	.28	.59	.12	**1**																				
Δ(STOCK2_nonCUSHING)	.20	-.17	.25	.70	**1**																			
Δ(STOCK1)	.17	-.03	.18	.04	.07	**1**																		
Δ(STOCK3)	.77	-.04	.79	-.14	-.13	-.12	**1**																	
Δ(STOCK4)	.09	-.13	.12	-.06	.04	.03	.05	**1**																
Δ(STOCK5)	.32	-.03	.33	.01	.03	-.13	-.08	-.07	**1**															
Δ(SPREAD 2_1)	.04	.16	-.01	.13	.02	.01	-.02	.02	-.01	**1**														
Δ(SPOT_WTI)	-.02	.04	-.03	.02	-.01	.06	.01	.00	-.11	-.30	**1**													
Δ(PROD_US)	.17	.09	.14	.15	.09	-.01	.03	.07	.18	.05	-.07	**1**												
Δ(REFINERINPUTUS)	.08	.09	.05	.09	.02	-.01	.01	-.01	.09	.09	-.02	.45	**1**											
Δ(REFINERINPUT1)	.02	.09	-.01	.03	-.05	-.03	.03	-.05	-.02	-.02	-.05	.00	.16	**1**										
Δ(REFINERINPUT2)	-.05	.03	-.06	-.10	-.15	.05	-.04	-.02	.03	.05	-.04	.11	.36	.09	**1**									
Δ(REFINERINPUT3)	.12	.11	.09	.14	.07	.02	.01	.01	.12	.11	-.01	.46	.89	-.10	.06	**1**								
Δ(REFINERINPUT4)	.00	-.14	.05	-.10	.01	-.10	.07	-.19	.07	-.01	.01	-.01	.13	.14	.09	.01	**1**							
Δ(REFINERINPUT5)	-.08	-.09	-.06	-.04	.03	-.09	-.01	.04	-.09	-.07	.05	.02	.24	-.07	.04	-.02	.01	**1**						
Δ(IMPORTS_NET_NOSPR)	.52	.12	.48	.13	.05	.18	.41	-.07	.11	.01	.03	.09	.31	.07	.10	.29	.06	.02	**1**					
Δ(IMPORTS1)	.09	.05	.07	.03	-.01	.35	-.05	-.05	.04	.02	.06	-.09	-.05	.11	.10	-.09	-.02	-.07	.20	**1**				
Δ(IMPORTS2)	.08	.09	.06	.15	.10	-.06	.03	-.03	.04	-.01	.03	-.10	.03	-.07	.13	.01	.05	-.02	.19	-.05	**1**			
Δ(IMPORTS3)	.42	.10	.39	.09	.02	.04	.45	-.01	-.06	-.02	.05	.14	.29	.01	.02	.30	.06	.04	.76	-.23	-.04	**1**		
Δ(IMPORTS4)	.06	.05	.05	.02	-.02	.09	.02	.06	.00	.03	.04	.03	.03	-.02	-.02	.03	.10	.03	.04	.04	-.03	.00	**1**	
Δ(IMPORTS5)	.09	-.05	.11	-.03	.01	-.06	.00	-.08	.31	.04	-.11	.03	.10	.05	.00	.09	-.03	.03	.24	-.13	-.01	-.15	-.15	**1**

Table 33: Polynomial Distributed Lag (PDL) Estimation of the Impact of the Futures Spread Changes on Cushing Crude Inventory Changes

The dependent variable, ΔSTOCK, is the change Cushing crude inventories. Variable definitions are in Table 30. Any (+1) variables indicate a lead for that specific variable. The regression is run via OLS (Ordinary Least Squares) with the Newey-West heteroscedasticity adjustment. Data is weekly. Model 1 estimates over the 4/16/2004 - 7/08/2011 period, has 377 observations.

Panel A.

	Model 1 Δ Cushing stock 2004-2011		Model 1 winsorized Δ Cushing stock 2004-2011	
	Coeff.	p-value	Coeff.	p-value
C	-556.14	0.022	-588.92	0.008
Δ(SPOT_WTI)	23.98	0.159	20.11	0.183
Δ(REFINERINPUT2)	-0.22	0.703	-0.08	0.883
Δ(REFINERINPUT2)(+1)	-0.25	0.673	-0.21	0.715
Δ(PROD_US)	0.55	0.039	0.59	0.021
Δ(PROD_US)(+1)	-0.28	0.270	-0.26	0.307
Δ(IMPORTS2)	0.43	0.212	0.37	0.266
Δ(IMPORTS2)(+1)	-0.29	0.433	-0.30	0.387
Z2	185.98	0.002	190.82	0.001
Z3	-13.45	0.003	-13.80	0.002
Z4	0.33	0.011	0.34	0.008
Z5	0.00	0.036	0.00	0.025
ΔPDL_1	167.89	0.000	162.41	0.001
ΔPDL_2	-59.45	0.001	-63.13	0.001
ΔPDL_3	-0.12	0.952	0.30	0.878
ΔPDL_4	1.10	0.070	1.33	0.050
Joint Wald Test ΔPDL_1-ΔPDL_4		**0.000**		**0.000**
Adjusted R-squared	15%		16%	

Panel B.

	Δ SPREAD2_1		Δ SPREAD2_1	
Lags	Coeff.	p-value	Coeff.	p-value
0	282.03	0.000	265.64	0.000
1	324.29	0.000	319.85	0.000
2	333.20	0.000	334.89	0.000
3	315.40	0.000	318.71	0.000
4	277.50	0.000	279.27	0.000
5	226.12	0.000	224.52	0.000
6	167.89	0.000	162.42	0.000
7	109.42	0.023	100.91	0.028
8	57.33	0.246	47.95	0.307
9	18.26	0.698	11.49	0.799
10	-1.20	0.977	-0.50	0.990
11	5.60	0.900	19.92	0.692
12	45.26	0.574	80.70	0.386
Sum of Lags	2161.08	**0.000**	2165.76	**0.000**

Table 34: Polynomial Distributed Lag (PDL) Estimation of the Impact of the Futures Spread Changes on the U.S. non-SPR Crude Oil Inventory Changes

The dependent variable, ΔSTOCK, is the change in U.S. non-SPR crude inventories. Variable definitions are in Table 30. Lagged autoregressive error terms are included when needed. Any (+1) variables indicate a lead for that specific variable. The regression is run via OLS (Ordinary Least Squares) with the Newey-West heteroscedasticity adjustment. Data is weekly. Model 1 estimates over 12/11/1992 - 7/8/2011, has 969 observations and is presented with original and 1% winsorized data; Model 2, over 12/11/1992 - 4/9/2004, has 591 observations; Model 3, over 4/23/2004 - 7/8/2011, has 376 observations; Model 4, excludes Cushing from U.S. inventories for 4/23/2004 to 7/8/2011, has 377 observations.

Panel A.

	Model 1 Δ U.S. stock 1992-2011		Model 1 winsorized Δ U.S. stock 1992-2011	
	Coeff.	p-value	Coeff.	p-value
C	-1984.29	0.000	-1847.15	0.000
Δ(SPOT_WTI)	-29.23	0.420	-26.32	0.470
Δ(REFINERINPUTUS)	-1.03	0.017	-0.94	0.021
Δ(REFINERINPUTUS)(+1)	1.88	0.000	1.89	0.000
Δ(PROD_US)	4.21	0.000	4.18	0.000
Δ(PROD_US)(+1)	0.61	0.521	0.65	0.494
Δ(IMPORTS_US)	1.37	0.000	1.33	0.000
Δ(IMPORTS_US)(+1)	-0.90	0.000	-0.88	0.000
Z2	1111.54	0.000	1078.12	0.000
Z3	-96.63	0.000	-94.53	0.000
Z4	2.81	0.000	2.76	0.000
Z5	-0.03	0.000	-0.03	0.000
ΔPDL_1	454.26	0.021	444.08	0.023
ΔPDL_2	-68.21	0.152	-63.73	0.182
ΔPDL_3	-7.48	0.274	-6.96	0.304
ΔPDL_4	1.38	0.406	1.27	0.448
Joint Wald Test ΔPDL_1-ΔPDL_4		**0.017**		**0.018**
Adjusted R-squared	28%		28%	

Panel B.

	Δ SPREAD2_1		Δ SPREAD2_1	
Lags	Coeff.	p-value	Coeff.	p-value
0	295.49	0.157	301.47	0.147
1	435.43	0.002	429.92	0.002
2	518.91	0.001	506.33	0.001
3	554.24	0.002	538.32	0.002
4	549.70	0.004	533.53	0.005
5	513.61	0.009	499.58	0.010
6	454.26	0.021	444.08	0.023
7	379.96	0.054	374.67	0.057
8	299.00	0.123	298.96	0.124
9	219.70	0.224	224.59	0.217
10	150.34	0.327	159.18	0.302
11	99.24	0.438	110.35	0.386
12	74.69	0.670	85.73	0.621
Sum of Lags	4544.57	**0.005**	4506.70	**0.005**

Table 34 (Continued): Polynomial Distributed Lag (PDL) Estimation of the Impact of the Futures Spread Changes on the U.S. non-SPR Crude Oil Inventory Changes

Panel A.

	Model 2 Δ U.S. stock 1992-2004		Model 3 Δ U.S. stock 2004-2011		Model 4 Δ U.S. non-Cushing 2004-2011	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
C	-2558.21	0.000	-1557.91	0.066	-1330.06	0.067
Δ(SPOT_WTI)	-64.10	0.568	0.46	0.983	-34.02	0.262
Δ(REFINERINPUTUS)	-1.70	0.033	-1.30	0.000	-1.30	0.000
Δ(REFINERINPUTUS)(+1)	1.77	0.017	2.23	0.000	2.21	0.000
Δ(PROD_US)	4.02	0.092	3.02	0.000	3.00	0.000
Δ(PROD_US)(+1)	-0.22	0.909	-0.32	0.669	0.20	0.788
Δ(IMPORTS_US)	1.16	0.000	1.88	0.000	1.81	0.000
Δ(IMPORTS_US)(+1)	-0.71	0.004	-1.72	0.000	-1.54	0.000
Z2	1164.76	0.000	1160.14	0.000	1025.31	0.000
Z3	-97.58	0.000	-102.29	0.000	-90.76	0.000
Z4	2.77	0.000	2.95	0.000	2.64	0.000
Z5	-0.03	0.000	-0.03	0.000	-0.02	0.000
ΔPDL_1	1147.91	0.001	142.75	0.547	60.72	0.803
ΔPDL_2	-85.05	0.398	-54.83	0.324	-12.94	0.823
ΔPDL_3	-20.09	0.112	-5.31	0.393	-6.60	0.326
ΔPDL_4	-0.28	0.937	1.77	0.211	0.82	0.625
AR(1)	-0.15184	0.000	0.55464	0.000	0.47128	0.000
Joint Wald Test ΔPDL_1-ΔPDL_4		**0.001**		**0.584**		**0.3721**
Adjusted R-squared	21%		69%		61%	

Panel B.

	Δ SPREAD2_1		Δ SPREAD2_1		Δ SPREAD2_1	
Lags	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
0	995.87	0.046	-102.14	0.410	-277.19	0.061
1	1106.14	0.001	62.69	0.687	-142.57	0.364
2	1184.69	0.000	163.73	0.420	-45.85	0.828
3	1229.84	0.000	211.62	0.359	17.89	0.942
4	1239.89	0.000	217.00	0.367	53.61	0.834
5	1213.15	0.000	190.49	0.428	66.24	0.793
6	1147.91	0.001	142.75	0.547	60.72	0.802
7	1042.49	0.002	84.39	0.719	42.00	0.858
8	895.18	0.008	26.06	0.911	15.02	0.948
9	704.30	0.036	-21.62	0.923	-15.28	0.945
10	468.14	0.137	-48.00	0.815	-43.96	0.829
11	185.01	0.555	-42.44	0.804	-66.08	0.720
12	-146.78	0.739	5.67	0.969	-76.70	0.700
Sum of Lags	11265.80	**0.000**	890.20	**0.667**	-412.14	**0.848**

Table 35: Polynomial Distributed Lag (PDL) Estimation of the Impact of the Futures Spread Changes on PADD2 Crude Inventory Changes

The dependent variable, ΔSTOCK, is the weekly change in PADD2 crude inventories. Variable definitions are in Table 30. Any (+1) variables indicate a lead for that specific variable. The regression is run via OLS (Ordinary Least Squares) with the Newey-West adjustment. Data is weekly. Model 1 estimates over 12/11/1992 - 7/8/2011, has 968 observations and is presented with original and 1% winsorized data; Model 2, over 12/11/1992 - 4/9/2004, has 591 observations; Model 3, over 4/16/2004 - 7/8/2011, has 377 observations; Model 4, excludes Cushing from PADD2 inventories from 4/16/2004 to 7/8/2011, has 377 observations.

Panel A.

	Model 1 Δ PADD2 stock 1992-2011		Model 1 winsorized Δ PADD2 stock 1992-2011	
	Coeff.	p-value	Coeff.	p-value
C	-1020.25	0.000	-1028.80	0.000
Δ(SPOT_WTI)	16.82	0.219	14.43	0.276
Δ(REFINERINPUT2)	-1.88	0.000	-1.81	0.000
Δ(REFINERINPUT2)(+1)	0.38	0.360	0.35	0.388
Δ(PROD_US)	0.92	0.021	0.90	0.021
Δ(PROD_US)(+1)	0.58	0.095	0.56	0.103
Δ(IMPORTS2)	0.87	0.002	0.85	0.002
Δ(IMPORTS2)(+1)	-0.51	0.099	-0.51	0.087
Z2	344.50	0.000	341.92	0.000
Z3	-25.92	0.000	-25.62	0.000
Z4	0.68	0.000	0.67	0.000
Z5	-0.01	0.000	-0.01	0.000
ΔPDL_1	289.48	0.000	278.10	0.000
ΔPDL_2	-51.74	0.012	-48.89	0.012
ΔPDL_3	-2.59	0.228	-2.53	0.211
ΔPDL_4	0.72	0.289	0.70	0.269
Joint Wald Test ΔPDL_1-ΔPDL_4		**0.000**		**0.000**
Adjusted R-squared	13%		13%	

Panel B.

	Δ SPREAD2_1		Δ SPREAD2_1	
Lags	Coeff.	p-value	Coeff.	p-value
0	351.06	0.000	330.11	0.000
1	393.38	0.000	372.35	0.000
2	408.90	0.000	388.67	0.000
3	401.94	0.000	383.23	0.000
4	376.84	0.000	360.20	0.000
5	337.91	0.000	323.77	0.000
6	289.48	0.000	278.10	0.000
7	235.88	0.000	227.38	0.000
8	181.42	0.002	175.76	0.002
9	130.44	0.029	127.44	0.028
10	87.25	0.128	86.57	0.120
11	56.18	0.316	57.35	0.298
12	41.55	0.589	43.93	0.564
Sum of Lags	3292.21	**0.000**	3154.85	**0.000**

Table 35 (Continued): Polynomial Distributed Lag (PDL) Estimation of the Impact of the Futures Spread Changes on PADD2 Crude Inventory Changes

Panel A.						
	Model 2 Δ PADD2 stock 1992-2004		Model 3 Δ PADD2 stock 2004-2011		Model 4 Δ PADD2 non-Cushing 2004-2011	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
C	-850.00	0.000	-1073.35	0.002	-517.21	0.072
Δ(SPOT_WTI)	-15.93	0.735	19.03	0.212	-4.95	0.726
Δ(REFINERINPUT2)	-1.80	0.000	-2.23	0.001	-2.01	0.001
Δ(REFINERINPUT2)(+1)	0.64	0.225	-0.11	0.868	0.14	0.799
Δ(PROD_US)	0.06	0.897	1.49	0.001	0.95	0.015
Δ(PROD_US)(+1)	0.94	0.156	0.17	0.610	0.45	0.125
Δ(IMPORTS2)	0.71	0.047	1.23	0.004	0.80	0.026
Δ(IMPORTS2)(+1)	-0.47	0.238	-0.55	0.221	-0.26	0.499
Z2	309.33	0.000	383.50	0.000	197.52	0.008
Z3	-24.00	0.000	-28.71	0.000	-15.26	0.008
Z4	0.64	0.000	0.74	0.001	0.41	0.016
Z5	-0.01	0.000	-0.01	0.003	0.00	0.030
ΔPDL_1	602.68	0.000	205.46	0.002	37.57	0.497
ΔPDL_2	-109.90	0.000	-31.27	0.194	28.18	0.154
ΔPDL_3	-5.82	0.223	-2.14	0.429	-2.02	0.426
ΔPDL_4	2.89	0.008	0.03	0.970	-1.07	0.116
Joint Wald Test ΔPDL_1-ΔPDL_4		**0.000**		**0.001**		**0.3416**
Adjusted R-squared	11%		17%		5%	
Panel B						
	Δ SPREAD2_1		Δ SPREAD2_1		Δ SPREAD2_1	
Lags	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
0	428.66	0.023	309.69	0.005	27.66	0.784
1	645.63	0.000	304.65	0.000	-19.63	0.780
2	764.31	0.000	294.44	0.000	-38.76	0.558
3	802.02	0.000	279.24	0.000	-36.16	0.595
4	776.10	0.000	259.22	0.000	-18.28	0.782
5	703.87	0.000	234.57	0.001	8.45	0.889
6	602.68	0.000	205.46	0.002	37.57	0.497
7	489.84	0.000	172.08	0.013	62.67	0.240
8	382.70	0.001	134.61	0.064	77.28	0.160
9	298.58	0.007	93.23	0.205	74.97	0.190
10	254.81	0.017	48.11	0.484	49.31	0.395
11	268.73	0.020	-0.56	0.993	-6.15	0.922
12	357.67	0.027	-52.60	0.504	-97.85	0.261
Sum of Lags	6775.59	**0.000**	2282.15	**0.000**	121.08	**0.837**

Table 36: Polynomial Distributed Lag (PDL) Estimation of the Impact of the Futures Spread Changes on PADD 1, 3, 4, and 5 Crude Inventory Changes

The dependent variable, ΔSTOCK, is the change PADD 1,3,4 and 5 crude inventories. Variable definitions are in Table 30. Lagged autoregressive and moving average error terms are included when needed. Any (+1) variables indicate a lead for that specific variable. X denotes 1,3,4, and 5 for the PADD 1,3,4 and 5 equations respectively. The regression is run via OLS (Ordinary Least Squares) with the Newey-West heteroscedasticity adjustment. The weekly data is from 12/11/1992 to 7/08/2011 and has 968 observations**.**

	Δ PADD1 stock		Δ PADD3 stock		Δ PADD4 stock		Δ PADD5 stock	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
C	72.09	0.374	-650.44	0.289	-114.41	0.013	-520.45	0.064
Δ(SPOT_WTI)	1.48	0.803	-13.22	0.702	-0.05	0.989	-26.68	0.156
Δ(REFINERINPUT_X)	-0.71	0.109	-0.78	0.070	-2.00	0.000	-2.42	0.001
Δ(REFINERINPUT_X)(+1)	1.59	0.000	1.70	0.001	1.80	0.000	0.59	0.391
Δ(PROD_US)	0.18	0.547	0.95	0.384	0.10	0.222	1.71	0.003
Δ(PROD_US)(+1)	0.13	0.588	1.16	0.212	0.12	0.143	-1.05	0.102
Δ(IMPORTS_X)	0.60	0.000	1.22	0.000	0.20	0.413	1.47	0.000
Δ(IMPORTS_X)(+1)	-0.62	0.000	-0.91	0.000	-0.16	0.456	-0.67	0.015
Z2	7.19	0.723	506.15	0.000	52.65	0.000	253.93	0.000
Z3	-0.66	0.658	-45.68	0.000	-4.43	0.000	-22.61	0.000
Z4	0.01	0.740	1.37	0.000	0.13	0.000	0.66	0.000
Z5	0.00	0.793	-0.01	0.000	0.00	0.000	-0.01	0.000
ΔPDL_1	-4.30	0.830	152.87	0.352	-13.05	0.450	60.97	0.251
ΔPDL_2	16.59	0.154	0.75	0.986	-3.62	0.492	-25.18	0.245
ΔPDL_3	0.38	0.776	-3.93	0.512	0.65	0.347	-3.26	0.182
ΔPDL_4	-0.76	0.108	0.08	0.958	0.13	0.478	0.81	0.288
AR(1)	0.33	0.000			-0.12	0.002	-0.30	0.000
AR(2)	0.07	0.036						
MA(1)	-0.921	0.000						
Joint Wald Test ΔPDL_1-ΔPDL_4		**0.548**		**0.926**		**0.784**		**0.539**
Adjusted R-squared	34%		23%		7%		15%	

Table 37: Alternative Specification Models of the Impact of the Futures Spread Changes on Cushing Crude Inventory Changes. Alternatives Include - Using % Cushing Inventory Change as a Dependent Variable, Adding Lagged and Cross-PADD Controls

The dependent variable, ΔSTOCK, is the change in Cushing inventories. In Model 1, it is a percentage change * 100; in Models 2 and 3 it is the barrel change in inventories. Variable are defined in Table 30. Any (+ 1) variable indicates a lead for that specific variable, while (-1) is a lag. The regression is run via OLS (Ordinary Least Squares) with the Newey-West heteroscedasticity adjustment. Data is weekly. Models 1-3 estimate over 2004-2011, have 377 observations. Model 1 uses percentage instead of barrel ΔSTOCK, Model 2 adds lagged variables, Model 3 adds cross-PADD controls**.**

Panel A.

	Model 1 % Δ Cushing stock 2004-2011		Model2-with lags Δ Cushing stock 2004-2011		Model 3-with PADD3 Δ Cushing stock 2004-2011	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
C	-270.08	0.005	-515.15	0.036	-532.50	0.026
Δ(SPOT_WTI)	12.36	0.095	22.91	0.168	21.55	0.200
Δ(REFINERINPUT_2)(-1)			1.36	0.006		
Δ(REFINERINPUT_2)	-0.15	0.618	-0.03	0.961	-0.26	0.651
Δ(REFINERINPUT_2)(+1)	-0.17	0.577	-0.03	0.954	-0.17	0.774
Δ(PROD_US)(-1)			0.53	0.064		
Δ(PROD_US)	0.33	0.014	0.68	0.006	0.37	0.128
Δ(PROD_US)(+1)	-0.13	0.363	-0.20	0.385	-0.40	0.118
Δ(IMPORTS_2)(-1)			-0.34	0.393		
Δ(IMPORTS_2)	0.25	0.150	0.21	0.573	0.41	0.223
Δ(IMPORTS_2)(+1)	-0.09	0.556	-0.45	0.202	-0.43	0.225
Δ(STOCKS_3)					-0.03	0.121
Δ(IMPORTS_3)					0.26	0.001
Z2	91.97	0.000	178.13	0.004	194.89	0.001
Z3	-6.64	0.001	-13.24	0.005	-14.59	0.002
Z4	0.17	0.006	0.34	0.011	0.37	0.006
Z5	0.00	0.023	0.00	0.029	0.00	0.019
ΔPDL_1	62.55	0.001	164.07	0.001	173.22	0.000
ΔPDL_2	-23.22	0.001	-59.93	0.000	-59.11	0.000
ΔPDL_3	0.11	0.906	0.06	0.977	-0.18	0.924
ΔPDL_4	0.37	0.117	1.14	0.060	1.06	0.077
Joint Wald Test ΔPDL_1-ΔPDL_4		**0.000**		**0.000**		**0.000**
Adjusted R-squared	12%		17%		17%	

Panel B.

	Δ SPREAD2_1		Δ SPREAD2_1		Δ SPREAD2_1	
Lags	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
0	125.64	0.000	279.69	0.000	292.69	0.000
1	134.97	0.000	322.77	0.000	331.91	0.000
2	133.40	0.000	331.80	0.000	339.01	0.000
3	123.14	0.000	313.61	0.000	320.34	0.000
4	106.44	0.000	275.04	0.000	282.25	0.000
5	85.50	0.000	222.92	0.000	231.09	0.000
6	62.55	0.001	164.07	0.000	173.22	0.000
7	39.81	0.040	105.34	0.033	114.98	0.015
8	19.50	0.316	53.56	0.298	62.73	0.197
9	3.85	0.833	15.54	0.752	22.81	0.621
10	-4.92	0.760	-1.86	0.965	1.58	0.968
11	-4.59	0.811	8.18	0.848	5.39	0.901
12	7.07	0.840	52.49	0.494	40.58	0.607
Sum of Lags	832.35	**0.000**	2143.13	**0.000**	2218.59	**0.000**

Table 38: Alternative Specification Models of the Impact of the Futures Spread Changes on U.S. Crude Inventory Changes. Alternatives Include - Using % U.S. Inventory Change as a Dependent Variable and Adding Lagged Controls

The dependent variable ΔSTOCK, is the change in U.S. non-SPR inventories. In Models 1 and 2, it is the percentage change *100; in Models 3 and 4 it is the barrel change in inventories. Variable are defined in Table 30. Lagged autoregressive and moving average error terms are included when needed. Any (+ 1) variable indicates a lead for that specific variable, while (-1) is a lag. The regression is run via Ordinary Least Squares with the Newey-West heteroscedasticity adjustment. Data is weekly. Models 1 and 3 estimate over 1992-2011 and have 969 observations; Models 2 and 4 over 2004-2011 and have 377 observations.

Panel A.

	Model 1 % Δ U.S. stock 1992-2011		Model 2 % Δ U.S. stock 2004-2011		Model3-with lags Δ U.S. stock 1992-2011		Model4-with lags Δ U.S. stock 2004-2011	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
C	-61.454	0.000	-71.069	0.003	-2363.15	0.000	-2247.78	0.003
Δ(SPOT_WTI)	-1.032	0.366	-0.026	0.966	-25.61	0.451	8.44	0.648
Δ(REFINERINPUTUS)(-1)					-1.45	0.000	-0.55	0.092
Δ(REFINERINPUTUS)	-0.031	0.024	-0.040	0.000	-1.61	0.000	-2.16	0.000
Δ(REFINERINPUTUS)(+1)	0.062	0.000	0.065	0.000	1.45	0.000	1.80	0.000
Δ(PROD_US)(-1)					3.77	0.000	2.93	0.000
Δ(PROD_US)	0.142	0.000	0.088	0.000	5.11	0.000	5.03	0.000
Δ(PROD_US)(+1)	0.021	0.502	-0.018	0.409	0.60	0.559	0.28	0.669
Δ(IMPORTS_US)(-1)					0.90	0.000	1.49	0.000
Δ(IMPORTS_US)	0.044	0.000	0.057	0.000	2.05	0.000	3.21	0.000
Δ(IMPORTS_US)(+1)	-0.028	0.000	-0.055	0.000	-0.57	0.003	-1.11	0.000
Z2	34.913	0.000	41.034	0.000	1172.76	0.000	1275.53	0.000
Z3	-3.040	0.000	-3.519	0.000	-98.63	0.000	-108.28	0.000
Z4	0.089	0.000	0.101	0.000	2.81	0.000	3.08	0.000
Z5	-0.001	0.000	-0.001	0.000	-0.03	0.000	-0.03	0.000
ΔPDL_1	14.342	0.014	9.582	0.127	472.80	0.011	238.67	0.278
ΔPDL_2	-2.054	0.166	-1.600	0.331	-67.18	0.155	-84.50	0.084
ΔPDL_3	-0.254	0.220	-0.302	0.060	-9.18	0.146	-6.79	0.220
ΔPDL_4	0.041	0.428	0.061	0.141	1.24	0.447	2.16	0.084
AR(1)			0.609	0.000			0.57	0.000
AR(2)			-0.004	0.948				
AR(3)			-0.191	0.001				
Joint Wald Test ΔPDL_1-ΔPDL_4		**0.017**		**0.097**		**0.010**		**0.304**
Adjusted R-squared	28%		70%		31%		76%	

Table 38 (Continued): Alternative Specification Models of the Impact of the Futures Spread Changes on U.S. Crude Inventory Changes. Alternatives Include - Using % U.S. Inventory Change as a Dependent Variable and Adding Lagged Controls

Panel B.

	Δ SPREAD2_1		Δ SPREAD2_1		Δ SPREAD2_1		Δ SPREAD2_1	
Lags	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
0	8.69	0.186	-4.92	0.120	278.25	0.157	34.78	0.709
1	13.15	0.003	2.37	0.599	424.62	0.002	221.49	0.085
2	15.88	0.001	7.23	0.222	515.51	0.000	329.83	0.055
3	17.12	0.002	10.01	0.131	558.35	0.001	372.76	0.060
4	17.11	0.003	11.08	0.101	560.56	0.001	363.24	0.085
5	16.10	0.006	10.82	0.099	529.57	0.004	314.23	0.148
6	14.34	0.014	9.58	0.127	472.81	0.011	238.67	0.282
7	12.08	0.037	7.74	0.205	397.68	0.038	149.54	0.509
8	9.55	0.094	5.66	0.349	311.63	0.106	59.78	0.794
9	7.00	0.189	3.72	0.531	222.08	0.223	-17.65	0.936
10	4.69	0.306	2.27	0.680	136.45	0.375	-69.79	0.726
11	2.85	0.464	1.69	0.719	62.16	0.609	-83.68	0.595
12	1.73	0.747	2.34	0.560	6.64	0.967	-46.37	0.685
Sum of Lags	140.29	**0.003**	69.60	**0.211**	4476.30	**0.004**	1866.82	**0.340**

Table 39: Alternative Specification Models of the Impact of Futures Spread Changes on Cushing and U.S. (non-SPR) Crude Inventory Changes. Alternatives Include Using Monthly Seasonal Dummies and non-PDL Spread Structure

The dependent variable, ΔSTOCK, is the change in inventories for Cusing in Model 1 and for U.S (non-SPR) in Models 2 and 3. These models do not use ΔPDL spread terms and seasonal Z variables, but use actual spread lags and monthly dummy variables. Variable definitions are in Table 30. Lagged autoregressive and moving average error terms are included when needed. Any (+ 1) variables indicate a lead for that specific variable. X denotes PADD 2 data in Model 1 and U.S. data in Models 2 and 3. The regression is run via OLS (Ordinary Least Squares) with the Newey-West heteroscedasticity adjustment. Models 1 evaluates Cushing inventory changes from 2004-2001 has 377 observations; Model 2 U.S. inventory changes from 1992-2011 has 969 observations; Model 3 U.S. inventory changes from 2004-2011, has 377 observations.

	Model 1 (no PDL or Zs) Δ Cushing stock 2004-2011		Model 2 (no PDL or Zs) Δ U.S. stock 1992-2011		Model 3 (no PDL or Zs) Δ U.S. stock 2004-2011	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
C	490.84	0.004	-1990.45	0.000	-2020.14	0.010
Δ(SPOT_WTI)	4.86	0.727	-45.39	0.118	3.13	0.876
Δ(REFINERINPUT_X)	-0.15	0.817	-1.26	0.005	-1.50	0.000
Δ(REFINERINPUT_X)(+1)	-0.41	0.517	1.72	0.000	2.15	0.000
Δ(PROD_US)	0.40	0.139	3.90	0.000	2.77	0.000
Δ(PROD_US)(+1)	-0.31	0.275	0.21	0.825	-0.56	0.460
Δ(IMPORTS_X)	0.36	0.322	1.31	0.000	1.83	0.000
Δ(IMPORTS_X)(+1)	-0.31	0.405	-0.96	0.000	-1.82	0.000
JAN	-649.41	0.001	2539.72	0.000	3099.97	0.001
FEB	-565.73	0.012	2716.80	0.000	3359.83	0.000
MAR	-31.41	0.890	4205.47	0.000	4017.87	0.000
APR	-231.04	0.249	3486.20	0.000	3828.18	0.000
MAY	-477.90	0.035	2142.67	0.000	2295.30	0.016
JUN	-771.39	0.003	926.52	0.089	982.58	0.284
JUL	-297.25	0.269	1019.91	0.048	1201.85	0.186
AUG	-762.99	0.001	1059.09	0.047	1219.87	0.204
SEP	-934.94	0.000	690.61	0.236	698.94	0.450
OCT	-467.93	0.044	3273.74	0.000	3096.60	0.003
NOV	33.93	0.879	2187.38	0.000	2396.10	0.010
Δ Spread2(-1)	90.92	0.328	419.65	0.017	147.96	0.376
Δ Spread2(-2)	245.56	0.000	342.70	0.114	40.73	0.863
Δ Spread2(-3)	285.23	0.000	130.71	0.591	-20.67	0.943
Δ Spread2(-4)	164.99	0.022	419.62	0.068	176.90	0.480
Δ Spread2(-5)	176.31	0.001	478.21	0.055	483.24	0.030
Δ Spread2(-6)	97.54	0.097	882.58	0.001	754.19	0.008
Δ Spread2(-7)	176.81	0.009	565.98	0.069	521.06	0.090
Δ Spread2(-8)	95.09	0.177	240.18	0.395	168.80	0.600
Δ Spread2(-9)	6.05	0.907	189.11	0.446	-90.19	0.705
Δ Spread2(-10)	-28.03	0.536	22.72	0.899	-62.01	0.739
Δ Spread2(-11)	-55.49	0.298	-65.46	0.729	-59.92	0.741
Δ Spread2(-12)	77.16	0.143	220.94	0.318	82.74	0.609
AR(1)					0.58	0.000
AR(2)					-0.02	0.732
AR(3)					-0.13	0.049
Joint Wald Test Δ SPRD2		**0.000**		**0.039**		**0.252**
Adjusted R-squared	15%		28%		70%	

Table 40: Alternative Specification Models of the Impact of the Futures Spread Changes on Cushing and Total U.S. (non-SPR) Inventory Changes. Alternative Spread Definition is the Difference Between the Two-Month Future and the Spot WTI Crude Price

The dependent variable, ΔSTOCK, is the change in inventories for Cushing in Model 1 and for U.S (non-SPR) in Models 2 and 3. Variable definitions are in Table 30. Lagged autoregressive and moving average error terms are included when needed. Any (+ 1) variables indicate a lead for that specific variable. X denotes PADD 2 data in Model 1 and U.S. data in Models 2 and 3. The regression is run via OLS (Ordinary Least Squares) with the Newey-West heteroscedasticity adjustment. Data is weekly. Models 1 evaluates over 2004-2001, has 377 observations; Model 2, over 1992-2011, has 969 observations; Model 3, over 2004-2011, has 377 observations.

Panel A.

	Model 1 Δ Cushing stock 2004-2011		Model2 Δ U.S. stock 1992-2011		Model 3 Δ U.S. stock 2004-2011	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
C	-584.66	0.018	-1985.58	0.000	-1516.11	0.073
Δ(SPOT_WTI)	12.74	0.419	-34.42	0.347	3.46	0.876
Δ(REFINERINPUT_X)	-0.20	0.739	-1.03	0.017	-1.29	0.000
Δ(REFINERINPUT_X)(+1)	-0.27	0.661	1.88	0.000	2.25	0.000
Δ(PROD_US)	0.55	0.040	4.19	0.000	2.97	0.000
Δ(PROD_US)(+1)	-0.28	0.279	0.57	0.538	-0.44	0.553
Δ(IMPORTS_X)	0.44	0.203	1.37	0.000	1.89	0.000
Δ(IMPORTS_X)(+1)	-0.27	0.464	-0.90	0.000	-1.71	0.000
Z2	194.54	0.002	1107.82	0.000	1158.45	0.000
Z3	-14.05	0.003	-96.24	0.000	-102.24	0.000
Z4	0.35	0.011	2.80	0.000	2.95	0.000
Z5	0.00	0.036	-0.03	0.000	-0.03	0.000
ΔPDL_1	143.89	0.001	395.21	0.020	94.03	0.633
ΔPDL_2	-55.68	0.001	-57.10	0.111	-70.47	0.081
ΔPDL_3	-1.63	0.228	-7.28	0.142	-4.03	0.436
ΔPDL_4	1.43	0.009	1.24	0.275	1.64	0.122
AR(1)					0.55	0.000
Joint Wald Test ΔPDL_1-ΔPDL_4		**0.000**		**0.039**		**0.287**
Adjusted R-squared	13%		28%		69%	

Panel B.

	Δ SPREAD2_SPOT		Δ SPREAD2_SPOT		Δ SPREAD2_SPOT	
Lags	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
0	111.46	0.043	208.10	0.119	18.07	0.862
1	203.41	0.000	343.83	0.003	140.95	0.254
2	249.33	0.000	427.83	0.002	206.64	0.200
3	257.79	0.000	467.53	0.003	224.97	0.227
4	237.34	0.000	470.37	0.005	205.76	0.298
5	196.52	0.000	443.79	0.009	158.83	0.426
6	143.89	0.000	395.21	0.020	94.03	0.633
7	88.01	0.042	332.07	0.047	21.18	0.912
8	37.41	0.422	261.80	0.107	-49.90	0.788
9	0.66	0.989	191.85	0.205	-109.37	0.528
10	-13.70	0.731	129.64	0.323	-147.40	0.327
11	2.89	0.927	82.61	0.445	-154.17	0.175
12	58.98	0.236	58.20	0.637	-119.84	0.118
Sum of Lags	1574.00	**0.000**	3812.82	**0.010**	489.74	**0.772**

Table 41: Alternative Specification Models of the Impact of the Futures Spread Changes on Cushing and Total U.S. (non-SPR) Inventory Changes. Alternative Spread Definition Is the Difference Between the Three- and the One-Month WTI Crude Futures

The dependent variable, ΔSTOCK, is the change in inventories for Cusing in Model 1 and for U.S (non-SPR) in Models 2 and 3. Variable definitions are in Table 30. Lagged autoregressive and moving average error terms are included when needed. Any (+ 1) variables indicate a lead for that specific variable. X denotes PADD 2 data in Model 1 and U.S. data in Models 2 and 3. The regression is run via OLS (Ordinary Least Squares) with the Newey-West heteroscedasticity adjustment. Data is weekly. Models 1 estimates over 2004-2001, has 377 observations; Model 2, over 1992-2011, has 969 observations; Model 3, over 2004-2011, has 377 observations.

Panel A.

	Model 1 Δ Cushing stock **2004-2011**		Model2 Δ U.S. stock **1992-2011**		Model 3 Δ U.S. stock **2004-2011**	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
C	-554.72	0.029	-2001.48	0.000	-1656.81	0.053
Δ(SPOT_WTI)	24.64	0.167	-25.83	0.499	1.24	0.955
Δ(REFINERINPUT_X)	-0.21	0.724	-1.02	0.018	-1.30	0.000
Δ(REFINERINPUT_X)(+1)	-0.27	0.650	1.88	0.000	2.23	0.000
Δ(PROD_US)	0.55	0.037	4.20	0.000	3.02	0.000
Δ(PROD_US)(+1)	-0.27	0.271	0.61	0.514	-0.32	0.662
Δ(IMPORTS_X)	0.43	0.208	1.37	0.000	1.89	0.000
Δ(IMPORTS_X)(+1)	-0.27	0.452	-0.90	0.000	-1.71	0.000
Z2	185.02	0.003	1114.38	0.000	1174.50	0.000
Z3	-13.36	0.005	-96.90	0.000	-103.20	0.000
Z4	0.33	0.014	2.82	0.000	2.98	0.000
Z5	0.00	0.041	-0.03	0.000	-0.03	0.000
ΔPDL_1	105.49	0.001	326.70	0.008	146.23	0.340
ΔPDL_2	-38.47	0.003	-43.97	0.184	-22.10	0.554
ΔPDL_3	-0.19	0.886	-5.04	0.260	-4.27	0.313
ΔPDL_4	0.71	0.110	0.93	0.423	0.83	0.402
AR(1)					0.55	0.000
Joint Wald Test ΔPDL_1-ΔPDL_4		**0.000**		**0.008**		**0.795**
Adjusted R-squared	15%		28%		69%	

Panel B.

	Δ SPREAD3_1		Δ SPREAD3_1		Δ SPREAD3_1	
Lags	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
0	175.92	0.003	207.33	0.157	-53.42	0.587
1	204.23	0.000	303.79	0.002	46.67	0.657
2	210.84	0.000	362.15	0.000	113.42	0.391
3	200.00	0.000	388.02	0.001	151.79	0.310
4	175.98	0.000	387.00	0.001	166.74	0.284
5	143.06	0.000	364.69	0.003	163.24	0.293
6	105.49	0.001	326.70	0.008	146.23	0.340
7	67.54	0.042	278.63	0.025	120.69	0.428
8	33.49	0.346	226.08	0.069	91.57	0.546
9	7.59	0.828	174.65	0.137	63.83	0.665
10	-5.89	0.845	129.96	0.197	42.44	0.754
11	-2.68	0.925	97.59	0.257	32.34	0.779
12	21.48	0.665	83.17	0.498	38.51	0.711
Sum of Lags	1337.03	**0.000**	3329.74	**0.001**	1124.05	**0.403**

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Appendix 1: Polynomial Distributed Lag (PDL) Model

An example of how we set up a fourth degree PDL model is shown below based on the distributed lag model using twelve lags of X, which in our main model is ΔSPREAD:

$$Y_t = \lambda + \beta_0 X_t + \beta_1 X_{t-1} + \cdots + \beta_{12} X_{t-12} \tag{A.1}$$

where β_i can be approximated by a fourth degree polynomial:

$$\beta_i = \alpha_0 + \alpha_1 i + \alpha_2 i^2 + \alpha_3 i^3 + \alpha_4 i^4 \qquad \text{where } i = 1 \text{ to } 12$$

$$\begin{aligned}
\beta_0 &= \alpha_0 \\
\beta_1 &= \alpha_0 + \alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 \\
\beta_2 &= \alpha_0 + \alpha_1 2 + \alpha_2 2^2 + \alpha_3 2^3 + \alpha_4 2^4 \\
\beta_3 &= \alpha_0 + \alpha_1 3 + \alpha_2 3^2 + \alpha_3 3^3 + \alpha_4 3^4 \\
&\vdots \qquad \vdots \qquad\quad \vdots \qquad\qquad \vdots \\
\beta_{12} &= \alpha_0 + \alpha_1 12 + \alpha_2 12^2 + \alpha_3 12^3 + \alpha_4 12^4
\end{aligned} \tag{A.2}$$

Substituting β_i from Equation (A.2) into the distributed lag Equation (A.1), and transforming it yields:

$$\begin{aligned}
Y_t = \lambda &+ \alpha_0 X_t + (\alpha_0 + \alpha_1 + \alpha_2 + \alpha_3 + \alpha_4) X_{t-1} + (\alpha_0 + \alpha_1 2 + \alpha_2 2^2 + \alpha_3 2^3 + \alpha_4 2^4) X_{t-2} \\
&+ (\alpha_0 + \alpha_1 3 + \alpha_2 3^2 + \alpha_3 3^3 + \alpha_4 3^4) X_{t-3} + \cdots + (\alpha_0 + \alpha_1 12 + \alpha_2 12^2 + \alpha_3 12^3 + \alpha_4 12^4) X_{t-12}
\end{aligned}$$

which can be rewritten as:

$$\begin{aligned}
Y_t = \lambda &+ \alpha_0 (X_t + X_{t-1} + X_{t-2} + \cdots + X_{t-12}) + \alpha_1 (X_{t-1} + 2X_{t-2} + 3X_{t-3} + \cdots + 12X_{t-12}) + \cdots \\
&+ \alpha_4 (X_{t-1} + 2^4 X_{t-2} + 3^4 X_{t-3} + \cdots + 12^4 X_{t-12})
\end{aligned}$$

or

$$Y_t = \lambda + \alpha_0 Z_{0t} + \alpha_1 Z_{1t} + \alpha_2 Z_{2t} + \alpha_3 Z_{3t} + \alpha_4 Z_{4t}$$

where the Z variables are constructed using 12 lags of X:

$$Z_{0t} = X_t + X_{t-1} + X_{t-3} + \cdots + X_{t-12}$$
$$Z_{1t} = X_{t-1} + 2X_{t-2} + 3X_{t-3} + \cdots + 12X_{t-12}$$
$$Z_{2t} = X_{t-1} + 2^2 X_{t-2} + 3^2 X_{t-3} + \cdots + 12^2 X_{t-12}$$
$$Z_{3t} = X_{t-1} + 2^3 X_{t-2} + 3^3 X_{t-3} + \cdots + 12^3 X_{t-12}$$
$$Z_{4t} = X_{t-1} + 2^4 X_{t-2} + 3^4 X_{t-3} + \cdots + 12^4 X_{t-12}$$