Do Foreign Gifts Buy Corporate Political Action? The Causes and Consequences of the Saudi Crude Discount Program

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Abstract

Between 1991 and 2003, Saudi Aramco sold its crude to U.S. refineries at a substantial discount relative to Asian refineries at a total cost of approximately 8.5 billion USD. Using variation in discount receipts across refineries over time, I find that the discount rents were entirely captured by refiners as profits and were not passed through to consumers in the form of lower retail gasoline prices. There is also evidence that the discount policy affected refiners' political action. In particular, I find that discount receipts are associated with an increase in refiners' overall political donations, and that other types of profit shocks were not associated with changes in political giving. This suggests that the effect of the discount was not simply a consequence of the increase in refining profits. Finally, I show that the discount resulted in a reallocation of contributions toward members of congressional committees that reviewed bills of interest to Saudi Arabia and away from those who received donations from pro-Israel interest groups.

1 Introduction

Political and economic concerns are fundamentally linked in the world petroleum market. Access to a dependable oil supply is critical to economic and political stability, and these supplies are very dependent on local political climates. Oil is used as a political tool by suppliers, and is a frequent topic of diplomatic intervention. At the center of this is Saudi Aramco, the world's largest single producer of crude oil and holder of 25 percent of global reserves. Because of its position as a global swing producer, the economic and political drivers of its output decisions attract a great deal of attention.

In addition to deciding how much to produce, however, Saudi Arabia also decides where to sell its crude, a decision which receives much less attention but which is perhaps no less strategic. From 1991 to 2003, Saudi Arabia maintained a position as the top supplier of foreign crude to U.S. refiners in order to support its political alliance with the United States. Although oil is often thought of as having one world price, Saudi Aramco supported this export strategy by selling the same crude at different prices in different geographic markets. Maintaining the pricing differentials required by its export targets appears to have been both politically strategic and quite expensive: between 1991 and 2003, Saudi Arabia spent approximately 8.5 billion USD selling discounted crude to the United States. The per-barrel discount relative to the Asian price reached a high of 6.30 USD, 30 percent of the U.S. crude price in 2001, and was worth 1.9 billion dollars that year alone. In achieving its export target, Saudi Arabia therefore transferred substantial rents to the U.S. oil industry in the form of discounted crude supplies. In addition to determining the total value of this transfer through its export quotas and pricing policies, Saudi Arabia also controlled how these rents were distributed within the United States; discounted crude was targeted at specific refineries using highly restrictive sales contracts.

Despite the magnitude of this transfer, the Saudi crude discount program has received almost no attention in the academic literature or in the popular press.[1] The first task of this paper is to document both the size of these rents and identify the refiners that received this gift. This paper then evaluates the success of this allocation mechanism as a political tool by identifying where rents accrued as a result of the policy and how these rents affected political action by discount recipients. To do this, I first determine where rents were captured by estimating the effect of discounts on refinery-owner profits and local gasoline prices. I then examine the effect of discount receipts on one particular type of measurable corporate political action: contributions to congressional campaigns. The analysis follows the money from the original oil shipment to the campaign funds of federal politicians.

The empirical analysis relies on several key features of the market for Saudi crude in the United States. All U.S. refiners pay the same official per-barrel price for Saudi crude each month, but quantities differ both across refineries and within a single refinery from month to month. These quantities are based on long-term contracts, but are subject to unilateral changes by Saudi Aramco

[1] Despite considerable attention to Saudi Arabia's petroleum production and exports, *The Quest* – Daniel Yergin's history of the world energy market post 1991 – never mentions this program.

each month. This yields variation in the total value of the discount to each refinery, which in turn creates variation in discount receipts across refining companies and in the geographical distribution of discounted crude. Because of this, it is therefore possible to estimate the effect of the discount on company-level outcomes (profits and political contributions) and market-level prices for refined products.

There are several key results. First, I find that there was a great deal of heterogeneity in the value of the discount received by different companies and significant geographical dispersion in the destination of Saudi crude. Despite their similar refining capacities, for example, refiners Marathon and Tosco received very different amounts of Saudi crude: a total of 680 million barrels were delivered to Marathon's refineries, and just 20 million to Tosco refineries over the period. The amount received also varied considerably from year to year; in just one year, Marathon's crude receipts increased from 41 million barrels in 1997 to 75 million barrels in 1998. Similar variation is found across refineries and within a single refinery over time; Chevron's Richmond refinery near Oakland received 118 million barrels of Saudi crude over the period, with annual receipts varying by as much as 24 million barrels from year to year. The nearby (and similarly-sized) refinery in Martinez, which was owned by Shell for most of the period, processed no Saudi crude.

This variation allows for an estimation of the impact of discount receipts both on refiner profits and gasoline prices in local markets. Correspondingly, the second result is that most of the discount rents were captured by refinery owners as profits rather than passed through to consumers as lower gasoline prices. This is to be expected given that the discount was targeted only at certain refineries, so the effect on market-level costs tended to be infra-marginal. The capture of rents appears to have been almost complete, supporting the idea that the discount was purposefully targeted at specific refiners. Finally, I find that discount receipts affected refining company political contributions, with recipients targeting more of their financial support to politicians on committees that considered bills of interest to Saudi Arabia. I also find that funds tended to be diverted away from congressmen who received donations from pro-Israel interest groups.

The results described above tie together several different areas of study. First, although the Asian price premium (or, U.S. discount) for Saudi crude has attracted occasional comment in the trade press on petroleum markets, it has received very little attention in the academic energy literature. Exceptions are several papers that have attempted to explain the premium in terms of models of price discrimination[2] or regulatory distortions[3]. Other papers have discussed strategies for Asian consuming nations to reduce or eliminate the premium through regulatory reform (Ogawa 2003) or by improving pipeline infrastructure (Jaffe & Soligo 2004).

This paper also provides evidence on the incidence of non-marginal cost changes in the oil

[2] Soligo & Jaffe (2000) model Saudi Aramco's pricing decision as that of a dominant firm operating in two fully separated markets and assert that Asian/European price ratio is consistent with reasonable values of supply and demand elasticities and Saudi market shares. In a response, Parsons & Brown (2003) propose an alternative model of international oil markets as a Cournot duopoly, with Gulf OPEC producers competing in both markets with local suppliers.

[3] Horsnell (1997) argues that government involvement in Asian procurement has been at least partially responsible for the higher prices Asian firms pay for oil.

refining industry. Borenstein & Kellogg (2012) examine the effect of a similar change in average input costs caused by the oil glut in the U.S. Midwest beginning in early 2011. As in this paper, they find that the relative decrease in local crude oil prices did not pass through into wholesale gasoline and diesel prices, and conclude that refiners must have received the rents generated by the crude price shock. This paper complements their analysis by examining a setting with richer variation in cost changes and showing that not only was the cost decrease not passed through into prices, but that it was instead captured by refiners as profits rather than by retailers or other market intermediaries.

In addition to documenting the existence and incidence of the discount, this paper also adds a quantitative dimension to the literature on the political economy of global energy markets. As far as I know, this paper is the first to provide empirical evidence for the use of Saudi oil not only directly as a tool of political leverage, but through transfers to American companies. The political motivations behind Saudi supply patterns have been previously examined from a historical perspective, notably by Moran (1981) and more recently in a comprehensive history by Jaffe & Elass (2007). Moran (1981) argues that OPEC behavior is best understood by looking at the political motivations of Saudi Arabia between 1973 and 1980. In an unpublished working paper, Jaffe & Elass (2007) similarly argue that Saudi Aramco's strategies and aims have been often designed to meet the kingdom's foreign policy goals; they outline the kingdom's policy of maintaining a position as the top global supplier of crude to the United States beginning in 1990, and provide a historical survey that follows the eroding relationship between the two countries and subsequent policy reversal in 2003.

The rest of the paper proceeds as follows. Section 2 gives some background on U.S.-Saudi relations, and Section 3 describes the history of the discount policy and how Saudi Aramco targeted the discount rents. Section 4 provides evidence on who captured the discount rents, and Section 5 discusses how discount receipts affected political action by U.S. oil refiners. Section 6 concludes.

2 Background: U.S.-Saudi Relations

2.1 Aramco Before Nationalization

Although the discount policy did not begin until 1990, the defense of Saudi political interests by American oil companies began in the 1930s with the simultaneous foundation of Saudi Arabia and its oil concession to an American oil company. What followed over the next sixty years was the evolution of a complex web of political and economic connections between the Saudi government, a consortium of American oil companies, and the U.S. government. Throughout this period, the Saudi government used its oil to try to influence U.S. foreign policy, with U.S. oil companies acting as both its willing conduits and active partners.

The Kingdom of Saudi Arabia was founded by King Abdul-Aziz Ibn Saud in September of 1932, four months after Standard Oil of California (SoCal, now Chevron) discovered oil in Bahrain. The United States recognized the country in 1933, the same year that the King granted SoCal an

exclusive sixty-six year concession for oil exploration and production in the al-Ahsa region (FTC 1952). The King hoped that this concession to the geographically distant United States would protect the kingdom from the more immediate interference of the British (Jaffe & Elass 2007). In 1936, SoCal joined with Texaco to form the California-Arabian Standard Oil Company (Casoc), which first struck oil at Dammam Well No. 7 in 1938. Impressed by the discovery, the king extended Casoc's original concession to cover a 440,000 square mile area of Saudi Arabia (Sampson 1975, 109). This discovery also prompted President Roosevelt to charge the Secretary of State with protecting U.S. interests in the Saudi oil concession (Jaffe & Elass 2007). Following the subsequent discovery of three more major oil fields, the company was renamed Aramco (the Arabian-American Oil Company) in 1944.

The consortium of American partners expanded following the Second World War, with what later became Mobil and Exxon buying in to the partnership. The kingdom also began to take a more active role in the company, with Saudi representatives joining the newly-formed Executive Committee in 1950. To bolster its alliance with Saudi Arabia and to protect the company against nationalization pressures, the U.S. government arranged a deal in December 1950 to give 50 percent of Aramco's profits to the kingdom as a "tax", which was deducted from the taxes owed by the consortium companies to the U.S. government (Yergin 1991, 447). This was the first in a series of moves by the U.S. government to use Aramco as a channel of influence between the two countries.

By the Arab-Israeli wars of the 1960s and 1970s, the company had become both a source of leverage for the United States as well as a representative of Saudi foreign policy toward the U.S. In 1967, oil minister Sheikh Yamani warned the U.S. of the "consequences" of giving aid or support to Israel, sending his message through Aramco for emphasis (Brown 1999, 268). Another account quotes Yamani as saying that "if the United States directly supports Israel, Aramco can anticipate being nationalized 'if not today, then tomorrow.' If the U.S. does not stay out of this conflict, the U.S. is finished in the Middle East." (*Foreign Relations of the United States*, 1967).

The company managed to resist full nationalization over the next few decades, with the country instead opting to slowly increase its profit share and replace American managers with Saudi personnel. As Saudi influence over the company grew and the political situation in the Middle East deteriorated, the American consortium began to feel increasing tension between the interests of the Saudi and U.S. governments. Following the outbreak of the Yom Kippur War, Aramco's American partners advocated for the Saudi political agenda. In May of 1973, the directors of Exxon, Mobil, Texaco and SoCal called on their contacts at the State Department, the Pentagon and the White House to urge the government to support the Saudi position in the Arab-Israeli hostilities (Sampson 1975, 292-293). On June 21, 1973, Mobil published an "advertorial" in the New York Times calling on the U.S. government to join with the Soviet Union in insisting on a peace agreement in the Middle East. The article argued that continued American prosperity depended on U.S. support of Saudi interests in the Middle East, and warned that "political considerations may become the critical element in Saudi Arabia's decisions, because we need the oil more than Saudi Arabia will need the money" (*New York Times*, 1973). Oil minister Yamani later wrote to Mobil's

president praising the ad and calling it a "positive step".[4] That July, SoCal's chairman sent out his own letter to the company's employees and shareholders asking them to pressure their representatives to "acknowledge the legitimate interests of all the peoples of the Middle East" and encourage Washington to improve relations with Arab governments (Sampson 1975, 294). On October 12, six days after the start of the Yom Kippur War, the chairmen of Exxon, Texaco, Mobil and SoCal sent a joint memo to President Nixon's chief of staff warning that U.S. aid to Israeli forces would result in "a critical and adverse effect on our relations with the moderate Arab producing countries" and the loss of American influence in the region "to the detriment of both our economy and our security" (Sampson 1975, 300). Indeed, the oil embargo began five days later on October 17th, and Aramco was compelled to enforce the Saudi boycott of oil sales to the U.S. and other Israeli supporters to maintain its concession.

In 1981, American oil companies again inserted themselves in the middle of Saudi-U.S. diplomacy concerns preceding the controversial sale of the AWACS (Airborne Warning and Control System) surveillance planes, which was proposed by the Reagan administration.[5] Once again, the oil industry launched an extensive political campaign in support of Saudi Arabia. Mobil in particular spent more than half a million dollars on full-page advertorials in the New York Times, again emphasizing the importance of the economic partnership between Saudi Arabia and the United States. Mobil's president also personally called Arkansas senator David Pryor to lobby for the sale (Bard 2010). Congress eventually approved the landmark sale, despite strong opposition from American voters, the State of Israel, and the Israel lobby.

In the meantime, Aramco's ownership had been slowly transferred to the Saudi government, with Saudi Arabia completing its purchase of Aramco's assets by the end of 1980. American interests continued to manage the company, however, and the final paperwork for full nationalization was not signed until 1990 (Yergin 1991, 652). During this time, a precursor to the discount scheme resulted in Yamani's termination as oil minister. In 1986, Yamani had been charged by the king to both increase Saudi production and to increase the worldwide oil price. Yamani thought this was impossible, and instead offered some customers a secret 50 cent-per-barrel discount on their contract price to try to meet the production quotas. The discount caused overall oil prices to fall and spurred tensions with other OPEC members, and the King relieved the previously highly successful oil minister of his post. This action announced the King's intention to control oil policy more directly rather than working through OPEC (*New York Times* 1986, *PIW* 1986, *Financial Times* 1986, Adelman 1995, Jaffe & Elass 2007).

[4] In an extremely bizarre incident, Mobil Oil took out another full-page ad in the New York Times on May 8, 1980 regarding a documentary called "Death of a Princess" that was set to air on PBS two days later. The film told the story of a young Saudi princess who had been publicly executed for committing adultery. It was considered extremely unflattering by the Saudi regime, and Mobil (which was one of the major supporters of PBS) called on the network to cancel the broadcast. The last line of the article read:

"We hope that the management of the Public Broadcasting Service will review its decision to run this film and exercise responsible judgment in the light of what is in the best interest of the United States." (*New York Times*, 1980).

[5] James Atkins, former Ambassador to Saudi Arabia, predicted that Saudi Aramco would keep the crude price at 32 dollars if the AWACS sale was allowed to proceed (Adelman 1993).

After nearly sixty years of Saudi-U.S. partnership, control of Aramco passed fully to the Saudi government in 1990. Even without its American partners, the newly-independent Saudi Aramco would continue in its role as a critical conduit for diplomatic relations between Saudi Arabia and the United States.

2.2 Diplomacy After Nationalization: "Oil for Security"

Just as the American-owned Aramco served as an intermediary for American and Saudi interests through the 1980s, Saudi Aramco has continued to work to achieve the kingdom's foreign policy goals since nationalization. While the company's core mission is to maximize oil revenues, these goals are often superseded by the government's foreign policy agenda. The most significant examples of this are the use of Saudi Arabia's considerable excess production capacity to stabilize U.S. oil supplies and the U.S. export quota policy.

Saudi Aramco has used its excess capacity at key moments to serve U.S. economic interests during oil supply emergencies. The first such incident occurred just after full nationalization in 1990, when Iraqi forces invaded Kuwait at the start of the first Gulf War. As promised, American forces were immediately deployed to Saudi Arabia, and President Bush sent a letter to King Fahd requesting that the kingdom immediately increase production in order to replace lost U.S. crude supplies from Iraq and Kuwait. The King agreed, and within three months the company had raised production by 2 million barrels per day (bpd) to 7.3 million bpd. The oil price, which had surged to 40 dollars per barrel on the news of the invasion and UN boycott, fell immediately back to pre-invasion levels (Jaffe & Elass 2007). Another notable instance of this strategic export expansion occurred in 2002, when Saudi Aramco pledged to replace U.S. supplies lost during the Venezuelan oil strike. In return for this type of strategic assistance, the U.S. provided the Saudis with domestic intelligence, protection against external threats, and advanced weaponry. The American commitment to protect the Gulf states was first explicitly stated in 1980[6] and later reiterated by President Reagan, who specifically articulated a commitment to intervene to protect Saudi Arabia in particular. This commitment was borne out most clearly at the beginning of the Gulf War, when American forces arrived in Saudi Arabia less than two weeks after the invasion of Kuwait.

The United States is also by far the main supplier of military equipment to Saudi Arabia, with U.S. supplies accounting for 66.4 percent of Saudi arms imports between 1990 and 2010 (SIPRI, 2011). In 1990, President Bush waived a number of congressional bans to proceed with a multi-billion dollar arms sale to Saudi Arabia that included F-15s, Stinger and Patriot missiles and launchers, M60A3 and Abrams tanks, Apache and Blackhawk helicopters and other equipment (SIPRI, 2011). The size of these arms deals continued to increase throughout the 1990s under both the Bush and Clinton administrations (Figure 1).

[6] "Let our position be absolutely clear: An attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States of America, and such an assault will be repelled by any means necessary, including military force."
President Jimmy Carter, *State of the Union Address*, 1980.

2.3 Saudi Interests in the Middle East Peace Process

In addition to security and weapons, Saudi Arabia's other main diplomatic concern has been American engagement in the Israeli-Palestinian peace process. Saudi Arabia has long supported Palestinian claims to sovereignty, and has used its economic and diplomatic relationship with the United States to pursue this agenda. Indeed, the most overt use of Saudi oil as a political weapon occurred before 1990, with the threatened expropriation of Aramco in 1967 and the oil embargo of 1973, both of which occurred in response to American support of Israeli military actions. Since then, Saudi advocacy has focused mostly on U.S. diplomacy toward Israel.

There have been several notable instances where the Saudi regime has put diplomatic pressure on the United States to intervene in the Arab-Israeli conflict. Following the surge in violence that followed the failure of the 2000 Camp David summit, Crown Prince Abdullah reportedly refused an invitation to visit Washington in June 2001 to indicate Saudi displeasure over insufficient U.S. efforts to prevent Israeli military action against Palestinians (*New York Times*, 2001a). Later that year (and less than two months after the September 11th attacks), the Saudi Foreign Minister declared that the Saudi government was "angrily frustrated" with the Bush administration's failure to engage with the Palestinian leadership in the peace process (*New York Times*, 2001b). Crown Prince Abdullah subsequently proposed a new Saudi-backed peace plan, which was adopted by the Arab League in 2002. Despite repeated diplomatic pressure from Saudi Arabia, however, the U.S. failed to pressure Israel to accept the plan and U.S.-Saudi relations continued to deteriorate. As described in the next section, this deterioration in diplomatic relations coincided with the abandonment of the discount policy.

3 The Discount Policy

3.1 History

The discount policy began in 1990 as a politically-motivated export quota policy. Following Aramco's full nationalization and transition to Saudi control, King Fahd directed the company to maintain a position as the top supplier of foreign crude to the United States. The stated purpose of this policy was to cement Saudi Arabia's strategic alliance with the United States by making itself critical to U.S. energy security. Achieving the quota on a month-to-month basis was initially quite straightforward; Aramco supplied as much as a third of total U.S. imports in the early 1990s while keeping the U.S. price for Saudi crude roughly the same as the world price. By the end of the decade, however, increasing competition from Mexico, Venezuela and Canada forced Aramco to cut its U.S. prices to defend its market share (Figure 2). The discount reached a high of $6.30 per barrel in 2001, 30 percent of the U.S. selling price at the time (Figure 3). The total value of the discount over the policy period from 1991-2003 was 8.5 billion dollars.

As the discount became larger, the Saudi government faced increasing pressure from Aramco

to abandon the expensive quota policy.[7] Faced with a string of political disappointments at the beginning of the 2000s, the Saudi government also began to question the benefits of a close alliance with the United States.[8] Saudi Arabia also began to feel the political strain of its relationship with the U.S. Although Saudi Arabia declined to participate in Operation Iraqi Freedom in 2003 (and voiced its disapproval of American intervention in Iraq), it became a target of a string of Al Qaeda attacks in the aftermath of the war. Tensions again worsened after the report on the 9/11 terrorist attacks described alleged Saudi links with the hijackers and funding sources from within the Saudi government. At the same time, Saudi pressure for the U.S. to intervene in the escalating Arab-Israeli conflict went unheeded, and President Bush declined to intervene with Israel in support of King Abdullah's proposed peace plan. In light of the lackluster geopolitical response of the United States to Saudi interests, the commercial costs of the export policy seemed too great.

The policy was suspended in 2003, with Aramco allowing the average discount to fall to zero and ceding the top exporter spot to Canada.[9] Saudi crude exports, which had averaged 15.9 percent of total gross imports in the first half of 2003, fell to 13.1 percent in the second half of the year and then to 11 percent in the beginning of 2004. Industry observers noted the apparent policy change[10], and Saudi Aramco President Abdullah Jumah publicly acknowledged the shift in February 2005[11].

3.2 Discount Distribution

The prices that refiners pay for Saudi crude deliveries are determined by Aramco's Official Selling Prices, or OSPs. Aramco's OSP announcement is made about a month in advance of delivery, and consists of a differential relative to the spot price of a different benchmark crude for each of the four markets (see Figure 4). Over the policy period, these benchmark crudes were West Texas Intermediate (WTI) for the U.S., dated Brent for Europe and the Mediterranean, and the Oman-Dubai average (ODA) for Asia. These differentials reflect factors such as the quality differences between the marker crude and the Saudi crudes, transportation costs[12], and product prices in different markets. The price that refiners pay is then calculated using the previously announced differential and the average price of the marker crude over the month. Figure 4 shows a sample OSP release from Platts from December 2001 announcing the pricing differentials on January deliveries.

For example, the January differentials for Arab Light to the U.S. and Asia were -4.05 and +0.25,

[7] For more details see Jaffe & Elass (2007).

[8] Saudi arms purchases also fell dramatically after 2000, dropping from 1.7 billion dollars a year from 1990-1999 to .5 billion from 2000-2011.

[9] At the same time, all American troops were withdrawn from Saudi Arabia in September 2003.

[10] "Has Saudi Arabia abandoned its pivotal policy of being the largest crude supplier to the U.S.? The world's top oil exporter has long had the biggest share of the world's largest oil market and has favored volume over price to retain the top spot. Intriguingly, since the spring of last year, in the wake of the U.S.-led invasion of Iraq, the Saudis have ceded their prime position to others."("Saudis Drop Volume, Lose U.S. Top Spot" *Petroleum Intelligence Weekly*, May 12, 2004.)

[11] Jad Mouawad and Simon Romero, "Saudis in Strategy to Export More Oil to India and China," *The New York Times*. February 18, 2005.

[12] Although Aramco considers differences in transportation costs in determining the price differentials, all OSPs reflect fob prices and do not include transportation.

respectively. During January, the average WTI price was 19.48 dollars per barrel, and the average spot prices of the Oman and Dubai crude markers was 18.34 dollars per barrel. The price paid by U.S. refiners for January deliveries of Arab Light was $19.48 - 4.05 = 15.43$ dollars per barrel, and the price for Asian refiners was $18.34 + 0.25 = 18.59$ dollars per barrel. The value of the "discount" that month was therefore the difference between the realized Asian and U.S. prices, i.e. $18.59 - 15.43 = 3.16$.

$$\begin{aligned}
\text{Discount} &= \text{Asian Price} - \text{U.S. Price} \\
&= (\text{ODA} + \text{Asia Differential}) - (\text{WTI} + \text{U.S. Differential}) \\
&= (18.34 + 0.25) - (19.48 - 4.05) \\
&= 18.59 - 15.43 \\
&= 3.16.
\end{aligned}$$

In addition to dictating the prices that refiners pay, Saudi Aramco also directly controls how much crude each refinery receives each month. Saudi Aramco only sells crude through long-term contracts with specific refineries, and crude resale is not permitted. Although many petroleum producers trade their crude on a spot basis and/or allow their crude to be traded by buyers *ex post*, Saudi Aramco does neither and keeps tight control over where its crude is processed. Any resale by refiners results in permanent blacklisting from future contracts, and even companies that refine Saudi crude in multiple locations must specify the particular refinery where they will process each shipment. Refineries must therefore be prepared to either process or store whatever quantity they receive in a particular month. Contract quantities are specific to refinery capacity to process Saudi crude, and potential buyers submit detailed contract applications to the Crude Oil Sales Department in Dhahran that provide refinery specifications and operating figures as well as audited balance sheets and detailed corporate profiles. Once approved, these contracts may then be renewed on an annual basis at the discretion of the refinery and Saudi Aramco.

Despite the rigidity of the contract rules for refiners, the actual delivered quantities vary significantly from month to month. While annual contracts specify the quantity that refiners are willing to buy in terms of barrels per day, deliveries are subject to unilateral cuts by Aramco. Quantities may be cut, for example, following a decrease in OPEC quotas or a mandate from the Saudi government[13] Indeed, there is significant monthly variation in the quantities that buyers receive each month, both at the refinery and company level (Figure 3). Although Aramco frequently changes quantity deliveries, it is very unusual for refiners to cut their orders even when prices are high.[14]

[13] In practice, Saudi Aramco can at its discretion give some flexibility to buyers to switch between the several crude grades it produces or to ask for a change in the total quantity. In the month prior to delivery, Saudi Aramco announces its price differentials. Customers then indicate their preferences, and Saudi Aramco takes their requests into account when issuing the final allocation.

[14] "Despite their grumbling, customers - sensitive to the strategic importance of Saudi contracts - will not dare threaten to reject their March supplies. 'We can only hope that we're compensated next month with a deep discount on the April formula,' says an industry source. ... One US contract holder, none too pleased with the March price adjustment, carefully described the change as 'very inconsistent with the market.' .... Again, however, loyalty to

Refinery inputs are constrained by physical capital in the short run, and most refineries require the composition of their input blend to be fairly consistent. Refiners can replace a shortage of Saudi crude by buying a fairly close substitute crude on the spot market, but these prices are usually higher than term contract prices. Aramco also tries to keep its contract terms fairly attractive on average so that customers want to renew their contracts over the long term and so that they can continue to place their desired quantities in the U.S. market.

4 Where Did the Discount Go?

The first task of this paper is to track down where discount rents accrued when Saudi Aramco sold discounted crude to the United States, whether captured by refiners as excess profits or passed on to consumers in the form of lower product prices. I next provide an overview of the relevant features of the U.S. refining industry and a basic model to give some intuition on the incidence of the discount. I then discuss the data required for this part of the analysis, the empirical framework, and the results from the estimation.

4.1 Market Details

At their most basic, refineries blend input crude oil and then distill it into its constituent hydrocarbons, isolating the molecules and then blending them into end products like propane, gasoline, jet fuel and diesel. Although all refineries perform this same basic process, they vary a great deal in their complexity and in what sorts of crude oil they can process and what finished products they output. Topping refineries, the most basic type, include only distillation units and produce mainly unfinished oils. Hydroskimming refineries add a hydrotreating and reforming unit to the basic topping refinery configuration, allowing the refinery to remove sulfur from more sour crudes so that outputs conform to environmental standards. The most versatile (and most expensive) refinery type are catalytic cracking or coking refineries, which also feature gas-oil conversion plants, olefin conversion plants, and coking units to reduce or eliminate the production of residual fuels. These refineries are able to break larger (and less valuable) molecules and reform them into lighter, more valuable products like gasoline and jet fuel. The product mix is determined both by the blend of molecules in the input crude mix as well as the sophistication of the refinery.

Most refineries blend different crude oils before distillation begins. This allows them to maintain consistent processing conditions and mitigate the corrosive effects of cheaper sour crudes. Refiners periodically run linear programming models to determine the optimal quantity and quality of their inputs and outputs and to make (small) adjustments to their refinery operating parameters. Most secure a certain amount of "baseload" crude under term contracts, which are less flexible but offer more attractive prices, and then balance their remaining crude slate in the spot markets. If a

Aramco seems certain to win out over momentary irritation. 'We are painfully aware of the new prices, but we're dealing with it,' the customer added." *Petroleum Intelligence Weekly*, "Buyers Bemoan Saudi Price Hikes, Eyes Now on Iraq" (Feb. 8, 1999).

refinery gets a cut in its monthly crude order from Saudi Aramco, then, they will buy other similar crudes on the spot market to fill the shortfall rather than curtailing their run. Mexican Isthmus-34, for example, is a good substitute for a refinery using Arabian Light in its crude mix and is available on the spot market at most locations where Saudi crude can be delivered. Spot market prices are usually higher than term contract prices, however, so replacing a shortfall of Saudi crude on the spot market tends to increase input costs.

Once the crude oil has been fully processed, refined products are transported to wholesale racks by either pipeline, barge, truck or rarely by railroad (Figure 5) (Association of Oil Pipelines 2009). Pipelines are the least expensive way to move products,[15] and mainly connect areas of high refining output with those of high demand. Trucks usually make only local trips, and most trips by petroleum tank trucks are no longer than 50 miles (Untiet 1984). Refiners sell products to retailers out of these local wholesale racks, who then mark up the prices to sell to consumers. Retail margins make up a fairly small proportion (about ten percent) of consumer prices, however, and do not seem to move with wholesale prices.

The two primary possible destinations for discount rents are therefore refiner profits and consumer prices.

4.2 Model

Although changes in crude oil costs certainly influence the consumer price of gasoline[16], there is reason to think that discounts targeted at specific refineries will be captured as profits rather than passed on to consumers, even in a competitive market.[17] Over the policy period, Saudi oil accounted for about ten percent of crude refined in the United States, and crude receipt varied substantially across refineries in the same local area. This section therefore models the receipt of Saudi crude as a heterogeneous cost shock across refineries in a given market.

The gasoline wholesale market is characterized by a relatively small number of refineries with fixed capacities. At most, cities have 12 refineries that supply refined gasoline to wholesale racks for retail distribution. Most refineries operate at full capacity for most of the year, and even with regular shutdowns for maintenance overall capacity utilization is around 90%. Though fixed costs are large, the majority of marginal costs are the price of crude inputs. These vary across time as the

[15] Transportation costs by pipeline, barge and truck are estimated at 2, 4.5 and 35 cents per gallon per thousand miles of transportation (Jacobs 2002).

[16] The literature on the nature of the dynamics of crude price pass-through into gasoline prices began with Bacon (1991), though the link between crude and gasoline prices was already well-established. Further detailed work on the magnitude and speed of gasoline price responses to crude prices can be found in Borenstein & Shepard (1996), Borenstein, Cameron & Gilbert (1997), Borenstein & Shepard (2002), and Bachmeier & Griffin (2003). Even though several of these papers find that the pass-through of crude price changes to gasoline prices is not immediate, full pass-through of all common shocks occurs within a month or two of the initial shock. Because I examine pass-through at the annual level, I avoid these dynamic pass-through concerns and assume that all discount effects pass through to gasoline prices in the year that they occur.

[17] Borenstein & Kellogg (2012) find that refiners, not consumers, captured the rents generated by a temporary depression in crude prices in the Midwest. As in this section, their model generates this lack of pass-through into product prices as a consequence of the fact that most refiners are capacity-constrained, and are therefore operating at the vertical part of their supply curves.

price of crude fluctuates, and across refineries according to refinery sophistication. While common shocks to costs do pass through into gasoline prices, cost shocks targeted to specific refineries will tend to affect profits but not prices. To make this clear, I consider a simple model of the wholesale refined product market characterized by a finite number of refineries with fixed short-run capacities.

Consider a city (or wholesale market) with n possible refineries with marginal costs c_i such that

$$c_1 \leq c_2 \leq \cdots \leq c_n$$

and capacities $k_1, \ldots, k_n$. Demand is given by $D(p)$, where p is the gasoline (or product) price. In this market, equilibrium will consist of an m and p^* such that

1. No additional firms want to begin producing:

$$c_{m+1} \geq D^{-1}\left(\sum^{m} k_i\right)$$

2. No producing firms want to exit the market:

$$D^{-1}\left(\sum^{m-1} k_i\right) > c_m$$

3. The marginal refinery (m) is maximizing profits:

$$p^* = \text{argmax}_{p:D^r(p)\leq k_m}(p - c_m)\left[D(p) - \sum^{m-1} k_i\right]$$

The equilibrium price p^* therefore comes from the marginal firm's profit maximization facing the residual demand from all lower-cost firms producing at capacity.
Therefore (for non-corner solutions)[18]:

$$p^* = \frac{c_m}{1 + \frac{1}{\epsilon_D^r}}$$

where ϵ_D^r is the elasticity of residual demand:

$$D^r(p) = D(p) - \sum^{m-1} k_i$$

Note that p^* is only a function of the marginal firm's marginal costs, i.e. $p^* = p^*(c_m)$.
The profit of the marginal firm is:

$$\pi_m(c_m) = (p^*(c_m) - c_m)D^r(p^*(c_m))$$

[18]For solutions where the marginal firm produces at capacity, decreases in costs will not affect prices even for marginal firms. Increases will sometimes increase prices if they are sufficiently large.

For inframarginal firms ($i < m$):

$$\pi_i(c_i, c_m) = (p^*(c_m) - c_i)k_i$$

Therefore non-marginal shocks to marginal cost will only affect refiner profits (π_i) and will not pass through into prices. Decreasing the costs of the marginal firm (c_m) will lower prices, increase profits of the marginal firm (π_m) and lower profits for other firms (π_i). Figure 6 shows a simple example of how profits and prices are affected under targeted and common (non-targeted) cost cuts. Panel i shows the market without any discounts. There are m firms in the market, and the marginal firm m sets a price p^* above its own marginal cost (the highest one in the market) to maximize its own profits facing the residual demand curve. Panel ii shows the effect of a common shock to costs, such as a decrease in the "world price" of crude, i.e. a drop in price affecting all grades and types of crude oil. Because this common shock reduces the costs of the marginal refinery, this refinery increases its production and the price of gasoline decreases. In panel iii, several of the inframarginal refineries experience a targeted decrease in costs (such as the discount) that is not given to the marginal refinery. In this case, profits increase for all of the discount recipients, but the market product price remains unchanged.

Consequently, this simple model shows that we would expect most receipts of discounted crude to affect refiner profits and not to pass through into product prices. Since most refiners are inframarginal, most of the discounted crude is also inframarginal; only changes in the amount of Saudi crude sold to the one marginal producer in each market would even partially be passed through into the price.

4.3 Data

In this part of the analysis, I follow the discount through each stage of the refining process from the delivery of the discounted crude to the refinery to local gasoline prices.

4.3.1 Total Discount Value

The key independent variable for the analysis in this paper is the refinery-level value of the discount received from Saudi Aramco, i.e. the per-barrel discount multiplied by the quantity of crude delivered to each refinery. I calculate the per-barrel discount that U.S. refiners receive relative to Asian refiners using Saudi Aramco's official selling prices. As described above, Saudi Aramco takes a variety of measures to prevent the emergence of a secondary market in its crude, so these prices should accurately reflect the prices that refiners pay to purchase Saudi crude oil. The OSP releases are published each month by Platts for each of the major crude grades in each market, and the time series of the realized selling prices (these differentials plus the relevant benchmark) are available from Bloomberg. The series for Arabian Light, Arabian Medium, and Arabian Heavy are available for Europe, the U.S., and Asia beginning in January 1991, and I use these series to

construct a single average discount for Saudi crude.[19] I use the Asian price as the benchmark to calculate the discount, as East Asia was the primary alternative destination for Saudi crude exports. Asian markets received about half of total Saudi crude exports by 2003 and 65 percent by 2010. At the same time, the share that went to the North American market fell from what had been a steady 25 percent from 1991 to 2003 down to 18 percent in 2010[20].

In order to estimate the effects of the discount on refinery profits and local retail prices, it is critical to identify which refineries received crude shipments from Saudi Arabia in each month. All of this information comes from the Energy Information Administration (EIA), which monitors domestic petroleum refining operation and which collects data on all foreign crude imports through the EIA-814 Monthly Imports Report. This data is publicly available at the refinery-level from the EIA starting in 1986. I match this data to a list of all operating refineries in each year constructed using the EIA Refinery Capacity Report (from EIA-820), which lists all operating U.S. refineries in each year for 1994, 1995, 1997, and 1999-2010 and reports capacity, owner, and state for each refinery. There are 178 refineries listed in the report. When matched with the importer data, this lists all refineries operating in a given year and how much crude each refinery imported from Saudi Arabia and elsewhere.

Receipts vary a great deal across refineries and within each refinery from month to month, which leads to considerable variation in discount values among refinery owners and across states. Of the 178 operating refineries, 58 used crude imported from Saudi Arabia between 1991 and 2003. Most deliveries of Saudi crude go to refineries along the Gulf Coast, but a surprising amount also goes to inland refineries and to refineries in California and along the East Coast (Figure 7). Coastal refineries are mostly supplied by tanker and offshore terminal, and inland refineries receive deliveries by pipeline within a couple of weeks of delivery by tanker. There is also a great deal of variation in the fraction of inputs that come from Saudi Arabia. The Texaco refinery in Delaware, for example, got more than half of its inputs from Saudi Arabia over the period. Mississippi and Arkansas also got over half of their crude inputs from Saudi Arabia (Figure 8).

4.3.2 Refiner Profits

To estimate the impact of the Saudi crude discount on refiner profits, I use data on annual profits from refining operations for the 40 publicly-traded companies that owned at least one U.S. refinery during the sample period. These data come from Standard and Poor's Compustat North America dataset. Because many U.S. refineries are owned by large corporations with multiple business lines, I use profits data from the Business Segments Dataset, which includes companies' self-reported balance sheet data by business type. The relevant segments were identified using the

[19] Since only overall sales volumes for all the crude types are available, I calculate the discount as a weighted average of the discounts on the three different crude grades. The weights are left fixed over time and are based on the volumes published in the IEA Oil Market Report over the 1998-2003 period. The average discount is calculated as

$$AvgDiscount_t = 0.35 \cdot LightDiscount_t + 0.46 \cdot MediumDiscount_t + 0.19 \cdot HeavyDiscount_t.$$

[20] Export figures are from United Nations Commodity Trade Statistics Database.

segment-specific NAICS classification for petroleum refining and the segment name as reported by the company. The analysis focuses on operating profits, which represents sales of the refining business segment less its allocated share of operating costs and expenses. For comparison, I also use overall net income as a measure of total company profits. This is also available from Compustat, and represents quarterly income (or loss) after subtracting all expenses and losses from all revenues and gains. The reporting for this item is more consistent across companies, but is a much noisier indicator of the variable of interest.

In order to link company profits to refinery imports, it is also necessary to determine annual corporate ownership of each refinery. Ownership of individual refineries was established using the EIA Refinery Capacity Reports and supplemented using corporate profiles from the Moody's/Mergent Industrial Manuals. Refineries owned through a join enterprise were assigned to either the U.S.-listed corporation or to the majority stakeholder.[21] Refineries that changed ownership mid-year were assigned to the company that owned the refinery for the majority of the year. Table 1 provides some summary statistics on the publicly-traded refinery owner companies that appear in the profits analysis. Discount receipts for these companies also vary tremendously, and are not necessarily related to company size. Chevron and Texaco, for example, received over 4 billion dollars worth of crude discounts, an amount equal to 10% of their overall refining profits. The similarly-sized Shell, however, received only 0.08 billion in discounted crude, 0.2% of total refining profits. Smaller companies like Marathon and Valero received about a billion dollars in discounts over the period as well. There is also great deal of variation in the fraction of inputs that come from Saudi Arabia. Texaco, for example, received Saudi imports at 7 of its 10 refineries and devoted approximately 45 percent of its processing capacity to refining Saudi crude.

4.3.3 Retail Gasoline Prices

In addition to examining the effect of the discount on refining profits, I also look at the impact on consumers though changes in the retail price of gasoline in local refinery markets. For this part of the analysis, refineries were matched to the largest city within an hour travel time by road. Monthly retail price averages for the 75 cities with local refineries was provided by the Oil Price Information Service (OPIS). OPIS uses data from credit card receipts to capture daily station-specific retail gasoline prices for up to 120,000 stations throughout the U.S., and their data include prices for most major retailers regardless of ownership. This daily station data for regular unleaded gasoline was aggregated up to the city-month level for this paper.

I link this price data for each city to refining capacity and Saudi crude quantities in its wholesale market. I define a city's market in two different ways. In the first, local markets are defined using the assumption that refineries serve only cities within an hour travel time by truck. I alternatively define a refinery's market as any city that is "down-pipe" of the refinery using directional product pipeline information from 2004 (Figure 9).[22] Under the first definition, for example, retail prices

[21] Texaco is an exception to this, and was excluded from the regressions due to its Motiva joint venture with Saudi Aramco.

[22] This is similar in spirit to Muehlegger (2006), who also uses product pipelines (as well as truck and barge access)

in St. Paul and Chicago are assumed to be affected only by the refineries operating in their local area. The second market definition takes into account that there is a product pipeline going from Bismarck to St. Paul, and from St. Paul to Chicago. Prices in Bismarck are still only affected by refineries in the local area, but St. Paul prices are now also affected by refineries in Bismarck as well as in St. Paul, and prices in Chicago by refineries in Bismarck and St. Paul.

4.4 Empirical Framework and Results

In this section, I investigate what refiner characteristics determine receipt of Saudi crude, and where discount rents ended up. To determine whether the discount was captured as profits or passed through to consumers, I estimate the effect of discount receipts on refinery owner profits and local retail gasoline prices.

4.4.1 Who received the discount?

To get a sense of which features made companies most likely to receive Saudi crude, I first construct a dummy variable ($D(Recipient)$) equal to 1 if the company received Saudi crude at any point over the policy period. I estimate a simple linear probability model for this dummy variable on a set of refiner characteristics. These include total refining capacity over the period as well as a dummy variable indicating whether the company owned any refineries that had processed Saudi crude in the 1989/1990 period, indicating that the company had the technical capacity (without any further investment) to process crude from Saudi Arabia. I also construct a set of dummy variables that indicate whether the company owned a refinery in a particular state to get at geographical effects. Anticipating the results in section 5, I also include a set of variables indicating political contributions by these companies in the 1989/1990 period to check whether recipients differed from non-recipients in their political leanings.[23]

The results from the LPM for discount receipt on refiner characteristics (Table 2) reveal that the most important requirements to have received Saudi crude are technical. Companies that owned at least one refinery with demonstrated capacity to process Saudi crude were 65 percent more likely to have received Saudi crude over the policy period. Of course, the availability of substitute crude inputs means that these firms do not require Saudi crude, and that refineries that did not process Saudi crude in the pre-period may still have had the capacity to do so. Firms may also have updated refinery specifications during the period to enable Saudi crude capacity. Nonetheless, this variable is significant in all seven specifications and its magnitude is quite consistent. There is no indication that firms with larger overall refining capacity were more likely to receive Saudi crude, and these coefficients are close to zero and statistically insignificant. Former Aramco partners were surprisingly no more likely to get Saudi crude than other refiners controlling for technical refining capacity.

to calculate the approximate transportation costs for a refinery to serve markets in each state.

[23]The political contributions data are discussed in detail in section 5.

The coefficients for the state dummy variables are not reported in the table, and are jointly significant but mostly individually not statistically significant. These estimates tend to be positive for states that are easily accessible by barge (e.g. Alabama, Louisiana, California, New Jersey) and negative for those that are difficult to reach (e.g. Alaska, Arizona, Illinois, Nevada). (Including these dummy variables in the other regressions has very little effect on the point estimates, but makes the standard errors substantially larger.)

The estimates on the aggregates for overall contributions, contributions to politicians and contributions to committees are all small and statistically insignificant. The aggregates by politician characteristics (party, pro-Israel donation recipients) are also very small and close to zero, indicating that the overall contribution patterns of recipients and non-recipients were very similar in the pre-period. Recipients and non-recipients do appear to have varied in how their contributions were allocated across members of various committees, however; companies with more contributions to members of the House Armed Services and Senate Foreign Relations committees were more likely to receive Saudi crude. Companies with more donations to members of the House Energy, House Foreign Affairs, and Senate Armed Services committees were less likely to get Saudi crude.

4.4.2 Refining Profits

To determine the extent to which the discount was captured as profits, I estimate the relationship between company-level refining profits and both total annual quantities and discount values:

$$\begin{aligned} \pi_{jt} &= \beta \cdot DiscValue_{jt} + \alpha_j + \gamma_t + \epsilon_{jt} \\ \log(\pi_{jt}) &= \tilde{\beta} \cdot \log(q_{jt}^{saudi}) + \tilde{\alpha}_j + \tilde{\gamma}_t + \tilde{\epsilon}_{jt} \end{aligned}$$

The value of the discount to a refiner can be expressed in terms of the percentage discount on the crude price (d_t), the per-barrel price of crude (c_t), and the number of barrels the refiner receives from Saudi Arabia in year t, q_{jt}^{saudi}. We can then write the refiner's production function:

$$\begin{aligned} \pi_{jt} &= (p_t - c_t)q_j^{cap} + \beta \cdot DiscValue_{jt} + \epsilon_{jt} \\ &= \mu_t q_j^{cap} + \beta \cdot d_t \cdot c_t \cdot q_{jt}^{saudi} + \epsilon_{jt} \end{aligned}$$

where p_t is the average product price and q_j^{cap} is refinery capacity. μ_t is the difference between the average product price and the cost of crude, i.e. the refining profits per barrel or the "crack spread".

In this case, β can be consistently estimated using firm fixed-effects as long as μ_t is fixed over time and does not vary with the crude price, i.e. $\mu_t = \mu$. This leaves us with:

$$\pi_{jt} = \underbrace{\mu q_j^{cap}}_{\alpha_j} + \beta \cdot DiscValue_{jt} + \epsilon_{jt} \tag{1}$$

This was approximately true from 1983-2003, with the crack spread, which estimates the value

added by the refining operation, remaining fairly constant in real terms at around 12 USD per barrel (Figure 10).[24]

A more serious empirical problem is created by integrated refiners. Since these firms also sell crude, the crude price now enters the calculation for the discount value as well as the profitability of their exploration and production business lines.

$$\pi_{jt} = \mu \cdot q_j^{cap} + \beta \cdot \underbrace{d_t \cdot c_t \cdot q_{jt}^{saudi}}_{DiscValue_{jt}} + \underbrace{c_t \cdot q_j^{crude} + \epsilon_{jt}}_{\eta_{jt}}$$

Now $\text{Cov}\left(DiscValue_{jt}, \eta_{jt}\right) > 0$, and $\hat{\beta}$ overestimates the effect of the discount on refiner profits. Intuitively, the discount per barrel can only be large when the price of crude is also large – you cannot have a six-dollar discount when the crude price is only five dollars. We would also expect refiners that produce crude to have higher profits when the oil price is higher. Even though I use refining profits in this analysis to try to mitigate this effect, these self-reported segment profits are likely to co-move with overall company profits.

One solution to this problem is to use a log-log specification and add time fixed effects to remove time-varying factors (c_t, d_t) from the discount. The coefficient $\tilde{\beta}$ now estimates the percent change in profits associated with an increase in the quantity of Saudi crude that a refiner receives.

$$\log \pi_{jt} = \tilde{\beta} \cdot \log(q_{jt}^{saudi}) + \tilde{\alpha}_j + \tilde{\gamma}_t + \tilde{\epsilon}_{jt} \tag{2}$$

Since the discount per barrel is mostly positive over this period, a positive estimate indicates that an increase in the total discount value to a refiner is associated with an increase in firm profits.

Results from the profit regressions (Table 3) indicate that most of the discount appears to be captured by refiners as profits. On average, the discount value is equal to about two percent of refining profits, and the average discount is one dollar per barrel over the period. Full capture would therefore be consistent with a coefficient of 0.02 in column 1. The actual point estimate is 0.016, i.e. a 1.6 percent increase in profits associated with doubling the amount of Saudi crude delivered. When the sample is restricted only to observations with non-zero amounts of Saudi crude and positive profits, the point estimate increases to 0.17.

The estimate from the level regression in column 3 is too large to be plausible (implying a three dollar increase in profits for every dollar of discount), and is likely biased upward for the reasons discussed in the previous section. Consistent with the hypothesis that the upward bias of the estimate in the level regression is due to measurement error due to other business lines, the point estimate in column 3 does go down when I exclude the supermajors (BP/Amoco, ConocoPhillips, ExxonMobil, and Shell) that have substantial income from crude production. The estimate in

[24]The crack spread is calculated as the difference in cost between a barrel of crude and a representative mix of typical outputs. For example, a simple version (the 2-1-1) is calculated as the difference in cost of 2 barrels of crude and a barrel of gasoline and a barrel of heating oil/diesel. Here I use the 6-3-2-1 crack spread, which is the difference in the total cost of 6 barrels of crude and outputs of 3 barrels of gasoline, 2 barrels of heating oil/diesel, and 1 barrel of residual fuel oil. Trends are the same for each of the four standard spreads.

column 1 decreases slightly (but remains significant), and the estimate in column 2 increases slightly.

To support the interpretation that the receipt of discounted crude increases profits through reducing costs rather than by increasing output, I also estimate the effect of annual district-level Saudi crude receipts on total refinery output.[25] Because events like refinery shutdowns and capacity expansions are likely to affect both production levels and inputs, I control for total district refining capacity. I use time fixed effects to capture trends in capacity utilization rates and district fixed effects to control for district-level heterogeneity in refinery efficiency.

Table 4 reports the results from this regression of the log of production on Saudi crude receipts controlling for refining capacity and year and district fixed effects. These estimates are all very small; a doubling in the Saudi crude delivery is associated with around a 0.3 percent increase in production even though about ten percent of crude inputs came from Saudi Arabia. This is in contrast to the estimates in columns (1) of Table 4, which indicates a 1.6 percent increase in profits for the same increase in Saudi crude quantity. The primary channel for the impact of the receipt of discounted crude on profits is therefore the discount on costs rather than an increase in production.

4.4.3 Retail Gasoline Price

As for profits, I examine the extent to which the discount was passed through to consumers by estimating the effect of the city-level discount per gallon of refined gasoline and quantity share in production on local gasoline prices:

$$\begin{aligned} RetailPrice_{mt} &= \rho \cdot DiscGal_{mt} + \lambda_m + \eta_{st} + \epsilon_{mt} \\ \log\left(RetailPrice_{mt}\right) &= \tilde{\rho} \cdot \log\left(\frac{q_{mt}^{saudi}}{q_{mt}^{cap}}\right) + \tilde{\lambda}_m + \tilde{\eta}_{st} + \tilde{\epsilon}_{mt} \end{aligned}$$

The retail gasoline price can be expressed as a per gallon markup on the crude costs per barrel (p_t^g) plus some state-level tax τ_{st}. The observed price is this counterfactual price (η_{st}) plus the effect of the discount, which is expressed here as the discount value per gallon of gasoline refining capacity multiplied by ρ, the share of the discount which is passed on to consumers. This yields:

$$RetailPrice_{mt} = \underbrace{p_t^g + \tau_{st}}_{\eta_{st}} + \rho \cdot DiscGal_{mt} + \epsilon_{mt} \tag{3}$$

Using the constant crack spread μ, p_t^g can be expressed as a markup μ over the price of crude c_t divided by the number of gallons of gasoline per barrel:

$$p_t^g = \frac{\mu + c_t}{19.5}$$

where 19.5 is the average number of gallons of gasoline refined from a 42 gallon barrel of crude oil.

[25] Although refining capacity is available at the refiner level, capacity utilization rates are only released at the district level. The EIA defines twelve such refining districts: East Coast, Appalachian No. 1, Indiana-Illinois-Kentucky, Minnesota-Wisconsin-North and South Dakota, Oklahoma-Kansas-Missouri, Texas Inland, Texas Gulf Coast, Louisiana Gulf Coast, North Louisiana-Arkansas, New Mexico, Rocky Mountain, and the West Coast.

The discount per gallon is calculated as the total discount to refineries in market m divided by the total number of gallons of gasoline refined in that market:

$$DiscGal_{mt} = \frac{d_t c_t q_{mt}^{saudi}}{q_m^{cap}}$$

As discussed earlier, one of the primary challenges here is defining the local market in order to link refineries to the appropriate retail gasoline prices. I do this two ways: first by assuming that refineries only serve cities within an hour travel by truck, and second by linking each refinery to all cities "down-pipe" of the refinery. These two definitions affect how q_{mt}^{saudi} and q_m^{cap} are calculated. Under the first definition, they refer to Saudi imports and refinery capacity only in refineries within an hour's travel from the city. Under the second, they refer to imports and capacity of all refineries up-pipe.

Again, taking logs and using state by month fixed effects removes any bias caused by the crude price appearing in both the counterfactual gasoline price and the value of the discount.

$$\log\left(DiscGal_{mt}\right) = \underbrace{\log(d_t c_t)}_{\gamma_t} + \log(q_{mt}^{saudi}) - \underbrace{\log(q_m^{cap})}_{\lambda_m}$$

The primary specification is therefore

$$\log\left(RetailPrice_{mt}\right) = \tilde{\rho} \log\left(\frac{q_{mt}^{saudi}}{q_m^{cap}}\right) + \tilde{\lambda}_m + \tilde{\eta}_{st} + \tilde{\epsilon}_{mt} \tag{4}$$

The pass-through coefficient $\tilde{\rho}$ is therefore identified off of variation in the changes in Saudi crude shares across cities within the same state.

The results from these regressions show no evidence that discounts were captured by consumers in the form of lower refined product prices (Table 5). Estimates in column 1 give fairly precise zeros (with standard errors clustered at the city level), even when compared with a full pass-through benchmark of -0.04[26]. The full pass-through benchmark for cities that receive positive amounts of Saudi crude (column 2) is -0.15, so these estimates are also very close to zero. Large standard errors on the estimates in column 3 make their interpretation more difficult, but the point estimates are nonetheless quite small. Panel A of column 3, for example, indicates that a one-cent increase in the per-gallon discount value decreases gasoline prices by 0.03 cents. These estimates are consistent with the large pass-through into refining profits in Table 3.

[26]The average unleaded gasoline price is $1.34, and Saudi inputs make up about 5.5 percent of total inputs, so a 1 percent increase in the Saudi input share would decrease prices by 0.04 percent.

4.5 Results

5 Political Action by Discount Recipients

While it is impossible to directly measure the effect that the discount actually had on U.S. foreign policy toward Saudi Arabia, we can observe how the companies that received the discount behaved as a result of the policy. As described earlier in the paper, there are plenty of cases where American oil companies took (sometimes rather extraordinary) political action to support Saudi interests. The most easily measurable type of corporate political action is financial contributions to political campaigns. In this section, I examine the relationship between discount receipts and political contributions by American refiners during the policy period. In particular, I focus on refiner contributions to Members of Congress, particularly those who serve on key committees and those who appear to be most sympathetic to Israeli political interests. It is important to note that direct contributions to politicians from individual donors represent only a fraction of financial support from companies to politicians, and a smaller fraction still of total political action by corporations. Overall, individual donors account for only about half of the money that goes to House candidates and two thirds of the money that goes to Senate candidates (Center for Responsive Politics 2012). The rest comes from PACs and candidates' personal resources. The advantage of focusing on individual donations is that it shows the direct link from refiners to politicians so that patterns of giving can be examined in addition to overall levels of giving. Patterns that are seen in this small, transparent part of political action by discount recipients may be suggestive of overall patterns of behavior as it relates to the receipt of the crude discount.

5.1 Saudi Arabia and the U.S. Congress

The empirical results in the literature on political contributions and policy influence are mixed. In particular, despite the conventional wisdom in political economy, it has proven very difficult to show direct causal links between contributions and voting behavior, though there is some evidence that regulatory outcomes are influenced by political contributions (de Figueiredo & Edwards 2007). In their study of the incidence of the costs and benefits of several transportation-sector environmental regulations, Holland, Hughes, Knittel, & Parker (2011) find patterns in the political donations by organizations and politician voting behavior that suggest that districts used campaign contributions to influence the House vote on the Waxman-Markey cap and trade bill. In particular, they find evidence that organizations that opposed the Waxman-Markey bill were more likely to donate money to House members from districts that would be negatively impacted by the bill, with a similar pattern in the contributions of supporters to candidates from districts that would benefit. Further, they find that political contributions from organizations that opposed the bill were associated with a large reduction in the likelihood of voting for the bill. As discussed by Ansolabehere, de Figueiredo & Snyder (2003), campaign contributions likely affect policies in other ways besides through roll call votes, including securing access to legislators at other stages of the policy-making process. Indeed, politicians likely find it desirable to promote client interests in ways that are

observable to clients but not to voters. Because of these difficulties in observability, I assume that corporate donors allocate their donations strategically, whether with the intent of affecting policy or to demonstrate loyalty to Saudi interests.

In particular, contributions to federal legislators are an important channel corporations can use to advocate for Saudi interests. Many bills pass through Congress that affect Saudi Arabia, including bills regarding arms sales, trade, aid[27], and immigration[28]. Most of these are referred to the House Committee on Foreign Affairs or the Senate Committee on Foreign Relations. Committees exercise a great deal of power over the legislation they review, and can both block legislation by tabling it or by revising the bill before they send it to the floor for a vote. In 1992, for example, none of the bills opposing the sale of F-15XP fighter planes to Saudi Arabia made it out of committee. In another example, the House Foreign Affairs Committee tabled the Persian Gulf Security Cost Sharing Act (2001), which would have required Saudi Arabia to defray the cost of U.S. military deployments in the region.

Committees can also amend popular bills to turn them from aggressive foreign policy changes into purely symbolic gestures. The House Committee on Foreign Affairs had added Presidential waiver authority to several anti-Saudi bills, including the Anti Economic Discrimination Act of 1995, which would have stopped the sale of military equipment to countries participating in the boycott of Israel. Another notable example of this was an amendment to the 2005 Foreign Appropriations bill, which stated that "[n]one of the funds appropriated or otherwise made available pursuant to this act shall be obligated or expended to finance any assistance to Saudi Arabia." Changes to this amendment made in committee allowed the President to waive this rule provided that he certified to the Congressional Appropriations committees that Saudi Arabia was cooperating in the war against terrorism. Although the amendement passed[29], it was immediately waived by Presidential Determination. A subsequent bill (the Prohibit Aid to Saudi Arabia Act of 2005), that attempted to imposed the ban on U.S. aid to Saudi Arabia without waiver authority was not passed on by the House Foreign Affairs Committee.[30]

In the rest of the paper, I look at how the level and composition of direct corporate donations to Members of Congress vary with discount receipts.

5.2 Data

In this part of the analysis, I match company-level discount receipts to corporate political donations. Although it is illegal for corporations to contribute to political campaigns directly, in practice

[27]Examples of aid-related bills include H.R.3137.IH (2003) which prohibited assistance or reparations to Cuba, Libya, North Korea, Iran, Syria and Saudi Arabia, as well as Amendment 708 to H.R. 4818, (the Foreign Operations Appropriations bill for FY2005).

[28]See for example, H.R. 604 and 3934. These bills would have halted the issuance of visas to Saudi citizens until the President certified that the Saudi government did not discriminate in its visa policies on the basis of religious affiliation or cultural heritage.

[29]Vote 217-191, see roll call http://clerk.house.gov/evs/2004/roll389.xml

[30]In practice the U.S. provides almost no aid to Saudi Arabia, and the ban targeted a small $25,000 International Military Education and Training grant for Saudi military training.

they do contribute through personal donations by their managers and employees. These individual donors account for approximately two-thirds of campaign money to Senate candidates and half of the financing for House candidates. By federal law, all contributions to federal candidates, political action committees (PACs), or parties of over 200 dollars must be reported to the Federal Election Commission (FEC). These reports include the name and address of the donor, as well as the donor's employer and occupation. These data are published by the FEC and aggregated by the Center for Responsive Politics (among others). I use these data to construct total annual campaign contributions by employees of all U.S. refining companies to each member of the House and Senate for the 1991-2003 period. I merge these with data on congressional committee assignments from Stewart & Woon (2012) and Nelson (2012) to construct total contributions by committee. Table 6 shows some summary statistics on political contributions for the 26 companies that received crude from Saudi Aramco, both public and private. (Though they are excluded from this table, all 126 refining companies are used in the analysis.) The positive relationship between Saudi imports and total political contributions over the period can be seen graphically in Figure 11, which plots the log of total company campaign contributions against the log of total Saudi imports over the discount policy period.

For the politician-level contributions analysis, committee assignments and political contributions are matched to the set of all Members of Congress collected in Stewart & Woon (2012), which begins in 1993. The merged politician by refiner-level dataset contains information on politician characteristics including party affiliation, committee assignments, chamber seniority, and contributions from other types of interest groups. In particular, the analysis classifies politicians according to the degree to which they receive contributions from donors affiliated with pro-Israel groups. One categorization simply assigns a dummy variable equal to one for politicians who received any contributions from pro-Israel donors. Another categorizes politicians according to their approximate quintile of average pro-Israel donations. The first group is the approximately 27 percent of politicians who never received any contributions from pro-Israel organizations during their time in Congress. The second group collects the 27th through 40th percentile of recipients, the third the 40th through 60th percentile, the fourth the 60th through 80th percentile, and the fifth the 80th percentile and above.

Table 7 gives some summary statistics for the total annual contributions at the company by politician level. Since most politician-refinery-year observations are zeros, the left hand panel shows statistics conditional on a donation occurring. The median contribution to a single politician is around one thousand dollars per year, though the maximum contribution is very high; in 1996, Koch Industries affiliates and employees contributed almost $45,000 to Representative Sam Brownback's (R-KS) campaign. The median total giving by a company in a single year is $7,404, but again the maximum is quite high; ExxonMobil donated over $374,000 in direct contributions in 2000.

5.3 Results

5.3.1 Contribution Aggregates

As in the profits analysis, I estimate the pass-through of discounts into political contributions using the regression

$$Contrib_{jt} = \theta \cdot DiscValue_{jt} + \alpha_j + \gamma_t + \epsilon_{jt} \tag{5}$$

where j is the contributing refining company and t is the year. One possible concern here is the effect of refiner profits on contributions. If corporations increase overall contributions or change their contribution patterns when their profits are high, θ may capture the spurious common effect of overall crude price on contributions (via profits) and the discount value or the indirect effect of the discount through its effect on profits. I therefore also run this regression on a the subsample of public companies (for which I have refining profits) both with and without profit controls.

Results for the aggregate contribution regressions are reported in Tables 8a and 8b. Table 8a shows the results for the whole sample of refiners (both public and private). Column 1 shows the relationship between discount receipts and total donations, and Columns 2 and 3 break this out into aggregates for contributions to politicians and to PACs. The estimate in Panel A of Column 1 indicates a small but positive relationship between the discount and overall political contribution by refiners – a one-million dollar increase in the discount value is associated with an approximately 385 dollar increase in contributions. This is consistent with the fact that contribution magnitudes tend to be much smaller than the discount value. Among discount recipients, the average discount amount is 45 million dollars per year and often varied substantially from year to year; the average annual fluctuation in the value of the discount was 25 million dollars. The average discount, then, is associated with a contributions increase of 17,325 dollars, which is quite substantial compared with the annual company average of 18,578 dollars from Table 7. Positive and significant estimates of the elasticity of contributions with respect to discount receipts in Panel B confirm this relationship. Table 8b reports the same results for the subsample of corporations that report profits data. The results are consistent with the estimates in Table 8a, though the point estimates tend to be larger. Controlling for profits has almost no effect on the estimates for this subsample, which is reassuring for the full sample results.

I also address the direct effect of profits on contributions by separating profits into two parts one instrumented by the value of the discount and another instrumented by hurricane events and examining the effect of the two parts of profits on contributions. To capture non discount-related variation in refiner profits, I use hurricane landfall events as an instrument for annual profits. Hurricanes affect oil and petroleum product production in several ways. As a hurricane approaches the coast, offshore platforms are evacuated and wellheads are plugged to prevent leakage. These offshore platforms are sometimes destroyed by hurricanes, which imposes direct costs on producers and disrupts oil supplies. In addition to shutting down upstream crude, hurricanes also affect downstream infrastructure. Underwater pipelines can be damaged, and ports may stop accepting shipments. Onshore refineries can also be heavily damaged; Hurricane Rita, for example, caused

refining capacity losses of more than 4.9 million bpd due to direct damage or power interruptions along the Texas coast (EIA 2006).[31]

To construct the hurricane instrument, I create a dummy variable equal to 1 if a company had a refinery in a state that was hit by a hurricane in that year. This is further split into dummy variables for each hurricane category i.e. dummy variables indicating the most severe hurricane level experienced by a refinery owned by company j in year t. I focus on the most damaging hurricanes, i.e. those that were classified as category 2, 3, or 4 on the Saffir-Simpson scale, with sustained surface wind speeds of 82-95 knots, 96-112 knots, and 113-136 knots, respectively.[32]

I then use these hurricane indicators to instrument for profits in a regression of political contributions on refining profits and discount receipts.

$$(FS) \qquad \begin{aligned} Profits_{jt} &= \delta \cdot DiscValue_{jt} + \zeta_1 \cdot \mathbb{1}(\text{Category 2})_{jt} + \zeta_2 \cdot \mathbb{1}(\text{Category } 3^+)_{jt} + \alpha_j + \gamma_t + \epsilon_{jt} \\ \widehat{Profits}_{jt}^{\,hurr} &= \widehat{\zeta}_1 \cdot \mathbb{1}(\text{Category 2})_{jt} + \widehat{\zeta}_2 \cdot \mathbb{1}(\text{Category } 3^+)_{jt} \end{aligned}$$

$$(SS) \qquad Contrib_{jt} = \beta_1 \cdot \widehat{Profits}_{jt}^{\,disc} + \beta_2 \cdot \widehat{Profits}_{jt}^{\,hurr} + \alpha_j + \gamma_t + \nu_{jt} \tag{6}$$

I then test $\beta_1 > \beta_2$ to determine whether the discount had a larger effect than other types of profits. Table 9 reports the results for the regression of total contributions on discount value and profits orthogonal to the discount. Panel A reports results from the first stage regression, which confirm that discounts increase profits and hurricanes decrease them, and that the hurricane instruments and the discount have comparable explanatory power for profits. The results in panel B show that only discount receipts seem to have an effect on total contributions, with a one million dollar increase in the discount associated with a 317 thousand dollar increase in contributions (column 1). Column 2 shows the corresponding elasticity estimate, and a ten percent increase in the discount is associated with a 3 percent increase in political contributions. Profits not associated with the discount have no statistically significant effect on contributions, and the point estimates are close to zero as well. In both regressions we can reject the hypothesis that discount receipts and orthogonal profit shocks have the same effect on contributions.

The second set of results (Table 10) shows the relationship between the discount value and the way that total contributions were allocated among various committees. For the foreign policy committees, for example, the regression is of the share of congressional contributions that go to members of the House or Senate foreign policy committees.

$$Share_{jt}^{FP} = \frac{Contrib_{jt}^{FP}}{Contrib_{jt}^{total}} = \theta \cdot DiscValue_{jt} + \alpha_j + \gamma_t + \epsilon_{jt} \tag{7}$$

[31] Other papers have examined the effect of hurricanes and tropical storms on U.S. refined product markets, including Fink, Fink & Russell (2010), Kaiser, Dismukes & Yu (2009) and Lewis (2009).

[32] There are five relevant hurricane landfall events in the sample. Two of these were category two hurricanes: Bob (New York 1991) and Georges (Mississippi 1998). The two category three hurricanes were Andrew (Louisiana 1992) and Bret (Texas 1999), and there was one category four hurricane, Iniki (Hawaii, 1992). Hurricane landfall and severity data comes from NOAA (2006).

Though the standard errors on these estimates are large, the pattern is suggestive. Though the coefficient on contributions to the foreign policy committees is not statistically significant, there is a substantial increase in contributions to members of the Appropriations committees, which also review Saudi-relevant legislation. The coefficient in Column 2 indicates that a one billion dollar increase in the discount is associated with a 39 percentage point increase in the share of contributions that go to appropriations committee members. The average discount of 45 million dollars would therefore correspond to a 1.8 percentage point increase. This is about seven percent of the average share of 27 percent. I also include some results for "placebo" committees, that would be less likely to be concerned with Saudi affairs. Most of these coefficients are negative and significant with the exception of the House Post Office and Senate Labor committees, which appear to be unaffected.[33]

5.4 Politician-Level Contributions

To further understand the effect of the discount on political giving, I also examine the effect of the discount on corporate contributions at the politician level. In this part of the analysis, company-year level discount receipts are interacted with a set of politician characteristics (g_i) to estimate how discount receipts affected contributions to different types of politicians. These politician characteristics include a dummy variable for receiving contributions from Pro-Israel interest groups, quintiles of the level of pro-Israeli contributions, party affiliation and committee membership. This yields:

$$Contrib_{ijt} = \theta \cdot g_i \cdot DiscValue_{jt} + X_{it}\beta + \alpha_i j + \gamma_t + \epsilon_{jt} \tag{8}$$

where the subscript i indicates the politician, and j and t the company and year. Controls X_{it} are dummies for the time-varying politician characteristics (chamber seniority and committee membership).

In Table 11a, we see that the discount tended to decrease giving to pro-Israel politicians, with a one billion dollar increase in discount receipts decreasing annual contributions by an additional 180 dollars to politicians who received pro-Israel funding (column 1). Column 2 shows this same result split up by quintile, and the point estimates (though not statistically significant) indicate larger penalties for politicians in the highest pro-Israel funding quintiles associated with the discount. The pattern is similar in the regression with the full set of interactions and the coefficients are individually significant. Republican politicians benefit more from the discount than Democrats and independents. Republican candidates get a 166 dollar boost from companies that received an additional billion dollar discount relative to Democrats and independents (column 3). Again, the pattern is the same in column 5, with Republicans taking a 141 dollar increase. The evidence on the committee membership patterns is much more mixed, and contrasts with the patterns in the aggregate contribution regressions. Point estimates on the committee membership interactions are very sensitive to controls, and are large and negative for the House Foreign Affairs committee

[33] As in Table 5, most of these results remain the same when I control for profits, though the further loss of observations increases the standard errors substantially.

in both columns 4 and 5. Estimates for members of other committees are noisy, and although point estimates are quite large none are statistically significant. When the sample is restricted to years when the discount was large (1998-2003, Table 11b), the patterns become more clear for the pro-Israel and committee assignment results. In particular, the estimate of the discount penalty to pro-Israel donation recipients increases to 253 dollars, and a statistically significant pattern of larger penalties to politicians who received more pro-Israel money emerges (column 2). The large positive effect on members of the Senate Appropriations committee is statistically significant in columns 4 and 5 at around 2,400 dollars. The negative estimate for members of the House Foreign Affairs committee decreases to 621 dollars (column 4), and the magnitude of the (still statistically insignificant) point estimate for the Senate Foreign Affairs members decreases as well.

In general, these results indicate significant politician-level heterogeneity in the impact of the discount on funding by refining companies. Top beneficiaries were Republicans and candidates who did not receive funding from pro-Israeli groups. If Israeli interest groups donated more to candidates that were perceived as being pro-Israel, this could indicate that the discount caused refining companies to divert funds away from pro-Israel politicians, a move consistent with the Saudi political agenda toward the Arab-Israeli conflict.

It is important to note here that all of these estimates are quite small. The 253 dollar penalty to pro-Israel donation recipients, for example, implies that the average discount of 45 million dollars would be associated with just an eleven-dollar decrease in contributions to these candidates. From Table 7, the average contribution to these candidates, however, is only 38 dollars, so the eleven-dollar increase is a reasonable proportion of the total, though difficult to think of as practically significant. Nonetheless, the pattern of the change in this type of contribution is likely suggestive of other political responses, both financial and otherwise, by discount recipients.

6 Conclusion

This paper looks at the Saudi crude discount policy as a specific example of Saudi strategic political behavior with a clearly measurable cost. Using the Saudi crude price to Asia as a benchmark, the value of Saudi crude discounts to the U.S. was 8.5 billion dollars over the policy period, reaching a peak of 1.9 billion dollars in 2001. Given these enormous costs, a natural question is - what were they buying? Again, intuition suggests that the benefits of the policy are difficult to measure, if not actively obscured. Even though we are unable to observe what Saudi Arabia purchased with the discount as a whole, however, we can see how the distribution of these rents affected discount recipients. In particular, this paper shows that the discounted crude was almost entirely a gift to refinery owners. This gift seems to have induced some amount of pro-Saudi political action on the part of recipients. In their political contributions, where this action is most clearly measurable, this paper finds a link between the discount and the level of funds donated to political campaigns as well as the composition of that giving. In aggregate, firms were more likely to give to members of key congressional committees, such as appropriations and foreign policy. On the politician level,

there is some evidence that candidates that were less pro-Israel were more likely to see an increase in funding from discount recipients.

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Figure 1: Annual Value of U.S. Weapons Sales to Saudi Arabia, mil 1990 USD. Source: SIPRI

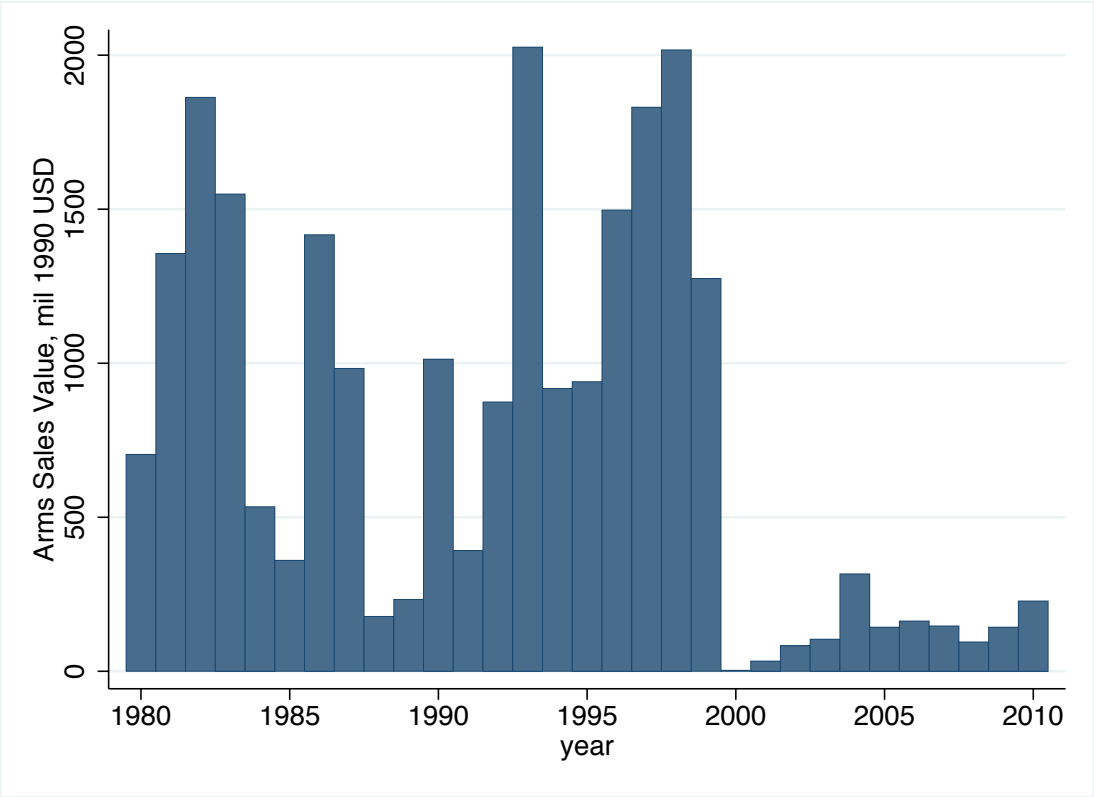


Figure 2: U.S. Crude Imports by Country of Origin, mil bbl per month (12mma). Source: EIA-814.

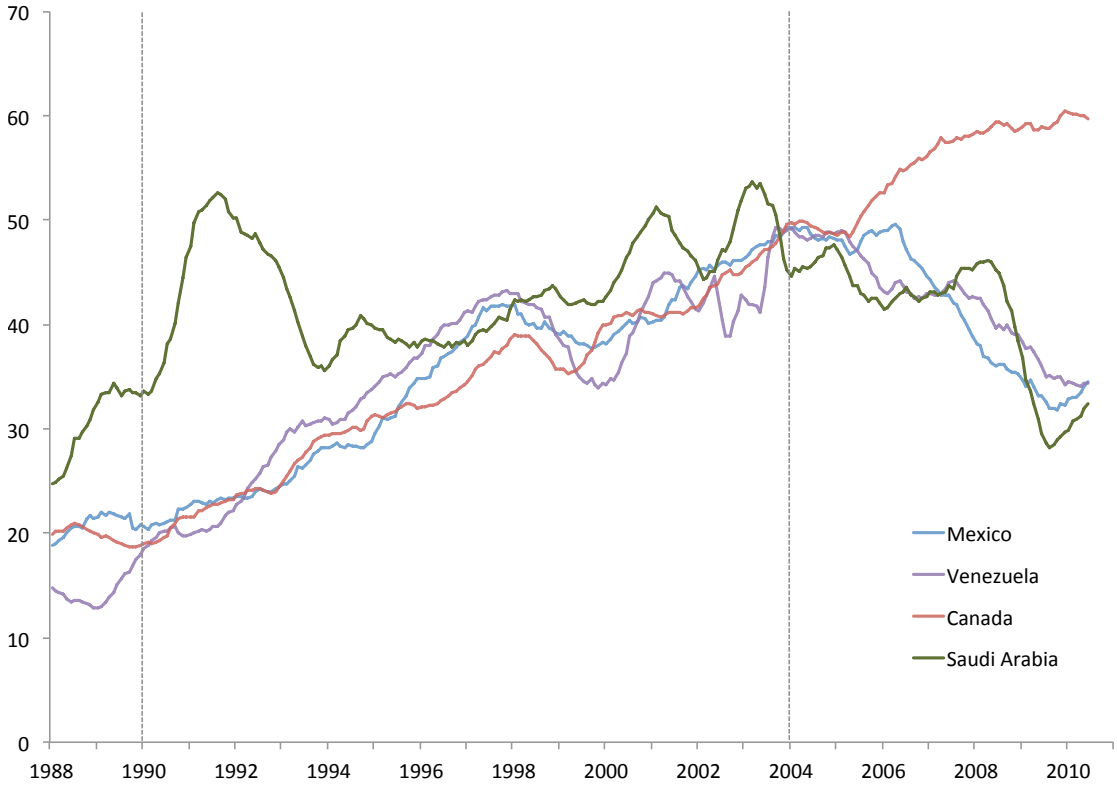
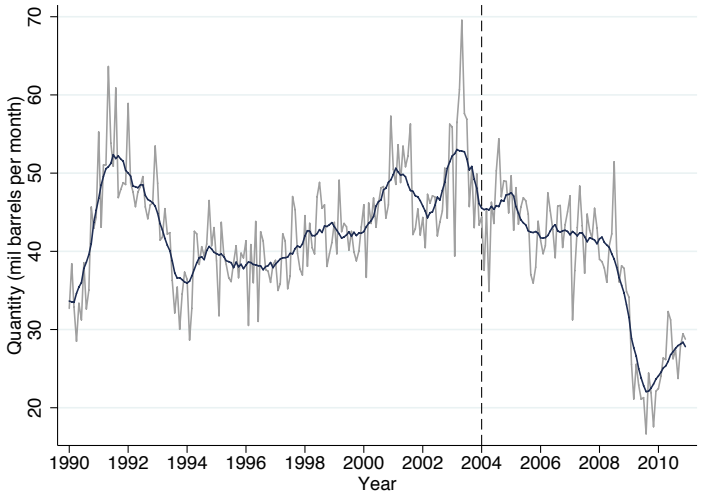
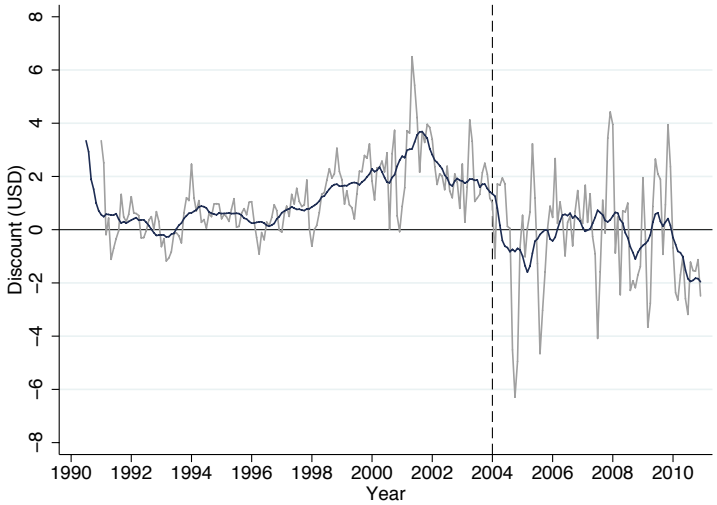


Figure 3: Saudi Crude Quantity, Discount, and Discount Value

(a) Saudi Crude Deliveries to U.S. Refineries, mil bbl per month. Source: EIA-814



(b) Saudi Crude Discount to U.S. Refineries, ($p_{ASIA} - p_{US}$). Source: Platts



(c) Total Value of the Saudi Crude Discount, mil 2000 USD per month

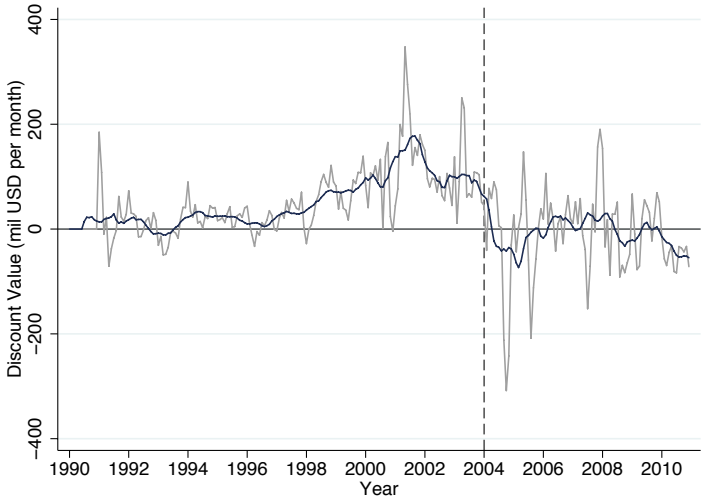


Figure 4: Sample OSP Releases for December 2001. Source: Platts.

Singapore (Platts) - 4 Dec 2001/9.58 pm EST/2.58 GMT

	Benchmark	Aug	Sep	Oct	Nov	Dec	Jan
Extra Light	WTI	-2.75	-3.35	-3.25	-3.05	-3.05	-2.75
Arab Light	WTI	-4.30	-4.80	-5.10	-4.75	-4.75	-4.05
Arab Medium	WTI	-5.35	-6.05	-6.40	-5.95	-5.75	-4.85
Arab Heavy	WTI	-7.00	-7.40	-6.80	-6.30	-6.65	-5.65

All prices are FOB Ras Tanura.

--Platts Global Alert--

Singapore (Platts) - 4 Dec 2001/7.20 pm EST/0.20 GMT

	Benchmark	Aug	Sep	Oct	Nov	Dec	Jan
Super Light	(Oman+Dubai)/2	+2.85	+1.95	+1.55	+1.15	+1.05	+1.05
Extra Light	(Oman+Dubai)/2	+1.65	+1.15	+1.15	+0.75	+0.55	+0.55
Arab Light	(Oman+Dubai)/2	+0.50	+0.30	+0.30	+0.20	+0.20	+0.25
Arab Medium	(Oman+Dubai)/2	-0.30	-0.20	-0.20	-0.10	-0.20	-0.10
Arab Heavy	(Oman+Dubai)/2	-1.10	-0.80	-0.80	-0.55	-0.65	-0.50

Sales of Saudi crude into Asia loading FOB Ras Tanura are priced versus the average of Oman/Dubai, plus or minus a differential.

--Platts Global Alert--

Figure 5: Crude Refining Inputs and Refined Product Distribution

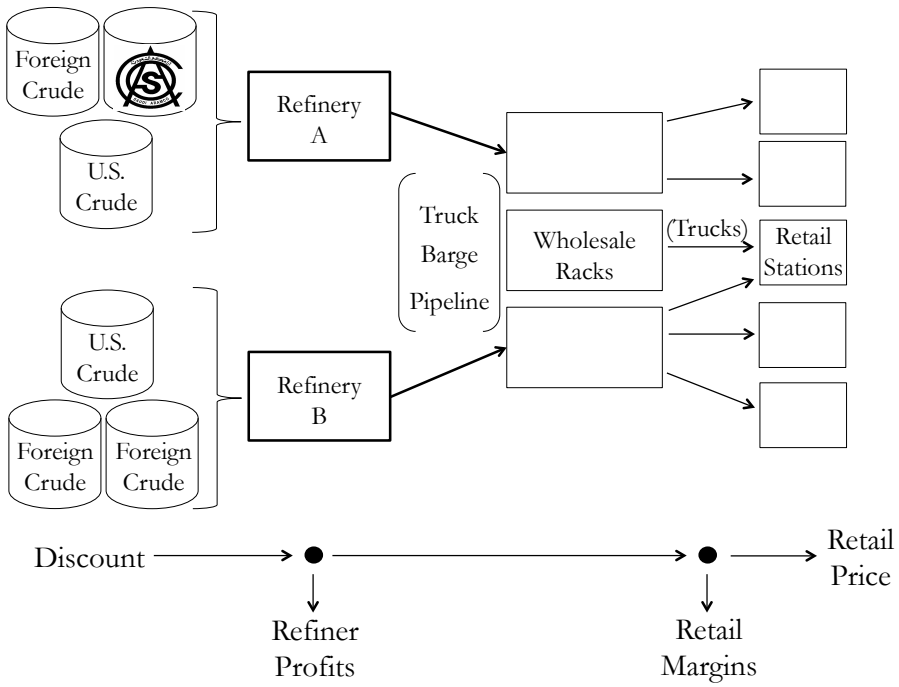
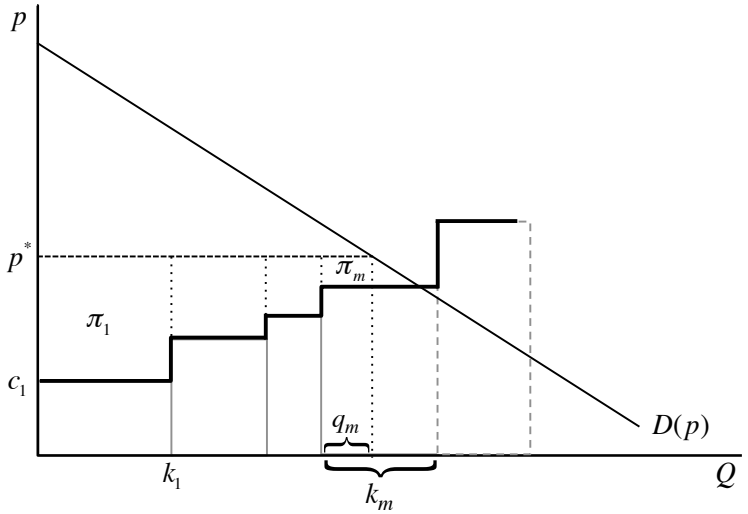
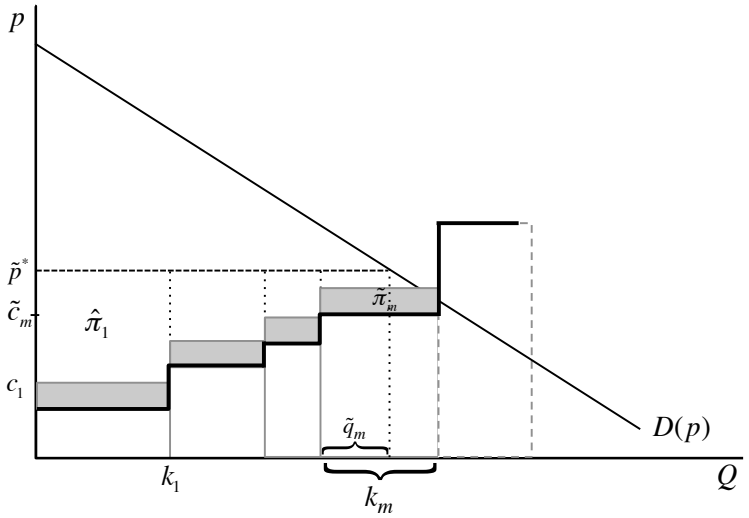


Figure 6: Common cost shocks affect both price and profits, but inframarginal shocks affect only profits.

i. Equilibrium without discounts



ii. Common crude price shock affects both price and profits



iii. Discount to inframarginal producers affects profits but not prices

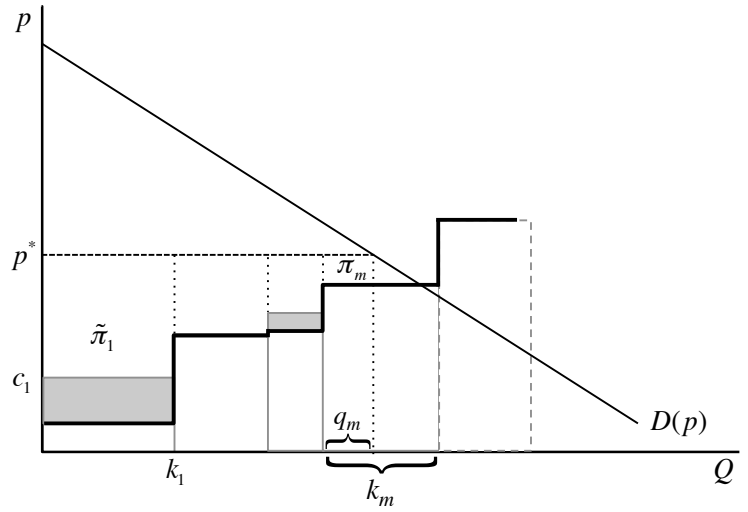
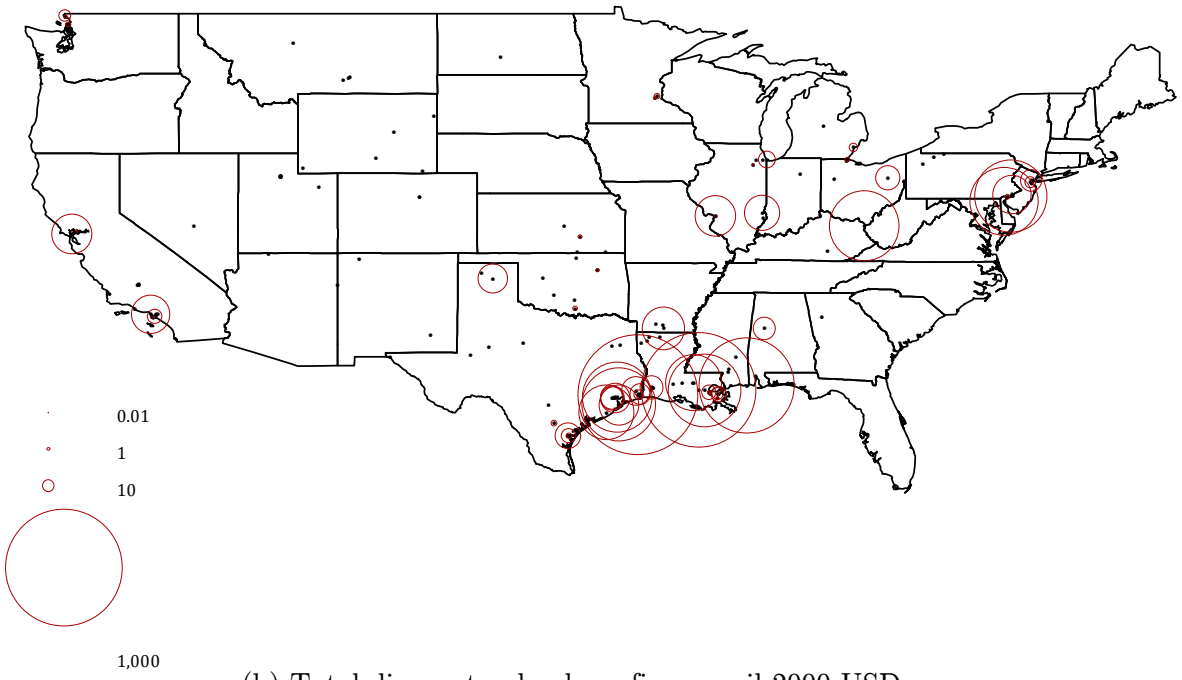


Figure 7: Geographic Destinations of Saudi Crude and Discount Value, 1991-2003

(a) Saudi crude quantity by refinery, mil bbl



(b) Total discount value by refinery, mil 2000 USD

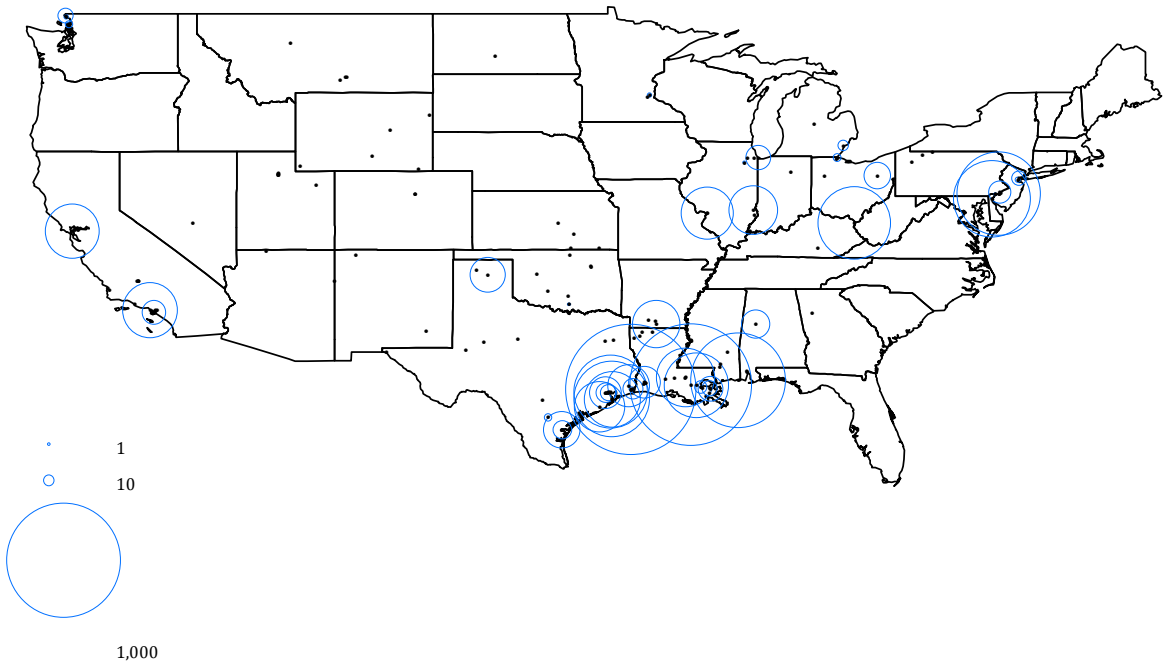


Figure 8: State-level Saudi inputs as a share of total refining capacity

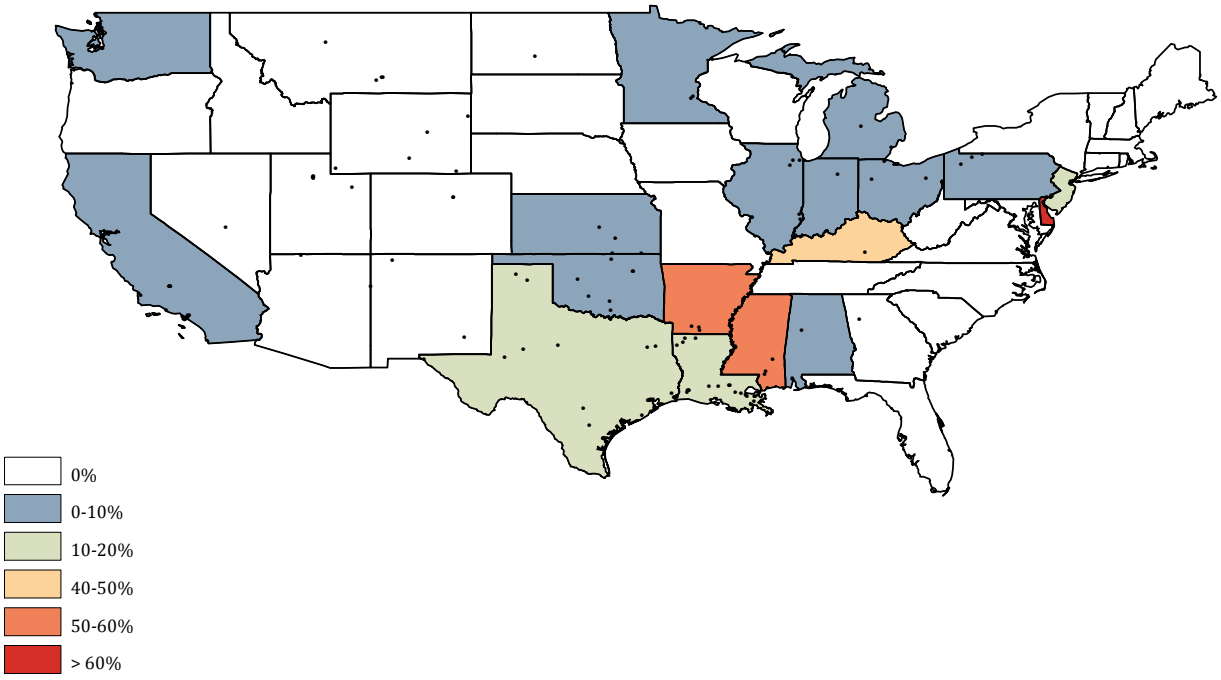
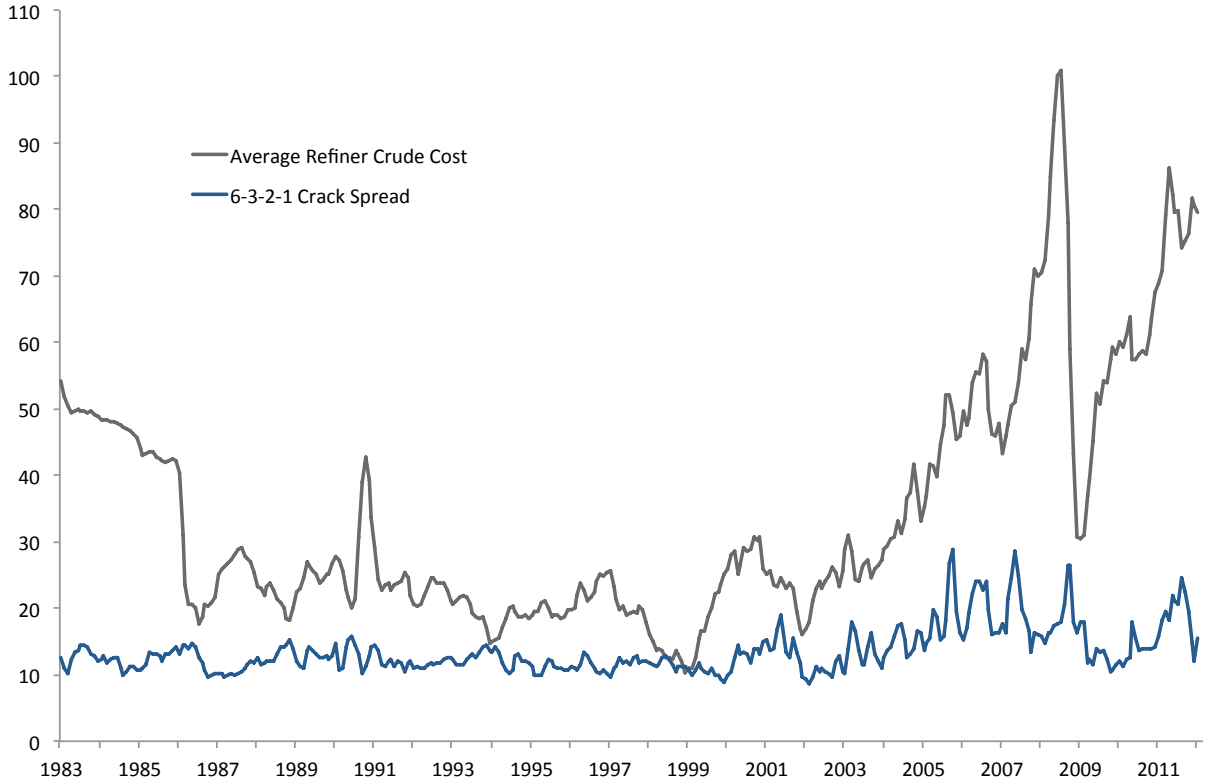


Figure 9: Products Pipelines, 2004.

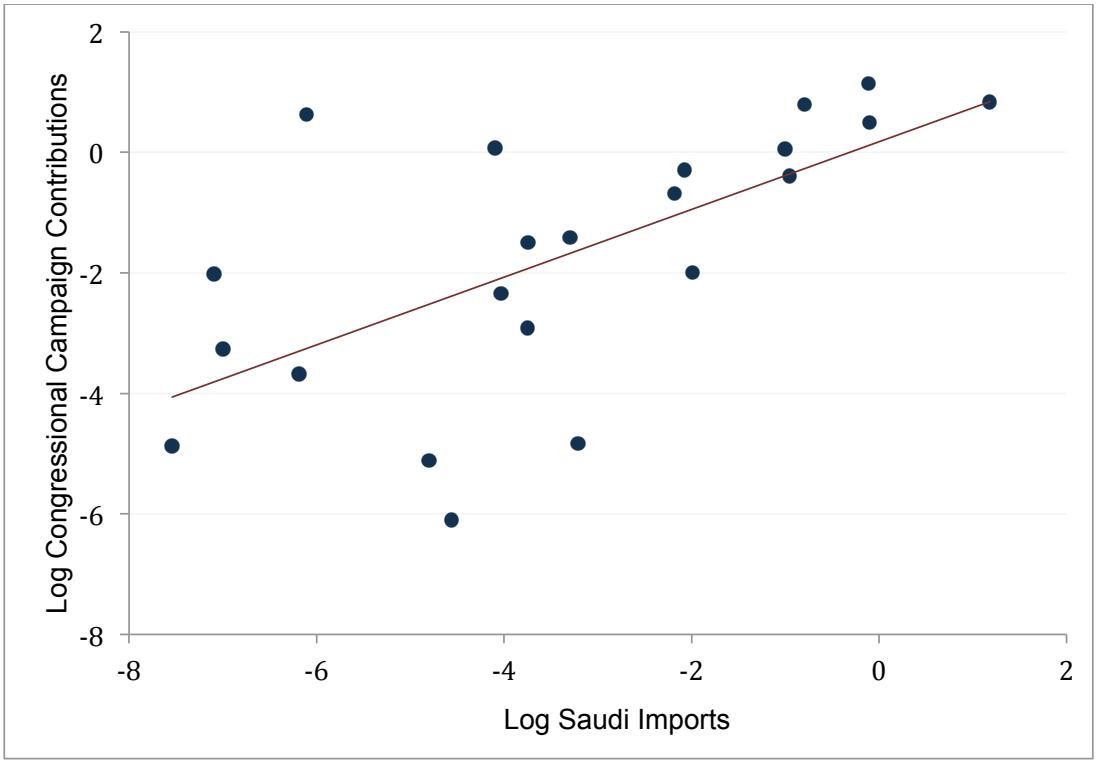
Note: The pipelines in this map were used to construct the markets in panel B of table 3.
Source: http://www.theodora.com/pipelines/united_states_pipelines.html#map

Figure 10: Crack Spread and Average Refiner Crude Cost



Note: The crack spread is calculated as the difference in cost between a barrel of crude and a representative mix of typical outputs. For example, a simple version (the 2-1-1) is calculated as the difference in cost of 2 barrels of crude and a barrel of gasoline and a barrel of heating oil/diesel. Here I use the 6-3-2-1 crack spread, which is the difference in the total cost of 6 barrels of crude and outputs of 3 barrels of gasoline, 2 barrels of heating oil/diesel, and 1 barrel of residual fuel oil. Trends are the same for each of the four standard spreads. Source: EIA.

Figure 11: Correlation of Total Saudi Imports and Total Campaign Contributions by Company



This figure plots the log of total congressional campaign contributions (mil USD) over the 1991-2003 period against the log of total Saudi imports (thousands of barrels).
Fitted line is ln(*amount*) = 0.562 * ln(*Saudi imports*) + 0.175; F(1,20) = 13.55.

Table 1: Refinery owner characteristics and receipts, 1991-2003

Owner	Discount Value (bil USD)	Saudi Imports (bil bbl)	Refining Capacity (bil bbl)	Share of inputs from Saudi	No. Refs	No. Saudi Refs	Refining Profits (bil USD)	Discount Share of Profits
Chevron / Texaco	4.05	3.26	10.16	0.32	18	12	39.84	0.10
Marathon	1.01	0.68	3.50	0.19	7	6	10.81	0.09
ExxonMobil	0.97	0.89	9.03	0.10	10	8	73.94	0.01
Valero	0.84	0.39	1.82	0.21	14	6	4.71	0.18
BP / Amoco	0.57	0.45	9.28	0.05	15	6	34.68	0.02
ConocoPhillips	0.46	0.37	4.97	0.07	17	5	1.17	0.39
Royal Dutch Shell	0.09	0.13	4.13	0.03	15	7	40.13	0.002
Premcor	0.08	0.04	1.70	0.02	6	2	1.10	0.07
Tosco	0.06	0.02	2.53	0.01	10	2	3.22	0.02
Murphy	0.05	0.02	0.61	0.03	2	1	0.33	0.12
Sunoco	0.05	0.11	3.45	0.03	6	2	1.52	0.03
Lyondell	0.03	0.04	1.25	0.04	1	1	0.99	0.03
Alon USA	0.02	0.01	0.34	0.02	2	1	0.04	0.50
Fina	0.01	0.02	0.78	0.03	3	1	0.05	0.20
Total	0.002	0.002	0.62	0.003	3	1	13.72	<0.001
UDS	0.001	0.001	1.27	0.001	4	2	3.31	<0.001
Amerada Hess	0	0	2.46	0	2	0	0.13	0
Citgo	0	0	2.37	0	4	0	1.53	0
Tesoro	0	0	0.94	0	6	0	1.12	0
UnoCal	0	0	0.67	0	3	0	0.57	0
Mapco	0	0	0.56	0	2	0	0.64	0
Farmland Industries	0	0	0.54	0	2	0	0.07	0
Crown Central Petrol	0	0	0.47	0	1	0	-0.04	0
PDVSA	0	0	0.39	0	1	0	0.99	0
Frontier	0	0	0.35	0	2	0	0.42	0
Holly	0	0	0.31	0	3	0	0.55	0
United Refining	0	0	0.29	0	1	0	0.09	0
Delek	0	0	0.26	0	1	0	0	.
Pennzoil - Quaker State	0	0	0.28	0	3	0	0.72	0
Giant Industries	0	0	0.18	0	3	0	0.42	0
Big West	0	0	0.11	0	1	0	0	.
Calumet	0	0	0.10	0	3	0	0.00	.
Huntway Refining	0	0	0.06	0	2	0	0.06	0
AIPC	0	0	0.03	0	1	0	-0.06	0
Suncor	0	0	0.02	0	1	0	0.34	0
Greka Energy	0	0	0.01	0	1	0	0.00	.
SABA Petrol	0	0	0.01	0	1	0	0	.

Notes: This table provides sample statistics on the refinery-owners that are publicly-listed. Columns 1-6 are calculated using refinery-level observations on monthly Saudi imports and crude prices and annual refinery capacity reports from the EIA. Columns 5 and 6 indicate the number of unique refineries that were owned by the company during the policy period and the number of these that received any amount of Saudi crude during the period. Total refining profits is the sum of the annual operating profits variable for refining operations from the Compustat Business Segments data, and total net income is the sum of the quarterly net income entries from the Compustat aggregation of the SEC-10K filings.

Table 2: Refiner Characteristics and Saudi Crude Receipts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Saudi Crude Refinery (89/90)	0.647***	0.639***	0.637***	0.642***	0.635***	0.637***	0.626***
	(0.086)	(0.125)	(0.090)	(0.090)	(0.089)	(0.087)	(0.103)
Total Refining Capacity	0.025	0.062	0.007	-0.005	0.008	0.002	0.062
	(0.030)	(0.058)	(0.032)	(0.039)	(0.035)	(0.035)	(0.082)
Former Aramco Partner	-0.012	0.036	-0.080	-0.090	-0.079	-0.070	-0.554
	(0.113)	(0.247)	(0.130)	(0.130)	(0.104)	(0.132)	(0.676)
Overall Political Contributions, 1989-1990			0.001				
			(0.001)				
Politicians				0.001			
				(0.001)			
Committees				-0.001			
				(0.002)			
Pro-Israel Recipients					0.001		
					(0.001)		
Republican						0.001	
						(0.001)	
Democratic						0.001	
						(0.001)	
House Appropriations							0.072
							(0.053)
House Armed Services							0.116**
							(0.056)
House Energy							-0.058**
							(0.026)
House Education and Labor							-0.024
							(0.073)
House Foreign Affairs							-0.213**
							(0.087)
House Post Office							-0.199
							(0.135)
Senate Appropriations							0.011
							(0.015)
Senate Armed Services							-0.158*
							(0.083)
Senate Energy							-0.026
							(0.024)
Senate Foreign Relations							0.095*
							(0.054)
Senate Government Affairs							0.145
							(0.102)
Senate Labor							0.088
							(0.068)
State Dummies		x					
N	115	115	115	115	115	115	115

Notes: Results for LPM regression of a dummy for whether a refining company received Saudi crude during the policy period on a set of refiner characteristics. These include whether the company ever owned a refinery that had processed Saudi crude in the pre-policy period (1989-1990), total refining capacity in billions, an indicator for the former Aramco partners, and pre-period political contributions to Members of Congress by party affiliation and committee membership. All political contributions are in thousands of 2000 USD. State dummies indicate whether a company owned any refineries in a particular state.

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Impact of the Discount on Refining Profits

	quantity: log (1)	quantity: log (2)	value: level (3)
Discount Value	0.016**	0.169***	3.38**
	(0.007)	(0.045)	(1.56)
Companies	39	16	39
N	317	81	317

Notes: Columns 1 and 2 report results from the regressions of log annual company-level refining profits on log quantity of Saudi crude delivered to refineries owned by the same company in that year for the 1991-2003 period. In the regression in Column 1, 1 is added to profits and 1 to quantity to avoid losing observations (both in billions) and column 2 drops observations with negative profit observations or zero Saudi quantities. Column 3 shows the results from a regression of the level of refining profits on total discount value. All regressions include company and year fixed effects. Observations for Texaco are excluded due to Motiva joint ventures with Saudi Aramco. Standard errors are clustered at the company level.

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Saudi Crude Receipts and Refinery Output

	(1)	(2)	(3)
ln (Saudi Crude Receipts)	0.001	0.004*	0.003*
	(0.002)	(0.002)	(0.001)
ln(Refining Capacity)	1.103***	1.142***	0.661***
	(0.081)	(0.065)	(0.174)
District FE	x	x	x
District FE * t			x
Year FE		x	x
N	156	156	156

Notes: This table shows the results from the regression of log annual district-level production on the log of Saudi crude receipts to all refineries in the district for the 1991-2003 period. Refinery output is calculated at the district level for twelve refining districts using refining capacity from the EIA Refining Capacity Report and capacity utilization rates from the EIA-810 Monthly Refinery Report. One is added to all three variables to avoid dropping observations. Standard errors are clustered at the district level.

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Impact of the Discount on City-Level Retail Gasoline Prices

	quantity: log (1)	quantity: log (2)	value: level (3)
Panel A: Local Markets			
Discount per Gallon	-0.0002	-0.001	-0.031
	(0.0007)	(0.002)	(0.112)
H_0: full pass-through (p-value)	<0.001	<0.001	<0.001
Panel B: Pipeline-Connected Markets			
Discount per Gallon	0.0001	-0.001	-0.002
	(0.0009)	(0.002)	(0.142)
H_0: full pass-through (p-value)	<0.001	<0.001	<0.001
Cities	75	31	75
N	5326	1375	5326

Notes: Columns 1 and 2 report results from the regressions of the log of monthly city-level gasoline prices on log of Saudi crude deliveries as a share of total local refining capacity for the 1998-2003 period. In the regression in Column 1, .01 is added to share to avoid losing observations and column 2 drops observations with zero Saudi quantities. Column 3 shows the results from a regression of gasoline price levels on monthly discount per gallon of local refining capacity. Panel B reports the same results accounting for all imports and refining capacity "up-pipe" of the city. The second row in both panels reports the p-value of an F-test of the coefficient against the full pass-through benchmark of -0.04 for columns 1, -0.15 for column 2 and -1 for column 3. All regressions include city and state x year x month fixed effects. Standard errors are clustered at the city level.

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Political Contributions and Discount Value by Company, 1991-2003

Corporation	Total Contrib	Politician Contrib	PAC Contrib	Discount Value	Saudi Share of Inputs	Share of Saudi Exports	Refining Profits	Discount Share of Profits
Chevron/Texaco	7.720	2.704	4.928	4,049	0.683	0.475	39,840	0.10
Marathon	3.806	2.053	1.682	1,005	0.441	0.131	10,810	0.09
ExxonMobil	7.093	4.296	2.669	970	0.185	0.129	73.940	0.01
BP/Amoco/ARCO	8.592	2.586	2.681	567	0.130	0.066	34,680	0.02
Valero	1.636	0.745	0.852	835	0.211	0.056	4,710	0.18
ConocoPhillips	3.403	1.370	1.938	460	0.218	0.053	1,170	0.39
Ergon	0.263	0.202	0.049	172	0.345	0.020	.	.
Royal Dutch Shell	1.245	0.810	0.384	85	0.030	0.018	40,130	0.002
Sunoco	1.696	0.561	1.112	45	0.033	0.016	1,520	0.03
Lyondell	0.0002	0	0.0002	34	0.035	0.006	990	0.03
Premcor	0.014	0.009	0.003	81	0.024	0.006	1,100	0.07
Hunt	1.036	0.286	0.700	62	0.232	0.005	.	.
Tosco	0.793	0.306	0.474	64	0.009	0.003	3,220	0.02
Fina	0.113	0.052	0.058	13	0.030	0.003	50	0.26
Murphy	0.688	0.150	0.496	45	0.029	0.003	330	0.14
Coastal	2.762	1.136	1.575	27	0.014	0.002	.	.
Phibro	0.007	0.007	0	2	0.018	0.002	.	.
Chalmette	0	0	0	19	0.027	0.002	.	.
Alon USA	0.010	0.007	0.003	22	0.024	0.001	40	0.55
Koch	6.214	2.471	3.615	1	0.001	0.0003	.	.
Total	0.037	0.031	0.006	2	0.003	0.0003	13,720	<.001
Basis	0.001	0.001	0	0	0.021	0.0003	.	.
Orion	0	0	0	1	0.005	0.0002	.	.
Sinclair	0.046	0.040	0.004	-1	0.002	0.0001	.	.
UDS	0.186	0.150	0.010	1	0.001	0.0001	3,310	<.001
Flint Hills	0.008	0.008	0	1	0.001	0.0001	.	.

Notes: Includes all public and private companies with any Saudi imports over the period. Columns 1-4 are calculated using data from the FEC filings available at http://data.influenceexplorer.com/docs/contributions. Column 2 includes only direct contributions to campaigns for House and Senate seats, and Column 3 totals contributions to political committees. Columns 4-7 are calculated using refinery-level observations on monthly Saudi imports and crude prices and annual refinery capacity reports from the EIA. Total refining profits is the sum of the annual operating profits variable for refining operations from the Compustat Business Segments data. All dollar values are millions of real 2000 USD.

Table 7: Summary Statistics for Politician-Level Political Contributions: 1993-2003

	Conditional (>0)					Unconditional	
	Mean	Median	Max	SD	N	Mean	N
Overall	1,487	997	44,901	1,883	10,680	34	464,954
Received pro-Israel Contributions	1,595	1,026	44,901	2,042	8,218	38	337,583
ISR27-40	1,187	933	38,732	1,852	1,314	26	59,307
ISR40-60	1,182	937	17,618	1,370	2,204	28	92,447
ISR60-80	1,709	1,053	31,402	2,074	2,534	46	93,418
ISR80+	2,130	1,157	44,901	2,496	2,166	50	92,411
Republican	1,572	1,006	44,901	2,014	7,701	52	230,456
Democrat	1,269	958	21,155	1,472	2,977	16	232,655
Independent	721	721	963	342	2	1	1,354
House	1,247	951	44,901	1,584	8,515	28	379,093
Senate	2,431	1,406	31,402	2,554	2,165	61	85,861
House Appropriations	1,244	960	38,732	1,746	1,210	1,224	1,223
Senate Appropriations	2,508	1,877	21,155	2,517	708	2,454	721
House Foreign Affairs	1,136	697	44,901	2,085	591	1,097	606
Senate Foreign Relations	2,478	1,199	31,402	3,103	393	2,439	399
Company-Level Total	34,861	7,404	374,089	57,333	453	18,578	850

Notes: This table reports annual average values for contributions by refining companies to members of congress. The left panel reports statistics on the non-zero entries in the dataset, e.g. the size of an annual contribution conditional on a contribution being made by that company to that politician in a given year. The right panel reports statistics on the entire annual company by politician sample, including zeros for years in which the politician was a member of congress and the company existed but no contribution was made. The last row of the table gives annual averages by company. Contribution values are in 2000 USD.

Table 8a: Discount Correlation with Refiner Political Contributions

	Total (1)	Politicians (2)	PACs (3)
	Panel A: Levels		
Discount Value	0.385**	0.107	0.271***
	(0.170)	(0.092)	(0.086)
	Panel B: Elasticities		
ln(Discount Value)	0.440***	0.432***	0.418**
	(0.149)	(0.114)	(0.186)
Companies	115	115	115
N	1033	1033	1033

Notes: Panel A shows the results from regressions of total annual political contributions on total discount value (in thousands) in the same year over the 1991-2003 period, and Panel B reports the elasticity of giving with respect to changes in the value of the discount. Column 1 shows the correlation with total overall political contributions, and columns 2 and 3 break this overall effect into the effects on contributions to individual politicians and to PACs. All regressions include company and year fixed effects. Observations for Texaco are excluded due to Motiva joint ventures with Saudi Aramco. Standard errors are clustered at the company level.
*** p<0.01, ** p<0.05, * p<0.1

Table 8b: Discount Correlation with Refiner Political Contributions: Public Only

	Total (1)	Politicians (2)	PACs (3)
	Panel A1: Levels (Controlling for Profits)		
Discount Value	0.929***	0.423***	0.507***
	(0.211)	(0.060)	(0.167)
	Panel A2: Levels (No Profit Controls)		
Discount Value	0.914***	0.370***	0.542***
	(0.235)	(0.060)	(0.198)
	Panel B1: Elasticities (Controlling for Profits)		
ln(Discount Value)	0.466***	0.363**	0.523**
	(0.153)	(0.150)	(0.162)
	Panel B2: Elasticities (No Profit Controls)		
ln(Discount Value)	0.462***	0.352**	0.533***
	(0.150)	(0.147)	(0.177)
Companies	38	38	38
N	316	316	316

Notes: Panels A1 and A2 show the results from regressions of total annual political contributions on total discount value (in thousands) in the same year over the 1991-2003 period, and Panels B1 and B2 report the elasticity of giving with respect to changes in the value of the discount. Column 1 shows the correlation with total overall political contributions, and columns 2 and 3 break this overall effect into the effects on contributions to individual politicians and to PACs. All regressions include company and year fixed effects and panels A1 and B1 control for refining profits. Observations for Texaco are excluded due to Motiva joint ventures with Saudi Aramco. Standard errors are clustered at the company level.
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Profit Shocks and Total Political Contributions

	levels (1)	elasticity (2)
Panel A: First Stage (Profits on Discount and Hurricane Indicators)		
Discount Value	3.89**	1.90***
	(1.67)	(0.57)
I(Category 3)	-2.57***	-0.93***
	(0.24)	(0.05)
I(Category 4)	-0.21**	-0.11*
	(0.09)	(0.06)
Partial R^2 (Discount Value)	0.004	0.006
Partial R^2 (Hurricane Indicators)	0.010	0.010
Panel B: Second Stage (Contributions on Profits)		
Discount Value	0.317***	0.302**
	(0.089)	(0.092)
Profits from Hurricane Shocks	-0.005	-0.002
	(0.013)	(0.030)
F-test *p*-value	0.001	0.007
Companies	38	38
N	316	316

Notes: Results from a two-stage least squares procedure showing the effects of discount receipts and profits shocks associated with hurricanes on total refiner political contributions over the 1991-2003 period. Profits are in thousands of 2000 USD and contributions in 2000 USD. Regressions include company and year fixed effects. Observations for Texaco are excluded due to Motiva joint ventures with Saudi Aramco. One is added to contributions, discount, and profits (all in billions of 2000 USD) to avoid losing observations in the regressions in column 2.
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Discount Value and Share of Political Contributions by Committee

	FP (Both) (1)	Approp (Both) (2)	Energy (Both) (3)	Education (House) (5)	Post Office (House) (6)	Labor (Senate) (7)	Indian Affairs (Senate) (8)
Discount Value	0.113	0.385**	-0.508**	-0.677**	-0.035	0.021	-0.358**
	(0.084)	(0.156)	(0.254)	(0.280)	(0.067)	(0.068)	(0.148)
Sample Average	0.104	0.271	0.223	0.040	0.010	0.030	0.065
Companies	77	77	77	77	77	77	77
N	532	532	532	532	532	532	532

Notes: This table reports the relationship between the total Saudi discount value and share of total refiner political contributions by committee membership over the 1991-2003 period. Discount value in billions of 2000 USD. All regressions include company and year fixed effects. Observations for Texaco are excluded due to Motiva joint ventures with Saudi Aramco. Standard errors are clustered at the company level.
*** p<0.01, ** p<0.05, * p<0.1

Table 11a: Discount Receipts and Politician-Level Political Contributions: 1993-2003

	(1)	(2)	(3)	(4)	(5)
(ISR=1)*DiscValue	-118.21*				
	(66.70)				
(ISR27-40)*DiscValue		-65.65			-20.51
		(92.88)			(90.36)
(ISR40-60)*DiscValue		-72.93			-47.54
		(74.46)			(75.18)
(ISR60-80)*DiscValue		-140.73			-152.78
		(89.07)			(94.70)
(ISR80+)*DiscValue		-176.70			-162.53
		(138.87)			(135.90)
Republican*DiscValue			166.23**		140.54*
			(73.18)		(77.91)
(House Approp)*DiscValue				92.99	57.16
				(402.97)	(403.16)
(Senate Approp)*DiscValue				1685.37	1705.26
				(1079.05)	(1080.74)
(House For. Aff.)*DiscValue				-1177.70***	-1212.62***
				(398.24)	(402.23)
(Senate For. Rel.)*DiscValue				-1570.44	-1543.64
				(1278.91)	(1262.46)
N	464,954	464,954	464,954	464,954	464,954

Notes: This table shows the results from the regression of annual politician by company level political contributions on the interaction of company discount values with politician characteristics. All regressions include politician by company and year fixed effects and controls for committee membership and discount value. Discount value in billions of 2000 USD, contributions in 2000 USD. Standard errors are clustered at the politician by company level.
*** p<0.01, ** p<0.05, * p<0.1

Table 11b: Discount Receipts and Politician-Level Political Contributions: 1998-2003

	(1)	(2)	(3)	(4)	(5)
(ISR=1)*DiscValue	-253.11***				
	(85.52)				
(ISR20-40)*DiscValue		-196.84*			-178.00
		(110.49)			(109.40)
(ISR40-60)*DiscValue		-214.56**			-208.00***
		(89.16)			(89.75)
(ISR60-80)*DiscValue		-406.76***			-438.21
		(127.28)			(129.67)
(ISR80+)*DiscValue		-175.11			-243.06
		(172.81)			(179.81)
Republican*DiscValue			30.45		0.19
			(93.02)		(102.97)
(House Approp.)*DiscValue				-605.49	-578.65
				(383.80)	(377.23)
(Senate Approp.)*DiscValue				2375.64**	2432.25**
				(1192.79)	(1185.21)
(House For. Aff.)*DiscValue				-621.36*	-616.60
				(377.95)	(378.35)
(Senate For. Rel.)*DiscValue				-582.36	-567.95
				(1043.25)	(1038.65)
N	223,213	223,213	223,213	223,213	223,213

Notes: This table shows the results from the regression of annual politician by company level political contributions on the interaction of company discount values with politician characteristics. All regressions include politician by company and year fixed effects and controls for committee membership and discount value. Discount value in billions of 2000 USD, contributions in 2000 USD. Standard errors are clustered at the politician by company level.
*** p<0.01, ** p<0.05, * p<0.1