

POLITICAL WINDS, FINANCING CONSTRAINTS AND PHARMACEUTICAL
INNOVATION

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ABSTRACT

There has been considerable recent debate over the short and long run effects of regulating prescription drug prices in the US, but there is little empirical evidence concerning the effect of prices on the returns to R&D. This paper focuses on the 2006 midterm elections, in which the Democratic victory significantly reduced expected prices for certain types of drugs. The empirical work links changes in firms' stock prices with their assets to estimate the effect of expected prices on the value of current and pre-market drugs. In addition, we distinguish the direct effect of prices on the value of pre-market drugs from an indirect affect that arises from financing constraints. Preliminary results suggest that the value of marketed drugs declined after the election, and we find some evidence for a financing effect.

1. INTRODUCTION

In December of 2003, President Bush signed the Medicare Prescription Drug, Improvement, and Modernization Act (MMA), which provided subsidized prescription drug insurance for the elderly (Medicare Part D). As has been documented elsewhere, the design of the MMA and Medicare Part D was more about politics than policy (Oberlander, 2007). In fact, support for the MMA was largely along party lines, particularly in the House of Representatives, where passage of the MMA (H.R.1) was by a narrow majority. One of the most contentious issues in the debate over the MMA was whether the Federal government would negotiate prescription drug prices. Democrats supported the Rangel-Dingell Amendment, which would have required such negotiation.¹ However, the final version of the MMA prohibited the federal government from negotiating prices and this aspect of the MMA reflected a Republican victory that was widely supported by the Pharmaceutical industry.

Careful observers have noted that the value of allowing the government to negotiate prescription drug prices depends on the extent to which prices affect pharmaceutical innovation. Lowering prices through centralized government purchase would increase consumer surplus, but may reduce pharmaceutical investment and innovation, adversely affecting future consumer surplus (Hughes, Moore and Snyder, 2002). Similar considerations underlie the evaluation of other recent policy proposals to control the growth of prescription drug spending, such as establishing price ceilings or allowing Canadian imports.

¹ The House voted on the Amendment on June 25, 2003. The Amendment stipulated that:

Medicare contractors will obtain guaranteed reductions in prices, and the Secretary of Health and Human Services will have the authority to use the collective purchasing power of Medicare's 40 million beneficiaries to negotiate lower drug prices, taking into account prices paid in other countries and by other payers in the U.S. (Congressional Record, Rangel-Dingell Amendment to H.R.1 June 25, 2003)

Several recent papers have attempted to quantify the effect of prescription drug prices on innovation, and to evaluate the tradeoffs of reducing prices. Giaccotto, Santerre and Vernon (2005) and Golec and Vernon (2006) find a positive correlation between prices and research and development (R&D) spending.² These results are then combined with estimates of the effect of R&D on the number of new drugs and estimates of the effect of a new drug on consumer surplus (e.g., Lichtenberg, 2002), to obtain an estimate of the long run effect of prices on consumer surplus. Santerre and Vernon (2006) compare the estimated the long run effect with the estimated short run effect, and conclude that the net effect of reducing prescription drug prices is negative, as the long run effect is much larger in magnitude.

In this paper, we take a different approach to investigate the short and long run effects of pharmaceutical prices, focusing on the effects of prices on firms' current and future profitability. Specifically, we use changes in pharmaceutical stock prices in response to changes in political control of the US Congress in 2006. As the Medicare Part D debate illustrates, and as described in more detail below, the two major political parties in the US have well defined positions on pharmaceutical price regulation; Democrats are much more likely than Republicans to allow the government to administratively set pharmaceutical prices. The Democratic victory in the 2006 mid-term election therefore represents a discrete change in the probability that future pharmaceutical prices will be administratively set by government. We estimate the effect of the policy on the value of currently marketed drugs and on the value of drugs in development stages. The estimate of the latter effect provides evidence on the effect of price regulation on profit incentives, and hence, innovation.

² Scherer (2001) finds a strong association between profitability and R&D, which he suggests may be due to financing constraints or the correlation between current and future profitability. Finkelstein (2004) and Acemoglu and Linn (2004) find a strong response of innovation to profit incentives and Qian (2007) finds that innovation responds to patent protection in more developed countries. It is difficult to directly infer the effect of drug prices on innovation from these studies, however.

As we document below, pharmaceutical stock prices declined immediately after the election, but the decline was widely observed:

“The drug makers Pfizer, Merck and Johnson & Johnson paced the stock retreat on speculation that a Democratic-controlled Congress would reduce subsidies for medicine. A group of health care shares in the Standard & Poor’s 500-stock index fell the most in three years.” (New York Times Nov. 10, 2006)

We argue that the stock price decline was due to three causes. First, the Democrats had pledged to allow the government to negotiate Medicare prescription drug prices, which affected the expected revenue of currently marketed drugs.³ The effect on stock prices varies across firms according to the prescription drugs they currently sell; firms with a relatively large share of sales from the elderly would experience a relatively large decrease in stock price because of the Medicare policy. Second, the election reduces the value of pre-market drugs (i.e., drugs in development phases, or the “pipeline”), because the firm will earn lower revenues for drugs that are eventually approved. This effect also varies across firms and depends on the types of pre-market drugs being developed by the firm – the share of drugs that would eventually be used by the elderly. The third effect arises from financing constraints, which also varies by firm. Several studies have found that the external cost of raising capital may be substantially larger than the internal cost for pharmaceutical firms (Lerner, Shane and Tsai, 2003, and Metrick and Nicholson, 2006).⁴ A decrease in cash flow reduces the value of pre-market drugs because the firm must raise additional external funds. Price negotiation would reduce cash flow, and a firm

³ Future work will consider other policy proposals by the Democrats.

⁴ There is a much larger empirical literature investigating the effect of financing constraints on investment. A number of studies have estimated the relationship between cash flow and investment, e.g., Blanchard, Lopez-de-Silanes and Schleifer (1994), Lamont (1997) and Rauh (2005). A major difficulty in this approach has been identifying changes in cash flow that are uncorrelated with unobserved investment opportunities or other firm characteristics (Gilchrist and Himmelberg, 1995 and Erickson and Whited, 2000). The advantage of an event study with a short event window is that we can focus on changes in asset values due to the election, which are presumably uncorrelated with slowly moving changes in investment opportunities.

with a relatively large decrease in cash should also experience a large decrease in the value of pre-market drugs.

We measure the magnitude of these three effects by relating in a regression model changes in stock prices (i.e., post-election abnormal returns) to the value of current elderly prescription drug sales; detailed measures of a firm's drug pipeline and R&D capital stock; and the interaction between prescription drug sales and the research and development variables. The empirical strategy uses cross-firm variation in the types of marketed and pre-market drugs, and variation in abnormal returns.

There are several advantages to this approach relative to the previous literature. First, we focus on a discrete change in expected profitability whereas previous research in this area largely relies on slowly moving changes in prices, or cross-country price variation, both of which may be confounded with other factors. Golec, Hegde and Vernon (2006) is the study most closely related to ours and it focuses on changes in pharmaceutical stock prices associated with the introduction of the Clinton health care proposal. In contrast, this paper focuses on a much more defined, short term event. Second, we can compare short and long run effects of regulation in the same empirical setting rather than simulating these effects from disparate estimates drawn from several studies. Third, the empirical strategy provides a unique opportunity to distinguish the effect of financing constraints on the value of pre-market drugs from the effect of lower expected revenues. Finally, the analysis offers novel insight into the expected profitability of pre-market drugs. As argued below, the association between changes in stock prices and the distribution of pre-market drugs provides an estimate of the change in future value of the drugs in development. A small change in the value of pipeline drugs suggests that these drugs have relatively little value, for example, because they are "me-too" drugs. Previous estimates of the distribution, for

example those presented in Grabowski and Vernon (2000), are based on historical outcomes. In this paper, we provide some evidence on the profitability of prescription drugs that are currently in development stages.⁵

This paper reports several preliminary results. First, there is a negative relationship between a firm's post-election abnormal stock return and elderly drug sales, which is consistent with a decrease in the value of currently marketed drugs. There is also a negative relationship between a firm's post-election abnormal return and the value of firms' R&D. Finally, there is some evidence for a cash flow effect, in which firms with a larger decline in cash flow experience a larger decline in the value of the R&D stock.

2. EFFECT OF THE 2006 ELECTION ON MARKET CAPITALIZATION

2.1 PARTY CONTROL OF CONGRESS AND PHARMACEUTICAL PRICING

In both rhetoric and action, the Republican and Democratic parties have staked vastly different and clearly defined positions with regard to pharmaceutical price regulation. The 2003 MMA was largely a Republican-initiated and -designed policy that was passed with minimal input of Democrats. Therefore, it is no surprise that the MMA reflects the Republican position that it is inappropriate and harmful for the government to negotiate prescription drug prices.

In contrast, the Democrats have stated repeatedly that they want the federal government to negotiate prices. This position was evident in the debate leading up to passage of the MMA and continues today. The current Democratic Party Platform, which dates from 2004 and remains the primary statement of policy for Democrats, includes the following:

The current Medicare drug program serves drug companies more than seniors.... It

⁵ Long run welfare estimates typically do not incorporate the distribution of expected welfare across drugs. Abbott and Vernon (2007) use empirical estimates of this distribution to calibrate a model that characterizes firms' decisions to advance drugs through clinical trial phases, but do not perform any long run welfare calculations.

forces seniors into HMOs. Elderly Americans deserve a real prescription drug benefit – one that uses the government's purchasing power to lower costs and ensures access to new therapies for their illnesses.

Surrounding the 2006 election, many top Democratic leaders made it clear that they wanted to change the MMA to allow the government to negotiate prescription drug prices:

Representative Nancy Pelosi, the California Democrat who is in line to become the House speaker, has said the House will take up legislation to repeal that ban in its first 100 hours under Democratic control. Senate Democrats have expressed a similar desire. The eight Democrats newly elected to the Senate all say Medicare should have the power to negotiate with drug makers. (New York Times Nov. 13, 2006)

The pharmaceutical industry also recognized the Democratic position at the time:

Hoping to prevent Congress from letting the government negotiate lower drug prices for millions of older Americans on Medicare, the pharmaceutical companies have been recruiting Democratic lobbyists, lining up allies in the Bush administration and Congress, and renewing ties with organizations of patients who depend on brand-name drugs. (New York Times, Nov. 26, 2006)

Thus, the record is clear. A Democratic victory in 2006 was expected to significantly increase the probability that the federal government would negotiate and lower prescription drug prices.

There was considerable uncertainty over the outcome of the 2006 election. Before the election, the probability of a Democratic victory in both houses was approximately one-in-four, according to the Iowa Electronic Market, and the election significantly increased the probability that the federal government would negotiate prices.

In sum, given the starkly contrasting positions of the two major political parties and the uncertainty over the outcome of the 2006 election, the Democratic victory in 2006 represents an opportunity to study the expected effect of price controls on pharmaceutical innovation. Pre- to post-election, there was a significant change in the likelihood that pharmaceutical prices would be set administratively. The efficiency of the stock market implies that such a change should be quickly capitalized into stock prices, and we can use the change in stock prices to infer the effect

of pharmaceutical price regulation. We describe below in more detail how we accomplish this task.

2.2 THE ELECTION, CASH FLOW AND ASSET VALUES

To motivate the empirical strategy, this section describes a simple two-period model that illustrates the effect of a negative price shock on the value of pre-market drugs. The model follows Kaplan and Zingales (1997), in which the cost of externally raising funds is greater than the internal cost, perhaps arising from asymmetric information or agency problems (Myers and Majluf, 1984 and Hart and Moore, 1995). It is widely believed that such a characterization applies to the pharmaceutical industry (see above citations).

There are two types of consumers, elderly and young, which consume disjoint sets of drugs. Firm i holds patents to N drugs, of which N^e are consumed by the elderly and N^y are consumed by the young. In the first period, each elderly drug earns the firm profits of π^e , and each young drug yields profits of π^y ; second period profits of both types of drugs equal zero. The firm's first period profits from marketed drugs are $\pi = N^e \pi^e + N^y \pi^y$.

The firm has two projects it can undertake, one of which is to market a drug that will be consumed by the elderly, and the other is to market a drug for the young. Each project, $j = \{e, y\}$, requires an investment I^j . The firm earns variable profits of $P^j F(I^j)$ for the project in the second period, where P^j is the expected price of output and $F' > 0$. The firm can use cash, W^j , and external funds, E^j , to fund the project, so that $I^j = W^j + E^j$. The firm faces financing constraints, and k is a reduced form measure of the wedge between the internal and external cost of funds. The additional cost of external funds is then $C(E^j, k)$, which is increasing in both

arguments. The firm injects a fixed proportion of its first period profits into the project, so that $W^j = \alpha^j \pi$. The firm's only choice variable is E^j , and the value of the project, V^j , is:

$$V^j = \max_{E^j} P^j F(\alpha^j \pi + E^j) - C(E^j, k) - \alpha^j \pi - E^j \quad (1)$$

The value is simply the difference between variable profits and costs, which include the additional cost of external funds. Equation (1) shows that the value of the firm's projects depends on the expected price, P^j ; a project with a higher expected price has a larger value. The first order condition is:

$$\frac{\partial F}{\partial E^j} = \frac{\partial C}{\partial E^j} + 1 \quad (2)$$

Equation (2) yields the optimal amount of external finance. Expected prices and first period profits are sufficiently high that V^j is positive for both of the projects.

Suppose that before the first period, there is a negative shock to π^e and P^e , the profits of current and the price of future elderly drugs. The shock has several effects on the value of the firm's assets. The profits from marketed drugs decline, in proportion to N^e . The shock also reduces the value of project e for two reasons. First, as equation (1) shows, the value of the project is increasing in the expected price, which we refer to as the revenue effect. Furthermore, the amount of cash available to finance the project declines because of the decrease in available cash, $\alpha^j \pi$. The Envelope Theorem and equation (2) imply that the decrease in cash reduces the value of the elderly project, beyond the revenue effect, which we refer to as the financing effect. Note that the value of project y also declines, because of the decrease in available cash.

There may be heterogeneity across firms in the value of their projects. For example, one firm may have an elderly project with a high expected price, relative to the price of another firm's project. An important result of this simple model is that even if all expected elderly prices

decrease by the same amount, the effect of the shock on the value of each project may vary. Some projects may have been marginal before the election, in the sense that the net present value was positive, but close to zero. If the reduction in price causes the net present value to fall below zero, the firm would not continue investing in the project. Therefore, the reduction in value would be smaller in magnitude than the reduction for a project the firm continues financing.⁶

3. ESTIMATING THE EFFECT OF DRUG POLICY ON ASSET VALUES

3.1 EFFECT OF THE ELECTION ON VALUES OF MARKETED AND PRE-MARKET DRUGS

The value of a firm depends on the value of its marketed and pre-market drugs.⁷ As Section 2.1 shows, the election decreased the expected value of both types of drugs, because of the increase in probability the government would negotiate prices. The model in Section 2.2 suggests three reasons why the expected Medicare policy of Democrats affected firm values.

First, the value of marketed drugs decreases, but the effect on firm values varies substantially across firms. Drugs have considerable heterogeneity in their age-sales profiles; for example, antibiotics are consumed mainly by the young, and cardiovascular drugs by the elderly (Acemoglu and Linn, 2004). As Section 2.2 indicates, the effect of Medicare price policies on the total value of a firm's marketed drugs depends on the share of its revenue accounted for by the elderly.⁸ If price regulation affects the price of elderly drugs equally, the change in expected sales is proportional to the firm's drug sales to the elderly, M_i^e .

⁶ The conclusion is similar if the function $F(I)$ varies across projects. The results also would be similar in a model of irreversible investment with uncertainty. Schwartz (2004) suggests that the reduction in expected prices would have a smaller effect on the value of marginal drugs because the option value would increase.

⁷ The firm may have other assets that we cannot measure but that are valued by the market, such as basic research productivity. In the empirical work we assume that changes in the values of these assets are uncorrelated with changes in the values of observable assets.

⁸ We ignore potential spillover effects, in which the government negotiation affects other drug prices, for example, drugs purchased under Medicaid. We hope to explore this issue in future work.

The second effect is that the value of a firm's pipeline projects decreases because of the decrease in expected prices, i.e., the revenue effect. As with the first channel, this effect varies across firms. For example, the expected price might not change for an antibiotic in clinical trial phase, but would change for a cardiovascular drug. The variable RD_i^e is the stock of projects of firm i that belong to therapeutic categories primarily consumed by the elderly. If expected prices for elderly drugs change by the same amount, RD_i^e is proportional to the change in the value of the firm's pre-marketed drugs, because of the revenue effect.

Finally, in Section 2.2 the reduction in the firm's cash flow reduces a project's value, because the firm needs to increase the amount of external finance. The effect depends positively on the firm's change in cash flow, which is proportional to M_i^e . As noted above, the change in cash flow affects the value of all pre-market drugs, both those used by the elderly and the young. Assuming that the change in value of the R&D stock is proportional to the change in cash flow, the value of R&D decreases in proportion to $M_i^e \cdot RD_i^j$, the product of the elderly drug sales and the stock of each drug type, where $j = \{e, y\}$.

3.2 EMPIRICAL STRATEGY

The empirical analysis focuses on changes in stock prices after the 2006 Congressional election. The Democratic victory in both Houses was a surprise, and represents a substantial decrease in expected prescription drug prices. The current analysis focuses on the effect of the election on the value of elderly drug sales and pre-market drugs, due to policies (e.g., price negotiation) that would differentially affect drugs used by the elderly. Future work will incorporate clinical trial data and consider other policy shocks and spillovers into other types of drugs, as well as other

political events (e.g., the failure of the Democrats to overcome a Senate filibuster on the proposed Medicare bill in April of 2007).⁹

We construct a data set of pharmaceutical and biotechnology firms, as described below, and estimate abnormal stock returns after the election. The abnormal returns are used to estimate the change in asset values due to the three channels described in Section 3.1.

Specifically, we estimate a cumulative abnormal return (CAR) for firm i over the seven days following the election, CAR_i . The CAR is the dependent variable in the following regression:

$$CAR_i = \beta_0 + \beta_1 M_i^e + \beta_2 RD_i^e + \beta_3 M_i^e RD_i^e + \beta_4 RD_i^y + \beta_5 M_i^e RD_i^y + \varepsilon_i \quad (3)$$

The variable M_i^e is the firm's pre-election revenue from sales to the elderly. The variable RD_i^e is the firm's stock of pre-market drugs classified in categories primarily used by the elderly. The third variable is the interaction of the elderly R&D stock with elderly sales. The variables RD_i^y and the final interaction term are defined similarly, where RD_i^y is the R&D stock of drugs classified in young categories. Note that all independent variables are normalized by the firm's stock market capitalization prior to the election.

The variable M_i^e is a proxy for the firm's expected revenue from sales to the elderly for its marketed drugs. The coefficient β_1 corresponds to the percent change in elderly drug sales, which we expect to be negative. Similarly, the R&D variable is a measure of the firm's pre-market elderly drug stock, and the coefficient β_2 is the percent change in the value of the elderly stock, which should also be negative. The coefficient on the interaction of the elderly market and elderly R&D stock is β_3 , which is expected to be negative; a firm with large sales to the elderly

⁹ In principle, we could also analyze changes in stock prices associated with the initial passage of the MMA. It is difficult to identify large discrete changes in the probability the bill would be passed, as it was considered for many years in both Houses.

experiences a large decline in expected cash, which reduces the value of the R&D stock because of financing constraints. The final two variables are the R&D stock of non-elderly drugs, and the interaction of the variable with elderly sales. The coefficient on the non-elderly drug stock, β_4 , may be negative, if the government was expected to also negotiate prices on other drugs, for example, under Medicaid; regardless, the magnitude should be smaller than β_2 . The coefficient on the non-elderly interaction term, β_5 , would be negative if the reduction in cash flow from elderly drug sales causes the value of the R&D stock to decrease.

The parameters are identified by variation across firms in the types of marketed and pre-market drugs. The main assumption is that the ratio of a firm's sales to its market value is uncorrelated with changes in the values of unobserved firm characteristics, such as the quality of basic scientific research.

4. DATA AND SUMMARY STATISTICS

Estimating equation (3) requires data from the Center for Research on Security Prices (CRSP), Compustat, and the Medical Expenditure Panel Survey (MEPS). Future work will incorporate patent data and clinical trial data from Pharma.

A key variable in our analysis is prescription drug sales of each pharmaceutical firm. We use data from the 2004 Medical Expenditure Panel Survey (MEPS), which is a publicly available data set produced and maintained by the Agency for Healthcare Quality and Research. The MEPS is a household survey that collects information from individuals, employers, and medical providers about the use and cost of medical care. It is the most comprehensive and reliable source of information on the use and costs of prescription drugs in the US. Each MEPS

respondent is asked about their prescription drug use and for each prescription, information about that prescription such as dosage and cost is obtained from the dispensing pharmacy.

We calculate elderly prescription drug sales by firm from respondents' reported use of prescription drugs, multiplied by the price paid for each prescription (which was supplied by the pharmacy). To obtain national figures we apply sample weights provided in MEPS. We identify firms using the National Drug Code maintained by the FDA and supplied by the dispensing pharmacy for all prescriptions.¹⁰ We calculate prescription drug sales to persons age 65 and over for each firm.

Table 1 provides some summary statistics for key variables. There are 20 firms in the sample with positive elderly drug sales. Table 1 splits the sample at the median of the firm's share of elderly drug sales in total prescription drug sales. Each cell reports means with standard deviation in parentheses. Firms in the two categories have similar mean market capitalization, prescription drug sales, total firm sales and capitalized R&D.

5. CORRELATION OF STOCK RETURNS WITH ELDERLY DRUG SALES

Figures 1-3 show the estimated CARs and the correlation of the CARs with firms' elderly prescription drug sales. Figure 1 plots the value-weighted CAR, illustrating the firms' stock performance for the two months around the election. The first sample includes firms with positive elderly drug sales. The second sample includes the twenty largest pharmaceutical or biotechnology firms with zero elderly prescription drug sales; as a result, they should not

¹⁰ Approximately 20 percent of prescriptions did not have a national drug code (NDC) that could be used to link the prescription to a specific pharmaceutical manufacturer. However, these prescriptions did have a brand or generic name that could be matched to a NDC. To match them, we found all prescriptions with these names for which there was a valid NDC. Next, we calculated the share of spending on these prescription names by firm using the NDC. We then allocated the total spending on these prescriptions using the firm share obtained from the sample with both a valid NDC and name.

experience a change in sales of marketed drugs. The CAR on a particular date is the sum of the abnormal returns from October 1, 2006 to that date. The vertical lines indicate the day of the election and one week after the election. Before the election the CARs of the two samples are fairly highly correlated. For firms with positive elderly drug sales, there is clearly a large decline in the CAR the day after the election, of about four percent. The average CAR of the other firms does not decrease, and the resulting difference persists for several weeks after the election. The difference indicates that the election had a significant impact on the value of marketed elderly drug sales.

For firms with elderly drug sales, Figure 2 plots the CAR of each firm against the ratio of its elderly drug sales to its pre-event market capitalization (the CAR is estimated from November 7 – November 14). There is a negative correlation, as indicated by the solid line, meaning that firms with a larger share of elderly drug sales experience a large decline in stock market capitalization. The pattern is again consistent with the interpretation that the election reduced the value of marketed elderly drug sales.

Figure 3 shows the distribution of CARs for the same sample of firms, where the CAR is constructed as in Figure 2. Although the average CAR of firms with elderly drug sales is about negative four, there is considerable variation around the mean. The figure shows the CAR distribution for the sample of firms with zero elderly sales. The distribution is to the right of the distribution of the first sample of firms, but there is considerable variation within this sample as well. The following regression analysis uses the variation in CARs to estimate the change in value of marketed and pre-market drugs.

6. PRELIMINARY REGRESSION RESULTS

This section discusses the results of estimating a simplified version of equation (3). We do not yet have sufficient data to distinguish a firm's elderly and non-elderly R&D stock, and we combine the variables in the following equation:

$$CAR_i = \gamma_0 + \gamma_1 M_i^e + \gamma_2 RD_i + \gamma_3 M_i^e RD_i + \varepsilon_i \quad (4)$$

The elderly drug sales variable is the same as before, and the R&D variable is the capitalized R&D, calculated from Compustat, following Chan, Lakonishok and Sougiannis (2001).¹¹ The variable is an estimate of the capitalized value of the firm's previous R&D expenditure. The coefficient on this variable would be negative if the revenue effect causes a decrease in the value of R&D stock. To the extent that the election mainly affected the value of pre-market elderly drugs, the coefficient γ_2 would be biased towards zero, and would be smaller in magnitude than β_2 . The coefficient on the interaction term would be negative if a decrease in cash flow causes a decrease in the value of the R&D stock. With respect to the interaction term, equation (4) is a restricted version of equation (3), imposing the constraint that $\beta_3 = \beta_5$, i.e., that the cash flow effect is the same for elderly and non-elderly pre-market drugs.

The first column in Table 2 omits the R&D and interaction variables in equation (4). The coefficient is negative, -0.027, with standard error 0.012, and is significant at the five percent level. The point estimate implies that the value of marketed elderly drugs declined by about three percent, which is consistent with the patterns in Figures 1 and 2.

Column 2 includes the R&D variable, in addition to the elderly sales variable, and column 3 also includes the interaction of the two variables. The point estimate on the R&D variable in column 2 implies that the value of the R&D stock declined by about two percent. The point

¹¹ Specifically, the R&D stock is equal to a weighted sum of R&D spending of the current and four previous years, where the weights decrease linearly from one.

estimate is slightly smaller than the point estimate on elderly drug sales, although neither coefficient is statistically significant. Column 3 provides some evidence for a financing effect, and the specification implies that the effect explains the entire reduction in the value of the R&D stock.

The results are nearly identical if the sample is expanded to include large pharmaceutical firms with zero elderly marketed drug sales. There is thus some evidence that the election reduced the value of marketed and pre-market drugs, but the evidence for the R&D variables is weaker. In future work, we hope to obtain more detailed data on firms' R&D stocks, and refine the measurement of elderly drug sales.

7. CONCLUSIONS

We have argued that the 2006 midterm election represents a unique opportunity to investigate the short and long term effects of reducing prescription drug prices. The Democratic victory represents a discrete change in expected drug prices, which differentially affected drugs, depending on their age profile of consumption. We link abnormal returns after the election with firms' assets, which are comprised of currently marketed prescription drug sales and the stock of R&D. Preliminary results suggest that the value of marketed drugs declined significantly, as did the value of capitalized R&D. There is also some evidence that financing constraints explain much, if not all, of the change in the value of capitalized R&D. In addition to obtaining more detailed data on firms' R&D assets, future work will investigate other changes in expected pharmaceutical policies due to the 2006 election.

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Table 1

Summary Statistics For Firms With Elderly Drug Sales		
	<u>Firms With Low Elderly Sales Ratio</u>	<u>Firms With High Elderly Sales Ratio</u>
Number of Firms	10	10
Stock Market Capitalization	49.55 (59.26)	48.58 (63.20)
Prescription Drug Sales	5.87 (3.77)	7.20 (7.47)
Elderly Prescription Drug Sales	1.51 (1.12)	2.97 (2.88)
Total Firm Sales	20.20 (17.94)	15.28 (16.34)
Capitalized R&D	8.05 (6.46)	7.57 (8.47)

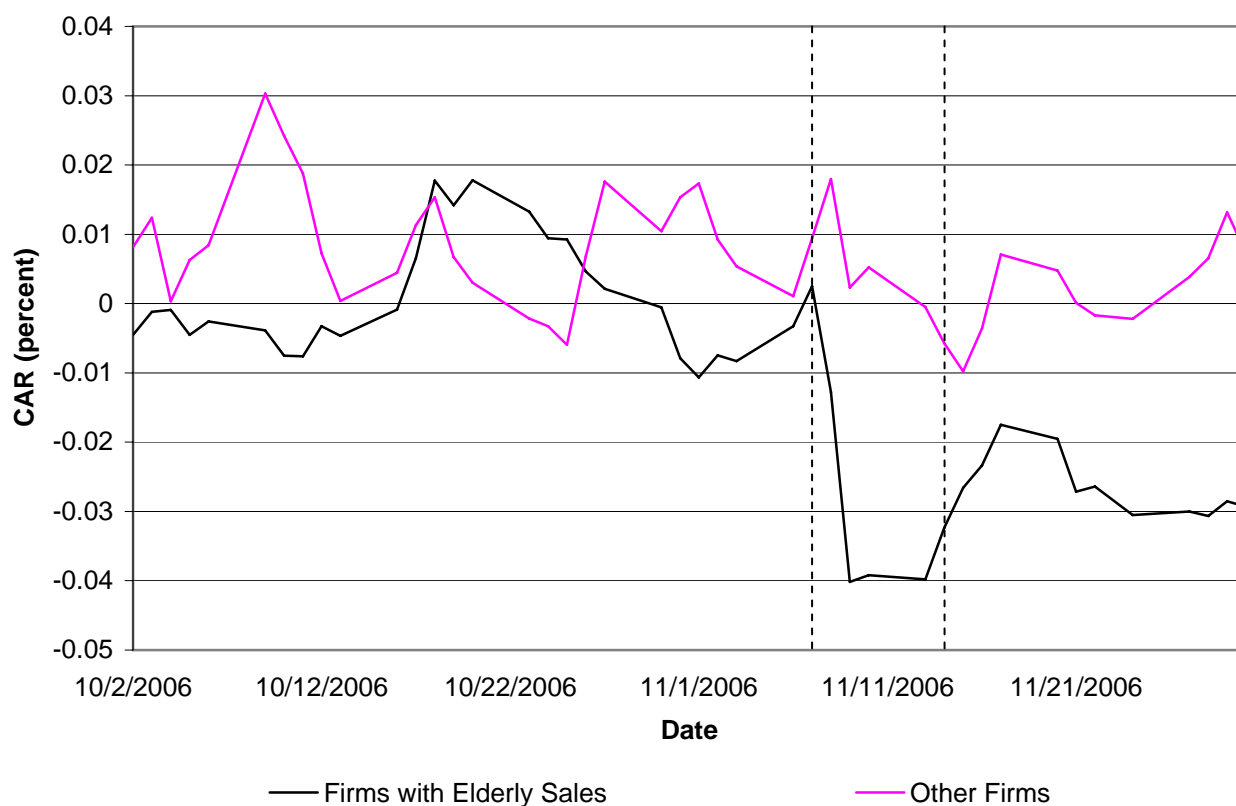
Notes: Cells report means with standard deviations in parentheses. All figures are in billions of 2006 dollars. Data sources are CRSP, Compustat and the MEPS. Stock market capitalization is the value of outstanding shares on November 6, 2006. Prescription drug sales is the value of sales of all drugs, computed from MEPS. Elderly prescription drug sales is the value of sales of drugs to individuals aged 65 and greater, computed from MEPS. Elderly sales ratio is the ratio of elderly prescription drug sales to prescription drug sales. The first column reports statistics for the firms whose ratio is below the median, and the second column reports statistics for firms above the median. Total firm sales is obtained from Compustat. Capitalized R&D is the value of the firm's R&D stock, following Chan, Lakonishok and Sougiannis (2001). See text for additional details on variable construction.

Table 2

Effect of the 2006 Election on Asset Values						
	Dependent Variable: Cumulative Abnormal Return					
	(1)	(2)	(3)	(4)	(5)	(6)
Elderly Prescription Drug Sales	-0.027 (0.012)	-0.024 (0.013)	-0.037 (0.015)	-0.050 (0.015)	-0.047 (0.015)	-0.045 (0.012)
Capitalized R&D		-0.017 (0.013)	-0.002 (0.022)		-0.016 (0.018)	0.012 (0.032)
Elderly x R&D			-0.231 (0.186)			-0.246 (0.166)
Number of Observations	20	20	20	40	40	40
R ²	0.09	0.12	0.19	0.08	0.12	0.16
Sample Includes	Firms with Elderly Sales	Firms with Elderly Sales	Firms with Elderly Sales	All Firms	All Firms	All Firms

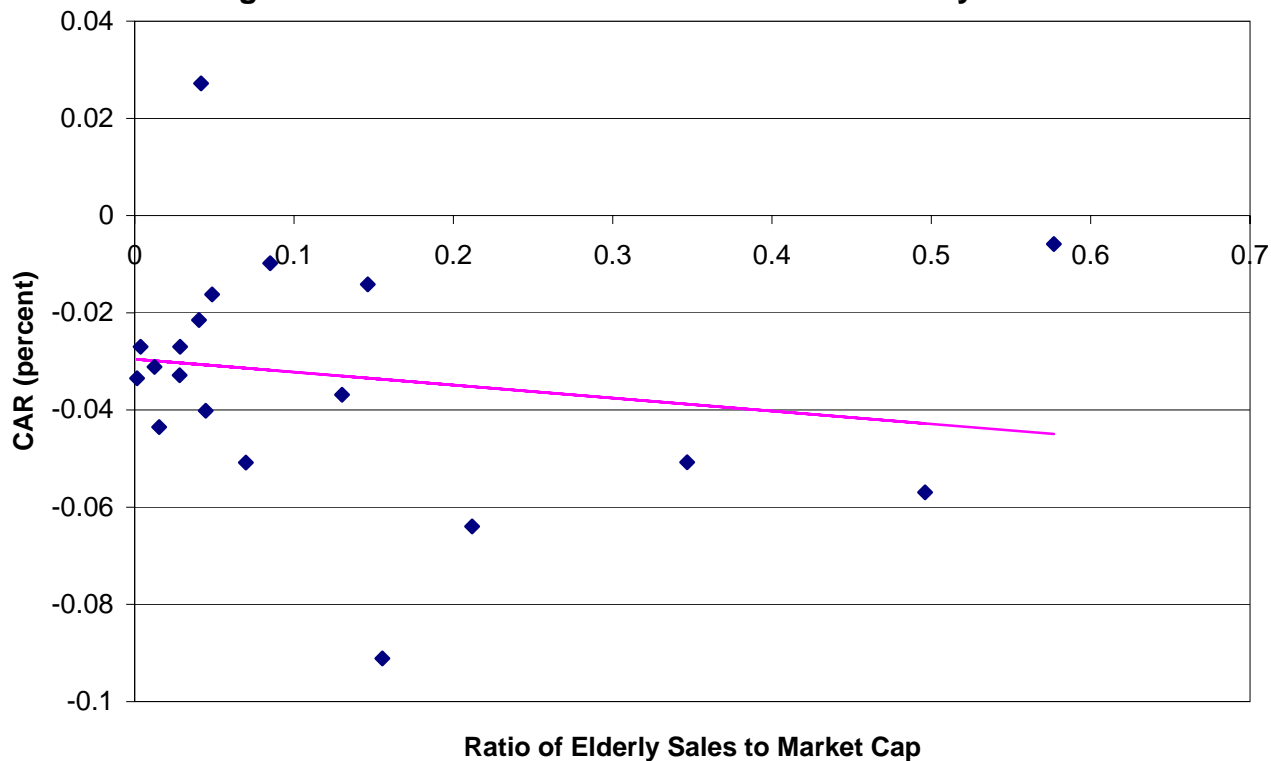
Notes: Huber-White standard errors in parentheses. The table reports the estimated coefficients from equation (4). The dependent variable is the firm's cumulative abnormal return, computed as in Figure 2. Elderly prescription drug sales and capitalized R&D are constructed as in Table 1, and Elderly x R&D is the interaction of the variables. All variables are normalized by the firm's market capitalization on the day before the election. Columns 1-3 include firms in Table 1 and columns 4-6 also include pharmaceutical firms with zero prescription drug sales, as defined in Figure 1.

Figure 1: Cumulative Abnormal Returns 10/1/06 - 11/30/06



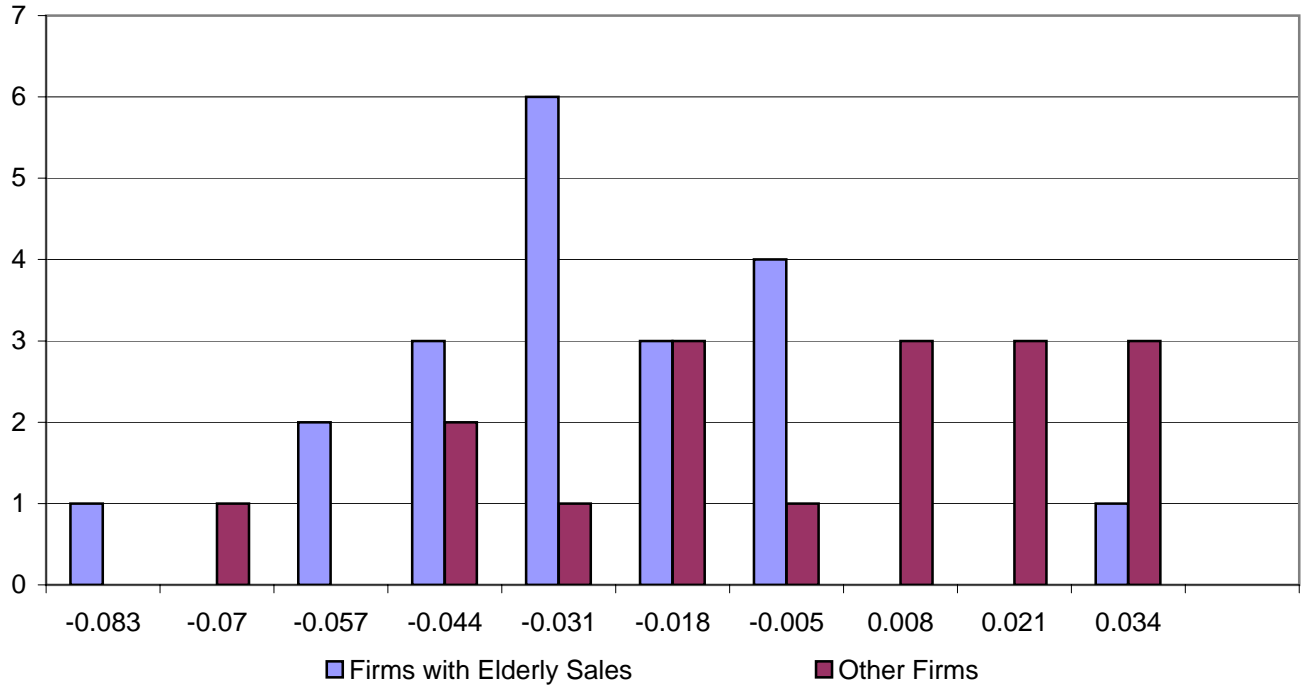
Notes: The figure plots value-weighted abnormal returns. The first sample includes firms with positive elderly sales in the MEPS, and the second sample includes the 20 largest pharmaceutical and biotechnology firms with zero elderly drug sales. The cumulative abnormal return (CAR) is estimated from a three-factor model, in which the estimation window includes October 1, 2005 - September 30, 2006. Cumulative abnormal returns are plotted from October 1, 2006 until November 30, 2006. The vertical lines indicate the beginning and end of the event window used to estimate the CARs in Table 2: November 7, 2006 and November 14, 2006.

Figure 2: Cumulative Abnormal Returns vs Elderly Sales



Notes: The figure plots the estimated CAR against the ratio of the firm's elderly drug sales to market capitalization on the day before the event window. The sample includes all firms with elderly drug sales. Cumulative abnormal returns are computed as in Figure 1, and the firm's elderly drug sales and market capitalization are computed as in Table 1. The solid line shows the predicted values from a linear regression of the CAR on the ratio of elderly sales to market capitalization.

Figure 3: 2006 Cumulative Abnormal Return Distribution



Notes: The figure plots the distribution of cumulative abnormal returns across firms in the indicated sample. Firms are assigned categories as in Figure 1, and CARs are estimated as in Figure 2.