Retracting A Gift: How Does Employee Effort Respond To Wage Reductions?*

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Abstract

Since the days of Henry Ford, employers have argued that higher pay induces employees to provide additional effort. While the converse is also thought to be true, there is little empirical evidence testing such a hypothesis. Not only are significant company-wide, permanent pay cuts rarely observed in practice, measures of employee effort are typically difficult to quantify. This paper aims to fill this void in the literature by examining the effort responses of U.S. commercial airline pilots following recent pay cuts. We find only limited support for the hypothesis that pay cuts lead to lower effort (measured by increased delay rates).

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"There are lots of penalties to cutting pay. You lose the enthusiasm and loyalty of your work force. People measure success with pay. A cut in pay means you haven't been doing well."

–Business agent of a retail workers' union local with 16,000 members (Bewley, 1999 pp. 175).

1 Introduction

Economists have offered many different reasons to explain an apparent labor market inefficiency: why wages are not cut when unemployment is high. Some of the most prominent theories used to explain wage rigidity include contract theory (Fischer 1977), implicit contract theory (Baily 1974), fair wage theory (Keynes 1936; Akerlof and Yellen 1990), insider-outsider theory (Lindbeck and Snower 1988) and efficiency wage theory (Solow 1979) which in turn includes the shirking model (Shapiro and Stiglitz 1984), the partial gift-exchange model (Akerlof 1982), the adverse-selection model (Weiss 1980), and the labor turnover model (Stiglitz 1974).[1] Surveys of wage-setting company executives confirm that employers are reluctant to cut pay even when unemployment is high (Blinder and Choi 1990; Bewley 1995 and 1999; Agell and Lundberg 1995; Campbell and Kalani 1997). In fact, most executives cited in these surveys favor lay-offs instead of pay cuts due to the negative effects of a pay cut on employee morale, productivity and turnover, especially turnover of the companies' most valuable employees (Bewley 1995, 1999). Laboratory experiments (Fehr, Kirchsteiger, and Riedl 1993; Fehr, Gachter and Kirchsteiger 1997) show that reciprocal motivations are important to sustain a cooperative employee attitude since employees respond to generous compensation by providing extra effort. A double auction experiment by Fehr and Falk (1999) reveals a positive relationship between workers' effort and the wage level. Laboratory evidence has also linked pay cuts to an increase in quitting (Valenzi and Andrews 1971), higher levels of employee theft (Greenberg 1990; Giacalone and Greenberg 1997), and reduced productivity (Pritchard, Dunnette, & Jorgenson, 1972).

While there are numerous theories, firm surveys, and laboratory experiments on the causes of wage rigidities and potential adverse repercussions on productivity and effort following a wage reduction, there has been little empirical work—to our knowledge—examining employee performance following an actual permanent wage reduction.[2] The lack of such research is most likely the result of data availability (or the lack thereof), since any study of employee effort following pay reductions requires instances of permanent, company-wide pay reductions *and* firm specific data that can reliably measure employee effort, both of which are extremely difficult to come by.

This paper examines changes in on-time flight performance (our proxy for unobservable pilot effort) of major U.S. airlines following announcements of significant and permanent reductions in pilot wages. Over the past three years, pilots (and other employees) at several large U.S. network carriers have experienced dramatic pay reductions as a result of bankruptcies, negotiations under the threat of bankruptcy or contractually mandated arbitrations between carriers and their unions.[3] While most pay cuts between carriers and their pilots unions have been negotiated consensually (even for carriers in bankruptcy), others have been unilaterally imposed by an independent arbitrator. In some instances, there have been significant (and widely reported) increases in delay and cancellation rates immediately after an announced pay cut. For example, in April 2005, the percentage of Alaska Airlines' flights that arrived on-time by U.S. Department of Transportation (DOT) standards was 77%.[4] Following the decision by an independent arbitrator to reduce Alaska's pilot pay rates by 26% on April 30, 2005, Alaska's on-time performance plummeted to 59% in May and 49.8% in June.[5] Since weather, seasonality and airport specific differences can contribute to airline delays (Mayer and Sinai, 2003a & 2003b; Mazzeo, 2003; Rupp, 2005) and cancellations (Rupp and Holmes, 2006), our estimations control for these and other relevant factors. We believe our paper is the first of its kind to examine the effect of actual, permanent, wage rate reductions on employee effort. In a recent related paper, Mas (2006) studies "final offer" arbitration decisions for police contracts across New Jersey municipalities, where an arbitrator decides between final wage proposals of the union and municipality. Mas finds that when a police union loses an arbitration decision, several measures of police performance indicate a reduction in effort in the following months (i.e., arrest rates and average sentence length decline, while crime reports increase).

Although changes in effort by other airline employee groups that have experienced a pay reduction (often concurrently with pilots) may also be a contributing factor in effort-induced changes in delay rates, we focus exclusively on pilots for a number of reasons. First, at some airlines (i.e., Northwest and Alaska) pilots were the only employee group that experienced a pay reduction during our sample period.[6] Likewise, at airlines where all employee groups saw their pay reduced, wage cuts for pilots were typically the largest (in percentage and dollar terms), and often significantly more than for other employee groups. In addition, we believe that the link between effort and delays is the most clear cut for pilots. Not only do pilots have the final say as to if and when a flight is prepared to depart (and thus are in the "best" position to induce a delay), pilots—unlike many other airline employee groups—have few opportunities for other types of "poor" behavior. In contrast, baggage handlers could choose to misdirect passenger bags to wrong destinations, mechanics could work more slowly on planes undergoing routine maintenance and flight attendants and ticket agents could be less courteous to passengers. Moreover, pilots are somewhat unique in that they are essentially unsupervised, whereas other ground-based employee groups work under the scrutiny of management supervisors. Finally, unlike most other airline employees, pilots have highly specialized skills that are not easily transferable outside of the airline industry. Hence pilots have fewer non-airline industry job options and consequently, we suspect that pilots are less likely to show dissatisfaction over a pay cut by simply quitting and taking a job in another sector of the economy.[7]

The contributions of this paper to the wage rigidity literature are three-fold. First, this paper provides empirical evidence of the link between wage reductions and employee effort. These findings are relevant to existing theories of wage rigidity. Second, this paper examines whether existing survey evidence is correct in the widely held belief that permanent pay reductions adversely affect employee effort and productivity. Third, this natural experiment of wage compression in the airline industry provides an opportunity to test the veracity of laboratory experiments which simulate the effort response of workers to temporary wage reductions. We note that the stakes are considerably smaller in the laboratory compared to the airline industry where the typical senior pilot (prior to the broad series of wage cuts) earned in excess of $200,000 per year.[8] Moreover, in this study, airline pilots experience a permanent pay reduction whereas pay cuts for subjects participating in economic experiments likely view reductions in laboratory earnings as changes in temporary income. This distinction is potentially important since the permanent income hypothesis (Friedman 1957) suggests that consumption behavior depends primarily upon the permanent income rather than temporary or transitory income.

Interviews of randomly selected individuals by Kahneman, Knetsch, and Thaler (1986) reveal that wage reductions are more likely to be considered fair if they enable the firm to avert a loss rather than result in a gain for the company.[9] Surveys of company executives confirm these perceptions of "fairness", which underscores the importance of justifying the wage cut to employees since pay reductions that are perceived to assist in a firm's survival are deemed justified while pay cuts perceived mainly to improve a company's profit prospects are not (Blinder and Choi 1990, Bewley 1999). In fact, laboratory experiments reveal a reduction in employee theft when the employer provides adequate explanation for the pay reduction (Greenberg, 1990). Hence, our study also examines the link between flight performance and pilot pay cuts for both bankrupt carriers (where employees may view the pay cuts as being justified) and non-bankrupt carriers (which may be considered less justified).

In support of the widely held belief that pay cuts adversely affect effort, we find both more frequent and longer flight delays the week following a pay cut announcement. We also find, however, that the effect on pilot effort is very short-lived. Indeed, after the first week, we find no difference in airline flight performance. These findings are in marked contrast to Mas (2006) who documents persistent adverse effects on police performance following arbitration decisions in favor of the municipality. Our somewhat surprising result (i.e., that a large, permanent pay cut does not induce a longer-lived reduction in pilot effort) provides counter-evidence to a widespread belief among company executives that pay cuts adversely effect morale, productivity, and effort. We should note, however, that there are several institutional factors in the airline industry that we suspect play important roles in influencing pilot behavior and hence these pilot results may not be indicative of other labor groups outside of the airline industry. In particular, we note that airline pilots at large U.S. carriers remain among the highest paid group of professionals in the economy even after their recent pay cuts. Likewise, the seniority system among pilots (whereby a pilot that switches carriers loses her seniority) tends to severely limit pilot mobility and plays an important role in understanding our results.

Our results also indicate a notable difference in changes in pilot effort depending on the financial situation of the carrier. Specifically, we find significant declines in airline performance following pilot pay cuts at non-bankrupt carriers, whereas there is no detectable change in performance after pay cuts at bankrupt carriers. These results are consistent with Mas (2006) who indicates the importance of "reference points". Pilots at bankrupt carriers may have feared even larger pay cuts that could potentially be imposed by a bankruptcy court judge if they did not reach a consensual agreement, or even worse, the possible liquidation of the carrier. On the other hand, pilots at non-bankrupt carriers may believe that their wage reductions are unjustified. We argue that bankruptcy is a clear signal of a firm's financial distress and hence makes management's requests for pay cuts more credible. Consequently, we believe that our findings support the hypothesis that fairness plays an important role in determining whether or not pilots change their level of effort.

The remainder of this paper is organized as follows. Section 2 provides some institutional background on the airline industry and describes the factors that led to the reduction in pilot pay rates. Section 3 specifies the model used to explain wage rigidity for airline pilots followed by the econometric specification. The data are discussed in section 4. Estimation results are presented in Section 5. Section 6 provides concluding remarks and suggestions for further research.

2 Pilot Pay Changes In the U.S. Airline Industry

In this section, we provide some background on the factors that led to the series of pilot wage cuts studied in this paper.

2.1 Background

Between 1995 and 2000, the U.S. airline industry experienced its most profitable period in history, with U.S. passenger carriers generating over $20 billion in net profits.[10] Such strong profitability, however, provided the heavily unionized airline pilots with a very strong bargaining position to negotiate new contracts.[11] Towards the end of this period and continuing into 2001, pilots at a number of the large network carriers received significant pay increases. For example, in October 2000, United Airlines pilots became the highest paid in the industry when its pilots agreed to a new contract that increased their hourly pay rates by 20-29%. In June 2001, Delta and its pilots subsequently signed a new contract, resulting in similar wage rate increases for its pilots and establishing Delta's pilots as the highest paid in the industry.

Just as many of the large network carriers and their pilots were agreeing to new, long term contracts at significantly higher pay rates, there were signs that the industry's profitability was waning. For example, the collapse of the "dot-com" and telecom bubbles that had sustained a significant amount of high-fare business travel in the preceding years had collapsed.[12] Likewise, the growth of Internet distribution channels such as Expedia, Travelocity and Priceline starting in 1998 greatly reduced search costs and had started to create an unprecedented level of pricing transparency.[13] Finally, and perhaps most importantly, competition from the so-called "low cost carriers" (LCCs) such as Southwest Airlines, JetBlue and AirTran intensified enormously throughout the 1990s and reached what many industry analysts considered to be a "tipping point" by 2001.[14]

In addition to the competitive changes discussed above, the airline industry suffered what was perhaps its single largest demand "shock" in history with the terrorist attacks of September 11, 2001 (Ito and Lee, 2005). More recently, airlines have been plagued by record high fuel costs. Together, these factors have plunged the U.S. airline industry into what is undoubtedly its worst financial crisis in history. Between 2001 and 2004, for example, the industry recorded net losses of over $32 billion—significantly more than the profits the industry had earned between 1995 and 2000, and three times as large as the losses from the previous cyclical downturn (1990-1992). Consequently, since 2000, more than a dozen passenger carriers—including United, US Airways (twice), Northwest and Delta—representing more than half of all U.S. airline capacity have filed for Chapter 11 bankruptcy protection.

2.2 Pilot Compensation

Pilots at virtually all commercial U.S. passenger airlines are paid an hourly rate based on their role (Captain or First Officer), years of experience and the type of aircraft flown (with larger aircraft typically commanding higher hourly rates).[15] Table 1 illustrates some hourly pilot pay rates for top-of-scale captains (i.e., those with 12 years or more of experience) as of September, 2005.

While a typical airline pilot spends somewhere between 45 and 65 hours per month actually piloting an aircraft (known as "hard" or "block" hours), they also receive credit for a number of non-flying hours based on various formulae, and consequently, a pilot's paid (or "credit") hours is usually significantly higher than

Table 1: HOURLY TOP-OF SCALE PILOT (CAPTAIN) PAY RATES AS OF SEPTEMBER 2005

Aircraft	Carrier					
	American	Continental	Delta*	Northwest*	United	US Airways
Boeing 737/Airbus A320	$156	$163	$174	$180	$129	$125
Boeing 767	$169	$175	$204		$149	$144
Boeing 777/Airbus A330	$193	$186	$216	$209	$178	$160

Notes and Sources: *Does not include rate reductions resulting from Chapter 11 reorganization. Rates for Boeing 737 are for "Next Generation" (i.e., –700, –800 and –900 series). Northwest and US Airways data in Boeing 777/Airbus A330 row represents Airbus A330 rate. Northwest, United and US Airways data for Boeing 737/Airbus A320 row represents Airbus A320 rate. Source: Airlinepilotcentral.com.

his or her actual flight hours.[16] Virtually all pilot contracts also guarantee pilots a minimum number of credit hours per month, regardless of the number of hours actually flown.[17] Since a pilot's seniority at a given airline—which in turn determines the aircraft and seat (captain or first officer)—is the primary factor that determines the hourly wage rate of a pilot and because pilots cannot transfer their seniority across airlines, there has traditionally been very little mobility among pilots from one airline to another in the U.S. airline industry. The primary exception is pilots that work their way up from regional (i.e., small aircraft) carriers to large jet carriers and pilots who become furloughed at one carrier and seek employment at another carrier.

2.3 Recent Pilot Pay and Pension Cuts

Over the past several years, numerous carriers have secured large, permanent cuts in pay rates for pilots (as well as other employees) and two carriers (United and US Airways) have terminated their defined benefit pension plans.[18] These pay rate and benefit reductions have been the result of several different mechanisms. Section 1113(c) of the U.S. Bankruptcy Code, for example, permits an airline to reject a collective bargaining agreement ("CBA") if certain requirements are met.[19] For example, United Airlines used the §1113(c) process to secure pilot pay cuts of 29 percent in January 2003 and an additional 11.3 percent in January 2005. Likewise, US Airways used the §1113(c) process to secure two separate pilot pay cuts since 2002.[20] Northwest, which filed for Chapter 11 bankruptcy protection on September 14, 2005, filed to reject its pilot (and other labor) contracts under §1113(c) relief and recently reached a tentative agreement for an additional pilot pay cut of 23.9%.[21] Similarly, Delta Air Lines—which also filed for

Chapter 11 bankruptcy protection on September 14, 2005, has also recently used the §1113(c) process to secure additional pilot wage concessions.[22]

A second way that carriers have reduced pilot (and other employee) wage rates has been through the imminent threat of bankruptcy. Prior to its first bankruptcy filing in August 2002, US Airways negotiated a 26 percent pay reduction with its pilots in the hopes of avoiding a bankruptcy filing. In April 2003, American—on the brink of bankruptcy—reached a consensual agreement with its pilots union to reduce their wage rates by 23 percent, thus avoiding an imminent bankruptcy filing.[23] In October 2004, Delta too was "on the courthouse steps" when it came to an agreement with its pilots union to reduce wage rates by 32.5 percent, roughly two weeks after Northwest reached an agreement with its pilots union for a 15 percent pay reduction. Finally, Continental secured $418 million in annual labor cost savings, including a pilot pay cut of 8.9 percent in March 2005 under the specter of significant layoffs and a potential bankruptcy had its targeted savings not been reached.[24]

A final way in which a carrier in our study achieved a significant pilot wage cut was via an "interest arbitration" decision. In particular, the CBA that was in effect between Alaska Airlines' and its pilots' union (ALPA) until May 2005 enabled an independent, third party arbitrator to decide (among other things) rates of pay if Alaska and its pilots were unable to reach a consensual decision on new rates by the end of 2004. Since one of the criteria the CBA instructed the arbitrator to consider was the rates of pay at Alaska's competitors—and since these rates had been falling—the arbitrator awarded Alaska (whose pilot pay rates had become among the highest in the industry) a 26 percent pay reduction in April 2005.[25]

A summary of all pilot pay cuts and pension terminations considered in our event-study analysis appears on Table 2.

3 The Model And Empirical Specification

Bewley's (1999) survey of company executives suggests that the morale model (e.g., partial-gift exchange model proposed by Akerlof (1982)) has received the most empirical support to explain wage rigidity. Resistance to pay cutting is due to employers anticipating a negative reaction from their employees. Experiments

Table 2: Summary of Pilot Compensation Cuts In Sample

Carrier	Reduction (%)	Notify Date	Effective Date	Notes
Alaska	–26%	April 29, 2005	May 1, 2005	Interest Arbitration decision.
American	–23%	April 1, 2003	May 1, 2003	Outside of bankruptcy.
Continental	–8.9%	February 28, 2005	April 1, 2005	Outside of bankruptcy.
Delta	–32.5%	October 28, 2004	December 1, 2004	Outside of bankruptcy.
Northwest	–15%	October 14, 2004	December 1, 2004	Outside of bankruptcy.
United	–29%	December 27, 2002	January 1, 2003	Chapter 11.
United	–11.8%	January 18, 2005	January 1, 2005	Chapter 11.
United	Pension Termination	May 10, 2005	May 10, 2005	Chapter 11. Pension taken over by U.S. PBGC.
US Airways	–26%	July 6, 2002	July 1, 2002	Outside of bankruptcy.
US Airways	–8%	December 11, 2002	January 1, 2003	First Chapter 11 filing.
US Airways	Pension Termination	March 1, 2003	March 31, 2003	Second Chapter 11. Pension taken over by U.S. PBGC.
US Airways	–18%	October 1, 2004	October 15, 2004	Second Chapter 11 filing.

Notes: All pay rate cuts listed in Table 2 were consensually agreed to between the carrier and their pilots' union with the exception of Alaska Airlines. Northwest and Delta are both likely to secure additional pilot pay cuts as part of their 2005 bankruptcies. Source: Various media reports.

by Fehr and Gachter (2002) provide additional support for Bewley's findings. Following efficiency wage theory, we assume that an airline is not able to perfectly monitor the effort of its pilots. Airlines provide pilots with a generous wage level (see Table 1 for actual pilot hourly wage rates) and in return, pilots reciprocate by providing effort that exceeds the minimum necessary. For example, pilots might report to work earlier than assigned, be willing to fly overtime, or do everything in their control to ensure flights depart on time.

During the late 1990's and continuing into 2001, pilot unions at several airlines negotiated a series of "industry leading" contracts due—in large part—to the record profits that airlines had been earning. Richard Dubinsky, the head of ALPA at the time noted that "We don't want to kill the golden goose. We just want to choke it by the neck until it gives us every last egg."[26] Since 2001, however, the airline industry has suffered almost constant turmoil and experienced unprecedented financial losses which in turn has led to significant pay and benefit reductions at each of the large network carriers. Pilots likely consider the airlines' current financial situation, when determining the "fairness" of a wage offer. Hence, fair wage theory predicts that pilots are more likely to be understanding of pay cuts made by carriers experiencing severe financial distress (i.e., bankruptcy) compared to those carriers not in bankruptcy. Following the partial-gift exchange model of Akerlof (1982) and incorporating views on fair wages (Kahneman, Knetsch, and Thaler 1986) we view effort, e, as a function of the wage offer w and the employee's view of a fair wage f:

$$e = e(w, f(S)) \tag{1}$$

where:

$$\frac{\partial e}{\partial w} > 0, \qquad \frac{\partial e}{\partial f} > 0$$

That is, effort is increasing in both the wage offer and the employee's view of a fair wage. We posit that an employee's view of what constitutes a fair wage is in turn a function of the employee's subjective probability S that the firm will survive, $f(S), f'(S) < 0$, $0 \leq S \leq 1$. Among the factors that are likely to be important in determining S are the airline's financial position (liquidity, cost structure, etc.) and whether or not the airline is currently in bankruptcy. We argue that a carrier's bankruptcy status is particularly important in shaping S since an overwhelming majority (i.e., almost 90 percent) of U.S. airlines that declared bankruptcy between 1978 and 2004 are no longer operating today.[27]

We emphasize that the purpose of this paper is to test the veracity of existing beliefs held by company executives on their aversion to wage rigidity, not to propose a new model of reciprocity in labor relations.[28] Hence we now examine airline pilot effort following substantial pay reductions.

3.1 Event-study analysis

Since airline pilot effort is unobservable, we proxy pilot effort by using a variety of flight performance measures. Thus, our underlying assumption is that consistently reliable flight performance requires (among other things) greater pilot effort. This assumption is justified given the fact that an airline captain is the ultimate authority in determining if and when a flight is ready to depart. Indeed, an ALPA attorney argued during the opening day of Delta Air Lines' §1113(c) bankruptcy case that "[a pilot] is the commander of that flight in much the same sense as the commander of a British frigate in the 19th century was. What he says is the final word."[29]

Our primary performance measure is an airline's on-time arrival rate, specifically, the proportion of daily flights arriving within 15 (or 30) minutes of the scheduled arrival time. The 15 minute measure is the Department of Transportation's standard on-time definition and is also widely reported by the media. Since the 15 and 30 minute cut-offs are arbitrarily determined, we also use a continuous measure of flight delays: the average arrival delay (in minutes).[30]

The explanatory variable of interest is the carrier's flight performance immediately following the announcement of a pilot pay cut. It is important to emphasize that while pay reductions become effective on a specific date, the information regarding the potential for a pay reduction evolve over time. Typically, there are meetings between the negotiating committee of the pilots' union with company management. Proposals and counter-proposals are traded back-and-forth between the union and the company, often requiring several iterations before reaching an agreement. Once a tentative agreement is reached between the representatives of the pilots union and the company, the agreement is voted on by the rank-and-file pilots. All labor contracts must be approved by a majority of pilots before going into effect. Finally, once the contract is approved there is an effective day when the new wage and benefit changes take effect.

We use the tentative agreement date as the event date for the pay reduction, since this is the initial date when pilots learn the details of their proposed new labor contract. All pay cuts listed on Table 2 (with the exception of the 26 percent pay cut at Alaska Airlines which was imposed by an independent arbitrator) were approved by pilots and have gone into effect. The average pilot pay cut between October 2001 and June 2005 was 20 percent. Two carriers, US Airways and United Airlines, also terminated their defined benefit pension plans (turning them over to the Pension Benefit Guarantee Corporation (PBGC)), resulting in significant reductions in post-retirement benefits. In these situations, we used the date the bankruptcy judge approved the pension termination as the event date.

We are interested in comparing the on-time performance following a pay cut announcement relative to the period immediately preceding the announcement. Focusing on relatively short event windows allows us to more clearly identify the effect of pay cuts on pilot effort without introducing pre-existing carrier specific trends in on-time performance. The length of the pre-announcement comparison period is the same for all carriers. Since US Airways has two pay cut events that are 80 days apart (December 11, 2002 and March 1, 2003), we opt to use a 40 day pre-announcement and 40 day post-announcement comparison periods for all carriers.

It appears that the timing of pay cut announcements is not random since airline bankruptcies (or near bankruptcies) and in turn pay cuts, have frequently occurred at the onset of the slower traffic period following Labor Day. Hence we include month × year dummies to control for the calendar date/seasonal changes in demand for air travel. In addition, carrier dummies control for on-time performance differences which exist among carriers. To control for the variation in passenger loads (fuller flights take longer to load and are more prone to depart late), we include day of the week effects since mid-week flights tend to have lighter passenger loads.

One approach to determine the magnitude of the change in on-time performance is to conduct an event-study analysis (Jacobson, LaLonde, and Sullivan, 1993). Hence we estimate the following model:

$$\begin{aligned} Y_{itr} &= \beta X_{itr} + \text{carrier fixed effects} + \text{calendar fixed effects} + \chi_{i,-40} + \chi_{i,-39} + ... + \chi_{i,-1} + \chi_{i,0} \\ &\quad + \chi_{i,1} + ... + \chi_{i,40} + \varepsilon_{itr} \end{aligned} \tag{2}$$

where i is a carrier, t is a calendar date, r is a route. β is a vector of estimated regression coefficients of X_{itr}, which represents important flight delay variables including weather, airport congestion, and whether an airport serves as a hub for a specific carrier. The dependent variable Y_{itr} is a daily measure of flight delays along a route (where a route is defined as a directional airport-pair[31]). The variable $\chi_{i,-40}$ is an indicator function which takes the value of 1, 40 days prior to a pay cut announcement by carrier i, and 0 otherwise. The variables $\chi_{i,-39}, \chi_{i,-38}, \ldots, \chi_{i,40}$ are defined analogously. All carriers are included in the sample, even if the pilots are not experiencing a pay cut during the sample period (this enables us to identify the carrier effects). Figure 1 illustrates a simple average of 15+ minute flight delays for both the pay cutting carrier and all other non-pay cutting carriers for each day from 40 days prior to and 40 days after the pay cut announcement (not controlling for any other factors). Prior to the pay cut, there is little systematic difference between the average delay rates for pay cutting carrier and all other carriers. Immediately after the pay cut announcement at day 0, there appears to be a slightly higher rate of 15 minute delays for the pay cutting carrier, however, after about day 7, this gap disappears. Figure 2 provides a plot of each of the estimated coefficients $\chi_{i,-40}$ to $\chi_{i,40}$ from equation (2) (i.e., controlling for other important flight delay factors such as weather, airport congestion, and carrier specific effects) with the event-time on the horizontal axis. Again we see a slight increase in the occurrence of 15+ minute delays for the first week after the pay cut announcement, but no obvious pattern thereafter.

[Insert Figure 1 and Figure 2 about here]

3.2 Econometric Specification

We now turn to the formulation of our primary empirical model. Since the event-study estimated coefficients from equation (2) indicate an increase in flight delays during the first week, we track flight performance for *7*, *14,* and *28 days* following the announcement date. We use relatively short event windows in order to avoid contamination by other events. Given that financial condition of the airline may influence whether the wage cut is perceived as "fair", we measure the flight performance of wage reductions at non-bankrupt airlines (*7 Days & Nonbankrupt)* and bankrupt carriers (*7 Days & Bankrupt*). This latter variable is an indicator of pay cut agreements negotiated when the carrier was in Chapter 11 bankruptcy (analogous dummy variables are defined for 14 and 28 days).

A Breusch-Pagan (1979) test for heteroskedasticity overwhelmingly (p-value <0.0001) rejects the null hypothesis of homoskedasticity, hence we use the following weighted least squares (WLS) estimation:

$$Y_{itr}\sqrt{n_{itr}} = \alpha\sqrt{n_{itr}} + \zeta_{FE}\sqrt{n_{itr}} + \beta X_{itr}\sqrt{n_{itr}} + \gamma D_{itr}\sqrt{n_{itr}} + \varepsilon_{itr} \quad (3)$$

where α is a constant, ζ_{FE} denotes various fixed effects including calendar date (month $\times$ year), carrier effects, and day of week effects, and n_{itr} is the number of daily scheduled flights by carrier i at date t on route r. The dependent variable $Y_{itr}\sqrt{n_{itr}}$ represents a daily weighted average of flight performance for each carrier on a route. D_{it} is the pay cut dummy variable which equals 1 if carrier i has announced a significant pay cut reduction within the past 7 (14 or 28) days and 0 otherwise, and ε_{ijt} is the error term. After performing the WLS estimation, the Breusch-Pagan test no longer rejects the null hypothesis of homoskedasticity. Because we suspect that delays for a particular carrier likely occur in bunches due to unobserved events such as a weather event that we cannot control for (i.e., high winds at hub airport) or unobserved labor unrest, we cluster standard errors into the following groups: carrier × month × year (e.g., Delta June 2003).

The hub variable *airline hub origination* (*airline hub destination*) is an indicator variable assuming the value 1 for flights originating from (destined for) a carrier's hub airports. Following Lee and Luengo-Prado (2005), we define an airport as a carrier's hub if 50 percent or more of its passengers at the respective airport are making a connection. Since airport congestion is an important flight delay determinant (Mayer and Sinai, 2003a; Mazzeo, 2003), we include *airport flights orig. (dest.),* which is the total number of daily departing and arriving flights at the origination (destination) airport. We include flight distance between airports in the regressions since longer flights provide a larger window for the carrier to "make-up" time while airborne and hence arrive on-time. Finally, the regressions include severe weather measures of daily rain and snow at origination and destination airports.

Since some airports experience unique capacity (e.g., New York's LaGuardia) or location-specific weather constraints such as morning fog (e.g., San Francisco or Seattle), we include airport fixed effects in some estimations. Likewise, we include carrier fixed effects in every estimation to control for firm specific differences in flight scheduling practices (i.e., some carriers may "pad" their flight schedules, allowing additional time, to give the impression of fewer delays).

3.2.1 Difference-in-Difference Models

To check the robustness of our results, we also estimate difference-in-difference models of a carrier's flight performance following pilot pay cut announcements. The difference-in-difference approach compares a given carriers' system-wide performance relative to other carriers serving the same airport. The advantage of the difference-in-difference estimation is that it enables us to control for inherent airport specific differences in performance between hub and non-hub carriers, given that hub carriers typically have higher delay rates compared to their non-hub counterparts operating at the same airport due to the peaking of flights by hub carriers (Brueckner 2002, Mayer and Sinai 2003a). In constructing our difference-in-difference regressions, we compare a carrier's performance at its primary airports with all other carriers operating at these same airports.[32] The first step of the difference-in-difference estimation is to find the difference in performance of the hub carrier with the non-hub carriers:

$$Diff_{ith} = Y_{ith} - Y_{-ith} \tag{4}$$

where Y_{ith} measures the daily mean flight performance of carrier i's flights on day t originating from airport h, and Y_{-ith} is the daily mean flight performance for all carriers other than carrier i on day t for flights originating from airport h. Since there are typically several primary airports for a given carrier i, we divide n (the number of carrier i's flights at airport h) by the sum of n flights at every primary airport for carrier i:

$$Weight_{ith} = \frac{n_{ith}}{\sum_{h=1}^{m} n_{ith}} \tag{5}$$

where m is the total number of primary airports. The *Weight* expression enables larger hub operations to be more representative of carrier i's flight performance, which is denoted as follows:

$$WeightDiff_{ith} = Weight_{ith} \times Diff_{ith}. \tag{6}$$

Finally we sum the *WeightDiff* expression across all m primary airports for carrier i:

$$SumDiff_{it} = \sum_{h=1}^{m} WeightDiff_{ith}. \tag{7}$$

The *SumDiff* is calculated daily for each carrier in the sample. The above expressions can best be illustrated with the following example: calculating the *SumDiff* for 15+ minutes late US Airways' flights on May 15, 2003. Y_{ith} (the proportion of US Airways flights 15+ minutes late) at its three primary airports, Charlotte (CLT), Pittsburgh (PIT), and Philadelphia (PHL) was 0.4153, 0.3520, and 0.3077, respectively. Y_{-ith} (non-US Airways' flights 15+ minutes late) at these same three airports was 0.2333, 0.1309, and 0.2222, resulting in a $Diff_{ith}$ of 0.1820, 0.2211, and 0.0855. US Airways had 236 (CLT), 179 (PIT) and 143 (PHL) scheduled flight departures at its three primary airports for a total of 558 flights on May 15, 2003.

This corresponds to a $Weight_{ith}$ of 0.423 (CLT), 0.321 (PIT), and 0.256 (PHL). Next, the $WeightDiff_{ith}$ is 0.423 × 0.1820 (CLT), 0.321 × 0.2211 (PIT), and 0.256 × 0.0855 (PHL). Finally, $SumDiff_{it}$ adds each of the $WeightDiff_{ith}$ figures, resulting in a 0.1699 value for US Airways. This number is interpreted as follows: on May 15, 2003, US Airways had a flight delay rate (15+ minutes) at its primary airports (CLT, PIT, PHL) that was 17 percentage points higher than other carriers at the same three airports.

We estimated the following difference-in-difference regression:

$$SumDiff_{it} = \alpha + \beta W_{it} + \gamma D_{it} + \varepsilon_{it} \tag{8}$$

where W_{it} represents the weighted weather conditions (snow and rain) at carrier i's primary airport, D_{it} is the pay cut dummy variable previously defined, and ε_{it} is the error term. We include weather conditions since Rupp and Holmes (2006) find that hub airlines have inherent advantages over non-hub airlines in operating flights during severe weather conditions (e.g., better access to de-icing equipment, maintenance/service personnel, replacement flight crews, etc.). We choose to weight the weather conditions using the $Weight_{ith}$ definition from equation (5), since an inch of snow at a larger hub likely has a greater impact on a hub carrier's flight performance than an inch of snow at a smaller hub. Next, we turn to the flight data used in this analysis.

4 The Data

4.1 The Sample

Data on flight delays and cancellations come from the U.S. Bureau of Transportation Statistics (BTS) TranStats database.[33] There were twelve permanent pilot pay reductions (ranging from 8 percent to 32.5 percent) by major U.S. carriers between October 2001 and June 2005 (see Table 2). Since we want the pre- and post-announcement comparison periods to be the same for all events, we track flight performance 40 days prior and 40 days after the pay cut announcements. We aggregate the individual flight data at the daily route-level measure, since we are interested in the overall flight performance of a carrier (rather than estimating delays for individual flights). For example, if American Airlines offers 12 daily flights between Dallas and Atlanta, we calculate each performance measure at the route-level by computing the proportion American's Dallas–Atlanta flights on date t that were delayed.[34] After collapsing the individual flight-level observations into carrier-route-level daily observations and including only the 80 day period surrounding a pay cut announcement, our 45-month sample period has 1,390,462 observations.

Most airports are active weather reporting stations, hence daily weather data at origination and destination airports comes from the U.S. National Oceanic & Atmospheric Administration (NOAA).[35] We are able to match daily weather data with 99.0 percent of our flight data, resulting in 1,377,036 useable observations. We include weather measures for daily snowfall and rain at both origination and destination airports.

Since the first pay cut in our sample occurs on July 6, 2002, Table 3 reports summary statistics of flight performance between May 2002 and June 2005. These summary statistics support our previous findings from Figures 1 and 2 that there is a reduction in flight performance during the 7 days immediately following a pay cut announcement. Each of the four flight performance measures reveal a slightly deteriorating service quality. For example, comparing the entire sample period with the 7 days following a pay cut, we find that the proportion of flights delayed 15+ minutes increases from 19.0% to 21.3%. Likewise, the proportion of flights delayed 30+ minutes increases by about two percentage points, from 10.9% (entire sample) to 12.6% (7 days after pay cut). The flight cancellation rate registers a modest increase from 1.3% to 1.7% during the week following a pay cut. Finally, the average arrival delay increases by about 1.5 minutes from 4.39 minutes to 5.96 minutes during the week following a pay cut announcement. Expanding the window to include the first 14 days after the pay cut announcement, however, we find much limited impact on flight performance with the four performance measures returning to their sample averages.

[Place Table 3 about here]

5 Estimation Results

5.1 The Effect of Wage Reductions on Flight Performance

Estimation results from the equation (3) WLS regressions appear in Tables 4–6. For presentation purposes, we have suppressed estimated coefficients for the day of week, month, year, and carrier effects. Our primary results are summarized in Table 4 (15+ minute delays). We are most interested in the effect on 15 minute delays since this represents the DOT's criteria that is widely reported both by the media.[36] Consequently, if pilots wished to shows their displeasure to management by inducing a delay, we suspect that it would show up most prominently in the 15+ minute measure. Indeed, we find marginally higher rates of 15+ minute arrival delays during the seven days after a pay cut (Model 1). The regression estimate of 0.0298 suggests that for every 100 scheduled flights, there are an additional 2.98 flights arriving 15+ minutes late the week after a pilot pay cut announcement.

[Insert Table 4 about here]

It is important to emphasize that pilot pay cuts do not occur in a vacuum since pilot pay cuts usually occur when a carrier is in financial distress, hence management may also be simultaneously seeking wage concessions from other non-pilot employee groups. In fact, there are only three instances (US Airways March 1, 2003, Alaska and Northwest) in our sample of twelve events where pilots were the sole labor group experiencing a wage reduction at the airline (i.e., no other employee group experienced a pay cut during the 80 day window straddling the pilot wage reduction). There are four instances where other labor groups (e.g., flight attendants, baggage handlers, mechanics, or customer service agents) accepted pay reductions prior (between 1 and 30 days) to the pilot agreement. Likewise, there are two instances where pilots and at least one other major labor group experienced pay cuts on the same day, and three instances where other labor groups experienced a wage reduction after the pilots (by between 9 and 15 days). To control for other labor groups that experience a pay cut, we created an indicator variable *non-pilot pay cut* which takes the value 1 after another major airline labor group accepts a wage reduction and 0 otherwise.[37] After controlling for wage cuts by non-pilots, we find no significant change in flight delays during the week after a pilot pay cut announcement (see model 2). Both the *7 days* and the *non-pilot pay cut* variables in model 2 have positive coefficients (0.024 and 0.012 respectively), however, we cannot reject the hypothesis that they have no effect on flight delays. Moreover these results suggest that we should control for pay cuts by other labor groups, hence all remaining specifications include the variable: *non-pilot pay cut*.

Model 3 decomposes the effect of wage reductions for bankrupt and non-bankrupt carriers. The results are quite striking: pay cuts for non-bankrupt carriers lead to a substantial deterioration in flight performance, while pay cuts at bankrupt carriers have no noticeable impact on flight performance. The results suggest a more than 4 percentage point increase in the occurrence of flight delays for non-bankrupt carriers during the week after the pay cut announcement. Figure 3 shows the average flight delays for both bankrupt and non-bankrupt carriers before and after the pay cut announcement (these averages of course, don't control for other important delay factors such as weather, airport congestion, etc.). Before the pay cut, the bankrupt carrier frequently has more flight delays, while after the pay cut the non-bankrupt carrier commonly has more 15+ minute flight delays. Model 4 includes airport fixed effects. Our results are robust to the airport fixed effects specification since we find results similar to model 3 as nonbankrupt carriers again have significantly higher occurrences of 15+ minute delays while nonbankrupt carriers experience no notable changes in performance following pilot pay cuts.

[Insert Figure 3 about here]

Expanding the event window to include the first 14 days following a pilot pay cut, we find no discernible change in 15+ minute flight delays during the two weeks after a pay cut (see model 5) for either bankrupt or non-bankrupt carriers. Similar results are found when we include airport fixed effects (model 6). Moreover, examining the 28 days after a pay cut reveals no change in any of our flight performance measures (see the Appendix). Given the lack of significance for any period longer than one week, we believe that pilot pay cuts have negligible long-term effects on flight performance. Next we consider an alternative measure of flight performance, 30+ minute flight delays.

Figure 4 presents daily averages for 30+ minute flight delays for both the pay cutting carriers and non-pay cutting carriers ranging from 40 days before to 40 days after the pay cut. There appears to be a slight increase in the occurrence of 30+ minute delays for the carriers who cut pilot wages during the week following the announcement. Thereafter, no discernible pattern appears. Figure 5 shows the estimated daily coefficients (from -40 to +40 days surrounding the event) from estimating equation (2). We find an increase in 30+ delays immediately after the pay cut for the initial week, which is followed by an undetectable pattern.

[Insert Figure 4 and Figure 5 about here]

Table 5 reports WLS regression results for 30+ minute flight delays. We find a positive, yet statistically insignificant coefficient for *7 days* (see model 1). A similar result is also found when we control for non-pilot pay cuts, as both 7 days and non-pilot pay cut have positive and insignificant coefficients (model 2). Separating the bankrupt and non-bankrupt carriers, model 3 reveals that a larger positive coefficient for non-bankrupt carriers compared to bankrupt carriers one week after a pay cut, however, both variables remain statistically insignificant. Similar results are found with the inclusion of airport fixed effects (model 4). The distinction between non-bankrupt and bankrupt carriers performance using 30+ minute delays is more striking graphically (see Figure 6) as there appears to be a substantially higher rate of 30+ minute flight delays for non-bankrupt carriers after the pay cut.

[Insert Table 5 and Figure 6 about here]

Expanding the window to include the two week period after a pay cut reveals no change in 30+ minute delays (model 5) for either bankrupt or non-bankrupt carriers 14 days after a pay cut. Once again, as a robustness check we find similar results when including airport fixed effects (model 6). In sum, we find little evidence that pilot pay cuts significantly impact the frequency of extended flight delays (i.e., those lasting 30+ minutes). While visual evidence (Figure 6) seems to suggest that extended delays are more common following pay cuts by non-bankrupt carriers, we find little statistical evidence to support such a claim (Table 5). Next, we turn our attention to the third and final flight performance measure that we will examine: the average duration of flight delays.

Given that the 15 and 30 minute cut-offs are somewhat arbitrary, the average duration (in minutes) of flight delay provides a more accurate depiction of the typical waiting time experienced by passengers. Table

6 reports WLS regression results for average minutes of flight delays. Model 1 indicates that the average delay *increases* by approximately 2 minutes during the week following a pay cut (recall that during the sample period May 2002 to June 2005, the average delay was approximately 4.5 minutes). After controlling for pay cuts by other labor groups, model 2 reveals that the average delay increases by less than 2 minutes the week after a pilot pay cut. Moreover the 7 days coefficient loses its statistical significance. Models 3 and 4 separate the additional delay experienced by non-bankrupt carriers (2.3 minutes) versus bankrupt carriers (1.4 minutes) during the week following a pilot pay cut. Neither of these coefficients, however, achieve statistical significance. Considering the 14 day period, we find no change in the length of arrival days following pilot wage reductions (models 5 and 6). The airport fixed effects estimation (model 6) attributes a slight increase in flight delays (approximately one minute) due to pay cuts by non-pilot labor groups.

[Insert Table 6 about here]

In sum, this analysis of flight performance following pilot pay cuts reveals the following: (1) The week following a pilot pay cut we find a small and short-lived effect of the occurrence of 15+ minute flight delays and the average length of delay; (2) After controlling for pay cuts by other employee groups, we find limited impact on flight performance during the week after a pilot pay cut; (3) Moreover, two weeks and four weeks after a pilot pay cut, there is no discernible change in flight performance which suggests little long-term effort effects following pilot pay reductions; and (4) The financial position of the carrier cutting pay matters as we find little impact on performance at bankrupt carriers following pay cuts, whereas non-bankrupt carriers that reduce pay experience a short-lived deterioration in flight performance with more frequent 15+ minute flight delays.

5.2 Difference-in-Difference Results

Results from our difference-in-difference estimations of equation (8) appear in Table 7 for each of the seven carriers that cut pilot pay during the sample period. The advantage of the difference-in-difference specification is that it enables a performance comparison across airlines at the same airports over time.

In particular, changes in flight performance following a wage reduction can be examined to determine whether the *relative* flight performance of carriers changes following pay cuts. In addition, the difference-in-difference estimations serve as a robustness check of the pay cut regression results discussed previously.

Table 7 reveals significantly higher rates of flight delays (15+ minutes) for four of the seven carriers during the week after a pilot pay cut. Using the 15+ minute delay measure, the magnitudes for these four carriers range from an increase of 1.6 percentage points (United) to 22.8 percentage points (Alaska). Recall that for the entire sample, 19 percent of flights arrive 15+ minutes late. Hence the delay increase at United translates into an 8 percent increase in delays while Alaska experienced a 120 percent increase in flight delays one week after a pilot pay reduction. The two remaining carriers with notable increases in flight delays following a pay cut are Continental and Northwest, which experienced a 6.5 and 7.4 percentage point increase, respectively.

[Insert Table 7 about here]

The bottom half of Table 7 shows difference-in-difference results for the two-week period following a pilot pay cut. On the whole, we find similar results for the two-week period compared to the one-week period since the same four carriers (Alaska, Continental, Northwest and United) experienced significantly more 15+ minute flight delays. We note, however, that the magnitude of the estimated coefficient is smaller for three of the four carriers, indicating fewer 15+ minute delays for the two week period compared to the one week period. During the two week period following a pay cut, Alaska had the largest change in performance with a 17.1 percentage point increase in delays, followed by Northwest and Continental at 7.8 and 5.5 percentage points, respectively. United's increase in flight delays is a slight 1.3 percentage points. These results are consistent with our pooled regressions, which showed no systematic impact on flight performance for either the two-week or four-week period following a pilot pay cut. Next, we examine difference in difference estimates for 30+ minute flight delays.

Table 8 shows that four of the seven carriers (Alaska, American, Continental and United) experience an increase in 30+ minute flight delays. For these longer delays, American is "new" to the group compared to the 15+ minute delays while Northwest is no longer one of the affected carriers. The smallest increase occurs at United with a 1.6 percentage points higher rate of 30+ minute delays, while the effect at Alaska is most pronounced: 16.5 percentage points higher. More modest increases occur at American (4.9 percentage points) and Continental (3.3 percentage points). For the two week period following a pay cut (the bottom half of Table 10), the difference-in-difference estimations indicate that most carriers are experiencing fewer extended delays compared to the first week. Alaska is the standout with a 13 percentage point increase in 30+ minute delays (a reduction from their first week of 16.5 percentage points). Each of the other carriers (American, Continental, Northwest) have a 3.0 or smaller percentage point increase in 30+ minute delays two weeks after a pay cut.

[Insert Table 8 about here]

Finally, Table 9 summarizes difference-in-difference results for the length of flight delays. Alaska (16 minutes) and United (2 minutes) are the only two carriers that experienced significantly longer flight delays one week after a pilot pay cut. Two weeks after a wage reduction, we find four carriers experienced significantly longer flight delays: Alaska (11.8 minutes), Continental (3.5 minutes), Northwest (3.1 minutes) and United (1.7 minutes).

[Insert Table 9 about here]

5.3 Discussion of Results

Two results from our analysis of the effect of pay cuts on pilot effort stand out. First, why are effort reductions among pilots experiencing large pay cuts apparently so short-lived? Second, why are the performance differences following pay cuts for bankrupt and non-bankrupt carriers so different? We address each of these questions in turn.

Why Are Pilot Effort Effects So Short-Lived? Given that Mas (2006) and considerable laboratory evidence (e.g., Fehr and Gachter, 2000) indicate that wage reductions adversely impact employee effort, why do we find such short-lived impacts on pilot effort following pilot wage reductions?

One potential explanation of the limited impact from pilot wage reductions on effort is that pilots could be fully expecting the wage reductions prior to the announcement of the tentative agreement. That is, perhaps the actual wage reductions have already been "priced in" to pilots' expectations. To test this hypothesis, we turn to the financial markets. By examining the stock market reaction following the announcement of pay cuts, we can effectively determine whether or not they were considered surprises. To determine the unanticipated movement in the stock price, we calculate the daily abnormal returns (A_{it}) as discussed by Brown and Warner (1985) as follows:

$$A_{it} = R_{it} - R_{mt} \tag{9}$$

where R_{it} is the return to the pay cutting carrier i at day t and the market return R_{mt} is proxied by the AMEX airline index.[38] In other words, the abnormal return is the change in the stock price of airline i that cannot be explained by the overall movement in the airline industry resulting from factors that influence all carriers more or less equally (i.e., fuel prices, etc.). At day t = 0, carrier i announces the pay cut.[39] When possible, the 100 trading days prior to the announcement (from t = -101 to t = -2) comprise the estimation period which is used to calculate the variance for the t-statistics. To prevent event overlap, in two cases the estimation period was shortened to 70 trading days (United's wage reduction on January 18, 2005) and 50 trading days (US Airways' wage cut on December 11, 2002). The cumulative abnormal returns (CAR) is the sum of A_{it}.

We report the CAR (%) calculated for the three days surrounding the pay cut announcement on Table 10. We find positive abnormal returns to the stock of the pay cutting carrier for 10 of the 12 events, with an average cumulative return of 22.3% during this three-day window. Table 11 reports significant single day returns for the day before (+4.71%), the day of (+8.74%), and day after (+8.85%) the pilot pay cut. Finally, the bottom of table 11 reports various two and three day CAR windows, all of which register positive and significant returns. In sum, positive abnormal returns from the financial markets suggest that pilot pay cuts (or their magnitude) were surprising, and hence, we have reason to believe that pilots were also surprised by these pay cut announcements.

[Insert Table 10 and Table 11 about here]

Likewise, two somewhat unique characteristics of the labor market for commercial airline pilots may help to explain our somewhat surprising result that wage cuts lead to only short-lived reductions in pilot effort. First, even after accounting for the set of pilot pay cuts documented in our analysis, U.S. commercial airline pilots—as a group—are still among the most highly paid professionals in the U.S. economy. For example, following the 32.5 percent wage rate reduction agreed to in late 2004 by Delta Air Lines pilots, average monthly pilot earnings at Delta were \$12,653, compared to average earnings of \$10,888 for Physicians, \$10,010 for Judges and \$8,950 for Lawyers.[40] Thus, notwithstanding the broad series of recent wage reductions, pilots are still well compensated, especially considering the average number of hours worked per month.

Second, the seniority system in place at virtually every airline—combined with the fact that thousands of pilots have been furloughed since September 11th, 2001—implies that the reservation wage for most major airline pilots is still substantially below their post-pay cut wage. For example, a top-of-scale US Airways Boeing 737 Captain still earns \$125 per hour, even after three rounds of pay cuts. If this pilot were to leave US Airways and pursue a position at another carrier that is currently hiring (for example, a low cost or regional carrier), she would be forced to abandon her accumulated seniority and start at the bottom of the seniority scale at the new carrier, resulting in a substantially lower wage.[41] In light of these factors, we suspect that after an initial period of reduced effort, pilots are likely to come to the conclusion that their new wage rates are still “fair”, especially when compared to their next best alternative. And as surveys of company executives suggest, employees’ views on the fairness of pay cuts are likely to have a strong impact on employee effort and morale (Blinder and Choi 1990, Bewley 1999).

Bankruptcy Differences We now discuss our second noteworthy finding: that substantial performance differences exist between bankrupt and non-bankrupt carriers following a pilot pay reduction. At the outset, we note that care must be taken when interpreting these results since there can be significant differences among the financial condition of even the non-bankrupt carriers in our data set. In particular, our results suggest that the arbitration decision at non-bankrupt Alaska Airlines provoked a substantial negative effort response by pilots. Recall that Alaska was the only carrier to have a pay cut imposed via an arbitration decision. When Alaska Airlines is excluded from our sample, the magnitude of the non-bankrupt carrier coefficients and t-statistics falls by about one-tenth.[42]

Nonetheless, we believe that bankruptcy serves as a credible signal to pilots (and labor generally) regarding the severity of a carrier's financial crisis. Put differently, pilots are likely to update their "survival" probability of a carrier once it declares bankruptcy. In contrast, non-bankrupt carriers seeking wage concessions are more likely to be met with skepticism regarding whether the pay cut being sought is genuinely needed in order to survive. Likewise, we believe that the issue of fairness also plays an important role. In bankruptcy, airlines typically invoke the full protection of the bankruptcy laws to force all stake-holders (i.e., aircraft leaseholders, debt holders, vendors, etc.) to make significant concessions.[43] In contrast, carriers are far more limited as to what they can accomplish outside of bankruptcy with respect to non-labor cost savings. Consequently, an out-of-bankruptcy restructuring often leaves labor feeling "singled out", and consequently, pilots (and labor generally) are likely to view pay cuts outside of bankruptcy as "unfair."

6 Conclusions

This paper examines changes in employee effort following a reduction in pay by studying various airline flight performance measures following a significant and permanent reduction in pilot pay rates. Our study finds only limited evidence to support the concerns expressed by company officers in interviews (Bewley 1999) regarding the adverse effects on employee morale from wage cuts as well as theories linking gift-wages and effort (Akerlof 1982).

In particular, we find that when an employer (a U.S. airline) retracts a high wage "gift" to their employees (airline pilots), there is some evidence which suggests that in the period directly following the pay cut—pilots (especially those working at nonbankrupt airlines) supply less effort, which results in more frequent and longer flight delays. This reduction in pilot effort following pay cuts, however, is short-lived. In fact, for the two week and four week periods after a pilot pay cut we find no significant differences in flight performance.

We believe that two factors somewhat unique to the labor market for commercial airline pilots help to explain this surprising result. First, since airline deregulation in 1978, commercial pilots have received labor market rents (Hirsch and Macpherson, 2000). Hence, even after the recent pay cuts experienced by pilots over the past several years, commercial airline pilots at large U.S. carriers are still well compensated. Pilot salaries rival those of physicians, lawyers and other high-paying professions, yet pilots work substantially fewer hours than most other highly paid professionals. Second, the seniority system in place at virtually every airline—combined with the large number of pilot layoffs in the wake of September 11th—implies that the reservation wage for most major airline pilots is still substantially below their post-pay cut wage. Consequently, after an initial period of reduced effort, pilots are likely to come to the conclusion that their new wage rates are still "fair", especially when compared to their next best alternative. Surveys of company executives suggest that employees' views on the fairness of pay cuts are likely to have a strong impact on employee effort and morale (Blinder and Choi 1990, Bewley 1999).

Performance differences of bankrupt and non-bankrupt carriers are also consistent with the notions of fairness and effort documented in the literature. In particular, we find evidence that is consistent with the belief that pay cuts by bankrupt firms are viewed as being more "fair" than pay cuts by non-bankrupt firms. Indeed, it is only among pilots at the non-bankrupt carriers where we consistently find lower effort following a pay cut. Even among this set of pilots, we find that the reduction in effort is short-lived. Recent field experiments by Gneezy and List (2006) suggest that short-lived changes in effort may not be unique to airline pilots, since they observe short-lived effects on effort by employees who received a "gift" of wages above the market-clearing level. Whether our findings of a short lived effort response to pilot pay reductions are generalizable to occupations beyond the airline industry is a topic for future research.

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Notes

[1]See Campbell and Kamlani (1997) for a summary of the theories of wage rigidity.

[2]Greenberg (1990) examines employee theft at three Midwestern manufacturing plants following a 15% across-the-board pay cut lasting ten weeks.

[3]The trend of pay and benefit concessions in mature industries characterized by large firms saddled with high legacy costs is a problem both in the United States and abroad. See, for example, "As GM battles surging costs, workers' health becomes issue", *The Detroit News*, April 8, 2005. In Germany, for example, workers at Siemens AG in June 2004 agreed to wage freezes and longer work-hours after the firm threatened to move 2,000 jobs to Hungary. Likewise, German auto workers at both DaimlerChrysler and Volkswagen in 2004 agreed to pay freezes and longer work hours in response to impending layoffs.

[4]The U.S. Department of Transportation defines a flight as delayed if it arrived at the gate 15 minutes or more after its scheduled arrival time.

[5]These delays were widely reported in the media. See, for example, "Alaska Airlines Seeing More Delays and Cancellations", *USA Today*, 10 June 2005.

[6]While not technically a pay cut, most baggage handling positions at Alaska were outsourced in May 2005, shortly after the pilot pay cut agreement.

[7]For example, in the six months following a set of company-wide permanent pay cuts at Delta Air Lines in late 2004, "quit rates" among pilots reached 0.2%, while quit rates for non-pilot groups ranged from 3.9% (flight attendants) to 13.5% (reservation agents). See *Declaration of Michael L. Wachter In Support of Motion to Reject ALPA Collective Bargaining Agreement*, In re: Delta Air Lines, Inc., et al, v. Debtors, Chapter 11 Case No. 05-17923 (PCB), United States Bankruptcy Court, Southern District of New York.

[8]In contrast, subjects in laboratory experiments conducted by Fehr and Falk (1999) typically earned between $18 and $49 for a session lasting 2.5 hours.

[9]This idea of fairness is similar to the theory of inequity proposed by Adams (1965), who suggests that inequitably paid workers experience dissatisfaction and will hence be motivated to address this inequality.

[10]Source: U.S. Air Transport Association, http://www.airlines.org/econ/d.aspx?nid=1034.

[11]Pilots at virtually all large commercial airlines in the U.S. are represented by the Airline Line Pilots Association (ALPA) with the primary exception being American Airlines' pilots who are represented by the Allied Pilots Association (APA). JetBlue's pilots are currently non-unionized.

[12]For example, according to the U.S. Department of Transportation's DB1B database, the percentage of passengers purchasing First, Business or Unrestricted economy class tickets on the Big Six Legacy carriers fell from 21% during the first quarter of 1998 to 12.5% during the first quarter of 2001.

[13]As noted by one industry analyst, "There is almost no loyalty left....Once the Internet took hold, the airlines' assumptions about the viability of their existing fare structures and customer bases went to hell in [a] hand basket." See "The New Breed of Business Travel," *New York Times*, 16 July 2002.

[14]By 2001, for example, approximately 70% of U.S. domestic origin and destination passengers flew in city-pair markets where a low cost carrier had a least a 5% market share, up from slightly less than 25% in 1990. As summarized by a Continental Airlines executive: "[there is now] a low-fare network in this country that did not exist previously... We've finally reached the point, perhaps, where [LCC] penetration may be fatal [to the major carriers' high cost business model]," see "Low cost airlines put crunch on biggest carriers," *The Wall Street Journal*, 19 June 2002.

[15]Pilots at Southwest Airlines are paid based on the number of trips flow.

[16]For example, a pilot's "duty-rig" guarantees pilots paid credit hours based on the number of hours on duty. A typical duty-rig might be "1 for 2", meaning that for each two hours a pilot is on duty, he or she will receive at least one credit hour. Likewise, a pilot's "trip-rig" guarantees pilots credit hours based on the total amount of time he or she is away from base on a trip. For example, a "1 for 4" trip rig would mean that if a pilot is away from base for 40 hours, he or she would be guaranteed at least 10 hours of paid credit.

[17]In 2004, for example, the guaranteed credit hours at major U.S. carriers ranged from 64 at American to 85 at America West. Source: *U.S. Airlines Salary Survey and Career Earnings Comparison*, 2004 Edition, AIR Inc.

[18]Both United and US Airways' defined benefit pension plans were taken over by the Pension Benefit Guarantee Corporation (PBGC), a U.S. government corporation. Under the PBGC, the maximum annual benefit for an age 60 retiree (the maximum age that a U.S. commercial airline pilot is permitted to fly until) is approximately $30,000, a fraction of what most retiring pilots would have been eligible for under their carrier's previous defined benefit plan had it not been terminated.

[19]In particular, Section 1113(c) states that "The court shall approve an application for rejection of a collective bargaining agreement only if the court finds that: (1) the trustee has, prior to the hearing, made a proposal that fulfills the requirements of subsection (b)(1); (2) the authorized representative of the employees has refused to accept such proposal without good cause; and (3) the balance of the equities clearly favors rejection of such agreement (*11 U.S.C. § 1113(c)*). Section 1113(b)(1) requires that a debtor "(A) [M]ake a proposal to the authorized representative of the employees covered by such agreement, based on the most complete and reliable information available at the time of such proposal, which provides for those necessary modifications in the employees benefits and protections that are necessary to permit the reorganization of the debtor and assures that all creditors, the debtor and all of the affected parties are treated fairly and equitably; and (B) provide... the representative of the employees with such relevant information as is necessary to evaluate the proposal."

[20]Both United and US Airways also secured significant non-pilot pay cuts under §1113(c).

[21] See "Northwest Pilots Approve Deal, Regional Jet Order Expected", *Aviation Daily*, May 4, 2006.

[22] See "Delta Sends Tentative Deal To Members, Allows 76-Seat Jets", *Aviation Daily*, April 25, 2006. Since most other employee groups at Delta Air Lines are not unionized, Delta does not need to apply for relief under §1113(c) of the bankruptcy code to reduce pay rates for these groups.

[23] American's pilot reductions coincided with wage rate reductions of 15% to 16% for other employee groups.

[24] At the end of 2005, Continental and its flight attendants also reached an agreement for labor cost savings reported to be worth approximately $82 million annually.

[25] It is important to note that most pay reductions in the U.S. airline industry have been accompanied by profit sharing plans whereby employees would receive a portion of the company's future profits.

[26] Source: "The Death of the Golden Egg", *Financial Times*, 27 December 2004.

[27] See *Bankruptcy and Pension Problems are Symptoms of Underlying Structural Issues*, U.S. General Accounting Office, GAO-05-975, September 2005.

[28] For example, see Danthine and Kurmann (2005) for a structural model of efficiency wages based on reciprocity.

[29] See opening statement of ALPA In Re: Delta Air Lines., et al, v. Debtors, *Transcript of Evidentiary Hearing On Motion To Reject ALPA CBA Before The Honorable Prudence C. Beatty*, 16 November 2005.

[30] We also considered flight cancellations as a performance measure. We found, however, no detectable difference in flight cancellation rates in any of our event windows (one, two, or four weeks) after a pay cut announcement. Hence we opt not to report these insignificant results.

[31] For example, flights from Boston (BOS) to Los Angeles International (LAX) and flights from LAX to BOS are treated as distinct routes.

[32] The airports we consider as primary airports for each carrier are: American (DFW, ORD, MIA, STL (after 1 Jan. 2002); Alaska (SEA); Continental (CLE, EWR, IAH); Delta (ATL, CVG, SLC, & DFW (before 1 Feb. 2005)); Northwest (DTW, MEM, MSP); United (DEN, IAD, ORD, LAX, SFO); US Airways (CLT, PHL, PIT).

[33] www.transtats.bts.gov.

[34] A flight cancellation is also counted as a 15+ and 30+ minute flight delay. Flight cancellations, however, are omitted from the average minutes of flight delay estimation.

[35] In cases of missing weather data, we substituted the nearest weather reporting station within a radius of twenty-five miles.

[36] See, example, "Northwest clocks worst on-time record", *The Detroit News*, November 4, 2005.

[37] Because Alaska's pilot pay cut came in close proximity to the out-sourcing of most of the carriers' baggage handling positions, we also treat this incident as a *non-pilot pay cut* for estimation purposes.

[38]The AMEX airline index (XAL) is an equally weighted index of the large capitalized airlines.

[39]In situations where the stock market is closed on an announcement date, the event date is the first trading day when the market is open.

[40]See *Declaration of Michael L. Wachter In Support of Motion of Reject ALPA Collective Bargaining Agreement*, In re: Delta Air Lines, Inc., Chapter 11 Case No. 05-17923, United States Bankruptcy Court, Southern District of New York.

[41]For example, the starting hourly pilot wage rates (for co-pilots) at Southwest, JetBlue and AirTran are $50, $43 and $37 per hour respectively. Source: www.airlinepilotcentral.com.

[42]For example, re-estimating model 4 in Table 4 without Alaska reduces the coefficients and t-statistics for *7 days & nonbankrupt* from 2.31 (t-statistic = 1.81) to 2.05 (t-statistic = 1.58).

[43]For example, Section 1110 of the U.S. Bankruptcy Code allows carriers to reject aircraft leases, providing them with significant leverage to renegotiate lease terms.

Table 3 - Flight Performance After Pilot Pay Cut Announcements, October 2001 and May 2005

Service Quality	Average for Entire Sample	First 7 Days After Pay Cut	First 14 Days After Pay Cut
Proportion 15+ Minutes Delayed	0.190	0.213	0.190
Proportion 30+ Minutes Delayed	0.109	0.126	0.107
Proportion Canceled	0.013	0.017	0.012
Minutes of Arrival Delay	4.390	5.958	4.222
Observations	1,377,036	28,888	57,670

Table 4: Event Study Estimates of the Effect of Wage Reductions on 15+ Minute Flight Delays

Event Time Window (-40 days to +40 days) for Wage Cuts Occuring Between May 2002-June 2005.

Minutes Late:	15+ (1)	15+ (2)	15+ (3)	15+ (4)	15+ (5)	15+ (6)
Days After Pilot Pay Cut						
7 Days	0.0298 * (0.0177)	0.0241 (0.0172)				
7 Days & Nonbankrupt			0.0426 * (0.0246)	0.0437 * (0.0241)		
7 Days & Bankrupt			0.0053 (0.0209)	0.0047 (0.0205)		
14 Days & Nonbankrupt					0.0055 (0.0214)	0.0063 (0.0209)
14 Days & Bankrupt					-0.0101 (0.0203)	-0.0111 (0.0200)
Non-pilot pay cut		0.0116 (0.0082)	0.0110 (0.0081)	0.0129 (0.0080)	0.0142 * (0.0081)	0.0161 ** (0.0079)
Hub Variables						
Airline Hub Origination	0.0255 ** (0.0037)	0.0255 ** (0.0037)	0.0255 ** (0.0037)	0.0297 ** (0.0029)	0.0255 ** (0.0037)	0.0297 ** (0.0029)
Airline Hub Destination	-0.0189 ** (0.0034)	-0.0189 ** (0.0034)	-0.0189 ** (0.0034)	-0.0006 (0.0027)	-0.0189 ** (0.0034)	-0.0005 (0.0027)
Logistical Variables						
Airport Flights Orig. (in 1000s)	0.0239 ** (0.0022)	0.0238 ** (0.0022)	0.0238 ** (0.0022)	0.0035 (0.0103)	0.0238 ** (0.0022)	0.0035 (0.0104)
Airport Flights Dest. (in 1000s)	0.0361 ** (0.0024)	0.0360 ** (0.0024)	0.0359 ** (0.0024)	0.0046 (0.0100)	0.0359 ** (0.0024)	0.0047 (0.0100)
Distance (in 1000s of miles)	0.0178 ** (0.0015)	0.0178 ** (0.0015)	0.0178 ** (0.0015)	0.0123 ** (0.0016)	0.0178 ** (0.0015)	0.0123 ** (0.0016)
Weather Variables						
Snow Origination	0.0064 ** (0.0003)	0.0064 ** (0.0003)	0.0064 ** (0.0003)	0.0062 ** (0.0003)	0.0064 ** (0.0003)	0.0062 ** (0.0003)
Snow Destination	0.0045 ** (0.0002)	0.0045 ** (0.0002)	0.0045 ** (0.0002)	0.0044 ** (0.0002)	0.0045 ** (0.0002)	0.0044 ** (0.0002)
Rain Origination	0.0013 ** (0.0000)	0.0013 ** (0.0000)	0.0013 ** (0.0000)	0.0013 ** (0.0000)	0.0013 ** (0.0000)	0.0013 ** (0.0000)
Rain Destination	0.0015 ** (0.0000)	0.0015 ** (0.0000)	0.0015 ** (0.0000)	0.0015 ** (0.0001)	0.0015 ** (0.0000)	0.0015 ** (0.0001)
Constant	0.1746 ** (0.0157)	0.1753 ** (0.0156)	0.1876 ** (0.0164)	0.4450 ** (0.0359)	0.1751 ** (0.0156)	0.4435 ** (0.0359)
Airport Fixed Effects?	No	No	No	Yes	No	Yes
Mean of Dependent Variable	0.190 [0.29]	0.190 [0.29]	0.190 [0.29]	0.190 [0.29]	0.190 [0.29]	0.190 [0.29]
R-squared	0.162	0.162	0.162	0.183	0.162	0.180
Observations	1,377,036	1,377,036	1,377,036	1,377,036	1,377,036	1,377,036

Note: Standard errors (in parentheses) are clustered by month, year, and carrier (i.e., Delta June 2003). Standard deviation are in brackets. Regressions include month x year, carrier, and day of week indicator variables. * and ** indicate statistical significance at the 10% and 5% levels, respectively.
"Airport Fixed Effects" include indicator variables for each origination and destination airports.
Observations are daily route averages for each carrier.

Table 5: Event Study Estimates of the Effect of Wage Reductions on 30+ Minute Flight Delays

Event Time Window (-40 days to +40 days) for Wage Cuts Occuring Between May 2002-June 2005.

Minutes Late:	30+ (1)	30+ (2)	30+ (3)	30+ (4)	30+ (5)	30+ (6)
Days After Pay Cut						
7 Days	0.0224 (0.0152)	0.0196 (0.0151)				
7 Days & Nonbankrupt			0.0314 (0.0230)	0.0321 (0.0228)		
7 Days & Bankrupt			0.0075 (0.0170)	0.0072 (0.0168)		
14 Days & Nonbankrupt					0.0026 (0.0158)	0.0031 (0.0156)
14 Days & Bankrupt					-0.0059 (0.0155)	-0.0065 (0.0153)
Non-pilot pay cut		0.0058 (0.0058)	0.0054 (0.0059)	0.0064 (0.0058)	0.0080 (0.0058)	0.0090 (0.0057)
Hub Variables						
Airline Hub Origination	0.0087 ** (0.0024)	0.0087 ** (0.0024)	0.0087 ** (0.0024)	0.0129 ** (0.0020)	0.0087 ** (0.0024)	0.0129 ** (0.0020)
Airline Hub Destination	-0.0188 ** (0.0024)	-0.0188 ** (0.0024)	-0.0188 ** (0.0024)	-0.0061 ** (0.0019)	-0.0188 ** (0.0024)	-0.0061 ** (0.0019)
Logistical Variables						
Airport Flights Orig. (in 1000s)	0.0204 ** (0.0019)	0.0203 ** (0.0019)	0.0203 ** (0.0019)	0.0090 (0.0063)	0.0203 ** (0.0019)	0.0090 (0.0063)
Airport Flights Dest. (in 1000s)	0.0311 ** (0.0019)	0.0311 ** (0.0019)	0.0310 ** (0.0019)	0.0158 ** (0.0071)	0.0310 ** (0.0019)	0.0158 ** (0.0071)
Distance (in 1000s of miles)	0.0004 (0.0010)	0.0004 (0.0010)	0.0004 (0.0010)	-0.0036 ** (0.0011)	0.0004 (0.0010)	-0.0036 ** (0.0011)
Weather Variables						
Snow Origination	0.0058 ** (0.0002)	0.0058 ** (0.0002)	0.0058 ** (0.0002)	0.0057 ** (0.0002)	0.0058 ** (0.0002)	0.0057 ** (0.0002)
Snow Destination	0.0043 ** (0.0002)	0.0043 ** (0.0002)	0.0043 ** (0.0002)	0.0043 ** (0.0001)	0.0043 ** (0.0002)	0.0043 ** (0.0001)
Rain Origination	0.0011 ** (0.0000)	0.0011 ** (0.0000)	0.0011 ** (0.0000)	0.0011 ** (0.0000)	0.0011 ** (0.0000)	0.0011 ** (0.0000)
Rain Destination	0.0012 ** (0.0000)	0.0012 ** (0.0000)	0.0012 ** (0.0000)	0.0012 ** (0.0000)	0.0012 ** (0.0000)	0.0012 ** (0.0000)
Constant	0.1081 ** (0.0117)	0.1085 ** (0.0117)	0.1202 ** (0.0130)	0.0203 (0.0292)	0.1083 ** (0.0117)	0.0192 (0.0291)
Airport Fixed Effects?	No	No	No	Yes	No	Yes
Mean of Dependent Variable	0.109 [0.229]	0.109 [0.229]	0.109 [0.229]	0.109 [0.229]	0.109 [0.229]	0.109 [0.229]
R-squared	0.171	0.171	0.171	0.187	0.171	0.187
Observations	1,377,036	1,377,036	1,377,036	1,377,036	1,377,036	1,377,036

Note: Standard errors (in parentheses) are clustered by month, year, and carrier (i.e., Delta June 2003). Standard deviation are in brackets. Regressions include month x year, carrier, and day of week indicator variables. * and ** indicate statistical significance at the 10% and 5% levels, respectively.
"Airport Fixed Effects" include indicator variables for each origination and destination airports.
Observations are daily route averages for each carrier.

Table 6: Event Study Estimates of the Effect of Wage Reductions on Length of Flight Delay

Event Time Window (-40 days to +40 days) for Wage Cuts Occuring Between May 2002-June 2005.

Dependent Variable:	Minutes Delay (1)	Minutes Delay (2)	Minutes Delay (3)	Minutes Delay (4)	Minutes Delay (5)	Minutes Delay (6)
Days After Pay Cut						
7 Days	2.1934 * (1.3117)	1.8083 (1.2926)				
7 Days & Nonbankrupt			2.2272 (1.7832)	2.3109 (1.7557)		
7 Days & Bankrupt			1.3795 (1.8398)	1.3299 (1.7988)		
14 Days & Nonbankrupt					-0.1516 (1.5020)	-0.0919 (1.4713)
14 Days & Bankrupt					-0.0102 (1.7580)	-0.0870 (1.7328)
Non-pilot pay cut		0.7917 (0.6507)	0.7777 (0.6567)	0.9469 (0.6462)	1.0281 (0.6371)	1.1960 * (0.6254)
Hub Variables						
Airline Hub Origination	1.9467 ** (0.3201)	1.9452 ** (0.3205)	1.9457 ** (0.3207)	2.2415 ** (0.3422)	1.9467 ** (0.3207)	2.2417 ** (0.3421)
Airline Hub Destination	-1.1634 ** (0.3131)	-1.1646 ** (0.3135)	-1.1641 ** (0.3136)	0.0353 (0.3195)	-1.1630 ** (0.3134)	0.0356 (0.3194)
Logistical Variables						
Airport Flights Orig. (in 1000s)	1.6473 ** (0.1807)	1.6404 ** (0.1806)	1.6397 ** (0.1807)	0.2297 (0.9530)	1.6393 ** (0.1809)	0.2337 (0.9539)
Airport Flights Dest. (in 1000s)	2.1581 ** (0.1948)	2.1506 ** (0.1949)	2.1499 ** (0.1948)	-0.0413 (0.7353)	2.1494 ** (0.1945)	-0.0393 (0.7350)
Distance (in 1000s of miles)	-0.0746 (0.1278)	-0.0753 (0.1279)	-0.0752 (0.1279)	-0.5273 ** (0.1284)	-0.0754 (0.1279)	-0.5273 ** (0.1282)
Weather Variables						
Snow Origination	0.6479 ** (0.0319)	0.6482 ** (0.0319)	0.6482 ** (0.0319)	0.6521 ** (0.0323)	0.6488 ** (0.0319)	0.6527 ** (0.0323)
Snow Destination	0.3934 ** (0.0394)	0.3936 ** (0.0394)	0.3936 ** (0.0394)	0.3863 ** (0.0394)	0.3942 ** (0.0395)	0.3868 ** (0.0394)
Rain Origination	0.1165 ** (0.0054)	0.1166 ** (0.0054)	0.1166 ** (0.0054)	0.1160 ** (0.0054)	0.1166 ** (0.0054)	0.1160 ** (0.0054)
Rain Destination	0.1339 ** (0.0060)	0.1340 ** (0.0060)	0.1340 ** (0.0060)	0.1335 ** (0.0061)	0.1340 ** (0.0060)	0.1335 ** (0.0061)
Constant	3.6467 ** (1.3815)	3.6985 ** (1.3773)	5.6051 ** (1.3603)	--	3.6968 (1.3823)	--
Airport Fixed Effects?	No	No	No	Yes	No	Yes
Mean of Dependent Variable	4.39 [27.24]	4.39 [27.24]	4.39 [27.24]	4.39 [27.24]	4.39 [27.24]	4.39 [27.24]
R-squared	0.128	0.128	0.128	0.138	0.128	0.138
Observations	1,371,533	1,371,533	1,371,533	1,371,533	1,371,533	1,371,533

Note: Standard errors (in parentheses) are clustered by month, year, and carrier (i.e., Delta June 2003). Standard deviation are in brackets. Regressions include month x year, carrier, and day of week indicator variables. * and ** indicate statistical significance at the 10% and 5% levels, respectively.
"Airport Fixed Effects" include indicator variables for each origination and destination airports.
Observations are daily route averages for each carrier.

Table 7: Flight Delays - The Effect of Wage Reductions on Flight Performance
Difference in Difference Estimates of Percentage of Flights Arriving 15+ Minutes Late
Event Time Window (-40 days to +40 days) for Wage Cuts from May 2002 - June 2005.

Carrier: Minutes Late:	Alaska 15+	American 15+	Continental 15+	Delta 15+	Northwest 15+	US Airways 15+	United 15+
Days After Pay Cut							
7 Days	0.2283 **	0.0488	0.0651 **	-0.0121	0.0741 **	-0.0089	0.0163 *
	(0.0339)	(0.0325)	(0.0194)	(0.0420)	(0.0297)	(0.0130)	(0.0084)
Weather Variables							
Snow Origination	--	0.0010	0.0012 ^	-0.0021	0.0008	0.0014	-0.0010
		(0.0012)	(0.0006)	(0.0040)	(0.0011)	(0.0009)	(0.0010)
Rain Origination	0.0002	0.0011 **	0.0006 **	0.0007 **	-0.0001	0.0005 **	0.0005 **
	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0003)	(0.0002)	(0.0002)
Constant	0.1125 **	0.0016	0.0080 **	-0.0008	0.0318 **	0.0332 **	-0.0089 **
	(0.0057)	(0.0025)	(0.0030)	(0.0037)	(0.0038)	(0.0048)	(0.0022)
R-squared	0.042	0.032	0.068	0.063	0.013	0.023	0.023
Observations	574	574	574	574	574	574	574

Carrier: Minutes Late:	Alaska 15+	American 15+	Continental 15+	Delta 15+	Northwest 15+	US Airways 15+	United 15+
Days After Pay Cut							
14 Days	0.1706 **	0.0263	0.0550 **	-0.0020	0.0776 **	-0.0072	0.0127 *
	(0.0349)	(0.0179)	(0.0193)	(0.0233)	(0.0169)	(0.0110)	(0.0076)
Weather Variables							
Snow Origination	--	0.0011	0.0011 ^	-0.0020	0.0008	0.0014	-0.0010
		(0.0012)	(0.0006)	(0.0040)	(0.0011)	(0.0009)	(0.0010)
Rain Origination	0.0002	0.0011 **	0.0006 **	0.0007 **	-0.0001	0.0005 **	0.0005 **
	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0003)	(0.0002)	(0.0002)
Constant	0.1112 **	0.0014	0.0075 **	-0.0009	0.0306 **	0.0335 **	-0.0092 **
	(0.0056)	(0.0025)	(0.0030)	(0.0037)	(0.0038)	(0.0049)	(0.0022)
R-squared	0.046	0.122	0.072	0.062	0.025	0.023	0.024
Observations	574	574	574	574	574	574	574

Note: Difference in difference estimations are defined as the difference in the average daily flight delay rates at carrier X's hub airports versus the average daily flight delay rates for all other carriers at carrier X's hub airports.
* and ** indicate statistical significance at the 10% and 5% levels, respectively.
Robust standard errors are in parentheses.

Table 8: Flight Delays - The Effect of Wage Reductions on Flight Performance
Difference in Difference Estimates of Percentage of Flights Arriving 30+ Minutes Late
Event Time Window (-40 days to +40 days) for Wage Cuts from May 2002 - June 2005.

Carrier: Minutes Late:	Alaska 30+	American 30+	Continental 30+	Delta 30+	Northwest 30+	US Airways 30+	United 30+
Days After Pay Cut							
7 Days	0.1646 ** (0.0367)	0.0493 * (0.0270)	0.0332 ** (0.0165)	-0.0076 (0.0204)	0.0089 (0.0136)	-0.0106 (0.0106)	0.0159 ** (0.0076)
Weather Variables							
Snow Origination	--	0.0007 (0.0014)	0.0008 (0.0005)	-0.0017 (0.0027)	0.0004 (0.0008)	0.0021 ** (0.0008)	-0.0007 (0.0008)
Rain Origination	0.0001 (0.0001)	0.0011 ** (0.0002)	0.0005 ** (0.0001)	0.0006 ** (0.0001)	-0.0001 (0.0003)	0.0003 * (0.0002)	0.0004 ** (0.0001)
Constant	0.0855 ** (0.0043)	0.0026 (0.0024)	-0.0173 ** (0.0024)	-0.0220 ** (0.0032)	0.0013 (0.0033)	0.0120 ** (0.0040)	-0.0038 ** (0.0017)
R-squared	0.037	0.141	0.074	0.058	0.001	0.026	0.024
Observations	574	574	574	574	574	574	574

Carrier: Minutes Late:	Alaska 30+	American 30+	Continental 30+	Delta 30+	Northwest 30+	US Airways 30+	United 30+
Days After Pay Cut							
14 Days	0.1302 ** (0.0266)	0.0263 * (0.0152)	0.0308 ** (0.0148)	0.0013 (0.0128)	0.0176 * (0.0092)	-0.0063 (0.0088)	0.0099 (0.0067)
Weather Variables							
Snow Origination	--	0.0008 (0.0014)	0.0008 (0.0005)	-0.0016 (0.0027)	0.0004 (0.0008)	0.0021 ** (0.0008)	-0.0007 (0.0008)
Rain Origination	0.0001 (0.0001)	0.0011 ** (0.0002)	0.0005 ** (0.0001)	0.0005 ** (0.0001)	-0.0001 (0.0003)	0.0003 * (0.0002)	0.0004 ** (0.0001)
Constant	0.0844 ** (0.0043)	0.0024 (0.0024)	-0.0177 ** (0.0024)	-0.0221 ** (0.0032)	0.0009 (0.0033)	0.0121 ** (0.0042)	-0.0039 ** (0.0017)
R-squared	0.045	0.137	0.077	0.058	0.002	0.026	0.022
Observations	574	574	574	574	574	574	574

Note: Difference in difference estimations are defined as the difference in the average minutes of flight delay at carrier X's hub airports versus the average minutes of flight delay for all other carriers at carrier X's hub airports.
* and ** indicate statistical significance at the 10% and 5% levels, respectively.
Robust standard errors are in parentheses.

Table 9: Average Minutes of Flight Delay - The Effect of Wage Reductions on Flight Performance
Difference in Difference Estimates of Length of Flight Delay, Event Time Window (-40 days to +40 days) for Wage Cuts from May 2002 - June 2005.

Carrier: Dep. Variable:	Alaska Minutes Late	American Minutes Late	Continental Minutes Late	Delta Minutes Late	Northwest Minutes Late	US Airways Minutes Late	United Minutes Late
Days After Pay Cut							
7 Days	15.9123 ** (3.8766)	-0.6648 (3.1221)	4.4105 (2.7640)	-1.5595 (2.9791)	2.9664 (2.0144)	-0.8406 (1.0000)	2.3191 ** (1.0107)
Weather Variables							
Snow Origination	--	-0.0628 (0.1812)	0.1202 (0.1528)	-0.0791 (0.5179)	-0.3525 * (0.1652)	0.2260 * (0.0986)	-0.1199 (0.0990)
Rain Origination	0.0372 ** (0.0151)	0.1014 ** (0.0321)	0.0481 ** (0.0116)	0.0725 ** (0.0205)	-0.0469 (0.0372)	0.0348 * (0.0206)	0.0711 ** (0.0212)
Constant	6.6735 ** (0.4945)	-0.6772 ** (0.2912)	1.5273 ** (0.3095)	0.7387 * (0.4105)	2.6366 ** (0.3873)	1.6573 ** (0.4311)	0.2560 (0.2155)
R-squared	0.032	0.083	0.045	0.070	0.052	0.024	0.044
Observations	574	574	574	574	574	574	574

Carrier: Dep. Variable:	Alaska Minutes Late	American Minutes Late	Continental Minutes Late	Delta Minutes Late	Northwest Minutes Late	US Airways Minutes Late	United Minutes Late
Days After Pay Cut							
14 Days	11.7999 ** (2.9832)	-0.0335 (1.6036)	3.4764 * (1.9407)	0.5058 (1.9983)	3.1131 ** (1.2328)	-0.5761 (0.8603)	1.6744 ** (0.6791)
Weather Variables							
Snow Origination	--	-0.0654 (0.1794)	0.1185 (0.1521)	-0.0719 (0.5173)	-0.3503 * (0.1655)	0.2255 * (0.0986)	-0.1180 (0.0987)
Rain Origination	0.0368 ** (0.0153)	0.1013 ** (0.0322)	0.0483 ** (0.0116)	0.0723 ** (0.0205)	-0.0464 (0.0372)	0.0347 * (0.0206)	0.0713 ** (0.0211)
Constant	6.5848 ** (0.4958)	-0.6823 ** (0.2961)	1.4960 ** (0.3101)	0.7084 * (0.4139)	2.5897 ** (0.3906)	1.6749 ** (0.4480)	0.2153 (0.2187)
R-squared	0.035	0.083	0.046	0.070	0.054	0.024	0.044
Observations	574	574	574	574	574	574	574

Note: Difference in difference estimations are defined as the difference in the average daily flight cancellation rates at carrier X's hub airports versus the average daily flight cancellation rates for all other carriers at carrier X's hub airports. ^, * and ** indicate statistical significance at the 10%, 5% and 1% levels, respectively. Robust standard errors are in parentheses.

Table 10 - Cumulative Abnormal Returns (CAR) following Pilot Wage Reduction Announcements

Carrier	Notify Date	Wage Reduction (%)	CAR (%) Window (-1,1)
Alaska	29-Apr-05	-26%	0.7%
American Airlines	1-Apr-03	-23%	106.7%
Continental	28-Feb-05	-8.9%	12.1%
Delta Airlines	28-Oct-04	-32.5%	11.2%
Northwest Airlines	14-Oct-04	-15%	8.6%
United	27-Dec-02	-29%	33.3%
United	18-Jan-05	-11.8%	-3.4%
United	10-May-05	Pension termination	7.9%
US Airways	6-Jul-02	-26%	10.1%
US Airways	11-Dec-02	-8%	3.8%
US Airways	1-Mar-03	Pension termination	-3.2%
US Airways	1-Oct-04	-18%	79.7%
Average		-19.8%	22.3%

Note: In situations where the stock market is not open on announcement date (weekend or holiday), the event date is the next trading day.

Table 11 - Average Daily and Cumulative Abnormal Returns with Test Statistics Surrounding Pilot Compensation Reduction Announcements (N = 12)

	AR (%)	t-statistic
Daily abnormal returns:		
Event day -1	4.71%	2.30
Event day 0	8.74%	4.09
Event day 1	8.85%	4.15
	CAR (%)	t-statistic
Cumulative abnormal returns:		
Event window (-1, 0)	13.46%	4.14
Event window (0, 1)	17.60%	5.40
Event window (-1,1)	22.31%	5.70

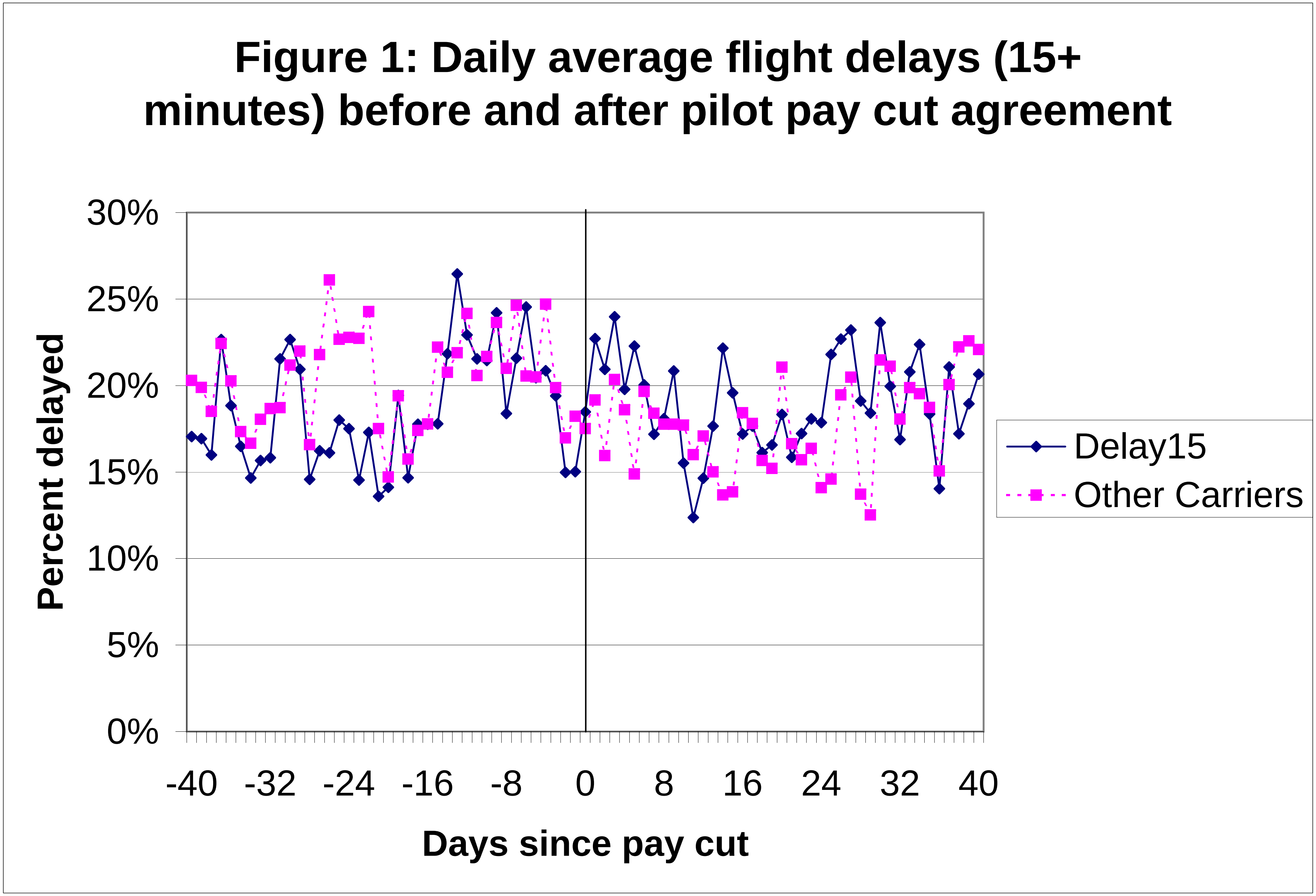


Figure 1: Daily average flight delays (15+ minutes) before and after pilot pay cut agreement
Percent delayed
30%
25%
20%
15%
10%
5%
0%
-40
-32
-24
-16
-8
0
8
16
24
32
40
Days since pay cut
Delay15
Other Carriers

Figure 2: Regression-adjusted event study estimates of the effect of pilot pay cuts on flight delays (15 minute);-40 to +40 days event window

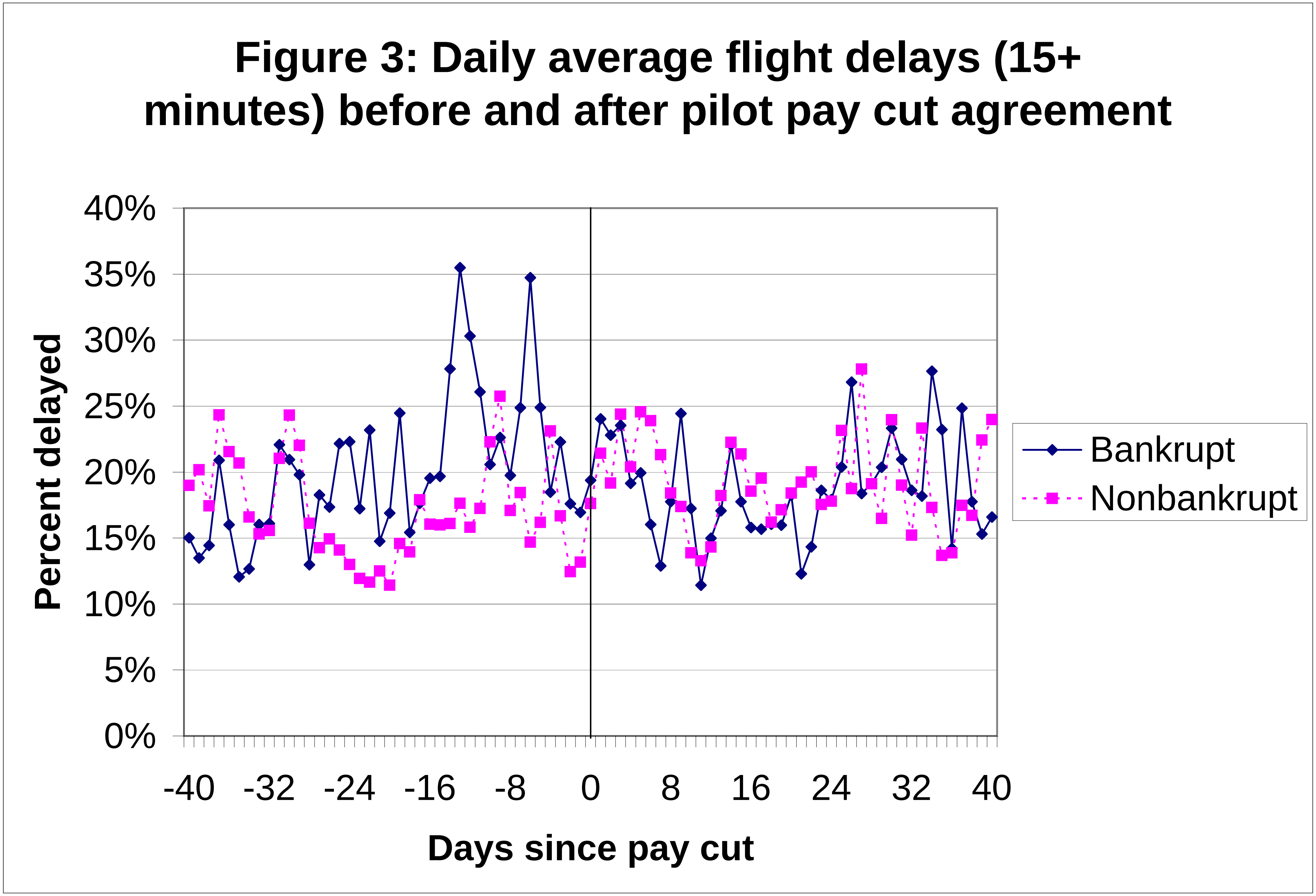
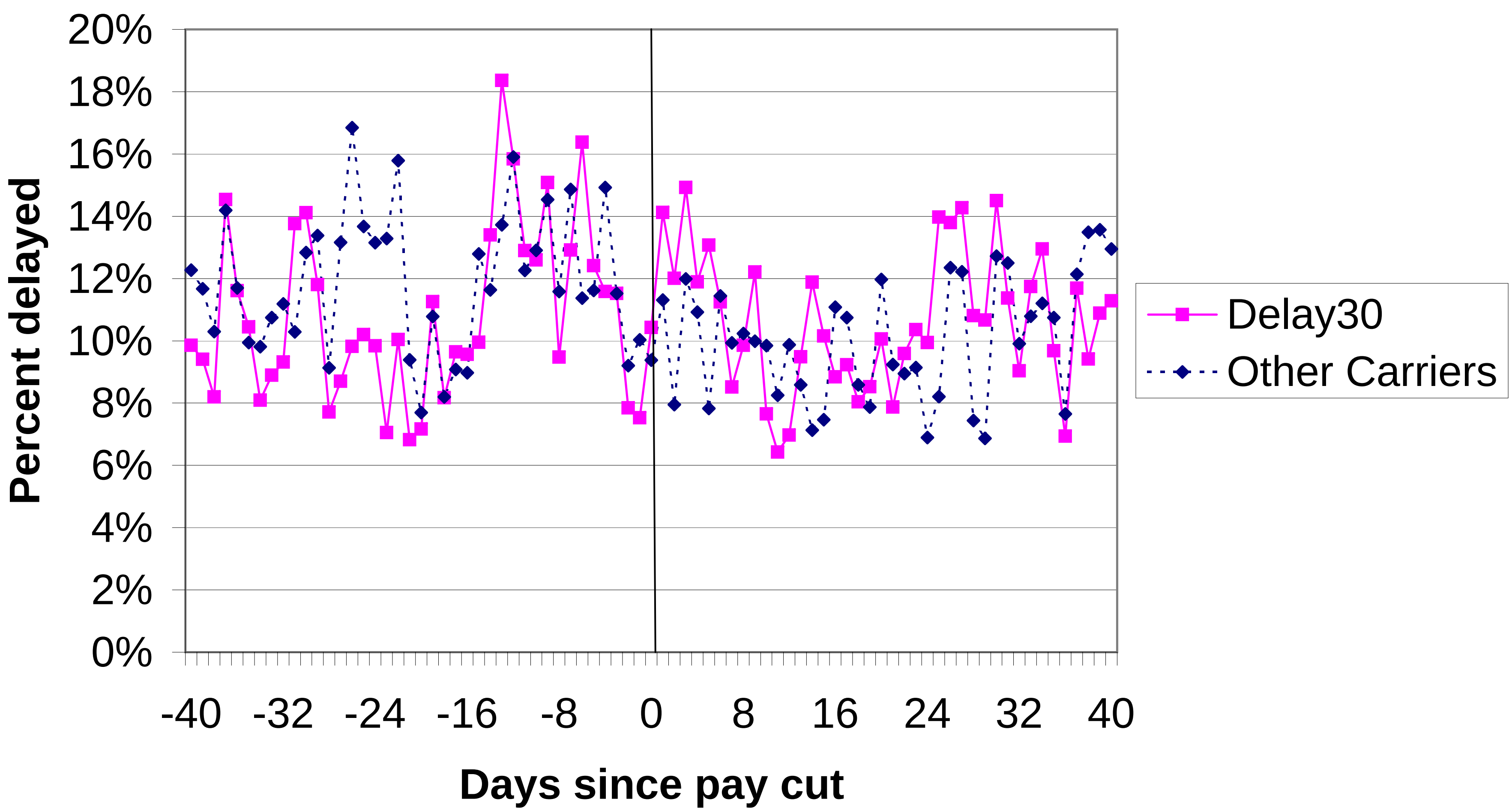


Figure 3: Daily average flight delays (15+ minutes) before and after pilot pay cut agreement
40%
35%
30%
25%
20%
15%
10%
5%
0%
Percent delayed
-40
-32
-24
-16
-8
0
8
16
24
32
40
Days since pay cut
Bankrupt
Nonbankrupt

Figure 4: Daily average flight delays (30+ minutes) before and after pilot pay cut agreement



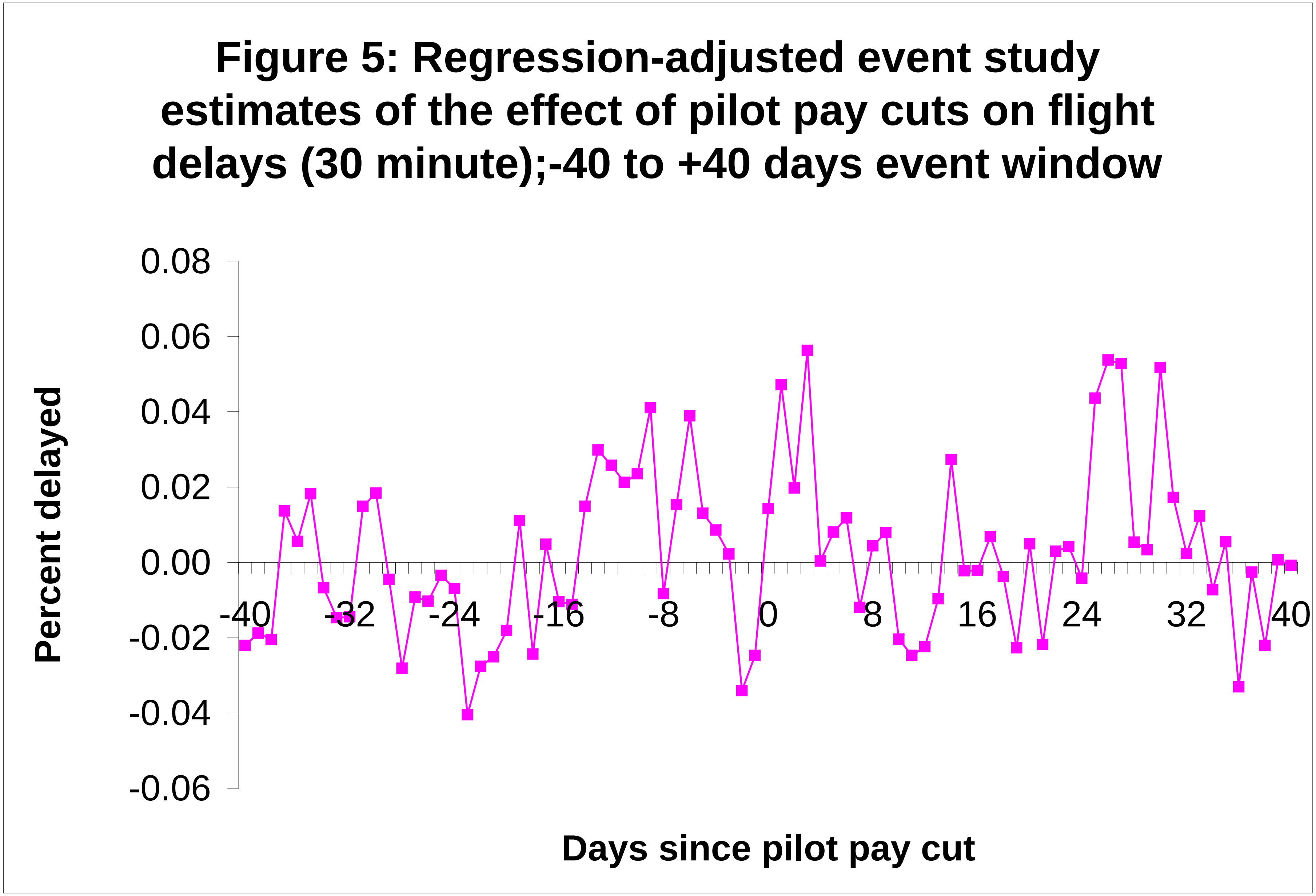


Figure 5: Regression-adjusted event study estimates of the effect of pilot pay cuts on flight delays (30 minute);-40 to +40 days event window
Percent delayed
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.06
-40
-32
-24
-16
-8
0
8
16
24
32
40
Days since pilot pay cut

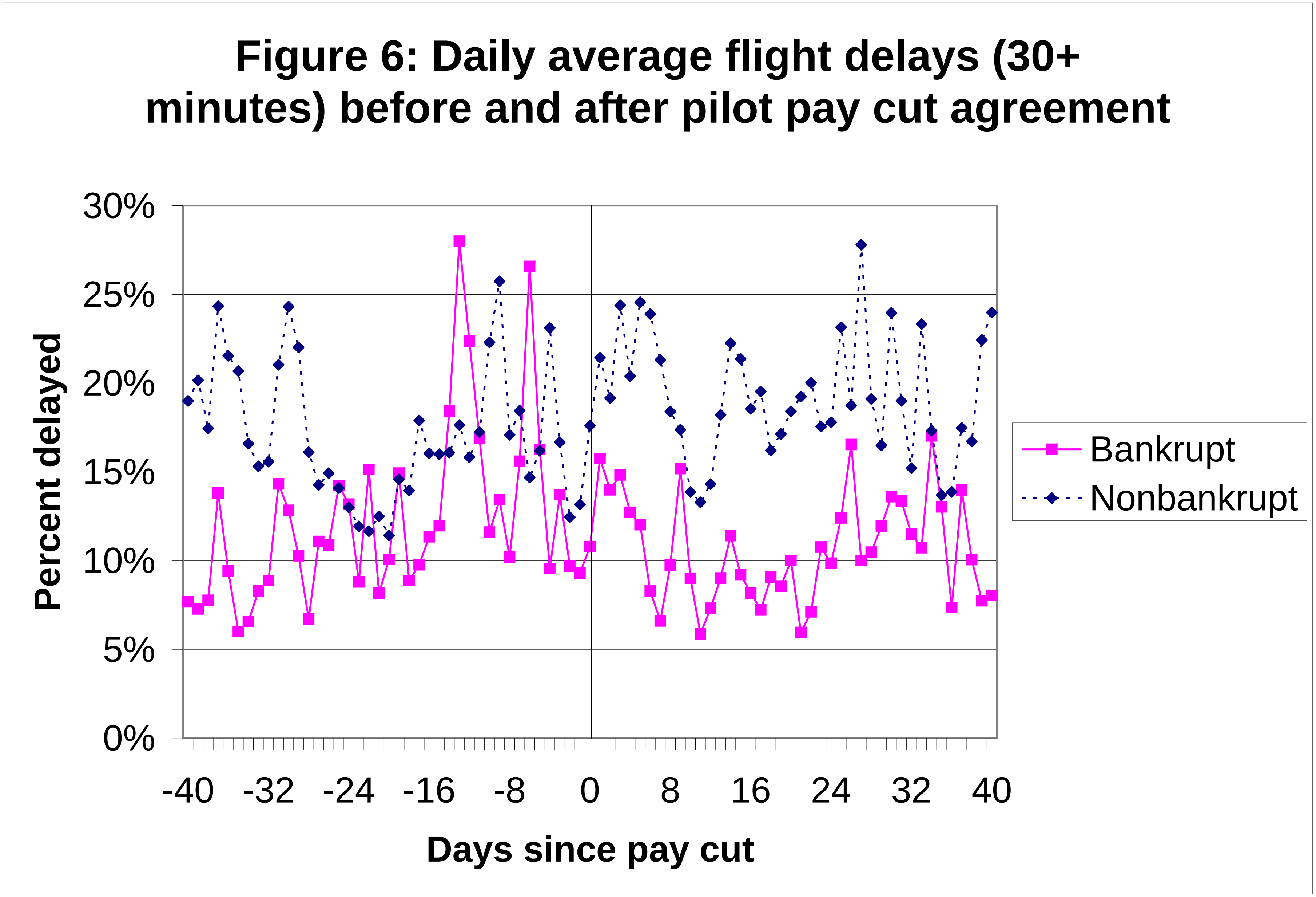


Figure 6: Daily average flight delays (30+ minutes) before and after pilot pay cut agreement
Percent delayed
30%
25%
20%
15%
10%
5%
0%
-40
-32
-24
-16
-8
0
8
16
24
32
40
Days since pay cut
Bankrupt
Nonbankrupt

Appendix: Event Study Estimates - One Month After Pilot Wage Reductions

The Effect of Pilot Wage Cuts on Airline Performance Event Time Window (-40 days to +40 days) for Wage Cuts between May 2002 and June 2005.

Dependent Variable:	15+ Minutes Late	30+ Minutes Late	Minutes of Delay	Flight Cancellation
Days After Pay Cut				
28 Days	0.0046	0.0034	0.4220	0.0022
	(0.0119)	(0.0081)	(0.8965)	(0.0017)
Non-pilot pay cut	0.0119	0.0061	0.7679	-0.0023
	(0.0087)	(0.0058)	(0.6863)	(0.0014)
Hub Variables				
Airline Hub Origination	0.0255 **	0.0087 **	1.9452 **	-0.0043 **
	(0.0037)	(0.0024)	(0.3202)	(0.0008)
Airline Hub Destination	-0.0189 **	-0.0188 **	-1.1646 **	-0.0028 **
	(0.0034)	(0.0024)	(0.3131)	(0.0008)
Logistical Variables				
Airport Flights Orig.	0.0238 **	0.0203 **	1.6408 **	0.0048 **
(in 1000s)	(0.0022)	(0.0019)	(0.1806)	(0.0008)
Airport Flights Dest.	0.0360 **	0.0311 **	2.1511 **	0.0050 **
(in 1000s)	(0.0024)	(0.0019)	(0.1948)	(0.0009)
Distance	0.0178 **	0.0004	-0.0751	-0.0045 **
(in 1000s of miles)	(0.0015)	(0.0010)	(0.1278)	(0.0005)
Weather Variables				
Snow Origination	0.0064 **	0.0058 **	0.6488 **	0.0030 **
	(0.0003)	(0.0002)	(0.0319)	(0.0002)
Snow Destination	0.0045 **	0.0043 **	0.3943 **	0.0030 **
	(0.0002)	(0.0002)	(0.0394)	(0.0002)
Rain Origination	0.0013 **	0.0011 **	0.1166 **	0.0002 **
	(0.0000)	(0.0000)	(0.0054)	(0.0000)
Rain Destination	0.0015 **	0.0012 **	0.1340 **	0.0002 **
	(0.0000)	(0.0000)	(0.0060)	(0.0000)
Constant	0.1753 **	0.1085 **	3.6967 **	0.0145 **
	(0.0156)	(0.0117)	(1.3790)	(0.0025)
Airport Fixed Effects?	No	No	No	No
Mean of Dependent Variable	0.190	0.109	4.39	0.013
	[0.29]	[0.229]	[27.24]	[0.084]
R-squared	0.162	0.171	0.128	0.163
Observations	1,377,036	1,377,036	1,377,036	1,377,036

Note: Standard errors (in parentheses) are clustered by month, year, and carrier (i.e., Delta June 2003). Standard deviation are in brackets. Regressions include month, year, carrier, and day of week indicator variables. * and ** indicate statistical significance at the 10% and 5% levels, respectively. Observations are daily route averages for each carrier.