



## Tarmac delay policies: A passenger-centric analysis



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### ABSTRACT

In this paper, we analyze the effectiveness of the 2010 Tarmac Delay Rule from a passenger-centric point of view. The Tarmac Delay Rule stipulates that aircraft lift-off, or an opportunity for passengers to deplane, must occur no later than 3 h after the cabin door closure at the gate of the departure airport; and that an opportunity for passengers to deplane must occur no later than 3 h after the touchdown at the arrival airport. The Tarmac Delay Rule aims to protect enplaned passengers on commercial aircraft from excessively long delays on the tarmac upon taxi-out or taxi-in, and monetarily penalizes airlines that violate the stipulated 3-h tarmac time limit. Comparing the actual flight schedule and delay data after the Tarmac Delay Rule was in effect with that before, we find that the Rule has been highly effective in reducing the frequency of occurrence of long tarmac times. However, another significant effect of the rule has been the rise in flight cancellation rates. Cancellations result in passengers requiring rebooking, and often lead to extensive delay in reaching their final destinations. Using an algorithm to estimate passenger delay, we quantify delays to passengers in 2007, before the Tarmac Delay Rule was enacted, and compare these delays to those estimated for hypothetical scenarios with the Tarmac Delay Rule in effect for that same year. Our delay estimates are calculated using U.S. Department of Transportation data from 2007. Through our results and several sensitivity analyses, we show that the overall impact of the current Tarmac Delay Rule is a significant increase in passenger delays, especially for passengers scheduled to travel on the flights which are at risk of long tarmac delays. We evaluate the impacts on passengers of a number of rule variations, including changes to the maximum time on the tarmac, and variations in that maximum by time-of-day. Through extensive scenario analyses, we conclude that a better balance between the conflicting objectives of reducing the frequency of long tarmac times and reducing total passenger delays can be achieved through a modified version of the existing rule. This modified version involves increasing the tarmac time limit to 3.5 h and only applying the rule to flights with planned departure times before 5pm. Finally, in order to implement the Rule more effectively, we suggest the tarmac time limit to be defined in terms of the time when the aircraft begin returning to the gate instead of being defined in terms of the time when passengers are allowed to deplane.

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## 1. Introduction

In 2007, flight delay levels in the U.S. were very high in general. But on February 14, 2007, in the midst of what came to be known as the “Valentine’s Day Blizzard”, passengers on flights originating at New York City’s John F. Kennedy International

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**Table 1**

Non-cancelled flights (including diversions) that experienced lengthy tarmac times during taxi-out in 2007, as reported by BTS.

Length of taxi-out times (min)	Number of occurrences
60–119	75,833
120–179	7507
180–239	1370
240–299	239
300–359	36
360 or greater	9

Airport (JFK) suffered extremely long delays. Some of these passengers endured as much as 7 h of delay on their aircraft, often without access to food. Boarded and pushed back from the gates, the aircraft were unable to return to a gate to allow passengers to deplane in the deteriorating weather conditions. The media learned about the situation of the trapped passengers, and outrage ensued. Lengthy tarmac times, defined as those lasting more than 3 h, were fairly common in 2007. That year, there were 1654 instances of 3 h or longer *taxi-out times*, defined as the period of time between cabin door closure and aircraft lift-off. In this paper, we will use the terms *tarmac time* and *taxi-out time* interchangeably. Moreover, the actual number of instances with taxi-out times greater than or equal to 3 h was much higher, as the 1654 count does not include the flights that pushed back from their gates, joined the departure queue, later were cancelled, and then taxied back to a gate to deplane. Additionally, if we include flights with intermediate taxi-out times, that is, those between 1 and 3 h, the number increases dramatically. As shown in Table 1, using data from the Bureau of Transportation Statistics (BTS) (2007), the number of flights with taxi-out times between 1 and 3 h was approximately 50 times the number of flights with taxi-out times of 3 h or longer. Note that, for reasons explained later in this section, we will focus our analysis on taxi-out times (rather than taxi-in times).

### 1.1. The Tarmac Delay Rule and airline response

Following these events, amid pressure from consumer advocacy groups, the U.S. Department of Transportation announced a policy known as the Tarmac Delay Rule (the “Rule”) on December 21, 2009, which went into effect on April 29, 2010. The Rule stipulates that aircraft lift-off, or an opportunity for passengers to deplane, must occur no later than 3 h after the cabin door closure at the gate at the departure airport; and that an opportunity for passengers to deplane must occur no later than 3 h after touchdown at the arrival airport. There are two exemptions: (1) if the pilot determines that moving from the departure queue or deplaning passengers would constitute a safety or security risk and (2) if local air traffic control decides that airport operations would be significantly disrupted by the delayed aircraft returning to a gate or deplaning area. Latitude for local decision-making is written into the Rule allowing local air traffic control to decide what constitutes a significant disruption to operations. The Rule requires that carriers and individual airports develop a plan that is mutually agreeable for deplanement in case a violation is imminent. In case of flights delayed at the departure airport, the pilot must request clearance to leave the departure queue to taxi to a gate or other deplanement area in sufficient time to comply with the Rule; that is, the aircraft cannot begin to head back to a gate or other deplanement area at the end of the 3-h period. Instead, passengers wanting to be deplaned must be fully deplaned at the 3-h limit. Additionally, food and water must be made available no later than 2 h from push-back (for departing aircraft) and from touchdown (for arriving aircraft). Operable lavatory facilities must be available as well. The Rule currently applies to U.S. flag carriers operating domestic flights, and to international flights (operated by any carrier), originating or landing at U.S. airports (in this latter case the limit on time on the tarmac is 4 h). Flights operated by aircraft with less than 30 seats are exempt. The Rule’s penalty to the airlines for non-compliance is a fine of up to \$27,500 per passenger. In actuality, fine level varies from case to case. As of Jan 15th 2015, the Department of Transportation had issued 17 orders assessing \$5.24 million dollars in total for violations of the Rule (U.S. Department of Transportation, 2015). The largest penalty was on January 2nd into January 3rd, 2014, when the Department of Transportation fined Southwest \$1.6 million dollars for 16 flights violating the rule. Shown in Fig. 1, taken from the U.S. Government Accountability Office (GAO) report (2011), are the various points in the taxi-out process when decisions must be made.

Since the announcement and implementation of the Rule, frequency of taxi-out times of 3 h or longer has significantly decreased, as depicted in Fig. 2, using data from BTS (2006–2013). We compare the annual average number of operated flights with tarmac time of 3 h or longer, and the annual average number of scheduled operations, from 2006 to 2008, the three years just prior to the announcement of the Rule, with the same numbers for 2011–2013, the first three years after the implementation of the Rule. The annual average number of operated flights with 3 h or longer tarmac time decreased by 99.6% from the pre-Rule period of 2006–2008 (1408.3 flights) to the post-Rule period of 2011–2013 (5.7 flights). The annual average number of scheduled operations, however, decreased only by 14.1% (from 7.2 million to 6.2 million flights). This data suggests that the Rule has been highly effective in keeping passengers off the tarmac for lengthy periods of time during the taxiing-out operation.

In order to control for the difference in the number of scheduled operations across this time period (and thus to indirectly control for airport congestion), we compare the 2013 numbers with the 2009 numbers. The Rule did not get implemented

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