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Threat of Entry and Debt Maturity: Evidence from Airlines

Gianpaolo Parise*

Abstract

I explore the effect of the threat posed by low-cost competitors on debt structure in the airline industry. I use the route network expansion of low-cost airlines to identify routes where the probability of future entry increases dramatically. I find that when strategic routes are threatened, incumbents significantly increase debt maturity *before* entry occurs. Overall, the main findings suggest that airlines respond to entry threats trading off financial flexibility for lower rollover risk. The results are consistent with models in which firms set their optimal debt structure in the presence of costly rollover failure.

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I. Introduction

Access to funding has important implications for a firm's ability to survive in competitive markets. For instance, previous literature explains that "deep-pocketed firms" will attempt to drive financially constrained competitors out of business (see, e.g., Telser (1966); Bolton and Scharfstein (1990)), while highly leveraged incumbents are less likely to survive in a competitive environment (Zingales (1998)). A natural *ex ante* implication of this is that if firms anticipate tougher competition in the future, they should seek to adapt their financial structure today.

How incumbents should accomplish that in practice is, however, unclear. Previous research indicates that leverage ratios are highly persistent (Lemmon, Roberts, and Zender (2008)), while holding excess cash reserves can be significantly expensive (Jensen (1986), Holmström and Tirole (2000)). A growing theoretical literature suggests that firms should avoid to refinance in bad times, securing long-term financing just before bad news arrives and cash flows are affected (e.g., Brunnermeier and Yogo (2009)). However, the interactions between debt maturity choices and the expectations of future negative shocks have generally been overlooked by the empirical literature.

This paper tests whether the threat of entry by low-cost competitors affects corporate debt maturity decisions using data from the American domestic airline industry. The choice of airlines as the main setting for such an analysis is driven by two considerations. First, domestic flights are (relatively) homogeneous products offered in a very competitive market. Second, while an increase in the threat of entry may have a trigger effect on debt maturity, it is empirically challenging to identify a setting in which such a threat is observable to the incumbent. A domestic airlines setting allows to exploit that low-cost airlines expand in a predictable way to assess which markets are going to be affected.

Building on Goolsbee and Syverson (2008), the evolution of the route network expansion of the major low-cost carriers is used to identify which markets are threatened. In particular, I use domestic flight data collected by the U.S. Department of Transportation from 1990 to

2014 to establish flight routes for each air carrier. The focus is on situations where a low-cost carrier begins to operate at one endpoint of a route (having already been operating out of the other endpoint), *but before it starts flying the route connecting the two endpoints.*

As an illustrative example, consider Southwest's entry into Washington Dulles International Airport. Southwest began to fly out of Dulles (IAD) in October 2006, with nonstop flights to four cities in its network, and one-stop service to several others. However, upon entering Dulles Airport, Southwest did not immediately start flying on the route Dulles (IAD)-Cleveland (CLE). Cleveland is also a Southwest airport: The airline flew between CLE and other airports, but not the CLE-IAD route. It is therefore reasonable to expect that, after Southwest began to operate at both endpoints of the route, competing airlines soon realized that the probability of Southwest entering the Dulles (IAD)-Cleveland (CLE) route had risen dramatically (in fact it started to fly the route in 2007).[1]

In my empirical analysis, I show that conditional on entry at the second endpoint airport of a route in year t, the probability of actual entry in the route in the following year increases by 25 percentage points with respect to an unconditional probability of less than 2%. Similarly, the probability of entry within the next three years increases by 36 percentage points.[2] Aggregating route-level threats at the airline level and using data on route-level passenger traffic, I can estimate what fraction of each incumbent market is exposed to likely entry of low-cost competitors. Using a 10% random sample of tickets sold, I show that the actual entry of low-cost airlines have a disruptive effect on prices: average fares drops by 7.3% against an average profit margin in the airline industry of 1% only.[3] Such a dramatic impact suggests that threatened airlines should seek to improve their financial structure before entry occurs.

[1] This example is quoted from Goolsbee and Syverson (2008).

[2] Estimates for Southwest Airlines are reported. Different estimates are obtained for different low-cost carriers. The lowest coefficients are found for AirTran (12 and 18 percentage points for entry in the next year and within the next three years, respectively). The highest coefficients are found for Virgin America (34 and 65 percentage points).

[3] The number is from the International Air Transport Association (IATA) annual report available at http://www.iata.org/about/documents/iata-annual-review-2013-en.pdf

This paper finds that a one standard deviation increase in the threat of entry triggers an increase of 4.5 percentage points in the proportion of long-term debt held by incumbent airlines (a 7.4% increase relative to the baseline of 60%). This effect is particularly strong for airlines whose debt is rated as "speculative" and that are financially constrained, i.e., airlines that have in general a more difficult access to credit. Conversely, I find that the threat of entry has no significant effect on the leverage ratio. To provide additional support to my findings, I build a dataset of debt issuances and I explore how the threat of entry relates to debt characteristics. I find that threatened airlines issue debt instruments with longer maturity and with covenants. Additionally, I show that while public airlines are in general more likely to issue bonds, threatened airlines increase their debt maturity mostly via loans. Finally, replicating my analysis on a sample of 755 observations from public and private airlines using less precise proxies of debt maturity, I find that the effect of the threat of entry is even stronger for private airlines.

Overall, my results are consistent with models deriving the optimal debt maturity structure in the presence of costly rollover failure. Longer debt maturity allows firms to reduce rollover (or liquidity) risk, i.e., the risk that lenders are unwilling to refinance when bad news arrives. Rollover risk enhances credit risk (He and Xiong (2012)), magnifies the debt overhang problem (Diamond and He (2014)), weakens investment (Almeida, Campello, Laranjeira, and Weisbenner (2011)), and exposes the firm to costly debt restructuring (Brunnermeier and Yogo (2009)). My findings suggest that airlines find it optimal to commit to longer debt maturity to minimize the cost of rollover risk when the entry of low-cost competitors is likely. I provide evidence against alternative explanations based on shifts in the demand for transportation, signaling behaviors, changes in financial market conditions, agency costs, and changes in the asset side of the incumbents.

This paper contributes to three streams of literature. First, a growing literature has been devoted to exploring the implications of rollover risk in different settings. Rollover risk played a role in the credit crunch that followed the financial crisis, in the default of Bear Stearns and Lehman Brothers, as well as in the fall of corporate investment in the United States.[4] Graham and Harvey (2001) indicate, using a survey of 392 financial executives, that the cost of refinancing in "bad times" is the second most important factor affecting the decision to issue long-term debt. Several recent theoretical papers predict that firms should manage rollover risk when they expect a negative shock to occur with high probability (Diamond (1991), Brunnermeier and Yogo (2009), Diamond and He (2014)). This paper provides a first attempt at offering empirical support for that prediction.

Second, an extensive literature analyzes the determinants of capital structure. Most existing studies focus on the choice between equity and debt, treating the latter as uniform. However, a growing body of research recognizes that there is wide heterogeneity in debt and that firms might adjust their debt structure, which is more flexible, while leaving debt ratios unchanged (Rauh and Sufi (2010); Colla, Ippolito, and Li (2013)). My paper adds to those studies, showing that threatened firms increase debt maturity without changing significantly their level of leverage. In particular, previous papers document that debt maturity is affected by a firm's quality (Guedes and Opler (1996)), agency costs (Barclay and Smith (1995)), firm size and asset maturity (Stohs and Mauer (1996)), information asymmetries (Berger, Espinoza-Vega, Frame, and Miller (2005)), growth opportunities (Billett, King, and Mauer (2007)), asset liquidation values (Benmelech (2009)), and changes in the supply of long-term government bonds (Greenwood, Hanson, and Stein (2010); Badoer and James (2015)). My results suggest that the threat of entry is an additional economically relevant determinant of the structure of debt maturity.

Finally, a growing literature in finance explores empirically the relation between product market competition and several corporate variables, including leverage (Chevalier (1995); Zingales (1998); Campello (2003); MacKay and Phillips (2005); Banerjee, Dasgupta, and Kim (2008) and Xu (2012)), governance (Giroud and Mueller (2010) and Giroud and Mueller (2011)), innovation (Aghion, Bloom, Blundell, Griffith, and Howitt (2005)), investments

[4] See He and Xiong (2012) and Almeida, Campello, Laranjeira, and Weisbenner (2011).

(Akdoğu and MacKay (2008); Frésard and Valta (2015); Cookson (2014a); and Cookson (2014b)), cash holdings (Hoberg, Phillips, and Prabhala (2014)), and cost of debt (Valta (2012)). The paper that is probably closer to mine in terms of its research methodology and focus is Khanna and Tice (2000). In that paper, the authors study the effect of Wal-Mart's entrance in a local market on incumbents' choice to expand/retreat depending on their capital structure. Similarly, most of the literature explores the contemporaneous relation between product market competition and corporate choices. Conversely, my paper focuses on how incumbents adjust their financial structure before the actual entry of low-cost competitors occurs. Additionally, this is to the best of my knowledge the first paper to explore the effect of competitive threats by low-cost competitors on debt structure.

The remainder of the paper is organized as follows. Section II derives the testable hypotheses, Section III briefly outlines the empirical design, Section IV describes the data used, Section V presents the main empirical results, and Section VI provides additional results and robustness checks. Section VII concludes.

II. Hypotheses

In a frictionless world, firms should always be able to finance positive NPV projects. However, in the presence of frictions efficient firms may be forced to exit the market due to lack of funds. Do firms take this into account when making financing decisions? In this paper, I focus on the relation between debt maturity, leverage, and competitive threats. As a first plausible strategy to manage risk, I explore the possibility that firms decrease leverage in order to achieve greater financial flexibility:

H1: *Airlines respond to entry threats decreasing leverage*

This hypothesis follows from Bolton and Scharfstein (1990), Chevalier (1995), Zingales (1998), Campello (2003), and Khanna and Tice (2000). Overall, previous papers indicate that high leverage firms are more easily pushed out of the market, are less likely to enter into a price war and to expand. Therefore, it would seem optimal from an incumbent perspective to decrease leverage ex ante before actual entry occurs.

There are however at least three considerations that would work against a reduction of leverage before competition increases. First, firms mostly target tight leverage ratios[5] and even more so in regulated industries (Graham and Harvey (2001)). The expectation of future competition does not affect the asset side of the incumbent,[6] suggesting that firms may actually wait actual entry before adjusting their capital structure. Consistent with this argument, Xu (2012) shows that in the manufacturing industry firms reduce leverage only when their profitability decreases due to an *actual* increase of competition. Second, if the threat of entry is reflected into the stock price, firms may be less likely to issue equity to reduce leverage, suggesting that the leverage ratio is not going to change (Baker and Wurgler (2002)). Finally, issuing equity when a firm faces rollover failure may actually result in a transfer of value from shareholders to lenders in the case of default, making shareholders less likely to buy shares in the first place (He and Xiong (2012)).[7] Alternatively, from a firm's perspective it would be possible to substitute short-term debt with debt of longer maturity while leaving the overall debt level substantially unchanged:

H2a: *Airlines respond to entry threats issuing long-term debt in order to reduce rollover risk*

This hypothesis follows from Diamond (1991), Brunnermeier and Yogo (2009), Almeida, Campello, Laranjeira, and Weisbenner (2011), and Diamond and He (2014).

According to the previous literature, firms borrow short-term to increase financial flexibility (Brunnermeier and Yogo (2009)), signal underpricing (Flannery (1986)), because of agency costs (Myers (1977), or are forced by lenders (Brunnermeier and Oehmke (2013)).

[5]44% of the respondents to the survey conducted by Graham et al. indicate to have very strict or somehow strict debt targets, while only 19% indicate to have no target.

[6]The threat of entry can actually affect the stock price, however CFOs mostly decide leverage based on book values (Graham and Harvey (2001).)

[7]The latter arguments assume that firms decrease leverage issuing equity. This is however not the only way to decrease leverage. Firms can also buy back debt using cash or selling assets. However, both these strategies seem unlikely if a firm expects competition to increase in the near future as they would decrease its chances to survive in a tougher environment.

However, when a firm is unable to rollover its debt at maturity, it will have to go through costly debt restructuring. The cost of restructuring are potentially three: First, coordination among dispersed bond owners may be difficult (Buchheit and Gultai (2004)). Second, firms will have to seek more expensive sources of financing. And third, firms may be forced to liquidate assets at fire sale prices (Pulvino (1998); Shleifer and Vishny (2011)). Additionally, short-term debt *increases* the debt overhang problem in bad times. Short-term debt is less sensitive to firm value, implying a more volatile equity value that, in turn, imposes a stronger overhang in bad times (Diamond and He (2014)). Finally, He and Xiong (2012) argue that short-term debt exacerbates rollover risk. Losses in rolling over the debt are bear by equity holders while maturing debt holders are paid in full. This conflict may lead a firm to default at a higher fundamental threshold. Empirical motivation for *H2a* is also provided by Almeida, Campello, Laranjeira, and Weisbenner (2011). The authors show that firms with large portions of long-term debt maturing right at the time of the crisis cut investment more severely. This suggests that the same firms would have been better off issuing long-term debt just before the crisis hit. According to Brunnermeier and Yogo (2009), the optimal financial strategy for incumbents would be to issue bonds of the shortest maturity as long as subsequent rollover is guaranteed and issue bonds of longer maturity when negative news may lead to rollover failure.

Alternatively, incumbents may issue long-term debt to signal to the low-cost competitors that are ready to engage in a price war, to support investment policies, or the increase in debt maturity may simply reflect a change in the demand for transportation. Additionally, the increase in debt maturity may result from a situation of distress or because of heterogeneity in hedging strategies:

H2b: *Threatened airlines issue long-term to signal that they are going to lower prices*

H2c: *Threatened airlines issue long-term to increase investment*

H2d: *Threatened airlines issue long-term as the demand for transportation increases*

H2e: *Threatened airlines issue long-term because they are close to financial distress*

H2f: *Threatened airlines issue long-term as a result of a hedging strategy*

The hypotheses above are tested in section V.

III. Data and Summary Statistics

To conduct my analysis, I use data from different sources. Form 41 filings collect financial information for public and private airlines operating in the United States from 1990 to 2014, Compustat North America Fundamentals Annual includes public firm financials, Compustat Industry Specific Annual includes specific data on the airline industry, the T-100 domestic market dataset contains data on routes and passenger traffic, Mergent includes data on bond issuance, Dealscan contains data on loans, additional analysis using data from Capital IQ are reported in the Appendix. For most of the main analysis, I use data obtained by hand-matching financial data from Compustat North America Fundamentals Annual and the T-100 domestic market dataset using airline names. The sample covers the years from 1991 to 2014.[8]

A. Airline data

There are two main available sources of financial data for airlines: Compustat North America Fundamentals Annual and compulsory filings of all airlines operating domestic flights in the United States (commonly referred to as Form 41) that I obtain from the U.S. department of transportation. I match airlines' flights to other Form 41 datasets using the variable "airline ID." Importantly, both samples are free from selection bias as the U.S. Department of Transportation makes data available for all operating and defunct airlines for the 1990-2014 period. I match airlines by name to Compustat. This reduces significantly the sample size, because most of the airlines operating in the United States are private regional airlines that

[8]The year 1990 is excluded since the T-100 domestic market dataset starts in 1990. Therefore, I have no way of determining whether an airline operating at an airport in 1990 was already present at that airport in 1989 or just entered in 1990.

are not included in Compustat. However, information on debt maturity available for such air carriers obtained via the Form 41 is significantly less detailed and several control variables are missing.[9] Therefore, I present results using financials from Compustat in Section V, while I present findings obtained using data from Form 41 filings (unmatched to Compustat) in Section VI.

The Form 41 sample includes 140 airlines.[10] This number falls down to 30 passenger airlines for a total of 384 observations after I match it to Compustat.[11] Those airlines, however, cover more than 80% of the domestic passenger traffic.

In my analysis, I consider as low-cost airlines Southwest Airlines, JetBlue, Allegiant Air, Frontier Airlines, AirTran, and Virgin America. AirTran is excluded from the sample after it was integrated into Southwest.[12] In the Appendix results are presented by dropping, one by one, each low-cost airline from the calculation of $Threat\ of\ Entry$ to make sure results are not driven by a specific low-cost airline.

B. Flight data

Data on flights are obtained from the T-100 domestic *market* dataset collected by the U.S. Department of Transportation. These data have an important conceptual difference with the T-100 domestic *segment* dataset. The former considers a route to be a "market" on the basis of its origin and destination city, no matter how many stopovers occur in between. The latter assumes that every stop breaks the flight into different markets: e.g., flights taking off from

[9]The maturity of long-term debt is not specified in form 41. Therefore, I can only distinguish between long-term debt due in one year and more than one year.

[10]This number excludes observations for airlines in severe financial distress.

[11]Examples of airlines that make it to the final sample include Alaska Airlines, American Airlines, Big Sky Airlines, Continental, Delta, Era Aviation, ExpressJet, Frontier Airlines, Great Lakes Airlines, Hawaiian Airlines, JetBlue, Mesa Airlines, Midway Airlines, and Northwest. Examples of airlines that are unmatched to Compustat include Aloha Airlines, Millon Air, Emery Worldwide Airlines, and Sierra Pacific Airlines.

[12]Codeshare agreements and alliances could potentially bias my results, since incumbents may choose not to alter their debt maturity structure when the threat of entry arises from a "friendly" airline. However, such alliances are rare for low-cost airlines. Southwest entered into a codeshare agreement with AirTran in 2013. JetBlue has several codeshare agreements with international carriers, but none of these carriers is included in my sample. Allegiant has no alliances or agreements with other companies. Frontier has a codeshare agreement with Great Lakes Airlines. However, dropping the "connected airlines" does not significantly alter the results.

Boston Logan (BOS) for destination Santa Barbara (SBA) with one stopover in Phoenix (PHX) and flights from Boston (BOS) to Santa Barbara (SBA) without any stopover (or with a different stopover) are considered the same market by the T-100 domestic market database, and two completely different markets by the segment database. In the paper, I present results using the first set of data.

Another important distinction is between airports and cities. Computing routes on the basis of airports assumes that two flights taking off from the same airport but landing in two different airports of the ***same*** city operate in completely different markets. Conversely, computing routes on the basis of cities assumes that travelers are indifferent between airports located in the same city. Low-cost airlines often do not operate in the main airport of a city but in a less busy (and sometimes more peripheral) one. For instance, Southwest Airlines does not fly from Chicago O'Hare, which is the main Chicago airport and one of the busiest airports in the world by number of takeoffs and landings. On the contrary, Southwest operates in Chicago Midway, a smaller airport situated 8 miles from Chicago's downtown. Therefore, in my analysis I determine routes on the basis of cities and not airports. For instance, I assume that the route from the Logan Airport in Boston to Chicago O'Hare would be affected if Southwest starts flying from Boston Logan to Chicago Midway. My flight sample is complete in the sense that every single domestic flight that took off in the 1990-2014 period is recorded. The matching of flight data with airlines' financials is conducted by airline name as indicated above.

C. Financial variables and summary statistics

The main variable of interest considered in my analysis is ***Debt Maturity***. I define ***Debt Maturity*** as the percentage of debt maturing in more than three years following the literature (see, e.g., Barclay and Smith (1995); Billett, King, and Mauer (2007); Custódio, Ferreira, and Laureano (2013); Harford, Klasa, and Maxwell (2014)). An alternative approach also used in the literature would be to compute the weighted average maturity of all outstanding debt instruments (see, e.g., Guedes and Opler (1996) and Benmelech (2009)). However, the former measure captures a firm's exposure to rollover risk while the latter does not. For instance, a low value of the former measure signals that a firm will have to go through major debt rollover within the next three years. Conversely, the latter measure has no clear implications for rollover risk. A firm that holds debt instruments with ***average*** maturity of 12 years might actually have higher exposure to rollover risk than a firm holding debt instruments with average maturity of 10 years if a larger part of the debt instruments of the former needs to be rolled over at the same time. Importantly, my measure of debt maturity is *by construction* negatively related to common proxies of rollover risk. Results obtained using as the dependent variable the fraction of debt that needs to be rolled over within one year (following Almeida, Campello, Laranjeira, and Weisbenner (2011)) as a more direct proxy of rollover risk are reported in Table A.2 in the Appendix.

As alternative measures of debt maturity, I present results using ***Debt Maturity*** 5, i.e., the percentage of debt maturing in more than five years, and ***Long Debt Issued***, i.e., the proportion of long-term debt that has just been issued scaled by book assets. I do not have data on the actual maturity of long-term debt in the Form 41 filings. Hence, when I run regressions on the full sample unmatched to Compustat, I define as rollover risk the fraction of liabilities that needs to be rolled over within one year over total liabilities (this approach is similar to Titman and Wessels (1988).)

For the average airline in my sample, 60% of the debt matures in more than three years: this number rises to 67% for the median airline (see Table I, Panel A). ***Debt Maturity*** is on average decreasing over time, similar to other American industries (see Custódio, Ferreira, and Laureano (2013)). The construction of financial variables is described in Table A.1 in the Appendix. All financial variables are winsorized at the 1st and 99th percentiles to mitigate the effect of outliers. Airlines are on average bigger and more leveraged than other firms in Compustat (the average book leverage is around 36%, a number about twice that reported by related studies on manufacturing firms see, e.g., Xu (2012)). Airlines in my sample hold on average 12.5% in cash and hold a large share of tangible assets (54% versus 25% in the manufacturing industry; see Xu (2012)).

On average 16% of the incumbents' market is under the threat of entry by low-cost carriers. This number, however, changes significantly from an airline to another and from year to year. Almost 25% of the airline-year pairs in my sample face a negligible threat of entry of less than 1% of their market, while for another 25% more than 21% of their market is threatened. Table I, Panel B reports data on the fleets: airlines in my sample owns on average 5 aircrafts, are able to fill 74% of their seats (i.e., the load factor is 74%), lease more than half of the fleet, pay 195 cents per gallon of fuel, and spend 74 cents per passenger-mile. The average age of the aircrafts is 10 years. Panel C presents data on debt issues: the average maturity of a new issues in my sample is 135 months, 62% of debt issues have covenants, 74% are bonds, and 61% of the bonds are asset-backed. Panel D shows summary statistics for the Form 41 sample unmatched to Compustat.

To make sure that the debt maturity structure in the airline industry "behaves" as in other industries and that, therefore, my results are potentially generalizable, in Table I, Panel E I report pairwise correlations between $Threat\ of\ Entry$, *Debt Maturity*, and other main financial variables. *Debt Maturity* and $Threat\ of\ Entry$ display a correlation of 13.5%. Importantly, $Threat\ of\ Entry$ display a correlation below 10% with all other financial variable of the incumbent (with the only exception being *Asset Maturity*).[13] This partially mitigates the concern that $Threat\ of\ Entry$ might be affected by the characteristics of the incumbent. Consistent with related studies based on all industries, debt maturity in my sample display a positive correlation with *Log Sales* (Barclay and Smith (1995), *Tangibility* (Benmelech (2009)), and *Asset Maturity* (Guedes and Opler (1996)), and a negative correlation with *Debt Maturity* and Tobin's *Q* (Barclay and Smith (1995), Guedes and Opler (1996)). Furthermore, I find a positive correlation between $Profitability$ and *Debt Maturity* while results from related studies are controversial (usually $Profitability$ is positively correlated with the proportion

[13]To account for the correlation between *Asset Maturity* and $Threat\ of\ Entry$, I include *Asset Maturity* as a control in all my regressions.

of long-term debt and negatively correlated with the average maturity of the outstanding debt instruments see, e.g., Custódio, Ferreira, and Laureano (2013) and Benmelech (2009)). However, the correlation between ***Profitability*** and ***Debt Maturity*** in my sample turns out to be insignificant in the multivariate analysis (see below).

IV. Empirical Design

The identification of a causal effect of competition on capital structure presents some empirical challenges including the following. First, the actual entry into a market is driven, among other things, by the financial structure of the incumbents (see, e.g., Chevalier (1995) and Lambrecht (2001)). For instance, highly leveraged incumbents with a relevant portion of their debt to roll over in the near future may be less likely to respond aggressively to new entrants. Hence, new firms are incentivized to enter markets dominated by firms having large debts with short maturities. At the same time incumbents may lengthen debt maturity as a strategic response to entry. These two opposite effects may lead to biased estimates or cancel each other out when exploring the contemporaneous relationship between competition and debt.

Second, the identification of direct competitors is problematic. Widely used classification standards include Standard Industrial Classification (SIC) codes, the North American Industry Classification System (NAICS), and the Global Industry Classification Standard (GICS) system. However, Hoberg and Phillips (2015) show that traditional classification methods fail to properly map the product market space.[14] Furthermore, such identification standards allow for the construction of proxies for competition only at the aggregate industry level.

[14] As a general example consider two hypothetical restaurant chains, the first one operating only in New York City and the second only in California. The California restaurant chain will not compete directly with the restaurants in New York City because their customers are located in different states. Hence, the opening of a new shop or a price adjustment will probably have no effect on the policies of the "rival." However, traditional industry classification standards would typically group the two together in a broad "restoration" category. Similarly, two airlines operating in completely different locations would hardly influence one another. For instance, although they belong to the same industry, it is unlikely that the financial decisions of Sierra Pacific Airlines are influenced by the sales of Alaska Airlines, because they do not compete on any single route.

It is, however, unrealistic to assume that all firms in the same industry are exposed to the same degree of competition. Consistent with this claim, MacKay and Phillips (2005) show that the position of a firm within an industry is much more relevant than between-industry differences in explaining financial structure.

This paper joins a recent stream of literature that attempts to measure exposure to competitive threats at the firm level (see, e.g., Cookson (2014a), Cookson (2014b), Hoberg, Phillips, and Prabhala (2014)). In particular, I exploit the result, provided in Goolsbee and Syverson (2008), that Southwest's airport presence is a strong predictor of actual route entry.[15] Specifically, when Southwest enters the second endpoint airport of a route but not the route itself, the probability that it will enter the route "soon" increases dramatically (see Figure 1). In this paper, I first generalize this approach to the six major low-cost airlines in the United States: Southwest Airlines, JetBlue, Allegiant Air, Frontier Airlines, AirTran, and Virgin America. Second, I aggregate this measure at the airline level to estimate the overall exposure of each incumbent airline's network to the future entry of low cost competitors.[16]

In my analysis, I focus on the threat posed by low-cost airlines as opposed to legacy (i.e., non-low cost) carriers for three reasons. First, using a 10% random sample of tickets sold by domestic airlines, I find that when a low-cost airline starts flying on a route, average fares charged on the route drop by 7.3%.[17] This number is particularly striking if one

[15]Empirical work that has shown that endpoint airport presence is correlated with entry includes Berry (1992) and Peteraf and Reed (1994), while Bailey (1981) describes a case in which this approach was used in antitrust policy. More broadly, the importance of airport presence is stressed in Borenstein (1989) and Borenstein (1990).

[16]In economics the airline industry is often used as a laboratory to address broader questions due to its large data availability. For instance, Borenstein (1990) and Kim and Singal (1993) study the effect of airline mergers on market power; Borenstein (1995) explores the pricing implications of airline bankruptcy; Forbes and Lederman (2009) look at the effect of ownership on renegotiation costs; Forbes and Lederman (2010) investigate the effect of vertical integration on operational performance in the airline industry; Borenstein and Rose (1994) study ticket price discrimination; and Azar, Schmalz, and Tecu (2014) explore the effect of common ownership on competition.

[17]In testimony before the Subcommittee on Aviation in September 2002 Donald J. Carty, American Airlines CEO, stated the following: "The challenge now for large network carriers like American is to revise our business model not only to deal with our old rivals, but (...) to prepare our company for long term success in an environment where *newer, lower cost competition represents a much bigger slice of the marketplace.*" (Testimony before the Subcommittee on Aviation, House Committee on Transportation and Infrastructure, September 24, 2002.)

considers that the average profit margin in the airline industry is around 1%.[18] Conversely, the entry of legacy carriers has a much more constrained effect on prices. Second, low-cost airlines have expanded significantly in the last 10 to 15 years. Figures 2 and 3 plot low-cost carriers' airport presence in the United States at the end of 1990 and 2014, respectively. The rapid expansion of low-cost carriers suggests that all existing airlines had to face low-cost competition eventually. Third, low-cost carriers (mostly) do not enter into alliances or codeshare agreements with competing airlines. Therefore, such airlines are usually regarded as competitors by other airlines operating in the same market.

To identify which routes are under the threat of entry, I exploit that low-cost airlines do not expand randomly but are more likely to enter into a route if they are already present at both endpoint airports. Therefore, the entry in year t at the second endpoint airport increases disproportionally the probability of actual entry on the route (usually in year t+1 or t+2), forcing incumbents to change their capital structure quickly. I run probit regressions for the probability of a low cost carrier's actual entry into a route in year $t+1$, conditional on its entrance at the second endpoint airport of the route in year t. The sample of all possible routes is obtained from flight data provided by the U.S. Department of Transportation.[19] The marginal probabilities are reported in Table II for entry in year t+1, t+2, and t+3 (time fixed effects are included and errors are clustered at the route level). Estimates for the marginal probabilities of entry in year t+1 conditional on entry at the second endpoint of a route (but not on the route itself) in year t are: 25% (Southwest), 17% (JetBlue), 17% (Allegiant), 26% (Frontier), 12% (AirTran), and 33% (Virgin America). All coefficients are statistically significant at the 1% level.

The marginal probabilities of entry in year t+2 and t+3 are reported as well (see Table

[18]See the IATA annual report at http://www.iata.org/about/documents/iata-annual-review-2013-en.pdf and "Why Airlines Make Such Meagre Profits?" The Economist - Feb 23, 2014.

[19]Following Goolsbee and Syverson (2008), I consider as potential routes only those on which the low-cost airline enters at some point. This approach rules out routes that the airline will never realistically enter. If I consider as potential routes all the routes in my sample, I would get smaller estimates but still positive and significant coefficients. For the purposes of this paper, however, the exact probability of entry is irrelevant. The necessary conditions for my identification strategy to hold are that entry is significantly more likely when the low-cost carrier operates at both endpoints of a route and that this is observable by the incumbents.

II). In general, the probability of entry at time t+2 is greater than the probability of entry at time t+3 but smaller than the probability of entry at time t+1. Hence, when the low cost carrier enters the second endpoint of a route, the incumbent can easily assess that the probability of actual entry in the near future has dramatically increased. Overall, the marginal probabilities of entry into the route within the next three years after the entrance at the second endpoint airport are 36% (Southwest), 31% (JetBlue), 27% (Allegiant), 28% (Frontier), 18% (AirTran), and 65% (Virgin America). The marginal probability of entry in year t+2 for Virgin America is not reported since the event never occurs (the sample for Virgin America is significantly smaller because this was the most recent low-cost carrier to enter the American market). The marginal probabilities for entry in year t+4 are significantly smaller or not statistically significant and are not reported. The marginal probabilities of entry conditional on the presence at one endpoint airport only are also either significantly smaller or statistically insignificant.

The results above suggest that incumbents should realize that the probability of entry on a route has increased when the low-cost carrier enters the second endpoint. However, entry into a single route would hardly be disruptive for the incumbent. Therefore, I aggregate such a measure of route threat for each airline at the annual level, looking how many routes are threatened out of all those in which the incumbent operates. Importantly, I need to assign a different weight to different routes because routes with higher passenger traffic are more important for an airline given the higher number of paying passengers and the strategic nature of the route (for instance, routes connecting to the hub in general have higher traffic, and incumbents are less likely to exit them). Data from the T-100 domestic market dataset allow me to have information on the exact passenger traffic for each airline/route/year combination. Hence, I define the threat of entry in the following way:

$$Threat\,of\,Entry_{i,t} = \sum_{k} \frac{Passengers_{k,i,t} \times I(Threatened\,Route)_{k,i,t}}{Passengers_{i,t}} \tag{1}$$

where $Passengers_{k,i,t}$ is the number of passengers for airline i, in year t, flying on route

k, while $I(ThreatenedRoute)_{k,i,t}$ is an indicator function that takes value of one if route k is under threat (because a low-cost airline just entered the second endpoint of the route in year t but has yet to enter the route itself) and takes a value of zero otherwise. The value of $Threat\ of\ Entry$ ranges from zero to one. A value of zero indicates that no routes for airline i in year t are under the threat of entry. A value of one indicates that all routes are under threat. Importantly, when an airline realizes that the probability of entry has changed, it should adapt its financial structure to account for higher rollover risk, i.e., should be taking steps to reduce rollover frequency *before* entry occurs (Diamond (1991)). In my empirical analysis, I seek to estimate the effect of such a threat on the structure of debt maturity. Therefore, I run the following regression:

$$DebtMaturity_{i,t} = \beta(ThreatofEntry_{i,t}) + \Gamma' X_{i,t} + \gamma_t + \gamma_i + \varepsilon_{i,t}, \qquad (2)$$

where $Threat\ of\ Entry_{i,t}$ is defined as in equation (1) and captures the exposure of airline i in year t to the threat of entry posed by the low-cost airlines. $DebtMaturity_{i,t}$ is defined in Section III. $X_{i,t}$ is a vector of time-varying controls. In my baseline specification, I include controls for (log) sales, profitability, tangibility, asset maturity, and changes in passenger traffic (this specification allows to maintain in my samples the maximum number of airlines). Robustness checks including several other variables are presented. γ_t and γ_i are time and airline fixed effects. It is important that both time and airline dummies are included as my analysis focuses on the effect of cross-sectional variations in the threat of entry on debt maturity and I want to account for shocks affecting the entire industry in a similar way as well as time invariant determinants.

Importantly, my results on the effect of threat of entry on debt maturity have a causal interpretation under the assumption that entry at the second endpoint airport of a route is exogenous. This is probably a strong assumption. The low-cost airline may enter the second endpoint airport of a route precisely because it plans to enter into the actual route afterwards. If both the decision to enter the second endpoint of a route and to increase debt maturity were driven by a common factor (or if the increase in debt maturity triggers the entry of the low-cost carrier into the airport) my estimates would be biased.

In my analysis, I mitigate endogeneity concerns in three ways. First, exploiting the rich data availability for airlines, I include a battery of controls that account for the most plausible common drivers of debt maturity structure and airport entry decisions (e.g., proxies of future profitability, changes in passenger traffic, distance to default, and cost-efficiency). Second, I replicate my results using *Entry* instead of *Threat of Entry* as the main independent variable. In fact, if the increase in debt maturity by the incumbent *causes* the low-cost airline's decision to target the same markets, I should find a even stronger correlation between debt maturity and actual entry. Third, I provide results for the effect of the announcement of the introduction of high-speed trains in the Northeast Corridor on the debt structure of airlines highly exposed to the corresponding routes. Because the introduction of high-speed trains was a decision taken by Amtrak several years before the announcement to the public and motivated by the high traffic in the area, this shock provides an exogenous increase in competition for incumbent airlines. Overall, my findings are consistent with a causal interpretation for the effect of threat of entry on debt maturity.

V. Empirical Results

This section presents the main empirical results of the paper. Section A addresses the channel through which the structure of debt is affected. Section B explores the effect of the threat of entry on leverage, Section C looks at the effect on debt maturity, providing evidence in support of the rollover risk channel. Finally, Section D considers alternative explanations.

A. Entry and Route Profitability

To understand why incumbents respond to entry threats, it is important to assess what the effects of the presence of low-cost carriers on profitability are. To do that, I exploit the

Domestic Airline Consumer Airfare Reports issued by the U.S. Department of Transportation. Average fares are computed using 12 years of data[20] from the Bureau of Transportation Statistics' Passenger Origin and Destination (OD) Survey, a 10% random sample of all airline tickets issued by U.S. carriers, excluding charter air travel. Fares are based on the total ticket value, which consists of the price charged by the airlines plus any additional taxes and fees levied at the time of purchase. Fares include only the price paid at the time of the ticket purchase and do not include other fees paid at the airport or on board the aircraft. Averages do not include frequent-flyer or "zero fares," or a few abnormally high reported fares. Ticket prices are reported in 2014 dollars (i.e., are adjusted for inflation). I estimate the marginal effect of low-cost airlines' presence on log ticket prices including dummy variables for each low-cost carrier.

Table III shows coefficients for the logarithm of average ticket prices for each route regressed on a dummy variable that takes a value of one when a low-cost airline actually operates on the route and a value of zero otherwise.[21] More precisely, the dependent variable is the average fare charged by air carriers operating on a given route recorded in the last quarter of the year. Results obtained using fares charged by only the largest carrier operating on the route are similar and are reported in Table A.5 in the Appendix. In my regressions, I include time and route fixed effects to capture how ticket prices change ***within*** the same route when a low-cost airline is present. I additionally cluster errors at the route level to account for time series correlation.

The presence of low-cost carriers has a dramatic effect on route profitability. Average fares are roughly 7% lower when a low-cost airline operates on a route. More specifically, average fares are 4% lower when Southwest flies. The decrease in average ticket price is 19%, 7%, 4% and 12% for JetBlue, Allegiant, Frontier, and AirTran, respectively. The coefficient estimated for Virgin Airlines is -0.11 (t-statistic of -2.23) when the other low-

[20]From 2000 to 2011.

[21]The effects of Southwest's entry on prices are well known (see, e.g., Morrison (2001)). More generally, there is consensus concerning the notion that competition impairs firms' profitability (Tirole (2010)) and increases cash flow volatility (Raith (2003); Gaspar and Massa (2006); Irvine and Pontiff (2009)).

cost airlines' fixed effects are not included. However, it becomes statistically insignificant in the full specification regression in which all low-cost dummies are included (see column 8). This potentially suggests that Virgin Airlines is mostly entering routes where other low-cost carriers were already operating and therefore does not have a price impact by itself. However, this could also be due to the relatively short time series (Virgin enters the American market in 2007 only). In the Appendix, I replicate my analysis excluding Virgin Airlines. The results do not change.

My sample does not include data on profit margins. However, the International Air Transport Association reports that the average profit margin in the industry is around 1%.[22] Such a disruptive effect on route profitability suggests that airlines should seek to increase their chances of survival in a tougher market.

B. *Threat of Entry and Leverage*

Table IV reports results for regressions of book leverage on $Threat\ of\ Entry$ and controls. I consider book leverage (instead of market leverage) because the increase in the probability of entry may already be discounted into the stock price of the incumbent airline[23] thereby inducing a mechanical change in market leverage. Additionally, Graham and Harvey (2001) indicates that CFOs mostly decide debt-equity ratios based on book values as market values fluctuate daily and are difficult to target.

The results suggest that the threat of entry does not have a significant effect on book leverage. Interestingly, most of the time-varying controls have at best a marginal effect on book leverage when both time and airline fixed effects are included. Some related studies exploring the determinants of leverage do not to include firm fixed effects in the main specifications (see, e.g., Xu (2012)). However, when the focus is on the effect of time-varying characteristics (such as competition) on leverage, we should expect to find within-firm vari-

[22] See the IATA annual report at http://www.iata.org/about/documents/iata-annual-review-2013-en.pdf

[23] In unreported results, I find a negative relation between $Threat\ of\ Entry$ and Tobin's q significant at the 10% level. This suggests that the market valuation of the firm incorporates the cost of possible entry.

ation as the (independent) variable of interest varies over time. In the airline industry, most of the variation in book leverage appears to be driven by airlines' time-invariant specificities.

My results are consistent with previous results in the literature suggesting that firms target tight leverage ratios (Baker and Wurgler (2002)), leverage is highly persistent (e.g., Lemmon, Roberts, and Zender (2008) find that the cross-sectional distribution of leverage in the year prior to the initial public offering predicts leverage 20 years later), and mostly firm-specific (MacKay and Phillips (2005)). Importantly, I do not claim that incumbent airlines would not be better off having lower leverage when competition increases but merely that to adjust capital structure in the short-run may be difficult. Additionally, my result does not necessarily imply that incumbents do not adjust leverage in *all* industries, but simply suggest that this not occur in industries where the financial structure is less flexible. Related to my result, Benmelech (2009) shows that when the value of the collateral rises, American railroads are able to borrow at longer maturities, however they do not change the overall level of debt.

Excluding airline fixed effects from my specification, several time-varying variables become statistically significant while $Threat\ of\ Entry$ stays insignificant. Overall, the results provided in this section suggest that the threat of entry does not have a causal effect on leverage. This result is also consistent with Graham and Harvey (2001) as in a survey of 392 financial executives, the authors find little evidence that product market factors affect debt to equity ratios. In particular, less than one out of four CFOs say their companies' debt levels and equity issuance decisions are influenced by the behavior of their competitors. I cannot however rule out the possibility that the limited sample size, decreases the power of my tests leading me to failing to reject the null. To mitigate this concern, in the following I replicate my analysis on a larger sample of 755 observations from public and private airlines, using coarser financial variables. I find however analogous results, see Table XII.

C. *Threat of Entry, Rollover Risk, and Debt Maturity*

In this section, I test the hypothesis that the threat of entry by low-cost competitors has an effect on debt maturity (H2a). This hypothesis follows from Diamond (1991), Brunnermeier and Yogo (2009), Almeida, Campello, Laranjeira, and Weisbenner (2011), and Diamond and He (2014). Table V provides the empirical results. In my empirical specification, I include airline fixed effects to account for time-invariant firm characteristics and I exploit that *Threat of Entry* is computed at the firm (i.e., not at the industry) level, creating cross-sectional heterogeneity as different airlines are exposed to the threat of entry to different degrees. Figure 2 suggests that at the beginning of my sample mostly airlines flying on routes in the South-West were exposed to the competition of low-cost carriers, while competition on North-East routes was lower. This situation reverses in the next decade (see Figure 3). To assume that all carriers are exposed to the same degree of competition at the same time would therefore be incorrect. I additionally include time fixed effects in my specification to control for time trends and shocks affecting all firms simultaneously. Errors are clustered at the firm level because corporate variables are in general persistent and observations are likely to be correlated in the time series. Results obtained estimating standard errors using block bootstrap are presented in Section VI.

The estimated effect of *Threat of Entry* on debt maturity is positive (0.33) and statistically significant at the 5% level (t-statistic of 2.55). However, *Threat of Entry* may be correlated with known predictors of debt maturity such as size, asset maturity, tangibility, and profitability (see, e.g., Barclay and Smith (1995); Guedes and Opler (1996); and Benmelech (2009). Additionally, it could be affected by a change in investment opportunities or a shift in the demand of transportation Hence, in the specifications reported in columns (2) and (3), I include several time-varying controls. Among such control variables, *Log Sales* and *Asset Maturity* are always significantly correlated with *Debt Maturity*, in line with results in Barclay and Smith (1995) and Benmelech (2009)). Furthermore, I find positive but statistically insignificant coefficients for *Tangibility*, and *Profitability*. A plausible explanation for this outcome is that the choice to include airlines' fixed effects in my model limits the magnitude and statistical significance of some of the control variables, possibly because most have very limited within-firm variation (e.g., ***Tangibility*** displays extremely high persistence in the time series). Consistent with this argument, both ***Tangibility*** and ***Profitability*** show a strong correlation with ***Debt Maturity*** in the univariate analysis (see Table I, Panel E) but not in the multivariate analysis when airline fixed effects are included. Another explanation is however that asset maturity and tangibility are capturing the same effect as the two variables are highly correlated (above 70%, see Table I, Panel E). Column 4 includes ***Chapter 11***, a proxy for an airline's financial distress situation; Tobin's q (***Q***)[24]; a variable capturing the trend in debt maturity and the credit and term spreads, while the time fixed effects are dropped (as they would be collinear with the last three variables). I find debt maturity to be trending down on average, similar to other American industries (see, e.g., Custódio, Ferreira, and Laureano (2013)).

Overall, ***Threat of Entry*** has a positive and significant effect on debt maturity in all specifications. A one standard deviation increase in threat of entry triggers an increase of 4.5 percentage points in the proportion of long-term debt held by incumbent airlines (a 7.4% increase relative to the baseline of 60%). This implies that airlines will have to refinance a lower fraction of debt in the following 3 years. I replicate the analysis using a proxy for rollover risk as the dependent variable, the estimated effect of threat of entry on rollover risk is negative and significant (see Table A.2 in the Appendix). This result is consistent with the prediction that firms will issue bonds of the shortest maturity as long as subsequent rollover is guaranteed and issue bonds of longer maturity when expecting negative news (Brunnermeier and Yogo (2009)). In short, this result suggests that incumbents incorporate entry threats

[24]The inclusion of Tobin's q reduces my sample as the variables needed for its construction are not available for all observations.

in their debt maturity decisions.[25]

The timing of the reaction to the threat of entry is of interest. If incumbents act mainly to decrease rollover risk they should issue long-term debt as soon as they realize that entry by low-cost competitors is likely but before actual entry occurs. Therefore, we should expect to find a contemporaneous relation between threat of entry and debt maturity. Conversely, if incumbents keep issuing long-term debt after the threat of entry increases, the results would be suggestive of a change in borrowing conditions unrelated to rollover risk. Table VI includes controls for the threat of entry in the two years before and after t. The effect of threat of entry on debt maturity is however driven by the threat of entry in the exact same year as maturity increases (note that actual entry has not yet occurred at time t). This would not be consistent with a progressive change in borrowing conditions. A more direct test of Brunnermeier and Yogo (2009) would be to use as dependent variable the issuance of long-term debt instead of debt maturity. The latter variable is used to be consistent with the previous literature and because it better captures the exposure to rollover risk (which can be approximated as 1-***Debt Maturity***). Results for the former are anyway similar and are reported in Section Table A.3.

What is the advantage for the incumbents in pushing refinancing ahead? Low-cost airlines are usually unlikely to exit a route once they enter it. Therefore, to increase debt maturity would potentially only posticipate refinancing failure. However, Diamond (1991) indicates that longer refinancing cycles are optimal in the presence of difficult market conditions as a firm minimizes the instances in which it gets exposed to refinancing risk (i.e., at each refinancing cycle). Overall, results in this section are suggestive of an active management of rollover risk in the presence of entry threats. Alternative explanations are considered in the following.

[25] The definitions "Debt Maturity" and "Long-term debt" are sometimes used in the paper interchangeably even though they are not the same concept. For the purpose of this paper however the same interpretation applies. Additionally, every result derived for debt maturity also holds for the issuance of long-term debt (see A.3). To take into account that the dependent variable is truncated (i.e., ***Debt Maturity*** varies only between 0 and 1), I replicate the main analysis using Tobit regressions. Results are qualitatively similar (see Table A.11 in the Appendix).

D. *Alternative explanations*

D.1. Rollover risk versus signaling

A conflicting hypothesis for the results presented in the previous section is the one based on signaling (H2b). Threatened airlines might issue long-term to signal to potential entrants to have the necessary financial resources to start a price war, making ex ante entry less desirable (see, e.g, Areeda and Turner (1975), Milgrom and Roberts (1982)). According to previous theoretical work, debt maturity can be used as a signaling device (e.g., Flannery (1986)). However, empirical support for this hypothesis is low (Barclay and Smith (1995), Guedes and Opler (1996), and Graham and Harvey (2001)). Additionally, according to Flannery (1986) firms should issue *short-term* debt to signal their quality. To disentangle between a rollover risk explanation and a signaling one, I replicate my analysis interacting ***Threat of Entry*** with proxies for rollover risk. According to the rollover risk hypothesis, the increase in debt maturity as a response to the threat of entry should be predominant in firms that are unlikely to readily find alternative sources of financing in the event of rollover failure. Conversely, signaling requires the incumbent to have an easy access to large pools of financial resources in order for the threat of a price war to be credible (Bolton and Scharfstein (1990), Chevalier (1995), Frésard (2010), and Boutin, Cestone, Fumagalli, Pica, and Serrano-Velarde (2013)).

I define as incumbents exposed to high rollover risk those which have a low rating of debt (speculative or missing) and are financially constrained. Rating data are obtained from Standard and Poor's; financially constrained airlines are defined using the SA index proposed by Hadlock and Pierce (2010).[26] Results reported in Table VII indicate that the effect of the threat of entry on debt maturity is stronger for financially constrained and poorly rated firms. As these firms will encounter significant difficulties in rolling over their debt at maturity, we should expect them to respond more significantly to the threat of entry. Conversely, a signal

[26]Hadlock and Pierce (2010) show that such a measure is better suited for identifying financially constrained firms than alternative measures such as the ***KZ*** index.

of being ready to "fight back" arising from such companies would probably be less credible. Overall, results in this section are consistent with the rollover risk hypothesis (H2a) and not consistent with the signaling hypothesis (H2b).

D.2. Asset side explanations

Another channel through which threatened airlines could respond to entry threats by low-cost competitors is via a change in the asset side of the balance sheet. For instance, threatened firms could react increasing investment (some evidence that competition has a positive effect on investment is provided by Cookson (2014a) and Frésard and Valta (2015)). According to this explanation a change in debt maturity would mainly reflect a change in the asset side. However, this would not necessarily contrast an explanation based on rollover risk. Even though threatened airlines may invest more, they can choose whether to finance new investment with long or short-term debt. The control variable *Asset Maturity* would capture a change in debt maturity which merely reflects a change in the maturity of the assets. In particular, Diamond and He (2014) suggest that short-term debt may cause underinvestment in the presence of bad news due to rollover risk. Empirical evidence of decreased investment due to rollover failure/risk is provided in Almeida, Campello, Laranjeira, and Weisbenner (2011).

To test whether the threat of entry triggers an increase in investment, I gather detailed data on each airline's fleet. I conjecture that airlines may respond to threats changing the asset side of the balance sheet in a number of ways. Namely, threatened airlines could increase the size of the fleet, invest in newer planes, increase the quality of the service, or increase the use of leasing contracts. Therefore, I explore the relation between *Threat of Entry* and investment, asset growth, fleet size, fleet age, expenditures per passenger/mile, percentage of the fleet that is leased. Results are presented in Table VIII. All estimated coefficients are non-statistically significant, suggesting that the threat of entry does not have an effect on investment. However, in unreported results, I find that the effect of the threat of entry on investment is significant at the 10% level in the subsample of financially unconstrained airlines. This would potentially suggest that the rollover risk motive is dominant in financially constrained firms, while pre-emptive investment occurs in financially unconstrained airlines. This explanation seems consistent with Cookson (2014b).

D.3. Demand side explanations

A concern with the previous results is that a change in the passenger demand could potentially drive both the decision of the incumbent to issue long-term debt ***and*** the choice of the low-cost airline to enter in the second end-point airport of a route (even though by construction the low-cost airline does not enter on the route itself). I conjecture that the entry of the low-cost airline on an "adjacent" route may potentially be driven by two factors. First, the passenger traffic in the area may be increasing. Second, even though the passenger traffic stays the same, clients' profitability may be increasing. To mitigate such concerns, I include in my regressions several controls for level and (present and future) change in passenger traffic and several controls for passengers' profitability. Results are presented in Table IX. Specification (1) includes controls for the change in passenger traffic from year t to $t+1$ (Δ_{t+1}Passengers), change in passenger traffic from year $t-1$ to t (ΔPassengers), and the log of current passengers. Specification (2) includes airlines' ***Load Factor*** (revenue-passenger-miles divided by available-seat-miles) and revenue-passenger-miles (***RPM***). Specification (3) includes the ratio of total revenues over total passengers. In all cases the estimated effect of threat of entry on debt maturity stays positive and significant. Additional evidence against the demand channel is provided in the Appendix.

D.4. Financial distress and investment opportunities

The airline industry presents several situations of severe distress. Most legacy carriers filed for protection under Chapter 11 at least once in their life. To rule out the hypothesis that unaccounted fragilities of the incumbents are driving the decision of the low-cost carrier to enter the second endpoint airport of a route and the decision of the incumbent to issue debt, I include in the specification reported in Table A.9 several controls. The controls included are $\boldsymbol{Chapter}$ 11, a dummy variable that takes a value of one if an airline filed for Chapter 11 protection and takes a value of zero otherwise, $\boldsymbol{Cash\ Flow}$, and the $\boldsymbol{Z-score}$ (a proxy of default risk).

Furthermore, unaccounted growth opportunities may affect both $\boldsymbol{Debt\ Maturity}$ and the strategic decision of the low-cost carrier to enter into the second endpoint airport of a route. Myers (1977) argues that firms with several growth options may use debt maturity to resolve the conflict between stockholders and bondholders over the exercise of these options. However, growth opportunities may also correlate with the decision of the low-cost carrier to expand. Therefore, following Pulvino (1998), I include two superior measures of firms' abilities to generate future cashflows that do not incorporate the market value of the airline: $\boldsymbol{REV}$ and $\boldsymbol{COST}$. $\boldsymbol{REV}$ equals load factor (revenue-passenger-miles divided by available-seat-miles) times revenue per revenue-passenger-mile and captures an airline's ability to fill the planes with high-revenue passengers. $\boldsymbol{COST}$ equals cost-of-goods-sold divided by available-seat-miles provides a proxy for cost efficiency. Results in Table A.9 (in the Appendix) suggest that neither financial distress status nor investment opportunities are driving the main result.

D.5. Exposure to fuel price

Heterogeneity in the strategies to hedge against movements in the oil price may also generate variations in debt maturity. Airlines' performance is in general significantly affected by fuel price and including time fixed effects may not be sufficient to account for that as different airlines have different hedging strategies. However, such strategies should be reflected into the actual spending on fuel per passenger-mile. Results reported in Table A.10 suggest that this is not the case.

D.6. Leasing

Threatened airlines could decide to rely more on leasing in order to increase their financial flexibility. Results reported in Table VIII suggest that this is not the case as the percentage of leased airlines does not vary with *Threat of Entry*. The main analysis is replicated using *Leasing* as the dependent variable. The estimated coefficients are never statistically significant (see Table A.8).

D.7. Agency costs

A potential alternative explanation for the main finding is that short-term debt acts as a device for disciplining the management (see, e.g., Calomiris and Kahn (1991)). According to this hypothesis, when competition intensifies short-term debt becomes less important since competition may have a similar disciplinary role (see Giroud and Mueller (2010) and Giroud and Mueller (2011)). However, I find that the increase in debt maturity is even stronger for private firms where the agency problem is less relevant as delegation is less common (results are reported in Section VI). Hence, the results do not seem to be consistent with this explanation.

VI. Further Results

This section presents evidence from debt issuances (Section A), results obtained replicating the analysis using Form 41 filings data (Section B), estimates using block bootstrapping (Section C), and additional robustness tests (Section D).

A. Evidence from Debt Issuance

While threatened airlines benefit from minimizing the frequency of refinancing cycles, it is unclear how financing choices vary in response to the higher credit risk implied by the threat of entry. My results suggest that the overall mix between debt and equity does not change for threatened airlines. However, Rauh and Sufi (2010) show that a significant proportion of firms that display a relatively stable ratio between equity and debt, undergo significant changes in debt composition.

In particular, a supply side perspective would suggest that lenders should take into account the higher risk of default implied by the threat of entry. For instance, threatened firms may have an incentive to "gamble for resurrection," issuing long-term debt to finance risky projects, therefore increasing significantly the risk for the lender. Bond ownership is dispersed and usually denotes loose control on the issuer. Conversely, bank and non-bank lenders enforce tight control on the borrower (Brealey, Leland, and Pyle (1977); Diamond (1984); Fama (1985)), are usually senior (Welch (1997)), and collateralized (Rajan and Winton (1995)). In the airline industry loans can be arranged on a bilateral basis for small amounts, or on a syndicated basis when bigger. A closer relationship between the lead financial institution and the borrower allows closer monitoring of the borrower (Morrell (2013)). Therefore, an equilibrium whereby a risky borrower obtains long-term financing is more likely to be reached with banks and private lenders as counterparties.

To conduct my analysis, I construct a sample of debt issues by airlines aggregating data from Mergent and Dealscan. In this section, I explore how the threat of entry affects debt issues' maturity and covenants. Two important caveats are however in order. First, the data are incomplete. I only have data for debt issues reported in Mergent (mostly bonds) and Dealscan (mostly syndicated loans) that I was able to match to my initial sample. I do not have data on leasing contracts[27], loans not included in Dealscan, and any other financial instruments issued by threatened airlines. Second, the maturity in months of each debt instrument is going to be a poor proxy for rollover risk compared to the one used in the previous sections. Therefore, the analysis provided in this section has mostly the function of corroborating the evidence provided in section V.

The sample is highly dominated by bonds. Out of 445 debt issues in my sample, 330 are

[27]This seems however a marginal problem as results in Table VII suggest that the threat of entry does not affect the percentage of aircraft leased.

bond issues and 115 are loans, additionally bonds display a much longer maturity on average (162 months versus 54 for loans) and a much larger principal value.[28] I run my regressions at the issue level including time fixed effects but not firm fixed effects as issue data are sparse (my approach follows the related literature see, e.g., Valta (2012)).

An increase of one standard deviation in the threat of entry triggers an increase of debt maturity of 10.5 months on average; an increase from 0 to 1 in the threat of entry would increase debt maturity by 59 months (see Table X). This number is in particular equal to 46 months for bonds and 96 months for loans. The result contrasts with the fact that the average maturity is significantly longer for bonds in my sample and, therefore, suggests that the access of threatened airlines to the bond market is somehow limited. This may be the result of agency concerns. For instance, higher default risk could lead borrowers to take excessive risk shifting the cost of default to the lender. A closer relationship between the lender and the borrower allows the former to exercise close monitoring on the threatened airline (Morrell (2013)). Additionally, in the case of rollover failure, loan borrowing decreases the cost of coordinating debt restructuring with multiple dispersed bondholders. This result is also consistent with the previous study by Denis and Mihov (2003), who suggest that high-quality firms issue bonds, while lower quality firms borrow from bank and non-bank private lenders. Additional evidence supporting this result is provided in the Appendix. In Table XI, I furthermore show that a one standard deviation increase in the threat of entry increases by 10% the probability that covenants are imposed. Overall, results in this section suggests that lenders are aware of the threat of entry and the increase in debt maturity is the result of bargaining process between airlines and lenders.[29]

[28]Consistently, in a sample based on all types of industries, Denis and Mihov (2003) show that bonds have an average maturity of 15.63 years, bank debt of 3.97 years, and non-bank private debt of 8.35 years.

[29]I additionally test whether the threat of entry has an effect on the cost of debt but I do not find evidence on this. The corresponding results are unreported.

B. Evidence from 41 Filings

In this section, I present results obtained conducting my analysis on Form 41 filings matched to the T-100 domestic market dataset. Form 41 filings are compulsory filings disclosing the main balance sheet entries of airlines operating in the United States. The advantage in using these data respect to Compustat is that 140 airlines disclose information in my sample period for a total of 755 observations including both public and private airlines. The disadvantage is that several variables that I used in the first part of analysis are missing. In particular, information of composition of the debt it is not disclosed. The only distinction reported is between liabilities due in less and more than one year. Therefore, in my analysis I focus on a rough proxy of rollover risk computed as liabilities due in less than one year over total liabilities. Additionally, I compute ***Tangibility*** as total equipment over total assets, ***Size*** as log book assets, ***Profitability*** as net income over total assets, and ***Leverage*** as total liabilities over total assets. I do not have information on asset maturity. I exclude all observations for which total liabilities are greater than total assets.

I look for information on the ownership status for each airline in my sample and I exclude those for which I am not able to find any information (this is likely to limit the number of private airlines, as information on public ones is readily available). Results reported in Table XII indicate that the effect of the threat of entry on leverage is not statistically significant even enlarging the sample size. Furthermore, my findings suggest that threatened airlines decrease their exposure to rollover risk and this is especially the case for privately owned airlines which are likely to be highly exposed to rollover risk but less affected by agency problems. In particular, a one standard deviation increase in the threat of entry triggers a decrease of 5 percentage points of the fraction of debt to rollover within one year in the sample of private airlines and a decrease of 3 percentage points in the sample of public airlines. Overall, results in this section are consistent with the rollover risk channel.

C. Block Bootstrap

Because corporate variables are in general persistent, observations are likely to be correlated in the time series. However, the widespread approach of clustering standard errors at the firm level potentially underestimates standard errors in my setting due to the relatively limited number of clusters. The standard bootstrap approach cannot be used either, as it only corrects for heteroscedasticity. Following the literature (see, e.g., Cameron, Gelbach, and Miller (2008) and Giroud, Mueller, Stomper, and Westerkamp (2011)), I alternatively use block bootstrapping to estimate standard errors. This approach draws blocks of observations instead of single ones, in order to preserve the existing correlation structure within each block while using the independence across blocks to consistently estimate the standard errors. I consider blocks at the airline level: I draw with replacement 500 bootstrap samples from each airline (block) present in the original sample. The result is reported in Table XII, column (1). Statistical significance is comparable to the results presented in Section V.

D. Further Robustness Checks

D.1. Entry and Debt Maturity

Most alternative explanations for the positive relation between threat of entry and debt maturity involve a reverse causality argument, i.e., debt maturity correlates with some unaccounted characteristic (e.g., future profitable opportunities, financial conditions of the incumbent) that drives the decision of the low-cost carrier to enter adjacent markets in order to enter an incumbent's market shortly thereafter. Such arguments imply that the relationship between entry and debt maturity should be even stronger since the best strategy for the low cost company to exploit the weaknesses of the incumbent (or to have access to incumbent's high profit opportunities) would be to enter *exactly* the same market. Conversely, the rollover risk hypothesis suggests that incumbents would be better off issuing long-term debt just before low cost airlines enter their own routes (Brunnermeier and Yogo (2009)).

Table A.6 in the Appendix shows results for the regression of ***Debt Maturity*** on ***Entry***, i.e., a variable that measures the proportion of the market of the incumbent in which low-cost carriers are actually entering. The estimated coefficient for the effect of actual entry on debt maturity is never statistically significant.

D.2. Acela Threat and Debt Maturity

The second test I consider is the introduction of the Acela high-speed train. The Acela Express is Amtrak's fastest train in the United States, able to reach a peak speed of 150 mph (240 km/h). It connects Boston with Washington D.C. via 14 intermediate stops including Baltimore, Philadelphia, and New York City. Since its first ride on November 17, 2000 Acela has helped Amtrak to capture a 75% share of air/train commuters between New York and Washington (up from 37%) and 54% of the traffic from New York to Boston (from 20%).[30]

High-speed trains are natural competitors for airlines over short to medium distances. Amtrak's fastest train makes the trip between Washington and New York in 2 hours 45 minutes, while planes travel the distance in 1 hour 20 minutes. Equivalent times for the New York-Boston trip are 3 hours 40 minutes by train, and 1 hour 15 minutes by plane. However, flights are often delayed because of weather or congestion. Amtrak arrives on time 90% or more of the time. Moreover, even if air shuttles worked perfectly, one still should account for the cost and time of traveling to the airport, waiting at the gate, sitting on the taxiway, and finally getting into the air. According to transportation experts, when in the ground travel and waiting times are added Acela and air carriers' travel times are comparable.[31]

Amtrak leased a high-speed train from Sweden for test runs in the Washington DC - New York City route in 1992. It is therefore unlikely that the decision to introduce the

[30] Data on traffic shares are reported in "Frustrations of Air Travel Push Passengers to Amtrak" The New York Times - August 15, 2012.

[31] Time is not the only variable determining the choice between plane and train. Price may also play a relevant role in the decision. Acela fares between New York and Washington range from an average of $165 for regular business class to $268 for first class; New York to Boston, $104 to $248; and Boston to Washington, $259 to $389. At US Airways, the lowest one-way ticket price between Washington and New York is $253, and the lowest first-class fare $570, before taxes and fees. Between New York and Boston, the fares are $273 and $503, and $376 and $382 between Washington and Boston (as of May 3, 2014).

high-speed train was driven by the debt maturity change or the financial condition of airlines operating mostly in the Northeast Corridor seven years later (Amtrak unveiled its plan for the Acela Express in March 1999.)[32] Therefore, I compute for each airline the exposure to Acela's routes as the annual number of flights among airports in geographical proximity (i.e., I consider routes obtained by all pairwise combinations of the following cities: Newark (NJ), New York City, Boston, Philadelphia, Baltimore, Washington D.C.) over total annual airline flights. I consider as exposed airlines having the 10% highest average exposure at the moment of the announcement. I consider all other airlines as non-exposed. Hence, I regress ***Debt Maturity*** on ***Acela Threat*** a dummy variable that takes a value of one for airlines highly exposed to Acela routes in the year of the announcement (1999) onward and takes a value of zero otherwise. Time and airline fixed effects are included and errors are clustered at the airline level. Results reported in Table A.7 indicate that airlines highly exposed to Acela routes increase by 15% the proportion of long-term liabilities held.

Overall, results in this section support a causal interpretation of the main result.

D.3. Additional controls

Table A.12 in the Appendix presents results from a "kitchen sink" specification including most of the available variables as controls. The estimated effect on debt maturity stays the same.

VII. Conclusion

The effect of the financial structure of firms on the competitive environment has been extensively debated. Several papers have shown that leverage determines entry/exit decisions and output choices, and both empirical and theoretical work claims that the financial structure of firms influences how competition evolves. This paper posits therefore that firms will adapt

[32]See "Amtrak Unveils High-Speed Shuttle Trains for Busy Travelers - Service between Boston and Washington is Designed to Compete with Airlines." Milwaukee Journal Sentinel. March 10, 1999.

their financial structure *ex ante* depending on their expectations on competitors' future entry decisions. More specifically, the question addressed by this paper is whether firms react to the threat of entry by disruptive competitors by increasing corporate debt maturity and/or decreasing leverage.

The setting of this paper is the U.S. domestic airline industry. Today the role of competition has important implications, especially for airlines since the industry is becoming increasingly concentrated due to mergers - e.g., Delta-Northwest (2009), United-Continental (2010), Southwest-AirTran (2011), American Airlines-US Airways (2013) - as well as alliances and codeshare agreements between companies that were competitors in the past. Additionally, airlines have some attractive features that make it possible to build a more precise identification strategy than similar studies based on all Compustat firms. The largest part of the empirical literature on product market competition focuses on broadly defined industries to identify competing firms and generally assumes that all firms within the same industry are exposed to the same level of competition or to the same shocks. However, MacKay and Phillips (2005) show that the largest part of the variation in financial structure is explained by within-industry differences among firms.

This paper proposes an identification strategy based on the threat of competition posed by low-cost carriers' network expansion and exploits data on flight routes to build a measure of expected competition at the firm level. The main findings suggest that incumbents incorporate entry threats by low-cost competitors when making debt issuance decisions. Airlines anticipating tougher competition seek to increase the proportion of long-term liabilities while leaving the leverage ratio substantially unchanged. This result offers empirical confirmation to a growing series of theoretical papers deriving optimal debt maturity structure in the presence of costly rollover risk (Diamond (1991), Brunnermeier and Yogo (2009), and Diamond and He (2014)). Consistent with a rollover risk channel, most of the empirical findings reported in this paper are driven by financially constrained and risky airlines, i.e., those that are less likely to refinance at a low cost if more efficient competitors enter the same market.

Overall, my findings support the claim that the structure of the debt has important implications for the competitive environment, and suggest that firms consider entry threats when making financing choices.

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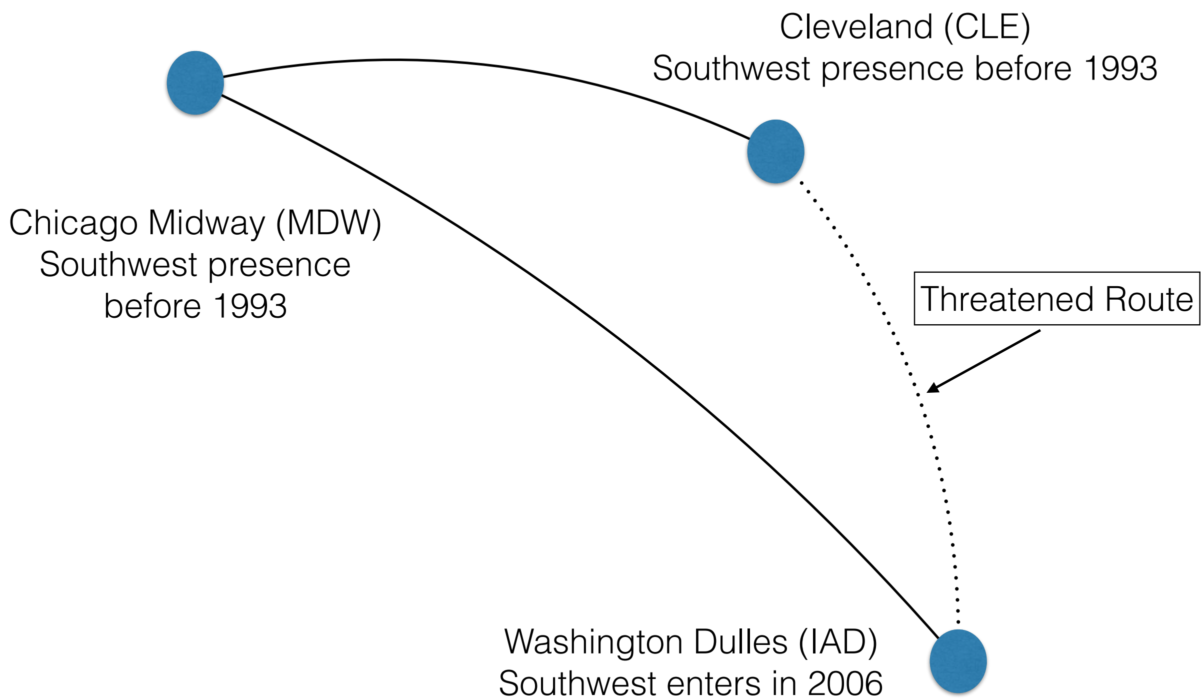

Figure 1: When a low-cost carrier enters the second endpoint airport of a route *but not yet on the route itself* the route is considered under threat since the probability of entry in the following year increases dramatically. For instance, Southwest started to fly from Dulles (IAD) on October 2006, with nonstop flights to four cities in its network, and one-stop service to several others. However, upon entering Dulles Airport, Southwest did not immediately start flying on the route Dulles (IAD)-Cleveland (CLE). Cleveland is a Southwest airport: the airline flew between CLE and other airports, just not the CLE-IAD route. It is therefore reasonable to expect that, after Southwest began to operate at both endpoints of the route, competing airlines soon realized that the probability of Southwest entering the Dulles (IAD)-Cleveland (CLE) route had risen dramatically (see Goolsbee and Syverson (2008)).

Figure 2: Low-cost carriers' airport presence at the end of 1990. Low-cost carriers are Southwest Airlines, JetBlue, Allegiant Airlines, Frontier Airlines, AirTran, and Virgin Airlines. Data are obtained from the T-100 Domestic Market database.

Figure 3: Low-cost carriers' airport presence at the end of 2014. Low-cost carriers are Southwest Airlines, JetBlue, Allegiant Airlines, Frontier Airlines, AirTran, and Virgin Airlines. Data are obtained from the T-100 Domestic Market database.

Table I: Summary Statistics

This table presents summary statistics and correlations among the main variables. Panel A presents statistics for a sample of airlines' financials obtained by matching Compustat and flight route data, Panel B shows statistics for the fleet of the airlines in the sample obtained from Compustat Industry Specific Annual, Panel C presents data on debt issues obtained by matching data on debt issuances obtained from Mergent and Dealscan to the main dataset. Panel D presents statistics from Form 41 filings of private and public airlines. Panel E shows pairwise correlations. The sample period goes from 1991 to 2014. All variables are defined in Table A.I in the Appendix. * indicates that the variable is constructed using less detailed information obtained from Form 41 filings only.

			Panel A: Airline characteristics			
	Obs.	Mean	25th	Median	75th	SD
Threat of Entry	384	0.1570	0.0137	0.1048	0.2184	0.1790
Maturity	317	0.5961	0.5176	0.6670	0.7606	0.2557
Issuance	367	0.0733	0.0047	0.0430	0.1010	0.0961
Leverage	372	0.3605	0.2057	0.3567	0.4803	0.2182
Cash Holdings	372	0.1250	0.0436	0.0949	0.1791	0.1101
Tangibility	372	0.5440	0.4336	0.5791	0.6770	0.1921
Profitability	372	0.0730	0.0313	0.0861	0.1333	0.1499
Chapter 11	310	0.0548	0.0000	0.0000	0.0000	0.2280
Investment Grade	384	0.1068	0.0000	0.0000	0.0000	0.3092
Q	285	1.4293	1.0470	1.1999	1.6307	0.6193
ΔPassengers	370	0.1270	-0.0073	0.0383	0.1254	0.3974
Asset Maturity	370	8.8831	4.9187	8.7872	11.5415	5.3089
Market Share	372	5.9087	4.5991	5.8302	6.9412	1.7933
			Panel B: Fleet characteristics			
N. Aircrafts	252	5.1131	3.9890	5.2149	6.1290	1.1852
Age Aircrafts (in years)	176	10.1640	7.2490	9.8000	12.4900	5.0038
Leased Aircrafts (in %)	229	0.5325	0.3301	0.4706	0.7461	0.2791
Exp. P/M	250	11.7964	9.3300	10.6900	12.4100	5.2141
Load Factor	253	74.1213	70.8000	76.3000	81.2000	11.1122
Cent x Fuel Price/Gallon	220	194.9051	92.675	200.9	299	98.25076
			Panel C: Issuance characteristics			
Issue Maturity (in months)	445	135	60	121	202	88
Covenants	445	0.62	0.0000	1.0000	1.0000	0.4864
Asset Backed	330	0.61	0.0000	1.0000	1.0000	0.4886
Bond	445	0.74	0.0000	1.0000	1.0000	0.4382
			Panel D: Form 41 Airline characteristics			
Threat of Entry	755	0.1322	0.0022	0.0809	0.1819	0.1606
Rollover Risk*	755	0.5337	0.3231	0.4961	0.7702	0.2699
Tangibility*	755	0.4911	0.3130	0.5380	0.6742	0.2408
Profitability*	755	-0.0054	-0.0177	0.0017	0.0140	0.0890
ΔPassengers	755	0.155	-0.0250	0.0493	0.1958	0.7774
			Panel E: Correlation coefficients			
	Maturity	Threat	Log Sales	Tangibility	Asset Maturity	Q
Maturity	1					
Threat of Entry	0.1352	1				
Log Sales	0.3965	0.0485	1			
Tangibility	0.4417	0.0745	0.292	1		
Asset Maturity	0.4971	0.1452	0.2585	0.7606	1	
Q	-0.2285	0.0146	-0.2878	-0.21	-0.1697	1

Table II: Probability of Entry

This table shows marginal effect estimates from probit regressions for entry of a low-cost carrier into a route in year t+1, t+2, and t+3 conditional on being entered at the second endpoint airport of the route (but not on the route itself) in year t. Possible routes are obtained from the T-100 Domestic Market database. Only years for which the low-cost carrier considered is actually operating are included. Year fixed effects are always included. Errors are clustered at the route level. t-statistics are reported in parentheses.

	Entry in Year:			Obs.	Pseudo-R2
	t+1	t+2	t+3		
Southwest Airlines	0.2456***	0.061***	0.0538***	68,118	0.1496
	(35.20)	(9.86)	(9.45)		
JetBlue	0.1668***	0.0623***	0.083***	7,021	0.2518
	(8.28)	(3.35)	(3.10)		
Allegiant	0.1705***	0.0720***	0.0299***	28,881	0.0663
	(17.38)	(6.97)	(2.93)		
Frontier	0.2587***	0.0406***	-0.0177**	29,796	0.1145
	(22.80)	(4.76)	(-2.51)		
AirTran	0.1175***	0.0422***	0.0182**	28,161	0.1505
	(14.03)	(5.71)	(2.53)		
Virgin America	0.3345***	.	0.3171**	415	0.1896
	(3.08)	.	(2.02)		

Table III: Low-Cost Airlines and Route Profitability

The dependent variable in the regressions is the log of the average fares for each route. *Low-Cost Dummy* is a dummy variable that takes a value of one if at least one low-cost airline operates on the route and takes a value of zero otherwise. *Southwest Dummy* is a dummy variable that takes value of one if Southwest Airlines operates on the route and takes a value of zero otherwise. Jetblue, Allegiant, Frontier, AirTran, and Virgin America dummies have a similar interpretation. Average fares are obtained from the U.S. Department of Transportation Statistics' Passenger Origin and Destination (OD) Survey. Fares are adjusted for inflation, cover the period from 2000 to 2012 and include a 10% sample of all airline tickets sold by U.S. carriers, excluding charter air travel. Average fares are average prices paid by all fare paying passengers. They cover first class fares paid to carriers offering such service but do not cover free tickets, such as those awarded by carriers offering frequent flyer programs. Time and route fixed effects are included and errors are clustered at the route level.

	Log Ticket Price							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Low-Cost Dummy	-0.0733***							
	(-11.12)							
Southwest Dummy		-0.0447***						-0.0403***
		(-6.11)						(-5.51)
JetBlue Dummy			-0.1981***					-0.1870***
			(-6.08)					(-5.55)
Allegiant Dummy				-0.0650***				-0.0683***
				(-4.93)				(-5.15)
Frontier Dummy					-0.0387***			-0.0398***
					(-4.44)			(-4.84)
AirTran Dummy						-0.1174***		-0.1126***
						(-6.74)		(-6.45)
Virgin Dummy							-0.1129**	0.0128
							(-2.23)	(0.17)
Route Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	75,525	75,525	75,525	75,525	75,525	75,525	75,525	75,525
R-squared	0.865	0.864	0.864	0.864	0.863	0.864	0.863	0.866

Table IV: Threat of Entry and Leverage

This table presents results from regressions of (book) *Leverage* on *Threat of Entry*. *Threat of Entry* measures the percentage of routes under threat weighted by the number of paying passengers. *Leverage* is defined as total debt over total book assets. The sample consists of all passenger airlines in Compustat that could be matched to the T-100 Domestic Market database. All other variables are described in Table A.1 in the Appendix. All regressions include an intercept (not reported) and year and airline dummies when indicated. Standard errors are clustered at the airline level. *t*-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, respectively.

	Leverage			
Model:	(1)	(2)	(3)	(4)
Threat of Entry	0.0245	-0.0356	-0.0896	0.0153
	(0.18)	(-0.33)	(-0.84)	(0.14)
Sales		0.0552	0.0101	0.0080
		(1.69)	(0.19)	(0.12)
Asset Maturity		0.0101*	-0.0015	-0.0034
		(1.97)	(-0.24)	(-0.57)
Tangibility			0.3816*	0.5253**
			(1.97)	(2.74)
Profitability			0.0840	0.0178
			(0.55)	(0.09)
ΔPassengers			0.0090	-0.0199
			(0.30)	(-0.73)
Chapter 11				-0.0709
				(-0.73)
Q				0.0470
				(0.93)
Airline Fixed Effects	Y	Y	Y	Y
Time Fixed Effects	Y	Y	Y	Y
Observations	372	370	357	239
R-squared	0.510	0.541	0.553	0.711

Table V: Threat of Entry and Debt Maturity

This table presents results from regressions of *Debt Maturity* on *Threat of Entry*. *Threat of Entry* measures the percentage of routes under threat weighted by the number of paying passengers. *Debt Maturity* is defined as the proportion of long-term debt maturing in more than three years following Barclay and Smith (1995) and Custódio, Ferreira, and Laureano (2013). The sample consists of all passenger airlines in Compustat that could be matched to the T-100 Domestic Market database. All other variables are described in Table A.1 in the Appendix. All regressions include an intercept (not reported) and year and airline dummies when indicated. Standard errors are clustered at the airline level. *t*-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, respectively.

	Debt Maturity			
Model:	(1)	(2)	(3)	(4)
Threat of Entry	0.3281**	0.2589**	0.2494**	0.2445**
	(2.55)	(2.47)	(2.74)	(2.66)
Sales		0.1479***	0.1201**	0.1312**
		(4.98)	(2.64)	(2.21)
Asset Maturity		0.0115*	0.0116**	0.0118*
		(1.90)	(2.37)	(2.05)
Tangibility			0.0250	0.1344
			(0.10)	(0.64)
Profitability			0.2256	0.0792
			(0.95)	(0.26)
ΔPassengers			-0.0648	-0.0765
			(-1.26)	(-1.25)
Chapter 11				-0.0569
				(-1.30)
Q				0.0043
				(0.07)
Trend				-0.0149**
				(-2.15)
Credit Spread				0.0744
				(1.39)
Term Spread				-0.0106
				(-0.94)
Airline Fixed Effects	Y	Y	Y	Y
Time Fixed Effects	Y	Y	Y	N
Observations	317	317	310	239
R-squared	0.488	0.552	0.564	0.582

Table VI: Timing

This table presents results from regressions of *Debt Maturity* on *Threat of Entry*. *Threat of Entry* measures the percentage of routes under threat weighted by the number of paying passengers. *Debt Maturity* is defined as the proportion of long-term debt maturing in more than three years following Barclay and Smith (1995) and Custódio, Ferreira, and Laureano (2013). Controls for past and future values for *Threat of Entry* are included. The sample consists of all passenger airlines in Compustat that could be matched to the T-100 Domestic Market database. All other variables are described in Table A.1 in the Appendix. All regressions include an intercept (not reported) and year and airline dummies when indicated. Standard errors are clustered at the airline level. *t*-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, respectively.

	Debt Maturity		
Model:	(1)	(2)	(3)
Threat of Entry(t+2)	-0.0651	-0.0982	-0.2089
	(-0.33)	(-0.50)	(-1.28)
Threat of Entry(t+1)	0.1571	0.1077	0.0044
	(0.98)	(0.66)	(0.05)
Threat of Entry(t)	0.2558*	0.2124**	0.1960**
	(2.00)	(2.10)	(2.56)
Threat of Entry(t-1)	0.1792	0.0334	0.0108
	(1.40)	(0.27)	(0.11)
Threat of Entry(t-2)	0.1605	-0.0084	0.0192
	(0.84)	(-0.06)	(0.20)
Sales		0.1366*	0.0970
		(2.01)	(1.06)
Asset Maturity		0.0105	0.0098
		(1.47)	(1.27)
Tangibility		0.0034	0.1662
		(0.01)	(0.62)
Profitability		0.2037	0.0721
		(0.65)	(0.25)
ΔPassenger		-0.2818*	-0.3561**
		(-1.97)	(-2.28)
Chapter 11			-0.1323
			(-1.61)
Q			0.0571
			(0.65)
Trend			-0.0090
			(-0.75)
Credit Spread			0.1090*
			(1.81)
Term Spread			0.0006
			(0.05)
Airline Fixed Effects	Y	Y	Y
Time Fixed Effects	Y	Y	N
Observations	235	235	180
R-squared	0.511	0.578	0.616

Table VII: Rollover Risk versus Signaling

This table presents results from regressions of *Debt Maturity* on *Threat of Entry* and interactions of *Threat of Entry* and easiness of access to financial resources. *Threat of Entry* measures the percentage of routes under threat weighted by the number of paying passengers. *Debt Maturity* is defined as the proportion of long-term debt maturing in more than three years following Barclay and Smith (1995) and Custódio, Ferreira, and Laureano (2013). *Investment Grade* is a variable that takes a value of one if the rating of the long-term debt for an airline is between AAA and BBB- included, while takes a value of zero otherwise. *SA* is the value of the *SA* Index computed as in Hadlock and Pierce (2010), i.e., -0.737 x total assets +0.043 x total assets^2 - 0.040 x age. The sample consists of all passenger airlines in Compustat that could be matched to the T-100 Domestic Market database. All other variables are described in Table A.1 in the Appendix. All regressions include an intercept (not reported) and year and airline dummies when indicated. Standard errors are clustered at the airline level. *t*-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, respectively.

	Debt Maturity		
Model:	(1)	(2)	(3)
Threat of Entry x Investment Grade	-0.4499***		-0.3575**
	(-3.84)		(-2.76)
Investment Grade	0.2209***		0.1838***
	(3.98)		(2.85)
Threat of Entry x SA		0.5077**	0.4344*
		(2.21)	(1.94)
SA		-0.6365**	-0.5730**
		(-2.53)	(-2.36)
Threat of Entry	0.2819***	2.0014**	1.7716**
	(3.17)	(2.42)	(2.24)
Sales	0.0960**	0.0587	0.0442
	(2.16)	(1.31)	(1.01)
Asset Maturity	0.0109**	0.0092*	0.0090*
	(2.38)	(1.76)	(1.74)
Tangibility	0.0572	-0.1953	-0.1474
	(0.25)	(-0.78)	(-0.62)
Profitability	0.2576	-0.0019	0.0504
	(1.12)	(-0.01)	(0.17)
ΔPassenger	-0.0732	-0.0479	-0.0556
	(-1.40)	(-1.07)	(-1.19)
Airline Fixed Effects	Y	Y	Y
Time Fixed Effects	Y	Y	Y
Observations	310	310	310
R-squared	0.582	0.592	0.604

Table VIII: Asset Side

This table presents results from regressions of ***Debt Maturity*** on asset side characteristics. ***Threat of Entry*** measures the percentage of routes under threat weighted by the number of paying passengers. ***Investment*** is capital expenditures scaled by book assets, ***Asset Growth*** is the log change in book assets, ***Fleet Size*** is the log of the number of aircrafts in the fleet, ***Fleet Age*** is the the log of the average age of the aircrafts in the fleet, ***Expense Pas./Mile*** is the dollar expenditures per passenger-mile (in cents), and ***%Leased Planes*** is the number of leased aircrafts over the number of leased aircrafts plus aircrafts owned. The sample consists of all passenger airlines in Compustat that could be matched to the T-100 Domestic Market database and to the Compustat Industry Specific Annual. All other variables are described in Table A.1 in the Appendix. All regressions include an intercept (not reported) and year and airline dummies when indicated. Standard errors are clustered at the airline level. *t*-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, respectively.

Model:	Investment (1)	Asset Growth (2)	Fleet Size (3)	Fleet Age (4)	Expense Pas./Mile (5)	%Leased Planes (6)
Threat of Entry	0.0523	0.7513	0.0131	-0.2589	-0.0391	0.0049
	(1.06)	(1.28)	(0.14)	(-1.36)	(-0.04)	(0.05)
Sales	-0.0307	-0.0507	0.7058***	-0.1251	-0.2768	0.0261
	(-1.22)	(-0.74)	(10.04)	(-0.56)	(-0.16)	(0.29)
Asset Maturity	0.0042	0.0478***	-0.0018	-0.0693**	0.0043	0.0050
	(1.15)	(4.33)	(-0.19)	(-2.49)	(0.05)	(0.42)
Tangibility	0.0658	-1.3944***	0.1970	1.8727*	-3.6850	-0.6644*
	(0.67)	(-5.79)	(0.67)	(1.93)	(-1.66)	(-1.83)
Profitability	0.0202	1.6276	-0.9745***	-1.0711	1.8131	-0.1953
	(0.24)	(1.38)	(-4.26)	(-1.03)	(1.02)	(-1.44)
ΔPassengers	0.0372	0.1808**	-0.0811	-0.0655	-0.0241	-0.0287
	(1.68)	(2.15)	(-1.46)	(-0.40)	(-0.01)	(-1.18)
Airline Fixed Effects	Y	Y	Y	Y	Y	Y
Time Fixed Effects	Y	Y	Y	Y	Y	Y
Observations	355	348	248	174	243	225
R-squared	0.508	0.304	0.987	0.862	0.844	0.910

Table IX: Demand Channel

This table presents results from regressions of *Debt Maturity* on *Threat of Entry*. *Threat of Entry* measures the percentage of routes under threat weighted by the number of paying passengers. *Debt Maturity* is defined as the proportion of long-term debt maturing in more than three years following Barclay and Smith (1995) and Custódio, Ferreira, and Laureano (2013). The sample consists of all passenger airlines in Compustat that could be matched to the T-100 Domestic Market database Additional demand side controls include the change in passenger traffic from year t to $t+1$ (Δ_{t+1}Passengers), log passengers, airlines' *Load Factor*, revenue per passenger mile (*RPM*), and total revenues over total passengers. All other variables are described in Table A.1 in the Appendix. All regressions include an intercept (not reported) and year and airline dummies when indicated. Standard errors are clustered at the airline level. t-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, respectively.

	Debt Maturity		
Model:	(1)	(2)	(3)
Threat of Entry	0.2409***	0.3025**	0.2720**
	(2.82)	(2.65)	(2.42)
Sales	0.0999**	0.1481	-0.5760
	(2.39)	(1.15)	(-1.22)
Asset Maturity	0.0105**	0.0053	0.0054
	(2.14)	(0.92)	(0.95)
Tangibility	-0.0169	0.0347	0.0280
	(-0.07)	(0.09)	(0.08)
Profitability	0.1845	0.1565	0.1861
	(0.76)	(0.46)	(0.58)
Δ_{t+1}Passengers	0.1193	0.1926	0.1821
	(1.20)	(1.63)	(1.64)
ΔPassengers	-0.0654	-0.0117	-0.0171
	(-1.08)	(-0.23)	(-0.33)
Passengers	0.0526	0.1108	0.1098
	(1.26)	(1.36)	(1.47)
Load Factor		0.0041	-0.0082
		(0.43)	(-0.77)
RPM		-0.0666	0.6669
		(-0.46)	(1.37)
Total Revenue/Passenger			0.0645*
			(1.76)
Airline Fixed Effects	Y	Y	Y
Time Fixed Effects	Y	Y	Y
Observations	298	207	206
R-squared	0.578	0.634	0.638

Table X: Threat of Entry and Debt Issuance

This table presents results from regressions of *Maturity* in months on *Threat of Entry*. *Threat of Entry* measures the percentage of routes under threat weighted by the number of paying passengers. The sample consists of debt issues by airlines collected from Dealscan and Mergent and matched by name to the main sample. Column (1) includes loans only, column (2) includes bonds only, column (3) includes both. *Relative Size* is debt issue in dollar over book assets. All other variables are described in Table A.1 in the Appendix. All regressions include an intercept (not reported) and year dummies. Standard errors are clustered at the airline level. *t*-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, respectively.

	Maturity (in months)		
	Loans (1)	Bonds (2)	All (3)
Threat of Entry	95.8026**	45.9176*	59.0525***
	(2.14)	(1.83)	(3.95)
Sales	-6.9866**	5.8095	10.0765*
	(-2.56)	(0.53)	(1.86)
Asset Maturity	2.6538*	1.2574	5.3968***
	(2.02)	(0.54)	(4.63)
Tangibility	-30.0853	48.8194	-40.8623
	(-1.16)	(0.78)	(-0.96)
Profitability	110.4259	13.0961	27.2283
	(0.62)	(0.12)	(0.23)
ΔPassengers	118.6279	6.0764	7.9775
	(1.80)	(0.21)	(0.24)
Relative Size	19.7563	0.3297	0.5233***
	(0.87)	(1.39)	(3.37)
Asset Backed		16.2290	
		(0.78)	
Redeemable		56.7119***	
		(3.10)	
Time Fixed Effects	Y	Y	Y
Observations	115	330	445
R-squared	0.501	0.337	0.292

Table XI: Threat of Entry and Covenants

This table presents results from a logit regression of ***Covenant*** on *Threat of Entry*. ***Covenant*** is a dummy variable indicating whether any covenant is attached to the issuance. *Threat of Entry* measures the percentage of routes under threat weighted by the number of paying passengers. The sample consists of debt issues by airlines collected from Dealscan and Mergent and matched by name to the main sample. Column (1) includes loans only, column (2) includes bonds only, column (3) includes both. ***Relative Size*** is debt issue in dollar over book assets. All other variables are described in Table A.1 in the Appendix. All regressions include an intercept (not reported) and year dummies. Standard errors are clustered at the airline level. ***t***-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, respectively.

	Covenant
	(1)
Threat of Entry	0.5792**
	(2.39)
Sales	-0.04542
	(-0.94)
Asset Maturity	0.0254**
	(2.12)
Tangibility	0.0375
	(0.11)
Profitability	-1.4793
	(-1.84)
ΔPassengers	-0.6317***
	(-2.66)
Relative Size	0.0027*
	(1.75)
Time Fixed Effects	Y
Observations	445
Pseudo R-squared	0.266

Table XII: Form 41 Filings

This table presents results from regressions of ***Leverage*** and ***Rollover Risk*** on ***Threat of Entry***. ***Threat of Entry*** measures the percentage of routes under threat weighted by the number of paying passengers. ***Leverage*** is defined as total liabilities over book assets, ***Rollover Risk*** is defined as the proportion of liabilities maturing within one year over total liabilities. The sample consists of all passenger airlines filing 41 forms that could be matched to the T-100 Domestic Market database. All regressions include an intercept (not reported) and year and airline dummies when indicated. Standard errors are clustered at the airline level. *t*-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, respectively.

	Leverage	Rollover risk		
Sample:	All (1)	All (2)	Private Only (3)	Public Only (4)
Threat of Entry	-0.0140	-0.2098***	-0.3193***	-0.1968
	(-0.18)	(-2.69)	(-3.07)	(-1.40)
Size	-0.0461	-0.0847**	-0.0354	-0.1446***
	(-1.39)	(-2.42)	(-0.84)	(-3.62)
Tangibility	0.2806***	-0.4513***	-0.4163**	-0.4516***
	(2.69)	(-5.38)	(-2.61)	(-5.44)
Profitability	0.0436	-0.0725	-0.0241	-0.2488
	(0.43)	(-0.72)	(-0.17)	(-1.57)
ΔPassengers	-0.0087	-0.0012	-0.0123	0.0033
	(-1.15)	(-0.15)	(-1.17)	(0.33)
Airline Fixed Effects	Y	Y	Y	Y
Time Fixed Effects	Y	Y	Y	Y
Observations	755	755	340	366
R-squared	0.653	0.778	0.824	0.771

Table XIII: Block Bootstrap

This table presents results from regressions of ***Debt Maturity*** on ***Threat of Entry***. ***Threat of Entry*** measures the percentage of routes under threat weighted by the number of paying passengers. ***Debt Maturity*** is defined as the proportion of long-term debt maturing in more than three years following Barclay and Smith (1995) and Custódio, Ferreira, and Laureano (2013). The sample consists of all passenger airlines in Compustat that could be matched to the T-100 Domestic Market database. All other variables are described in the Appendix. All regressions include an intercept (not reported) and year and airline dummies when indicated. Standard errors are estimated extracting a sample of 500 random observation from each airline (block bootstrap). z-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1%, respectively.

	Debt Maturity			
Model:	(1)	(2)	(3)	(4)
Threat of Entry	0.3281***	0.2589**	0.2494**	0.2445***
	(2.58)	(2.51)	(2.54)	(2.65)
Sales		0.1479***	0.1201**	0.1312**
		(4.10)	(2.30)	(2.08)
Asset Maturity		0.0115*	0.0116	0.0118*
		(1.91)	(1.59)	(1.78)
Tangibility			0.0250	0.1344
			(0.09)	(0.63)
Profitability			0.2256	0.0792
			(0.88)	(0.27)
ΔPassenger			-0.0648	-0.0765
			(-1.19)	(-1.12)
Chapter 11				-0.0569
				(-1.10)
Q				0.0043
				(0.07)
Trend				-0.0149**
				(-2.02)
Credit Spread				0.0744
				(1.55)
Term Spread				-0.0106
				(-0.95)
Airline Fixed Effects	Y	Y	Y	Y
Time Fixed Effects	Y	Y	Y	N
Observations	317	317	310	239
R-squared	0.488	0.552	0.564	0.582

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