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Competition and service quality: New evidence from the airline industry ☆

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ABSTRACT

Previous studies examine the relationship between competition and airline service quality by regressing on-time performance on market structure. These studies implicitly assume that market structure is exogenously determined with respect to service quality. To address the likely endogeneity of market structure I employ two distinct instrumental variables. The first is lagged market structure. The second exploits a global airline merger that induced differential variations in market structure across hundreds of airport-pair markets. I find that the effect of competition on airline delays is three times stronger than previous studies suggest.

1. Introduction

Empirical studies on the relationship between market concentration and prices have been central to the applied microeconomics literature for decades.[1] A related topic of considerable importance—that has attracted much less attention—is the relationship between concentration and product quality. Notably, economic theory yields ambiguous predictions on the sign of the relationship. Spence (1975) shows that under perfect information monopoly power may lead firms to increase or decrease quality. Other authors examine the relationship when consumers have imperfect information about product quality. Some of these models highlight how reputational effects may confer an incentive for sellers to provide quality in competitive markets (Klein and Leffler, 1981; Shapiro, 1983; Hörner, 2002), while others emphasize that competition may also erode the profit margins that make a reputation valuable, lessening the incentive for sellers to provide quality in competitive markets (Kranton, 2003; Bar-Isaac, 2005; Dana and Fong, 2011).[2] This theoretical ambiguity underscores the importance of empirical research, particularly in specific industry settings.

In the policy realm, antitrust law reflects a general presumption that competition between firms is beneficial for consumers. However, if competition erodes quality, policy may require a more nuanced approach. To be sure, quality undeniably has nontrivial effects on consumer welfare in industries such as health care, transportation, and legal services. Despite the importance, empirical research on the relationship between competition and quality is still relatively sparse. Among the exceptions are papers by Domberger and Sherr (1989) on legal services, Hoxby (2000) on public schools, and Matsa (2011) on supermarkets, all of which find a positive association between competition and quality.[3] Mazzeo (2003) and Rupp et al. (2006) examine the same question as this paper. They both find superior airline on-time performance, an important measure of service quality, in less concentrated airport-pair markets.[4] Their results suggest that competition induces airlines to provide better service quality. However, both studies assume that market structure is exogenously determined with respect to service quality—an assumption that is likely unrealistic.

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[1] See Schmalensee (1989) for a survey of the early literature. Recent examples include Dafny et al. (2012) and Hosken et al. (2011).

[2] When prices are set above marginal cost by a regulator, theoretical and empirical evidence indicates that competition improves quality (see, Douglas and Miller, 1974).

[3] Also, Dranove and White (1994) and Gaynor (2006) survey the growing research on competition and quality in hospital markets.

[4] A recent study commissioned by the FAA reported the total cost of US air transportation delays in 2007 was $32.9 billion, including $3.9 billion of lost consumer surplus incurred by consumers who avoided flying because of delays and $16.7 billion directly borne by airline passengers. The estimated $16.7 billion borne by passengers was calculated based on lost time due to flight delays, cancellations and missed connections, plus expenses incurred while being away from home for additional time. See,⟨http://its.berkeley.edu/sites/default/files/NEXTOR_TDI_Report_Final_October_2010.pdf⟩

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When regressing quality on market structure, there are two specific reasons to expect market structure is endogenous.[5] First, quality affects demand and market shares, thus, market structure and quality are codetermined. For example, consider a monopolist in a particular market. If the monopolist shirks on quality provision, other firms may find it profitable to enter, simultaneously lowering market concentration. Here low quality leads to a more competitive market structure, resulting in a negatively biased OLS estimate of the causal effect of competition on quality. Second, a firm's profit maximizing choice of service quality is likely a function of demand and cost factors that also affect market structure. Any such factors that are unobserved by the researcher will lead to correlation between market structure and the error term. For example, a positive shock to demand may make it more profitable for incumbents to provide high quality. At the same time high demand may draw new firms into the market, lowering concentration.[6] If the researcher does not observe the demand shock, there will be a positive bias on the estimated causal relationship between competition and quality. Alternatively, if a particular firm enjoys a positive shock to demand for its own service (or a negative shock to costs) it may find it profitable to offer high quality, establishing a dominant position and increasing concentration. If the econometrician does not observe the shock, there will be a negative bias. Given the multitude of potential avenues for correlation—not to mention the general theoretical ambiguity surrounding competition and quality—it is not possible to sign the likely bias a priori.

Using a five-year sample of panel data I examine how temporal variation in airport-pair market structure, measured by the Herfindahl–Hirschman Index (HHI), impacts airline on-time performance. I employ two distinct instrumental variable (IV) strategies borrowed from the literature on market structure and prices. The first strategy uses lagged market structure as an instrument for current market structure. Evans et al. (1993) and Davis (2005) analogously use lagged market structure as an instrument when studying the effects of market structure on prices in the airline and motion picture industries, respectively.[7] The second IV strategy relies on variation in competition caused by the 2008 merger between Delta Air Lines (DL) and Northwest Airlines (NW). Closely following Dafny et al. (2012), I use the merger between firms that operate on a global scale as a natural experiment, which generates differential variations in market structure across hundreds of airport-pair markets. Admittedly, mergers do not occur randomly, however the exogeneity of this instrument is carefully considered.

I generate OLS estimates that are equivalent to those found by Mazzeo (2003) and support the hypothesis that competition positively influences on-time performance (Rupp et al. (2006), use slightly different measures of competition to yield qualitatively similar results). More interestingly, the IV estimates indicate that the impact of competition on flight delays is roughly three times stronger than predicted by the OLS regressions. Notably, an overidentification test fails to reject the exogeneity of the two instruments. While the power of this test is limited when neither instrument is definitively exogenous, the fact that the two instruments correlate with HHI via distinctive mechanisms seemingly mitigates the likelihood of a Type II error. That is, it seems unlikely that the two notably different instruments would yield similar yet inconsistent estimates.[8] Several subsample regressions also explore the validity of the merger instrument. Lastly, I find that the results are robust to alternative measures of competition and on-time performance.

The remainder of the paper is organized as follows: Section 2 provides some background on airline delays and discusses the related literature. Section 3 describes the data set. Section 4 details the empirical specification. Section 5 presents the results and Section 6 discusses their implications. Section 7 concludes.

2. Airline delays as a measure of service quality

Airlines can exert effort to prevent delays. Employing extra labor and aircraft can mitigate delays arising from unscheduled maintenance, crew problems, fueling, aircraft cleaning, and baggage handling. Moreover, when an imminent delay arises, airlines can influence which routes are affected. For example, airlines can redeploy airplanes as well as flight and maintenance personnel to routes where the costs of delay are highest. It is also true that many flight delays arise due to exogenous events outside the airlines' control, such as congestion and weather. Nonetheless, in these situations airlines can again influence which flights experience delays. As explained by Rupp et al. (2005) and Forbes and Lederman (2010), when faced with flight schedule disruptions airlines make real-time adjustments and are often forced to choose which flights to delay.

Delays are costly to an airline because they can reduce future demand. In fact, prior research indicates that flight delays reduce demand and market fares.[9] Morrison and Winston (1989) estimate a logit demand model and find that a one percentage point increase in the share of flights delayed more than 15 min reduces passengers' willingness-to-pay by $1.31 per one-way fare. Forbes (2008a) exploits a legislative change at LaGuardia Airport that allowed new entry on a subset of routes, creating an exogenous change in congestion on other routes at LaGuardia. Consistent with Morrison and Winston's demand estimates, she finds that fares fall by $1.21 with each percentage point increase in the share of flights delayed over 15 min, on average.[10] In competitive markets she finds an even stronger effect with a one percentage-point increase in delays leading to a $1.70 decrease in fares. Finally, Suzuki (2000) constructs a model in which a traveler's choice of airline at time t depends on whether they experienced a flight delay at $t-1$. Using data from a specific city-pair market he tests the model, finding that fluctuations in market share can be explained by past on-time performance.

All else equal, the negative relationship between flight delays and demand for a particular carrier's service may be greater in

[5] The two issues outlined are analogous to those described by Evans, Werden, and Evans et al. (1993).

[6] Additionally, there is always a concern that some unobserved exogenous determinant of delays may confound the relationship. Prior studies have relied on variation in market structure across routes at the same airport to control for important airport effects such as congestion and weather. However, as Mazzeo (2003) mentions, it leaves open the possibility "that there is some unobserved factor explaining delays on particular routes that is correlated with the propensity for airlines to offer service on that route." The carrier-route fixed effects used in this study control for potentially confounding differences across routes, as well as all time invariant airport effects.

[7] Other studies have used lagged HHI as an instrument when HHI is employed as a control variable. See for example Bilotkach and Pai (2009).

[8] Consider the textbook example of a regression of wages on education, using *mother's education* and *father's education* as instruments. The instruments are employed because of a likely omitted variable for *ability*. However, the education levels of both parents are also likely correlated with ability. In this case, a test of the overidentifying restrictions is particularly weak because both instruments are chosen using a similar reasoning. Even if both instruments are endogenous, they will likely lead to similar yet inconsistent estimates, preventing the researcher from rejecting the null hypothesis that both instruments are exogenous. See Wooldridge (2008) page 529.

[9] Also note that Forbes (2008b) finds the number of consumer complaints increases with the percentage of flight delays and Foreman (1999) finds that publication of on-time performance data is associated with a decline in average delays.

[10] Dollar values from earlier studies have been inflated to 2008 dollars using the CPI.

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