

Regulatory Reform in the Airline Industry

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Government policy rather than market forces shaped the development and operation of scheduled passenger air service in almost all markets for the first six decades of the airline industry's history. Government intervention in commercial aviation coincided with the industry's inception in the aftermath of World War I, with many governments keenly cognizant of the potential military benefits of a robust domestic aviation sector. During these early days, interest in aviation outpaced the financial viability of fledgling airlines. Government support intensified worldwide as financial instability was exacerbated by the global economic depression in the 1930s and military interest in aviation was fortified by increasing geopolitical tensions. Relatively low entry barriers, combined with the lure of government subsidies, led to many small providers of passenger air transportation, and to concern over fragmentation and "destructive competition."

Pressure to rationalize the industry and promote the development of strong national air carriers manifested itself in subsidization and regulation of privately-owned firms in the U.S., and in public ownership in nearly all of the rest of the world. In the U.S., Post Office control through airmail contract awards ultimately gave way to direct economic regulation of prices and entry by an independent regulatory agency in 1938, though both direct and indirect subsidies through airmail rates continued as part of that regulation.¹ In Europe, state subsidies quickly evolved into consolidation and state ownership of domestic "flag" carriers. Restrictions on foreign ownership of domestic air carriers were universal.

International service was governed by tightly controlled bilateral agreements, which specified the cities that could be served and which carriers were authorized to provide service, typically a single carrier from each country. In many cases, these agreements negotiated market allocations across carriers that were enforced through capacity restrictions or revenue division agreements. Prices generally were established jointly by the airlines themselves, under the auspices of the International Air Transport Association (IATA), subject to approval by each carrier's government.

The transition to a more market-based aviation industry began in the U.S. in the mid-1970s. Enactment of the Airline Deregulation Act of 1978 eliminated price and entry regulation of the domestic airline industry and provided for ultimate closure of its regulatory agency, the Civil Aeronautics Board (CAB). Subsequent privatization efforts elsewhere have transferred many carriers from state-owned enterprises to the private sector, though countries continue to claim a national interest in domestic ownership of airlines operating within their borders. While there has been relaxation of regulation in some international markets, restrictive bilateral agreements continue to limit competition in most markets and countries continue to limit foreign ownership of domestic airlines. The notable exceptions are within the European Union--where formal restraints on commercial aviation have been liberalized considerably over the past 15 years with the creation of an open intra-European Union (EU) aviation market--and a handful of "open skies" agreements.² Apart from the EU, however, carriers continue to be prohibited from competing for passengers on flights entirely within another country (termed "cabotage" rights).

¹ The 1938 legislation also provided for federal authority over airline and airport operations. Ultimately, system operations, certification, and safety regulation was concentrated in the Federal Aviation Authority, leaving the CAB responsible for the economic (price and entry) regulation that is the focus of this chapter.

² For example, between the U.S. and Canada and the U.S. and the Netherlands.

This paper analyzes government intervention primarily in the context of U.S. domestic airline markets. This choice is dictated by three considerations. First, intervention in passenger aviation took place through an explicit formal regulatory system in the U.S, rather than through the more opaque operation of state-owned enterprise as elsewhere. Focusing on the U.S. enables a clearer discussion of government policies, their changes, and effects. From the inception of air travel, the United States has led the world in incorporating market incentives into its airline policies. While nearly every other country operated one or two state-owned airlines that dominated service, the U.S. relied on privately-owned carriers and even under regulation allowed the airlines substantial autonomy in their operations. Second, until the EU changes in the late 1990s, policy reform has taken place primarily within domestic aviation markets. As the U.S. has had the largest domestic passenger aviation market in the world, it provides a substantial “laboratory” for observing the effects of policy changes. The U.S. also was the first to deregulate airline pricing and entry, leading nearly all other countries by more than a decade, thereby providing a longer post-reform period in which to study the transition across regimes. Finally, and perhaps most importantly, the U.S. government has collected and published detailed financial, operational, and market data at the individual carrier, and in many cases, carrier-route, level from the regulated era and continuing through to the present. These unique data resources facilitate detailed econometric analyses that typically cannot be duplicated with the data that are publicly available on airlines in other countries. Their availability over much of the past 30 or more years has facilitated a wealth of analysis of regulatory reform and its impact.³

The remainder of this chapter first describes the inception, institutions, and operation of U.S. airline regulation. It then turns to a discussion of the events leading to deregulation of the industry, and evaluates the impact of those reforms. Finally, it highlights the key issues of ongoing contention in the industry, and assesses the lessons for government intervention in passenger aviation markets. A brief discussion of reforms elsewhere in the world will be included in the final version of this paper (with apologies to readers of this draft).

1. Airline Regulation⁴

The United States federal government began using private air carriers to supplement military airmail carriage in 1918, with early payloads devoted primarily to mail, not passengers. The Kelly Air Mail Act of 1925 (43 Stat. 805 (1925)) established a competitive bidding system for private air mail carriage and subsequent amendments provided explicit subsidies by enabling the Post Office to award contracts with payments exceeding anticipated air mail revenues on the routes.⁵ These subsidies, along with Ford Motor Company’s introduction of a 12-seat aircraft in

³ These data are now used to study aspects of firm behavior not directly related to regulation, but of broad interest to industrial organization economists, firms, and policymakers. See, for example, studies of entry determinants and incumbent responses (e.g. Berry, 1990; Berry, 1992; Whinston and Collins, 1992; Goolsbee and Syverson, 2005) and price level and structure determinants (e.g., Borenstein, 1989; Hurdle et al., 1989; Borenstein and Rose, 1994; Morrison, 2001).

⁴ This section is not intended to duplicate the many excellent treatises on airline regulation. See Caves (1962) and Levine (1965) for detailed discussions of the early airline industry and its regulation in the U.S. These sources, with Jordan (1970), Eads (1974), Douglas and Miller (1974), Bailey, Graham, and Kaplan (1985), and many others provide excellent analyses of the regulated era.

⁵ See Wolfram (2004) for an analysis of the performance of the early airmail contract award process.

1926, facilitated the expansion of passenger air service in the nascent U.S. air carrier industry. By the 1930s, reports of the Postmaster General’s efforts to “rationalize” the route system and encourage the “coordination” of vertically-integrated, national firms in the bidding process led to Congressional censure and 1934 legislation to establish regulatory oversight by the Interstate Commerce Commission (ICC). This was soon replaced by the Civil Aeronautics Act of 1938, in which the industry succeeded in establishing a system of protective economic regulation under what eventually became the Civil Aeronautics Board and operational and safety oversight under what was to become the Federal Aviation Administration (FAA).⁶ Our analysis focuses on economic regulation. FAA operational and safety functions have not been deregulated, and there is little evidence of interactions between economic and safety regulation in this setting (See Rose, 1990, 1992, and the citations therein).

Like many other industries during the Great Depression, policymakers and airline executives alike were eager to trade the “chaos” of market determination of pricing and network configuration for government “coordination” across air carriers, elimination of “unfair or destructive competitive practices,” and restriction of entry to that required by the “public convenience and necessity.”⁷ Perceived national defense interests in a robust domestic airline industry added to the appeal. To this end, the CAB was charged with “the promotion, encouragement and development of civil aeronautics,” and given authority to accomplish this through control of entry, rate levels and structures, subsidies, and merger decisions.⁸

Economic regulation of the U.S. airline industry persisted over the subsequent four decades in largely unchanged form. Two elements of regulation are most salient for this analysis: entry restrictions and rate determination.

When the CAB was formed in 1938, existing carriers were given “grandfathered” operating authority over their existing markets, as is typical in regulatory legislation. The CAB interpreted the public interest in avoiding destructive competition as implying a high hurdle for proposed new entry, effectively ruling out *de novo* entry of any new national (“trunk”) scheduled passenger service carrier after 1938. During World War II and its immediate aftermath, the CAB bowed to pressure to authorize entry by carriers providing service to and from smaller communities. These “local service” carriers were sparingly certified and restricted largely to “feeder” routes that avoided competition with existing trunk carriers. By 1978, they still accounted for fewer than 10 percent of domestic revenue passenger-miles. Mergers led to gradual consolidation in the market, with the 11 of the 16 original grandfathered trunk airlines and a dozen local service and regional carriers still operating in the late 1970s (Bailey, Graham, and Kaplan, 1985, 15). This consolidation occurred against a backdrop of explosive traffic

⁶ See the Civil Aeronautics Act of 1938, 52 Stat. 977 (1938), amended in 1958 by the Federal Aviation Act of 1958, 72 Stat. 731, 49 U.S.C. § 1341 (1958). In addition to economic regulation, these acts extended government oversight to aircraft certification, safety regulation of airline operations, airport development, and the air traffic control system. The safety functions were unaffected by changes in economic regulation, and are therefore beyond the scope of the present analysis. We discuss infrastructure policy in Section 3.

⁷ 49 U.S.C. § 1302, 1371 (1958). The exchange of government coordination and regulation for the “destructive competition” of the market was echoed in the origin of trucking regulation under the Motor Carrier Act of 1935, for example. See Kahn (1971), volume II, chapter 5.

⁸ 49 U.S.C. § 1302 (1958).

growth, with compounded annual growth rates of 14 to 16 percent in passenger enplanements and revenue-passenger miles between 1938 and 1977 (see Figure 1).

Expansion by incumbent carriers was similarly subject to strict oversight. As the Federal Aviation Report of 1935 argued: “To allow half a dozen airlines to eke out a hand-to-mouth existence where there is enough traffic to support one really first-class service and one alone would be a piece of folly.” (Meyer et al., 1981, 19). Trunk carriers wishing to expand onto routes served by an existing airline were required to show that their entry would not harm the incumbent carrier. The CAB only gradually allowed expansion of the trunk carriers to erode the highly concentrated route structure preserved in the grandfathered route networks. Growth of the local service carriers was largely stifled until the mid-1960s when political pressure against the rising subsidies they were receiving convinced the CAB to allow them to enter into some profitable higher-density trunk markets. This system resulted in no more than one or two carriers authorized to provide service in all but the largest markets. In 1958, for example, twenty-three of the hundred largest city-pair markets were effectively monopolies; another fifty-seven were effectively duopolies; and in only two did the three largest carriers have less than a ninety percent share.⁹

CAB authority over route-level entry gave it control over airline network configurations. Over time, the CAB used this authority to generate implicit cross-subsidies, awarding lucrative new routes to financially weaker carriers and using these awards as “carrots” to reward carriers for providing service on less-profitable routes (Caves, 1962, ch. 9). Thus, carrier networks were optimized to maintain industry stability and minimize subsidies, but had no necessary connection to cost-minimizing or profit-maximizing design. Though there was concentration of flight activity in airports at large population centers, the resulting networks were generally “point-to-point” systems, as illustrated in trunk carrier route maps (see Figure 2). Moreover, the regulatory route award process largely prevented airlines from re-optimizing their networks to reduce operation costs or improve service as technology and travel patterns changed.

Rate regulation was the second key component of government control. The CAB was authorized to restrict entry in order to prevent destructive competition, but monopoly routes raised the specter of monopoly pricing, another concern of legislators during the 1920s and early 1930s. Authority over rates was therefore deemed essential. An interesting transition occurred between the 1934 Act, which focused on maximum rates and elimination of excess profits, and the 1938 Act, which gave the CAB authority over minimum, maximum, and actual fares, at its discretion. Attention shifted from restraining market power in rate-setting toward ensuring profit adequacy. Control over fares was one tool given to the Board; another was authority to set airmail rates “sufficient to insure the performance of such service, *and together with all other revenue of the air carrier, to ... maintain and continue the development of air transportation to the extent and of the character and quality required for the commerce of the United States, the Postal Service, and the national defense*” (italics added, 72 Stat. 763, 49 U.S.C.A. 1376, in Caves, 1962, 129).

In keeping with this focus, the Board approved most general fare increases initiated by carriers and used the level of airmail rates and selective route awards to adjust profits toward implicit,

⁹ Caves, 1962, 20. This defines monopoly markets as a single carrier with 90 percent or greater market share; duopoly as two carriers with a combined 90 percent or greater market share.

and later explicit, target levels. Proposed discounts, however, were viewed with skepticism and typically disallowed on the grounds that they disadvantaged competitors or were unduly discriminatory across passengers, even if the discounts were associated with lower quality service characteristics. Over time, the fare structure became increasingly distorted in its relationship to cost structures, and resulted in fares substantially above minimum cost service in many markets.

Not until the 1970-1974 Domestic Passenger Fare Investigation did the Board develop a formal cost-based standard for judging the reasonableness of fares. The resulting Standard Industry Fare Level (SIFL) formula provided a nonlinear distance-based formula for calculating fares based roughly on industry-level costs and a target rate of return. SIFL-based fares better aligned the cross-market fare structure with the distance-based economies of modern jet aircraft, though the Board continued to build in some intentional deviations from cost, particularly with respect to greater margins on the longest routes and higher fares for local service carriers. The Board also returned to its historic preference for relatively level fare structures within markets, opposing a variety of promotional fares within markets on grounds of both discriminatory pricing and administrative complexity.

A stunningly different industry structure developed in some intrastate markets, which were exempt from federal economic regulation by virtue of not crossing state lines.¹⁰ California became the poster child for this exercise, as large “lightly regulated” intrastate California markets could be compared to CAB-regulated interstate markets of comparable distance and density on the East Coast.¹¹ Similar comparisons ultimately were drawn for markets in Florida and, following the certification of Southwest Airlines in 1971, in Texas as well. Michael Levine (1965) and William Jordan (1970) focused attention on this California. Levine argued that the scale of the air market between Los Angeles and the San Francisco-Oakland—the largest in the world at that point-- was attributable in large part to the higher growth rates stemming from dynamic competition among a number of carriers that kept service levels and load factors relatively high and fares remarkably low: “Although the lowest fare between Boston and Washington, served only by CAB-certificated trunk carriers, is \$24.65, [intrastate carrier] Pacific Southwest Airlines [PSA], using the same modern turbo-prop equipment, carries passengers between Los Angeles and San Francisco, only 59 miles closer together, for \$11.43. The jet fare is only \$13.50” (at 1433).

Keeler (1972) reached a similar conclusion based on his estimates of prices based on long-run competitive costs for airline service. The model, which predicted observed prices on unregulated intrastate routes to within about three percent of actual fares, suggested that regulated fares were substantially above competitive long-run costs—with 1968 margins ranging from 20 percent to nearly 100 percent over costs, generally increasing with distance.

¹⁰ The CAB attempted various legal arguments to bring intrastate markets under its jurisdiction, most creatively and successfully in the case of intra-Hawaiian markets.

¹¹ The California Public Utilities Commission had oversight authority for intrastate airline markets, but until mid-1965 could not regulate entry and exercised little interference in carriers’ rate-setting. See Levine (1965)

High CAB-regulated fares did not translate into supranormal profits for the industry, however, in contrast to the experience in other regulated sectors, such as trucking.¹² Keeler (1972, at 422) argued that high fares in conjunction with apparent normal rates of return to capital for airlines suggested that “airline regulation extracts high costs in inefficiency on high-density routes.” Carriers responded to high margins with behavior that increased costs, reduced realized returns, and raised the cost of meeting a given level of demand for air service. As Kahn (1971, II: 209) forcefully argued: “If price is prevented from falling to marginal cost... then, to the extent that competition prevails, it will tend to raise *cost* to the level of *price*.” Carriers continued to compete for passengers; with the suppression of price competition, they focused on schedule competition and other aspects of service quality.

Recognizing the potential significance of quality competition, the CAB over its history attempted direct control of some non-price dimensions of competition. These included enforcement of connecting flight requirements on many route awards (to restrict nonstop competition) and limits on the use of first-class and sleeper-seat configurations (or imposition of fare surcharges for such configurations). Largely unregulated dimensions of service quality included a litany of amenities: interior aircraft configuration including seat spacing, food and beverage service, in-flight entertainment, flight attendant appearances and services, and the like.¹³

The most costly forms of nonprice competition, however, focused on aircraft type, capacity, and scheduling. Here, regulatory action was mixed. Competition through new aircraft introduction was explicitly condoned by the Board. The CAB consistently refused to allow airlines operating older, slower, and less comfortable aircraft to charge lower fares than competitors offering service on newer aircraft, even when these lower fares were argued to be necessary to preserve demand for the lower-quality service. This policy effectively made demand lexicographic in aircraft speed and quality, pushing carriers toward faster adoption and diffusion of new aircraft.

Capacity costs were further increased by airline scheduling responses to fixed prices. With passenger demand a function of price, schedule convenience, and expected seat availability (which also increases in-flight quality by raising the probability of being next to an empty seat, and hence, more interior space), suppression of price competition encouraged carriers to increase flight frequency and capacity to compete for passengers. The intensity of flight competition was exacerbated by the apparent S-curve relationship between passenger share and flight share: a carrier with the majority of capacity on a route received a disproportionately high share of passengers (Eads, 1975, 31-34).

As Douglas and Miller (1974) pointed out, however, competing in flight frequency is largely a zero-sum game across carriers. Given fixed prices and rivals’ flight schedules, most of a carrier’s expected increase in passenger volume from adding another flight comes from business-stealing, not demand expansion. With high price-cost margins and the CAB legally prohibited from restricting carriers’ flight schedules, the equilibrium of the non-cooperative game is greater

¹² See Caves (1962) and Keeler (1972). Rose (1985, 1987) documents the magnitude of rents earned by regulated trucking firms.

¹³ Some of these dimensions of competition would not have survived the 1970s regardless of airline regulation; see, for example, Braniff’s “Air Strip” advertising campaign linked to its designer flight attendant uniform ensemble: http://www.randomhouse.com/knopf/authors/lawrence/videos/kpf_lawrence2_T1.rm

flight frequency and capacity, lower load factors (seats sold/seats available), and higher average costs. For example, average load factors in California intrastate markets exceeded 71 percent over 1960-1965, more than 15 percentage points higher than overall average load factors for trunk airlines in regulated markets over the same period (Keeler, 1972, 414). Load factors in regulated airline markets not only decreased with the number of competitors on a route, but also declined with distance (Douglas and Miller, 1974; Eads, 1974, 28-30). Observed load factors appeared to be lower than optimal load factors based on reasonable estimates of passengers' time valuations for all but relatively short monopoly markets (Douglas and Miller, 1974, 91; Eads, 1974, 30).

Moreover, if the CAB attempted to increase rates of return by increasing prices, as it did at various points in its history, service competition would intensify, leading to even lower load factors and higher average costs. As Douglas and Miller (1974, 54) eloquently argue, "the fare level and structure, instead of determining or controlling profit rates, should be viewed principally as determining ... the relative level of excess capacity and the associated level of service quality." Board efforts to raise carrier profits by increasing fares led to what became known as the "ratchet effect," increased flight frequency and declining load factors, ultimately increasing average costs rather than profitability. In the years just prior to deregulation, average load factors fell below 50% for the first time since the very beginning of the industry (see figure 3).

While rent dissipation through scheduling competition is well-documented, there is less evidence on whether labor also extracted a share of the profits. In some industries, regulatory rents were shared with labor, either through increased employment, increased wages, or some combination of both; see Rose (1987) for estimates of labor rent-sharing in the regulated trucking industry, and Hendricks (1994) and Peoples (1998) for cross-industry comparisons. While there is some reason to think airline workers would be able to benefit similarly--regulated airlines were heavily unionized, and labor relations were often contentious—not all factors tilted in the direction of labor strength. On the one hand, dependence on key occupations such as pilots, FAA certification requirements that effectively precluded airlines from replacing flight operations personnel during strikes, interunion rivalry for members of a given occupation class across firms, cooperation across unions representing different occupations within a firm, and CAB limits on airline competition all tended to enhance labor's ability to capture rents. On the other hand, the ability of firms to use the Railway Labor Act provisions to delay or block strikes stemming from contract disputes, the lack of national bargaining units, and the 1958 creation of the Mutual Aid Pact,¹⁴ which provided cross-firm strike insurance, served to limit labor gains. In addition, while regulated prices prevented airlines with lower labor costs from capturing market share by underpricing higher-cost rivals, regulated prices were set on the basis of industry rather than firm-

¹⁴ The Mutual Aid Pact established a system of strike insurance among participating airlines. By 1970, amendments to the Pact elicited participation by all trunk airlines but Delta. The initial pact provided that "each party will pay over to the party suffering the strike an amount equal to its increased revenue attributable to the strike during the term thereof, less applicable direct expenses." (Unterberger and Koziara, 1975, 27). Revisions over time specified guaranteed minimum payments at a specified fraction of the struck carrier's "normal air operating expenses." Unterberger and Koziara (1975) argue that the terms made some airlines more profitable during a strike than they were under normal operations, and contributed to increasing the number and duration of observed strikes.

specific costs, implying high-powered profit incentives for firms to reduce costs relative to industry norms.¹⁵

Empirical evidence suggests that pilots, in particular, were effective in negotiating pay and work rule agreements that captured a significant share of productivity enhancements due to adoption of larger, faster aircraft (Caves, 1962, 110). Comparisons of pilot wages and productivity levels between regulated carriers and intrastate carrier PSA are consistent with this pattern, although much of the productivity difference may be attributed directly to differential scheduling and fleet use resulting from PSA's focus on price rather than quality competition (Eads, 1974). Empirical estimates of the extent of regulatory labor wage gains based on wage responses to airline deregulation suggest relatively modest effects, however, on the order 10 to 15 percent of wages (Card, 1997; Peoples, 1998; Hirsch and Macpherson, 2000). Hendricks, Feuille, and Szerszen (1980) argue that estimates based on wage declines after deregulation may understate rent capture. They point out that deregulation increased the airlines' cost of strikes due to mandated elimination of the Mutual Aid Pact and increased competitive disadvantage of strikes in deregulated markets, and provided little immediate change in unionization rates or in market structure. Some support for their view is provided by Hirsch and Macpherson (2000), who find larger relative airline wage declines over time, and some evidence that wages follow firm profitability cycles.

2. Airline Deregulation in the United States¹⁶

In the mid-1970s, airline regulation began a drastic transformation. Hearings held by Senator Edward Kennedy's Judiciary Committee in early 1975 dramatized the costs and inconsistencies of CAB regulation, and seem to have pushed airline regulation onto the national agenda.¹⁷ Over the next three years, congressional hearings on the industry paralleled administrative reforms.

The appointment of pro-reform chairmen to the CAB heralded a dramatic departure in the Board's attitude toward regulation. The CAB became increasingly receptive to reform, approving discount fares and expanded charter operations under chair John Robson in 1976. This accelerated with the appointment of economist Alfred Kahn as chair in 1977. Kahn, whose 1971 book remains today the preeminent analysis of the origins, principles, and effects of economic regulation, led the Board through a series of administrative reforms that stood the agency's traditional preference for regulation over market determination of outcomes on its head.

Political forces coalesced around legislative deregulation in 1978, with industry opposition splintering and eventually giving way with the passage of the Airline Deregulation Act by Congress and its signing by President Carter in October 1978. The Act provided for a phaseout of regulatory authority by January 1983, and elimination of the CAB itself by 1985. The most significant regulatory legacy was a continuing program of subsidies and oversight of service to

¹⁵ By setting fares independent of an individual carrier's cost, this system would seem to yield high-powered incentives for cost-minimization and technical efficiency by individual carriers (Laffont and Tirole, 1992).

¹⁶ Hundreds, if not thousands, of books and articles have been written on the politics and economics of airline deregulation, with detail we cannot begin to replicate here. For a brief introduction, see Breyer (1982), Bailey, Graham, and Kaplan (1985), Kahn (1988), Borenstein (1992), Joskow and Noll (1994), Morrison and Winston (1995, 2000), and the references cited therein.

¹⁷ Breyer (1982, ch. 16), who was instrumental in focusing Kennedy's attention on airline regulation, provides a superb history and analysis of these events, and argues for Kennedy's role as a catalyst for eventual reform.

small communities under the “Essential Air Service” program. The EAS was supposed to phase out in the 1980s, but political forces have kept it alive to this day. For service to all but these very small airports, however, the transition to competitive markets occurred quite rapidly.

The confluence of several factors in the mid-1970s contributed to the re-examination and eventual repudiation of federal airline regulation in the United States. CAB fare increases over the late 1960s and early 1970s not only increased nominal fares but probably widened margins over competitive costs (Keeler, 1972). Experience with the intrastate markets in California, Texas, and Florida provided stark contrast between regulated and competitive fares. An increasing body of research documented the problems with and costs of federal airline regulation. All of this occurred against a backdrop of political concern with rising price levels and stagnant economic growth, exacerbated by the 1973-1974 OPEC oil price shock. None of this, however, provides an entirely satisfactory explanation for why the airline industry was deregulated, or why it happened in 1978 and not earlier (or later). Though an important role must be assigned to political entrepreneurship by Senator Ted Kennedy and administrative reforms implemented by Alfred Kahn, these were probably not the only determinants, particularly given the coincidence of airline deregulation with regulatory reform across such disparate industries as trucking, natural gas, and banking, among others (Joskow and Rose, 1989; Joskow and Noll, 1994). Peltzman (1989) argues that changing economic interests in regulation were an important contributor (but see the comments on his paper in the same volume); Joskow and Noll (1994) and their commentators argue for a more faceted political economy interpretation. With few such deregulatory events, however, it is difficult to disentangle the complex interactions that lead to such major changes in the role government plays in the business economy.

The CAB moved quickly to implement provisions of the Airline Deregulation Act of 1978 and accelerated the shift from government to market decision-making in the industry. Many entrepreneurs were quick to respond to the new opportunities – new entrants proliferated and some incumbents expanded rapidly – while management at some of the “legacy” airlines proved to be much less nimble. The impact of deregulation became evident in several areas: Removing regulatory price controls led to lower average prices, a substantial increase in price variation, and efforts to soften price competition through differentiation and increases in brand loyalty. Lifting entry restrictions altered market structure at the industry, airport and route levels, and led to re-organization of incumbent airline networks. The industry also developed new organizational forms, including code-sharing and alliances across airlines, particularly in the aftermath of tighter merger policy. Shifting from price to nonprice competition reduced many aspects of service quality, although the quality declines of most concern are attributable not to deregulation but to government infrastructure policy. While some of these impacts were anticipated during the debate over deregulation, others were quite unexpected (e.g., Kahn, 1988).

Price levels, dispersion, and loyalty programs

The aftermath of U.S. airline deregulation seemed to confirm the forecasts of academic economists and others who predicted substantial fare reductions and concomitant traffic growth. Between 1976 and 1986, average domestic yield (revenue per passenger-mile), as shown in Figure 4, declined by 30 percent in real terms, while revenue passenger-miles, shown in Figure

1, more than doubled. The subsequent two decades saw real yields decline an additional 26 percent, and traffic grow at an annual compounded rate of 3.3 percent.

Price levels: While aggregate growth statistics don't isolate the contribution of deregulation from the pre-existing trend toward lower airfares due to technological and productivity improvements, a simple counterfactual exercise is illustrative. In this, we construct the "as-if regulated" fare on each route from the Standard Industry Fare Level (SIFL) formula developed by the CAB in its final fare investigation.¹⁸ This appears as the top line on Figure 4. Based on the comparison of passenger-mile-weighted average yields and SIFL-based fares for tickets in Databank 1A, actual fares were roughly 30 percent lower than as-if regulated fares in 2004, saving passengers roughly five billion dollars.¹⁹

The gains from lower prices have not been distributed uniformly across airline customers. For example, while average fares were 30% below SIFL in 2004, 28% of economy class passengers paid a fare greater than the SIFL for the route on which they were flying. While deregulation advocates argued that the CAB may have allowed too little variation in fares—to account for difference across carriers in their service amenities, to better align demand fluctuations with shadow costs of capacity through off-peak discounts, or to recognize differential costs across leisure and business customers—it is safe to say that few if any people predicted the enormous range of prices, both across and within routes.

Variation in prices across routes: There is considerable variation in average price levels across routes, even after controlling for cost drivers. Passenger-weighted comparisons indicated smaller declines in yields and smaller differences between actual yields and SIFL yields than do passenger-mile-weighted comparisons, suggesting that long-distance passengers have benefited more from deregulation than have short-haul passengers. Fares also tend to be higher on concentrated markets and for flights in and out of airports dominated by a single carrier, all else equal.

The identity of competitors, in addition to the presence of competition, appears to be an important determinant of route average price levels. From the beginning of airline deregulation, there have been "no-frills" or "low-cost" carriers that have operated with much lower costs than the legacy airlines. The best known of these today is Southwest, but many others have entered and failed over the nearly three decades since deregulation. This is especially puzzling, because of the enormous cost advantages they seemed to maintain. Figure 5 tracks the standard industry cost measure of cents per available seat-mile for the legacy carriers (and their successor companies) and for some of the largest low-cost entrants that have operated since deregulation,

¹⁸ While the plausibility of this largely unchanging counterfactual is increasingly stretched as regulation recedes, the Department of Transportation continues to update this formula based on input cost and productivity changes. See <http://ostpxweb.dot.gov/aviation/domfares/siflb.pdf>. The calculation reported here exclude free travel tickets in the DB1A, which would tend to reduce actual yields while leaving SIFL unchanged. Dollar savings are scaled up from the 10 percent sample in the DB1A.

¹⁹ Morrison and Winston (1995, 12-14) perform a similar analysis of actual to SIFL fares for 1976 through 1993. They argue that deregulation increased productivity, and therefore adjust the SIFL index upward by 1.2 percent per year over 1978 and 1983, and by a constant 8.7 percent thereafter, to remove estimated deregulation-related productivity gains. This leads to an even greater gap between actual and SIFL yields, implying a greater fare impact of deregulation than is shown on our graph.

many of which did not survive or have made trips through bankruptcy court.²⁰ The presence of these low-cost competitors on a route substantially dampens average fare levels; see, for example, Morrison (2001) and Goolsbee and Syverson (2005) for recent analyses. In the last few years, the encroachment of low-cost carriers seems to have accelerated, due in part to continued expansion of Southwest and in part to the rapid growth of some other low-cost airlines (see Figure 6).

Variation in prices across passengers on the same route: Despite the CAB's reluctance to deviate from very simple fare structures (e.g., a single coach and first-class fare on each route), some price variation is undoubtedly efficient in the airline industry. With fixed capacity, stochastic demand, and a non-storable product, efficient prices will vary intertemporally with demand realizations. Even tickets on the same flight purchased at different times may carry different prices (See Prescott 1975, Salop 1978, and Dana 1999a and 1999b). While this suggests some change from a relatively level regulated fare structure, few observers were prepared for the often-bewildering array of fares available on any given airline-route, the tremendous variation in prices paid by different passengers on the same carrier-route, and the rapid increase in that variation after 1984.

Airlines were quick to use pricing flexibility to introduce fare variation. Shortly after deregulation, American Airlines introduced a menu of "Super Saver" fare schedules. These were targeted at increasing air travel among leisure travelers, with ticket restrictions that included both advanced purchase (14 or 21 days) and minimum stay (7 days or longer, generally). Airlines soon recognized that Saturday-night stay restrictions were nearly as effective as minimum stay requirements in selecting out low-elasticity business travelers from discount fare purchases, and imposed lower costs on the high-elasticity discretionary customers at whom the low fares were aimed. The Saturday-night stay restriction replaced minimum stay on discount tickets in most markets, and became the standard self-selection device for major airlines over the next twenty-five years.

The effect of this was an almost immediate boost in fare dispersion. Morrison and Winston (2000, 19) report that fare dispersion, which they measure by the Gini coefficient of fares at the carrier-route level, increased to about .15 in 1979, roughly where it remained through 1984. This implies an expected absolute fare difference between two randomly selected passengers on a carrier-route of about 30% of the mean fare. Average levels of fare dispersion mask significant differences across carriers and routes, however. Some carriers, particularly among the low-cost and entrant airlines, have relatively few ticket categories, and relatively low gradients of fare increases as restrictions are removed. Others may have 20 or more different ticket restriction/price combinations available for purchase on a given route. Moreover, there appear to be substantial differences across routes in dispersion. Borenstein and Rose (1994) analyze the determinants of price dispersion, with particular attention to the impact of competition, using a cross-section of carrier-routes in 1987. Their work suggests that dispersion increases with the move from monopoly to duopoly to more competitive route structure. This finding is consistent with price discrimination based not only on customer heterogeneity in their overall elasticity of

²⁰ The figure does not adjust for average flight distance, but most of the low-cost carriers have flown shorter flights than industry average which would normally imply higher cost per ASM.

demand for air travel (e.g., across business and leisure travelers), but also on heterogeneity in cross-brand price elasticities, such as might result from differences in airline loyalty.

Over time, however, fare structures grew even more complex, with an increasing variety of advanced purchase durations (3, 7, 14, and 21 days being most common), discounts for low-travel demand days or times, temporary price promotions, negotiated corporate discounts, upgradeable economy tickets, and most recently, web-only, auction-determined and “buyer offer” prices. The spread between the top unrestricted fares and lowest discounted fares also increased. Accompanying this has been the development and increasing sophistication of airline revenue management systems, which monitor the evolution of demand relative to forecast demand and allocate seats to each fare “bucket” to maximize expected revenue for the airline (Belobaba, 1987). American Airlines reported that yield management systems added approximately \$500 million to annual revenue for the airline in the early 1990s (Smith et al., 1992).

These factors have led to further increases in fare dispersion from its mid-1980s levels. Figure 7 shows the evolution of airline price variation, measured by the coefficient of variation in fares (standard deviation/mean) since 1984. The top curve reports the mean coefficient of variation in prices within a route; the bottom curve reports the mean coefficient of variation in prices for passengers within a carrier-route. As illustrated by the closeness of the two curves, cross-carrier price variation contributes relatively little to within-route dispersion; most is attributable to the enormous variation in prices any one carrier charges in a given market. The pattern illustrated in this figure is consistent with increasing concern over fare structure complexity and price dispersion through the 1990s. Price dispersion within carrier-routes nearly doubles between 1984 and 1998, before leveling off through 2001. The 2001 coefficient of variation of .55 implies a standard deviation that is more than half the mean fare. The more recent decline, post 9/11, is discussed in section 3.

Loyalty programs: American Airlines led the industry into the use of loyalty programs with its introduction of the first frequent flyer program in 1980. Other airlines quickly followed. Since then, airlines have offered loyalty programs not only for individual customers in the form of frequent flyer programs, but also for travel agents who steer clients their way, and to corporations in the form of bulk discounts. Frequent flyer programs evolved into businesses on their own in the late 1980s as airlines began to sell frequent flyer points to other retailers – hotels, supermarkets, credit cards for example – to then be given to customers. While other retail sectors have followed suit with their own loyalty programs, airline frequent flyer programs remain by far the most successful.²¹

Loyalty programs typically reward travelers or travel agents with a nonlinear schedule of potential rewards, generating an increasing return to incremental purchases. The programs for individuals and travel agents also take advantage of an incentive conflict that may exist between the entity paying for the ticket (often the individual’s employer or the agent’s customer) and the

²¹Recent changes to these programs have greatly devalued the frequent flyer points currency, increasing the miles needed to redeem award travel and reducing the number of seats available for those awards. This strategy seems to have reduced the concerns some analysts have voiced about the airlines’ liability represented by the billions of outstanding points.

person receiving the loyalty bonus (the traveler or travel agent).²² Loyalty programs soften price competition across carriers, as they induce a switching cost for travelers (or travel agents) by raising net cost if travel is spread over several airlines rather than concentrated on a single airline over time.²³ The programs also link service across markets, basing rewards on the total amount purchased from the airline in all markets, not just one city-pair, and providing greater redemption opportunities on airlines with substantial service in a passenger's home market. In this way, they potentially further insulate large network carriers from competition on individual routes. More recent refinements to the programs leverage the effect, by targeting rewards such as preferential boarding and seating, upgrade availability, and free travel availability only to the highest volume travelers flying 50,000, 100,000, or more miles on the airline within a calendar year.

During the 1980s, policymakers became concerned that some airlines used distribution systems to further insulate themselves from price competition. Until the late 1990s, travel agents issued more than 80% of all airline tickets, with the bulk of the remainder issued directly by the airlines. In the 1980s, agents started using computer reservation systems (CRSs) that allowed them to directly access airline availability and fare information. CRSs grew out of airlines' internal computer systems and were originally owned by the airlines. This raised the potential for airline owners to bias the systems' response to information queries in a way that advantaged them and limited price competition. Concern about bias of information displays in favor of one carrier became a competitive issue for much of the 1980s and 1990s, ultimately leading to formal regulatory restrictions on CRS display criteria in 1984 and 1992.

This concern has faded with the second major innovation in the distribution, use of the internet. As users of sophisticated electronic reservation and ticketing interfaces with travel agents, the airlines were well-prepared to move into internet sales of their product, and airline and independent travel agencies were early adopters of internet marketing and sales. This had particular appeal to airlines, who saw the internet as a way to bypass the traditional sales channel, travel agents, in favor of lower-cost electronic ticketing methods. For years, airlines had complained about inefficiency of travel agency distribution and the high cost of travel agent commissions, at ten percent or more of ticket prices. No single airline was willing to reduce their commission rate unilaterally, however, fearing that travel agents would "book away" from them. With the diffusion of internet sales, carriers saw an alternative.

In the last decade, online ticketing has skyrocketed, comprising more than 30 percent of sales in 2002 (GAO, 2003). Airlines have gradually eliminated travel agent commissions on domestic tickets and reduced commissions on international tickets. They now generally charge higher distribution fees for tickets not sold electronically, even for those booked directly with the airline over the phone. While reduced travel agency commissions and online ticketing have dramatically reduced airlines' distribution costs, the internet also has made it easier for customers to shop for low fares, find alternative airlines and routings, and generally become better informed about travel options and their costs. Some have argued that the greater

²² The most obvious manifestation of agency problems were short-lived promotions in late 1988 and 1989, such as the Eastern shuttle promotion handing passengers \$50 American Express gift cheques as they boarded, and Continental's promotion giving a \$50 bill (distributed at the airport) to customers traveling on high-fare tickets.

²³ Borenstein (1996) presents a model of repeat-buyer programs in network industries and discusses their use in many industries during the twentieth century.

transparency of airline fare structures to final consumers may have contributed substantially to reduced bookings for full-fare, unrestricted, tickets. While online travel search engines could be susceptible to display bias of various kinds (an issue that has attracted considerable attention with respect to their hotel listings, for example), the largest systems claim to present neutral airline displays, and allow consumers to re-sort search results according to a variety of criteria.

Entry and exit, airline networks, and market structure

Entry and exit: Expansion by existing carriers and entry by new firms dramatically altered industry structure in the immediate aftermath of deregulation. The eleven trunk and dozen local service/ Alaskan/ Hawaiian legacy carriers authorized to provide regulated jet service prior to 1978 were joined by forty-seven new entrants by 1984; see Figure 8. Most of the new entrants, and some of the legacy carriers, left the industry through acquisition or liquidation over the subsequent decade; forty-eight carriers exited between 1984 and 1987 alone.²⁴ Of the carriers who began interstate service through 1984, only seven operated in 1990, and only Southwest and America West remain in operation today. This appears to reflect more than transitional uncertainty in the aftermath of deregulation, as entry peaked again in the mid-1990s, with twenty-one new entrants between 1993 and 1995, three of which remained in operation through 2003. By 2004, twenty-six years after deregulation, nine of the twenty-three legacy carriers continued to serve the market, with a combined domestic market share of 67%.

Financial distress, reorganization and exit have been as much a part of the industry as new entry since deregulation. Of the seven airlines that currently carry at least five percent each of domestic U.S. traffic, three have filed Chapter 11 bankruptcy at least once and two currently are in bankruptcy. We discuss the causes and effects of this financial volatility in section three, but note here that Chapter 11 bankruptcy filings do not equate with an airline shutting down. Although some of the larger carriers that have entered bankruptcy have been liquidated, the majority have emerged to operate as publicly-held companies or been merged into another airline, generally without interrupting operations, or for no more than a short period, during the bankruptcy process.

While bankruptcies are costly for the affected firm's shareholders and its workers, and broadly disparaged by politicians and industry lobbyists, there is little evidence that they harm competitors or consumers. Borenstein and Rose (1995) found that airlines tend to lower their fares before entering bankruptcy, but healthy competitors don't follow and the fare declines are generally short-lived. When bankrupt carriers do reduce service, other airlines generally are quick to jump into their abandoned markets. Borenstein and Rose (2003) find no statistically discernible effect on the service to small and large airports when a carrier with operations at the airport declares bankruptcy. Even at medium sized airports, where they do find a statistically significant effect, total service to the airport declines by less than half the number of flights that the carrier offered before bankruptcy.

Airline networks: Incumbent airlines responded to elimination of regulatory restrictions on route awards by restructuring as well as expanding their networks. The almost immediate transformation from the point-to-point systems created by the CAB entry policies into hub-and-

²⁴ Correlation between entry rates and exit rates at the industry level is common; see Dunne, Roberts, and Samuelson (1998).

spoke networks was perhaps the most unanticipated result of deregulation, and fundamentally altered the economics of airline operations. The new networks served passengers traveling to and from the central hub airports with nonstop service, and passengers traveling between two points on the spokes with change-of-plane service through hub airports.

The hub-and-spoke configuration provided cost, demand, and competitive advantages. Hubs generally increased available flight options for passengers traveling to and from hubs and made possible more convenient service on routes for which demand is not sufficient to support frequent nonstop service at relatively low prices. Operating cost economies arise from the increased density of operations, allowing the airline to offer frequent service on a segment while maintaining high load factors. At the same time, because very few airports have the logistic or economic capacity to support more than one large-scale hub operation, competition at the hub airports typically is quite limited, yielding substantial market power for airlines at their own hubs. In addition, the frequent flights and extensive destinations available on the hub airline tend to give that airline a demand advantage *vis-à-vis* its competitors on routes out of the hub (Borenstein, 1991), arising from both fundamental consumer preferences and substantially enhanced by the development of airline loyalty programs subsequent to deregulation. These effects are reflected in greater competition on routes that are served through nonstop and connecting service through numerous alternative hubs compared to competition for service to and from the hub airports.

Considering concentration for trips to and from the twelve major hubs that have existed since the mid-1980s²⁵ reveals an interesting pattern. These routes had about the same concentration as the national average in 1984, but diverged markedly by 1989, with hub-route HHIs averaging 0.52 versus 0.43 for non-hub routes. Since then, the difference has gradually narrowed again. In the most recent data, concentration is again about the same on hub and non-hub routes.

Market Structure: While the early entry wave substantially reduced concentration in deregulated airline markets, merger activity in the mid-1980s acted as a substantial counterweight. Mergers peaked in the mid-1980s, when antitrust policy was relatively lax and greater credence was given to the view that potential competition could discipline prices as effectively as actual competition. By 1990, as antitrust policy became stricter in general and concerns about airline competition and hub dominance increased, merger activity slowed considerably. Since then, nearly all mergers have involved at least one airline that was in extreme financial distress. Other merger proposals, such as the USAir/United merger proposed in 1999, met with sufficient threat of antitrust opposition that they usually were withdrawn.

As mergers declined, alternative forms of horizontal linkages were introduced. In the 1980s, U.S. major airlines had pioneered partnerships with small commuter airlines that allowed each carrier to sell tickets for trips that use the commuter airline to bring the passenger to the carrier's hub and then the large carrier to fly between major airports. These partnerships allowed coordination of schedules and "code-sharing," which presented the product as a single-airline ticket. Other carriers, most notably American, chose instead to vertically integrate into the

²⁵ These are ORD, ATL, DFW, DEN, STL, DTW, MSP, PIT, IAH, CLT, SLC, and MEM.

commuter airline business, buying some commuter carriers and expanding their fleet to form American Eagle, which is wholly owned by American Airlines.²⁶

Code-sharing alliances between major carriers began with agreements between U.S. and foreign air carriers, as a response to continued entry regulation of international routes.²⁷ By the late 1990s, these were extended to relationships among many large U.S. airlines. Northwest and Continental, for instance, formed an alliance that allowed each to sell tickets under its own brand name that included flights on the other airline. These alliances, domestic and international, now generally include cooperative arrangements for frequent flyer plans, joint marketing, facilities-sharing, and scheduling, though prices are required to be set independently.

The net effect of these various changes in the industry was a decline in average concentration at the route level in the immediate aftermath of deregulation. From an average route-level Herfindahl Index (HHI) of about 0.56 in 1978 (Morrison and Winston, 1995), the HHI declined on both hub and non-hub routes through the early 1980s (see Figure 9). Concentration, particularly on hub routes, rose from the mid-1980s through the late 1990s. In the past few years, concentration levels for hub and non-hub routes have converged, in the range of about .50. How much of this re-consolidation was inevitable in an unregulated market and how much was the result of ancillary government policies including liberal merger policy continues to be debated. Two unanticipated developments—reconfiguration of airline route networks into hub-and-spoke systems, and strategic innovations in loyalty programs that differentiated airlines' services and dampened competition—contributed to increases in route-level concentration. Government policies, however, particularly with respect to antitrust, exacerbated any latent tendencies toward concentration. The question of whether market power concerns require something more than antitrust attention continues to surface, and is addressed in section three.

Service Quality

Once carriers were free to compete on price, the nature of competition required reevaluation. In general, airlines have found price easier to differentiate across passengers on a route than quality, apart from premium class service—business or first—with its own cabin. While some consumers attached high valuations to various aspects of quality, more seemed to prefer lower prices. Competition was diverted from less-valued nonprice dimensions (which led to high regulated era service quality) toward price, resulting in reductions in service quality. Some attributes associated with network reconfiguration and increased density, such as flight frequency and online connections, were maintained or improved; others, such as safety levels which continue to be regulated, were unaffected; and many, particularly those associated with on-board amenities, were reduced. Airport congestion and flight delays, which manifest among the visible and significant declines in service quality, are more properly attributed to the success of deregulation in increasing traffic and the failure of infrastructure policy to keep pace, rather than altered carrier choices under economic deregulation. Reduced levels of service quality overall by no means suggests that consumers as a group are worse off, though quality-loving, price-

²⁶ Some decisions on organizational form were undoubtedly influenced by expected operational and labor costs associated with ownership of commuter carriers.

²⁷ Frustrated by restrictions on entering international routes, major U.S. carriers also began to create “alliances” with foreign carriers that followed the same model as their partnerships with commuter airlines.

inelastic consumers may well be. We discuss below deregulatory impacts on service quality with respect to some of the key service quality metrics.

Flight frequency and connections: The reorganization of airline networks following deregulation led to increased frequency for service to and from hub airports and reduced non-stop service between smaller airports, all else equal (e.g., Bailey, Graham, and Kaplan, 1985, 83-86). While there were important variations across specific markets, the net effect was an average increase in frequency of nonstop service from small airports to medium and large airports, and a dramatic increase in availability of online connecting service to other destinations. Because online connecting service (change of aircraft but not airline) is associated with improved connections and better baggage handling, this improved the estimated net quality of service even though the overall fraction of passengers with connecting, as opposed to nonstop, tickets increased slightly after 1978 (Morrison and Winston, 1995, 21-23). Moreover, greater passenger volume has undoubtedly facilitated an increase in flight frequency in many markets, relative to the high price, low volume regulatory model, even with higher deregulatory load factors and hub network configurations. Figure 10 records changes in domestic service levels between 1984 and 2004. Not only have flights increased nearly 90 percent over the three decades, but the number of markets with nonstop service is almost 70 percent higher.

Load factors: Given the tendency toward inefficiently low load factors during the regulatory period (Douglas and Miller, 1974), it is not surprising that load factors generally have increased since 1978, as shown in Figure 3. Average load factors for domestic scheduled service climbed from lows of under fifty percent just prior to deregulation, to over sixty percent in the mid-1980s, and roughly seventy percent or more since the late 1990s. While much of this increase is due to carriers' ability to compete on price rather than flight frequency alone, it has been facilitated by the increasing sophistication of airline booking systems. These systems manage dynamic demand forecasts and seat allocation to the myriad fare classes, enabling airlines to fill seats that would otherwise go empty with a low-fare passenger, while reserving seats for likely last-minute high-fare passengers.

Higher load factors have contributed to lower costs per revenue passenger-mile, but also to lower quality flight experiences for consumers. With high load factors, late-booking travelers may have difficulty finding a seat on their preferred flight, and in-flight experiences become more crowded. Gone are the days of almost being assured an empty middle seat on most cross-country flights. While many travelers complain about crowded planes, it is important to recognize that airlines have the option of offering higher price, less-crowded flights. That virtually none choose to do so suggests that passenger demand is not sufficient to justify the price/cost tradeoff.

In-flight amenities: Quantifying the provision of in-flight amenities is difficult, but it seems clear that this area has experienced perhaps the greatest decline in quality since deregulation. The days of piano bars in 747s, gourmet meals, and designer flight attendant uniforms are long past for most travelers.²⁸ More significant for many passengers has been the decrease in their space on-board. Coach class seat width and pitch has decreased, even while Americans'

²⁸ Though Delta's low-cost subsidiary, Song, advertised designer flight attendant uniforms as part of its early promotion.

girths have increased, and high load factors make empty middle seats less and less common. The decline in amenities has not been monotonic or universal, however. In recent years, airlines have abandoned the headset or movie charges they imposed for in-flight entertainment, and some, like Jet Blue, promote their service with in-flight entertainment options. American and United have experimented with increases in seat spacing for at least some service. However, carriers that have differentiated themselves primarily by offering plusher on-board service have not been particularly successful, suggesting that when passengers vote with their wallets, low prices beat higher quality.

Oversales and denied boarding: With fixed capacity, uncertain demand, and last-minute cancellations or no-shows among passengers, airlines generally have found it optimal to offer more tickets than there are seats on a given flight. In the rare instances in which everyone on an oversold flight actually shows up, some passengers will be denied boarding. The CAB addressed this concern in the 1978 with a rulemaking on denied boarding compensation. Rather than ban oversales (one proposal), the Board attempted a market-based solution, which has persisted through today. Airlines are required first to seek volunteers to give up their seats, for some compensation that is at the discretion of the airline. Airlines may have some “standard offer” compensation, though many conduct informal auctions, increasing offered compensation (usually in the form of free travel, booking on the next available flight, and perhaps food or hotel vouchers) until the requisite number of volunteers are obtained. In almost 95 percent of the cases, this solves the problem.²⁹ In the remaining cases, passengers are to be boarded in order of check-in times, and those involuntarily denied boarding are awarded compensation determined by the regulation.³⁰ Denied boarding rates are collected and published by the Department of Transportation, in theory allowing passengers to infer their probability of being denied boarding before purchasing a ticket, though this seems unlikely to be a factor for all but perhaps a very few passengers.

The imposition of change and cancellation penalties and nonrefundable discount tickets for no-shows, most likely adopted to prevent business travelers from purchasing tickets intended for leisure travelers, have undoubtedly helped to increase the predictability of boarding rates among travelers holding those tickets. But as load factors have increased to sixty or seventy percent, the number of flights for which oversales are a potential problem has increased. Moreover, maintaining the administrative compensation cap for involuntary denied boardings at 1978 dollar levels has undoubtedly made it more binding relative to travelers’ time value.³¹ Yet involuntary denied boardings declined from 0.044 percent of all enplanements in 1980, to 0.016 percent in

²⁹ The overall denied boarding rate has varied within a narrow band of 0.15% to 0.22% since 1990; voluntary denied boardings account for 90% to 95% of these. See the U. S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Statistics 2003, Table 1-58, at http://www.bts.gov/publications/national_transportation_statistics/2003/html/table_01_58.html.

³⁰ Denied boarding compensation is not mandated if the oversale is due to substitution of smaller aircraft than originally scheduled, the passenger has not complied with check-in requirements, or the delay is less than one hour.

³¹ Since 1978, the compensation has remained at twice the passenger’s one-way fare subject to a cap of \$400 for delays greater than two hours, or half this for delays of less than two hours, plus accommodation on the next available flight. The presence of an administratively set cap can lead to inefficient outcomes (see Blanchard, 2004), but the cap is only a part of the cost of involuntarily denying boarding. Customer dissatisfaction and loss of repeat business may make the cap much less binding than the dollar limits would indicate, especially if the last to check-in customers are more likely to be business flyers.

1990, and 0.008 percent in 2003, suggesting a continued improvement in this aspect of service quality.³²

Travel time and delays: One of the most contentious issues in the deregulated airline environment has been the dramatic increase in travel time, particularly that due to congestion and delays.³³ Substantial increases in flight operations (see Figure 1), with limited increases in infrastructure capacity and few changes in infrastructure deployment, have led to dramatic increases in congestion at key points in the aviation system. This has not only increased scheduled travel time in many markets, but increased mean delay beyond scheduled travel time and increased uncertainty around expected arrival times. The Bureau of Transportation Statistics On-Time performance database reports that in 1987, roughly 26 percent of all flights arrived more than 15 minutes after their scheduled arrival, with a mean delay over all flights of 9.45 minutes. Despite lengthening schedules, this had increased to 27 percent of all flights arriving late, with a mean delay of 10.47 minutes in 2000, when flight delays at some airports reached unprecedented levels.³⁴

Flight delays have numerous causes. Some disruptions, such as severe weather, are beyond an airline or airport's control. Incentives to set schedule based on favorable, or even average, conditions (see Mayer and Sinai, 2003) make some delays inevitable. The existence of delays at hub airports, where congestion externalities are relatively small for the dominant carrier, suggests that airlines may optimize their networks with some expected delay built in (Mayer and Sinai, 2003). But a significant portion of delays appear due to inefficient infrastructure investment and utilization policies, as we discuss in Section three.

Safety: The level of airline safety has been a focus of government policy since the infancy of the industry, when Post Office airmail contracts were shifted from military aircraft to civilian contractors after a series of fatal accidents involving military pilots. Despite economic deregulation, the Federal Aviation Administration has maintained authority over all aspects of air carrier safety, from certification of new aircraft, to airline maintenance, training, and operating procedures, to airport and air traffic control system operation. Even though safety regulation was not reduced, some opponents to the Airline Deregulation Act warned that that the competitive pressures resulting from economic deregulation would reduce the level of safety provided by commercial airlines. Economic theory is not dispositive on whether such an effect would be expected (Rose, 1990).

Fortunately, there is no evidence that airlines have reduced their provision of safety since deregulation. While research finds some evidence that carriers' safety records may be influenced by their financial condition, particularly for smaller airlines (Rose, 1990 and Dionne, 1997), and Kennet (1993) finds that engine maintenance cycles lengthened somewhat after deregulation, economic analyses do not suggest lower levels of safety following deregulation. This is

³² See U. S. Department of Transportation, Bureau of Transportation Statistics, Table 1-58, *supra*.

³³ Morrison and Winston (1995, 25-26) report an increase in average actual travel time between 1978 and 1993 of roughly 9 minutes per flight segment for flights that existed throughout the period. This includes both scheduled and nonscheduled increases in elapsed time. For comparability, the Bureau of Transportation Statistics On-Time Performance database (http://www.transtats.bts.gov/tables.asp?table_id=236) reports mean delays over all flights in 1993 of 5.34 minutes, with 18% of flights arriving more than 15 minutes after scheduled arrival.

³⁴ See the discussion of LaGuardia airport's 2000 experience, below, and in Januszewski (2004).

consistent with a range of other work, and with continuing declines in overall and fatal accident rates for U.S. commercial airlines (see also Oster, Strong, and Zorn, 1992; Rose, 1992). This is not terribly surprising. Not only does safety continue to be directly regulated, but airlines also perceive strong safety reputations to be a prerequisite to attracting any passengers. The rapid demise of carriers, such as ValueJet, who fail to maintain such reputations lends credence to that view.

3. Continuing Issues in the Deregulated Airline Industry

Airline deregulation in the U.S. has clearly benefited consumers with lower average prices, more extensive and frequent service, and continued technological progress in both aircraft and ticketing. The industry continues to attract considerable attention from economists and policy makers, however, in part because its business practices have been so dynamic and differentiated while airline earnings have been tremendously volatile. If the fundamental question of industrial organization is the degree to which unfettered markets achieve efficient production and allocation of outputs, and the extent to which government intervention can improve such efficiencies, the airline industry may illustrate those issues as well as any.

After more than a quarter-century of experience since deregulation, some observers continue to call for renewed government intervention in the economic decision-making of the industry. The concerns divide somewhat imperfectly into three areas. First, is the current organization of the industry economically sustainable? U.S. airlines have lost billions of dollars during demand downturns that occurred at the beginning of the 1980s, 1990s and during 2001-2005. Do these losses indicate that fundamental change in the organization of the industry – e.g., to a tight oligopoly – is necessary before the sellers will be able to sustain a competitive rate of return over the long run? Or, alternatively, are the losses just the result of investor exuberance and management weakness that led to excess capital and inflated costs during high-demand periods, setting the companies up for extreme earnings downturns when demand weakens? Put differently, will firms' self-control of capacity and labor cost growth during good times be enough to reduce the cyclicity of the industry, or is the instability of this industry fundamentally different from most others?

Second, should market power be a significant public policy concern in this industry? Mergers and use of loyalty programs may raise barriers to entry by new firms and barriers to market expansion by existing firms, but how large are these effects, and can they be moderated through application of antitrust policy? Does the poor earnings record of the airlines demonstrate that market power is not a significant issue? Conversely, does the enormous apparent cost advantage of smaller airlines – which still have only slightly over 20% of the U.S. market -- indicate just the opposite, that the market power of incumbents has allowed them to impede the loss of market share to much more efficient rivals. If this is the case, then the market power may create both the usual static deadweight loss from underconsumption and production deadweight loss from exclusion of a more efficient firm.

Finally, much of the air travel infrastructure remains in government hands, and there remain questions about the efficiency of the interaction between government resources, including airport

facilities and air traffic control, and the private air transport sector. Congestion and delays soared prior to the collapse of traffic following 9/11, and show signs of re-emerging as critical issues. These suggest that government-run airport and air traffic control systems may have lagged behind the industry's dramatic expansion since deregulation. Are the government-controlled support activities well-coordinated with the private sector? Is imperfect coordination leading to significant inefficiencies in the industry? And, would privatization of these government services be likely to improve performance?

Sustainability of Airline Competition

Airline profits over the post-deregulation period have fluctuated wildly, with a high of nearly \$5.4 billion in net income in 1999 and a low of over \$11 billion in net losses in 2002. From observations like “the U.S. airline industry lost more money in 2002 than it had made in its entire history,”³⁵ two different, but related, theories have been argued to show that competition in the airline industry is not sustainable. These are versions of the “destructive competition” concerns that were raised in early discussions of the need for airline regulation in the 1920s and 1930s. Their basic idea is that unconstrained competition leads to prices too low to sustain viable firms. The outcome may be evolution into a monopoly or tight oligopoly, though supranormal profits associated with this structure may then set off another round of “excessive” investment and competition.

The first theory tends to be popular with the media and with some industry lobbyists pursuing a regulatory- or tax-relief agenda. Proponents of this theory note that the airline industry has substantial fixed costs and very specific assets used to produce a homogeneous good, and at the same time is subject to highly cyclical demand and frequent shocks to variable cost. In such an unregulated environment, it is argued, boom/bust cycles are inevitable and will lead to underinvestment, or, in the extreme, a complete collapse of funding for the industry.

While the description of industry-specific fixed costs and cyclical demand is reasonably accurate, it should be noted these are not unique to airlines. Moreover, the conclusion of inevitable collapse is difficult to reconcile with the history of this industry, or that of other capital-intensive industries that face unpredictable demand. Like those in other industries – steel, autos, semiconductors, oil refining, and telecommunications among others – airline earnings are likely to be volatile, which can lead to bankruptcies. With long-lived industry-specific capital, failures tend to change the identity of its owners with little effect on the overall capital stock. This can depress returns for extended periods of time, as we saw in oil refining for most of the 1980s and 1990s and in telecommunications infrastructure in the early 2000s.

These conditions present a problem in the economic or industrial organization sense only if the unpredictability results in returns insufficient to generate investment in the industry. In the airline industry, however, inadequate industry investment is virtually never mentioned as a problem. Over the last three decades, the far more frequent complaint from the airlines has been that there has been too much capital pouring into the industry; this complaint often is accompanied by a plea from the industry to limit entry and expansion in order to “rationalize” capacity and ensure adequate returns to investment.

³⁵ In undiscounted cumulative current dollars of accounting net income. A true, but perhaps not terribly meaningful statement.

The second theory appeals to the existence of scope and network economies in production of air transportation. Proponents argue that the efficient configuration of production implied by these economies suggests that the number of viable firms may be quite small in equilibrium. A nuanced version argues that there may be an “empty core” to the competitive game, if, for example, costs of producing a large set of air travel services among many cities are lowest if provided by one firm, but costs are not locally sub-additive. That is, if subsets of those routes could be served at a cost below the incumbent’s fares, an entrant serving just those routes could be profitable while rendering the reduced system of the incumbent unprofitable. The entrant’s set of city-pair markets might, in turn, be vulnerable to further attack by entrants serving other subsets of markets, leaving groups of markets that are not breakeven on a standalone basis.³⁶ Periodic upheavals in the industry might follow the breakdowns and reforming of coalitions.

There is little empirical support for either an empty core or natural monopoly characterization of the airline industry. There is widespread agreement among researchers and industry participants that economies of scale and density exist, but empirical estimates of their magnitude have found fairly modest advantages of size. Within the scale of the major airlines, there seems to be little correlation between overall size of operations and unit cost. After more than 25 years, there is no evidence that cost advantages are giving the largest airlines increasingly dominant positions, as indicated by figures 5 and 6.

We would note, moreover, that complaints of inadequate returns on investment are not unique to the deregulated environment, nor to the airline industry. Regulators faced ongoing claims of profit inadequacy, although economic analyses suggested that returns generally covered the industry’s cost of capital (Caves, 1962) and that attempts to increase returns through higher fares generally led to increased capacity investment rather than increased profitability (Douglas and Miller, 1974). While it is true that the level of profits in current dollars exhibits substantially greater fluctuations post-deregulation, this is to be expected given price inflation and the stunning increase in the scale of the industry. Figure 11 adjusts for both of these factors, using industry aggregate constant dollar net income per available seat-mile and constant dollar net income per revenue passenger-mile from 1960 – 2003.

Still, the airline industry volatility remains a concern and a puzzle. A more detailed examination of the evolution of the industry since deregulation, however, suggests that the instability probably shouldn’t be very surprising given the economic environment in which the companies operate.

The first factor contributing to earnings volatility is volatile demand. To illustrate demand volatility, suppose airline demand reflected only proportional shifts in an otherwise unchanging constant elasticity demand curve. For a given elasticity, ϵ , we can associate observed quantities (measured by aggregate domestic revenue passenger miles) and prices (measured by real average revenue per domestic revenue passenger-mile) with a demand curve of the form $\ln(Q) = \alpha + \epsilon \ln(P)$. Shifts in α needed to keep observed price and quantity pairs on a demand curve can be interpreted as demand shifts. Figure 12 illustrates the resulting implied demand shifts (changes in a normalized α) over 1960-2004, for assumed constant demand elasticities of -1.0, -1.5 and -

³⁶ For a discussion of the general theory of sustainability, see Baumol, Bailey, and Willig (1981).

2.0, respectively.³⁷ These demand elasticities are broadly within the range of industry elasticity estimates in the literature.³⁸ While a bit artificial, this captures the rapid changes that occur, not just following the September 11 attacks, but also around the recessions of the early 1980s and 1990s and at other times. Figure 13 presents the *changes* in α for the mid-elasticity case of -1.5. The implied demand changes are quite substantial and volatile. In the early 1980s, for instance, 15% growth in demand one year reverted to a 10% decline just two years later.

As a point of comparison, Figure 13 also overlays the airline demand volatility with similar measures for coal, gasoline, and electricity. Note that coal and gasoline are storable products—as are autos, steel, electronics and many other goods produced in high-fixed-cost industries—which allow further smoothing of adjustments to demand fluctuations through inventory changes. Electricity is not storable; as Frank Wolak reports in his chapter, earnings in the deregulated electricity production industry have also been quite volatile.

Volatility in demand creates greater earnings volatility if firms are not able to resize production quickly, reducing inputs and costs when demand slackens. Fixed capital costs make this difficult in the airline industry, but these are not the only costs that adjust slowly. Figure 14 shows the change in demand (using the series with assumed demand elasticity of -1.5) as well as the change in two major airline cost categories, denominated in constant dollars: labor (wage and benefits), which were 33% of airline costs in 2004 and capital (lease, depreciation and amortization costs for aircraft and other capital), which were 14 % of airline costs. The other large component of costs, fuel, is quite volatile due to exogenous oil price changes, but consumption is nearly proportional to service, which we discuss below. Figure 14 demonstrates a fundamental cause of earnings volatility in the airline industry: Not just capital costs, but also labor costs, are slow to respond to demand changes. Both cost series are noticeably smoother than the demand change.

Figure 15 shows the changes in output sold, measured by revenue passenger-miles, and capacity, measured by available seat-miles.³⁹ This indicates some degree of short-run supply inelasticity; perfectly elastic supply would result in no price adjustment and quantity that would change by the full demand shift. Reductions in demand do not trigger commensurate reductions in input costs in part because price adjusts downward in the short run and quantity sold falls less than the demand shift.

Interestingly, the common perception that planes fly very full when demand is strong and mostly empty when demand weakens is not supported by the data. The top line in figure 15, utilizing the right-hand axis, shows the load factor.⁴⁰ Load factor does not seem to be affected much at all by demand shocks; even in 2002, the domestic average load factor was 70%, the same as in 1998 and just one percentage point lower than in 2000. This suggests that airlines have managed their capacity and prices to keep utilization rates roughly constant in the presence of demand shocks.

³⁷ Many other factors undoubtedly changed over this period –most notably, demand elasticity -- so the graph should not be read as literally measuring exogenous demand shifts.

³⁸ Gillen, Morrison, and Stewart (2004) report a median air price elasticity of demand of -1.1 among the studies they survey.

³⁹ Available seat-miles (ASMs) are determined by flights, which are a function of the available aircraft and their intensity of use. Airlines can reduce ASMs by dropping flights over relatively short horizons, but this will not reduce capital costs if they do not scale back their fleet size.

⁴⁰ More precisely, load factor is revenue passenger-miles divided by available seat-miles.

The demand shock following September 11, 2001 illustrates the full dynamic of the interaction between demand and supply that causes earnings in the industry to be so volatile. From 2000 to 2002, demand fell 34% (using an assumed -1.5 price elasticity), real price fell 21%, output (RPMs) fell 6%, capacity (ASMs) fell 5%, and real labor expenses increased 3%.

Labor agreements in this industry generally negotiate both the compensation and work rules. While labor costs generally are thought of as variable costs, in the highly-unionized airline industry, they are certainly not easily or quickly changed. They are not accurately characterized as fixed costs either, however. Typically, the quantity of a fixed input can only be changed with a lag, but its purchase price is set exogenously. Wages of pilots and other high-skilled workers are clearly endogenous to airline demand and, it appears, to airline profits. Changes in an airline's financial health affect both the quantity of the semi-fixed input it wants to buy and the wage it pays. .

Labor relations in the industry are somewhat more complex than in most others, both because of the specialized skills and government safety certification required of some workers and because of the non-storability of the good. The former implies that input substitutes for highly skilled workers may not be available on short notice.⁴¹ The latter makes labor actions particularly costly to the airlines in terms of both lost business and reputation damage.

The power of the airline workforce has made it a quasi-shareholder in the airlines. During high-profit periods, labor has been able to negotiate attractive compensation packages; periods of sustained losses often lead to negotiated reductions. Changes in compensation packages typically lag earnings changes. There is now a well-established pattern at many legacy carriers: An airline's earnings decline, whether from adverse industry shocks or competitive disadvantages unique to the firm. The airline may pursue cost-saving initiatives, but labor is by far the largest cost category, and the second largest, fuel, is priced exogenously. Management therefore claims that it needs concessions from labor to remain viable. Labor unions are resistant to wage or benefit cuts, or restructuring work rules; they express skepticism about the airline's financial difficulty and blame losses on poor management. If the financial distress of the carrier continues, labor is faced with the possibility of carrier bankruptcy – which brings the bankruptcy court into the labor negotiations with its powers to impose wage and work-rule changes, merger into a stronger airline, or even the possibility of liquidation of the company. Generally, at this point, labor representatives become more accommodating and some sort of compensation reduction is agreed to.

Similarly, during strong financial periods, labor attempts to extract some of the profits, but multi-year union agreements mean that airlines can have extended periods of high earnings before the pressure to distribute some of those profits to labor grows. In both cases, the wage bill stickiness means that labor cost changes are out of sync with profit changes, exacerbating the profit swings.

Beyond volatile demand and the inability to quickly adjust costs, the most well-known source of airline earnings volatility is the cost of fuel. In 2004, fuel costs comprised 18% of total operating

⁴¹ In a notable exception, Northwest Airlines recently trained 1900 replacement workers in anticipation of a possible August 2005 mechanics strike.

expenses. Airlines can make incremental operating changes to affect the amount of fuel they use—flying at slower speeds and using their most fuel-efficient aircraft-- but their fuel cost per available seat-mile is driven primarily by oil price fluctuations. Those fluctuations are large and may be somewhat correlated with the demand downturns they face. Figure 16 shows the annual change in fuel cost per ASM. Note that the scale is different from the previous three graphs, and that this does not include the dramatic oil price increase in 2005.

Innovation: While the airline industry has more than a quarter-century of experience in a deregulated environment, it would be a mistake to assume that firms have had that much time to adjust to a new but stable business environment. Technological innovation in this industry has been relatively slow compared to telecommunications, electronics, media or a number of other industries, but the post-deregulation airline industry has been one of the leaders in experimentation with alternative production processes, pricing models, and organizational forms. It takes time to determine the success of a given experiment, and as one would expect, some of the experiments have not been successful.

Network configuration: The hub-and-spoke network is probably the best-known innovation attributed to airline deregulation. Though hubs existed prior to deregulation, their use expanded tremendously in the immediate aftermath of deregulation. However, while there are clear advantages of a hub system due to density economies and demand advantages, there also are costs, which have become more apparent over time. In the late 1980s, hubs were thought to be so powerful – both as an efficiency enhancement and protection from aggressive competitors -- that a race to develop as many hubs as possible ensued. Airlines set up new hubs at airports that ultimately proved unprofitable, and later retrenched.⁴² Recent developments in the industry, including the consistent profitability of Southwest Airlines, which does not operate a formal hub system,⁴³ have raised further questions about the viability of hub-based airline networks.

After initial focus on cost and competitive advantages of hubs, airlines are growing more cognizant of their limitations. Hubs may increase aircraft operating costs, particularly when tightly-banked—those that coordinate grouped arrivals of flights, and then departures 45 to 75 minutes later. These operations increase delays and congestion costs and reduce aircraft utilization (e.g., Mayer and Sinai, 2003). As delays increase, traveler inconvenience and missed connections also increase, reducing passenger demand (Januszewski, 2004). Some airlines currently are experimenting with “de-banking,” or rolling hubs, in which flight operations are smoothed over the day. For example, Figure 17 illustrates the evolution of American Airlines’ hub operations at Dallas-Forth Worth airport between 2001 and 2003, from the tightly-banked hub schedule developed during the 1980s to a rolling hub schedule with a smoother pattern of arrivals and departures. While de-banking hub operations may reduce some of the cost of hubs, rolling schedules also tend to increase passengers expected travel time, reducing their demand

⁴²Former hub airports include those in Nashville, Raleigh-Durham, Kansas City and Columbus, OH. Some airlines even considered opening “pure hubs,” airports located in remote areas in the middle of the country with no local demand, used just for passengers to change planes.

⁴³ Though Southwest does not schedule operations in a traditional hub model, it today operates small scale hubs at Dallas Love Field, Salt Lake City, Phoenix and Las Vegas, and 15% of its passengers travel on connecting itineraries.

for connecting flights. Further experimentation with network configuration is undoubtedly ahead.

Pricing and distribution: Many industries have learned from the sophistication airlines have developed in peak-load pricing, price discrimination, and revenue management. But the airlines themselves remain uncertain, and often in fundamental disagreement, over how much price segmentation is optimal and precisely how to accomplish it.⁴⁴ As shown in Figure 7, within carrier-route price dispersion peaked in 2001 and has since declined considerably. A dramatic decline in unrestricted ticket sales beginning in mid-2000, and continuing with the perceived slow return of high-fare passengers following September 11, 2001, have led many in the industry to argue that price dispersion has exceeded profit-maximizing levels. The unprecedented gap between unrestricted and discount fares in the late 1990s may have significantly altered purchasing patterns. This may have been exacerbated by changes in airline distribution methods: the difference in fares is readily apparent to travelers using online travel search engines, and travelers with some flexibility in their schedules can take advantage of search tools that readily provide potential cost savings from small schedule shifts.

Legacy carriers have not only been losing formerly high-fare passengers to restricted fares on their own networks, but also appear to be losing an increasing fraction of business travelers to low-cost carriers such as Southwest and Jet Blue, contributing to the increased market shares of those carriers. This defection is ascribed in part to generally lower unrestricted, walk-up fares on low-cost carriers, and in part to perceptions that their service, while no-frills, may be more reliable and consistently on-time, a valuable attribute for business travelers. Many airlines have in recent months announced dramatic reductions in unrestricted fares, in an effort to stem this trend. Airlines have also experimented with the kinds of restrictions they impose on discount tickets. The penetration of Southwest and other low-cost airlines with simpler pricing structures and no Saturday night stay requirements have led many legacy carriers to drop Saturday night stay restrictions, relying instead only on advanced-purchase requirements for their discounted fares. Uncertainty about the optimal ticket restrictions and level of price dispersion surely contributes to the volatility of the airlines operations and financial returns.

Organizational form: Perhaps the most important ongoing business innovation in the airline industry is in organizational form. In the early 1980s, an airline was a stand-alone entity that sold tickets for travel on the routes it served. During the 1980s, most major airlines formed code-sharing partnerships with small commuter airlines providing feed traffic for their hubs. Though strategic alliances have since expanded greatly in number, geographic scope, and the dimensions of activities on which partners coordinate, their role remains somewhat unclear. Alliances are not mergers, and most do not have antitrust clearance to cooperate on pricing. Rather, they are a hybrid organizational form in which firms that may compete in some markets cooperate and jointly sell their product in other markets. These agreements can be very complex,

⁴⁴ For example, the costly price war that erupted after American Airlines' 1992 introduction of its Value Pricing plan illustrates the intense divergence of preferred price structures across airlines.

both to be beneficial to both partners and to clear antitrust scrutiny; see Brueckner and Whalen (2002), Bamberger, Carlton, and Neumann (2004), and Lederman (2004).⁴⁵

This certainly is not an exhaustive list of the business changes the industry has seen since deregulation, but it illustrates how dynamic the airline business model has been and continues to be. The managerial skills necessary to run an airline are constantly changing. Airlines continue to experiment with alternative approaches to flight operations and scheduling, pricing, organizational form, distribution, and many other aspects of the business. The feedback process is slow and extremely noisy, making it difficult to determine which experiments are successes and which are failures. These issues are not unique to airlines, but combined with the demand volatility and cost stickiness discussed earlier, they suggest that industry volatility is unlikely to indicate a structural need for renewed government intervention.

Market Power Concerns

The salience of market power concerns has ebbed and flowed considerably over the post-deregulation period. They heightened during the mid- to late-1980s, as airline exits and consolidations led to dramatic increases in concentration, and again in the late 1990s, as profitability soared. Amid the recent financial distress of the industry, concerns about industry concentration and pricing power have abated. While it may be natural to worry more about market power when profits are high, the profit level tells us little about its extent. Market power raises profits relative to the competitive level. Given the factors discussed in the previous section – volatile demand, sticky costs, and repeated disruptions from business innovations – it is quite possible that airlines are making higher profits than would be the case if they were simple price takers. With the potential for inefficient production, labor rent-sharing, and poor or unlucky timing of fixed investment, low profits shed little or no light on the degree of market power that airlines present.

At the time of deregulation, it was recognized that most routes might be able to support only one or two firms and that market power could be an issue. The theory of “contestability” – that *potential* competition would discipline firms, forcing them to keep prices at competitive levels in order to deter new entry -- was put forth in support of deregulation. Through the 1980s, however, contestability theory as applied to airlines took repeated blows from studies that found the number of actual competitors significantly affected price levels on a route.⁴⁶ Potential competition has at best a modest effect disciplining pricing. Fares are markedly higher on routes served by only one airline than they are on routes with a number of active competitors, and tend to decline significantly with entry of a second and third competitor. By the end of the 1980s, the theory was seldom raised in the context of airlines.

In the late 1980s and early 1990s, the focus of market power analysis expanded from just route market shares to airport shares. The basis for this concern, first laid out by Levine (1987), was that an airline could use its dominant position at an airport to deter entry. A number of economic

⁴⁵ Though alliances have become a mainstay of operations among most of the large carriers, Southwest and the other low-cost airlines generally have not pursued. Southwest remains a stand-alone company with no alliance or joint-marketing agreements, selling tickets only for travel on its own planes.

⁴⁶ See Borenstein (1989, 1990, 1991, and 1992) and Hurdle et al. (1989), Abramowitz and Brown (1993).

analyses have found significant fare increases associated with market concentration at the airport level; See Borenstein (1989) and Evans and Kessides (1993). Airport dominance appears to be associated with fare increases, perhaps reflecting the impact of market power exercised through loyalty rewards programs in which the value of the rewards – to travel agents, corporations and individuals -- increased more than proportionally with the points earned; see Borenstein (1989, 1996) and Lederman (2004). By inducing travelers to concentrate their business with just one or a few airlines, these programs make it difficult for a new airline to successfully enter a small subset of routes at an airport dominated by another carrier. Airport dominance could also impede entry by giving the incumbent control over scarce gates, ticket counters and, at some airports, landing slots.

Some airlines and researchers have disputed the existence of a “hub premium”, arguing that studies finding such price differences across airports fail to control for differences in the business/leisure mix of travelers; see Gordon and Jenkins (1999) and Lee and Prado (forthcoming). The argument, however, has two serious flaws. First, the critique suggests that a finding of higher prices in markets with less elastic demand--more business travelers--should not be attributed to market power.⁴⁷ Second, in practice, most of these studies have determined the share of leisure traffic at an airport by examining the proportion of customers who purchase discount tickets. Indeed, a “leisure share” variable constructed as the proportion of passengers paying low fares goes a long way towards explaining where average prices are lower, but that sheds little light on the cause.

It is important to recognize that these patterns do not imply that passengers at dominated airports are necessarily worse off. Large airports with one or two dominant carriers generally are hubs and, as such, schedule a disproportionate number of flights compared to the local demand for air service. Improved service quality may offset part or all of the loss from higher prices resulting from airport dominance. Nor do these concerns necessitate regulation. Even if prices are above competitive levels, they may be no less efficient than are regulated prices. Moreover, the relevant question is whether appropriately executed competition policy could enable customers to receive the benefits of greater service without having to pay the higher fares associated with trips to and from the hubs.

Some of these concerns may be mooted by recent market developments. Figure 18 illustrates a trend toward convergence in prices across airports that is documented in Borenstein (2005). One can calculate an average fare premium at an airport in a given year by comparing the prices paid for trips to/from that airport to national average prices for similar distance trips.⁴⁸ For the average fare premium at the 50 largest airports, Figure 18 presents 10th, 25th, 75th and 90th percentiles during 1984-2004. Cross-airport price variation peaked in 1996 and has been declining since. Relative to national average, most of the most expensive airports have seen prices fall and fares at most of the cheapest airports have risen. The standard deviation of the fare premium measure across the 50 largest airports has fallen from 23% in 1996 to 15% in 2004. Though no research has yet analyzed the cause of this phenomenon, it seems likely that market power from airport dominance is declining.

⁴⁷ Some have suggested that there are significantly higher costs in serving business travelers, but in practice the magnitude of these cost differentials cannot explain the price differences across airports; see Borenstein (1999).

⁴⁸ The exact details of the airport premium calculation are presented in Borenstein (2005).

The decline in fare disparities across airports coincides with the expansion of low-cost airlines in the U.S. Many low-cost or “no-frills” startup airlines appeared in the 1980s, People Express being the most widely known, only to liquidate before the decade was over. With the exception of Southwest, they have until recently had difficulty gaining sufficient presence to ensure profitability and their continued existence. Southwest appears to have avoided their fate through relentless attention to employee relations and productivity, careful control over operating costs, and judiciously-paced expansion plans that until recently avoided head-to-head competition at dominated airports.

There clearly is a significant Southwest effect in the current airline industry; in terms of its increased market share, expansion into more markets, and price impact in markets it serves or may credibly begin to serve (Morrison, 2001, and Goolsbee and Syverson, 2005). Whether this is unique to Southwest, and hence non-replicable, or is poised to diffuse across other airlines, may be a significant determinant of future saliency of market power concerns in this sector.

Infrastructure Development and Utilization

Airport congestion was not a significant issue at most U.S. airports during the regulated era. Most airports operated well below their technical capacity and it was rare that air traffic controllers were required to impose more than minor delays due to excess demand for ground or air space. Four airports – National (Reagan) in Washington, D.C., Newark and JFK in New York, and O’Hare at Chicago—were subject to significant excess demand. Under the so-called High Density Rules, the FAA imposed limits on aggregate hourly operations (take-offs and landings) at these airports. Initially, take-off and landing “slots” were allocated through a negotiation process among incumbent carriers. As demand grew in the 1970s, however, capacity constraints began to bind in more areas. Perhaps not surprisingly given the explosive growth of air travel after 1978, the problem worsened substantially after deregulation. By 2000, fewer than three-quarters of all flights arrived at their destination airport on-time, defined by the FAA as landing within 15 minutes of scheduled arrival time.⁴⁹

Some operational delays are within the control of air carriers (e.g., Mayer and Sinai, 2003). But an increasing share appears linked to inadequate infrastructure in the airport and air traffic control system. The airline industry in the U.S. and throughout the world, regardless of the degree of economic regulation, relies on an infrastructure that is largely government-controlled. The U.S. air traffic control system, which directs all aircraft flight operations, is operated by the Federal Aviation Administration. This control extends to airport runway traffic management, but not to the airport facilities. Airport terminals are managed, and usually owned, by a local government entity, which can be a city, a county, or a special government entity established purely to oversee an airport. After September 2001, security at U.S. airports was turned over to the Transportation Security Administration, an agency within the U.S. Department of Homeland Security.

⁴⁹ A significant contribution to delay in 2000 was a surge in delays at a single airport – LaGuardia – resulting from Congressional fiat in AIR-21 legislation that capacity limits did not exist.

Unfortunately, the track record of these government-controlled components of the air transport system has not been particularly impressive. A preference, or in some cases, requirement, for administrative allocation of resources often has trumped any attempts to understand and employ market incentives in order to improve efficiency. Besides slow adoption of economic innovations that could improve economic welfare, technological innovation has also been slow in some areas.

Airport access: In 1985, the federal government addressed a small part of the problem by establishing limited property rights for takeoff and landing clearance at four highly congested airports. Most of these tradeable "landing slots" were then given to incumbents based on their prior level of operations at the airports. Some were held out for allocation to new entrants at below-market prices. A market for these slots has developed and has supported thousands of trades since the beginning of the program. The slot allocation program, however, has been extended to only six U.S. airports. Moreover, while this system has improved the allocation of scarce operational slots at these airports relative to negotiated allocations, it faces an uncertain future.

In 2000, Congress decided that small communities did not have sufficient access to service at slot-controlled airports, and it enacted legislation ("AIR-21") to suspend the High Density Rule (HDR) slot limits. LaGuardia was immediately opened to service using regional jets. The surge in scheduled service resulted in a 30 percent increase in operations, to almost 1400 daily, at an airport that was previously ranked as the second-most delayed airport in the country. The result was predictable. In September 2000, one-third of the flights at LaGuardia were delayed, with an average delay of more than 40 minutes. LaGuardia-related delays accounted for one-fifth of all delays in the country (Maillet, 2000). Januszewski (2004) analyzes the effect of these delays on travelers' willingness to pay for air travel. The FAA ultimately responded with a cap on total flight operations per hour and a lottery system to allocate these across carriers. In 2002, landing slots were to be abolished system-wide. A similar story replayed at Chicago O'Hare airport, where both American and United substantially increased scheduled service in anticipation of the elimination of slot constraints, leading once again to egregious delays and imposition of administrative solutions. The FAA has proposed to extend its administrative caps, and the future of this system remains uncertain.

The remaining (more than 300) airports that support commercial jet flights operate under a system known as "flow control," which is essentially queuing. Despite the success of market incentives in other parts of the industry, and growing interest in congestion pricing applied to some transportation segments,⁵⁰ there has been tremendous resistance to use of congestion pricing to allocate scarce runway capacity. In one case, a plan to use peak-load runway pricing at Boston's Logan airport was struck down by a federal court as being unduly discriminatory, because the system imposed higher per-passenger costs on small general aviation and commuter aircraft. Much of the opposition to runway pricing has been led by general aviation and small commuter aircraft operators who use the same airports and nearly as much scarce runway capacity as much larger commercial jets. Thus, it is not unusual for a fully-loaded wide-bodied jet to be delayed in taking off by a small plane carrying just four or fewer people. Though

⁵⁰ See the growth in private toll-roads in California, and positive responses to London's congestion tolls on automobiles driving within the center city.

general aviation has been discouraged at many highly-congested slot-controlled airports, the slot program legislation established special categories to allocate rights to smaller commercial aircraft.

Market-based airport facilities allocations are not without problems. Economists studying the possibility of pricing solutions to airport congestion have pointed out two potential concerns. First, a dominant airline at a slot-constrained airport could buy excess slots in order to deter entry. It is straightforward to show that a competitive entrant could be outbid by an incumbent that intended only to withhold the slot from use. There have been some accusations of this behavior by small airlines attempting to enter a slot-controlled airport, though these arguments have been undermined somewhat by the accompanying claim that the small airline should receive the slots at no cost. Still, the incentive of a firm with market power to restrict output is real and it turns out in practice to be very difficult to monitor for such behavior.⁵¹

A second concern is the complexity of determining efficient congestion prices. Conventional models of congestion pricing, such as highway congestion tolls, assume atomistic users. In that case, each user imposes the same congestion externality on all other users, and symmetric tolls can enforce efficient use of the scarce resource. For airports, such an assumption is clearly violated. Moreover, if airlines differ in their scale of operations, they will internalize the congestion externality of an additional flight to different degrees. Large carriers (with many flights) will internalize more of the externality; small carriers, less (see Brueckner, 2002, and Fan, 2003). For instance, if one airline has 60% of the flights at an airport, it will recognize that adding another flight at a peak time incrementally delays all of its existing flights. It will not fully internalize the congestion since 40% of the flights are operated by other airlines, but it will have more incentive to avoid further congesting peak periods than does an airline with 1% of all flights. This would argue for higher congestion tolls on smaller carriers, all else equal, and apart from any market power concerns. If airlines also exercise different degrees of market power, optimal toll design becomes even more complex—it is possible that optimal tolls would be zero or negative for large carriers with considerable market power. Designing such a system would be difficult; implementing it politically would likely be impossible. It seems crucial, however, to measure the potential costs of an imperfect market-based system to the status quo, not the first-best system. Greater use of market incentives could almost surely improve economic welfare relative to the current system, which is driven by a combination of historical property rights, administrative rules of thumb, and political clout.

In addition to inefficient access to scarce infrastructure resources, the current system provides no mechanism to tie investment in that infrastructure to scarcity signals. Airport regulation typically limits fees and prices to levels that provide a fair return on historic investment costs. This may restrict landing fees to levels too low to promote efficient scheduling of scarce capacity and preclude any price signals that might guide efficient investment in future capacity. At some airports, geography or neighborhood limits may effectively preclude expansion of capacity at any reasonable cost. At others, capacity expansion may be feasible. Allocating scarce capacity

⁵¹ A "use it or lose it" rule imposed at slot-constrained airports required that each slot be used on 80% of all days. In practice, this means that a firm could restrict output by 20% without being in violation of the rule, because they own many slots for each hour and can "assign" a given takeoff or landing to a different slot on different days.

through a price system and using revenue collected through that system to finance investment, may better discriminate between these two conditions.

Many of the market power concerns in congestion management of runways also arise in airport facilities management. The local authorities that operate airport terminals face the standard set of local development issues and financing concerns. They lease space to airlines and retail shops in order to finance operations. When they want to expand the facility, incumbent airlines are often the primary purchasers of the local bonds sold to finance the projects. In many cases, they have negotiated preferential access to terminal space in exchange for financing commitments. These may be necessary in order secure financing for airport facility expansions, but they can lead to inefficient exclusion of new competitors. The airport authority must balance financial constraints against the longer-run goal of attaining competitive air service that benefits the surrounding community.

Infrastructure technology: A more difficult area to analyze is that of technological innovation in government-controlled infrastructure. Many industry participants have bemoaned the technology lag in the country's air traffic control system. The government has admitted that the system is out-of-date and overburdened, but a plan to overhaul the system and install modern technology for air traffic control has recently been abandoned after an investment of more than \$4 billion. Some critics argue that a private company would not have made the same mistakes or delayed new technology adoption so long (see Hausman's discussion of government impediments to technological innovation in the telecomm sector). The airline industry is subject to a variety of government fees and taxes. While some of these are earmarked for aviation investment, there has been no direct link between the collections and infrastructure investment, and the government has at times used the surplus in the Aviation Trust Fund to meet other budget goals. This has led some to call for privatization of the infrastructure system, with fees and taxes flowing to the privatized entity. A privatized monopoly air traffic control system, while perhaps increasing efficiency relative to its objective function, would present a new set of concerns. We suspect that regulatory issues similar to those presented by a private monopoly electric grid operator, as discussed in Paul Joskow's chapter, would pose considerable challenges.

Conclusion:

Airline regulators attempted to assure a stable, growing industry that benefited consumers and the economy. The result was relatively high fares, inefficient operations, and airline earnings volatility. The failures of economic regulation of airlines prompted a pathbreaking shift in 1978, as the U.S. became the first country to deregulate its domestic airline industry. The result has been continued economic upheaval for the airlines, but lower fares and more efficient operations. The volatility in industry earnings has continued and average earnings have declined since deregulation.

Still, the continuing upheaval in the industry shows no signs of impeding the flow of investment in airlines or the benefits to consumers. Though the attacks of September 11, 2001 resulted in a major setback to the finances of the industry (even after the \$5 billion in cash gifts the federal government bestowed upon the airlines in the following weeks), their effect on the level of air service was very short-lived. More domestic routes had nonstop service in the summer of 2002 than in the summer of 2001 just prior to the attacks, and the daily number of domestic flights was nearly identical across the two years. Real fares were lower and the level of service was better

in 2004 than in any previous year. More city-pairs were connected by nonstop service than at any time in the previous 20 years and there were more commercial flights.

The average returns that the airlines have earned since deregulation are almost certainly insufficient to sustain the industry in its current state, although this conclusion would have been substantially different in the late 1990s. Concluding that competition in the industry is unsustainable, however, is certainly premature. The natural volatility in the demand for air travel will probably always cause earnings to be less stable than in other industries, but other factors that have depressed earnings are potentially controllable. Slow adjustment of labor costs is an institutional feature of the industry that may change either through new labor agreements at legacy carriers or through shift in market share to airlines that can adjust more nimbly. Much of the instability since deregulation has resulted from experimentation with flight scheduling, pricing, loyalty programs, distribution systems, and organization forms. Though clear, permanent answers to these management issues are unlikely to emerge, one would expect some learning to result from the experimentation and the range of strategies to narrow.

For most consumers, airline deregulation has been a benefit. For many airlines, it has been a costly experiment, though a few have prospered in the unregulated environment. Both the companies and economists studying the industry continue to learn from the industry dynamics.

References:

- Abramowitz, A. and Brown S. 1993. "Market Share and Price Determination in the Contemporary Airline Industry." *Review of Industrial Organization*. 8: 419-433.
- Bailey, Elizabeth E., David R. Graham and Daniel R. Kaplan. 1985. *Deregulating the Airlines*. Cambridge, MA: MIT Press.
- Bamberger, Gustave, Dennis Carlton, and Lynette Neumann. 2004. "An Empirical Investigation of the Competitive Effects of Domestic Airline Alliances." *Journal of Law and Economics*. 47(1, April): 195 – 222.
- Baumol, William, John C. Panzar, and Robert Willig. 1981.
- Belobaba, Peter. 1987. *Air Travel Demand and Airline Seat Inventory Management*. Ph.D. Dissertation. Massachusetts Institute of Technology.
- Berry, Steven T. 1992. "Estimation of a Model of Entry in the Airline Industry," *Econometrica*. 60(4): 889-917.
- Blanchard, Elliott. 2004. "terminal 250: Federal Regulation of Airline Overbooking."
- Borenstein, Severin. 1989. "Hubs and High Fares: Dominance and Market Power in the US Airline Industry.," *RAND Journal of Economics*. 20: 344-365.
- _____. 1990. "Airline Mergers, Airport Dominance, and Market Power." *American Economic Review Papers and Proceedings*. 80: 400-404.
- _____. 1991. "The dominant-firm advantage in multi-product industries: evidence from the U.S. airlines." *Quarterly Journal of Economics* 106: 1237-1266.
- _____. 1992. "The Evolution of U.S. Airline Competition." *Journal of Economic Perspectives*. 6 (1, Spring): 45-73.
- _____. 1996. "Repeat-Buyer Programs in Network Industries." in Werner Sichel ed., *Networks, Infrastructure, and The New Task for Regulation*, University of Michigan Press.
- _____. 1999. "Hub Dominance and Pricing." Testimony before the Transportation Research Board, January 21, 1999. Available at <http://faculty.haas.berkeley.edu/borenste/trb99.pdf>.
- _____. 2005. "U.S. Domestic Airline Pricing, 1995-2004," Competition Policy Center Working Paper CPC05-48, University of California, Berkeley, January. Available at <http://repositories.cdlib.org/iber/cpc/CPC05-048/>
- _____ and Nancy L. Rose. 1994. "Competition and Price Dispersion in the US Airline Industry." *Journal of Political Economy*, 102: 653-683.

Borenstein, S. and Rose, N. 1995. “Bankruptcy and Pricing Behavior in U.S. Airline Markets.” *American Economic Review Papers and Proceedings*, 85: 397-402.

Borenstein, S. and Rose, N. 2003. “The Impact of Bankruptcy on Airline Service Levels” *American Economic Review Papers and Proceedings*, 93: 415-419.

Brueckner, Jan K. 2002. "Airport Congestion When Carriers Have Market Power." *American Economic Review*. ,. 92(5): 1357-1375.

Brueckner, Jan K. and W. Tom Whalen. 2002. “The Price Effects of International Airline Alliances.” *Journal of Law and Economics*. 43 (2, October): 503-546.

Card, David. 1997. “Deregulation and Labor Earnings in the Airline Industry.” In James Peoples, ed. *Regulatory Reform and Labor Markets*. Boston: Kluwer Academic Publishers.

Caves, Richard. 1962. *Air Transport and Its Regulators: An Industry Study*. Cambridge, MA: Harvard University Press.

Dana, James D., Jr. 1999. “Using Yield Management to Shift Demand When the Peak Time is Unknown.” *RAND Journal of Economics*. 30 (3, Autumn): 456-474.

Dana, James D., Jr. 1999. “Equilibrium Price Dispersion Under Demand Uncertainty: The Roles of Costly Capacity and Market Structure.” *RAND Journal of Economics*. 30(4, Winter): 632-660.

Dionne, Georges. 1997. “Debt, Moral Hazard and Airline Safety: An Empirical Evidence.” *Journal of Econometrics*. 79 (2, August): 379-402.

Douglas, George W. and James C. Miller, III. 1974. *Economic Regulation of Domestic Air Transport: Theory and Policy*. Washington, D.C.: The Brookings Institution.

Dunne, Timothy , Mark J. Roberts, and Larry Samuelson. 1988. “Patterns of Firm Entry and Exit in US Manufacturing Industries.” *RAND Journal of Economics*. 19 (4): 495-515.

Eads, George. 1975. “Competition in the Domestic Trunk Airline Industry: Too Much or Too Little?” In Almarin Phillips, ed. *Promoting Competition in Regulated Markets*. Washington, D.C.: The Brookings Institution.

Evan, William N. and Ioannis N. Kessides. 1993. “Localized Market Power in the U.S. Airline Industry.” *Review of Economics and Statistics*. , 75(1): 66-75.

Fan, Terence. 2003. *Market-based airport demand management : theory, model and applications*. Ph.D. Dissertation. Massachusetts Institute of Technology.

General Accounting Office. 2003. *Airline Ticketing: Impact of Changes in the Airline Ticket Distribution Industry*. GAO-3-749.

Gillen, David W., William G. Morrison and Christopher Stewart. 2004. “Air Travel Demand Elasticities: Concepts, Issues and Measurement.” Final Report. Department of Finance. Canada. http://www.fin.gc.ca/consultresp/Airtravel/airtravStdy_e.html 2004.05.13

Goolsbee, Austan and Chad Syverson. 2005. “How Do Incumbents Respond to the Threat of Entry? Evidence from Major Airlines.” National Bureau of Economics Working Paper 11072.

Gordon, Robert J. and Darryl Jenkins. 1999. “Hub and Network Pricing in the Northwest Airlines Domestic System.” Northwestern University. Mimeo, September.

Hendricks, Wallace. 1994. “Deregulation and Labor Earnings.” *Journal of Labor Research*. 15 (Summer): 207-234.

Hendricks, Wallace, Peter Feuille, and Carol Szerszen. 1980. “Regulation, Deregulation, and Collective Bargaining in Airlines.” *Industrial and Labor Relations Review*. 34 (1, October): 67-81.

Hirsch, Barry T. and David A. Macpherson. 2000. “Earnings, Rents, and Competition in the Airline Labor Market.” *Journal of Labor Economics*. 18 (1): 125-155.

Hurdle, G. J., Johnson, R. L., Joskow, A. S., Werden, G. J., and Williams, M. A. 1989. Concentration, Potential Entry, and Performance in the Airline Industry. *Journal of Industrial Economics* 38: 119-139.

Januszewski, Silke. 2004. “The Effect of Air Travel Delays on Airline Prices.” Mimeo. University of California, San Diego. <http://weber.ucsd.edu/~sjanusze/www/airtrafficdelays.pdf>

Jordan, William A. 1970. *Airline Regulation in America: Effects and Imperfections*. Baltimore: Johns Hopkins Press.

Joskow, Paul L. and Roger G. Noll. 1994. “Economic Regulation.” In Martin Feldstein, ed. *American Economic Policy in the 1980s*. National Bureau of Economic Research Conference Report. Chicago: University of Chicago Press. 367-452.

Joskow, Paul L. and Nancy L. Rose. 1989.

Kahn, Alfred E. 1971. *The Economics of Regulation: Principles and Institutions*. 2 Volumes. New York: John Wiley & Sons, Inc.

_____. 1988. “Surprises of Airline Deregulation.” *American Economic Review*. 72 (2, May): 316-322.

_____. 2002. “The Deregulatory Tar Baby: The Precarious Balance Between Regulation and Deregulation, 1970-2000 and Henceforward.” *Journal of Regulatory Economics*. 21 (1, Jan.): 35-53.

Keeler, Theodore E. 1972. “Airline regulation and market performance.” *Bell Journal of Economics and Management Science*. 3(2, Autumn): 399-424.

Kennet, D. Mark. 1993. “Did Deregulation Affect Aircraft Engine Maintenance? An Empirical Policy Analysis.” *RAND Journal of Economics*. 24 (4, Winter): 542-558.

Lederman, Mara. 2004. “Do Enhancements to Loyalty Programs Affect Demand? The Impact of International Frequent Flyer Partnerships on Domestic Demand.” Mimeo, Rotman School of Management, University of Toronto.

Lee, Darin and Maria Jose Luengo Prado. forthcoming. “The Impact of Passenger Mix on Reported Hub Premiums in the U.S. Airline Industry.” *Southern Economic Journal*.

Levine, Michael E. 1965. “Is Regulation Necessary? California Air Transportation and National Regulatory Policy.” *The Yale Law Journal*. 74 (8, July): 1416-1447.

Levine, Michael E. 1987. “Airline Competition in Deregulated Markets: Theory, Firm Strategy and Public Policy.” *Yale Journal on Regulation*. 4(Spring): 393-494.

Maillet, Louise E. 2000. Statement Before the House Transportation and Infrastructure Subcommittee on Aviation on AIR-21 Slot Management at LaGuardia Airport. December 5, 2000. <http://www.house.gov/transportation/aviation/hearing/12-05-00/mailllett.html>

Mayer, Christopher & Todd Sinai. 2003. "Network Effects, Congestion Externalities, and Air Traffic Delays: Or Why Not All Delays Are Evil." *American Economic Review*. 93(4): 1194-1215.

Meyer, John R., Clinton V. Oster, Jr., Ivor P. Morgan, Benjamin Berman, and Diana L. Strassmann. 1981. *Airline Deregulation: The Early Experience*. Boston: Auburn House Publishing Co.

Morrison, Steven A. 2001. “Actual, Adjacent, and Potential Competition Estimating the Full Effect of Southwest Airlines.” *Journal of Transport Economics and Policy*. 35(2, May): 239-256.

Morrison, Steven and Clifford Winston. 1986. *The Economic Effects of Airline Deregulation*. Washington, D.C.: The Brookings Institution.

_____. 1995. *The Evolution of the Airline Industry*. Washington, D.C.: The Brookings Institution.

_____. 2000. "The Remaining Role for Government Policy in the Deregulated Airline Industry." In Sam Peltzman and Clifford Winston, eds. *Deregulation of Network Industries: What's Next?* Washington, D.C.: AEI-Brookings Joint Center for Regulatory Studies.

Oster, Clinton V., Jr., John S. Strong, and C. Kurt Zorn. 1992. *Why Airplanes Crash: Aviation Safety in a Changing World*. Oxford: Oxford University Press.

Peltzman, Sam. 1989. "The Economic Theory of Regulation after a Decade of Deregulation." *Brookings Papers on Economic Activity. Microeconomics*. 1-41. Comments on 42-60.

Peoples, James. 1998. "Deregulation and the Labor Market." *Journal of Economic Perspectives*. 12 (3, Summer): 111-130.

Prescott, Edward C. 1975. "Efficiency of the Natural Rate." *Journal of Political Economy*. 83(December): 1229-1236.

Rose, Nancy L. 1985. "The Incidence of Regulatory Rents in the Motor Carrier Industry." *Rand Journal of Economics*. 16 (Autumn): 299-318.

_____. 1987. "Labor Rent-Sharing and Regulation: Evidence from the Trucking Industry." *Journal of Political Economy*. 95 (December): 1146-1178.

_____. 1990. "Profitability and Product Quality: Economic Determinants of Airline Safety Performance." *Journal of Political Economy*. 98(5, October): 944-964.

_____. 1992. "Fear of Flying: The Economics of Airline Safety" *Journal of Economic Perspectives*. 6 (1, Spring): 75-94.

Salop, Steven C. 1978. "Alternative Reservations Contracts." Civil Aeronautics Board memo.

Smith, Barry C., John F. Leimkuhler, John F. and Ross M. Darrow. 1992. "Yield Management at American Airlines." *Interfaces*. 22(1): 8-24.

Tam, Ryan and R. John Hansman. 2003. "An Analysis of the Dynamics of the US Commercial Air Transport System." MIT International Center for Air Transportation. ICAT-2003-2.

Unterberger, S. Herbert and Edward C. Koziara. 1975. "Airline Strike Insurance: A Study in Escalation." *Industrial and Labor Relations Review*. 29 (1): 26-45.

Whinston, Michael D. and Scott C. Collins. 1992. "Entry and Competitive Structure in Deregulated Airline Markets: An Event Study Analysis of People Express." *RAND Journal of Economics*. 23(4): 445-462.

Wolfram, Catherine. 2004. "Competitive Bidding for the Early U.S. Airmail Routes." Mimeo, University of California, Berkeley.

<http://faculty.haas.berkeley.edu/wolfram/Papers/Airmail1204.pdf>

Figure 1: U.S. Airlines - Systemwide Traffic

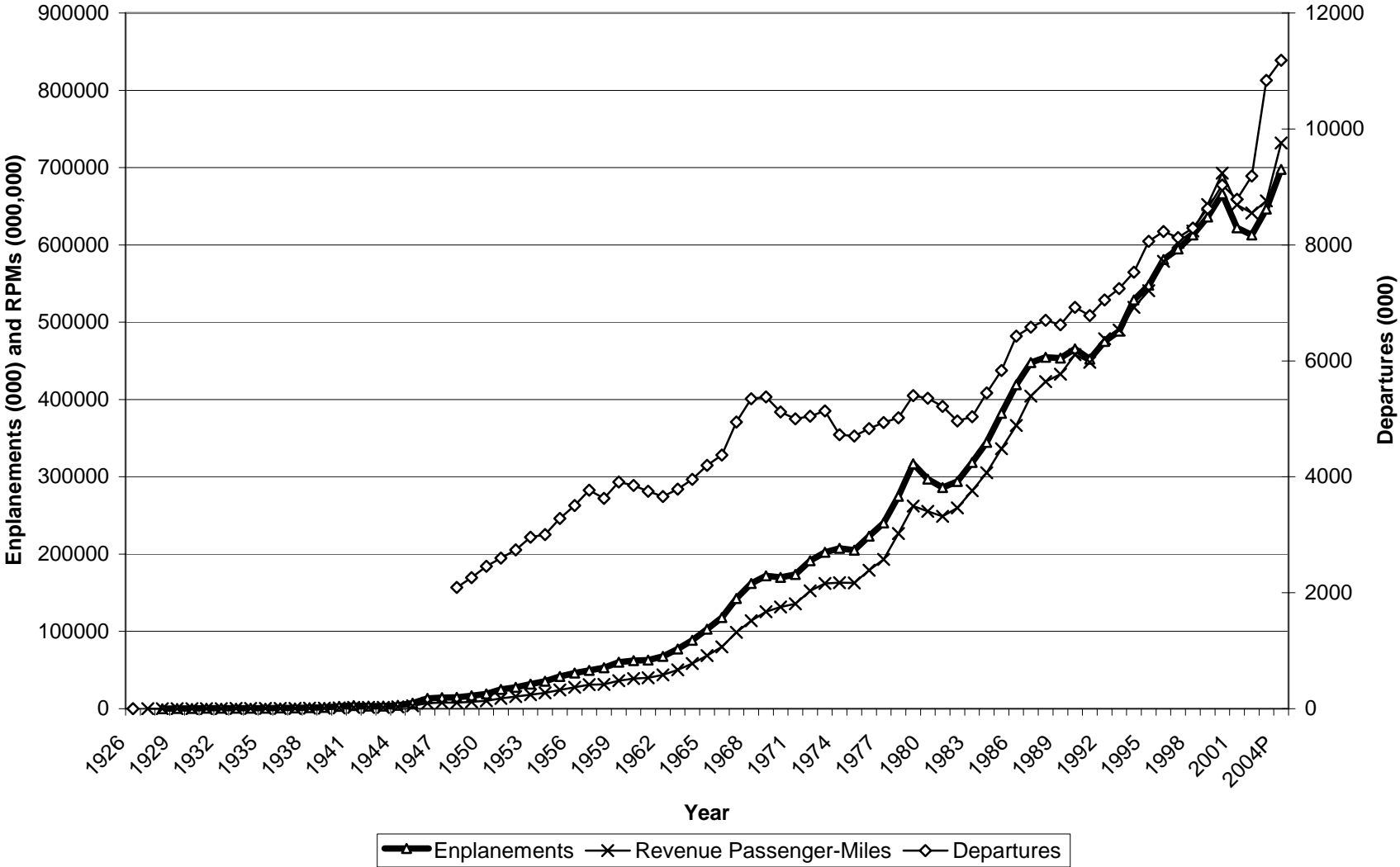
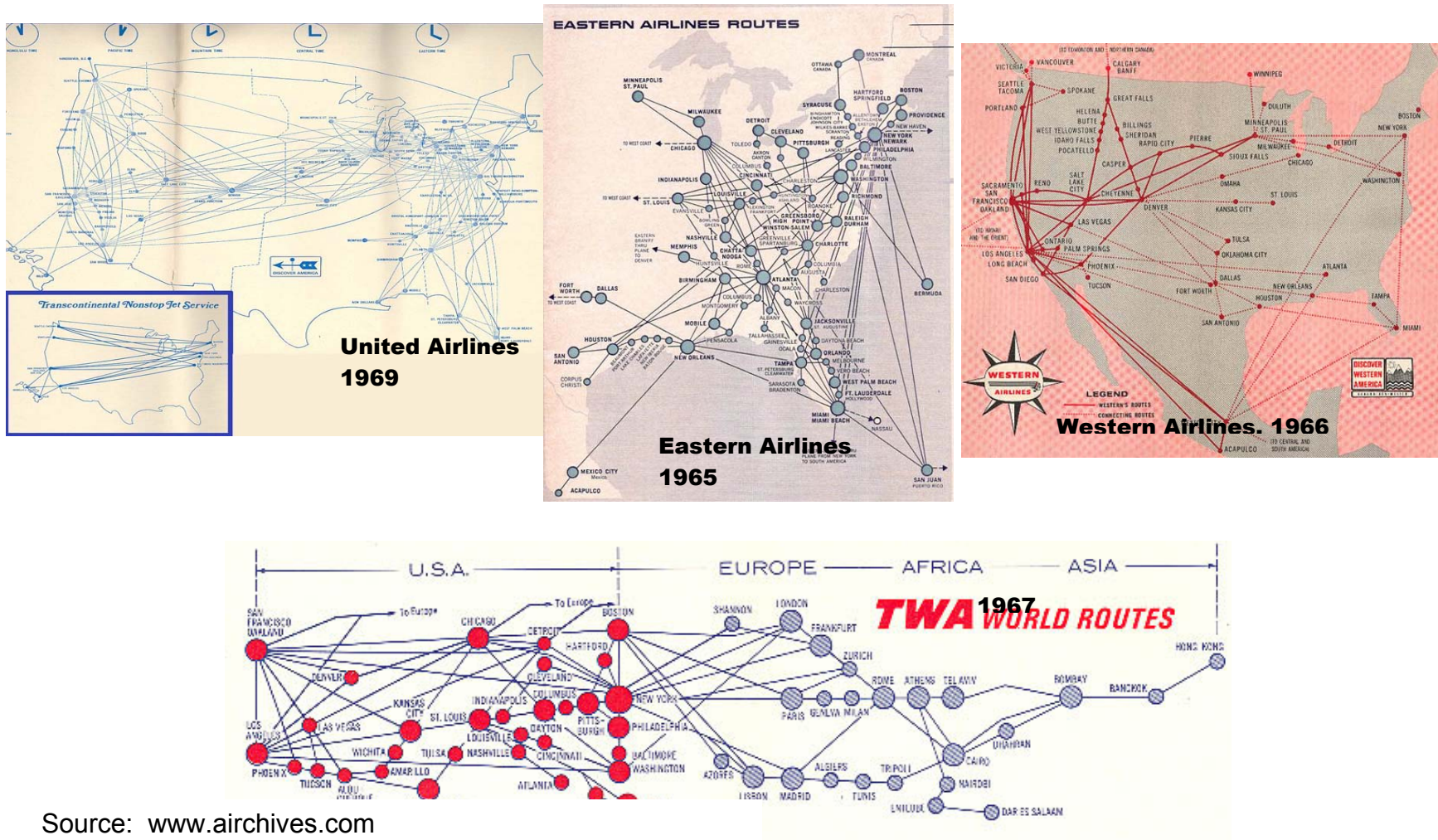


Figure 2: Selected Airline Route Maps, 1965-1969.



Source: www.airchives.com

Figure 3: Airline Industry Average Domestic Load Factors, 1960-2004



Figure 4: Domestic Airline Price Per Revenue Passenger-Mile, 1984 - 2004 (Quarterly)
(in 2000 constant dollars)

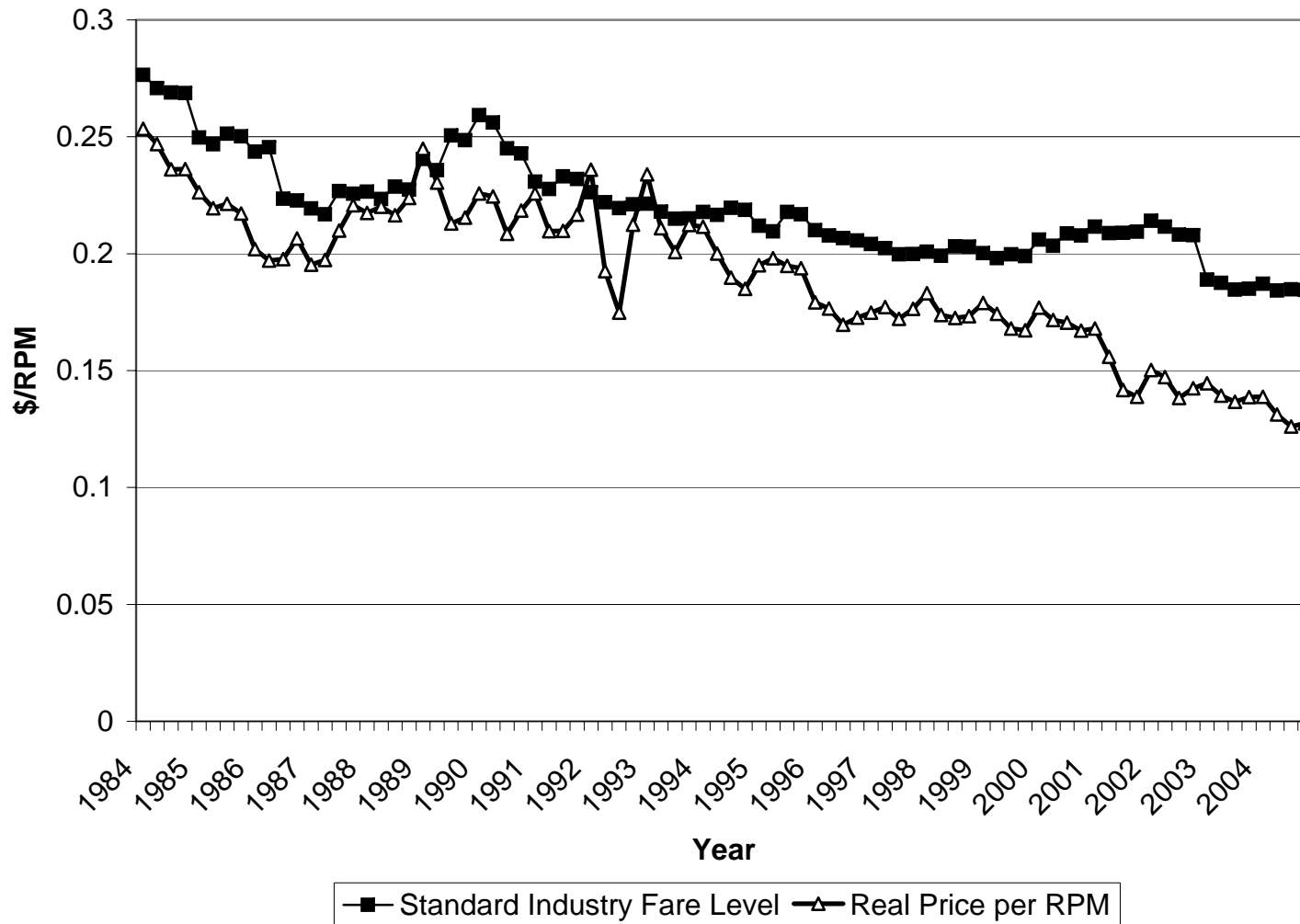


Figure 5: Average Cost/Available Seat-Miles for Legacy and Startup Carriers: 1984-2004

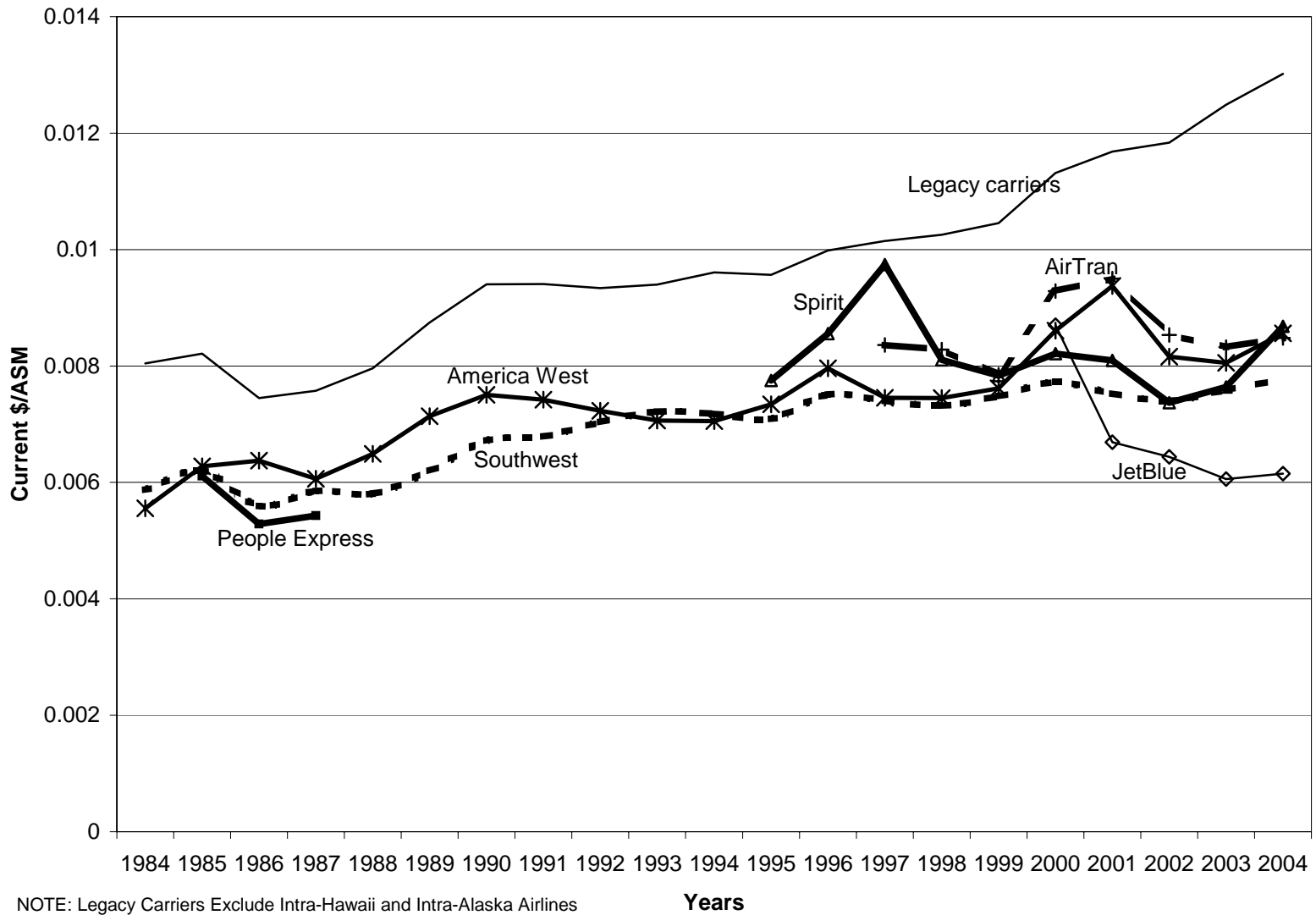


Figure 6: Market Share of Southwest and All Low-Cost Carriers (domestic)

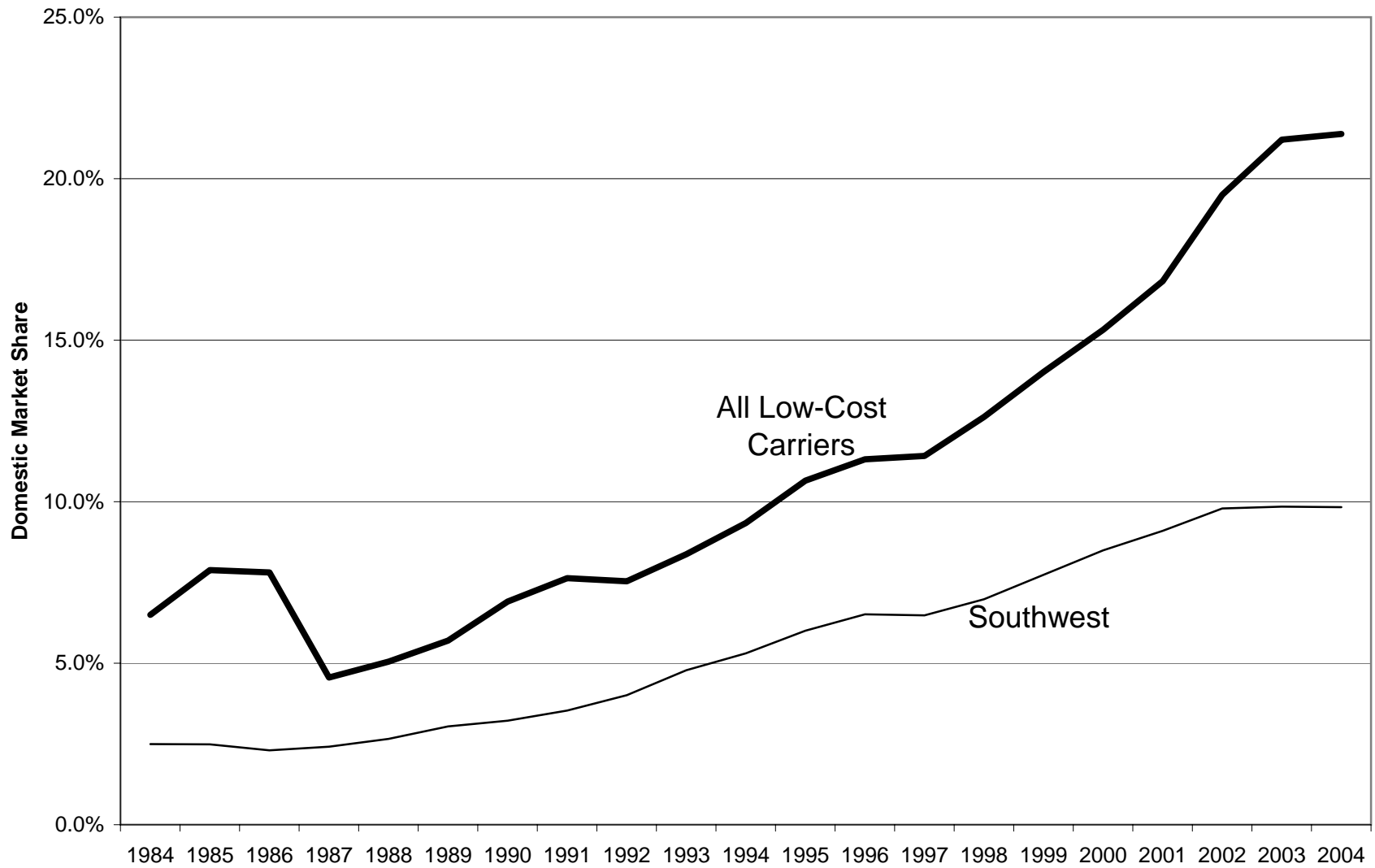


Figure 7: Price Dispersion Within Routes and Carrier-Routes, 1985 - 2004

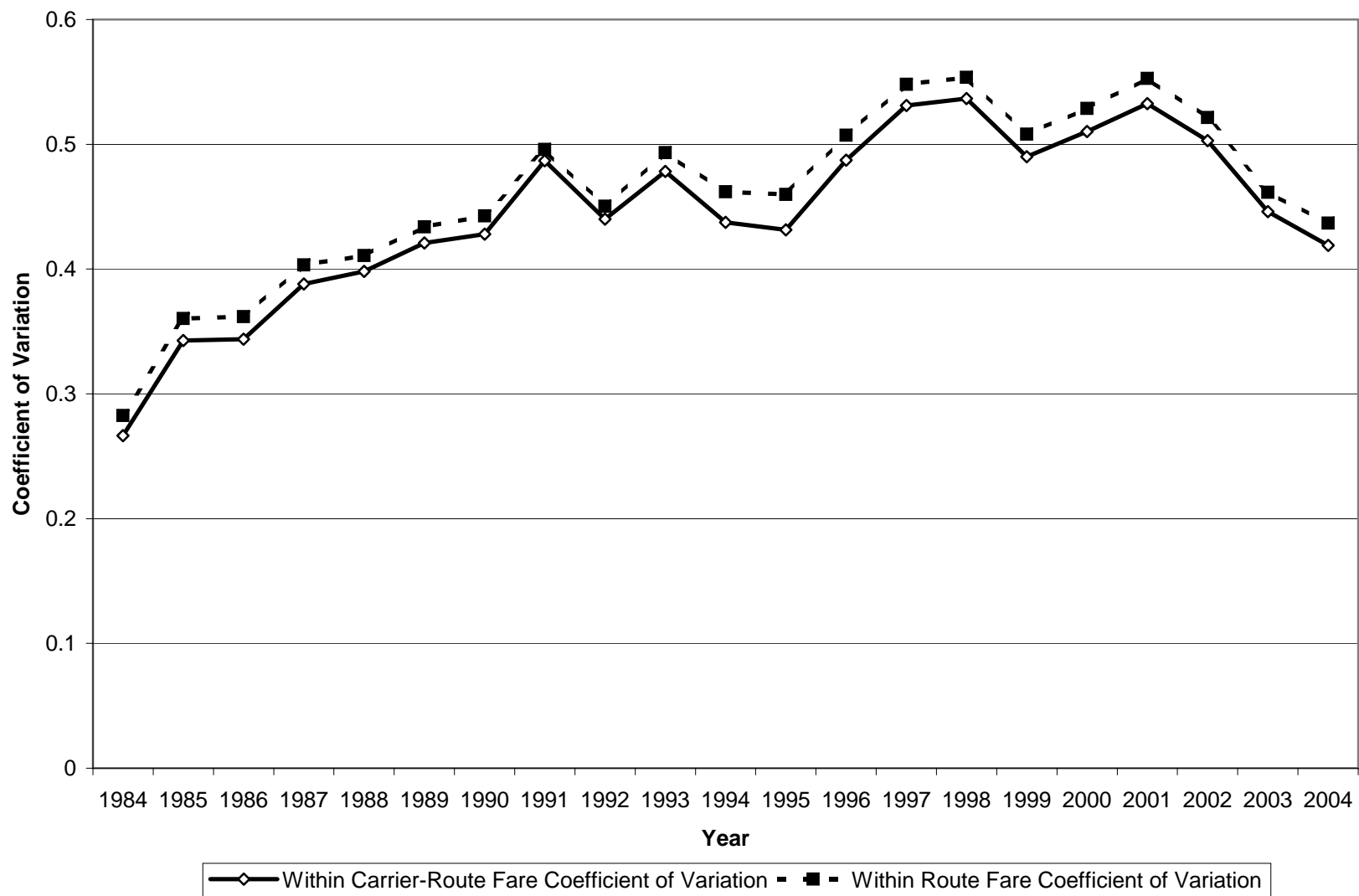
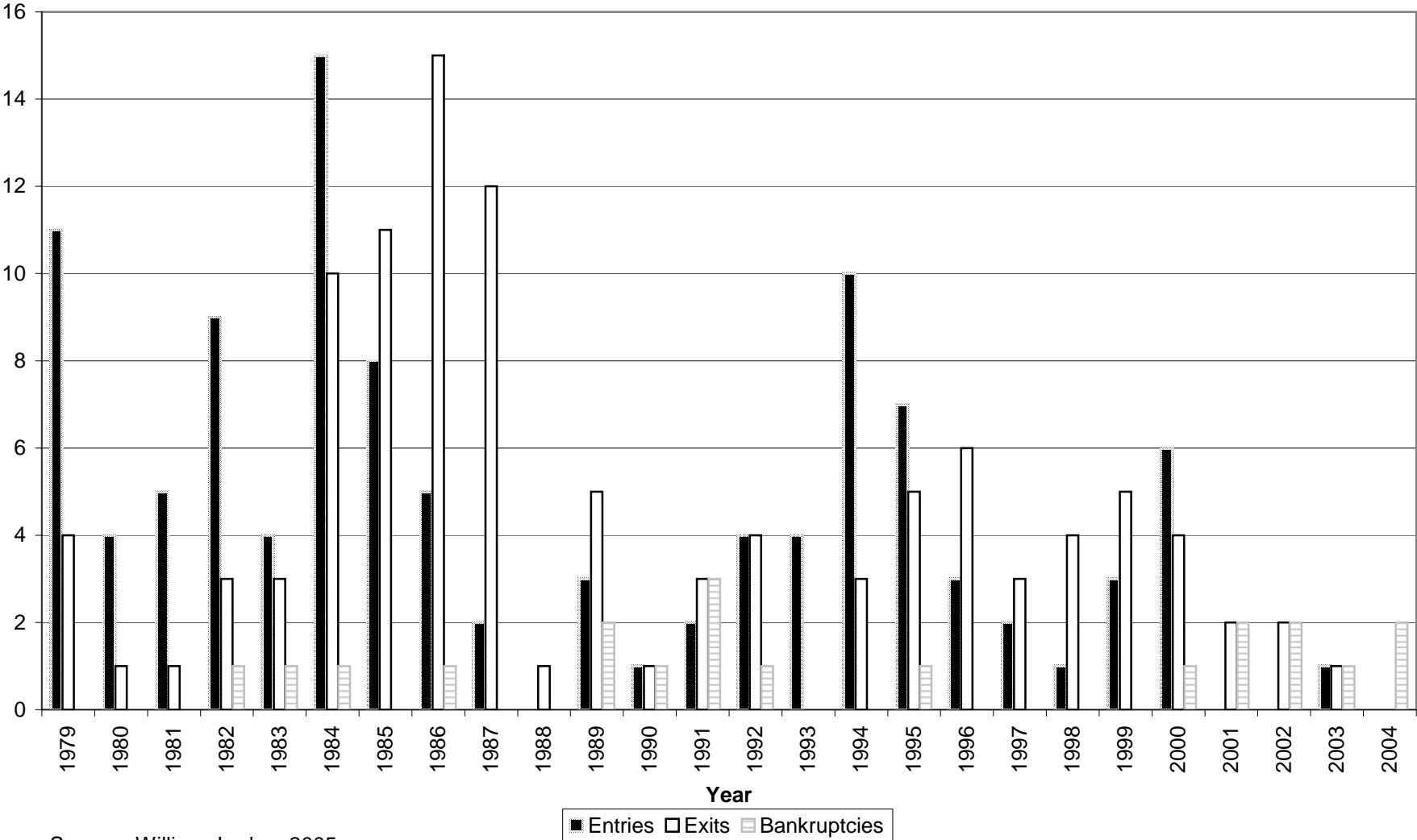


Figure 8: Airline Entries, Exits, and Bankruptcies By Year Since Deregulation



Source: William Jordan, 2005.

Figure 9: Route Level Concentration 1984-2004

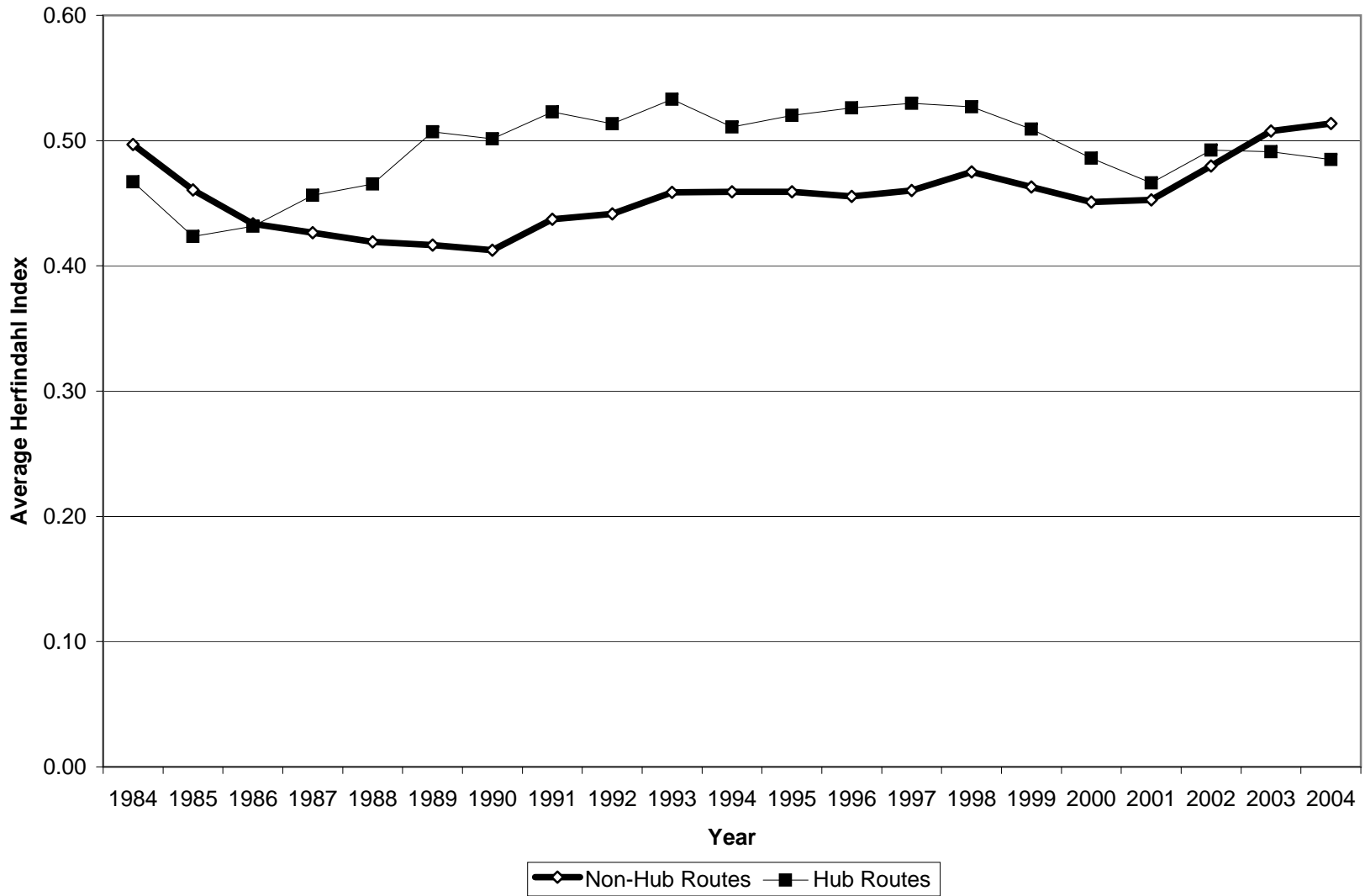
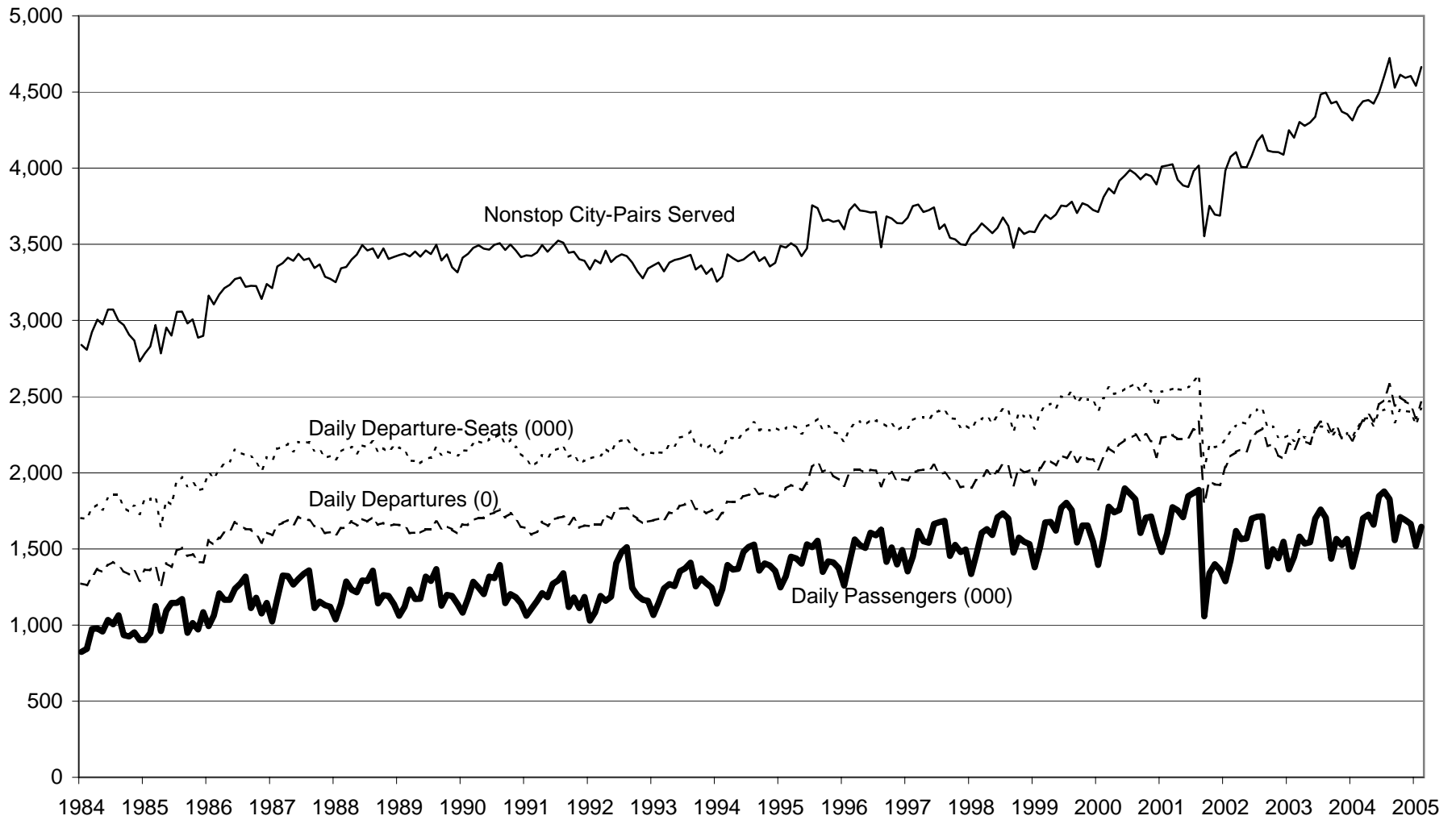


Figure 10: Domestic U.S. Airline Service: 1984-2005 (monthly)



Source: Authors' Calculations from T100 Service Segment Data **Years**

Figure 11: Airline Scaled Profit Rates, 1960-2003

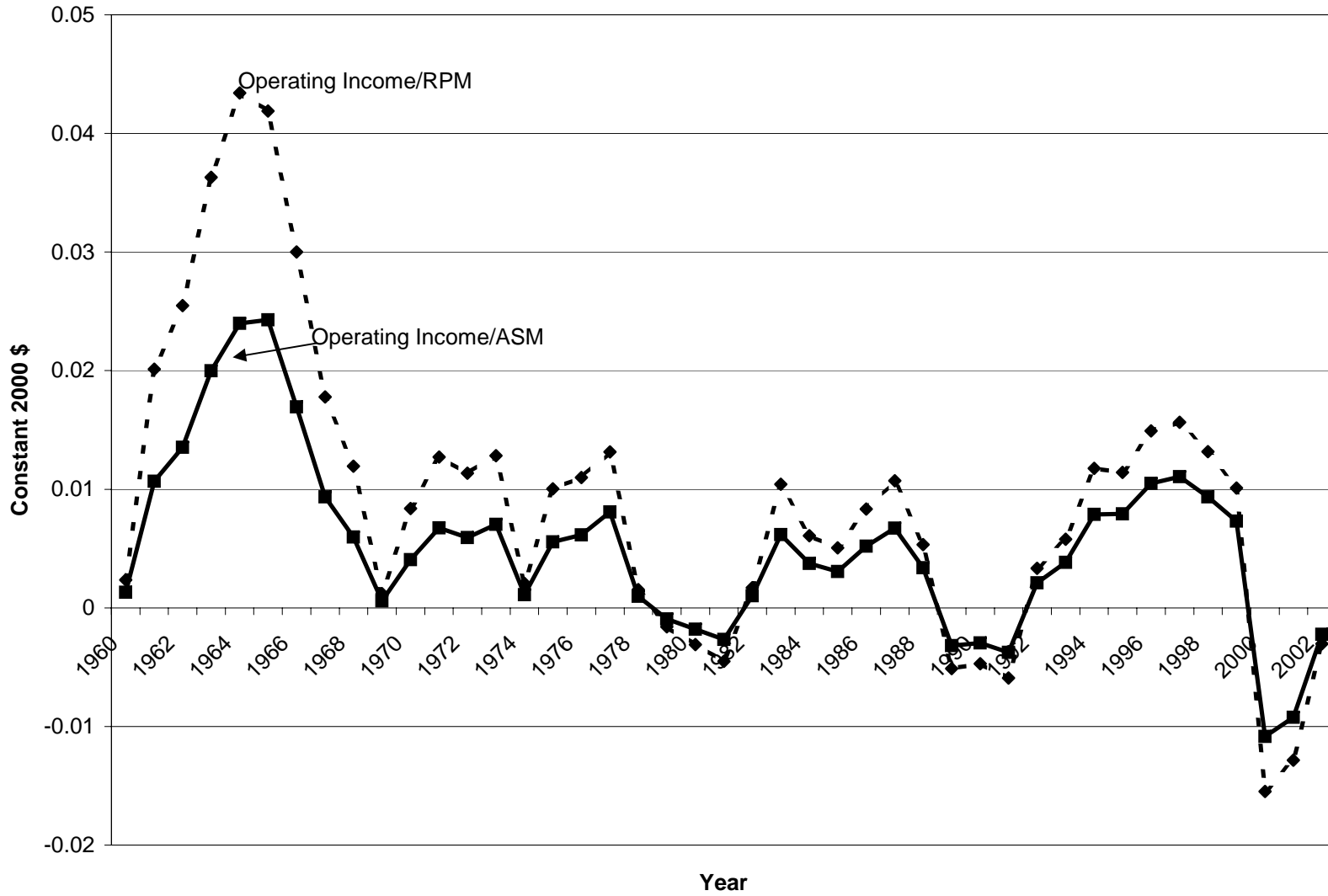


Figure 12: Air Travel Implied Demand Level, 1960-2004

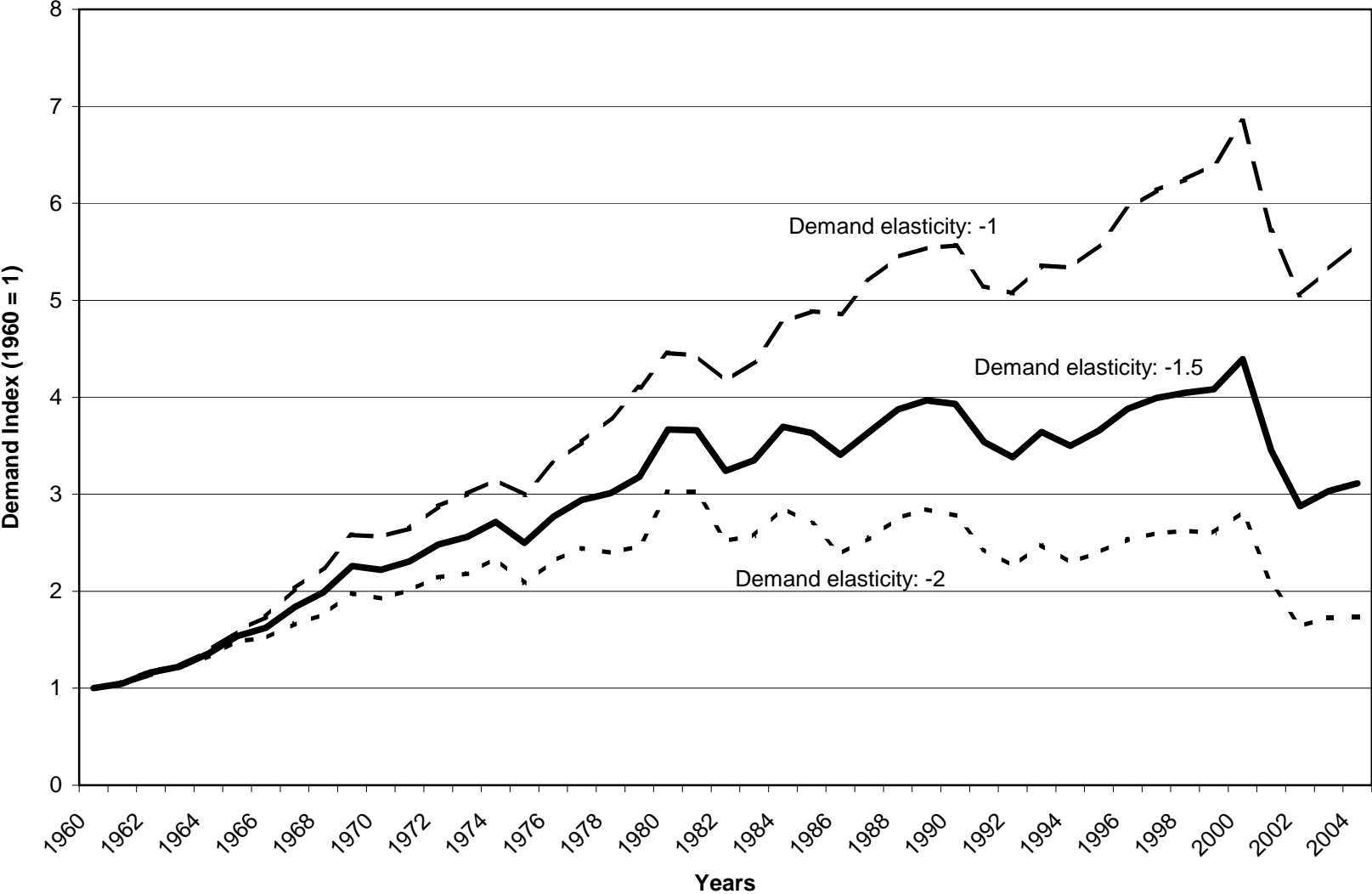


Figure 13: Implied Demand Changes for Air Travel, Gasoline, Coal and Electricity: 1961-2004

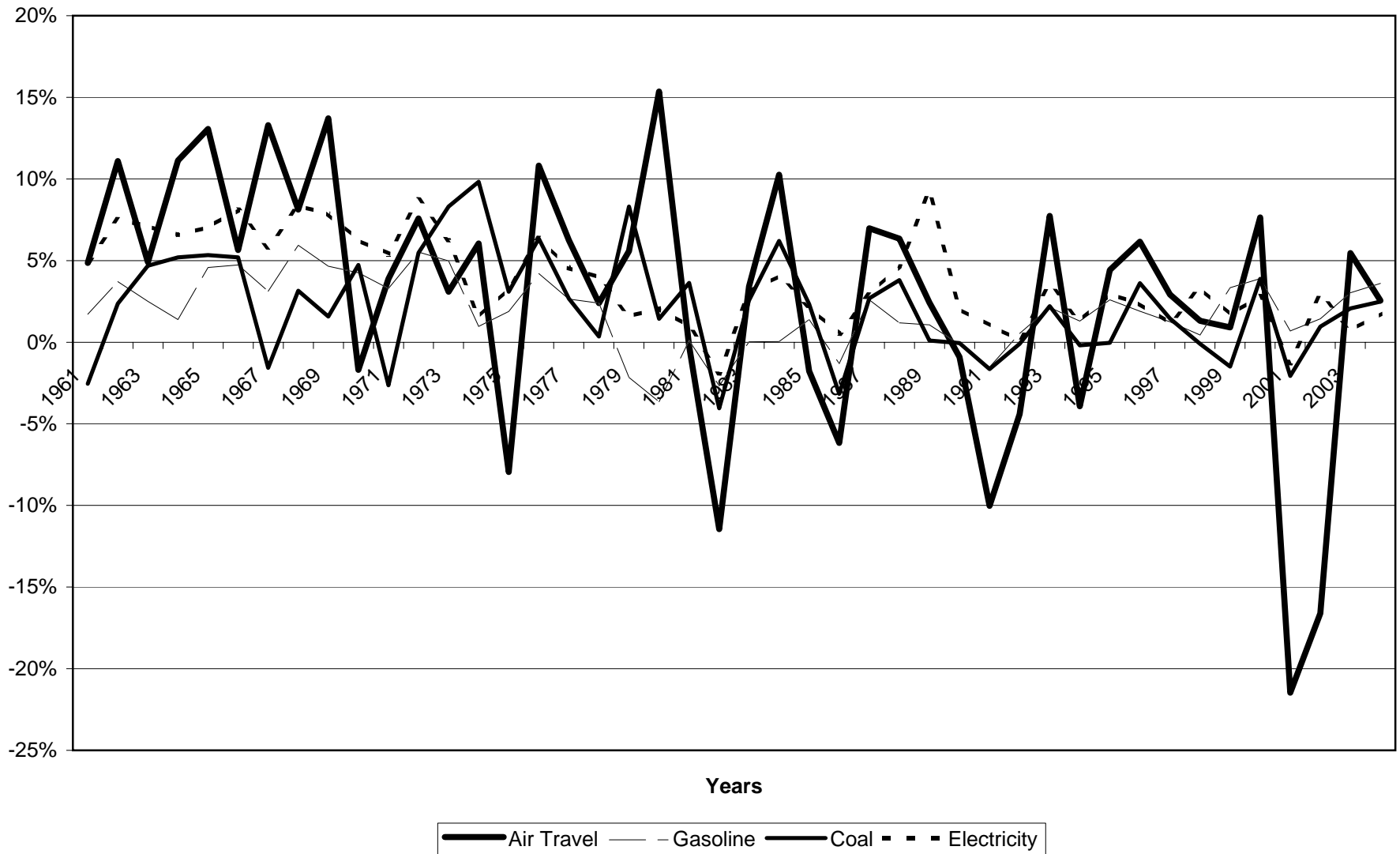


Figure 14: Changes in Implied Demand, Capital Expense and Labor Expense: 1989-2004

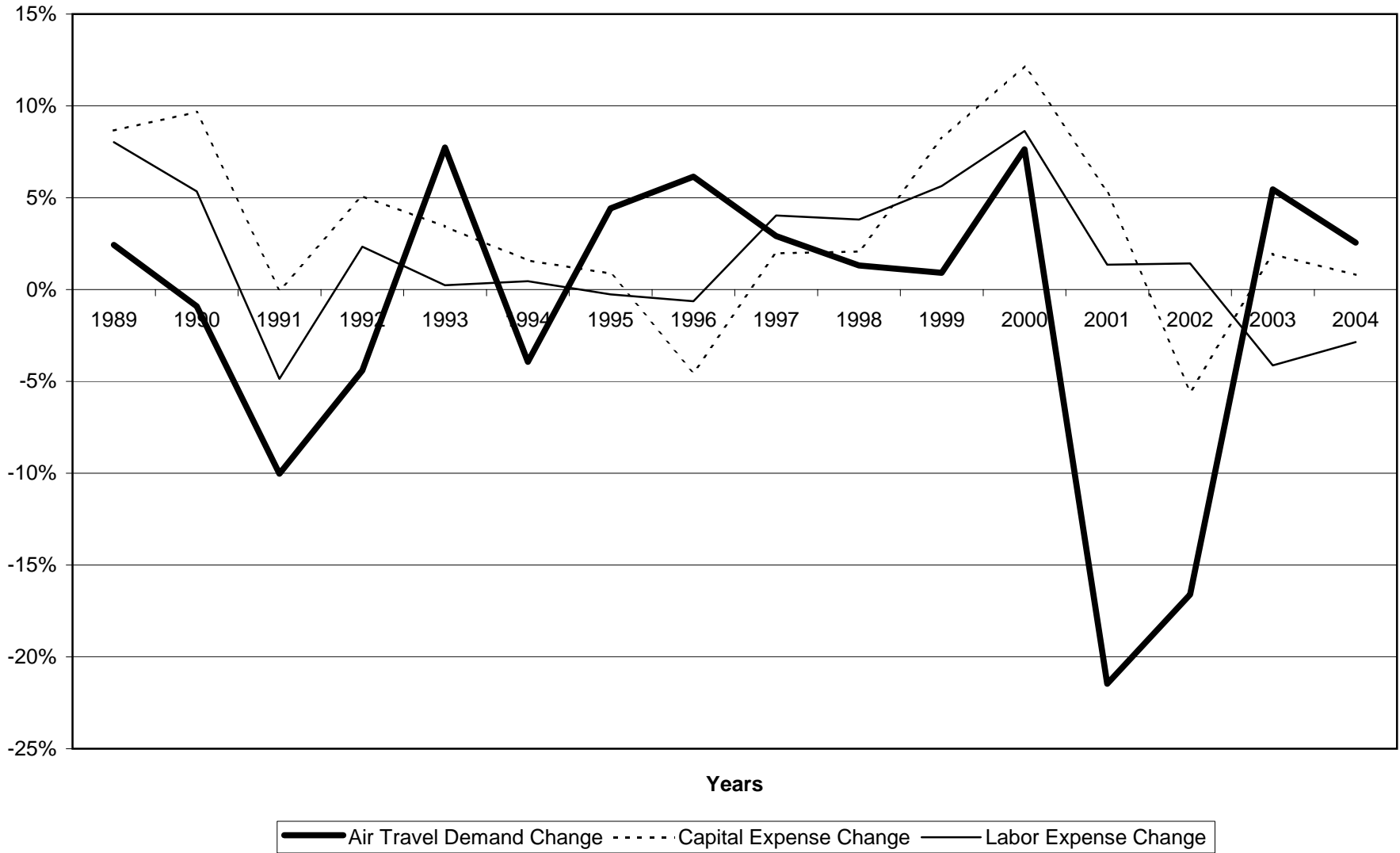


Figure 15: Changes in Implied Airline Demand, Capacity and Output: 1989-2004

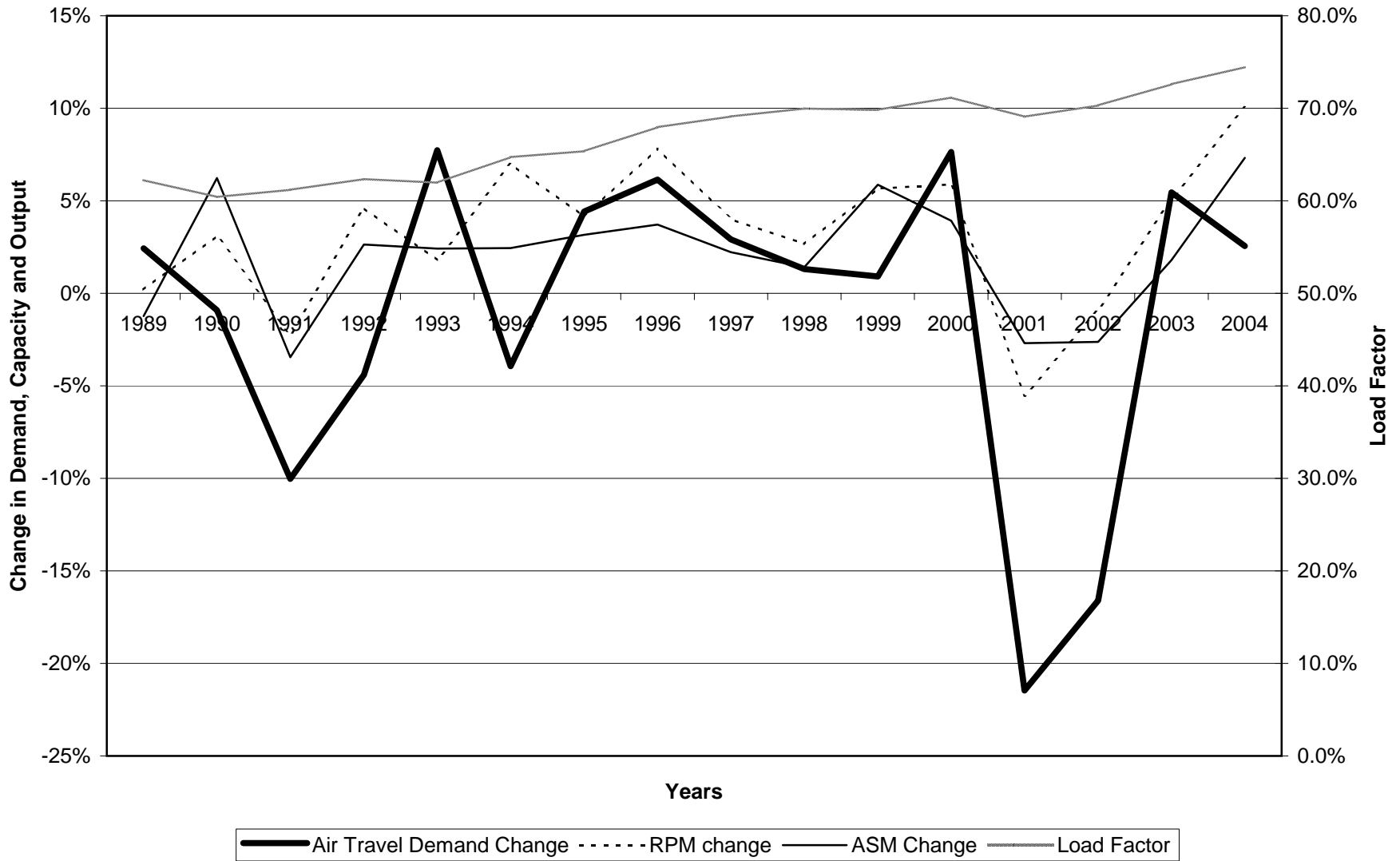


Figure 16: Changes in Implied Airline Demand and Fuel Cost/ASM: 1989-2004

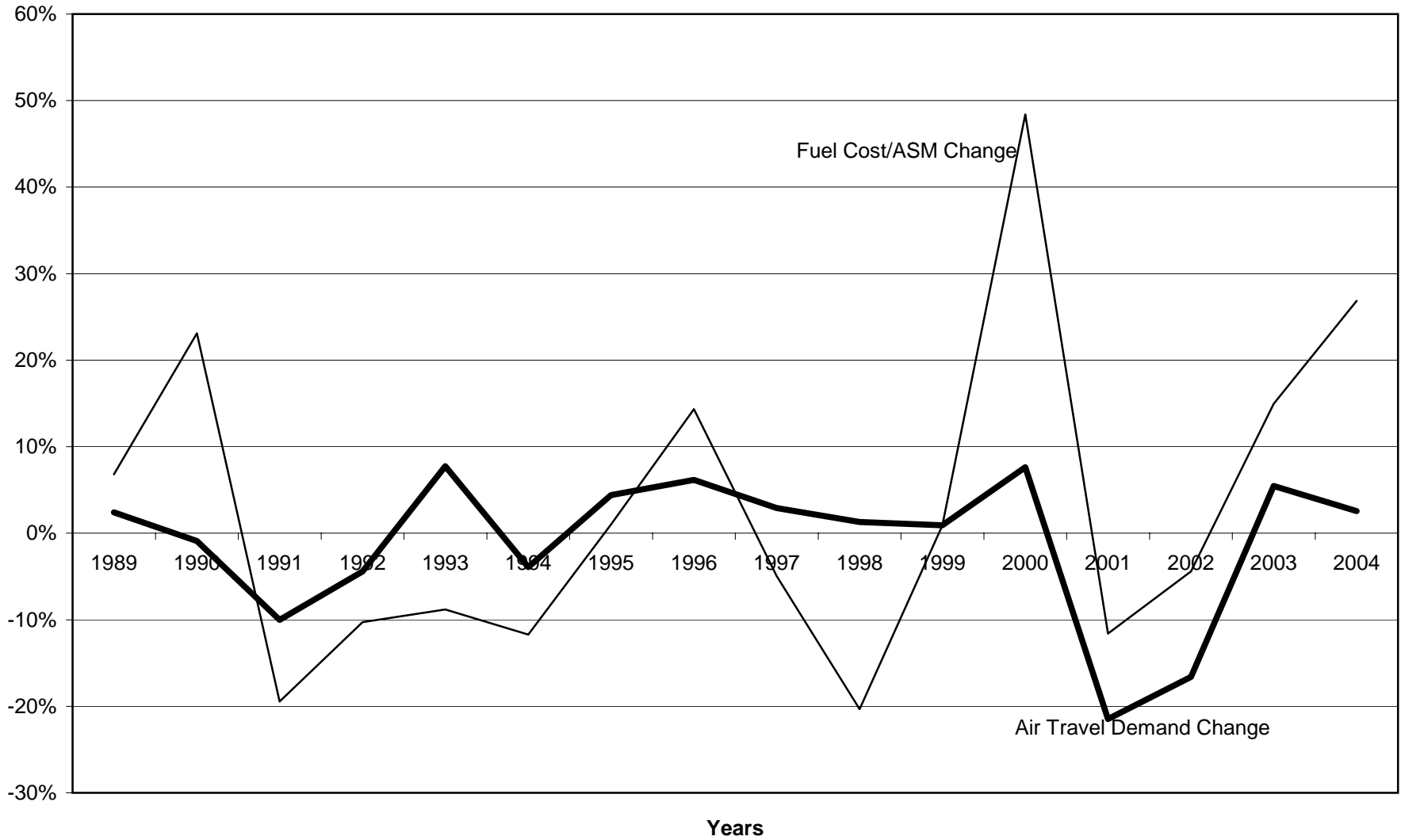
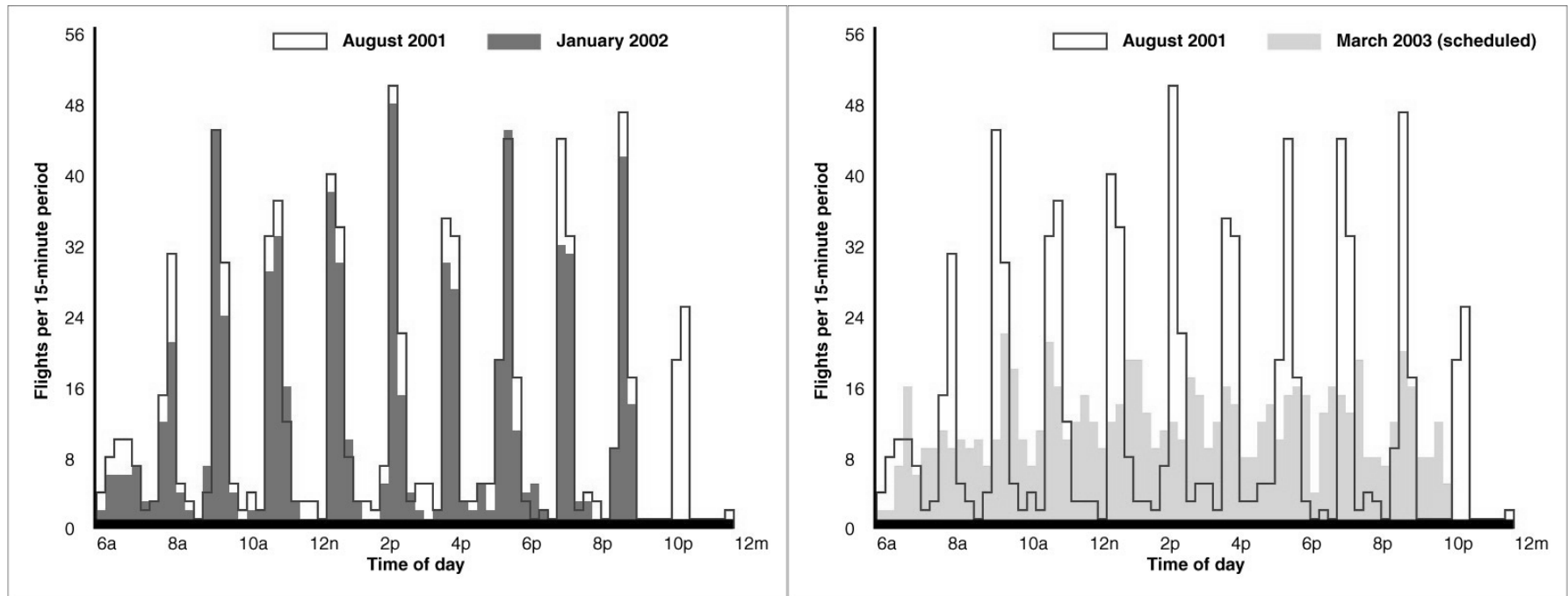


Figure 17: Conversion of American Airlines DFW hub to Rolling Hub Schedule, 2001 - 2003



Source: Tam and Hansman (2003, Figures 4-12 and 4-13).

Figure 18: Dispersion in Average Airline Prices Across 50 Largest Airports, 1984-2004

