Getting Subsidies Right:

U.S. Government Support to the Commercial Aircraft Industry

Eugene Gholz
MIT Center for International Studies
292 Main Street, E38-600
Cambridge, MA 02142
phone: 617 / 253-1288
fax: 617 / 253-9330
e-mail: eugholz@mit.edu

Version 1.5

January, 1997

Version 1.1 Prepared for the 1996 Annual Meeting of the
American Political Science Association
San Francisco, CA

Abstract

By examining the case of the American aircraft industry, this working paper develops a theory of the political economy of high technology industries. The traditional explanation for its industrial performance success, stressing an implicit military industrial policy, is shown to be unsatisfactory in light of the experiences of Lockheed, Convair, and Douglas; even Boeing's experience, if examined at the level of particular projects, does not support the conventional wisdom. Instead, I argue that economic regulation of the airline industry created an indirect, innovation-friendly demand pull. The traditional problem of information asymmetry faced by industrial policies, which often results in their protectionist "capture" by the target sector, was solved by using the airlines as an agent for allocating indirect government support to the American aircraft manufacturers. In fact, during the early jet era, U.S. policy-makers consciously rejected a traditional, direct development support. The third section puts that choice in the context of a theory of industrial policy-making. Finally, the paper concludes with a brief discussion of how the framework might be applied to the telecommunications switching sector.

This paper will focus on the experience of one of the United States' most successful industries, commercial jet aircraft, to develop a theory of the policy roots of industrial performance success in high technology sectors. How did policy contribute to the aircraft sector's competitiveness? The conventional wisdom suggests that government intervention tends to serve particular, protectionist political interests rather than the general welfare. This paper argues, however, that policies with respect to the aircraft industry escaped political capture. Explanations of the aircraft industry's success may offer lessons for other high technology sectors -- ways in which industrial policy can contribute to national prosperity despite the political constraints on policy-makers.

Strategic trade theory suggests that, in certain industries, government policy can capitalize on market failures to shift rents to successful producers, thereby increasing national wealth. On the other hand, economists warn that politicians trying to pursue strategic trade policy will open a Pandora's box of protectionism: because the prescribed economic intervention would be allocated by fallible, political processes, strategic trade policy may subsidize inefficient producers. Paul Krugman and others argue that the only solution is to tie the hands of government with a pure free trade policy, but the political visibility of high-tech industries will always allow lobbyists and policy entrepreneurs to put high-tech industrial policy on the agenda when business interests choose to invest in political action. Their political pressures, however, can be satisfied by a range of policy instruments. The issue for analysts is to understand, for each policy instrument, its expected economic effect and the associated risk of political capture.

The traditional story of the government's role in the aircraft industry emphasizes spin-offs from the huge Cold War defense effort as a de facto military industrial policy. This theory does not account for the decline of the commercial aircraft businesses of General Dynamics, Lockheed, and Douglas Aircraft -- all successful companies on the military side of the business. Nor can a military industrial policy provide as clear a picture as its proponents would like of Boeing's success, even though the theory concentrates

almost exclusively on that company's booming jet aircraft sales. Nevertheless there are good reasons why European industry analysts, Europhile American analysts, and most importantly European trade negotiators misperceive and/or exaggerate the importance of direct subsidies to American aircraft manufacturers.

However, a military industrial policy is not the only way in which the U.S. government could have abetted the development of an internationally competitive aircraft industry. In fact, airline regulation was an important indirect support to the manufacturing sector. By changing the competitive mode among airlines from price to quality competition, regulation changed the investment incentives of aircraft manufacturers' key customers to stimulate rapid innovation and to expand the market for newly-developed products. The airlines themselves had a clear understanding of the importance of various features of aircraft to their competitive prospects, and hence were not subject to as severe an information asymmetry *vis-à-vis* the aircraft industry as government bureaucrats were. Economic regulation of the airlines effectively allowed the government to employ a knowledgeable agent to distribute its support to the aircraft industry, mitigating the risk of political capture. A deductive explanation for the competitive success of the aircraft industry can be couched in terms of overcoming information asymmetries through careful employment of principal-agent relationships.

This paper is organized into two major sections. The first section treats the explanations for the success of the American aircraft industry. It begins with an empirical evaluation of the military industrial policy theory. An alternative explanation based on the indirect effects of economic regulation follows, and the section concludes with a brief deductive discussion addressing the advantages of indirect supports. The second section proffers a short theory of the process of industrial policy adoption in the United States. The theory is then applied to analyze the explicit decision of American policy-makers in the early jet age to eschew direct subsidization of the aircraft industry. The paper concludes with a speculative extension of the analysis to the telecommunications sector.

The Success of the American Aircraft Industry

By almost any standard, the post-World War II performance of the commercial aircraft manufacturing sector in the United States has been a rousing success. First Douglas Aircraft dominated the market for piston-powered airplanes with the DC-3 and later the DC-6 and DC-7. In the jet age, Boeing has been the market leader, rising with the development of the 707 and solidifying its dominance with the 747 and other aircraft. The value of complete civil airframes shipped by American manufacturers in 1995 exceeded $19 billion -- a lot of money even if the total has dropped precipitously from the 1992 peak of nearly twice that amount (in constant dollars).[1] Early evidence from 1996 suggests that the industry has passed the trough of this business cycle. The industry has also been America's leading export sector through most of the period.

The European Airbus Industrie consortium has steadily increased its market share since the launch of its first A-300 aircraft in the early-1970s and captured more than 50% of the market for the first time in 1994, although its sales were decisively beaten back by Boeing in 1995. Market share is neither a reliable nor a valid measure of competitiveness in the aircraft sector, because airlines announce orders for many aircraft at a time: between announcements, demand appears to dry up entirely, which means that market share estimates are highly variable depending on the specific date ranges compared. Furthermore, the aircraft models sold by Boeing, Douglas, and Airbus are highly differentiated products, raising issues of comparability: is one $150 million 747 sale worth more or less market share than 4 $37 million A-320s? Nevertheless, the intuitively obvious point is that the commercial jet aircraft market became hotly contested internationally for the first time in the 1980s and remains so today.

In fact, there have essentially always been three producers of commercial jet transport aircraft competing for the world airline market. In the 1950s, the British de

[1] Figures are from the U.S. Department of Commerce, Economics and Statistics Administration, and notably do not include related sales of aircraft engines. Competitive dynamics and the government role in the engine industry are quite different from those found in the airframe industry, and they are hence excluded from the analysis in this paper.

Havilland Comet was the first to reach the market, but early crashes, followed by an RAF demand that military deliveries of re-designed planes take precedence over exports, torpedoed its success.[2] The first round of competition was essentially between the Boeing 707 and the Douglas DC-8, with General Dynamics' Convair division following into the market with limited sales of its 880 and 990 models.[3] In the 1960s, with Convair knocked out, Boeing and Douglas extended their product lines to wide-body aircraft with the announcements of the 747 and DC-10 models. Lockheed, which had mistakenly believed that there would be a sustained market for turbo-prop transports and had consequently sat out the first round of the jet competition, contributed its L-1011 design, but soon found itself a two-time loser and finally exited the civilian transport aircraft market in the early-1980s.[4]

Airbus' first effort to join the battle followed on the heels of the early wide-body competition at the beginning of the 1970s. However, the real breakthrough for the European consortium did not come until the third round of investment by the world's airlines in jet equipment, in the 1980s' narrow-body competition between Boeing's 737 and 757, Douglas' DC-9 and MD-80, and Airbus' A-320. Prior to that time, trade in the aircraft sector had been almost entirely one-way, with U.S. manufacturers exporting around the world. Any profits or economic rents in the sector added exclusively to the U.S. GDP. With Airbus' rise, the stage was set for a trans-Atlantic strategic trade policy battle over who would secure the rents.

An idealized representation of the commercial aircraft industry as a duopoly in fact provided the original “cooked-up numbers” story to convey the concept of strategic trade.[5] Strategic trade policy adds imperfect competition and oligopolistic rents to the economic

---

[2] Keith Hayward, *The British Aircraft Industry*, New York: Manchester University Press, 1989, pp54-7.
[3] Roger Franklin, *The Defender*, New York: Harper & Row, 1987, pp153, 167.
[4] "Aircraft Shifts Course to Fight Through Storms Ahead," *Business Week* (May 16, 1959): 84-94, and Barry Bluestone, Peter Jordan, and Mark Sullivan, *Aircraft Industry Dynamics: An Analysis of Competition, Capital, and Labor*, Boston: Auburn House Publishing, 1981, pp8-9.
[5] Paul Krugman, *Peddling Prosperity*: *Economic Sense and Nonsense in the Age of Diminished Expectations.* New York: W.W. Norton and Company, 1994, pp235-8.

theory of international trade, and for the first time suggests that in certain industries government intervention can be welfare-enhancing.[6] The chosen sectors should be characterized by oligopolistic price distortions, such that some deadweight loss is inevitable and the only question remaining is the distribution of the oligopoly rents among firms. Government policy can add credibility to the quantity- or price-setting activities of domestic producers, helping them to capture rents (at the expense of overseas competitors).[7] Even if the government support of the oligopoly increases domestic price distortions, net domestic welfare can increase if a high enough percentage of the industry's sales are exports -- that is, if enough rents are extracted from foreign economies to compensate for the deadweight loss of the enhanced oligopoly.

In the case of the aircraft industry, a high ratio of fixed costs to variable costs, lumpy sales contracts that ensure market imperfections, and technological entry barriers suggest a continuing oligopoly structure. High and increasing export intensity suggests the potential for substantial rent-shifting returns: exports as a percentage of industry sales are increasing and will continue to increase.[8] And high-value, politically-visible sales campaigns and the geographic concentration of sectoral employment guarantee that politicians will always pay attention to the industry.

The real economic situation has been more complex than the idealized duopoly model. Competition from the third producer, Douglas Aircraft, has had a significant impact on industry pricing -- at least until Boeing's recently-announced plan to merge with

---

[6] Paul R. Krugman, "Introduction: New Thinking about Trade Policy," in Paul R. Krugman, ed. *Strategic Trade Policy and the New International Economics.* Cambridge, MA: MIT Press, 1986, p9. In addition to the rent-shifting argument for strategic trade, some authors contend that government trade policy can play a role in internalizing positive externalities, notably localized economic spillover benefits. However, only a few of the positive effects which an industry can have on downstream sectors are true externalities in the sense that they are not appropriable through normal market interactions, and, particularly in light of the increasing globalization of the high-tech economy, few strategic industry spillovers are truly country-specific. Sylvia Ostry and Richard R. Nelson, *Techno-Nationalism and Techno-Globalism: Conflict and Cooperation*, Washington: Brookings Institution, 1995, p28.

[7] Gene Grossman, "Promoting New Industrial Activities: A Survey of Recent Arguments and Evidence," Working Party No.1 of the Economic Policy Committee: Annex 1, Prepared for the Secretariat of the Organization for Economic Co-Operation and Development, September, 1989, especially pp21, 27.

[8] U.S. International Trade Commission, *Global Competitiveness of U.S. Advanced Technology Manufacturing Industries: Large Civil Aircraft*, Investigation No. 332-332, Publication 2667, August, 1993.

Douglas.[9] Rather than segmenting the market, Boeing, Airbus, and Douglas competed aggressively in almost every airline sales campaign:[10] variable profits might have been substantially higher if Boeing, the market leader, had allocated certain airlines' demand to each of its competitors and if Airbus and Douglas had reciprocated by easing off on competition for "Boeing's airlines;" however, the total profit picture, which includes the amortization of the huge fixed cost of developing each aircraft model, drove the three competitors to maximize market share even at the price of unit profits.[11] Douglas rationally persisted in competing with a "lean and hungry look" rather than as a "puppy dog" in the famous Fudenberg and Tirole representation of oligopolistic competition.[12] This aggressiveness reduced the rents available in the industry (and hence reduced the potential mercantilist benefits from aircraft trade).

The near-term situation in commercial aircraft markets after the coming Boeing-McDonnell Douglas merger will change in one crucial respect, which should boost rents-shifting possibilities. Boeing promises to continue to sell McDonnell Douglas' aircraft designs, including the MD-95 which is currently under development. But Boeing presumably will not price the Douglas planes as aggressively as Douglas management would have. Although the business press continues to portray the American company's huge size as a threat to Airbus, the European manufacturer may even benefit from the new

---

[9] Michael Skapinker, "Boeing the boss despite brave faces," *Financial Times* (December 16, 1996): 19.

[10] In a recent example, Boeing won a large order for 737 narrow-body aircraft from SAS, which had traditionally been a buyer of Douglas' products. Boeing and Airbus both competed particularly aggressively in that campaign, because Douglas had hoped to launch a new product, the MD-95, with the sale. Jeff Cole, "Boeing Is Offering Cuts In Prices of New Jets, Rattling the Industry," *Wall Street Journal* (April 24, 1995): A1. The MD-95 aircraft was later launched on terms less favorable to Douglas with an October, 1995, order from ValuJet Airlines. Kathryn Jones, "Market Place: McDonnell Douglas Seems a Tale of Two Aircraft Manufacturers," *New York Times* (October 19, 1995): D10. Jeff Cole, "McDonnell Seeks MD-95 Buyers Following Grounding of ValuJet," *Wall Street Journal* (June 19, 1996): B4.

[11] The development cost for a new aircraft model is very high, running well into the billions of dollars. Estimates place Boeing's fixed investment in its new 777 model around $5 billion; even derivative designs are expensive to develop, for example Boeing's consideration of a new 747-600X. Charles Goldsmith and Jeff Cole, "McDonnell Courted by Daimler-Benz to Join Airbus Efforts to Develop Jet," *Wall Street Journal* (May 14, 1996): A4. Even labor costs for aircraft manufacturers are quasi-fixed, because the industry is intensive in high-skilled, craft labor, further raising adjustment costs to cutbacks in sales. Alexander Kronemer and J. Edwin Henneberger, "Productivity in Aircraft Manufacturing," *Monthly Labor Review*, Vol. 116, No. 6 (June, 1993): 24-33.

[12] Drew Fudenberg and Jean Tirole, "The Fat Cat Effect, the Puppy Dog Ploy, and the Lean and Hungry Look," *American Economic Review, Papers and Proceedings*, Vol. 74: 361-68.

industrial organization and the higher pricing schedule that it is likely to bring.[13] The real question in the longer term is what the American industry's consolidation means for the entry of a major Asian player in Japan, Korea, China, or through a consortium.[14]

The remainder of this section will explain the success of American jet airframe manufacturers and draw lessons from this industry about the types of government supports that are most likely to strengthen high-tech sectors. First, traditional explanations which emphasize direct government support to Boeing and Douglas via a military industrial policy will be considered and rejected. In their place, I will then offer a demand-side explanation focusing on the indirect effects of regulation of the downstream airline market by the Civil Aeronautics Board. This section, by comparison to the British failures with the de Havilland Comet and Vickers Viscount airplanes, will particularly highlight the potential pitfall of political capture inherent in direct subsidization schemes. Finally, a third section will develop a theoretical model abstracting from the aircraft industry to an analytical explanation for the success of indirect supports.

Traditional Supply-Side Explanations

The U.S. government has never had an official, announced, transparent policy of subsidizing its commercial jet aircraft manufacturing industry. Nevertheless, many analysts have found what they believe to be evidence of government support. In one widely-read account, Laura Tyson concludes that

[13] One might predict that Boeing or Airbus would have sought to buy McDonnell Douglas (or its commercial aircraft operation) before, simply to eliminate Douglas' role in spoiling the high-price, duopoly equilibrium. There have, in fact, been attempts from both sides: Airbus-Douglas pacts in the late-1970s and late-1980s rapidly disintegrated in disputes over the value of the American firm, and an earlier round of merger talks between Boeing and Douglas in 1995-6 broke off when no agreed price could be reached for McDonnell's successful military manufacturing organization. The current deal has only been made possible by McDonnell's elimination from the U.S. Air Force's Joint Strike Fighter competition, which left the firm with a long backlog of orders for current military designs (F-15 and especially the F-18) but no independent prospects for the far future (post-2010). Boeing's CEO, Philip Condit, has indicated that a primary motivation for the merger was to gain entry to a bigger share of the defense business in the future. Michael Skapinker, "Military Spending Rise Spurred Boeing Bid," *Financial Times* (January 2, 1997): 1.

[14] For a discussion of Japan's strategic thinking in previous rounds of aircraft investment, see David B. Friedman and Richard J. Samuels, "How to Succeed without Really Flying: The Japanese Aircraft Industry and Japan's Technology Ideology," MIT Japan Program Working Paper 92-01, and Richard J. Samuels, *Rich Nation, Strong Army*, Ithaca, NY: Cornell University Press, 1994.

> The historical record indicates that the United States has had a makeshift, unintentional, but nonetheless effective industrial policy toward its commercial aircraft industry. ... Although US policy has not been designed to guarantee successful performance in the commercial operations of American aircraft producers, R&D support, large backlogs of 'safe' military contracts, and the government's unwillingness to allow a huge defense contractor to fail completely 'whatever its commercial sins' (Carroll 1975, 162) have emboldened American producers to undertake risky commercial ventures and have helped them raise the considerable financial wherewithal required to do so.[15]

This argument has a great deal of intuitive appeal and seems particularly plausible to analysts who are inclined to believe in the long reach of the military-industrial complex into American politics and society. Airbus Industrie makes similar allegations about an American military industrial policy in order to "justify" European governments' direct launch aid for Airbus planes. Again, the argument is intuitively plausible to European analysts, who know that the obvious European solution to the same problem, developing a healthy aircraft manufacturing industry, is to subsidize: if they would do it, why wouldn't we?[16] Airbus' public relations line on government support to American aircraft manufacturers argues as follows:

> Commercial aircraft programs developed in the United States are closely linked to military/government funding and support. The 707, which enabled Boeing to enter the commercial jet market, cost Boeing only $180 million because the military carried the burden of development costs (estimated at $2 billion) for a tanker aircraft, the KC 135. ... The 747, which started on the drawing board as a military transport, has grown to monopolize the large-end of the commercial aircraft business. The government-industry link, through the ... support provided, helped propel the US into a globally dominant position.[17]

In sum, there are two key features of the military industrial policy argument drawn from the Airbus brief and Tyson's chapter. First, they contend that the development of important American commercial jet aircraft models began with military programs, such that technology and financial support from the military projects "spilled over" to the commercial

---

[15] Laura Tyson, *Who's Bashing Whom? Trade Conflict in High-Technology Industries,* Washington, DC: Institute for International Economics, November, 1992, pp169, 171.
[16] For example, Laurent Rouaud, *Etude d'un Oligopole: Le Marché des Avions Civils,* Master's Thesis, Université des Science Sociales de Toulouse I, 1994.
[17] Airbus Industrie, *Competition in Commercial Aircraft Manufacturing: Airbus Industrie's View,* Corporate Communications, Blagnac Cedex, 1993, p7.

project. And second, they argue that participation by the American commercial aircraft manufacturers in military projects provided their business with enough stability that they could cover the high risks of the commercial aircraft business, which they otherwise would have been unable to tolerate. Neither of these views holds up under close scrutiny.

To begin with, the military industrial policy argument, as plausible as it may seem, fails even a first-glance test. The most successful American jet aircraft manufacturer, Boeing, did not maintain a major, steady commitment to defense work; in fact, during the 1980s, the share of Boeing production devoted to the military was considerably less than 20%. Boeing's last military aircraft, the B-52, went out of production nearly forty years ago. Lockheed and McDonnell Douglas, on the other hand, had much less success on the commercial side of their businesses, despite their much greater participation in the defense aircraft market.

Lockheed's experience in particular points up the problems military contractors have serving commercial aircraft markets. In the early 1970s, Lockheed's Georgia facility was in the final stages of development of the C-5A military transport aircraft -- one of the key programs which Airbus alleges aided the commercial jet aircraft industry in the U.S. At the same time, the Lockheed's California plant was developing the L-1011 commercial jet transport. When the C-5 program ran into technical problems, Lockheed was forced to divert engineers from the California plant to Georgia to try to catch up to the military's schedule. Combined with the effects of Rolls-Royce's bankruptcy (Rolls supplied the L-1011's engines), the military demand slowed L-1011 deliveries by nearly a year, by which time the market niche had been lost to Douglas.[18] At the time, analysts in the Office of the Secretary of Defense investigated the L-1011 program to determine if it had diverted funds or engineering effort from the C-5, but concluded that the commercial program was "clean."[19] Even with Lockheed's considerable resources and engineering and production

[18] Interviews with retired Lockheed executive Willis Hawkins, October, 1994.
[19] Author's correspondence with Charles Debelius, the analyst who did the OSD (SA) study, November, 1994.

experience, the financial argument for developing the C-5 and the L-1011 at the same time was weak. Tyson repeatedly touts the ability of the American aircraft manufacturers to diversify their financial risk across both military and commercial projects, but such financial diversification is only a risk-minimizing strategy when the portfolio holder has enough capital to suffer concurrent downturns in all aspects of the portfolio -- the very situation which faced Lockheed in the early-1970s.[20]

One more aspect of Lockheed's experience in the commercial jet transport market bears directly on the issue of military industrial policy. In the early-1960s, before the start of either the C-5 or the L-1011, Lockheed had designed and built another jet transport aircraft, the C-141, which had explicitly been designated in Lockheed's contract with the Air Force as a dual use aircraft. The idea was to stimulate a commercial all-cargo jet airline industry using the same plane that the Air Force ordered to transport troops and equipment. Lockheed's entry in the Air Force design competition surprisingly beat those of Douglas, Boeing, and Convair (the other manufacturers of commercial aircraft at that time), and Lockheed appeared poised to win as many as 400 commercial airline orders for the L-500 version of the C-141 aircraft.[21] However, although the aircraft was certified for commercial cargo use, Lockheed never sold any copies to the airlines, because the plane's military requirements left it unsuited for economical commercial use.[22] Ironically, Lockheed's best leads on sales of the L-500 were international, perhaps to JAL, and the American air cargo business continued to languish.[23] That failure of the dual use aspect of the C-141 was repeated by Lockheed's inability to get airlines interested in commercial versions of the C-5 and by the substantial design differences between the C-5 and the commercially-successful Boeing 747 wide body -- differences in wing structure, empennage, and fuselage shape.

---

[20] Interview with Cai von Rumohr, defense industry analyst at Cowen and Company, December, 1994.
[21] "'Breakthrough' on Cargo Jets," *Business Week* (March 25, 1961): 124.
[22] Roger D. Launius and Betty R. Kennedy, "A Revolution in Air Transport: Acquiring the C-141 Starlifter," *Airpower Journal*, Volume V, No. 3 (fall, 1991): 79.
[23] Interview with former Lockheed executive Robert Ormsby, November, 1994.

In the end, few analysts really take seriously Airbus' claims about commercial spin-offs from the C-5 program (to the 747, DC-10, and L-1011); but there is much less skepticism about military support to the first generation of American jet aircraft, notably Boeing's 707. Even some American industrialists -- for example, Donald Douglas, Jr. -- purport to believe Boeing garnered substantial advantages on the 707 from its KC-135 tanker production for the Air Force.[24] A recent study for the U.S. Air Force confirms important technical similarities between the 707 and military designs, emphasizing innovations that were introduced on the B-47 bomber which were later applied to both the 707 and the KC-135.[25] But other companies had access to the same technology such that it provided little competitive advantage to Boeing. Douglas and Lockheed had even built B-47s on their own lines beginning in 1950, giving them production experience with the new design characteristics,[26] and each had designed their own jet aircraft for the military from which they derived their own commercial design proposals.[27]

Among European companies, it was not lack of technical skill which limited their competitive options in the jet aircraft field: de Havilland's Comet I beat all of the American manufacturers to the market by several years with a flying aircraft in May, 1952. In fact, there was something of a policy crisis in the United States in the late-1940s and early-1950s as we struggled to "catch up" with the British technological lead in jet aircraft development.[28] Initially, it appeared as if the British were going to capitalize on their lead:

---

[24] Interview with Donald Douglas, Jr., former president of Douglas Aircraft, July, 1994. Of course, the Douglas family, as the previous reigning industry leader before Boeing's rise, had a certain interest in supporting this story.
[25] Joe Weingarten, *The Impact of Military Aviation on Civilian Aircraft Development: Evolution of the Boeing 386 Dash 80, KC-135 and Boeing 707,* Dayton, OH: Huffman-Wright Institute for Aerospace Research, May, 1994.
[26] Weingarten, p11.
[27] "Douglas Ready to Build Jet Transport," *Aviation Week* (August 11, 1952): 13. Specifically, the Douglas DC-8 traced some of its roots to the XB-43 bomber, according to "Industry Observer," *Aviation Week* (July 28, 1952): 11. Lockheed's early jet transport mock-ups were scaled-up versions of its F-90 fighter proposal. "Lockheed Tools Up for the Jet Age," *Business Week* (February 3, 1951): 55-60.
[28] "Aviation: U.S. Lags on Jets," *Business Week* (June 23, 1951): 87-8, and "Passenger Jets?" *Business Week* (October 8, 1949): 38-41.

> [I]t was not until the fifties that aircraft appeared which, though never introduced into United States service, were serious contenders in the American market. As it turned out, both of these aircraft were British, the Bristol Britannia turbo-prop and the de Havilland Comet jet. Both of these planes came from impressive pedigrees, being offered by firms known and respected throughout the world. Both Bristol and de Havilland had orders in their pockets when they came aggressively hunting business in the United States. And when each guaranteed full United States certification and after sales service and support, American carriers knew that these substantial companies possessed the wherewithal to perform. It is not surprising, therefore, that letters of intent to purchase were tendered by United States domestic carriers to Bristol and de Havilland.[29]

Imports of British flight equipment were only avoided when several early models of the Comet crashed. Although the RAF subsidized the redevelopment into the Comet IV, the British government insisted that its RAF models be delivered before the de Havilland company could offer any aircraft to airline customers. In the interim, Boeing came out with the 707 and Douglas with the DC-8, and the first round of jet transport purchases had passed. In fact, a crucial European lead in jet technology seems to have been lost due to clumsy government intervention[30] -- an experience not totally alien from American firms dealings with performance pressures from the U.S. military.

As for the financial aspects of the alleged link between the 707 and the KC-135, the picture is murkier. In its own defense, Boeing loudly proclaims that in 1952 it invested $16 million of its own money in building the model 367-80 (called the Dash 80) -- which was to become the prototype for both the 707 and the KC-135.[31] At that time, $16 million was approximately one-fourth of the net worth of the corporation -- a substantial investment in a prototype aircraft with no committed orders. On the other hand, Boeing was angling for a military contract to recoup this investment from very early on. Boeing records show that company officials made an extended sales visit to Wright-Patterson Air

---

[29] Aaron Jacob Gellman, *The Effect of Regulation on Aircraft Choice*, Unpublished MIT PhD Dissertation, Department of Economics, February, 1968, p282.
[30] Philip Gummett, "Civil and Military Aircraft in the UK," *History and Technology,* Vol. 9 (1992): 205, and Hayward, pp54-7.
[31] This claim is oft-repeated, for example in the "U.S. Government Response to the EC-Commissioned Report 'U.S. Government Support of the U.S. Commercial Aircraft Industry,'" reprinted in the Report of the Industry Sector and Functional Advisory Committees, *The Uruguay Round of Multilateral Trade Negotiations,* January, 1994.

Force Base, headquarters of the Air Materiel Command, as early as December, 1952, to try to sell the Air Force on their jet tanker design.[32] Quiet competitions for a jet tanker requirement had involved Boeing, Lockheed, and Douglas at Wright Patterson since mid-1951.[33]

In March, 1953, well before the Air Force had officially announced a purchase of Boeing jet tankers, Boeing had explicitly promised the Air Force that any design conflicts between commercial and military derivatives of the Dash 80 prototype would be resolved in favor of the military.[34] And even before that promise, an internal company document reminds engineers who was the real expected customer for the jet prototype:

> As long as this [is] a Company-sponsored project, any study or suggestions by the Military would not be binding. However, I was wondering if some top people from Engineering should again go over this in considerable detail with General Le May [Commanding Officer of the Strategic Air Command] when the necessary data is available for the sole purpose of determining if the plans will approach his requirements at the time when production may be expected. I presume that although commercial use is indicated, military orders will be essential at the outset.[35]

It is true that during the same period of time, Boeing had extensive discussions with the engineering departments of the major airlines,[36] but it is also clear that the financial commitment to the Dash 80 would not have been forthcoming without significant assurances of a military market. Boeing's inside track with the Air Force (or at least with the dominant branch of the early-Cold War Air Force, SAC, for whom Boeing built the B-47 and B-52 heavy bombers) was especially important when Lockheed's jet tanker "won"

---

[32] Memo from D. B. Martin to R. L. Bell, Re: Military Services Contact - December 1-12, 1952; Jet Transport-Tanker Activity, dated December 29, 1952, Boeing Archives, Seattle, Washington.
[33] Memorandum for Mr. McCone, Under Secretary of the Air Force, Subject: Tanker Aircraft, dated August 10, 1951, in KC-97 Correspondence File, Records of the Director of Procurement and Engineering, HQ, U.S. Air Force, RG 341, Entry 457, Box 20, National Archives, Washington, DC.
[34] Letter from Wellwood Beall, Boeing Vice President of Engineering and Sales, to Major General Mark C. Bradley, Jr., dated March 26, 1953, in the Boeing Archives, Seattle, WA.
[35] Memorandum from P. N. Jansen to W. E. Beall, E. C. Wells, and J. O. Yeasting, subject: Jet Tanker 367-80, dated June 23, 1952, at the Boeing Archives, Seattle, WA.
[36] Letter from Wellwood Beall to William Littlewood, American Airlines' Vice President of Engineering, dated January 9, 1953, at the Boeing Archives, Seattle, WA.

the technical competition held by the Air Materiel Command in 1954, but Boeing received the "interim" order to fulfill the tanker requirement anyway.[37] The Lockheed plane was never produced.

On the other hand, Boeing's victory, receiving "the juiciest plum to be dangled before the aircraft industry in several years,"[38] did not guarantee Boeing a dominant position in the civilian jet transport market. The military, as Lockheed found out years later when the C-5A and L-1011 programs ran into conflicts, is not a "good" customer, from a commercial viewpoint. Just as powerful military interests could steer contracts to their favored manufacturer, the military freely destroyed companies that fell from grace. Curtiss-Wright, a leading aircraft and engine firm and the second biggest company in America at the end of World War II, learned this lesson as it collapsed during the military procurement boom of the 1950s.[39] Furthermore, the military's insistence that its production needs be satisfied first, before any commercial deliveries, scared off some potential airline buyers -- driving them to purchase Douglas' rival plane, the DC-8.[40]

The bottom line of the military industrial policy argument on the 707 and KC-135 is that Boeing probably received a small net benefit from its military relationship. On the other hand, the crucial victories of the early period of jet development did not depend on a military industrial policy at all. Both Boeing and Douglas made money on their early jet designs -- although the profit, particularly to Douglas, did not come for many years.[41] The key to understanding the early jet transport competition is the threat that major U.S. airlines would buy the de Havilland Comet.[42] Boeing and Douglas were forced to invest in jet

---

[37] "Industry Observer," *Aviation Week* (July 5, 1954): 11, and Robert Hotz, "Boeing Gets Order for 88 Jet Tankers," *Aviation Week* (August 23, 1954): 13-4.
[38] "Tanker Competition," *Aviation Week* (August 9, 1954): 9.
[39] Eugene Gholz, "Procurement Politics: The Decline of Curtiss-Wright," *Breakthroughs*, Vol. 4, No. 1 (Spring, 1995): 9-17. Also, Eugene Gholz, "The Pattern of Cold War Defense Procurement: Theory Testing Using the Case of the Curtiss-Wright Corporation," in review.
[40] Pierre Muller, *Airbus, L'ambition Europeenne: Logique d'Etat, logique de marché*, Paris: L'Harmattan, 1989, p19.
[41] Interview with Dave Williams, General Manager, Strategic Business Development, Commercial Aircraft, McDonnell Douglas, October, 1995.
[42] Nat McKitterick, "Jet Liner Enigma: Delivery Dates," *Aviation Week* (September 15, 1952): 79-80.

designs in 1952, and a combination of bad luck and clumsy government intervention squandered the British technological lead. Of the two arguments distilled from the military industrial policy literature, neither government-supplied technology nor military-augmented financial stability saved the American aircraft manufacturers.

An Improved, Demand-Oriented View

Several prominent economists have tried to develop empirical models of the international competition in commercial aircraft, calibrated to actual sales data, in order to test strategic trade theories. These studies have been primarily interested in the effects of visible, direct government subsidies to Airbus Industrie -- estimating the effect of the Airbus subsidy on American (modeled as Boeing) production and on net consumer and producer surplus in Europe, the United States, and in the world.[43] In the various models, the U.S. industry is assumed not to receive government aid and to act only as a strategic oligopolist. Although the economists' models show proper skepticism of European claims of an American military industrial policy, ignoring all effects of U.S. government policy on the competitive situation in the aircraft sector is too extreme.

In fact, American aircraft manufacturers did benefit from substantial government aid, administered indirectly through CAB regulation of the airline industry. Since deregulation, airline capital investment budgets have cycled through a period of feast followed by famine, and the long-term outlook for aircraft demand from U.S.-flag airlines, now that the CAB's indirect subsidy is gone, is weak.[44] Fortunately, growing Pacific air

---

[43] Richard Baldwin and Paul Krugman, "Industrial Policy and International Competition in Wide-Bodied Jet Aircraft," in Robert E. Baldwin, ed., *Trade Policy Issues and Empirical Analysis*, Chicago: University of Chicago Press, 1988, pp45-78. Paul Krugman and Lael Brainard, "Problems in Modeling Competition in the Aircraft Industry," Paper prepared for the CEPR-NBER conference on strategic trade policy, July, 1988. Gernot Klepper, "Industrial Policy in the Transport Aircraft Industry," in Paul Krugman and Alasdair Smith, eds., *Empirical Studies of Strategic Trade Policy*, Chicago: University of Chicago Press, 1994, pp101-30.

[44] Elyse Golob, "The Impact of Deregulation on Investment and Production Strategies in the Commercial Aircraft Industry," Paper presented at the Transportation Research Board Annual Conference, Washington, DC, January 25, 1995, develops some of the arguments presented here, but in considerably less detail and without systematic hypothesis testing. Also, Robert D. Shriner, *The Troubled Airline Industry: Its Impact on Aircraft Manufacturers and the U.S. Economy*, Washington, DC: Aerospace Industries Association, June, 1993, p10.

travel markets will continue to provide a target for Boeing and Douglas export sales -- and for rent-shifting to the U.S. economy.

The traditional debate in the positive political economy of regulated industries is over whether the regulatory agency has been "captured" by the firms that it oversees. Civil Aeronautics Board regulation of the airlines is no exception.[45] But two simple tests belie this capture hypothesis. First, regulatory policies changed repeatedly, and not always in directions favorable to the airline industry. The CAB was charged both with promoting air transportation and with preventing "destructive competition" among airlines, and it balanced its goals by varying the amount of competition it allowed between city-pairs. From time-to-time, CAB decisions substantially increased competition on routes, eliminating rents that would otherwise have accrued to airlines -- highly unlikely behavior for a "captured" agency.[46] Second, and perhaps more telling because it aggregates the experience of many airlines over a long time period, CAB regulation did not yield super-profits for the trunkline carriers:

> Measured as a rate of return on investment, the airline industry's profits under CAB regulation characteristically have been mediocre or low relative to profits by other American industries -- even though consumer demand for air service has grown rapidly. During the thirty year period from 1947 to 1976, the CAB-certificated airlines' overall rate of return on investment was above 10.0 percent during only six years, between 5.0 and 9.9 percent sixteen years, and below 5.0 percent eight years. The airlines' highest rate for any year between 1947 and 1966 was 13.0 percent; and between 1967 and 1976, 9.6 percent.[47]

From the airlines' perspective, the whole point of "capturing" the regulator would have been to ensure a high rate of profit, and the history of dismal financial returns suggests that regulators truly considered consumer and national security interests in developing the American air transportation system.

---

[45] Bradley Behrman suggests that some of these academic critiques of the CAB may even have helped the pro-deregulation political forces in the middle of the decade. "Civil Aeronautics Board," in James Q. Wilson, ed., *The Politics of Regulation*, New York: Basic Books, 1980, p76.
[46] Anthony E. Brown, *The Politics of Airline Deregulation*, Knoxville: University of Tennessee Press, 1987, pp63-4.
[47] Behrman, "Civil Aeronautics Board," footnote 12, p404.

The actual implementation of CAB regulation principally took the form of a prohibition on price competition among airlines. The CAB allocated a direct subsidy to all classes of airlines until the 1950s (via intentionally generous payments for carrying air mail), but such transfer payments were phased out for trunklines during that relatively-prosperous decade. Instead, the Board set comfortable fares on all routes. As the Chairman of the CAB wrote,

> in the regulated transportation field a rate or fare cannot be fixed at a level that will permit only the strongest carrier to survive, it must be set at a level that will permit the survival of the bulk of the industry under honest, efficient, and economical management.[48]

By controlling which routes a carrier was "certificated" to serve, the CAB also had substantial indirect influence on other management decisions, but the CAB's procedural rules prevented it from controlling carriers' business strategies. Business strategies were interpreted to include decisions on capital investment, on service quality and amenities, and on departure frequencies.[49] The only specific equipment standards enforced by the CAB had to do with seating density in coach class (which had to be sufficiently higher than in first class to clearly differentiate the products) and with charging for meal service in coach class (which was explicitly required).[50]

Nevertheless, the Civil Aeronautics Board's regulation had substantial indirect influence on the investment budgets of the airlines -- all-important from the perspective of the aircraft manufacturers. By banning price competition, the CAB did not effectively suppress the competitive urges of the air carriers; instead, it simply shifted the competitive dynamic away from the price variable to quality of service.[51] One of the principal ways for an airline to improve service quality was to purchase the latest technology airplanes. A

---

[48] Letter from Oswald Ryan to Senator Hubert H. Humphrey, dated March 30, 1953, at the National Archives, College Park, MD, RG 197, Records of the Civil Aeronautics Board, Entry 23, Office of the Chairman, Outgoing Correspondence (Reading File), Box 55, May, 1952, to April, 1953.
[49] Brown, p67.
[50] Letter from James R. Durfee, Chairman of the CAB, to Senator Jacob K. Javitz, dated July 8, 1958, at the National Archives, College Park, MD, RG 197, Entry 23, Box 60.
[51] Alfred E. Kahn, *The Economics of Regulation: Principles and Institutions*, Volume 2, New York: John Wiley and Sons, 1971, p10.

second mechanism used to compete in the price-controlled airline industry was frequency of departures: to maximize convenience for as many travelers as possible, and to try to gain the perception of dominance on a particular city-pair route, carriers scheduled many more flights each day than needed to simply provide the transportation capacity demanded.[52] The total market demand for aircraft was expanded as a result.

The effects of quality competition on flight equipment investment decisions of the regulated airlines were quite pronounced -- for good reason, since introduction of new aircraft technologies could demonstrably shift market share on a given city-pair. Airlines, fully advised of unfavorable direct operating cost comparisons between new equipment and established aircraft designs, repeatedly chose to "upgrade" their product in order to provide advertisable differentiation in service quality -- faster speed of travel, a reduction in engine noise and vibration, or other quality improvements.[53] The demands of quality competition were quite stringent. In 1957, for example, Northeast Airlines, the weakest of the major U.S. airlines, introduced service from New York to Florida in competition with Eastern Airlines, one of the "Big Four" carriers; Northeast's financially-strapped investment program deployed relatively efficient DC-6A equipment on the route, which made very little market share headway against Eastern's more advanced Lockheed Super Constellations and DC-7s. Capital Airlines, on the other hand, introduced service on the New York-Atlanta run with its imported Vickers Viscount aircraft and immediately became the market share leader flying against Eastern's Lockheed models. The Viscount offered no advantages in terms of speed, but as the first turbo-prop service in the U.S. it was exciting and comfortable for passengers.[54]

Capital Airlines' acquisition of the Viscount is particularly important, because it is a rare case of aircraft imports into the United States. CAB regulation, while providing for augmented demand pull and consequently indirect support for the aircraft manufacturing

[52] Steven Morrison and Clifford Winston, *The Economic Effects of Airline Deregulation,* Washington: Brookings Institution, 1986, p4.
[53] Gellman, p256.
[54] Gellman, pp426, 457.

industry, did not differentiate between foreign and domestic producers of aircraft. When U.S. firms were technology or market leaders, quality competition abetted their sales efforts for new designs, but when foreign (British) designs were leaders, airline price regulation stimulated imports.

Fortunately for the American industry, foreign manufacturers almost never offered more advanced products than Boeing, Douglas, and Lockheed. CAB regulation as a result had the consequence of helping the Americans maintain their marketing advantages. In the case of the Viscount, turbo-prop designs were almost immediately supplanted in the late-1950s by the advent of fully jet-powered aircraft, and the Viscount never became dominant -- much as Lockheed's turbo-prop Electra failed to compete successfully with Boeing's 707 and Douglas' DC-8.[55] Donald Douglas, Sr., at the time CEO of Douglas Aircraft, explicitly indicated that the failure of the DC-7 to compete effectively with Lockheed's Electra for an important order from American Airlines led to the final commitment to build the jet-powered DC-8, which made the Electra obsolete.[56]

On the other side of the Atlantic, British industrial policy explicitly recognized the pressure to import high-quality aircraft during phases in which their aircraft industry did not offer a leading product -- notably during the 1948-52 period, before Comet sales came on line.[57] British policy-makers at that time redoubled their commitment to de Havilland's jet-powered Comet, using a direct subsidy to leap-frog the American competitors' advanced propeller-powered aircraft. In the interim, they authorized the import of some American-produced airplanes to keep British Overseas Airways competitive. The idea was that the aircraft trade deficit could be recouped later, when the Comet was available for export sales.[58] Of course, Comet exports never really materialized due to the crashes.

---

[55] The Electra did manage to sell some 200 copies, and so cannot be classified as an abject failure, but slack demand dropped to almost zero after two of the aircraft crashed in 1960. "The Big Switch from Aircraft," *Business Week* (April 8, 1961): 43-54.
[56] "Jet Transport Race Enters the Stretch," *Aviation Week* (June 13, 1955): 142.
[57] Notes by Major Thornton on "British Airlines and American Aircraft," April, 1947, Public Records Office, Kew Gardens, BT 217, File 1440.
[58] First interim report of the Interdepartmental Committee on Civil Aircraft Requirements, July, 1946, Public Records Office, Kew Gardens, BT 217, File 484, 1946-7 Civil Aircraft Requirements Committee.

The CAB was certainly conscious of the investment stimulus price regulation provided the aircraft manufacturing industry:

> By substituting quality competition for price competition, regulation has stimulated the demand for the newest types of aircraft which constitute one aspect of quality. This has accelerated the obsolescence of earlier types as carriers were precluded from offering service with older aircraft at a correspondingly lower price. To a much greater degree than in the consumer durable goods industries, new aircraft models incorporate improvements as well as changes. As a result, the fleets consisted, at any given time, of aircraft which were individually more productive than they would otherwise have been. The curtailed useful life which produced this fleet modernization must inevitably have produced higher total investment as well. If the industry were not subject to price regulation, equipment decisions would be based on a wide range of price/quality combinations, with the probability of efficient employment of capital correspondingly increased.[59]

The implication is that the distorted investment decisions of the airlines may have hampered efficiency in that sector -- specifically, the productivity of capital (the ratio of output to investment) was artificially reduced by regulation, lowering net returns -- but with compensating benefits for the traveling public, served by higher quality flight equipment, and for the aircraft manufacturing sector. The manufacturers also knew the beneficial effect of regulation on their business, although their opposition to deregulation was muted by their general lack of direct contact with the CAB and by the diversity of views on regulation exhibited by their airline customers.[60]

One prominent analysis of competition in the aircraft industry has suggested that the ability of the regulated airlines to pass through their equipment investment costs to air travel consumers (in the form of high CAB-specified fares) allowed American aircraft firms to produce inefficiently.[61] Presumably, if airlines were not carefully monitoring capital investment costs (because they arguably were not paying the bill), they would not object to padded bills from manufacturers. However, this result seems very unlikely, and in fact

[59] United States Civil Aeronautics Board, *Report of the CAB Special Staff on Regulatory Reform*, Washington: CAB, July, 1975, pp138-9.
[60] Letters to the CAB Special Staff on Regulatory Reform from Boeing, Douglas, and Lockheed are reprinted as an appendix to their report.
[61] Artemis March, "The US Commercial Aircraft Industry and its Foreign Competitors," MIT Commission on Industrial Productivity Working Papers, Vol. 1, Cambridge: MIT Press, 1989, p4.

regulation almost certainly made the aircraft manufacturing business more rather than less efficient. Because of the importance of scale economies in recouping development costs, competition among producers remained intense, limiting their ability to profit from inefficient production.[62] More importantly, the threat of imports, notably from the Viscount and the Comet, kept American manufacturers honest: they enjoyed economic returns to their technological and marketing lead, but they needed to innovate and stay efficient in order to maintain that lead. Finally, the size and relative stability of the regulated domestic aircraft market helped smooth spikes in demand; rapid changes drops and surges in the number of orders are an important restraint on aircraft manufacturing productivity. Aircraft industry productivity, as measured by the Bureau of Labor Statistics, advanced at an average compounded rate of 3.8% a year in the 1970s, under regulation. The compounded annual rate of advance dropped to 0.8% in the 1980s.[63] By this measure, airline regulation seems certainly to have enhanced aircraft sector industrial performance.

Frequency competition is the second mechanism by which economic regulation of the airlines expanded demand for the commercial aircraft sector. With airlines providing functionally-equivalent service at the same price, the remaining differentiation to attract customers was convenience of departure times. As a result, airlines scheduled many departures between all city-pairs in their networks in order to maximize their chance to entice passengers to choose their line. To provide the "extra" scheduled service, airlines needed "extra" aircraft. The over-investment was compounded by the beliefs of airline executives about marketing strategy:

[62] Tyson, pp156, 166.
[63] Kronemer and Henneberger, "Productivity in Aircraft Manufacturing."

> [F]requency competition is encouraged by the belief of many airline managers that the airline offering the greatest flight frequency receives a disproportionate share of the traffic on a particular route. While this practice may be only one of many causes of industry-wide overcapacity, it contributes to increases in the cost of operation and reduces industry profitability.[64]

Again, as in the case of quality competition-induced over-investment, the primary analyzed effect is a reduction in the operating efficiency and profitability of the airline industry -- but again, that negative effect is compensated by the beneficial effect on consumer surplus of the additional, convenient departure times and on producer surplus of the shifted demand curve faced by the aircraft manufacturing industry. It is also unclear that the airlines could have done better, from the standpoint of efficiency and profitability, in an unregulated environment. Airlines, despite their relatively poor returns, were by and large happy with the regulated environment until a few carriers broke from the pro-regulation coalition in the mid-1970s, just before deregulation was enacted.[65] All of them had unpleasant memories of the "destructive competition" of the pre-regulation phase of the air transport industry in the 1930s -- with essentially zero marginal cost associated with selling additional seats on an aircraft that is scheduled to fly a route regardless of the number of passengers, unregulated airlines have an incentive to discount their fares without limit in order to attract customers, including pricing well below average variable cost. Unrestricted fare competition can then be a certain recipe for bankruptcy.[66] The profit performance of the major air carriers since deregulation is not encouraging on this count.[67]

---

[64] Darrell E. Wilcox, *A Study of the Financial History of the U.S. Scheduled Airlines and the Improvement of Airline Profitability through Technology*, NASA Technical Memorandum TM X-73109, Washington, DC: NTIS, July, 1975, p2. See also p19.

[65] This timing suggests that airline regulation may have been maintained as a result of certain interest group alignments. When these alignments collapsed, a new deregulatory politics emerged. Behrman, pp94-5.

[66] Alfred Kahn, "Introduction: A Postscript, Seventeen Years After," in *The Economics of Regulation: Principles and Institutions*, second edition, Vol. I, Cambridge: MIT Press, 1988, ppxv-xvi. James Q. Wilson, "The Politics of Regulations," in James Q. Wilson, ed., *The Politics of Regulation*, New York: Basic Books, 1980, pp384. For a similar argument applied to the electricity industry, see James Q. Wilson, "Don't Short-Circuit Utilities' Claims," *Wall Street Journal* (August 23, 1995): A12.

[67] U.S. ITC, "Global Competitiveness...," p3-13. Several econometric models of the airline industry suggest that its profitability performance in the 1980s would have been even worse had CAB regulatory policies been continued. Morrison and Winston, "Economic Effects...," p40. These results will be discussed in more detail below.

Steven Morrison and Clifford Winston in their recent book *The Evolution of the Airline Industry* break with the historical analysis of the sector to suggest that travelers have more frequency choice in the post-deregulation market than they had under regulation.[68] Their argument, reversing the view that they took in their earlier book, *The Economic Effects of Airline Deregulation*, is that hub-and-spoke connections characteristic of deregulated airline networks offer more departures to more cities in the guise of trips through airlines' hubs: travel time may be slightly longer, but departure and arrival times are more flexible because passengers from and to many points are aggregated at the hub airport, making additional flights economical. Unfortunately, Morrison and Winston's new analysis conflates two changes in the airline industry that both occurred in the 1980s. One was that airlines adjusted to deregulation, and it is to that adjustment that Morrison and Winston attribute all frequency effects. However, deregulation also led to a new appreciation of the price elasticity of demand for air travel and a reduction in air fares (without a necessary loss in airline profitability, because load factors increased). Had regulated fares been reduced in keeping with the new conception of the elasticity and had regulated route maps adjusted to the hub-and-spoke configuration, the same frequency increases that Morrison and Winston measure for the 1980s probably could have been achieved without the disruption of destructive price competition. They argue that there is no evidence that the CAB was moving in that direction prior to deregulation,[69] but administrative deregulation began several years before Congress enacted the Airline Deregulation Act in 1978, which suggests exactly that the CAB was moving on its own towards a moderated evolution to lower fares and more-efficient airline networks.[70]

Why Indirect Government Support Works

[68] Steven A. Morrison and Clifford Winston, *The Evolution of the Airline Industry*, Washington: Brookings Institution, 1995, p33.
[69] Morrison and Winston, "Evolution...," p12.
[70] Behrman, p75.

The theoretical explanation for the success of the indirect support policy is a straight-forward principal-agent story.[71] The government, acting as the principal, wants to ensure the existence of a domestic high-tech firm in order to capture rents, keep up with important technology, garner prestige, and / or maintain domestic employment. The manufacturing firm, then, acts as the government's agent in acquiring those benefits. Unfortunately, the agent (firm) wants to maximize profits and does not care whether those profits are derived from rents captured from foreign consumers or from simple political capture of the principal's subsidy payments. Furthermore, the government is really composed of a number of independently-functioning bureaucracies with purview over trade and industrial policy, each with a slightly different institutionally-defined policy goal. In effect, the government is really multiple principals, and the agent, behaving strategically, can choose with which agency it will deal on any particular issue. The principal (government) now faces adverse selection when the agent chooses to maximize on a variable (profit) other than the government's preference for rent-shifting, employment, etc. In order to find the true nature of its agents[72] -- that is, whether they are truly export-competitive manufacturing firms or are political experts engaged in non-value-added, rent-seeking behavior -- the government must rely on an independent source of information, employing a second, intermediate level of agency to allocate support to the manufacturers. If all manufacturers must deal with this single intermediate agent, then the adverse selection problem is mitigated; if the intermediate agent's goals are more harmonized with those of the government than with the profit-seeking of the manufacturers, then agency cost is also minimized.

---

[71] For a general introduction that covers most of the principal-agent concerns raised here, see John W. Pratt and Richard J. Zeckhauser, "Principals and Agents: An Overview," in John W. Pratt and Richard J. Zeckhauser, eds., *Principals and Agents: The Structure of Business,* Boston: Harvard Business School Press, 1985, pp1-35.

[72] Kenneth J. Arrow, "The Economics of Agency," in John W. Pratt and Richard J. Zeckhauser, eds., *Principals and Agents: The Structure of Business,* Boston: Harvard Business School Press, 1985, pp38-42, briefly summarizes "hidden information" models of principal-agent interactions.

Specifically in the aircraft sector, the government's fear is that industrial policy bureaucrats may simply not know what aircraft characteristics are desirable for export sales. Firms may strategically choose when to bring an anti-dumping case viz. requesting an Export-Import Bank Loan in order to maximize the amount of the government subsidy (the adverse selection problem). Firms may also use government policy to extort rents from domestic consumers, increasing firm profits but not national GDP (the agency cost problem). On the other hand, the government can employ a more-knowledgeable agent than its own industrial policy apparatus to pass on its intended support to the "right" manufacturer. Airlines have intimate knowledge of the desirable market characteristics for commercial passenger jets, and they share the government's interest in choosing efficient producers of airplanes with those characteristics. Furthermore, the aircraft manufacturers cannot escape the reality that the airlines are their market: there is simply no one else to whom they can sell. The airlines, then, can serve the government as an intermediate agent to avoid both adverse selection and agency costs.

The classic criticism of strategic trade policy argues that governments cannot "pick winners."[73] Government economic expertise is often lacking, and natural information asymmetries help firms capture governments' policy-making authority.[74] Firms' true cost structure is not easily observed, and as a result the amount of subsidy required to stimulate output to the maximum rent-shifting level cannot be computed. In fact, the information asymmetry problem is likely to be particularly severe in high-technology industries that are naturally suited to strategic trade policy. Firms that understand and produce current technology often have an advantage in knowing where to place their bets on technological

[73] Examples are easy to find, e.g. S. M. Grossman, "Strategic Export Promotion: A Critique," in Paul Krugman, ed., *Strategic Trade Policy and the New International Economics,* Cambridge: MIT Press, 1986, and Herbert Stein, "Recycling Industrial Policy," *The American Enterprise* (July/August, 1992): 5-7.
[74] Information asymmetries are emphasized in the literature on agency and policy "capture," beginning with George Stigler, "The Theory of Economic Regulation," *Bell Journal of Economics and Management Science,* Vol. 2, No. 3 (1971).

advance; governments tend not to have this information, and companies are unlikely to make the information public if they gain competitive advantage by being secretive.[75]

The General Accounting Office draws the conclusion from this information asymmetry that direct subsidies to high-technology firms which do not specify how the money is to be spent might have the greatest competitive effect, since only the manufacturers know how to invest the money in a rational business strategy.[76] But this view assumes that the manufacturers' interest is in maximizing its competitiveness rather than in maximizing its profits or financial distributions to stockholders, and if businesses can exploit information asymmetries to make more profits with less work by simply "capturing" the subsidy, the direct subsidy mechanism is apt to fail.

Furthermore, if governments directly employ manufacturers as their agents by agreeing to provide subsidy in exchange for a promise to build exportable products, the deal is vulnerable to the inability to completely specify the contract. Firms may be able to avoid the intent of industrial policy entirely, even if the government knew exactly what to demand in the subsidy negotiation.[77] The bottom-line risk is that firms will divert subsidies to stockholders' pockets rather than using them to invest in new technology or to strategically deploy production capacity to deter potential competitors. A government plan to shift rents may be replaced by firms' consumption of the subsidy as a rent.[78]

To solve the asymmetric information and incomplete contracting problems, the government needs to employ a skilled intermediary to allocate its subsidy payments. There are two risks associated with this indirect policy: first, that the intermediary will divert the

---

[75] Richard R. Nelson, *High-Technology Policies: A Five-Nation Comparison*, Washington: American Enterprise Institute, 1984, pp12-3.
[76] United States General Accounting Office, *International Trade: Long-Term Viability of U.S.-European Union Aircraft Agreement Uncertain*, GAO / GGD-95-45, December, 1994.
[77] Incomplete contracting as a problem for principal-agent relationships has spawned a rapidly growing literature, including as an introductory example, Paul Milgrom and John Roberts, “Bargaining Costs, Influence Costs, and the Organization of Economic Activity,” in James E. Alt and Kenneth A. Shepsle, eds., *Perspectives on Positive Political Economy*, New York: Cambridge University Press, 1990, pp57-89.
[78] S. Lael Brainard and David Martimort, "Strategic Trade Policy Design with Asymmetric Information and Public Contracts," *Review of Economic Studies*, Vol. 63 (January, 1996): 81-105.

subsidy to its own stockholders; and second, that the intermediary will not share policy-makers' real goals.

In the first case, rent-seeking possibilities can be controlled if the government's agent is a competitive group of firms rather than a single enterprise. If the sector downstream from the high-technology manufacturing industry that the government wants to subsidize is subject to normal market forces -- that is, if the high-tech sector produces intermediate goods destined for purchase by a competitive industry -- the competitive pressures on the downstream firms acting as the government's agent will require them to invest the subsidy dollars in the upstream industry. No airline could afford to keep its capital investment "allowance" under CAB regulation, because if one of its competitors instead used the funds as intended and bought new aircraft, the rent-seeker would be driven out of business.[79] The regulation-induced shift from price competition to quality competition among airlines compounded the regime's innovation-stimulating effects. Note, however, that the same positive results cannot be achieved by using an upstream sector as an agent to allocate subsidy: the upstream sector sells its intermediate products as inputs to all downstream buyers, and consequently cannot provide the same demand pull for innovation; the upstream subsidy can only provide cheaper inputs to all firms in the high-tech manufacturing sector, which will have only a small effect on the oligopolistically-competitive equilibrium.

The traditional principal-agent problem of non-identical interests (incentive compatibility) also appears in the theory supporting the indirect mode of government support. The government and the chosen agent unquestionably share an interest in extracting the best possible product from the manufacturing sector at the lowest possible price -- effectively, in stimulating innovation. It is possible, if the domestic downstream

[79] On the other hand, regulation of monopoly telephone service providers in the United States ("Ma Bell") did not stimulate a strong, competitive telecommunications equipment industry in the United States, because AT&T's service division was able to capture the subsidy. For a detailed presentation of this argument, see Eugene Gholz, "Getting Subsidies Right: Government Support to High-Tech Industries," forthcoming PhD dissertation, MIT Department of Political Science.

industry has significantly different competitive characteristics from its foreign counterparts, that this stimulus to innovation will lead to developments that have no export potential, eliminating the strategic trade benefit of the support. Additionally (and more likely), the downstream sector certainly does not share the government's interest in buying its inputs only from domestic producers of the high-tech intermediate good, except to the extent that there are locational advantages in customer service or high transportation costs. Consequently, if the home industry's production cost and product quality are not at least comparable to its foreign counterparts', the indirect support will only result in more imports -- and additional payment of rents to overseas firms. For example, had the CAB's regulatory stimulus to the U.S. airlines continued into the late-1980s, when the Airbus A-320 was introduced with technology significantly ahead of Boeing's 737 and Douglas' MD-80, Airbus' revenues would only have been enhanced. On the other hand, had CAB regulation continued into that period, Boeing and Douglas would have been unlikely to stand still and might have introduced competitive redesigns of their aircraft, keeping up with the European product.

The need to avoid these two problems -- capture of the subsidy by the distribution agent and non-identity of interests between the government principal and the intermediary agent -- establishes the baseline criteria for an indirect support policy's effectiveness. When choosing to use an indirect support, the government must first confirm that the downstream sector to be used as an agent is competitive and that the targeted manufacturing industry is on a technological par with its foreign competitors.

The American Trade Policy Process

Knowing that airline regulation's indirect support to the aircraft sector stimulated a healthy, innovative, export-successful industry is insufficient both for a satisfying analysis of aircraft trade and for the basis of a theory of the political economy of high-tech trade. In addition to understanding why particular policies lead to sound industrial performance, we need to understand why those policies are adopted. The political process in aircraft and

other high-tech sectors is highly charged, and even the best-informed policy-makers face powerful constraints on their freedom to adopt "ideal" industrial policies. In a recent review article, Theodore Moran sketched a familiar litany of complaints with the American trade policy-making process:

> the policy process in the United States is producer-driven, consumer interests are underrepresented, adjudicative bodies do not (or are forbidden to) take into account the impact of trade restraints on the entire economy, users of sheltered inputs are particularly damaged, and protectionist policies frequently do not even help those industries that seek them.[80]

These charges suggest that U.S. companies should not be competitive in any sector in which policy plays an important role -- least of all in aircraft manufacturing, the archetypal case for strategic trade. The stark description, however, neglects some crucial aspects of the process. This section will explain the limited but still important role played by consumers in American trade policy formation.

As Moran observes, consumers generally are not represented directly by powerful interest groups; instead, the idea that consumers must be protected is embodied in the institutional design of the forums in which American trade policy is designed.[81] Rent-seeking activity of firms, who unlike consumers are directly represented by powerful interest groups, usually dictates the forum in which policies are chosen. Sometimes their pressure is strong enough to re-shape the institutional landscape -- particularly in high-tech sectors where regulatory institutions tend to be relatively young or may be by-passed by the pace of technological change. But more often, policy outcomes are determined by the balance of political power among interest groups constrained by the menu of options in the institutional environment.

---

[80] Theodore H. Moran, "Grand Strategy: The Pursuit of Power and the Pursuit of Plenty," *International Organization*, Vol. 50, No. 1 (Winter, 1996): 187.

[81] The standard work on the role of ideas in shaping trade policy institutions is Judith Goldstein, *Ideas, Interests, and American Trade Policy*, Ithaca: Cornell University Press, 1993. Goldstein's book lacks the emphasis on consumers and the effects that consumption patterns have on innovation and high-tech industrial performance success -- the key link between a positive theory of American trade policy and the normative implications of strategic trade -- but her focus is historical and theoretical rather than on high-tech industrial policy.

Theories of the Political Economy of Trade Policy

Trade policies around the world, and notably in the United States, disproportionately protect declining industries.[82] As a result, most analysts have sought to develop explanations of the policy process which would favor support to old industrial interests. Several variants on a theory of "endogenous protection," which argues that trade policy is subservient to domestic political interests and particularly to concentrated, industry-backed interest groups, are well developed.[83] Although the political battles in growing, high-tech industries (such as aircraft) are fought by different organizations in different institutional forums from the standard protectionist confrontations, the same intellectual framework can be extended to sunrise industries.[84]

The nub of the argument for why government policy disproportionately helps "losers" instead of "winners" is the observation that rents from protection are not equally appropriable by all firms. Subsidies or tariffs applied to growing industries would simply stimulate new entry or capacity expansion, dissipating the rent through additional competition;[85] industries with negative net investment, however, have unused capacity that would be costly to close down but that could be profitable to operate with protected or subsidized markets.[86] Consequently, firms' demand for protection depends on their

---

[82] Richard Baldwin, "Asymmetric Lobbying Effects: Why Governments Pick Losers," mimeo, September, 1993.

[83] A basic cite is Stephen F. Magee and Leslie Young, "Endogenous Protection in the United States, 1900-1984," in Robert M. Stern, ed., *U.S. Trade Policies in a Changing World Economy,* Cambridge: MIT Press, 1987.

[84] Suzanne Berger's article "Lame Ducks and National Champions: Industrial Policy in the Fifth Republic" distinguishes the two types of trade policy in France and argues that broader political trends in France shifted the locus of trade policy to the "protectionist" side during the 1970s (in William G. Andrews and Stanley Hoffman, eds, *The Fifth Republic at Twenty,* Albany, NY: State University of New York Press, 1981, pp292-310). For France, the move to protecting employment as the main indicator of policy success is confirmed in Suzanne Berger, "The Coming Protectionism: Trade and Identity in France," in *The New France in the New Europe*, Center for German and European Studies, Georgetown University, 1994. Detailed arguments describing French policy processes and institutions for declining and rising industries can be found in Élie Cohen, *L'État Brancardier* (Calmann-Lévy, 1989) and *Le Colbertisme <<high tech>>: Économie des Telecom et du Grand Projet* (Hachette, 1992). I am not aware of comparable works for the United States.

[85] Ignatius J. Horstmann and James R. Markusen, "Up the Average Cost Curve: Inefficient Entry and the New Protectionism," *Journal of International Economics,* Vol. 20 (1986): 225-47.

[86] Baldwin, "Asymmetric lobbying..."

position in the production profile.[87] Relatively simplistic applications of the theory assume that the demand for protection directly translates into control of trade policy: elected officials have no policy latitude, and only respond to concentrated interests' campaign contributions.[88] A more sophisticated view of the political process combines the production profile with the tendency for industries to be geographically concentrated -- in legislators' districts -- and again, policy-makers' range of policy choice is highly circumscribed.[89] The trade policy outcome is the same, regardless of the political model. Because collective action problems make it difficult for new industries to organize and because protectionist rents are asymmetrically appropriable (only by declining firms), subsidies usually cushion sunset industries rather than spurring rising ones.

In industries subject to the logic of strategic trade, however, neither collective action nor appropriability problems should be expected to block political participation by growing firms. Rent-shifting is conceivable because substantial entry barriers hamper new entry -- for the same reason that rents can be extracted from foreign consumers, domestic firms that benefit from the subsidy are unlikely to fear new competitors will be brought into the industry by the subsidy. The domestic firms that would benefit from the strategic trade support generally need not even fear subsidy-induced over-investment in production capacity by existing oligopoly members, because capacity-building is a long-term, visible, strategic choice that is used as a signaling mechanism to help set oligopoly prices. Firms are unlikely to give up this signaling tool in exchange for a short-term capacity expansion in response to a subsidy. In fact, most growing firms in high technology sectors maintain

---

[87] Firms are only expected to "invest" in lobbying to the extent that they can appropriate a return. Kevin B. Grier, Michael C. Munger, and Brian E. Roberts, "The Determinants of Industry Political Activity, 1978-1986," *American Political Science Review,* Vol. 88, No. 4 (December, 1994): 911-26. A similar theory, applied at the sectoral level rather than the firm level, is the most favored explanation in Peter Gourevich, *Politics in Hard Times,* Ithaca: Cornell University Press, 1986.

[88] For example, Baldwin, "Asymmetric Lobbying...," and Gene Grossman and Elhanan Helpman, "Protection for Sale," *American Economic Review,* Vol. 84, No. 4, September 1994, pp833-50. Note that the authors in each case are economists and their economic models are both complex and clever, even if their political analysis is somewhat shallow.

[89] James Cassing, Timothy J. McKeown, and Jack Ochs, "The Political Economy of the Tariff Cycle," *American Political Science Review,* Vol. 80, No. 3 (September, 1986): 843-62.

over-capacity at all times for its signaling advantages, and hence can immediately benefit from expanded production without any additional capacity investment at all. The same logic that is used to explain declining firms' interest in political action should then apply to high technology industries as well. And finally, the oligopolistic industrial organization of strategic trade sectors inherently minimizes collective action problems for lobbying. So even if most trade policy is expected to benefit senescent industries, strategic sectors should still be in a position to compete in the political as well as the economic realm.

The extent of producer control over trade policy is limited by two mitigating political factors, both of which can be associated with representative pluralist institutions at the core of American government. Most obviously, consumers can organize to balance the political power of manufacturers. Even though the ultimate consumers face only diffuse costs from producer-captured policies and hence would have to overcome severe collective action problems to exercise their pluralist voice, intermediate consumers -- downstream firms that use the "captured" good as an input -- should have no more trouble organizing than the upstream producer interest, *ceteris paribus.* In high technology sectors in particular, complex products are often not intended for direct consumption by the general public, or at least are only consumed by the general public with the "help" of a service provider, as in the case of the airlines or the telephone company. Protective policies for older industries -- industries with which diffuse consumers deal directly, in which consumers have no concentrated, service-providing interests to help them organize, and for which the endogenous protection literature was developed -- are more likely to be susceptible to the asymmetrical organizing power of producers and consumers.

In addition to the expected interest group balance between upstream and downstream producers, democratic governments have a further electoral check on the rent-seeking instincts of producers. Elected officials' re-election prospects are reduced by poor economic performance. As a result, they will only be susceptible to pressure groups up to the point at which the marginal negative political impact of subsidies' deadweight loss to

the economy is equivalent to the marginal political gain from the pork barrel allocation of rents.[90] But the combination of the huge information burden of calculating an exacting balance of marginal political gains and the uncertainty inherent in estimating the political weight that voters will give to the health of the economy makes it extremely unlikely that a simple investment equation will govern actual trade policy implementation. Nevertheless, an intuitive understanding of the trade-off between political gain and deadweight economic loss should make rational representatives particularly susceptible to strategic trade policies that offer the possibility of satisfying both their particular, sectoral patronage interest and their interest in the general welfare. We should expect a disproportionate share of elected representatives' attention to fall on high technology industries.

The principal way in which politicians' otherwise-insoluble information gathering burden is resolved is via delegation of power to executive bureaucracies. Historically, power over American trade policy was transferred from the legislative branch to the executive during the 1930s: Congress sought to tie its hands to avoid a repetition of the log-rolled Smoot-Hawley tariff and also to exploit the executive's ability to negotiate reciprocal trade liberalization agreements to improve Depression-era economic performance.[91] Since that time, a variety of bureaucratic institutions have developed to oversee parts of our sprawling trade policy, ranging from the International Trade Administration's oversight of the administered protection provisions of U.S. trade law (anti-dumping and countervailing duty provisions) to the U.S. Trade Representative's use of Section 337, Special 301, and Super 301 "unfair trade" laws; the Export-Import Bank provides financial support to firms engaged in international trade, and the Departments of Commerce and State host international trade shows and advocate on behalf of American firms' overseas marketing

[90] Ronald Rogowski, "Pork, Patronage, and Protection: Varying Propensities to Rent-Seeking among Types of Democratic Governments," mimeo, June, 1996. The classic economic statement of this pluralist balance between subsidy and deadweight loss is Gary Becker, "A Theory of Competition among Pressure Groups for Political Influence," *Quarterly Journal of Economics,* Vol. 98, No. 3 (August, 1983): 371-400, although Becker ignores all evidence and modeling of politics to the detriment of his reasoning in constructing his simple economic equilibrium.

[91] Kenneth A. Oye, *Economic Discrimination and Political Exchange,* Princeton: Princeton University Press, 1992.

efforts. In particularly important sectors, access to government channels is guaranteed through the institution of inter-departmental "Industrial Sector Advisory Committees" on which representatives of each of the trade-related government organizations is joined by private sector executives. ISAC 1, for example, is for the aircraft industry.

Each of the many potential access routes to governmental power on trade policy has certain known characteristics, instilled partly by the organizational rules designed when the institution was created and partly by subsequently-evolved precedent and the individual characters of the organizations' leaders.[92] In most cases, the new policy initiatives from the trade bureaucracy or investigations of alleged unfair trade practices are triggered by American firms' requests, and forward-looking firms choose strategically in which forum they will seek relief from whatever competitive pressure they are facing.[93] But the established bureaucratic procedures limit the range of policy help for which firms can lobby. Government officials have several policy options from which to choose how to satisfy business demand for assistance.[94] Strategic behavior by firms constrains policy-makers' autonomy, but bureaucratic autonomy also mitigates interest groups' ability to determine policy outcomes.

Because most of the government's trade institutions were created in order to insulate firms (and employment) from economic downturns or to protect declining industries from adjustment to changing international comparative advantage, the "supply" of policy response from the executive bureaucracies tends to shift upwards when domestic firms are experiencing hard times.[95] This coincides with a shift in the "demand" for government support: when business is going well, firms tend to distrust government power, which they fear for its populist overtones; when business is slow, firms seek *ad*

---

[92] Goldstein, "Ideas, Interests..."
[93] Goldstein notes, for example, that escape clause relief has historically been under-used relative to other forms of administered protection (p217).
[94] Steven K. Vogel, *Freer Markets, More Rules: Regulatory Reform in Advanced Industrial Countries,* Ithaca: Cornell University Press, 1996, p16.
[95] David Vogel, *Fluctuating Fortunes: The Political Power of Business in America,* New York: Basic Books, 1989, especially p42.

hoc trade assistance.[96] These two predictions point in the same direction -- tipping the interest group power balance on policy outcomes toward producers when the sectoral economy is in a downturn. In sectors in which the economic fortunes of high-tech manufacturers move in sync with the profitability of the downstream consumers of their intermediate good products, the sectoral downturn should increase equilibrium aid to both the consumer and producer firms, which will constrain the menu of government supports to both groups. On the other hand, if the upstream manufacturing sector is threatened by import competition which would otherwise improve the economic prospects of the downstream consumer firms, we should expect a more decisive relative shift in the policy outcome. Similarly, if upstream manufacturer market power is squeezing the profits of the downstream industry too much, the policy shift will go the other way and the consumer firms will receive the bulk of the relief.

Choice of American Supports to the Aircraft Industry

Early in the post-World War II era, which coincided with the crucial years in the development of commercial jet transport technology, American policy-makers consciously opted against an overt, European-style, direct subsidy program for the aircraft industry. In an annual series of votes, Congress repeatedly rejected so-called "prototype bills," which would have provided government funding for the design of new commercial aircraft. Instead, the peculiarly American system of indirect support to the industry was allowed to operate, stimulated by the threat of overseas competition.

The first prototype bill was introduced in 1948, and subsequent versions in each of the next five Congressional sessions did not differ substantively. The basic provision was for direct government loans to manufacturers of up to $20 million of development expenditure, although the amount was not to exceed 75% of the total cost of the development program. In an attempt to ensure that the product was commercially marketable, repayment obligations would be forgiven at the rate of $1-2 million of principal

[96] David Vogel, "Why Businessmen Distrust Their State: The Political Consciousness of American Corporate Executives," *British Journal of Political Science,* Vol. 8 (January, 1978): 45-78, especially p68.

per aircraft sold.[97] The military, the Civil Aeronautics Board, the airlines, and the aircraft manufacturers took a direct interest in the bills' progress, although they did not always take strong, public positions.

From the early post-war period, the military was regularly consulted on aviation matters, first through testimony before the President's Air Policy Commission and Congress' Brewster Commission and later through the Air Coordinating Committee. The Air Force's priority was always the equipment and modernization of the strategic bomber force,[98] and efforts to divert limited jet engine production capacity to commercial uses were frowned upon. Particularly after the outbreak of the Korean War, when strategic materials were rationed, the military regularly tried to scale back allocations to civilian projects -- including to the production of spare parts for the repair and maintenance of commercial aircraft impressed into the military supply effort.[99]

The Civil Aeronautics Board was a staunch institutional supporter of the prototype bills. The important point of the bill, from the CAB's perspective, was that it would increase the availability of more advanced flight equipment to the airlines at a lower capital investment cost. The CAB also understood that consumers appreciated the opportunity to fly on "modern" aircraft and anticipated an upward shift in demand for air transport if jet aircraft could be introduced into the trunklines' fleets.[100] Both the CAB's interest in the financial health of the airlines and in improving air transport service to consumers could be served through the acquisition of commercial jets. The CAB's position explicitly used the

[97] This proposed repayment mechanism was exactly the opposite of the risk-sharing loan procedure later used by European governments and the Airbus Industrie consortium. Airbus provided for repayment only if the program were to sell successfully (a mild performance disincentive), while the American prototype bills would have given manufacturers an incentive to sell aircraft at uneconomically low prices simply to satisfy the contract provision for loan forgiveness. The prototype bills' specifications are described in a letter from Oswald Ryan, Chairman of the CAB, to Senator Charles W. Tobey, Chairman, Committee on Interstate and Foreign Commerce, dated May 28, 1953, at the National Archives, College Park, MD, RG 197, Entry 23, Box 55.

[98] Michael Brown, *Flying Blind: The Politics of the U.S. Strategic Bomber Program.* Ithaca: Cornell University Press, 1992.

[99] "Civil Air O.K.'d," *Business Week* (November 11, 1950): 108, and Letter from Donald W. Nyrop, Chairman of the CAB, to C. R. Smith, President, American Airlines, dated October 10, 1951, at the National Archives, College Park, MD, RG 197, Entry 23, Box 54.

[100] Letter from Chan Gurney, Chairman of the CAB, to Senator Estes Kefauver, dated May 14, 1954, at the National Archives, College Park, MD, RG 197, Entry 23, Box 56.

threat that trunklines would import British jet and turbo-prop designs for lack of comparable American models as leverage in seeking Congressional support for the prototype bills, and a provision of the proposed loan program demanded that all production of government-supported models take place in the United States.[101]

The CAB's over-riding goal during the period, however, was to improve the financial health of the trunklines. Legislation passed in 1952 required that the CAB separate its direct subsidy payments to the airlines from the Post Office's reimbursement to the airlines for the cost of carrying air mail. The two payments formerly had been aggregated, in effect hiding the size of the subsidy burden paid out to the airlines. After subsidy separation, the CAB came under intense pressure to reduce the direct subsidy payments. In 1955 Congress even went so far as to appropriate less money to the CAB subsidy fund than the Board determined was needed.[102] The budgetary imperative led the Board to allow increases in air fares, passing through more of the airlines' costs to air travel consumers. At the same time, CAB pressure on the airlines to invest in new flight equipment was muted by the overwhelming short-term negative effect that large capital outflows for the purchase of new aircraft would have on airline balance sheets. Essentially, the budget-constrained CAB could not afford to push too hard on the prototype bills, because it could not afford to encourage trunklines to buy the resulting new aircraft designs. Instead, the CAB waited for the indirect effects of fare regulation to stimulate demand for commercial jet transports. The growing American economy of the 1950s promised to make this policy effective.

The airlines themselves largely shared the Board's reasons for supporting the prototype bills. In general, they believed that the introduction of jet aircraft designs would bring an increase both in operating efficiency and in the demand for air travel, leading to

[101] Letter from Oswald Ryan, Chairman of the CAB, to Senator Charles W. Tobey, Chairman, Committee on Interstate and Foreign Commerce, dated May 28, 1953, at the National Archives, College Park, MD, RG 197, Entry 23, Box 55.
[102] Letter from Ross Rizley, Chairman of the CAB, to Senator Carl Hayden, Chairman, Committee on Appropriations, dated April 27, 1955, at the National Archives, College Park, MD, RG 197, Entry 23, Box 57.

higher profits.[103] On the other hand, many carriers were operating recently-purchased piston aircraft and sought to recoup their investment by continuing to use those planes to serve their primary city-pairs. Airlines' investment interest was piqued only when the Comet actually became available and quality competitive pressures kicked in.[104] Even then, however, airlines for the most part could pass through their investment costs (unless the CAB determined that their investment strategy was egregiously unsound),[105] and their interest in the prototype bill as a cost-reducing measure was limited. As long as all airlines would have to pay the same costs to acquire new jet flight equipment, it was not particularly important what the realized cost level turned out to be, except to the extent that some carriers had acquired the latest piston technology more recently than others and consequently had more depreciation costs to amortize before buying jets.

The lobbying position of the aircraft manufacturing industry on the prototype bills is perhaps the most interesting of the major players. It seems straightforward to predict that the industry would support a direct subsidy. In fact, however, the Aircraft Industries Association had no official position, because despite strenuous arbitration by the AIA's staff, the aircraft manufacturing firms could not agree on a consensus view.[106] As a whole, the industry distrusted expansion of government involvement in the research and design of new commercial aircraft models. Manufacturers had quite a bit of experience in dealing with the Air Force as a customer, and that experience was far from universally positive.[107] Furthermore, leading manufacturers opposed the legislation on competitive grounds: they feared that the Air Force might pick a winning design and put the other

---

[103] "Subsidy No Help," *Business Week* (December 18, 1948): 36.
[104] "Aviation: U.S. Lags on Jets," *Business Week* (June 23, 1951): 87-8.
[105] Gellman, p62. For example, Northeast Airlines was denied an emergency subsidy payment on the grounds that the carrier's investments and operations had been mismanaged. Letter from James R. Durfee, Chairman of the CAB, to Floyd B. Odlum, President, Atlas Corp., dated November 5, 1958, at the National Archives, College Park, MD, RG 197, Entry 23, Box 60.
[106] AIA correspondence on the prototype bills is on microfilm at the Aerospace Industries Association's library in Washington, DC (Roll number 478).
[107] Confidential memorandum from Oliver Echols, AIA President, to the Eastern and Western Region Executive Committees of the Aircraft Manufacturers Council, dated July 30, 1948, re: So-Called Prototype Bill (S. 2644, HR 6501) in the Senate of the United States..., AIA library, Washington, DC, Microfilm roll number 479.

manufacturing firms out of the commercial aircraft business. These leading manufacturers (essentially Douglas and Lockheed) also expected to make more money selling additional copies of existing designs than they would make in the risky transition to jet-powered aircraft.[108] AIA members that were struggling under existing market conditions (particularly Convair), on the other hand, were more inclined to support the prototype legislation. This distribution of preferences is as a firm-level production profile theory would predict.[109]

Orders for the Comet placed by trunklines in the early-1950s (notably from Pan American) finally triggered an investment reaction from Boeing, even without a direct government subsidy in the form of a prototype support law. Of the major commercial aircraft manufacturers, Boeing had by far the least success with post-World War II piston-engine designs. The model 377 Stratocruiser was a disastrous money-loser. Boeing either faced exit from the commercial aircraft market or a high-risk investment in the upgrade to jet power.[110] Convair, the other manufacturer lagging behind in the production profile, waited too long for a direct government subsidy which never materialized.[111]

The outcome of the legislative process in the early-1950s was not so much a decisive rejection of direct subsidization as a reflection of the lukewarm support for the prototype bills' plan. Although the prototype bills repeatedly failed in Congressional votes, a more moderate bill appropriated government funds to pay for Civil Aeronautics Administration flight testing and type certification of American-manufactured jet

---

[108] "Subsidy No Help," *Business Week* (December 18, 1948): 36.

[109] Robert Leone, "Competition and the Regulatory Boom," in Paul MacAvoy, ed., *Governmental Regulation of Business: Its Growth, Impact, and Future*, Washington, DC: Chamber of Commerce of the United States, 1979, pp111-8.

[110] Interview with Roger Schaufele, retired Douglas Aircraft executive, August, 1994. Douglas, the established market leader, naturally moved more slowly into jets: "Donald W. Douglas made it clear this month that Douglas Aircraft Co. will not attempt to compete with Boeing Aircraft Co. for the early U.S. jet transport market. 'We do not now plan to begin construction on these newer turbojet types.... In our business, the race is not always to be the swiftest nor the first to start. ... There may be some distinction in being the first to build a jet transport. It is our ambition at Douglas to build the best and most successful.'" "Douglas Rules Out Early Jet Transports," *Aviation Week* (October 19, 1953): 13. Later experience showed that Douglas was mostly likely wrong to minimize first mover advantages.

[111] Convair's delays were compounded by their difficult relationship with TWA, the launch customer on the Convair 880 and 990 aircraft. Howard Hughes proved to be a very difficult client for both Convair and for Lockheed. Willis Hawkins Interview. Also, Franklin, *The Defender*.

airplanes.[112] The window of "need" for a prototype subsidy bill closed in the mid-1950s for two reasons: on the one hand, Boeing's strategic planners tried to leap-frog rival aircraft producers who were selling successful piston models via a company-sponsored jet development program; and on the other hand, the indirect subsidy provided by airline fare regulation expanded the demand for Boeing's new product and ensured that the other domestic manufacturers would follow Boeing into the new jet market segment. The threat of a surge in aircraft imports faded, ameliorating Congressional concerns. Airlines managed to improve their financial situation and to buy new jet airplanes, relieving the concerns that had led to CAB support for the prototype bills. And with the steady growth of the domestic economy through the 1950s, industrial policy concerns faded from the political agenda.

Lessons for International Trade Policy and Analysis

Understanding the origins of the American aircraft industry's export success is interesting and important by itself -- because aircraft is an economically and technologically leading sector, because so much money is at stake in the industry, and because it is such a visible part of the international political economy of trade. On the other hand, there are many other growing, high technology industrial sectors, and we would like to know how the successful experience of the American aircraft industry might be applied to other cases. Furthermore, for a true "test" of an inductive theory such as the one presented here, we should ideally look to new sources of data -- other sectors, countries, or time periods.[113] This concluding section will offer some first-glance evidence from the telecommunications sector and some speculation which contradicts widely-held beliefs in the international trade policy community.

---

[112] Letter from Ross Rizley, Chairman of the CAB, to Senator Warren G. Magnuson, Chairman, Committee on Interstate and Foreign Commerce, dated June 6, 1955, at the National Archives, College Park, MD, RG 197, Entry 23, Box 57.

[113] Gary King, Robert Keohane, and Sydney Verba, *Designing Social Inquiry: Scientific Inference in Qualitative Research*, Princeton: Princeton University Press, 1994.

The industrial structure and policy history of the American telecommunications sector have closely paralleled the aircraft industry. In broad outline, telecommunications equipment makers develop switching (and transmission) equipment with high fixed cost and substantial learning effects, constituting significant entry barriers and ensuring a worldwide oligopolistic industry structure. Purchases of central office switches are lumpy and are subject to network compatibility constraints, which make individual contracts large and highly visible politically. Service provider companies, intuitively akin to airlines, purchase switching equipment as an intermediate good, which they then use to produce the ultimate product, local and long-distance telephone service. The same market pattern applies to new telecommunications technologies, including the vaunted Internet.

Major technological changes were introduced in the telecommunications equipment market in the 1970s with the advent of digital switches; many analysts believe we are now in the midst of another technological transition, away from direct electronic connections to "asynchronous transfer mode" (ATM) technologies. The capital investment pattern of service providers, however, is strongly influenced by the competitive and regulatory dynamics of the industry. Major regulatory changes occurred in the early-1980s, at about the same time as in the airline industry.

In the regulated period, the Bell System monopoly in the United States lacked the competitive incentive to invest that applied to the airlines under CAB regulation. Consequently, service quality was not what it might have been in the U.S. in the early-1970s, although a series of high-profile problems led to a major regulator-inspired round of investment and significant improvement by the end of the decade.[114] Most importantly, AT&T's Western Electric division, which manufactured network equipment, was slow to develop digital switching technology -- well behind Canada's Northern Telecom and France's CGE (now called Alcatel-Alsthom). Essentially, a complacent Western Electric did not face much demand pull for innovation.

[114] Robert W. Crandall, *After the Breakup: U.S. Telecommunications in More Competitive Era,* Washington: Brookings Institution, 1991, p121.

Deregulation in the 1980s led to significant penetration of the American central office switching market by Northern Telecom, as the new RBOCs and competitive long-distance service providers used the last of their regulation-era investment budgets to rapidly upgrade their networks, girding for competition.[115] Major network investment, however, tapered off as the U.S. telephone system reached 100% digitalization, and the locus of competition has shifted to still-regulated and under-developed export markets in Europe and especially in Asia. The open question in the United States is whether there will in fact be a new major round of investment in ATM technology.

Early evidence suggests that deregulation-induced price competition (or the prospect of such competition, since parts of the telephone network remain regulated) has withered the investment budgets of telephone companies. Most of the RBOCs have scaled back early aggressive commitments to investment in video dial-tone and other new, expensive services.[116] In the hot area of the information superhighway, thin investment budgets are already threatening service quality:

[115] "Princes and pumpkins at the digital switching hour," *The Economist*, (August 29, 1987): 74-5.
[116] Leslie Cauley, "Phone Giants Discover the Interactive Path Is Full of Obstacles," *Wall Street Journal* (July 24, 1995): A1.

> Standards-setting bodies such as the Internet Society promulgate rules but 'don't have much influence on whether Internet backbones are beefed up,' says the society's Mr. Landweber. 'Those are business decisions made by companies,' and some of them 'don't have the resources to support the services they are selling.' ¶ The big backbone operators try to turn a profit by charging corporate clients and government agencies about $2,000 a month for full-time, high-speed access to the Internet. They also collect revenue from hundreds of 'access providers' -- ranging from big companies like AT&T Corp. to mom and pop outfits -- that link up to them. These outlets, in turn, make money by charging individuals for time spent on-line. Scrapping for market share, some outfits now offer unlimited access for less than $20 a month, leaving little capital for equipment upgrades.[117]

Manufacturers with major investments in development of new technology and even in new production facilities may find that they have no market for their goods.

However, the lesson of the beneficial effect of price regulation and service competition on the aircraft business may now apply directly to the telecommunications sector. Price regulation failed to induce quality competition before the 1980s because service was provided by a monopoly. Today, however, there are technological options for supply of telecommunications service from multiple providers; the fixed cost of network wiring has already been paid by cable TV companies, who can provide telephone service over their wires with suitable investment in switching equipment, and wireless telephony has developed to the commodity level, although it cannot yet rival line connections for shear volume of data transmission. In the United Kingdom, cable companies already compete with BT, the former government-owned monopoly carrier.[118] If the competitive dynamic were shifted from price to quality, we might see the same kind of demand pull for innovation and "over-investment" in telecommunications networks that we saw from the airlines under CAB regulation. Despite the current popularity of deregulatory proposals in

---

[117] Bart Ziegler, "Massive Amounts of Data Clog System Studded with Roadblocks," *Wall Street Journal* (August 23, 1996): B1.

[118] British telecommunications competition is regulated under a price cap rather than the old style of rate-setting by the regulatory agency. For a critique of price cap regulation, see Eugene Gholz, "Towards A Political Economy of High-Tech Investment: Telecommunications Regulation and the *Grand Projets*," Paper Presented at the Wissenschaftliches Institut für Kommunikationsdienste GmbH, Bad Honnef, Germany, June 21, 1995.

the telecommunications sector, economic regulation may be the best way to stimulate the next generation of improvement in telecommunications service.

A second recommendation based on the results of studying the aircraft industry is that, at least for high-technology industries, striving to make government supports "transparent" may be counterproductive. If the policy-making process of other high-technology interests follows the bureaucracy-constrained interest group model ascribed here to airlines and aircraft producers, increasing transparency may simply help lobbyists find access points for rent-seeking. "Investing" in the policy process is an *ad hoc* corporate solution to difficult economic times that is unlikely to be favored except when there are clear routes to financial benefit. Lack of transparency inherently increases firms' uncertainty in the pay-off to political investment, and hence reduces their incentive to lobby. Moreover, efficient distribution of government funds is best achieved by submerging the allocation process in a market mechanism, using well-informed consumers instead of "capturable," visible government bureaucrats to decide the incidence of government support. Transparency is never as subtle as high-technology strategic trade policy needs to be.

The market for high technology goods and services is inherently complex. Strong competitive currents in both the aircraft manufacturing and airline sectors have dissipated some economic rents and have at times driven firms into unsustainable, "destructive competition." The United States has not used direct subsidy policies to aid the aircraft industry, nor have we followed a quasi-indirect military industrial policy. However, rate regulation of the airline industry for a time provided an effective means to stabilize the airline sector and to stimulate a healthy, export-oriented aircraft industry. This regime was consistent with the strong influence of interest groups on the American policy-making process, and with the institutionalized pro-consumer orientation of our regulatory agencies. CAB regulation, however, fell victim to changing interest group alignments in the 1970s, even as a vigorous international competitor for the American aircraft manufacturing firms

emerged as the result of a successful European "catch-up" subsidy policy. One unintended consequence of deregulation, then, was that a government support mechanism suited for a leading American manufacturing sector was phased out just as that sector's decisive technological and marketing lead was overcome.