Chapter V

ECONOMIC ISSUES: AN ANALYSIS

Given the several ways in which the world may meet its future needs for advanced, intercontinental air transport, an analysis can now be presented of the economic implications for each scenario described in chapter IV. The aerospace industry has contributed significantly to improving the U.S. balance of trade and, in addiction, the level of employment in the industry is closely associated with the overall economic posture of the United States. Therefore, these two variables are the focus of this economic analysis.

ASSUMPTIONS

Two types of aircraft sales are examined in this analysis—total worldwide program sales by all manufacturers and total sales of U.S. programs alone. The difference between these two has significance for the U.S. economy. If worldwide sales are much larger than U.S. sales, the proportion of U.S. aircraft in the world fleet will be lower and so will be the U.S. aerospace industry's contribution to the balance of trade. In the analysis, the total aircraft sales are determined by multiplying the world market, defined in chapter IV, by the aircraft's selling price; U.S. aircraft sales are determined by multiplying the number of U, S.-manufactured aircraft in the world market by the aircraft's selling price.

As in chapter IV, the world market analyzed for each alternative included only those aircraft, subsonic or supersonic, that would be in competition with, or replaced by, other aircraft for long-range over water routes. Inevitably, other subsonic aircraft in each of the scenarios will be a part of the world market during the period from **1990** to **2010,** but these are not included in this analysis.

A key concern in this analysis was to identify the number of subsonic and/or supersonic aircraft in the world market that would be exported from the United States. The exports would be in addition to the number of U.S. aircraft purchased by U.S. airlines. The amount of U.S. aircraft exports will differ under each scenario.

The base case can be construed in two lights: viewed optimistically, it would involve the United States maintaining the major percentage of the world's market of advanced subsonic transports (ASUBTs); viewed less optimistically, it would assume that, on account of competition from comparable foreign subsonic aircraft, the hold of U.S. manufacturers on the world market of ASUBTs would diminish to about half.

In scenario 1, the assumption, based on the total number of long-range B-7475 and DC-10s exported to date, is that 70 percent of the 400 U.S.-built AST-IIIs in the world market would be exported and the remaining **30** percent would be sold to U.S. airlines.

Because scenario 2 only involves foreign manufacturers, there would be no U.S. exports to consider; on the contrary, to stay in competition, U.S. airlines would need to buy a certain number of foreign supersonic aircraft, the number depending on the type of aircraft produced.

The competitive scenario (scenario 3) assumes that U.S. airlines would initially have to purchase a small number of AST-Is just to remain in the market, but it is assumed that the United States would export 55 percent of the AST-IIIs introduced later.

Scenario 4, the consortium scenario, would allow for two cases. A consortium in which foreign efforts dominate would reduce the amount of both risk and profit, and would also allow

only a small number of AST-IIs to be exported by the United States. The U.S.-initiated consortium would develop and produce AST-IIIs, half of which would be U.S. exports.

RESULTS

Based on these assumptions, economic impacts were determined for each scenario. As table **6** reveals, the impact of choices regarding the development of a supersonic transport varies significantly among the scenarios. For example, cash inflow to U.S. manufacturers over the **20** years from 1990 to 2010 ranges from a high of $35 billion, * in the case of the United States alone introducing an AST-III, to a low of – $15.0 billion, in the case of the United States refusing involvement in any supersonic program despite the pursuit of such programs by foreign manufacturers.

U.S. aircraft manufacturer employment (column 9) and total U.S. aerospace employment (column 10) are both functions of total U.S. program sales (column **7):** aircraft manufacturer employment is calculated at the rate of **30** man-years per million dollars of U.S. aircraft sales and total aerospace employment is a multiple of aircraft manufacturer employment by a factor of **2.75.1** Cash inflow to U.S. manufacturers (column 11) is determined directly from the U.S. program sales (column 7) and the percent U.S. exports (column 8).

The base case would yield a return to the U.S. manufacturers of from $12.9 billion to $23.1 billion depending on which subsonic strategy is assumed and would produce from **0.77** million to 1.38 million man-years of effort in U.S. aircraft manufacturer employment. The U.S.-only scenario for supersonic transport development would yield a cash flow of $35.0 billion, which is from **50** to **170** percent greater than in the base case.

● A1I dollars are in 1978 values.

[1]R. D. Fitzsimmons, "Civil Aviation Joint Venture Analysis: The Effects of Several Proposed Alternatives, " **1971.**

Table 6.—Economic Impacts

1	2	3	4	5	6	7	8	9	10	11
Alternatives	World market	U.S.-manufactured aircraft	Foreign manufactured aircraft	Selling price per aircraft 1978$ (million)	Total program sales 1978 $ (billion)	Us. program sales 1978 $ (billion)	Percent Us. exports	U.S. aircraft manufacturer employment (million man-yrs)	Total U.S. aerospace employment (million man-yrs)	Cash inflow to U.S. manufacturers 1978$ (billion)
Base case	a. 850 ASUBTs	765	85	$60	$51.0	$45.9	50(385)	1.38	3.79	$23.1
	b. 850 ASUBTs	425	425	60	51.0	25.5	50(215)	0.77	2.10	12.9
Scenario1 (U.S. only)	400 AST-IIIs	400	0	125	50.0	50.0	70(280)	1.5	4.1	35.0
Scenario 2 (foreign only)	400 AST-Is	0	400	90	36.0	0	– 5	0	0	– 1.8
	400 AST-IIIs	0	400	125	50.0	0	-30	0	0	-15.0
Scenario 3 (Competition)	250 AST-Is and 250 AST-IIIs	0	250	90	22.5	0	– 5	0	0	– 1.1
		250	0	125	31.3	31.3	55(138)	0.94	2.6	17.3
Scenario 4 (Consortium)	a. 450 AST-IIs	135	315	110	49.5	14.9	50(68)	0.45	1.2	7.4
	b. 400 AST-IIIs	200	200	125	50.0	25.0	50(100)	0.75	2.1	12,5

SOURCE Office of Technology Assessment

If foreign manufacturers pursued the supersonic market without any U.S. competition (scenario 2), U.S. manufacturers would lose from $1.8 billion to $15.0 billion. The difference in the balance of payments between the U.S. introducing the AST-III and the same aircraft being introduced by foreign manufacturers might be as much as $50 billion. The difference between the case of foreign manufacturers alone developing the AST-III and the case of the United States and foreigners continuing to develop only subsonic aircraft would range from $27.9 billion to $38.1 billion.

In a competitive situation (scenario 3), in which 250 foreign AST-Is and 250 U.S. AST-IIIs are introduced, a total cash inflow to U.S. manufacturers of $17.3 billion would result. The difference in the balance of payments projected for scenario 3 and the base case ranges from – $5.8 billion to + $4.4 billion. The difference for scenario 3 and scenario 1 is $17.7 billion—a reduction of 51 percent. Since the employment difference for the same two scenarios is 38 percent, scenario 1 can be seen to provide a larger return (in terms of cash inflow) for the same investment (in terms of employment) than scenario 3.

In the case of a foreign-initiated consortium producing 450 AST-IIs (scenario 4a), total cash inflow to U.S. manufacturers would be $7.4 billion. Between this scenario and the base case, the balance of payments would differ by a negative $5.5 billion to $15.7 billion. Although this effort would result in the lowest cash inflow to U.S. manufacturers of any scenario involving the United States with the introduction of supersonic aircraft, it also involves the lowest cost and the least risk. It may be unrealistic, however, to assume that U.S. manufacturers would join a consortium in which they would have such a small share of the program.

However, if the United States were to join foreign manufacturers to develop and introduce 400 AST-IIIs, splitting the enterprise equally (scenario 4b), a total cash inflow of $12.5 billion would result to U.S. manufacturers. This would be anywhere from $0.4 billion to $10.6 billion less than the total cash inflow in the base case. Here it was assumed that the United States would build 50 percent, or 200, of the total world market of 400 AST-IIIs and that, on account of competition with foreign manufacturers, the United States would export to third-world countries 50 percent, or 100, of the U. S.-manufactured aircraft.

Scenario 4b points up the sensitivity of both employment and cash inflow values to variations in the level of participation of U.S. and foreign manufacturers in a consortium. For example, if the share of U.S. involvement were to increase from 50 to 70 percent and U.S. exports were to remain at 50 percent, the cash inflow to U.S. manufacturers would increase to $17.5 billion, which is 40 percent more than the $12.5 billion inflow in the 50/50 program split.

Finally, certain observations must be made to place the values in table 6 in perspective. First and most significant, the future market is uncertain. The economic variables are very sensitive to any changes in the assumptions on which projections have been made. Second, the values assigned for both employment and balance of payments are included within the 20 years from 1990 to 2010. In reality, however, the time frame for aircraft sales, exports, and employment differs for each scenario which affects the present worth of cash inflow over the period covered. Third, these figures focus on only a small portion of the total number of aircraft that will be in operation from 1990 to 2010, omitting consideration of long-haul subsonic aircraft that will not fly strictly over water routes and the entire medium- and short-haul markets.

As previously indicated, when the world requirements for all future long-range aircraft are considered, the expected sales could approach $150 billion. ASTs could command a third of these sales dollars. It should be remembered that the AST considered here was assumed to be restricted to only over water flights, mainly due to the sonic boom. If, as discussed in chapter III, a solution is found to this phenomenon, the market for the AST could expand significantly and a "third generation" AST after 2010 could replace most long-range subsonic aircraft. This occurrence would have a further significant impact on the U.S. balance of trade.

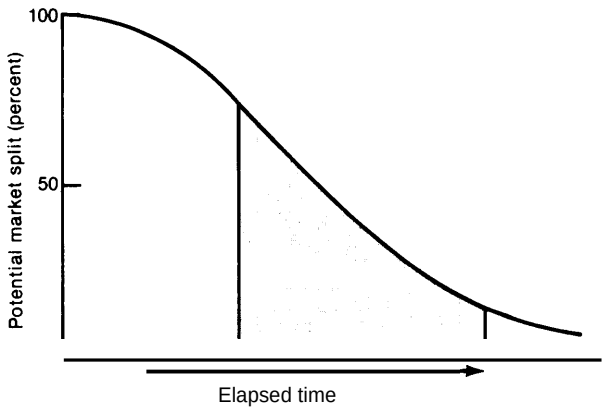
THE EFFECTS OF COMPETITION

In addressing the competitive situation of scenario 3, a significant question is when, if at all, the United States should enter a program of this nature. Two variables are important in this discussion—the aircraft type and the time of introduction. If both manufacturers introduce comparable aircraft into service at the same time, the market will most likely be shared about equally. As the time between introduction of the two aircraft widens, the first aircraft will have a firmer position on the market and an advantage over the competitor.

A second wrinkle enters the competitive situation by adding another variable, a more advanced aircraft, so that competition exists between an AST-III versus an AST-I. If manufacturers of two different aircraft decided to introduce their respective aircraft at the same time, the more advanced aircraft would capture nearly all of the market from the less advanced competitor, provided that the fare structures of the aircraft were similar. (Even if the fare structures were different, some passengers might be willing to pay more to travel in a more advanced aircraft offering them higher speed and greater convenience, including nonstop service.)

However, as the time between introductions widens, an AST-III, introduced after an AST-I, would most likely satisfy a smaller percentage of the market. This is illustrated by the diversion curve in figure 13. In fact, a period would come in which an advanced aircraft (AST-III) introduced by the United States would not be able to attract the market or divert any traffic from that being satisfied by the foreign aircraft (AST-I). Such an immunity of the market to U.S. penetration might occur despite the airlines' knowledge of the imminent introduction of a more advanced supersonic because they might be unwilling to wait the extra time for a more advanced aircraft and so buy a less advanced one. Moreover, having bought a less advanced one, they might not then be in a position to buy the superior aircraft. The key issue here is to be able to determine the time period when it would be inappropriate for the United States to enter the market with an AST-III.

Figure 13.—Time Between Introduction of AST-I and AST-III v. Market Split



SOURCE: Office of Technology Assessment.

One last point is relevant. While program costs influence selling prices, the basic determinant is the market. What are the airlines willing and able to pay? The existence of two competing programs tends to limit the profit potential of both programs because it may force prices below the market potential. On the other hand, lower prices for the aircraft may imply both lower fares for the traveler and increased aircraft sales.