FEDERAL AVIATION ADMINISTRATION
Office of Aviation Policy and Plans
Washington, D.C. 20591

Regulatory Evaluation of Part 121 Pilot Age Limit

April 15, 2008

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EXHIBITS

EXECUTIVE SUMMARY

The Age 60 Rule (121.383(c)) prohibited any U.S. air carrier from using the services of any person as a pilot, and prohibited any person from serving as a pilot, on an airplane engaged in operations under Part 121 if that person had reached his or her 60th birthday. Pursuant to the Fair Treatment for Experienced Pilots Act, FAA is raising the upper age limit for pilots serving in part 121 operations from age 60 to 65. As a result, pilots will have the option to work an additional 5 years. In addition to the changes to sections 61.23, 121.383, 121.411, and 121.412, which are quantified in this regulatory evaluation, the FAA is making amendments to sections 61.3(j), 61.77, and 121.440. There are numerous costs and benefits associated with these changes. However, because section 61.77 governs the operation of U.S.-registered civil aircraft leased by a person who is not a U.S. Citizen, we did not consider it here.

Key Impacts of the Act

- **Compensation Costs and Training Benefits:** As a result of congressional legislation raising the pilot upper age limit, airlines will retain many of their highest paid pilots who fly their largest aircraft for up to 5 years longer than would have been possible under the Age 60 Rule. Air carriers will hire fewer new pilots and may recall fewer furloughed pilots; air carriers may also save on the cost of training new pilots and pilots shifting from one seat to another or from one aircraft type to another. Depending on the age and seniority distribution of each airline's pilot corps, the carriers may experience both increases in pilot pay and benefits and reductions in training costs. How these two costs balance will depend on the specific circumstances of each airline.
- **Disability Costs:** Increasing the mandatory retirement age will cause disability costs to increase because (1) pilots who are already disabled will be paid to normal retirement age (65 instead of 60) and (2) pilots between 60 and 64 will be exposed to disability risks that will be borne by the airlines whereas previously those risks were borne by the individual pilots in retirement.
- **Hiring Benefits:** Because airlines will hire fewer new pilots, they will avoid associated recruitment costs.
- **First Class Medical Certificate Costs:** The Act requires that Part 121 pilots over age 60 hold an FAA first-class medical certificate with 6-month intervals on medical assessments. Some first officers hold commercial certificates that previously required only a 12-month interval between flight physicals; for these pilots, one additional medical assessment will be required each year.

Measuring the Economic Costs of the Act

All of the foregoing costs and cost savings will have a direct effect on airline accounts and some of them may be passed on to consumers. For example, compensation and disability costs will increase and training costs will fall.

The important question here is the extent to which additional costs incurred by airlines reflect economic costs. Economic costs are best measured as opportunity costs—the value of goods and services forgone as a result of the Act.

For most of the impacts described above, we take costs incurred by airlines as estimates of economic costs. If, as a result of the Act, fewer pilots need to be hired and trained, then fewer training pilots and facilities will be needed and the resources expended on hiring pilots (recruiting fees, background checks, etc.) will decline and the resulting savings are benefits of the Act. In this case, we use airline savings as estimates of economic cost savings (or economic benefits). Likewise, because an older pilot corps will on average be eligible for more vacation time under the Act, airlines will need more pilots and the costs incurred are treated as economic costs. Finally, we use the additional cost incurred by airlines of maintaining first class medical certificates as an estimate of economic costs associated with the Act.

However, we do not consider the higher compensation costs (salary, benefits, and disability) as true economic costs. Instead, we treat these as labor rents[1] and consider them as transfer payments between airlines and pilots. That is, the higher pilot compensation costs are treated as economic rent that will be earned by senior pilots at the expense of airlines. The economic literature suggests that employers pay senior employees more in order to provide them with incentives to work hard over a long career and to avoid shirking.[2] In a competitive labor market, such incentive contracts would pay pilots the value of their lifetime marginal productivity (VMP) over their careers, with compensation set below annual VMP early in the career and above annual VMP later. Since pilots are paid more than their annual VMP at the end of their careers, extending the mandatory retirement age beyond age 60 will result in increased economic rent earned by senior pilots. As a result, the higher compensation will result in transfers from airlines to pilots, but will not reflect true economic costs.[3]

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[1] Labor rents are payments to employees above the minimum payments they would accept to stay in their jobs.

[2] See: E.P. Lazear: "Labor Economics and the Psychology of Organizations" J. of Economic Perspectives (Vol. 5, No. 2, Spring 1991, pages 89-110) and "Why Is There Mandatory Retirement " (JPE Vol. 87, No. 6, 1979; pp. 1261-1284).

[3] This occurs because the contract was negotiated under one retirement regime and the terms are now applied to a new regime. In the long run, we would expect that some or all of this rent would be eliminated when contracts are renegotiated, especially in the face of competition from airlines that do not have as restrictive labor agreements.

A second issue related to measuring economic costs is the extent to which the Act causes airlines to change output. For example, if resulting cost increases cause airlines to reduce output, then the value of reduced airline services should be considered in estimating the economic costs associated with the Act.[4] In this analysis, we assume that the Act will result in only small output changes and that the economic costs of airline service reductions will be negligible.

Estimated Costs and Benefits of the Act

The following table enumerates the total costs and benefits of the Act over a 15-year period and then summarizes net benefits as the discounted present value of the stream of benefits and costs. Both accounting costs and economic costs are shown. The accounting costs are relevant because they show the distributional effects of the Act – a net transfer from airlines and consumers to pilots. The economic net benefits of the Act suggest that society is better off with the Act than without it.

(Benefits) and Costs of Changing Pilot Mandatory Retirement Age to 65												
	Constant 2007 Dollars											
	Sections 61.23, 121.383, 121.411 and 121.412								Sections 61.3(j) and 121.440			
	Salary	Pension Contributions	Disability Pay	Recruitment	Training	Reprogramming	Additional Pilots Scheduling and Vacation	Medical certificate	Salary	Line check	Total Constant Dollar Costs[2]	DPV Total Costs[2]
Total (Accounting Costs)	$2,253,407,476	$155,872,313	$1,173,427,286	($39,887,500)	($621,985,624)	$0	$51,444,611	$5,306,821	$3,818,813	$31,180,154	$3,012,584,349	$1,762,743,114
Total (Economic Costs)	$0	$0	$0	($39,042,500)	($439,768,672)	$0	$35,917,440	$5,060,459	$3,818,813	$31,180,154	($402,834,306)	($333,614,036)
Notes:												
1) Results of the accounting and economic cost estimates use different unit costs and therefore show different results in each cost category.												
2) Excludes paperwork costs, which are insignificant relative to the proposed rule's other costs. See section IV for more details on these costs.												

It is important to note that negative figures in this and following tables are benefits of the Act. Because the mandatory retirement age has been increased to age 65, airlines and consumers will incur "real costs" and "transfer payments" totaling $1.8 billion (present value) over 15 years, but society will have a cost savings or net benefit of $334 million in terms of real resource use (real costs reflect real resource use, whereas transfer payments are monetary payments from one group to another that do not affect total resources available to society)."

In addition to the above quantified benefits, the FAA estimates that the Act will result in an increase in the supply of pilots of approximately 12 percent over 5 years.[5] In particular, there may be a public interest in taking advantage of the experience of pilots aged 60 to 65. In addition, the Act makes FAA regulations consistent with ICAO Amendment 167 to increase the "upper age limit" for pilots operating in "international

[4] In theory, the costs of output reductions can be measured approximately as the loss in economic surplus in markets for airline services.

[5] Estimate based on the assumption that the Act will not discourage new pilots from entering the workforce.

commercial air transport operations" up to age 65. Previously, pilots certificated outside the United States and flying for a foreign air carrier on a non-U.S. registered aircraft, who were over age 60, were permitted to fly into the United States under ICAO standards through operation specifications. FAA has not estimated the value of these benefits because they are unquantifiable.

I. INTRODUCTION

The Age 60 Rule (121.383(c)) prohibited any U.S. air carrier from using the services of any person as a pilot, and prohibited any person from serving as a pilot, on an airplane engaged in operations under Part 121 if that person had reached his or her 60th birthday.

In November 2006, ICAO adopted Amendment 167 to increase the "upper age limit" for pilots operating in "international commercial air transport operations" up to age 65, provided the other pilot is under age 60. Previously, pilots certificated outside the United States and flying for a foreign air carrier on a non-U.S. registered aircraft, who are over age 60, were permitted to fly into the United States under ICAO standards through operation specifications.

On December 13, 2007, the President signed the Fair Treatment for Experienced Pilots Act into law, which raised to age 65 the upper age limit for pilots serving in 14 CFR part 121 operations. The legislation was effective December 13, 2007.

Accordingly, FAA is revising 14 CFR part 121. Additionally, FAA is making amendments to sections 61.3(j), 61.77, and 121.440. Because the Act also requires all part 121 pilots over age 60 hold an FAA first-class medical certificate, we have amended section 61.23 to conform with the requirements of the Act. While most pilots who fly internationally carry an FAA first-class medical certificate, some first officers may hold a commercial pilot certificate, which requires only a second-class medical certificate with a 12-month validity period. The recently revised ICAO standard (1.2.5.2.3) requires six-month intervals on medical assessments for individuals over age 60 engaging in "commercial air transport operations."

This report provides estimates of the change in resource costs and transfers among society members because the maximum commercial pilot age has been increased to age 65. The report provides a detailed review of the methodology and estimated total costs and benefits to Part 121 carriers.

A.1. Methodology

Section A1 presents the methodology for estimating costs related to the change in sections 61.23, 121.383, 121.411, and 121.412, including details on compensation-related costs. Section A2 features a discussion of other costs attributable to the Act. In Section A3, we distinguish between economic and accounting costs, with some of the latter being classified as transfers among members of society. Section A4 reports the costs related to the change in sections 61.3(j) and 121.440. Section A5 reports the economic costs of the Act (those costs to be included in a benefit cost analysis). Section A6 reports the total accounting costs in the context of the distributional consequences of raising the upper age limit.

A.1.1. Identifying Costs of the Act

In the United States, most pilots working for Part 121 carriers are assigned to their positions or seats (captain; first officer or co-pilot) and to aircraft type based on their seniority with the company. Not surprisingly, seniority is related to age, although other factors (e.g., age when a pilot begins a career; airline start-ups, reorganizations and furloughs) may also determine the seniority of a pilot as he or she grows older. Airlines establish crew bases (domiciles) where specific aircraft types and crews for them are based, and pilots bid into their domiciles, seat position and aircraft type based on seniority. At most airlines, pilots are paid more if they are captains and fly heavier aircraft and the most senior pilots generally are captains on the largest aircraft in the fleet. Finally, it should be noted that more senior pilots are generally paid more so that, for example, a 10-year captain will be paid more than a 5-year captain; most pilot contracts cap unit pay per hour so that, for example, very senior captains may not be paid more per hour than slightly less senior pilots, controlling for aircraft type.

Exhibit 1 illustrates some of the features of pilot assignments and pay rates that are typical of the industry. The data are monthly salaries for a legacy carrier's captains, which vary depending on the size of aircraft and seniority (years of service). Pay rates generally increase for captains for any given year of seniority as aircraft size increases from the DC9 on the right to the B747-400 on the left. Notice that some aircraft are common rated and have identical pay rates (e.g., A319/320). Finally, note that for any given aircraft type, monthly pay rates do not increase once seniority reaches about 12 years. To increase his or her pay after 12 years of service, a pilot must bid into a seat on a larger aircraft.

Exhibit 1: Legacy Carrier Captains' Monthly Pay Rates by Seniority

Seniority (Years of Service)	B747-400	B747-200	A330-200/300	B757	A319/A320	DC-9
1	$13,779	$13,109	$12,408	$11,097	$10,679	$9,647
2	$13,892	$13,216	$12,510	$11,187	$10,766	$9,725
3	$14,005	$13,323	$12,611	$11,278	$10,855	$9,804
4	$14,118	$13,430	$12,713	$11,369	$10,941	$9,883
5	$14,230	$13,538	$12,815	$11,460	$11,030	$9,961
6	$14,343	$13,645	$12,917	$11,550	$11,115	$10,039
7	$14,456	$13,753	$13,018	$11,640	$11,204	$10,118
8	$14,568	$13,859	$13,119	$11,731	$11,290	$10,198
9	$14,681	$13,967	$13,220	$11,821	$11,377	$10,277
10	$14,793	$14,073	$13,322	$11,913	$11,465	$10,356
11	$14,906	$14,181	$13,423	$12,003	$11,552	$10,435
12	$15,019	$14,288	$13,526	$12,094	$11,640	$10,513

Source: FH Solutions Inc.

One important effect of the Act will be that airlines will retain many of their highest paid pilots who fly their largest aircraft for up to 5 years longer than would be possible under the Age 60 rule. As a result, the companies will hire fewer new pilots and may recall fewer furloughed pilots; the firms may also save on the cost of training new pilots and pilots shifting from one seat to another or from one aircraft type to another. Depending on the age and seniority distribution of each airline's pilot corps, the firms may experience both increases in pilot pay and benefits and reductions in training costs. How these two costs balance will depend on the specific circumstances of each airline. To accurately estimate the accounting cost impacts, an effort was made to model each of the Part 121 carriers individually, using as much information as was available from the companies, third parties and FAA, and then making reasonable assumptions for any missing variables.

A.1.2. Reference Case/Scenario Case

To estimate the costs of the Act, two cases were developed: A reference or base case, where pilots must retire by age 60, and a scenario case, where pilot maximum age is age 65. In this section, we focus only on the likely differences in pilot assignments and hiring/recall in these two cases. Other complicating factors are discussed in the following section.

We make some key assumptions to isolate the impact of the Act from other effects that would occur over the same period.

The reference case is today's aircraft rotations, fleet composition and numbers of flight crews

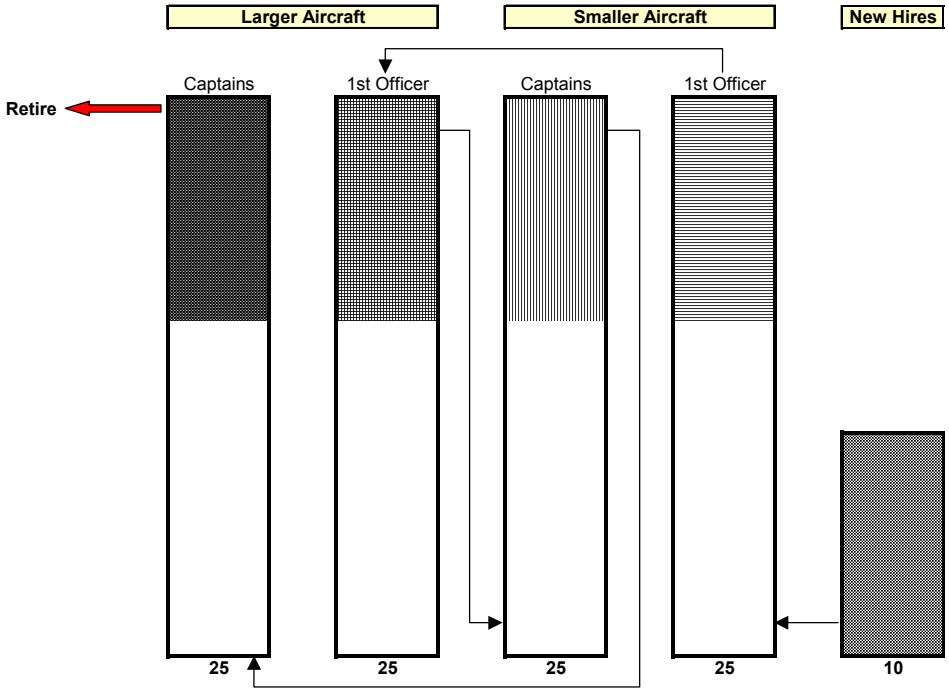
- The fleet is fixed as are the crew positions (seats) that need to be filled
- The ratio of crews to seats is fixed
- There is no difference in the permanent disability rates for pilots aged 55 to 60 and pilots aged 60-65
- Under the Act, we assume that the annual rate of voluntary retirement of pilots aged 55 to 60 would fall from two percent to one percent, reflecting the added economic opportunity made available by the Act.

Each airline will have full information on its pilot roster, seniority, age, current assignment (seat-captain or co-pilot) and aircraft. Assume for the moment that other complicating factors can be ignored (disability, early retirement, fleet growth/changes, furloughs, etc.), then it would be relatively easy for the company to assess the impact of the Act.

Exhibit 2 illustrates how pilot retirement and training events are tracked in the model.

Exhibit 2: 'Bump and Roll' Process

Simplified Process of Change in Pilot Assignments Due to Retirement



Suppose an airline has two aircraft types and a total of 100 pilots. If 10 senior captains retire from the largest aircraft type, then we would expect the 10 current captains with the most seniority on the smaller aircraft roster would move up to be captains on the larger aircraft. Using the same logic and constraints, we would assume that 10 current first officers on the larger aircraft would be promoted to captains on the smaller aircraft fleet; their seats would then be filled by current co-pilots on the smaller aircraft fleet and 10 new personnel would hired to fill the least senior pilot assignments—co-pilots on the smaller aircraft. As a result, the retirement of the ten senior captains would lead to:

- 10 current captains training to be captains on the larger aircraft;
- 10 current first officers training to be captains on the smaller aircraft;
- 10 current co-pilots on the smaller aircraft training to be co-pilots on the larger aircraft;

- 10 new personnel being hired and trained to be co-pilots on the smaller aircraft.

All of these moves and associated training and hiring costs could be avoided for up to 5 years if all of the pilots who would otherwise retire at age 60 instead remain with the carrier in their current positions for another 5 years. Offsetting these savings will be the higher costs of compensation (salary and retirement benefits) of a more senior pilot corps. The net cost to the carrier in each year will depend importantly on the unit costs of training, the number of aircraft types (and therefore number of potential bumps) and caps on pilot pay rates (whether very senior pilots are paid more than those slightly less senior).

Complicating Factors

There are a number of factors that can complicate the estimates of costs in the scenario and base cases, including the following:

- **Furloughed Pilots:** Airlines have had relatively large pools of furloughed pilots in the past whose status may be affected by the Act; for example, in Exhibit 2, when pilots retire, some furloughed pilots would be given preference over new hires in the replacement process. The impact on costs would be that in the base case, as pilots retire at age 60, some furloughed pilots would be recalled and would command higher pay rates than new hires. In the scenario case, the furlough recalls would be postponed. However, at present most furloughed pilots have been given the opportunity to be recalled; as a consequence, the effect of furloughed pilots is not considered in the analysis.

- **Aircraft Types:** There are two important characteristics of aircraft that may affect the analysis. First, physical distinctions between aircraft trigger training events when pilots change assignments; second, pay rates vary among aircraft based largely on aircraft weight. With regard to the latter, some airlines with similar size aircraft make no distinction in pay rates between them; as a consequence, pilots have little or no economic interest in moving from one aircraft type to another. We assume that, absent economic incentives, pilots will not change assignments. We also take account savings in training costs when aircraft are common rated—i.e., when a pilot can move from one aircraft to another because of common features (e.g., cockpit similarities.)

- **Voluntary Retirement:** Some pilots will choose to retire before the maximum age, but there will be an effect on the amount of bumping and rolling if the rate of retirement of pilots over 60 is higher than the rate for senior pilots less than 60. If this is the case, some of the reduction in

training costs (bumping and rolling) attributable to increasing the retirement age will not be realized. While there are no formal surveys of pilot intentions available to our knowledge, industry sources have suggested that on average pilots will elect to retire at age 62.5, or midway between the old retirement age and the new one. As a result, in the model we assume that 20% of the pilots over age 60 retire each year, resulting the in the distribution of pilots remaining in the work force shown in Exhibit 3. We have also assumed that under the Act, the annual voluntary retirement rate for pilots aged 55-59 will fall to one percent (from two percent), reflecting pilots' desire to avail themselves of the economic opportunity made possible by a later retirement age.

Exhibit 3: Effect of Retirement on the Population of Age 60+ Pilots

Age	Percent Remaining
60	100%
61	80%
62	60%
62.5	50%
63	40%
64	20%
65	0%

- **Disability Rates:** Similarly, if older pilots incur disability more frequently and for longer periods of time, then the reduced bumping and rolling in the scenario case will not be fully realized. There is some empirical data that suggests that older pilots are less able to maintain their first class medical certificates than younger pilots. A 1986 study published by the FAA Civil Aeromedical Institute shows such a relationship. But, there are methodological issues with this study and its age renders it less reliable than is desirable. A review of refereed journal articles[6] shows conflicting evidence on this issue. As a result, the disability rate for pilots age 60-65 is assumed to be the same as that for those aged 55 to 60. All of the studies reviewed show permanent disability rates in the range of 0.6 to 1.5% per year for pilots over age 55. A rate of 1.2 percent has been selected for this evaluation because the lower values are from small samples.

[6] Holt W. et al: "Airline Pilot Disability: The Continued Experience o a Major U.S. Airline" in **Aviation, Space & Environmental Medicine (ASEM)** (Volume 56, Number 10, pp 939-944) and Arva P. and Wagstaff A.: " Medical Disqualification of 275 Commercial Pilots: Changing Patterns over 20 Years" in **ASEM** (Volume 75, Number 9, pp 791-794).

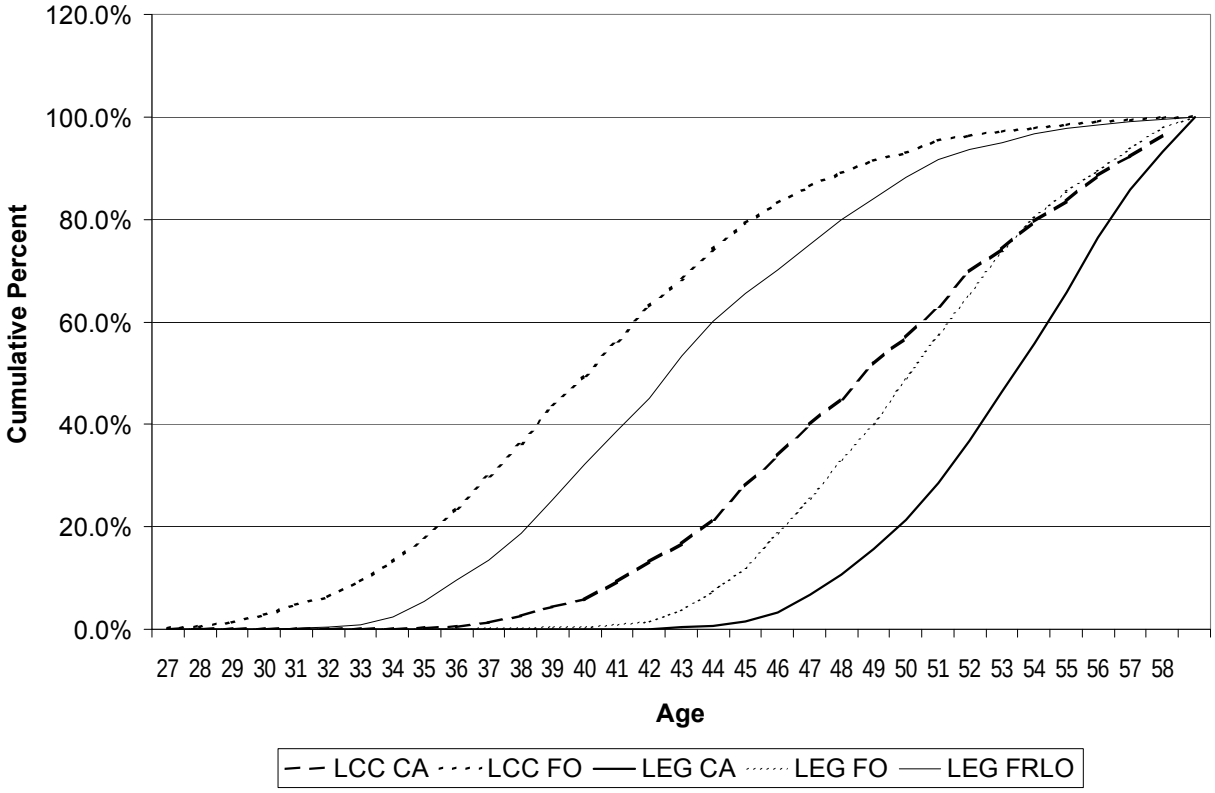
- **Sick Rates:** If older pilots incur more sick time, then more pilots may be needed to cover the flight schedule. We have found no empirical evidence to support a differential in sick rates.

- **Fleet Changes:** Fleet changes may affect both the amount of bumping and rolling and the age distribution of pilots. If a carrier makes a large cutback in its fleet, then its pilot age distribution will be skewed older because furloughs are also based on seniority. In the scenario case, it would have a larger proportion of senior pilots in the ranks for a longer period of time than would be the case under the old rule; the net impacts on costs would depend on the relative costs of training versus senior pilot pay. Fleet cutbacks might also increase the likelihood of concentration of senior pilots as discussed above. Fleet growth would have the opposite effects. In the present case, the fleets of carriers have been assumed to remain constant because there are no reliable fleet forecasts for individual carriers extending out for 15 years.

Characteristics of Pilot Corps

The FAA had a limited sample of airlines with complete information. As noted in the previous section, when data were incomplete, reasonable assumptions were made about the characteristics of an airline's pilot corps to complete the analysis. The key assumption is the relationship between age, seniority and the seat occupied by the pilot. For most airlines, we had information on the distribution of pilot ages but for many we had less information on seniority and the seat each pilot occupies. In such cases, we assumed that pilot seniority was a function of age and that most senior pilots sought the highest seat for which they were entitled. Exhibit 4 suggests that this assumption is valid, even though the relationships may not be perfect. The chart shows a cumulative distribution of the percentage of pilots occupying captain and first officer seats at a low cost carrier (LCC) and at a legacy carrier. Also shown are the same data for furloughed pilots at the legacy airline.

Exhibit 4: Cumulative Distribution of Pilot Assignments by Age for a Legacy and an LCC

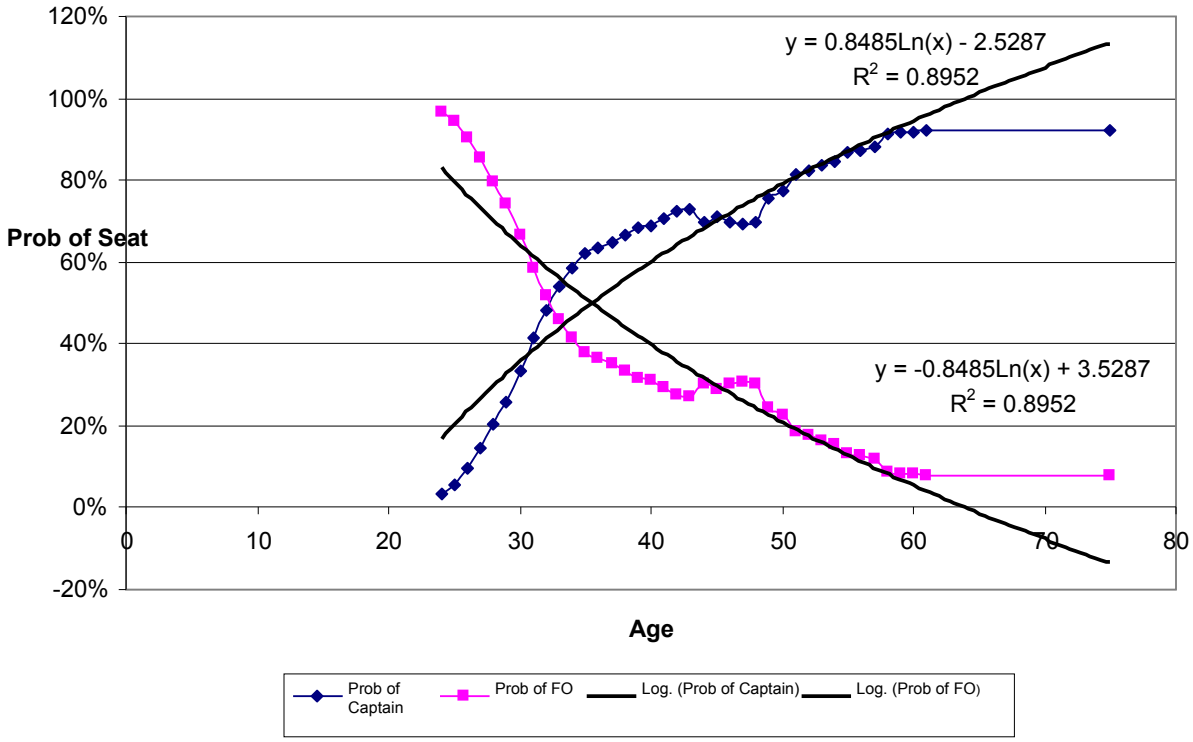


The data show that the youngest group of pilots is first officers with the LCC; this is not surprising given the fact that the LCC is a post-deregulation carrier. The next youngest corps of pilots is furloughed pilots from the legacy airline; in general, these pilots did not carry enough seniority to survive cutbacks in the legacy carrier's ranks after September 11, 2001. The third youngest group of pilots is the captains from the LCC, followed closely by the first officers from the legacy carrier. The oldest group by a wide margin is captains from the legacy carrier.

While it is true that some first officers are older than some captains within an airline, the general finding is that seniority and the seat occupied are functions of age.

To confirm this relationship, we examined groups of carriers: legacy, LCCs, regional, small/charter passenger airlines, small cargo airlines, and large cargo airlines. We took 5-year rolling average probabilities of being in a seat (captain or first officer) given a certain age, and found that pilot age was a very good predictor of the seat occupied. We found a very strong positive relationship between the probability of being a captain and age, especially once the data are smoothed by calculating five-year running averages. The negative relationship between age and the probability of being a first officer has identical characteristics. Exhibit 5 shows the relationships for regional airlines for which we had complete data.

Exhibit 5: Age as a Predictor of Seat



Data like that illustrated in Exhibit 5 were used to assign pilots to seats for airlines where data were incomplete. As a result, there are some relatively young captains and older first officers in the analysis, which reflects the actual circumstances revealed in the data provided by airlines. Pilot seniority was then assumed to be strictly a function of age and used to assign pilots to specific aircraft types.

Missing Data

Exhibit 6 provides a listing of the data used in the analysis, the sources used and assumptions made in cases where data were missing. For each airline, the analysis uses all of the information available from primary sources and then applies assumptions for missing data.

Some airlines provided detailed information on their pilot rosters, including the number of active pilots, their age, seniority, seat and aircraft. In cases where pilot counts were not available, an estimate was developed based on the number of crews (captain, first officer) per aircraft and the total fleet count.

Because airlines report that they will soon run through their furlough rolls, furlough counts were assumed to be zero, which results in an underestimate of the cost of replacing retired pilots in cases where some pilots might be recalled in the future.

In cases where airlines did not provide data on pilot seniority, we used relationships described above to assign pilots to seats. We then assumed seniority was a strict function of age and assigned pilots to aircraft type strictly based on seniority. In all cases, pilots were assumed to pursue their economic self-interest and so would bid into the seat/aircraft combination with the highest compensation. Data on pilot ages was available for most companies either directly or by merging FAA data on pilot medical records with data from the pilot registry to develop a distribution of pilots by age and employer. In those cases where age distribution of pilots was unavailable, a sample of airline data was applied.

Exhibit 6: Data Sources and Assumptions

Data	Primary Sources	Assumptions
Active pilots by airline	Airlines FAA OPSS	Crews per aircraft
Age	Airlines FAA CAMI	Assumed distribution--airline sample
Seniority	Airlines	Function of age
Pilots assigned to seat and aircraft	Airlines FAA fleet counts	Probability of seat = f(age); seniority = f(age) Airline fleet counts
Time since last training event	Industry sources: 3 years	Same for all airlines
Voluntary retirement rate: <60; >60	Industry Sources	Same for all airlines
Sick rates: <60; >60	Ditto	Ditto
Disability rates: <60; >60	Aero-medical Study literature	Same for all airlines--1.2%
Pay and retirement rates: Seniorty; Seat; Aircraft	Airlines	Airline sample
Disability pay as percent of pay	Industry Sources (50% of comp)	Same for all airlines
Training costs	Airlines	Airline sample
Static fleets/schedules	Airlines FAA OPSS	Same for all airlines

Pilot contracts stipulate the minimum time between major training events for individual pilots. Industry sources indicate that on average pilots may not incur major retraining (to upgrade either aircraft or seat) more than once every 3 years. This constraint was applied in the detailed analysis discussed later in the report.

Information on voluntary retirement, sick and disability rates was drawn from industry sources; using data on pilots in the 55 to 60 year cohorts, rates were extrapolated for the 60 to 65 year cohorts. Data on pilot pay and retirement rates were drawn from the companies, the AIR database[7] for major carriers and from FH Solutions for several other carriers. In cases where information on pilot pay was not available, sample data was applied. Training costs were estimated based on pay rates and general assumptions about other training costs (e.g., simulator time) for all carriers.

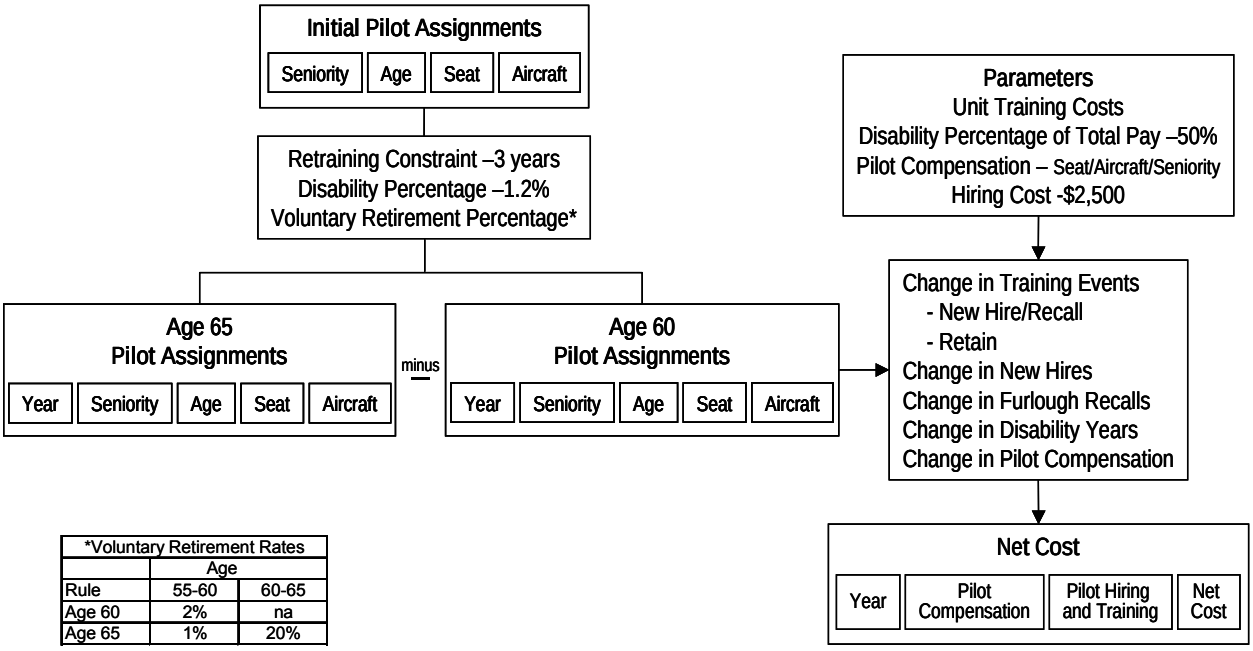
[7] U. S. Airlines/Corporate Salary Survey. Atlanta, GA: AIR, Inc., 2005.

Finally, carrier fleets and schedules were assumed to be static. Increases in fleet size would tend to cause carriers to hire new or recall furloughed pilots more quickly and would cause more bumping and rolling independent of the effects of the Act as more captain seats became available. A reduced future fleet would have opposite effects. Because of the way we distinguish between economic costs and accounting costs, this assumption concerning static fleets would not significantly affect our estimates of the economic costs and benefits of the Act.

A.1.3. Modeling Details

The modeling process is illustrated in Exhibit 7. For each airline, the analysis begins with an initial assignment of individual pilots to seat and aircraft by seniority. For some airlines, we have the actual pilot assignments. For others, the model assumes that the most senior pilots bid into the best seat available on the largest aircraft, and if seniority information is otherwise unavailable, that seniority is determined by age.

Exhibit 7: Pilot Assignment Methodology



*Voluntary Retirement Rates		
	Age	
Rule	55-60	60-65
Age 60	2%	na
Age 65	1%	20%

Details on the initial allocation of pilots are shown in Exhibit 8, which documents how the model treats cases where data for an airline are incomplete. For all airlines, we know at least the number of pilots and number of aircraft in the fleet. For some airlines, the initial pilot allocation is provided by a complete set information on seniority, age, seat and aircraft. For many more, information is incomplete. So long as information is available on pilot age, the allocation can be made by applying the relationship between age and the probability of seat assignment and assuming that seniority is strictly a

function of age. Where no information on the age distribution of the pilot corps is available, data from similar airlines were applied.

Exhibit 8: Developing Initial Allocations of Pilots to Seats for an Airline

	Airline					How Used
	Pilots	Seniority	Age	Seat	Aircraft	
Complete Data Set	x	x	x	x	x	Use as initial allocation of pilots to seats/ aircraft
Reduced Set #1	x		x			Apply relationship between age and the probability of a seat; assign to aircraft type based on seniority = f(age)
Reduced Set #2	x		Some			Apply available age data as a distribution to pilot totals; apply method for Reduced Set #1
Reduced Set #3	x					Apply age distribution from similar airlines (legacy; LCC; cargo; other); apply method method for Reduced Set #2

Once we have information on pilot age for every airline, the model calculates the future year when a pilot would have to retire due to the Act. As shown in Exhibit 9, the model also contains assumptions about whether pilots will become disabled or retire voluntarily before the legislated age of retirement. Industry sources have provided estimates of the percentage of pilots who voluntarily retire in the Age 60 and Age 65 cases.

Exhibit 9: Retirement and Disability Assumptions

Retirement and Disability Assumptions	Scenario	
	Age 60	Age 65
Annual Voluntary Retirement Rate: %/yr, ages 55-59	2%	1%
Annual Voluntary Retirement Rate: %/yr, ages 60-64	N/A	20%
Annual Disability Rate: %/yr, ages 55-59	1.2%	1.2%
Annual Disability Rate: %/yr, ages 60-64	NA	1.2%

The model tracks individual pilots and randomly selects pilots in the two scenarios for early retirement and disability according to these assumptions.

A.1.3.1. Cost of Compensation, Disability, Recruitment and Training

The model proceeds to reassign individual pilots in the Age 65 and Age 60 scenarios. First, pilots become disabled or retire (voluntarily or by legislation) in each year over the 15-year analysis period. This sets off the "bump and roll" and hiring process described earlier, under the assumption that pilots seek the best seat on the largest aircraft according to seniority. The model constrains individual pilots to a major retraining (seat or aircraft movement) once every three years.

For the two scenarios, the model follows individual pilots over the 15-year analysis period, tracking what seat and aircraft they are assigned to each year, when/if they become disabled and when they retire. The model also keeps track of training events (new hire or retraining (seat/aircraft). The model also tracks the number of retirees and new hires each year.

Exhibit 10 shows data for an individual pilot and how his/her advancement from captain on an A330 to B747 is affected by the Act. Note that the pilot becomes a B747 captain earlier under the Age 60 scenario at age 53 and so would have seven years as captain on the largest aircraft in the fleet. In the Age 65 scenario, the same pilot would become captain on the larger aircraft at age 57 and would have eight years in that seat. A retraining event would occur in year 5 of the analysis in the Age 60 scenario and in year 9 in the Age 65 case.

Exhibit 10: Example of Impact of Act on an Individual Pilot

Scenario	Age in 2007	Seniority in 2007	Year 0			Year 1			**Year 5**			**Year 9**		
			Job	Age	Retire	Job	Age	Retire	Job	Age	Retire	Job	Age	Retire
Age 65	48	22	330CA	48	65	330CA	49	65	330CA	53	65	**747CA**	**57**	65
Age 60	48	22	330CA	48	60	330CA	49	60	**744CA**	**53**	60	744CA	57	60

The model also follows individual pilot groups at each airline, keeping track of the age of pilots by seat and aircraft type. For example, Exhibit 11 shows the differences attributable to the Act in the number of pilots by age, training events and retirements for A330 captains at a legacy carrier. The numbers were derived by subtracting the Age 60 counts in each category from the Age 65 counts. As expected now that the Act is in effect, there will be more older pilots in the ranks, fewer training events, and fewer retirements. When pilots do retire, they do so with more seniority.

Exhibit 11: Age 65 Case vs. Age 60 Case

330CA	Age																					Retrain	Average Seniority	Retirees
Year	31	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65			
0																						0	0	0
1						-1			-2	-2	-4	-4	-9		-2	24						-46	0	-27
2			-1	-2		-4	-2	-4	-4	-9	-5	-6	-5	-11	1	28	24					-69	0	-31
3				-2	-2	-3	-5	3	-16	-6	-12	-11	-7	-6	-11	26	28	24				-71	1	-26
4					-4	-2	-4	-5		-24	-11	-20	-10	-7	-12	23	27	26	23			-71	1	-32
5				-1		-4	-4	-9	-9	-8	-39	-9	-23	-7	-7	18	22	28	28	24		-81	2	-30
6				-1	-1	-4	-5	-6	-15	-15	-15	-46	-6	-12	-4	30	26	25	29	20		-27	2	-9
7					-1	-1	-9	-6	-10	-23	-11	-33	-44	-8	-8	46	34	23	25	26		-64	2	-26
8						-2	-3	-14	-10	-17	-37	-24	-35	-32	-15	55	52	34	22	26		-86	3	-32
9					-1		-2	-5	-14	-19	-31	-49	-37	-35	-24	48	66	46	33	24		-32	3	-30
10		-2		-1		-1	-3	-5	-12	-9	-24	-41	-52	-40	-38	54	41	58	43	32		-57	5	-43
11			-2	-2	-2	-4	-10	-14	-19	-28	-16	-35	-44	-36	-42	42	65	42	57	48		-69	7	-43
12				-2	-5	-7	-14	-24	-33	-31	-36	-16	-39	-29	-20	30	52	64	55	55		17	9	-19
13				-1		-6	-8	-17	-31	-41	-38	-41	-30	-41	-20	48	46	56	69	55		50	10	4
14					-1	1	-7	-12	-22	-42	-46	-39	-44	-42	-37	37	67	63	61	63		-42	9	9
15			-2			-6	-1	-9	-15	-37	-46	-41	-32	-41	-44	16	62	66	72	58		6	8	15

The model keeps track of seat/aircraft, seniority, age, disability years, and retirement age for each pilot at an airline; it also keeps track of the number of pilots hired, retired and recalled from furlough each year. In the exhibit above, the carrier has 24 more 60-year-old A330 captains in Year 1 under the Age 65 case than Age 60 (shown by a positive 24). It has 2 fewer 59 year olds, 9 fewer 57 year olds, and so on. The sum across ages in each year is zero as the total number of A330 captains remains constant. As compared with the Age 60 case, the Age 65 case sees 27 fewer A330 captains retiring in year one and eliminates the need for 46 retraining events. To evaluate the cost impacts of these events, the model uses data derived from pilot contracts and industry sources. The following tables provide sample parameters used to value the impact of changing the mandatory retirement age of pilots.

Exhibit 12 shows that annual total (accounting) compensation (including pension) for an A330 captain at a legacy carrier ranges from $197,798 for a 1-year captain to $215,616 for a person with 12 or more years of seniority. Most captains would be at or near the maximum compensation level since the A330 is a large and therefore desirable aircraft from the standpoint of pilot pay.

Exhibit 12: A330 Captain Compensation Based on Seniority (capped after 12 years)

Years	Monthly @ 85.0 hrs	Annual Amount	23% Fringe Rate	Total Excluding Pensions	Pension Contribution Rate	Pension Contribution	Total Annual Compensation
1	$12,408	$148,900	$34,247	$183,147	$0	$14,652	$197,798
2	$12,510	$150,124	$34,528	$184,652	$0	$14,772	$199,424
3	$12,611	$151,327	$34,805	$186,132	$0	$14,891	$201,023
4	$12,713	$152,561	$35,089	$187,651	$0	$15,012	$202,663
5	$12,815	$153,785	$35,371	$189,156	$0	$15,132	$204,289
6	$12,917	$154,999	$35,650	$190,649	$0	$15,252	$205,901
7	$13,018	$156,213	$35,929	$192,142	$0	$15,371	$207,513
8	$13,119	$157,427	$36,208	$193,635	$0	$15,491	$209,126
9	$13,220	$158,641	$36,487	$195,128	$0	$15,610	$210,738
10	$13,322	$159,865	$36,769	$196,633	$0	$15,731	$212,364
11	$13,423	$161,078	$37,048	$198,126	$0	$15,850	$213,977
12+	$13,526	$162,313	$37,332	$199,644	$0	$15,972	$215,616

Exhibit 13 provides an example of pilot training costs; it shows estimates of initial training for A330 captains and first officers. The only distinction is due to the difference in hourly pay. It should be noted that for this carrier, there is also no distinction between initial training and moving from the first officer to the captain seat. So these values would apply to all pilot training events for A330 pilots for that carrier.

Exhibit 13: Pilot Training Costs

A330 C/O Initial Training		A330 F/O Initial Training	
Training - 8 weeks (incl. IOE)	149.33	Training - 8 weeks (incl. IOE)	149.33
C/O hourly pay	$ 159.13	F/O hourly pay	$ 98.02
Line Pilot Train Pay	$ 23,763	Line Pilot Train Pay	$ 14,638
Gnd School Instructor (Avg 10 day)	$ 2,459	Gnd School Instructor (Avg 10 day)	$ 2,459
Check Pilot - Sim (10 days @ TOS A330 pay)	$ 7,957	Check Pilot - Sim (10 days @ TOS A330 pay)	$ 7,957
Check Pilot - IOE (6+2 tvl)	$ 6,365	Check Pilot - IOE (6+2 tvl)	$ 6,365
Simulator Expense 20 hours @ $500/hr	$ 10,000	Simulator Expense 20 hours @ $500/hr	$ 10,000
Line Pilot Per Diem (Days in Trn * 24 hrs * rate)	$ 2,486	Line Pilot Per Diem (Days in Trn * 24 hrs * rate)	$ 2,486
Check Pilot Per Diem (6 days * 24 hrs * rate)	$ 295	Check Pilot Per Diem (6 days * 24 hrs * rate)	$ 295
Check Pilot Hotel (7 nights)	$ 420	Check Pilot Hotel (7 nights)	$ 420
Line Pilot Hotel (26 nights)	$ 1,560	Line Pilot Hotel (26 nights)	$ 1,560
A330 Captain	**$ 55,306**	**A330 First Officer**	**$ 46,180**

In the model, disabled pilots are paid at 50 percent of the rate they otherwise would get if they were flying the line. It is also assumed that an airline incurs recruitment costs of $2,500 each time it hires a new pilot.

For reasons discussed in detail below, all salary, retirement and disability related costs are classified as accounting costs and not economic or resource costs.

A.2. Cost of Obtaining First Class Medical Certificates

The Act requires that Part 121 pilots over age 60 hold an FAA first-class medical certificate. While most pilots who fly internationally hold an FAA first-class certificate, some first officers may hold a commercial pilot certificate which requires a second-class medical certificate with a 12-month validity period. The ICAO standard requires 6-month intervals on medical assessments for individuals over age 60 engaging in commercial air transport operations.

Based on FAA data, Exhibit 14 shows the percent of pilots that hold second-class medical certificates. We apply these percentages to the population of pilots between 60 and 65 years old. Industry sources indicate that the unit cost of a medical examination is approximately $200.

Exhibit 14: Distribution of Older Pilots by Medical Certificate

Medical Certificates Pilots >= 55 Years Employed by Part 121 Carrier			
	Class1	Class 2	Total
Air Transport Pilots	8,315	590	8,905
Commercial Pilots	37	131	168
	Class1	Class 2	Total
Air Transport Pilots	93%	7%	100%
Commercial Pilots	22%	78%	100%

A.3. Mandatory Retirement Age, Resource Costs and Transfers

In this benefit cost analysis, it is important to distinguish between economic or resource costs imposed by the Act and transfers of rents between members of society. Resource costs are properly attributable to the Act, but transfers are not a cost to society, even though some members may face higher costs.

The distinction is specifically made in OMB Circular A4:

"Distinguishing between real costs and transfer payments is an important, but sometimes difficult, problem in cost estimation. Benefit and cost estimates should reflect real resource use. Transfer payments are monetary payments from one group to another that do not affect total resources available to society. A regulation that restricts the supply of a good, causing its price to rise, produces a transfer from buyers to sellers. The net reduction in the total surplus (consumer plus producer) is a real cost to society, but the transfer from buyers to sellers resulting from a higher price is not a real cost since the net reduction automatically accounts for the transfer from buyers to sellers….
You should not include transfers in the estimates of the benefits and costs of a regulation.

Instead, address them in a separate discussion of the regulation's distributional effects. Examples of transfer payments include the following:

Scarcity rents and monopoly profits

Insurance payments

Indirect taxes and subsidies"

Distinguishing real costs from transfer payments associated with changing the Age 60 Rule requires consideration of the following:

- The effect of changing the mandatory retirement age on long term pilot contracts
- Identifying the market or reservation wage for pilots

A.3.1. Economics of Mandatory Retirement Contracts

The model of mandatory retirement economics developed by Lazear may be applied to the Age 60 problem.[8] Lazear shows that both workers and employers have an incentive to create long-term employment contracts with mandatory retirement ages in order to provide workers with incentives to work harder over a longer career and avoid malfeasance, thereby producing greater lifetime wealth. In competitive labor markets, workers expect to earn the value of their marginal product (VMP) over their working lives. Other things being equal, the worker would be indifferent between two streams of income that produce the same discounted present value. However, all things are not equal. Employers wish to provide workers with incentives to work hard and avoid malfeasance and workers wish to earn more income and create more wealth for themselves. Thus, the two parties reach an employment contract that pays workers less than the value of their marginal product in the early years of their careers, but more than VMP in the latter years. The worker, wishing to increase his wealth, works harder, stays with the company, and produces more and also has an incentive to avoid malfeasance which would otherwise increase employer costs; as a result, his or her VMP is higher than it would be otherwise and in efficient markets the lifetime earnings would also be higher.

The optimal retirement age occurs when the present value of lifetime earnings just equals the present value of lifetime marginal product. Ideally, this optimal retirement age would be set as the mandatory age of retirement. A mandatory age is required because the wage in later years exceeds VMP, and the reservation wage of the worker. Absent an incentive contract (e.g., workers doing piece work), in an efficient market, VMP in any year would equal the wage paid and at equilibrium, this would equal the reservation wage of the marginal worker (the amount required to induce him to work). But, under the postulated contract that provides desirable incentives, in the latter years the wage of the worker will exceed his or her VMP and reservation wage; as a result, he or she will not want to retire at that time. Therefore, a mandatory age limit must be set to cause retirement.

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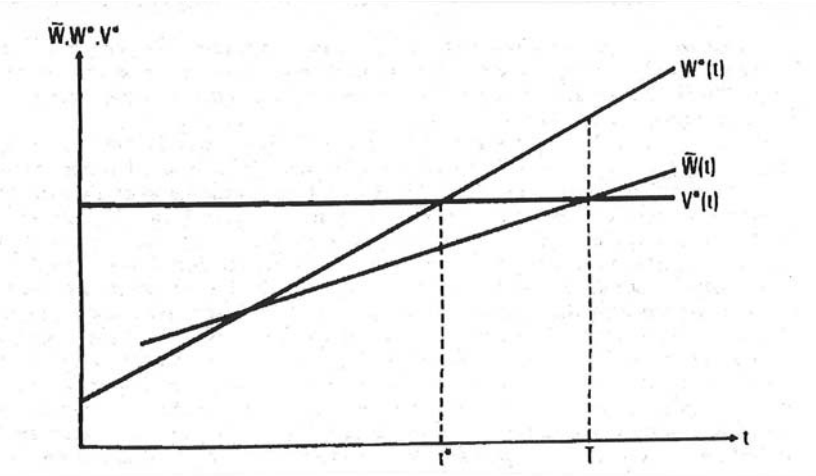
[8] See: E.P. Lazear: "Labor Economics and the Psychology of Organizations" **J. of Economic Perspectives** (Vol. 5, No. 2, Spring 1991, pages 89-110) and "Why Is There Mandatory Retirement " (**JPE** Vol. 87, No. 6, 1979; pp 1261-1284).

Exhibit 17 is a graph reproduced from Lazear's original paper. Time is on the horizontal axis and pay is on the vertical. V is the value of the worker's marginal product. The W* line shows the workers incentive pay structure, which is lower than V until time t*. W* is set in such a way that the sum of W* over all years until T (the mandatory retirement age) is the same as V (VMP) over all years until T. Thus, the worker earns no rents so long as he or she retires at T. But, at time T, W* (the wage rate) exceeds V (the value of marginal product) and the reservation wage W. So, the worker would not retire at T except that there is a mandatory retirement age T. So long as the retirement age remains at T and the labor market is competitive, the worker will earn his or her resource cost over a career and the resulting labor market will be optimal (from an economic efficiency standpoint).

Exhibit 15: Lazear Model of Mandatory Retirement



In the case of pilots, the government has until now set the mandatory retirement age of Part 121 pilots at age 60. As described in Lazear's paper, the contracts for pilots are graduated such that in early years of employment, pay rates are substantially lower than they are once a pilot has more seniority. In part these increases in pay rates may reflect increases in the pilot's value of marginal product (becoming a captain; flying larger aircraft longer distances). But, the shape of the wage scale over the working life of the pilot may also be designed to provide incentives to work harder and longer (to amortize training costs) and avoid malfeasance.

In the case of aviation, the private contracts between airlines and pilots have until now been accommodated to the government mandated retirement age. In terms of Lazear's model, the changes in pilot pay with seniority anticipated pilots retiring at age 60 and not sometime later. Firms have provided incentives for desirable behavior by paying wages in excess of VMP in the later years of a career under the expectation that the pilot will retire at age 60. Relaxing this government mandate has changed the private contract; because pilot pay exceeds the VMP and the reservation wage at age 60,

many pilots will decide to extend their careers beyond age 60, and increase their life-time wealth beyond levels that would have been possible under the contract with a mandatory retirement age of 60. As a result, the present value of their wages will exceed the present value of their marginal product. To the extent this is true, the pilots will have earned rents – funds in excess of their opportunity cost (their reservation wage). Therefore, it is important that we un-bundle these rents from any other costs imposed by the Act.

It is also important to note that over time pilots and employers will reach a new set of contracts that anticipates mandatory retirement at age 65; thus the pattern of wage increases over a pilot's life will change and the windfall earned as a result of the Act is likely to be eliminated. It is difficult to estimate how long it might take for the contracts to change, but many contracts last 5 or more years, and it may take more than one negotiating cycle to be fully worked out.

A.3.2. Estimating Resource Costs

The market for pilot services has other complications that should be mentioned. All pilots must be licensed and pass a physical examination, and pilots for Part 121 carriers must pass a more stringent set of criteria (type training, hours of experience, physical well-being, competency as a pilot) than private pilots. So long as there is a competitive market for pilots, licensing per se should not allow pilots to accrue economic rents. Given the cyclical nature of commercial aviation, there are likely to be times when pilots are in short or over supply, and these conditions may affect their life-time earnings and whether they earn rents.

Further, most pilots working for Part 121 carriers do so under the terms of union agreements that grant them seniority rights over their careers. In some market circumstances, these contracts may provide pilots with the opportunity to earn wages in excess of the value of their marginal products, which in turn are rents. Any changes in these rents are not resource costs and so should not be counted in a cost benefit study.

In order to distinguish resource costs from rents, ideally we would observe what pilot wages are in a free market environment, absent the effects of licensing, unionization, and the incentive pay structure postulated by Lazear. That is, we should estimate the cost of the Act using estimates of the value of pilot marginal product.

To estimate pilot VMP, we make two adjustments to actual pilot pay data:

- For all airlines, we level the incentive pay structure described by Lazear so that in each year a pilot occupying the same seat as he or she occupied in the previous year will make the same amount of money. Said another way, we assume that for any seat/aircraft combination, average VMP and average pay equal marginal VMP and pay. So, for an airline with one

aircraft type, all first officers make the same amount each month; all captains are paid more than first officers but all captains also have identical pay rates. If a pilot is promoted from first officer to captain or moves up to a larger aircraft, her pay will increase to reflect higher VMP. In a competitive market for pilots, the resulting pay rates should be equal to pilot VMP over their careers. In effect, we assume that average VMP (for a seat/aircraft type) equals marginal VMP for all pilots and each airline. Over their careers, pilots will always earn their lifetime VMP.

- We also adjust pay scales so that pilots in like positions (captain/co-pilots/aircraft type) produce similar lifetime VMP.

Adjusting for Incentive Pay—For each airline, we then restate pilot compensation eliminating the effect of seniority by substituting average pay rates for each seat/aircraft combination. In making this adjustment, we are assuming that the adjusted pay rates reflect VMP and that a co-pilot with 5 years seniority produces the same marginal product as someone with 20 years of seniority. The adjusted pay scales (and VMP) are constant, just as they are portrayed in Lazear's graphical illustration above (V^*_t). We use the same pay and retirement benefits rates in the Age 60 and Age 65 cases because we assume that VMP for a 59-year old captain flying a particular aircraft is the same as the VMP for pilots aged 60 through 64 flying the same aircraft.

Lifetime VMP—We adjust pilot pay rates at mainline carriers to produce similar lifetime VMP. Our rationale is that pilot compensation packages should eventually become similar in a competitive market and observed differences are probably due to timing and circumstance rather than differences in actual productivity.

A.3.3. Classifying Economic Costs and Transfers

Because fleets and the number of captains and first officers are constant over the 15-year analysis period, there are no compensation-related economic costs of the Act. For example, suppose an airline has 10 aircraft, 50 captains and 50 co-pilots. When we estimate economic costs, the 10 aircraft remain constant so there is no increase in the number of pilots required over time. Each captain will produce the same VMP and therefore will be paid the same; the same holds true for co-pilots. Lengthening the careers of pilots will have no impact on the pilot resources utilized or resource costs. As long as a fleet size is the same in the Age 60 and Age 65 cases, increases or decreases in fleet size would have no impact on our estimates of economic costs that are compensation related (salary, retirement) for the same reason.

There will be significant distributional impacts, however. These distributional consequences of the Act occur because actual (accounting) pilot wage scales are substantially graduated and pilots working beyond age 60 will be paid substantially more than their VMP or the pilots that would be hired to replace them under the prior

rule. That is, there will be an older work force under the Act, and because of the graduated wage scale, the net accounting cost of compensation for pilots will increase.

Distributional effects will also be due to higher disability payments from airlines (and consumers) to pilots. Disability costs will increase because (1) disabled pilots will be able to collect payments until the new retirement age (65 instead of 60), and (2) pilots 60 years and older will have five more years of working life during which they might become disabled. As a result, disability payments will go up and these are properly categorized under distributional consequences of the Act.[9] Like compensation, the impacts on airlines may be substantial but the change in compensation is a rent and not a resource cost because they exceed the pilot's VMP.

There are important economic costs as well. If as a result of the Act, fewer pilots need to be hired and trained, then fewer training pilots and facilities will be needed and the resources expended on hiring pilots (finders' fees, background checks, etc.) will decline and the resulting savings are benefits of the Act. Finally, the additional costs of maintaining first class medical certificates are also resource costs that would not otherwise be incurred except for the Act.

A.3.4. Model Runs for Economic Costs and Accounting Costs

In order to distinguish between economic and accounting (including transfers) costs of the Act, the model developed to analyze the effects of the statutory mandate has been run twice. To estimate economic costs, we adjust accounting wage scales so that pilots earn similar VMP over their careers and flatten the incentive structure of pilot pay rates. To estimate accounting costs and transfers, we run the model using actual accounting costs. The results are reported in sections A.5 and A.6.

A.4. Costs of Other Conforming Amendments

In addition to the changes to sections 61.23, 121.383, 121.411, and 121.412, which are quantified in this regulatory evaluation, the FAA is amending sections 61.3(j), 61.77, and 121.440. Because section 61.77 governs the operation of U.S.-registered civil aircraft leased by a person who is not a U.S. citizen, we did not consider it here. As stated in OMB Circular A-4 (Guidelines for the Conduct of Regulatory Analysis, September 17, 2003), analysis should focus on benefits and costs that accrue to citizens and residents of the United States. However we have estimated the costs of sections 61.3(j) and 121.440.

Section 61.3(j) affects part 125 pilots authorized to conduct certain international operations. The Act will allow these pilots to fly up to 5 years longer than would have been possible under the Age 60 Rule. Based on FAA data, approximately 108 part 125 pilots conduct international operations and we estimate that only 2 percent are age 60 to

[9] See OMB Circular A4.

65. For these pilots, air carriers will incur additional compensation costs of $3.8 million ($2.3 million, discounted) over 15 years.

Section 121.440 requires an average of one additional annual line check for every part 121 pilot of age 60 to 65. Based on the wage of a check airman, which we assume to be 10 percent higher than the wage of a turbojet captain ($91.35 an hour), we estimate air carriers would incur additional line check costs of $31.2 million ($18.9 million, discounted) over 15 years. These costs include $3.4 million of paperwork, which are based on 15 minutes of a check airman's time.

A.5. Economic Costs of the Act

This section reports on the economic costs of the Act. Pilot compensation has been adjusted and the Lazear incentive structure in pilot pay scales has been eliminated. As a result, there are no compensation-related economic costs of the Act. Disability-related costs have also been classified as transfers. The economic costs of the Act are due to medical testing, salary and line check costs. In addition, there are benefits associated with reduced training and hiring costs. Because benefits exceed costs, there is a net economic benefit (shown as a negative cost in Exhibit 16).

The total net economic benefits of the Act are estimated to be approximately $334 million over the 15-year analysis period; details are reported in Exhibit 16.

Exhibit 16: Summary of Economic Costs

	Sections 61.23, 121.383, 121.411 and 121.412				Sections 61.3(j) and 121.440			
	DPV Comp, Disability, Recruitment, Training	Reprogram. Costs	DPV Additional Pilots Scheduling And Vacation Costs	DPV Medical Certificate Costs	DPV Salary	DPV Line Check Costs	Total Constant Dollar Costs	DPV Total Costs
TOTAL	($375,089,147)	$0	$17,332,727	$2,891,211	$2,318,761	$18,932,411	($402,834,306)	($333,614,036)

Sections 61.23, 121.383, 121.411 and 121.412						
Constant Dollars						
Salary	Pension Contributions	Disability Pay	Recruitment	Training	Total Comp., Etc.	DPV Comp, Disability, Recruitment, Training
$0	$0	$0	($39,042,500)	($439,768,672)	($478,811,172)	($375,089,147)

A.6. Accounting Costs of the Act Including Transfers

This section reports on the accounting costs of the Act. These estimates are based on actual reported airline accounting costs and are not adjusted to produce similar VMP or for incentive pay scales. As a consequence, they represent an estimate of the added accounting costs to be borne by airlines and consumers resulting from the Act over the next 15 years, unless pilot compensation contracts are revised to offset some of the accounting cost impacts.

One of the important distinctions between accounting costs and economic costs is that in the former, there are large compensation and disability costs that will be transferred from airlines and consumers to pilots. Under the Act, airlines will have an older and more experienced pilot corps; because older pilots are generally more senior, average pilot compensation (salary and pension) will increase for many airlines. It is important to note that in the model, pilots are paid 50 percent of their compensation when disabled and the model assumes that once a pilot becomes disabled, he or she remains disabled until retirement.[10] Thus the effect of the Act is to add as many as 5 years of disability pay for each pilot disabled before age 60 and to add to the ranks of disabled pilots those who would otherwise not be working in the 60 to 65 year cohorts. Offsetting these negative effects of the Act, because pilots will stay in their jobs longer, there will be less bumping and rolling and therefore less training and lower recruiting costs.

Exhibit 17 summarizes the compensation-related accounting costs of the Act over a 15-year period.

Exhibit 17: Estimated Compensation, Disability, Recruitment and Training Accounting Costs (Constant Dollars)

	Sections 61.23, 121.383, 121.411 and 121.412						
	Salary	Pension Contributions	Disability Pay	Recruitment	Training	Total	Discounted Present Value
Total	$2,253,407,476	$155,872,313	$1,173,427,286	($39,887,500)	($621,985,624)	$2,920,833,950	$1,713,920,317

The total accounting costs of the Act are summarized in Exhibit 18. The total accounting costs in 2007 dollars over 15 years are estimated to be $3.01 billion. On a discounted present value basis (DPV), costs are estimated to be $1.8 billion. The bottom of the exhibit shows that most costs are due to compensation and disability, with some of these being offset by training savings.

[10] The data we have on disability rate are for permanent disability only.

Exhibit 18: Summary of Accounting Costs

	Sections 61.23, 121.383, 121.411 and 121.412				Sections 61.3(j) and 121.440			
	DPV Comp, Disability, Recruitment, Training	Reprogram. Costs	DPV Additional Plots Scheduling And Vacation Costs	DPV Medical Certificate Costs	DPV Salary	DPV Line Check Costs	Total Constant Dollar Costs	DPV Total Costs
TOTAL	$1,713,920,317	$0	$24,556,889	$3,014,737	$2,318,761	$18,932,411	$3,012,584,349	$1,762,743,114

Sections 61.23, 121.383, 121.411 and 121.412						
Constant Dollars						
Salary	Pension Contributions	Disability Pay	Recruitment	Training	Total Comp., Etc.	DPV Comp, Disability, Recruitment, Training
$2,253,407,476	$155,872,313	$1,173,427,286	($39,887,500)	($621,985,624)	$2,920,833,950	$1,713,920,317

It is important to note that the values in Exhibits 19 and 20 are based on accounting costs and not economic costs. As a result, the estimates for the various cost categories are different than those reported in Exhibit 18, where economic costs of the Act are reported.

A.7. PAPERWORK COSTS OF THE ACT

One of the purposes of the Paperwork Reduction Act is to "minimize the paperwork burden for individuals, small businesses, educational and nonprofit institutions, Federal contractors, State, local and tribal governments, and other persons resulting from the collection of information by or for the Federal Government" (Paperwork Reduction Act). The increased mandatory retirement age for pilots will cause airlines, pilots, and the FAA to incur additional paperwork burden (and hence an increase in paperwork costs). Over a 15-year period, total paperwork costs will be approximately $11.7 million[11] ($6.7 million, discounted)[12]. Total paperwork costs are composed of record keeping costs, reporting costs, and line check costs.

Under this Act, all pilots over age 60 serving in part 121 operations must hold a first-class medical certificate, valid for 6 months. Although most older pilots serving in

[11] $7,373,474 + $911,053 + $3,418,877 = $11,703,403.
[12] $4,101,988 + $506,834 + $2,075,922 = $6,684,744.

part 121 operations hold a first-class medical certificate, some pilots hold a commercial pilot certificate which requires a second-class medical certificate, valid for 12 months. Affected pilots will have to apply for medical examination twice a year to maintain a first-class medical certificate instead of once a year to maintain a second-class medical certificate. The following assumptions were used to calculate paperwork costs:

Estimated time for an Aviation Medical Examiner (AME) to decide final disposition on a medical certificate application: 15 min.

Estimated time for a first officer to complete a medical certificate application: 15 min.

Estimated time for a legal instrument examiner to process a medical certificate application: 15 min.

Average hourly salary of AME's: $85.43.

Average hourly salary of first officers: $67.69.

Average hourly salary of legal instrument examiners: $36.07.

Total number of medical applications over 15 years: 192,622.

Total number of medical applications deferred to the FAA over 15 years: 19,262.

Record Keeping Hours and Costs								
Year	# of medical applications	Carrier Hours	Pilot Hours	Total Record Keeping Hours	Carrier Costs	Pilot Costs	Total Record Keeping Costs	Record Keeping Costs Discounted
1	2,989	747	747	1,495	$63,839	$50,578	$114,417	$106,932
2	5,681	1,420	1,420	2,841	$121,335	$96,131	$217,466	$189,943
3	8,297	2,074	2,074	4,149	$177,208	$140,397	$317,605	$259,260
4	10,855	2,714	2,714	5,428	$231,841	$183,683	$415,524	$317,001
5	13,095	3,274	3,274	6,548	$279,683	$221,587	$501,270	$357,399
6	13,291	3,323	3,323	6,646	$283,869	$224,903	$508,773	$339,017
7	13,615	3,404	3,404	6,808	$290,789	$230,386	$521,175	$324,562
8	14,101	3,525	3,525	7,051	$301,169	$238,610	$539,779	$314,156
9	14,698	3,675	3,675	7,349	$313,920	$248,712	$562,632	$306,035
10	15,555	3,889	3,889	7,778	$332,224	$263,214	$595,438	$302,690
11	16,118	4,030	4,030	8,059	$344,249	$272,740	$616,989	$293,127
12	16,291	4,073	4,073	8,146	$347,944	$275,668	$623,611	$276,891
13	16,351	4,088	4,088	8,176	$349,225	$276,683	$625,908	$259,730
14	16,103	4,026	4,026	8,052	$343,928	$272,487	$616,415	$239,056
15	15,582	3,896	3,896	7,791	$332,801	$263,670	$596,471	$216,189
Total	192,622	48,156	48,156	96,311	$4,114,025	$3,259,448	$7,373,474	$4,101,988

Reporting Hours and Costs											
Year	# of medical applications	# of deferred medical applications	Carrier Hours	Pilot Hours	FAA Hours	Total Reporting Hours	Carrier Costs	Pilot Costs	FAA Costs	Total Reporting Costs	Reporting Costs Discounted
1	2,989	299	75	75	75	224	$6,384	$5,058	$2,695	$14,137	$13,212
2	5,681	568	142	142	142	426	$12,133	$9,613	$5,123	$26,870	$23,469
3	8,297	830	207	207	207	622	$17,721	$14,040	$7,482	$39,243	$32,034
4	10,855	1,086	271	271	271	814	$23,184	$18,368	$9,789	$51,341	$39,168
5	13,095	1,310	327	327	327	982	$27,968	$22,159	$11,809	$61,936	$44,160
6	13,291	1,329	332	332	332	997	$28,387	$22,490	$11,986	$62,863	$41,888
7	13,615	1,362	340	340	340	1,021	$29,079	$23,039	$12,278	$64,395	$40,102
8	14,101	1,410	353	353	353	1,058	$30,117	$23,861	$12,716	$66,694	$38,817
9	14,698	1,470	367	367	367	1,102	$31,392	$24,871	$13,255	$69,518	$37,813
10	15,555	1,556	389	389	389	1,167	$33,222	$26,321	$14,027	$73,571	$37,400
11	16,118	1,612	403	403	403	1,209	$34,425	$27,274	$14,535	$76,234	$36,218
12	16,291	1,629	407	407	407	1,222	$34,794	$27,567	$14,691	$77,052	$34,212
13	16,351	1,635	409	409	409	1,226	$34,923	$27,668	$14,745	$77,336	$32,092
14	16,103	1,610	403	403	403	1,208	$34,393	$27,249	$14,522	$76,163	$29,537
15	15,582	1,558	390	390	390	1,169	$33,280	$26,367	$14,052	$73,699	$26,712
Total	192,622	19,262	4,816	4,816	4,816	14,447	$411,403	$325,945	$173,705	$911,053	$506,834

As stated in A.4., Section 121.440 requires an average of one additional annual line check for every part 121 pilot of age 60 to 65. Based on 15 minutes of a check airman's time and 9,073 pilots between 60 and 65, we estimate paperwork costs of $3.4 million ($2,075,922, discounted) over 15 years.

II. COMPARISON OF COSTS AND BENEFITS

The Act will result in lower training and hiring costs. FAA has not valued any other benefits from the Act (such as the effect of an increase in the number of experienced pilots). The economic costs of the Act include added scheduling, medical, salary, and line check costs. The Act is estimated to have a net benefit to society of

approximately $334 million over 15 years (present value), but cause airlines to incur $1.8 billion in accounting costs in the same period.