

Aviation Infrastructure Taxes and Fees in the United States and the European Union

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The impact of infrastructure-related add-on taxes and fees on the cost of domestic U.S. air travel and of domestic and intraregional EU air travel is estimated. For the United States, an analysis of the *Origin and Destination Data Bank 1A Ticket Dollar Value* database shows that the average effective tax rate increased from 10.9% in 1993 to 16.1% in 2004. A large portion of the increase is due to a striking 25% decline in the real average base fare. The relative impact of taxes and fees is greatest on the least expensive tickets. The effective tax rate for low-cost carriers is moderately greater than for legacy carriers. For the European Union, a sample of about 335,000 tickets from January 13 and 14, 2004, was used, with the effective tax rate estimated at 12.5%. However, EU taxes and fees do not cover the cost of air navigation services, and thus the 12.5% effective tax rate should not be compared with the 16.1% U.S. rate. A preliminary correction for this difference suggests that the true effective tax rate is higher in the European Union than in the United States. The intra-European Union average of 12.5% also masks large differences among countries (which range from 6.6% for Luxembourg to 24.4% for the United Kingdom). The relative impact of taxes and fees on the least expensive tickets is even greater than in the United States.

The question of restructuring aviation taxes and fees is the focus of ongoing debate. In the United States, the aviation tax system is under scrutiny because declining fares are causing tax revenues to drop (1). In the European Union (EU), new fees are being considered, for example, to offset carbon emissions (2). Airlines on both sides of the North Atlantic are particularly concerned about taxes and fees that are added to the base fares (BFs) they charge. Add-on taxes and fees increase the direct cost of air travel to consumers. The Air Transport Association contends that “as a result of competitive forces at work in the industry, the absence of industry pricing power results in government imposed taxes and fees directly reducing industry revenue on virtually a dollar-for-dollar basis” (3).

The objective of this study is to provide background for the policy debate by presenting descriptive statistics and observations on infrastructure-related taxes and fees. The paper focuses on aggregate and distributive characteristics of the effective tax rate (ETR). ETR is defined as the total taxes and fees (TTFs) added to a ticket, divided by the BF—the fare net of taxes. This analysis covers domestic U.S. as well as domestic and intraregional EU airfares.

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The existing literature on the subject is limited and confined to the U.S. domestic market. Earlier work includes an analysis of 2002 data (4), a report by the Government Accountability Office (5), several publications by the Air Transport Association (3, 6) and a report focusing on business travelers (7). To the authors’ knowledge, the only publication with EU data is a dissertation by Yamanaka (8), which includes additional details on both U.S. and EU results.

U.S. TAXES AND FEES

Identification and History

Four types of taxes and fees are currently levied on domestic airfares in the United States: federal ticket tax (FTT), federal flight segment tax (FST), passenger facility charge (PFC), and federal security service fee (FSSF). A history of these taxes and fees is listed in Table 1.

The federal ticket and segment taxes are paid into the Airport and Airway Trust Fund. This fund finances congressional appropriations to cover “those obligations of the United States . . . which are attributable to planning, research and development, construction, or operation and maintenance of air traffic control, air navigation, communications, or supporting services for the airway system” (Internal Revenue Code, 26 U.S.C. § 4261, 1986). The FTT is currently equal to 7.5% of the BF.

The segment tax was \$3 per flight segment in 2002 and 2003 (Internal Revenue Code 1986). A built-in inflation adjustment raised the segment tax to \$3.10 in 2004 and \$3.20 in 2005 (9). Several exceptions exist: designated rural airports are exempt from the segment tax (Internal Revenue Code 1986), and special taxes exist for arrivals from and departures to Alaska and Hawaii (10).

The segment tax did not exist before October 1, 1997. A flat FTT rate was used that peaked at 10% in modern times (from 1990 to 1996). It was subsequently reduced to 7.5% after the introduction of the segment tax. The PFC was instituted to assist commercial airports to “finance eligible airport-related projects, including making payments for debt service” [Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR-21), 49 U.S.C. § 40117, 2000]. Starting on June 1, 1992, authorized airports could collect PFCs in the amount of \$1, \$2, or \$3 per enplanement. A higher PFC of \$4.50 was introduced on April 1, 2001 (11; AIR-21 2000). PFCs are collected for up to two boardings per one-way trip (AIR-21 2000), resulting in a maximum of \$18 per round-trip. In 1993, PFCs were collected at 89 airports, all but one of which charged the then-maximum of \$3; by 2004, roughly 35% of the 315 airports that collected PFCs charged \$3 and 65% charged \$4.50.

The most recently adopted domestic ticket tax is FSSF, created by the Aviation and Transportation Security Act (49 U.S.C. § 44940,

TABLE 1 History of U.S. Infrastructure-Related Taxes and Fees on Domestic Airline Fares

Year	FTT (%)	FST (\$)	PFC (max.) (\$)	FSSF (\$)
1941	5.0	—	—	—
1942	10.0	—	—	—
1943	15.0	—	—	—
1955	10.0	—	—	—
1956	5.0	—	—	—
1970	8.0	—	—	—
1980	5.0	—	—	—
1982	8.0	—	—	—
1990	10.0	—	—	—
1992	10.0	—	3.00	—
1997	9.0	1.00	3.00	—
1998	8.0	2.00	3.00	—
1999	7.5	2.25	3.00	—
2000	7.5	2.50	3.00	—
2001	7.5	2.75	4.50	—
2002	7.5	3.00	4.50	2.50
2003	7.5	3.00	4.50	2.50
2004	7.5	3.10	4.50	2.50
2005	7.5	3.20	4.50	2.50

NOTE: A dash (—) indicates the tax or fee was not applicable. Years with no changes in the tax and fee structure are omitted.

2001). It authorizes a \$2.50 tax per enplanement as of February 1, 2002 (12) and is limited to a maximum of two segments per one-way trip or \$10 per round trip.

Numerous other federal infrastructure and security taxes and fees are assessed on air carriers but fall outside the scope of this paper because they apply only to international travel or are not directly added to tickets, or both. Air carriers also pay nonfederal charges (e.g., landing fees and airport leases), but such fees are not added directly to tickets and therefore also fall outside the scope of this study.

Methodology and Data Analysis

The total fare for an air trip consists of the sum of two parts, BF (total fare less any applicable taxes and fees) and TTFs:

$$\text{TTF} = \text{FTT} + \text{FST} + \text{FSSF} + \text{PFC}$$

For any sample of tickets, ETR is defined as

$$\text{ETR} = \frac{E(\text{TTF})}{E(\text{BF})} \times 100\%$$

where $E(\text{TTF})$ and $E(\text{BF})$ represent the average values for that sample, weighted by the number of passengers.

The US Department of Transportation *Origin and Destination Data Bank 1A Ticket Dollar Value Survey* (DB1A), which provides “the full itinerary and the dollar amounts paid by each passenger” for a “continuous 10% sample of airline tickets” (13), was used to sample domestic airline tickets. The DB1A survey aggregates sam-

pled tickets with identical combinations of itinerary and fare. Thus, each record can correspond to more than one passenger.

The specific database used in this study is a modified version of the original DB1A survey (14), referred to here as DB1A*. In DB1A*, round-trip tickets are broken into two records, each representing a one-way trip. Data for the second quarters of 1993, 2002, and 2004 were obtained. The second quarter of 2002 (2002Q2) was the first quarter in which the FSSF was assessed during all 3 months of a quarter. The purpose of looking at 1993 data was to obtain a longer-term perspective on how the tax burden has evolved. Table 2 lists the original data availability for each of the three quarters before processing.

Because the DB1A survey includes only the total fare paid, the component taxes and the BF had to be computed for this study. A procedure was prepared for this purpose (4) and tested with a sample of fares obtained from two online travel agencies, Expedia.com and Orbitz.com.

Overall ETR

After four filters were applied to the data to reduce the level of abnormal data (4), the results listed in Table 3 were obtained. Overall ETR (i.e., including both one-way and round-trip) has increased from 10.9% in 1993 to 16.1% in 2004. Average TTFs in 2004 were \$40.57, with the average BF equal to \$251.43. In 2004, FTT was responsible for slightly less than one-half of total taxes, and the segment tax, security fee, and PFC contributed to the other half in roughly similar amounts. In 1993, the FTT (at the time equal to 10% of the BF) accounted for about 92% of the average TTFs.

Because of the large number of tickets in the sample, estimates of the means for all three periods are robust. In all cases, the 95% confidence interval is within 0.1% of the corresponding estimate (8).

A remarkable aspect of Table 3 is that the overall average BF has declined by 25% in constant (2004) dollars. This decline reflects the much-discussed recent inability of most U.S. airlines to price fares at a profitable level despite significant increases in their largest cost components as a result of competitive pressures. The average TTFs per ticket increased by only 10.4% between 1993 and 2004. Therefore, the increase in ETR from 10.9% to 16.1% is clearly due in large part to the decline in fares. As another illustration of this effect, had the BF been the same in 2004 (\$337.25) as in 1993, the ETR would have been about 13.9% instead of the actual 16.1%, *ceteris paribus*.

Table 3 shows that the average origin–destination (O-D) distance has increased over the years. This trend may have accelerated since 2001 as a result of increased processing times at airports

TABLE 2 DB1A Data Availability

Quarter	Ticket Category	Records	Passengers
1993Q2	One-way	216,559	1,490,367
	Round trip	2,789,104	2,762,341
	Total	3,005,663	4,252,708
2002Q2	One-way	342,605	965,105
	Round trip	3,796,366	4,325,318
	Total	4,138,971	5,290,423
2004Q2	One-way	434,568	1,169,361
	Round trip	3,968,092	4,666,534
	Total	4,402,660	5,835,895

TABLE 3 Comparison of 1993, 2002, and 2004 Average Fares, Taxes, Fees, and Effective Tax Rates (ETRs)

Quarter	Ticket Category	Total Fare (\$)	Base Fare (\$)	TTF (\$)	FTT (\$)	FST (\$)	PFC (\$)	FSSF (\$)	ETR	Segments per Ticket	O-D Distance (miles)
1993Q2	All	373.99	337.25	36.74	33.72	—	3.02	—	10.9%		
	One-way	153.49	138.29	15.20	13.83	—	1.37	—	11.0%	1.18	579
	Round trip	493.29	444.89	48.40	44.49	—	3.91	—	10.9%	2.71	1009
2002Q2	All	321.99	278.83	43.16	20.91	7.62	8.27	6.35	15.5%		
	One-way	242.91	215.05	27.86	16.13	4.04	4.33	3.36	13.0%	1.28	871
	Round trip	338.00	291.74	46.26	21.88	8.35	9.07	6.96	15.9%	2.65	1005
2004Q2	All	292.00	251.43	40.57	18.86	7.25	8.62	5.84	16.1%		
	One-way	208.58	182.97	25.60	13.72	3.96	4.72	3.20	14.0%	1.28	959
	Round trip	312.54	268.29	44.25	20.12	8.06	9.58	6.50	16.5%	2.60	1048

NOTE: All fares and taxes and fees are shown in 2004 dollars. A dash (—) indicates the tax or fee was not applicable.

and the resulting shift to other modes for trips of 200 miles or less. Also, in both 2002 and 2004, about 70% of itineraries consisted of nonstop flights. This finding is significant because nonstop itineraries reduce the impact of segment-based tax components (i.e., the segment tax, security fee, and PFC) on the ETR.

Distributive Aspects and Sensitivity of the ETR

Some distributive characteristics of the ETR were also examined, namely, its magnitude relative to the BF, trip distance, and type of airline. Overall ETR has increased significantly between 1993 and 2004, but the increase has not been as dramatic as claimed in several media articles (15, 16) and is largely due to the decline of the average BF. However, a striking change has taken place in how ETR varies with BF. As indicated in Table 4, passengers whose BF was less than \$200 experienced an average ETR of more than 20% in both 2002 and 2004. At the opposite extreme, passengers whose BF was more than \$800 experienced an average ETR of 10% or less. This difference is not entirely surprising because the segment tax, security fee, and PFC vary only with the number of connections and are independent of the BF. However, the steepness of the increase is remarkable. A detailed review of ETR experienced by each individual passenger shows that in 2002, 63.6% of passengers experienced a rate greater than the overall average of 15.5% for that year.

In sharp contrast, ETR varied only slightly with BF in 1993, ranging from 11.9% when the BF was less than \$100 to 10.1% when the BF was greater than \$2,000. For fares of \$800 or more, the ETR in

2004 and 2002 was less than 10%—lower than in 1993. It is safe to conclude that the increase in ETR was not a leading cause of the dramatic decline in demand for high-priced tickets experienced since 2000. The blame must be placed elsewhere.

Perhaps surprisingly, ETR currently varies little with trip distance. For example, in 2002 ETR varied from a low of 13.8% for trips longer than 2,000 miles each way to a high of 16.5% for trips between 200 and 500 miles. This is partly because the average BF increases less than linearly with trip distance. For example, the average BF for a distance in the 1,000- to 2,000-mile range is only 78% greater than for a distance less than 200 miles. Also, trips with longer distances are more likely to include a connection at an intermediate airport. This increases the total segment tax, security fee, and PFC for such trips.

Table 5 contains a comparison between legacy and low-cost carriers (LCCs) for 2004. The legacy carriers in the sample are American, Continental, Delta, Northwest, United, and US Airways; the LCCs are ATA, JetBlue, and Southwest. Overall ETR for the LCCs is about 3.2% higher than for the legacy carriers. This differential is also observed in the 2002 data and apparently has not been sufficient to slow down the continuing growth in the LCCs' market share.

Nonetheless, the 3.2% difference is smaller than expected given that the LCCs charge a BF of only 56% of that charged by legacy carriers (\$165.73 vs. \$297.92). One reason for this difference is that the average number of segments per itinerary is significantly lower for LCCs than for legacy carriers. It means that the total segment tax, security fee, and PFC charged to LCC tickets is less, on average, and reflects two aspects of LCC versus legacy carrier operations: the

TABLE 4 Average ETR by Base Fare Range in 2004Q2 (all tickets)

Base Fare Range	Passenger Share		Average BF (\$)		Average TTF (\$)		Average ETR	
	2004Q2	2002Q2	2004Q2	2002Q2 (2004 dollars)	2004Q2	2002Q2 (2004 dollars)	2004Q2	2002Q2
BF ≤ \$100	10.8%	10.7%	77.72	82.81	19.65	21.04	25.3%	25.4%
\$100 < BF ≤ \$200	38.6%	41.3%	156.49	161.38	32.79	33.84	21.0%	21.0%
\$200 < BF ≤ \$400	38.7%	34.0%	271.30	285.18	44.29	45.85	16.3%	16.1%
\$400 < BF ≤ \$600	7.1%	7.6%	480.95	506.80	60.34	62.74	12.5%	12.4%
\$600 < BF ≤ \$800	2.5%	2.8%	689.88	723.17	75.29	77.81	10.9%	10.8%
\$800 < BF ≤ \$1000	1.2%	1.5%	889.81	936.06	89.18	93.09	10.0%	9.9%
\$1000 < BF ≤ \$2000	1.1%	1.9%	1,294.38	1,397.74	119.37	127.78	9.2%	9.1%
\$2000 < BF	0.1%	0.3%	2,517.17	2,593.99	210.54	216.91	8.4%	8.4%
All	100.0%	100.0%	251.43	278.83	40.57	43.16	16.1%	15.5%

TABLE 5 Legacy Versus Low-Cost Carriers, 2004Q2

Carrier Type	Ticket Category	No. of Pax	Base Fare (\$)	TTF (\$)	FTT (\$)	FST (\$)	PFC (\$)	FSSF (\$)	ETR	Segments per Ticket	O-D Distance (miles)
Legacy	All	2,110,520	297.92	44.62	22.34	7.39	8.93	5.96	15.0%		
	One-way	315,599	255.75	31.07	19.18	3.93	4.80	3.17	12.1%	1.27	1,102
	Round trip	1,794,921	305.33	47.00	22.90	7.99	9.66	6.45	15.4%	2.58	1,200
LCC	All	1,251,888	165.73	30.14	12.43	6.06	6.77	4.88	18.2%		
	One-way	345,282	112.74	19.02	8.46	3.62	4.04	2.92	16.9%	1.17	845
	Round trip	906,606	185.91	34.37	13.94	6.99	7.81	5.63	18.5%	2.25	843

average O-D distance flown by LCC passengers is 844 miles vs. 1,186 miles for legacy carrier passengers, and the route networks of legacy carriers rely more heavily on connections at hub airports.

Finally, the following simple example illustrates the potential applications of this work to policy making. In February 2005, the Bush administration proposed, as part of its 2006 budget, to increase the security fee from \$2.50 to \$5.50 per enplanement, with a cap of \$8 each way. The intent was to generate an additional \$1.5 billion to meet the funding requirements of the Transportation Security Administration (TSA). Airlines reacted negatively to the proposal, and a heated public debate ensued (17). With the 2004Q2 DB1A* ticket sample, it is estimated that the proposal would have increased overall ETR from 16.1% to a range of 18.3% to 18.7%. The lower limit assumes that the airlines would have left the BF unchanged and that passengers would have absorbed the entire security fee increase; the upper limit assumes that the airlines would have left the total fare (BF + TTF) unchanged and therefore would have absorbed the entire increase. The proposed increase did not make it to the final 2006 budget (18).

EU TAXES AND FEES

This section presents the results to date of an analysis of ETR in the “original 15” European Union member countries (EU-15; Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and the United Kingdom). Of interest are both domestic travel within these countries and international travel between any pair of these countries (i.e., intra-EU travel).

Complexity

Estimating the impact of infrastructure-related aviation taxes and fees on the cost of EU-15 air travel has proved a far more challenging task than for the United States. The most fundamental reason is that no comprehensive publicly available database (analogous to the DB1A survey) exists for EU air travel. One must resort to partial and less accessible data for a study of the type attempted here. Also, the structure of taxes and fees in the European Union is far more complex: 43 kinds of ticket taxes and fees are currently in effect for domestic and intra-EU air travel in the 15 countries investigated (8). Many of these taxes and fees vary depending on such details as point of boarding, country of destination, and, in some cases, choice of airline (19). Simply understanding how these taxes and fees apply requires a major effort.

The cost of en route and terminal air navigation services (ANSs) is not reflected in any taxes and fees charged directly to passengers

in the European Union. This situation is unlike in the United States, where the federal ticket and segment taxes are used in part to fund FAA’s air traffic control operations. Carriers flying in European airspace make payments to EUROCONTROL for en route ANS and to EUROCONTROL or to the member state involved for terminal area ANS. EUROCONTROL, in turn, distributes its ANS revenues among the member states according to well-established formulas. As a result, comparisons of ETR values between the EU-15 and the United States must be performed carefully to be meaningful.

EU tickets also frequently include two tax codes, YQ and YR (here collectively referred to as YQYR), that are reserved for airline surcharges such as temporary surcharges for fuel or increased security costs. Despite appearing on the tickets as add-on taxes and fees, YQYR proceeds actually constitute additional revenue for the airlines. In this analysis, such fees are therefore added to the BF instead of being included in TTFs. The total amount of YQYR charges observed in the EU-15 ticket sample was approximately 26% of the total add-on charges, significantly affecting ETR estimates.

Methodology and Data Analysis

Because of the lack of a database similar to DB1A, this study relied on ticketing data made available by Amadeus Global Travel Distribution S.A. for the EU-15 analysis. Amadeus is a global distribution system (GDS) company with access to the seat inventories of more than 400 airlines worldwide, processing approximately 450 million bookings yearly (20). Amadeus is a leading GDS in Europe with a regional market share of 55% (21).

For 2 days (Jan. 13 and 14, 2004), the study team collected ticket data consisting of 1,120,507 issued tickets, representing 2,626,580 flight segments. The data were filtered to exclude personal information and include only information about itineraries, fares, taxes, fees, country where the ticket was purchased, currency in which the fare was computed, and other transactional details. All monetary values were converted into U.S. dollars with currency exchange rates provided by the OANDA Corporation (22).

Six filters were applied to the database in sequence to exclude tickets for travel outside the EU-15 nations and to eliminate bad or incomplete records (Table 6). These filters reduced the number of usable tickets to about 335,000—far fewer than the several million per quarter contained in the DB1A* database for the United States.

As in the U.S. study, ETR was defined as the percentage by which the BF that the airline charged is increased by the TTFs that the traveler paid directly. However, to account for YQYR, the ETR expression was modified to

$$ETR = \frac{E(TTF) - E(YQYR)}{E(BF) + E(YQYR)} \times 100\%$$

TABLE 6 Filters Used for Preparing EU-15 Records

Filter Step	Filter Description	Records Remaining	Tickets Remaining	Remaining Tickets %
	Unfiltered data	2,626,580	1,120,507	100.0
1	Bad and irrelevant records elimination	2,218,776	970,853	86.6
2	EU market filter	864,341	423,556	37.8
3	Fare and tax detail availability filter	799,365	393,426	35.1
4	Segment numbering filter	729,746	362,809	32.4
5	Base fare discrepancy filter	688,471	341,093	30.4
6	Number of segments filter	663,825	334,782	29.9

where E(TTF), E(BF), and E(YQYR) represent the weighted averages of TTFs, BF, and the total amount of YQ and YR per ticket, respectively.

The EU-15 results are based on a narrow sample of two consecutive days in January, which could be distorted by exogenous events or seasonal variations. At the time of writing, the authors' research is focused on expanding this limited sample (see conclusions section). Another important caveat is that some LCCs, including the two largest European LCCs—Ryanair and easyJet—do not use GDS services. LCCs constitute approximately 20% of the EU-15 market (23). Because the GDS ticket sample does not cover these carriers, ETR estimates for the EU-15 presented here are possibly on the low side, because tax rates tend to be higher when BF is low.

Results for the EU-15

Table 7 shows how much add-on taxes and fees increase the cost of a ticket for domestic EU and intra-EU air travel. The overall ETR for the 2-day sample of 2004 tickets was 12.5%. One-way tickets have a higher BF than round-trip tickets (\$166.43—58% of the round-trip BF, \$287.96), leading to a significantly lower ETR (8.8%). Also, many one-way tickets were issued in countries with low tax rates.

It is worth noting that if YQYR were treated as part of TTFs instead of BF, overall ETR would be equal to 16.5%. Although there is little logical basis for treating YQYR in this way, the 16.5% estimate may be an important indicator of how passengers perceive the size of the ETR. One can reasonably assume that most passengers view YQYR the same as the many other tax codes that appear on their tickets and not as a surcharge that represents airline revenue.

The aggregate results of Table 7 mask the fact that ETR values vary greatly across EU-15 countries (Table 8 and Figure 1). The EU-15 nations can be divided into three groups: four "low ETR" (<10%), seven "average ETR" (10% to 15%), and four "high ETR" (>15%)

countries. A high ETR value can be the result of high taxes or low fares. For example, the UK ETR is the highest in all itinerary categories (overall, domestic, and intra-EU), but low fares are clearly the main cause. In Spain, a low tax rate keeps the ETR consistently low despite relatively inexpensive fares. Finally, Denmark has the highest TTFs, but relatively high fares keep the ETR lower than it would be otherwise.

In all countries except Ireland and Spain, domestic ETR is considerably higher than intra-EU rate. It is not because higher taxes and fees are levied on domestic tickets but because intra-EU BF levels are significantly higher than domestic levels. At the same time, intra-EU TTFs are only slightly higher than domestic totals in most countries. Intra-EU ETR values also vary less from country to country than domestic ETR, simply because differences in tax rates among the EU-15 countries are less extreme when more than one country is involved in an itinerary.

As shown in the last column of Table 7, the average number of flight segments for EU-15 itineraries is clearly smaller than for U.S. itineraries. About 88% of one-way trips and 82% of round-trips in the EU-15 sample were nonstop flights, compared with approximately 70% for the U.S. sample. The most important reason for this difference is the short distances between principal western European traffic-generating areas, which encourage nonstop service. In addition, major European airlines do not use hub-and-spoke strategies as intensively as their U.S. counterparts.

The study also examined how the EU-15 ETR varies with BF. This approach was motivated by the earlier finding that taxes and fees have a much larger impact on low-fare tickets in the United States. Table 9 indicates that this effect is even more severe in the European Union: ETR values vary greatly across BFs, from 2.0% to 42.3%. This variation is because TTFs increased by only a factor of 2 between the lowest and highest BF ranges, whereas the BFs increased by a factor of 40. Also, note that passengers with a BF of less than \$250 (62.3% of passengers in the sample) face a significantly higher average ETR than the overall mean of 12.5%.

TABLE 7 Average ETRs, 2004

Ticket Category	No. of Tickets in Sample	Base Fare (US\$)	TTF (US\$)	YQYR (in TTF) (US\$)	ETR	Segments per Ticket
All	334,782	264.84	43.57	9.40	12.5%	
One-way	63,688	166.43	18.18	3.21	8.8%	1.12
Round trip	271,094	287.96	49.54	10.86	12.9%	2.18

TABLE 8 ETRs, by Origin Country

Origin Country	O-D Type	No. of Tickets in Sample	Base Fare (US\$)	TTF (US\$)	YQYR (in TTF) (US\$)	ETR
Austria	All	4,437	375.47	68.21	19.39	12.4%
	Domestic	384	248.23	53.59	15.87	14.3%
	Intra-EU	4,053	387.53	69.60	19.73	12.2%
Belgium	All	3,289	362.19	52.38	6.00	12.6%
	Domestic	0				
	Intra-EU	3,289	362.19	52.38	6.00	12.6%
Denmark	All	6,624	357.75	65.19	12.48	14.2%
	Domestic	2,339	214.57	58.97	9.38	22.1%
	Intra-EU	4,285	435.91	68.58	14.17	12.1%
Finland	All	10,240	269.72	58.70	11.46	16.8%
	Domestic	6,137	186.79	57.96	10.23	24.2%
	Intra-EU	4,103	393.76	59.81	13.30	11.4%
France	All	67,935	344.50	51.24	9.77	11.7%
	Domestic	51,479	279.84	50.23	9.38	14.1%
	Intra-EU	16,456	546.77	54.38	10.99	7.8%
Germany	All	71,609	306.03	56.74	17.02	12.3%
	Domestic	44,998	254.77	54.09	15.94	14.1%
	Intra-EU	26,611	392.72	61.24	18.83	10.3%
Greece	All	2,073	203.27	47.95	8.09	18.9%
	Domestic	1,159	121.24	37.98	4.57	26.6%
	Intra-EU	914	307.29	60.59	12.56	15.0%
Ireland	All	1,829	165.54	42.29	9.07	19.0%
	Domestic	45	132.47	20.85	2.82	13.3%
	Intra-EU	1,784	166.38	42.83	9.23	19.1%
Italy	All	12,942	291.70	39.69	14.17	8.3%
	Domestic	8,024	201.45	32.91	12.71	9.4%
	Intra-EU	4,918	438.93	50.75	16.54	7.5%
Luxembourg	All	1,189	350.80	37.36	13.28	6.6%
	Domestic	0				
	Intra-EU	1,189	350.80	37.36	13.28	6.6%
Netherlands	All	3,231	351.77	58.17	7.00	14.3%
	Domestic	9	170.42	56.11	6.82	27.8%
	Intra-EU	3,222	352.28	58.18	7.00	14.2%
Portugal	All	1,597	293.31	32.54	4.49	9.4%
	Domestic	491	170.87	22.94	0.00	13.4%
	Intra-EU	1,106	347.66	36.81	6.48	8.6%
Spain	All	85,797	195.56	14.94	1.02	7.1%
	Domestic	69,957	159.33	10.90	0.02	6.8%
	Intra-EU	15,840	355.54	32.77	5.41	7.6%
Sweden	All	13,169	310.73	58.88	12.49	14.4%
	Domestic	8,397	231.82	55.35	10.49	18.5%
	Intra-EU	4,772	449.58	65.10	16.01	10.5%
United Kingdom	All	48,821	163.15	51.26	9.14	24.4%
	Domestic	19,282	130.48	49.44	8.47	29.5%
	Intra-EU	29,539	184.47	52.45	9.58	22.1%

Preliminary Comparison with the ETR for Domestic U.S. Travel

As pointed out in the section on methodology and data analysis, one major difference between U.S. and EU add-on taxes and fees is that the former fund ANS costs, whereas the latter do not. Any comparison of U.S. and EU-15 ETR values must take this difference into consideration, because ANS costs are substantial on both sides of the Atlantic. Unfortunately, no European data collection mechanism is comparable to U.S. carriers' monthly USDOT Form 41 filings, which readily identifies the amounts paid by individual airlines for ANS.

The study team has collected detailed data from two of the largest European airlines, Lufthansa and SAS Group, on their ANS costs in

2004 for intra-EU flights. This information—independently provided by the two carriers and mutually consistent—indicates that ANS costs would add roughly 7% to estimated ETR (see the section on EU-15 results). Both Lufthansa and SAS have flights throughout Europe and are based in countries where the ETR is close to the EU-15 average of 12.5% (e.g., ETR for Lufthansa is 13.6%). This suggests the conjecture that with ANS costs taken into account, the EU-15 ETR would be approximately 19% to 20% (i.e., 12.5% + 7%). This rate would be slightly higher than the 16.1% for U.S. domestic air travel in the second quarter of 2004. However, this estimate is only preliminary, serving primarily as a good launching point for future investigation. For example, this comparison does not take into account that a portion of U.S. air traffic control costs are subsidized by general tax revenues.

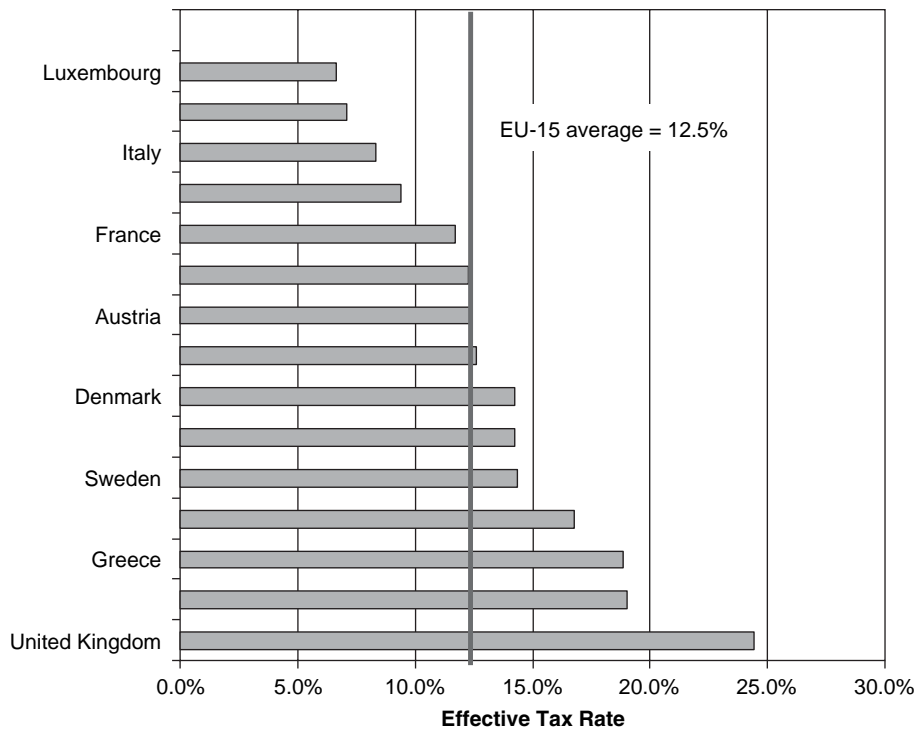


FIGURE 1 Average ETRs by origin country (sorted in increasing order).

CONCLUSIONS

The analysis above presents aggregate and distributive estimates of ETR for domestic U.S. air travel and for domestic EU-15 and intra-EU air travel. The estimates for the United States derive from large databases and are statistically highly reliable. They also offer a historical perspective on ETR. The estimates for the EU-15 nations are based on much smaller samples and are far less reliable. They also exclude tickets issued by charter carriers and several large LCCs. Nonetheless, the estimates provide a good indication of the magnitude of the ETR in the EU-15 and the surprisingly large differences that seem to exist among individual EU-15 nations. This study also includes a conjecture, based on data from two major EU airlines, of how EU-15 ETR would compare with that for the United States when accounting for ANS costs.

The study team is strengthening the EU analysis by incorporating a new, much larger sample of more than 2 million EU tickets. This sample is comparable in size to one-quarter of the DBIA database

and contains tickets issued during 15 days evenly spread throughout 2004. Analysis of this expanded sample should result in more reliable estimates of the EU-15 ETRs and allow the exploration of additional issues.

The second area currently under investigation is an improved comparison of all the infrastructure-related costs that airlines must contend with on both sides of the Atlantic. In addition to taxes, fees, and ANS costs, carriers must pay landing fees, fuel taxes, terminal ownership or lease costs, and, in the United States, the TSA Air Carrier Security Fee.

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TABLE 9 Average ETRs for Different Base Fare Ranges

Base Fare Range (US\$)	No. of Tickets in Sample	Base Fare (US\$)	TTF (US\$)	YQYR (in TTF) (US\$)	ETR
BF ≤ 100	90,628	56.76	33.73	6.81	42.3%
100 < BF ≤ 250	117,760	165.21	42.10	8.74	19.2%
250 < BF ≤ 500	84,419	360.33	48.74	10.74	10.2%
500 < BF ≤ 1000	32,333	657.09	57.71	13.75	6.6%
1000 < BF ≤ 2000	9,407	1,260.64	61.33	15.53	3.6%
2000 < BF	235	2,305.16	65.28	18.35	2.0%
All	334,782	264.84	43.57	9.40	12.5%

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REFERENCES

1. Alexander, K. A Flier's Market: Fares Here Are Cheaper, If You Can Find the Seats. *The Washington Post*, June 1, 2005, p. D1.
2. Parker, G. Pollution Levy Could Push Up Price of European Air Fares. *Financial Times*, July 24, 2005, p. 8.
3. *Airlines in Crisis: The Perfect Economic Storm*. Air Transport Association, Washington, D.C., 2003, pp. 15–18.
4. Karlsson, J., A. Odoni, and S. Yamanaka. The Impact of Infrastructure-Related Taxes and Fees on Domestic Airline Fares in the U.S. *Journal of Air Transport Management*, Vol. 10, 2004, pp. 285–293.
5. *Summary Analysis of Federal Commercial Aviation Taxes and Fees*. GAO-04-406R. U.S. Government Accountability Office, Washington, D.C., 2004.
6. *Report on the Financial Condition of the U.S. Airline Industry*. Air Transport Association, Washington, D.C., July 2004.
7. Morrison, S. A., and C. Winston. *Fares and Taxes Paid by Business Travelers: A Report to the National Business Travel Association*. Institute of Business Travel Management, Alexandria, Va., 2003.
8. Yamanaka, S. *The Impact of Infrastructure-Related Taxes and Fees on Airline Fares in the US and the European Union*. Masters thesis. Massachusetts Institute of Technology, Cambridge, Mass., 2005.
9. *Domestic Ticket Taxes*. Air Transport Association, Washington, D.C., No. 10, 2005. <http://www.airlines.org/econ/d.aspx?nid=5382>. Accessed Dec. 20, 2003.
10. *Aviation Tax: Market Segment Specialization Program Guide*. Training Publication Distribution System No. 83026E. Internal Revenue Service, Washington, D.C., 1999.
11. *Passenger Facility Charges*. Air Transport Association, Washington, D.C. <http://www.airlines.org/econ/d.aspx?nid=1277>. Accessed Dec. 21, 2003.
12. *U.S. (or U.S.-Approved) Aviation Excise Taxes and User Fees*. Air Transport Association, Washington, D.C. <http://www.airlines.org/econ/d.aspx?nid=4919>. Accessed Dec. 21, 2003.
13. Office of Airline Information Sources of Aviation Data, Bureau of Transportation Statistics, USDOT. <http://www.bts.gov/oai/sources>. Accessed Dec. 28, 2003.
14. Borenstein, S. 1993Q2, 2002Q2, and 2004Q2 data. In *Translation of DBIA Data*. (Quarterly CD-ROMs). University of California, Berkeley, March 17, 1996, April 29, 2003, and Nov. 20, 2004, respectively.
15. Lindsey, L. The Status Quo Won't Fly. *The Wall Street Journal*, April 1, 2003, p. A14.
16. Ott, J. Old Issues Fade: Economic Realities Pervade Contract Talks, but Labor Has Plenty to Say About Management. *Aviation Week & Space Technology*, March 1, 2004, p. 49.
17. Alexander, K. It's Two for the Money in Bush's Budget. *Washington Post*, Feb. 8, 2005, p. E1.
18. Lipton, E. House Approves \$32 Billion Security Budget. *USA Today*, May 18, 2005, p. 16.
19. *IATA List of Ticket and Airport Taxes & Fees*. International Air Transport Association, Montreal, Quebec, Canada, Sept. 2004.
20. *Facts and Figures*. Amadeus Global Travel Distribution S.A. <http://www.amadeus.com/en/5020.jsp>. Accessed May 2, 2005.
21. Moores, V. Amadeus Sees No EU GDS Deregulation Before 2006. *Air Transport Intelligence*, Sept. 28, 2004.
22. *Historical Currency Exchange Rates*. OANDA Corporation. <http://www.oanda.com/convert/fxhistory>. Accessed May 2, 2005.
23. Ison, S. European Union Low-Cost Airline Market: Development and Impact. Presented at 84th Annual Meeting of the Transportation Research Board, Washington, D.C., 2005.

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