# Appendix B: Empirical Addendum: Response

## I. Introduction and Summary

This Appendix responds to Applicants' September 8, 2009 submission, which addressed the Department of Justice's empirical analysis of trans-Atlantic fares. Applicants state (p.3): "DOJ's methodology for analyzing non-stop and connecting transatlantic fares is fundamentally flawed and asked the wrong question." In support of this statement, Applicants cite a report by Compass/Lexecon ("Compass"), "Competitive Effects of Airline Antitrust Immunity," which they sponsored. As explained below, the Compass report contains numerous errors in data and methods which render its results unreliable.

### *A. Non-Stop Competition Lowers Fares on Trans-Atlantic Routes*

In the Star Alliance proceeding, we submitted empirical analysis that fares on trans-Atlantic routes are higher if those routes are served by fewer competing carriers. See "Appendix B: Empirical Addendum" to DOJ's submission in the Star proceeding. This material is attached to the current DOJ submission.[1]

In particular, we focused on fares paid by the vast majority of passengers for travel on non-stop trans-Atlantic flights. The data showed that, all else equal, fares on routes served only by carriers in an antitrust immunized alliance are 15% higher than on routes served by two

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[1] The original attachment table in Appendix B in DOJ's Star comments contained a transcription error. It should have listed the routes Dallas-Frankfurt and Dallas-London instead of "Detroit-Frankfurt" and "Detroit-London." A corrected route table has been supplied as part of the route table in Appendix A which otherwise reproduces DOJ's Appendix B: Empirical Addendum, in the Star comments.

independent non-stop carriers, and 22% higher than on routes served by three independent non-stop competitors.

These results capture an empirical regularity between fares and the degree of non-stop competition on trans-Atlantic hub-to-hub routes. They provide empirical evidence in support of the normal antitrust presumption that eliminating or substantially reducing competition through merger or collaboration enhances the market power of the remaining suppliers and leads to higher prices, harming consumers. They also quantify the harm to passengers that can result from antitrust immunity.

These empirical results have been challenged by Applicants, based largely on the Compass report, which purports to show no effect on non-stop fares of granting antitrust immunity, even when the immunity would eliminate all non-stop competition on a given route. This Appendix explains the flaws in the Compass study and reports on additional work reinforcing our previous findings.

### *B. Antitrust Immunity Does Not Lower Connecting Fares*

In the Star proceeding, we also conducted empirical analysis to learn whether antitrust immunity leads to lower fares for *connecting* passengers. Importantly, we distinguished between the presence of an alliance and the granting of antitrust immunity to that alliance. We found that major alliances do indeed benefit connecting passengers in comparison with interline arrangements, but antitrust immunity does not. In particular, we found that, other things equal, immunized alliance fares are 3.6% *higher* than non-immunized code-share alliance fares.

The Compass submission states: “DOJ’s finding of higher fares for ATI service holds only when one fails to include sufficient (and standard) controls to account for the various factors that lead to different fares for different types of service.” (p. 4) Compass then purports to show in its empirical analysis that immunized alliance fares are, on average, 3.4% lower than non-immunized code-share alliance fares. However, this portion of the Compass report contains numerous errors in data and methods. This Appendix explains that our empirical work in the Star proceeding controlled for the factors controlled for in the Compass report and for additional important factors that must be controlled for to measure more accurately the differences in fares across types of tickets.

We have conducted additional work to test the robustness of our previous findings. This new analysis confirms and strengthens the findings we reported in the Star proceeding for alliances collectively by looking at each of the three major alliances individually. We find that the currently immunized alliances have failed, at least so far, to deliver lower fares for connecting passengers compared to non-immunized code-share tickets. Within the oneworld alliance, we find that non-immunized code-share tickets are already priced comparably to online tickets. Since online fares already incorporate the types of pricing efficiencies that Applicants claim they can achieve with antitrust immunity, this finding does not support Applicants’ claim that they need antitrust immunity to generate pricing efficiencies for connecting fares.

## II. Price Effects from the Loss of Non-Stop Competition

Correcting the errors made in the Compass analysis, we obtain results that further support our findings in the Star matter regarding non-stop competition on trans-Atlantic routes.

## *A. Capacity Expansion Argument*

Compass states (¶8): "One expected result of joint decision making by carriers in an immune alliance is to create strong incentives (due to network effects) to expand capacity on those transatlantic routes that serve an important role in carrying connecting traffic over the combined network (such as the main routes at issue in this matter). Such capacity expansions naturally put downward pressure on fares, an effect not present for situations in which a carrier exits a route."

Applicants make this same argument in their submission: "Network carriers make route and capacity decisions based on network considerations, which dictate that they increase capacity on hub-to-hub routes to better compete for flow traffic. Higher fares would only result if a reduction in the number of competitors is accompanied by a reduction in capacity, a variable for which DOJ did not control." (p. 4, citation omitted) We disagree with Applicants.

First, Applicants do not distinguish between the formation of an alliance and the granting of antitrust immunity. Alliances are beneficial for connecting passengers, and forming an alliance can indeed make it worthwhile for the alliance members to add capacity on their trans-Atlantic hub-to-hub routes. However, our analysis does not support the assertion that granting antitrust immunity to an alliance lowers connecting fares below what could be achieved without immunity.

Second, even if antitrust immunity did induce the carriers to expand their hub-to-hub capacity by an additional amount beyond that achieved with an non-immunized alliance, it simply does not follow that this expanded capacity would lead to lower fares on hub-to-hub local traffic.  Applicants assert that the incentive to expand capacity would be “to better compete for flow traffic.”  However, there is no evidence to support the conclusion that expanded capacity creates “excess capacity” specifically for local traffic and that would, in turn, provide an incentive to offer lower non-stop fares.  This argument also does not take into account that the highly sophisticated yield management systems used by Applicants are designed to maximize the profits they can capture given the flights they are operating.  Lacking any non-stop competition on a given route, Applicants would have a strong incentive to operate their yield management systems in a manner that would lead to substantially higher fares for local traffic on that route.

The claim that antitrust immunity (ATI) will lead to greater capacity to serve connecting traffic and thus “naturally put downward pressure on fares” for local passengers can be tested empirically.  We have performed this test, and the data reject this hypothesis.

To test the greater capacity hypothesis, we define an ATI variable equal to the number of additional ATI carriers on a route, over and above the number of independent competitors.  For example, if the only two carriers serving a route are in an ATI alliance with each other, the two carriers count as a single independent competitor, but the ATI variable equals 1 on that route because there is one additional ATI carrier.  If the presence of an additional ATI carrier lowers fares, then the ATI variable will have a strongly negative and statistically significant effect on fares.

We have estimated our model including the new ATI variable.  The results are listed in Table 1.  As shown in our results, once we control for the number of independent competitors, the competitive effect of additional ATI carriers is small and not statistically significant.  Our analysis shows that granting antitrust immunity to the only two carriers on a trans-Atlantic hub-to-hub route leads to significantly higher fares.

This result may also be shown to hold using data on more routes and over a broader time period. For example, using yearly data for 2008, we compute the average price paid by coach passengers for non-stop travel on a trans-Atlantic route in 2008. We include all seventy-nine trans-Atlantic routes for which there was no change in the number of independent non-stop competitors in 2008 (so that we correctly measure the number of competitors and avoid measurement problems due to seasonal entry and exit). We estimate the model, including the ATI variable and adding a control for multi-hub presence, to explain how average non-stop fares in 2008 varied across these routes.[2] As shown in Table 2, the competitive effect of additional ATI carriers is again small and not statistically significant. In addition, we find that average non-stop fares on routes with one independent non-stop competitor are 19.6% higher than on routes with two independent non-stop competitors, and 26.6% higher than on routes with three independent non-stop competitors. These fare effects are statistically significant. These results

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[2] Routes beyond the 65 routes in the DOJ and Compass analyses differ significantly (from the 65 routes) in terms of the presence of multiple hub airlines at both endpoints of the routes. Applicants and the literature, in numerous publications, emphasize the effects of hubs on pricing (see references in Borenstein S. and Rose N., 2009, "How Airline Markets Work...Or Do They? Regulatory Reform in the Airline Industry," forthcoming in N. Rose ed., *Economic Regulation and Its Reform: What Have We Learned?,* University of Chicago Press). To control for these differences, we include in the model a MULTI_HUB variable, which equals 1 for routes between two hubs of an immunized alliance and routes where at least two carriers have their principal trans-Atlantic hub airport(s) and are present at both airports in the route, and 0 otherwise. As shown in Table 2, we estimate that fares on routes with multi-hub presence are 17.6% higher on average than in other routes, all else equal. The MULTI_HUB variable is not necessary in DOJ's Star and Compass' oneworld work, since the 65 routes analyzed are selected based on multi-hub presence.

support our previous findings: fares are significantly higher on routes with fewer independent non-stop competitors.

## *B. Cross-Section vs. Panel Analysis*

Our analysis was based on studying fares using a cross-section of 65 trans-Atlantic routes during the third quarter of 2008. Compass criticizes our use of a cross-section and instead uses a panel of quarterly data from these same routes over a four year period, 2005-2008. In the Compass model, average fares vary based on the number of distinct carriers serving a route, the market shares of these carriers for non-stop passengers in the route, whether the route has multiple ATI carriers, and "fixed effects" (0-1 dummy variables) for the year-quarter and route-quarter.

The panel approach is fundamentally different from the cross-section approach. Under the cross-section approach, one attempts to control for differences in route characteristics (distance, population) and isolate the remaining differences in fares across routes resulting from the number of competitors. Under the panel approach, the focus is entirely on *changes* over time in the number of competitors on a route.[3] In particular, the competitive effects Compass examines in its model are year-over-year changes during the same quarter on a given route.

### 1. Errors in Compass Data on Entry and Exit

During the Star proceeding, we considered doing a panel analysis, which can have some advantages. However, we chose not to estimate a panel model in large part because, after accounting for the data limitations, there simply were not enough changes over time in the number of competitors to reliably employ a panel model. In particular, the available data, properly understood, only reliably track five entry/exit episodes over the four-year period 2005-2008. This is an insufficient number of entry/exit episodes to estimate the fare effects of entry and exit.

The Compass analysis is based on a larger number of routes with entry and exit: fifteen rather than just five. However, as we now explain, the available data does not allow one to reliably analyze these additional ten routes.

The DOT's DB1B data that we and Compass use to compute average fares does not include tickets ticketed by foreign carriers that have no flights operated by U.S. carriers. In particular, there are no online data for foreign carriers. As a result, when the only incumbent airlines on a route are foreign carriers, there are not enough tickets in the DOT's DB1B data for the average fare measure for the route to be reliable.[4]

This limitation of the DB1B data makes it extremely difficult to conduct a panel analysis to study the impact on fares of entry and exit events on the trans-Atlantic hub-to-hub routes that we and Compass examine. First, there are rather few entry and exit events in trans-Atlantic routes to begin with. Across the 65 routes at issue, only 15 routes experienced changes from

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[3] Any variables that do not change over time, including distance, population, and potentially the number of competitors, are absorbed in the "route fixed effects" terms used by Compass.

[4] The tickets picked up in the DB1B data in this situation are a tiny number of code-share fares ticketed by U.S. partners of the foreign carriers.

one-to-two, or two-to-one, carriers over the period 2005-2008.[5] Second, when there are only two airlines with non-stop service on a trans-Atlantic route, often one is a U.S. airline and the other is a foreign carrier. Consider a route with one airline, a foreign carrier, in which a second airline, a U.S. airline, enters. The lack of foreign data means that there are no reliable fare data for the period in which the foreign airline was the only airline providing non-stop service on the route. That is, there are no reliable data to compute a pre-entry price in the route. Only after the U.S. airline enters are there sufficient data to compute an average fare reliably. Therefore, the only trans-Atlantic routes on which there are sufficient data to analyze shifts from one-to-two, or two-to-one, carriers are routes in which the incumbent airline prior to entry, or the remaining airline after exit, is a U.S. airline. There are only *five* trans-Atlantic routes that experienced such a change from two-to-one, or from one-to-two, independent competitors during the 2005-2008 time period.[6]

With this data limitation in mind, we now examine the fifteen routes used by Compass to study changes from one-to-two, or two-to-one, non-stop carriers.

On three of these routes, the incumbent carrier is a foreign carrier and the entrant is a U.S carrier. On these routes, therefore, given the lack of foreign carrier data, Compass computes the pre-entry average fare (when the foreign airline was the sole carrier) based on too few tickets to

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[5] For an additional 4 routes, the number of independent competitors did not change, but the number of ATI carriers (from the same alliance) did change. As we highlight in our analysis (confirmed subsequently when we reproduce the Compass analysis), a change in the number of additional ATI carriers on a route is not equivalent to the entry or exit of an independent competitor on that route.

be reliable. As an example, in 1st quarter data for the Chicago-Amsterdam route, KLM was the only non-stop carrier in 2006, but both KLM and United had non-stop flights in 2007. The 2006 fare data that Compass uses to compute the pre-entry average fare include only two tickets.[7]

On another seven routes, problems arise because Compass defines a carrier as operating on a route in a given quarter if and only if it operates 61 or more flights from the U.S. to Europe that quarter. This definition generates illogical entry and exit events on routes in the Compass panel analysis. For example, consider 1st quarter data in the New York City-Stockholm route. SAS offered more than 61 flights on this route from 2005 through 2008, whereas Continental offered 58 flights 2006, 64 flights in 2007, and 73 flights in 2008. In the DBIB data, there are no fare data for 2005 (since SAS was the only carrier in the route), but there are fare data in 2006, 2007, and 2008. Lacking fare data for the pre-entry period when SAS was the only carrier, Compass treats Continental as absent from the route in 2006, because it offered 58 flights, fewer than 61, but present on the route in 2007 because it then offered 64 flights. Compass therefore treats 2006 as the pre-entry period and 2007 and 2008 as the post-entry period.[8] Clearly, this method incorrectly identifies the date when Continental actually entered the route.

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[6] Across trans-Atlantic routes other than the 65 routes that both Compass and DOJ analyze, there are only *two* additional routes that experienced such a change from two-to-one, or from one-to-two, independent competitors during the 2005-2008 time period. There simply are too few data to reliably employ a panel model.

[7] The 2007 data, after United enters, include 402 tickets. Likewise, across 3rd quarter data for the Denver – London route, British Airways is the only competitor in 2005, 2006 and 2007 and both British Airways and United are competitors in 2008. We observe 21 tickets for 2005, 12 tickets for 2006, 18 for 2007, and 912 for 2008. So the pre-entry fare in Compass' analysis is based on a mere 20 or less tickets per year, and even these are not a representative sample.

[8] Likewise, in 1st quarter data for NYC-Athens, Olympic Airways served the route non-stop from 2005 through 2008. Delta offered 73 flights in 2005, 61 flights in 2006, 61 flights in 2007, and 51 flights in 2008. Compass treats Delta as exiting the route in 2008, though it flew only 10 fewer flights than in 2007 (and Delta kept on serving the

Once these data problems are recognized and understood, there are only five true entry/exit episodes left in the DOT DB1B data. This number is too small for reliable estimation.

### 2. Biases in Compass Methodology

These same data errors introduce significant downward biases in the estimated effect of entry on fares as reported by Compass. Put differently, Compass will tend to find that entry had no effect on fares even if entry did in fact lead to lower fares.

In the example given just above, Compass compares the 1st quarter fare data on the New York City-Stockholm route from 2006 to 2007. Other things equal, we would expect the fares to be very similar, since Continental only increased its flight frequency slightly, from 58 to 64. Observing no change in fares from 2006 to 2007 tells us nothing about the true impact on Continental's entry, which must be measured from 2005 to 2006. But Compass, by incorrectly treating Continental's entry as taking place in 2007, would conclude that going from one non-stop carrier to two non-stop carriers has no impact on fares. This is precisely what Compass purports to find.

In our cross-sectional study, we also counted an airline as a competitor in a route if it offered at least 60 flights in each direction (during the 3rd quarter 2008). We carefully tested the robustness of our cross-sectional findings to this flight threshold.[9] Our findings are not sensitive to the level of this threshold. In fact, we obtain even larger estimates of 2-1 and 3-2 fare effects

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route non-stop through 2008). The Compass analysis is thus based on using 2005-2007 as the pre-exit period and 2008 as the post-exit period. The only "post-exit" fare data observed are Delta tickets that were sold in competition with Olympic Airways. These fares reflect competition between two non-stop carriers.

[9] See footnote 7, p.48, of the DOJ's Star comments.

using a threshold as low as 10 flights in a quarter. Moreover, none of the few carriers with a low number of flights across the routes in our analysis resulted from entry or exit because there were no airlines that entered or exited any of these 65 routes in the DOT's 3rd quarter 2008 data.

The role of the 60-flight threshold is fundamentally different in Compass' panel methodology than in our cross-sectional methodology. Because the Compass panel analysis is entirely driven by entry/exit events, the precise definition of such events, and the precise timing of such events, is critical. One more example can illustrate this. Consider the 1st quarter data for the Philadelphia-Paris route. Air France offered 66 flights in 2005 and 2006 and 60 flights in 2007 and 2008. There clearly was no entry and exit by Air France on this route, but Compass counted this as an exit event by Air France. Compass counts Air France as a non-stop carrier on this route during 2005-2006, because it offered more than 61 flights, but not during 2007-08, because it then offered only 60 flights. We would not expect the slight reduction in frequency by Air France to lead to higher fares. But the Compass methodology would infer from unchanging fares in this situation that reducing the number of non-stop carriers from two to one has no effect on fares.

More generally, for panel analysis to be fully accurate, the data on fares should line up, temporally, with the entry and exit events in question. Here, the average fares are calculated on a quarterly basis, but the entry and exit events rarely occur at the very beginning or end of the quarter. As noted above, this is a significant problem when only one US carrier is on a route. The problem extends in a more subtle way, however, every time any carrier enters or exits. For example, Continental entered the New York City – Barcelona route with non-stop flights in mid-

May 2006. When Continental entered, Delta was serving the route, so we have data on fares throughout the entire quarter. What would we expect to see in the data if we knew the effect? Suppose that Continental's entry in the middle of the second quarter 2006 (mid-May) in fact drove down fares on the route by 10%; that is, the actual effect of entry was a 10% decrease in all fares on the route. Calculated over the entire 2nd quarter 2006, the measured impact of Continental's entry on average fares would be only a 5% decrease: no effect for the first half of the quarter followed by a 10% decrease for the second half. The approach taken by Compass will estimate the effect of entry on fares as 5%, rather than the correct 10%. The method used by Compass systematically gives an under-estimate of the actual effect of entry on fares.

A similar problem applies to Compass' analysis of the effect of changes in carriers' ATI status on fares. The change in ATI status in SkyTeam following the SkyTeam II proceedings occurred on May 22, 2008. To see why this matters, consider the 2nd quarter data for the Atlanta-Amsterdam route. Both Delta and KLM had non-stop flights in the route from 2005 through 2008. They did not have ATI prior to May 22, 2008 but they did after that date. Suppose that the ATI grant increased fares by 15%. Calculated over the entire first quarter, the measured impact of ATI on average fares would be only 5%: no effect for (roughly) the first two months of the quarter followed by 15% in June 2008. But Compass treats the 2nd quarter 2008 fare data in this route as representative of post-ATI fare data, whereas fare data for 2005-2007 represent pre-ATI fare data. In Compass' analysis therefore, the ATI grant would be found to increase fares by only 5%, one-third of the true increase of 15%. In claiming that the 2nd quarter

2008 is an ATI quarter, Compass biases downward the estimates of the impact on fares of the change in ATI status in this route. Compass does likewise for the Detroit-Paris route.

Furthermore, the entry and exit events being studied are themselves choices made by the carriers. This creates a well-known bias in a panel study. For instance, the model does not account for trends in demand or costs that affect entry/exit and fares over time in some specific subset of routes, such as routes out of NYC. To illustrate, suppose that a route-specific increase in demand over time, making it profitable for a carrier to enter a given route. Suppose that observed fares go down 5% after entry. Suppose further that the 5% drop in fares arises from two offsetting effects: an increase in demand (which tends to increase fares by 10%) and the addition of a new competitor on the route (which tends to decrease fares by 15%). By failing to account for the shift in demand, one could conclude (in error), by comparing fares before and after entry, that adding a new competitor only causes fares to fall by 5%. The true figure (by construction in this example) is 15%. The Compass panel study is subject to this problem, which biases downward the estimates of the impact on fares of adding (or removing) an independent competitor.

### 3. Implementation Errors by Compass

Compass makes further errors in extracting the route data from the DOT's DB1B database. [redacted]

[redacted]

In the Compass model, average fares vary, in part, based on the number of distinct carriers serving a route and the market shares of non-stop passengers of the carriers on the route. Compass makes data errors in computing carriers’ market shares [redacted]

[redacted]

[redacted]

As a result the Compass model is mis-specified and uses inaccurate market share data. This is significant because changes in entry/exit in a route affect not only fares in that route but also carriers' markets shares in the route, and these changes in market shares in turn affect fares. Compass' estimates of the fare effects of entry/exit are unreliable because they are based on analysis using flawed data on carriers' market shares.

In addition, including firms' market shares as an explanatory factor in a price model creates a standard endogeneity bias problem, since unobserved factors in the model that affect market shares on a route also affect prices. Compass does not acknowledge or correct for this problem.

Lastly, since the market shares are strongly correlated with the number of carriers, the inclusion of market shares in the model likely creates a co-linearity problem between the market share variables and the variable measuring the number of competitors. This well-known problem tends to increase the standard errors on the variables measuring the number of competitors and thus makes it appear that the results are not statistically significant. [redacted]

[redacted]

### 4. Mistakes in Compass Discussion of Estimated Fare Effects

Compass errs when it reports on the estimated fare effects of entry/exit in its model because it omits any additional fare effects of the change in carriers' market shares that must inevitably accompany entry and exit in a route.

Industrial organization economists routinely specify statistical models to explain how prices vary in relation to the number of competitors, controlling for demand or cost factors that may also affect prices. They report on the results of these models using statements such as: "we estimate that a reduction in the number of competitors increases fares by 15%, holding all else equal." This "holding all else equal" wording is important. It presumes that when the number of competitors changes no other potential causal factors in the model also change. If this is correct, then one can fairly represent that the fare effect of changing the number of competitors is solely given by the change in the variable denoting the number of competitors in the model.

The Compass report fails to make this acknowledgement about its panel model when the number of airlines on a route changes. In the Compass model, two sets of variables measure the effects from the number of airlines on fares in a route: (1) the variables denoting the number of distinct non-stop carriers in the route, and (2) the variables denoting the *shares* of carriers of non-stop passengers on the route.[10] Both of these sets of variables change when the number of airlines changes in a route due to entry or exit.

To illustrate the problem, suppose that a route is served by two airlines, each with a 50% market share. Suppose one carrier subsequently exits. This exit reduces the number of carriers from two to one *and* causes large changes in the market shares of the two carriers, with the remaining carrier's market share rising from 50% to 100%. Compass discusses the fare effects of a change in the number of airlines *as if* the market shares would be unchanged. But this is logically impossible. In reporting its results, Compass fails to account for the additional fare effects from resulting changes in market shares. Compass therefore errs when it reports the estimated effects of carriers from a change in the number of distinct carriers given its model specification.

### 5. Correcting Errors, Compass' Approach Supports Our Findings

As we have explained, the data limitations mean there are too little reliable data to conduct a panel analysis. Nevertheless, ignoring this significant shortcoming, we have reproduced the Compass panel analysis correcting the errors noted above. Specifically:

We use the same data as Compass [redacted]

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[10] The Compass report obscures this problem by referring to "Carrier Fixed Effects" in Table 4. Compass did not in fact use what would normally be called carrier fixed effects. Footnote 15 of the Compass report states: "In addition, we include 'carrier fixed effects' – in the form of the share of each carrier on the route – to account for changes in fares that are due to change in the identity of the competitors on a route, rather than the competitive effects associated with changing the number of carriers."

We use the same method as Compass to identify non-stop entry/exit events on a route, counting the number of independent non-stop competitors in a route and defining the ATI variable to be the number of additional ATI carriers in a route.[11]

We estimate the same model specification as Compass except we do not include the shares of the carriers serving non-stop passengers. The variables denoting the number of independent competitors then represent the net effect of entry/exit on observed average fares.

Our results are listed in Table 3. These results contrast sharply with those obtained by Compass. [redacted] More generally, the corrected findings support our earlier results: a reduction in the number of competing airlines offering non-stop trans-Atlantic flights may result in large, statistically significant price increases.

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[11] In contrast, while Compass claims to measure the number of "non-stop competitors" in its panel data tables, Compass actually measures the number of separate non-stop carriers on a route, regardless of whether they are competing with another carrier or whether they are immunized with that carrier. Compass then defines the ATI variable to measure whether some of these carriers are less "separate" from each other than Compass initially assumes them to be.

## III. The Effect of Alliances on Prices for Connecting Passengers

In our Star comments we provided empirical analysis of trans-Atlantic fares for connecting traffic to evaluate the hypothesis that antitrust immunity allows alliance partners to cooperate more effectively and thus benefits connecting passengers.

More specifically, we analyzed fare differences across different types of tickets – online, ATI, code-share, and interline – on a given route.[12] We estimated fares based on the type of ticket, the major U.S. airline reporting the ticket to DOT, the mileage and number of coupons in the ticket's itinerary, and "route-year-quarter fixed effects." These "route-year-quarter fixed effects" control for factors that are invariant to the specific route in a specific year and quarter, such as the level of competition on the route at the time. For connecting routes, we found that, on average, interline fares are 7.8% higher than code-share fares and ATI fares are 3.6% higher than code-share fares.[13] These fare differentials are statistically significant.

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[12] A ticket is an *online ticket* if all of the coupons in the ticket are operated and marketed by a single airline. An *ATI ticket* is a ticket that lists two or more airlines as operating or marketing carriers and all of the airlines are immunized members of the same alliance (SkyTeam, Star, or oneworld). A *code-share ticket* is a ticket that lists two or more airlines, and all listed airlines are members of the same alliance (SkyTeam, Star, or oneworld), but at least one of the airlines is not an immunized alliance member. Lastly, a ticket is an *interline ticket* if it lists two or more carriers that are not members of the same alliance. These interline tickets encompass traditional interline tickets as well as tickets that derived from bilateral code-share arrangements between airlines not in alliances or in different alliances.

[13] Comments of the Department of Justice on the Show Cause Order, Docket OST-2008-0234, p. 52. We note, more generally, that DOJ makes no representation that fare differences across tickets, as estimated based on this type of work, are informative about causality between immunity grants and double marginalization. We discuss results in relation to double marginalization because the Applicants and Compass have repeatedly made such a representation in their filings.

We found that alliances (oneworld, Skyteam, and Star) may indeed produce lower fares relative to interline arrangements, but antitrust immunity is not needed to achieve lower fares. Instead, low fares are routinely achieved by codesharing without any grant of antitrust immunity.

### *A. Compass Response to DOJ Study*

Compass states that “the reason for DOJ’s results is its use of a specification that fails to control for the same factors as have been controlled for in the relevant academic literature.”[14] This statement is incorrect. The fare model in the Compass report, and the academic paper cited by Compass, include “fixed effects” that control for factors that are invariant *either* across routes at a given time *or* to a route over time. The model we used is more robust than these models because it includes “route-year-quarter fixed effects” that control for factors that are invariant to a specific route at a specific time --- and not simply across routes at specific time or over time on a specific route. Our model thus controls not only for the same factors controlled for in the Compass report and the cited academic paper, but also for additional factors specific to a given route in a given quarter. This allows us to measure more accurately the differences in fares across types of tickets.

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[14] Compass, p.14, ¶ 26. The academic literature referred to by Compass consists of one academic paper that uses data from the 1990s. In addition, Compass evidently failed to read the DOJ submission carefully, writing: “it is unclear whether DOJ included carrier fixed-effects in its analysis. Table 2 refers to carrier fixed-effects, but they are not mentioned in the text of the DOJ comments.” Fixed-effects are dummy variables. On p.50 of the text of DOJ’s Star comments, we indicated: “We use dummy variables to denote each of the type of tickets (online, immunized alliance, non-immunized alliance, or interline ticket) and carriers.”

## *B. Extension of Previous DOJ Analysis*

We now refine our previous analysis of fare differences by type of ticket. More specifically, we now estimate how ATI, online, and code-share fares differ within and across each of the three major alliances: oneworld, Star, and SkyTeam. The new analysis presented here confirms and strengthens the findings we reported in the Star proceeding for all alliances collectively: on connecting routes, code-share fares are lower than ATI fares for each of the alliances.

We use the same data as in our Star comments. That is, we define a route as a city-pair, with its origin in the U.S. its and destination in Europe, to focus on U.S. consumers.[15] We eliminate routes with non-stop flights, to focus on connecting fares. We eliminate routes from U.S. cities that are gateways for European carriers, to ensure we have representative ticket data (because European airlines do not report to DOT's DB1B data). We identify tickets for flights that are operated, marketed and sold by each alliance. We label a ticket as a oneworld ticket (SkyTeam, Star, respectively) if all of the flights in the ticket are operated and marketed by members of the oneworld alliance (SkyTeam, Star, respectively). For each ticket in each

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[15] We use third quarter data for 2005 through 2008. Within Europe, we focus on destinations in the European Union, Switzerland, Norway, and Croatia. We extract from DOT's DB1B data tickets with itineraries that represent round-trip travel with same starting and ending city. Itineraries may have up to 6 coupons, but no more than 3 coupons one-way and no surface transfers. Tickets with round-trip fares below $100 (in 2008 quarter three dollars) are dropped. We use all of the tickets in the data (except for online tickets by Maxjet and Eos Airlines). Relative to the Star data, we now include tickets that list two or more major U.S. airlines; this expands the total number of tickets in our data by about 5%.

alliance, we then identify whether the ticket is online, ATI or code-share.[16] All other tickets in the data list two or more carriers that are not members of the same alliance. These tickets are classified as "interline" tickets; they include traditional interline tickets as well as tickets that obtain from code-share arrangements between airlines not in alliances or in different alliances.

We estimate a model that explains how individual ticket prices in a route at a given time differ based on the type of ticket, the alliance that operated and marketed the ticket (instead of the airline that reported the ticket to DOT, as we did in Star), the mileage and number of coupons in the ticket's itinerary, and "route-year-quarter fixed effects." These "route-year-quarter fixed effects" control for all factors that are invariant to the specific route at the specific time, including the level of competition on the route. We define dummy variables ("fixed effects") to identify each of the type of ticket and alliance and, in this analysis, we interact these variables in order to estimate how ATI, online and code-share tickets differ both within and across each alliance. Our results are reported in Table 4.

Table 4 shows that on connecting routes, oneworld code-share fares currently are 1.6% less than online fares offered by oneworld members.[17] As online fares already incorporate any pricing efficiencies associated with unified control, this finding undermines Applicants' claim that they need ATI to reduce a double-marginalization problem in connecting fares.

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[16] A ticket is online if all of the coupons in the ticket are operated and marketed by a single airline in the alliance. A ticket is ATI if it lists two or more airlines as operating or marketing carriers and all of the airlines listed on the ticket are immunized members of the alliance. All other alliance tickets are code-share tickets. Code-share tickets list two or more airlines, and all listed airlines are members of the alliance, and at least one of the airlines is not an immunized alliance member. Our data include online, ATI, and code-share tickets for each alliance.

More generally, we find in looking at the SkyTeam alliance and the Star alliance that ATI has failed to deliver pricing efficiencies equivalent to ordinary codeshare arrangements with other non-immunized members of each alliance. We find that SkyTeam ATI fares are 7.2% higher than SkyTeam code-share fares, and Star ATI fares are 11.7% higher than Star code-share fares. These fare differences are statistically significant. This evidence undermines the Applicants' claims that antitrust immunity enables alliance members to reduce fares below those offered under non-immunized code-sharing arrangements.

To summarize, across the models we have estimated in this proceeding and the Star proceeding, code-share fares are systematically lower than each of interline *and* ATI fares on connecting routes. This evidence shows that alliances may produce pricing efficiencies relative to interline arrangements, but antitrust immunity is not necessary to achieve such pricing efficiencies.

### C. Compass Analysis of ATI and Connecting Fares

Compass also provides a model of price differences across tickets on a route based on the type of ticket. Compass aggregates the ticket data and computes average prices by route, type of ticket, and set of carriers that are listed as marketing the various flights on the ticket. Compass then specifies a model where average fares vary based on the type of ticket, the set of marketing carriers listed on the tickets, and other controls, which include some "average" characteristics of these tickets, the population and income at the U.S. city and European country in the route, two

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[17] Although the point estimates differ by 1.6% in Table 4, and both coefficients are statistically different from zero,

oddly defined Herfindahl-Hirschman Indices of concentration, and “year-quarter fixed effects” and “route fixed effects.”

Compass claims to find that, all else equal, on connecting routes, ATI tickets have lower fares than code-share tickets. As we show below, Compass’ analysis is fundamentally flawed. Moreover, when we reproduce Compass’ analysis and correct for some important errors in that analysis, we obtain results that support our findings.

### 1. Errors in Compass’ Discussion of Estimated Fare Effects in its Model.

Compass represents that its results accurately measure average fare differences between online, ATI and code-share tickets. We disagree.

Compass principally differentiates tickets by the type of the ticket (ATI, code-share, online, interline) *and* the set of carriers listed as marketing a flight on these tickets. For example, if a one-stop connecting code-share ticket lists American as the marketing carrier on the first flight and British Airways as the marketing carrier on the second flight, then the price of the ticket in Compass’ model depends on a dummy variable indicating that the ticket type is code-share and a dummy variable indicating that the set of marketing carriers is American-British Airways. Note that Compass’ American-British Airways variable only denotes that American and British Airways are listed as marketing some flight(s) on the ticket. That variable does not indicate that American and British Airways jointly set the price of the ticket since they do not have ATI.

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the two coefficients are close enough that they are not statistically different from each other.

The marketing carriers listed on a ticket are a defining feature of the type of ticket.[18] To illustrate, consider two one-stop connecting tickets on which both flights are operated by United. On the first ticket, Lufthansa is listed as the marketing carrier on both flights. The set of marketing carriers for this ticket is thus Lufthansa-Lufthansa, and this is an ATI ticket because Lufthansa and United are Star alliance members with ATI. On the second ticket, US Airways is listed as the marketing carrier on both flights. The set of marketing carriers for this ticket is US Airways-US Airways, and this is a code-share ticket because, even though US Airways and United are Star members, they do not have ATI. The set of marketing carriers listed on each ticket is the distinguishing feature that defines the first ticket as ATI and the second ticket as code-share.

This example is representative of how ticket type and marketing carriers simultaneously differ between the vast majority of code-share and ATI tickets sold by an alliance. Over 80% of the code-share tickets sold by the Star or SkyTeam alliance list a non-ATI member as one of the marketing carriers, whereas all ATI tickets sold by that alliance solely list ATI carriers. These code-share and ATI tickets thus differ by *both* ticket type (ATI vs. code-share) and marketing carriers.

Consequently, the average fare difference between the vast majority of code-share and ATI tickets sold by an alliance depends on the variables denoting the ticket type *and* the

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[18] All online tickets list a single marketing carrier, by definition, whereas all interline tickets and a majority ATI and code-share tickets list two or more marketing carriers. Indeed, these tickets pair flights from different airlines to form the ticket itinerary and some airlines maintain their two-letter code as ‘marketing’ carrier on the flight(s) they

marketing carriers. In our example, the price of the Star ATI ticket depends in Compass' model upon a dummy variable indicating that the ticket type is ATI and a dummy variable indicating that the set of marketing carriers is Lufthansa-Lufthansa. The price of the Star code-share ticket depends on a dummy variable indicating the ticket type is code-share and a US Airways-US Airways carrier dummy variable. The fare difference between the Star tickets thus depends on the difference between each of the ATI and code-share ticket type variables and the Lufthansa-Lufthansa and US Airways-US Airways marketing carriers variables.

Nonetheless, Compass represents in its study that the average fare difference between ATI and code-share fares is produced *solely* by the difference between the ATI and code-share ticket type variables. This is incorrect because, for the vast majority of these tickets, that fare difference also depends on the variables denoting the marketing carriers on the tickets. Compass therefore fundamentally errs when it represents that its results accurately measure the average fare difference between ATI and code-share tickets sold by the alliances.[19]

Furthermore, Compass' results do not accurately measure average differences between ATI and code-share fares charged by a given set of marketing carriers. To accurately measure that difference, the code-share and ATI ticket type variables should be estimated using principally the data on ATI and code-share tickets with common marketing carriers. Compass

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operate. For example, on oneworld code-share tickets, American and British Airways maintain their marketing codes on the transatlantic flights they operate.

[19] Over 65% of code-share tickets list two or more marketing carriers, whereas all online tickets list a single marketing carrier. The average fare difference between these code-share tickets and online tickets thus depends on the difference between the code-share and online variables *and* the variables denoting the marketing carriers on the tickets. Despite this, Compass represents in its study that the average difference between online and code-share fares is *solely* given by the difference between the online and code-share variables.

does not do this.  In the Compass model, the code-share ticket type variable is common to fare differences between all code-share and ATI, online, or interline tickets.  Compass thus estimates this code-share variable using data for *all* code-share tickets, not just the few code-share tickets sold by the alliances that list sets of marketing carriers that are common to ATI tickets.

Compass' failure to properly account for the carrier variables and the resulting incorrect measurement of the ATI and code-share effects explain a significant portion of the difference between our results and the results reported by Compass.  To illustrate, we estimate the Compass model on the Compass data without including in that model the marketing carrier variables.  This means that the variables denoting the types of ticket now solely represent the net effects on average fares of changing the type of tickets.  The results are listed in Table 5.  They contrast sharply with those reported by Compass. [redacted] This result undermines Applicants' claims that granting ATI will allow them to solve problems of double marginalization, and highlights the importance of correctly measuring estimated fare differences across tickets.

### 2. Data Errors

Compass errs in classifying tickets by their oneworld, SkyTeam, and Star alliance and ATI affiliation.  To illustrate, [redacted]

[redacted][20] These affiliation errors are not inconsequential. Our analysis shows that tickets issued under code-share agreements between airlines that are *not* in the same alliance, which we count as interline tickets, have higher fares than alliance code-share tickets. By counting these code-share tickets as *alliance* code-share tickets, Compass is biasing upwards the average fare of alliance code-share tickets in its study. Compass is thus more likely to find higher fares for code-share tickets than ATI tickets.

Compass also does not acknowledge or correct for the standard endogeneity bias problem that occurs when it includes HHIs as an explanatory factor in its fare model, because unobserved factors in the model that affect concentration in a route may also affect fares.

Compass further purports to use data for the same types of routes as in the literature, but it does not and it makes errors. [redacted]

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[20] [redacted]

[redacted] The HHI values used by Compass are therefore inaccurate.[21]

To determine if the additional data for gateways served by European carriers changes any of our conclusions, we re-estimate our alliance model presented in Table 4 using data that includes, [redacted], routes from U.S. cities that are gateways for European airlines. Although this procedure substantially expands the available number of routes for computing the estimates, these routes have only a partial sample of all tickets because of the absence of foreign carrier data noted previously. Using these data (with their potential problems), we find that code-share fares are significantly lower than ATI fares, all else equal.[22] Results from this larger route sample are listed in Table 6.

### 3. Problems with Compass' Analysis of Carve-Outs

Compass (¶31) writes that "on connecting routes, the fares on an otherwise ATI itinerary including a carve-out segment are higher than fares on itineraries with 'full' ATI service." This conclusion is based on a poorly designed experiment by Compass and is not supported by the evidence.

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[redacted]

[21] As previously noted, Compass makes another basic data error: [redacted]

[22] There is no problem with incorrectly computing HHIs in our Star and oneworld analyses because the "route-year-quarter fixed effects" included in our model *de facto* control for factors that are invariant to a specific route at a specific time, such as the level of competition or HHIs. With no need to compute HHIs, we avoid one of the problems of the Compass model.

To reach its conclusion, Compass slices the data exceedingly finely without including adequate controls in the model. For instance, there are no controls in the model for how segment characteristics in a connecting ticket generally affect fares in that ticket. When small sub-samples of data are used, the problem of controlling for meaningful differences in those samples becomes substantial, and reported parameter values can devolve into an exercise in cherry-picking the data. To illustrate, one can easily identify fully immunized ATI tickets that have fares that are *higher* than those on the ATI tickets with a carve-out segment.[23] Finding a set of routes that have prices above the overall average represented by the ATI variable is not hard. However, attributing policy conclusions to such small groups is neither justified nor supported on this limited evidence.

In fact, our Star and oneworld analyses show that, on connecting routes, code-share tickets, which by definition include non-immunized segments, are priced lower than ATI tickets. Under the terms of the immunity grant, ATI carriers are legally able to cooperate fully on all connecting routes, including those with carved-out segments. Thus, ATI fares on all routes with non-immunized segments should reflect the alleged efficiencies of ATI pricing.

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[23] We follow the Compass analysis and estimate the DOJ's model in the Star comments with six mutually exclusive types of tickets rather than four: online, interline, code-share, ATI, ATI with a carve-out segment (as in Compass' analysis), and ATI with a Chicago-Munich or San Francisco-Frankfurt segment. These latter segments are served non-stop by United and Lufthansa and are <u>not</u> carved-out under their Star ATI grant. ATI tickets including one of these segments are thus "full" ATI service tickets. We estimate DOJ's model including the six types of tickets. We find that, on connecting routes, average fares for "full" ATI service itineraries including a Chicago-Munich or San Francisco-Frankfurt segment are 1.7% <u>higher</u> than those for ATI itineraries including a carved-out segment (we estimate a similar fare difference if we likewise extend our oneworld model).

### 4. Nested Logit Model Used by Compass Gives Dubious Results

The final section of the Compass report describes a nested logit demand model of consumer choice. This model does not generate plausible results and cannot be considered reliable.

Compass notes that it estimates that on connecting routes, round-trip consumers are willing to pay an extra $470 (28 percent of average fares in the data) to fly online rather than ATI and an extra $350 to fly ATI rather than code-share.[24] In other words, the Compass model implies that in order to get a consumer to buy a round-trip code-share ticket when online service is available, the code-share ticket would have to be priced some $820 (=$470+$350) lower than the online ticket, or a reduction of 65% in the average ticket price. These monetized fare differences appear to reflect a poorly specified econometric model, not actual consumer behavior. They are also sharply at odds with the basic fare data. In the DOT DB1B data for 3rd quarter 2008, for example, we observe that, on connecting routes with all three types of itineraries, round-trip consumers actually paid similar fares for each of online, code-share, and ATI itineraries (about $1,279, $1,274, and $1,387, on average, respectively).

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[24] Compass, p.21, ¶34 and fn.31. We have doubled the figures reported by Compass to get round-trip figures because Compass writes that "all our fare results are based on a single direction of flight. So for a round trip, the dollar values would be doubled." Compass, p.21, fn.30.

**Table 1.**

**DOJ’s Model in Star Comments including ATI variable**

**Price Effects from Differences in Non-stop Competition across Transatlantic Routes.**

*The Dependent Variable is ln (Average Fare)*

| Explanatory Variables | Estimate (Standard Error) | Change in # of non-stop independent competitors | Estimated Fare Effect (in percentages) |
|---|---|---|---|
| # of non-stop independent competitors: | | | |
| 1 | --- | --- | --- |
| 2 | -0.147*<br>(0.049) | 2 to 1 | +15.8%* |
| 3 | -0.202*<br>(0.056) | 3 to 1 | +22.3%* |
| 4 | -0.270*<br>(0.080) | 4 to 1 | +31.0%* |
| 5 or more | -0.431*<br>(0.106) | | |
| Additional ATI Competitors | -0.014<br>(0.033) | | |
| **Other Controls** | | | |
| Constant | 1.219<br>(0.985) | | |
| ln (miles) | 0.639*<br>(0.117) | | |
| Mean of City Populations in the Route | 0.941<br>(0.885) | | |

Data: DOT OD DB1B, 2008 Q3.
R-squared = 0.59. Robust Standard errors computed.
* indicates statistical significance at the 99% confidence level
Percentage effects calculated as exp(-coef) - 1

**Table 2.**

**Extension of DOJ’s Model for oneworld Comments including ATI variable**

**Price Effects from Differences in Non-stop Competition across Transatlantic Routes.**

*The Dependent Variable is ln (Average Fare in 2008)*

| Explanatory Variables | Estimate (Standard Error) | Change in # of non-stop independent competitors | Estimated Fare Effect (in percentages) |
|---|---|---|---|
| # of non-stop independent competitors: | | | |
| 1 | --- | --- | --- |
| 2 | -0.179*<br>(0.069) | 2 to 1 | +19.6%* |
| 3 | -0.236*<br>(0.073) | 3 to 1 | +26.6%* |
| 4 | -0.324*<br>(0.084) | 4 to 1 | +38.3%* |
| Additional ATI Competitors | -0.039<br>(0.067) | | |
| Multi Hub | 0.162*<br>(0.057) | | |
| **Other Controls** | | | |
| Constant | -0.113<br>(1.055) | | |
| ln (miles) | 0.764*<br>(0.127) | | |
| Mean of City Populations in the Route | 0.608<br>(0.941) | | |

Data: DOT OD DB1B, yearly for 2008. The sample data include 79 routes.
R-squared = 0.56. Robust Standard errors computed.
* indicates statistical significance at the 99% confidence level
Percentage effects calculated as exp(-coef) - 1

**Table 3.**

**<u>Compass' Panel Analysis Model</u>**

**Price Effects from Loss of Non-stop Competition in Transatlantic Routes.**

*The Dependent Variable is ln (Average Fare)*

| Explanatory Variables | Estimate (Standard Error) | Change in # of non-stop independent competitors | Estimated Fare Effect (in percentages) |
|---|---|---|---|
| Number of Competitors >= 1 | --- | --- | |
| Number of Competitors >= 2 | [redacted] | 2 to 1 | [redacted] |
| Number of Competitors >= 3 | [redacted] | 3 to 2 | [redacted] |
| Number of Competitors >= 4 | [redacted] | 4 to 3 | [redacted] |
| Additional ATI Competitors | [redacted] | | |
| **Other Controls** | | | |
| Constant | Yes | | |
| Route-Quarter Fixed Effects | Yes | | |
| Year-Quarter Fixed Effects | Yes | | |
| Carrier Effects | No | | |

Data: DOT OD DB1B, All Quarters 2005-2008.
Robust Standard errors computed.
* indicates statistical significance at the 99% confidence level
** indicates statistical significance at the 95% confidence level
Percentage effects calculated as exp(-coef) – 1.

**Table 4.**

**Extension of DOJ’s Model for oneworld Comments**

**Price Differences Across Tickets based upon the Type of Ticket.**

*The Dependent Variable is ln( Ticket Fare )*

| Explanatory variables: | | Estimate | Standard Error | Estimated Fare Differences relative to interline[1] | Within each alliance, Estimated Fare Differences relative to code-share[2] |
|---|---|---|---|---|---|
| ***oneworld alliance*** | Online | -0.111 | 0.008* | -10.5%* | +1.6% |
| | Code-share | -0.127 | 0.014* | -11.9%* | --- |
| | ATI[3] | 0.026 | 0.069 | +2.6% | +16.5%** |
| ***SkyTeam alliance*** | Online | -0.030 | 0.006* | -3.1%* | +7.2%* |
| | Code-share | -0.100 | 0.017* | -9.5%* | --- |
| | ATI | -0.042 | 0.008* | -4.1%* | +6.0%* |
| ***Star alliance*** | Online | -0.072 | 0.007* | -6.9%* | +3.8%* |
| | Code-share | -0.110 | 0.012* | -10.4%* | --- |
| | ATI | -0.000 | 0.009 | -0.0% | +11.7%* |
| Interline ticket | | --- | --- | --- | |
| Mileage of ticket | | -0.076 | 0.034** | | |
| # of coupons in ticket | | -0.052 | 0.004* | | |
| Route-year-quarter fixed effects | | Yes | | | |

$R^2$ = 0.29. The sample data include 123,522 coach tickets (class “X”). Tickets per alliance: Oneworld: 3,688 code-share, 129 ATI, 12,739 online. SkyTeam: 2,859 code-share, 11,879 ATI, 47,462 online. Star: 4,710 code-share, 8,649 ATI, 19,355 online. Interline:12,052 tickets

Data: DOT OD DB1B, 3rd quarter 2005, 2006, 2007, 2008. Robust standard errors computed.
* Indicates statistical significance at a 99% confidence level.
** Indicates statistical significance at a 95% confidence level.

[1] Percentage effects calculated as exp(coef) - 1

[2] Percentage effects calculated as exp(coef - code-share coef) within each alliance.

[3] There are very few ATI oneworld tickets in the data (129 tickets out of 123,522 total tickets).

### Table 5.

### Compass' Model estimated on the Compass Data

**Price Differences Across Tickets based upon the Type of Ticket.**

*The Dependent Variable is ln (Average Fare)*

| Explanatory Variables: | | Estimate | Standard Error | Estimated Fare Differential (relative to code-share) |
|---|---|---|---|---|
| ***Type of ticket:*** | Online | [redacted] | [redacted] | [redacted] |
| | Code-share | --- | --- | --- |
| | ATI | [redacted] | [redacted] | [redacted] |
| | Interline | [redacted] | [redacted] | [redacted] |
| Coupons | | [redacted] | [redacted] | |
| Mileage on the Route | | [redacted] | [redacted] | |
| One-way Flight | | [redacted] | [redacted] | |
| HHI OA | | [redacted] | [redacted] | |
| HHI Interline | | [redacted] | [redacted] | |
| Open Sky | | [redacted] | [redacted] | |
| Population of US City | | [redacted] | [redacted] | |
| Income of US City | | [redacted] | [redacted] | |
| Population of EU City | | [redacted] | [redacted] | |
| Income of EU City | | [redacted] | [redacted] | |
| Constant | | Yes | | |
| Route-Quarter Fixed Effects | | Yes | | |
| Year-Quarter Fixed Effects | | Yes | | |
| Carrier Fixed Effects | | No | | |

Data: DOT OD DB1B, 3rd quarter 2005, 2006, 2007, 2008.
Weighted least-squares with robust standard errors.
* indicates statistical significance at the 99% confidence level
Percentage effects calculated as exp(coef) - 1

**Table 6.**

**Extension of DOJ's Model for oneworld Comments** [redacted]

**Price Differences Across Tickets based upon the Type of Ticket.**

*The Dependent Variable is ln( Ticket Fare )*

| Explanatory variables: | | Estimate | Standard Error | Estimated Fare Differences relative to interline[1] | Within each alliance, Estimated Fare Differences relative to code-share[2] |
|---|---|---|---|---|---|
| ***oneworld alliance*** | Online | -0.120 | 0.006* | -11.3%* | +3.5%* |
| | Code-share | -0.155 | 0.009* | -14.4%* | --- |
| | ATI[3] | -0.095 | 0.045** | -9.1%** | +6.2% |
| ***SkyTeam alliance*** | Online | -0.039 | 0.004* | -3.8%* | +5.4%* |
| | Code-share | -0.092 | 0.012* | -8.8%* | --- |
| | ATI | -0.011 | 0.005** | -1.1%** | +8.4%* |
| ***Star alliance*** | Online | -0.087 | 0.005* | -8.3%* | +3.1%* |
| | Code-share | -0.118 | 0.008* | -11.1%* | --- |
| | ATI | 0.006 | 0.006 | 0.0% | +13.2%* |
| Interline ticket | | --- | --- | --- | |
| Mileage of ticket | | -0.009 | 0.025 | | |
| # of coupons in ticket | | -0.085 | 0.003* | | |
| Route-year-quarter fixed effects | | Yes | | | |

$R^2 = 0.25$. Sample data include routes from U.S. cities that are gateways for European airlines. The sample data include 230,927 coach tickets (class "X"). Tickets per alliance: Oneworld: 9,944 code-share, 581 ATI, 18,528 online. SkyTeam: 5,510 code-share, 27,078 ATI, 76,166 online. Star: 11,353 code-share, 24,743 ATI, 30,608 online. Interline: 26,416 tickets.

Data: DOT OD DB1B, 3rd quarter 2005, 2006, 2007, 2008. Robust standard errors computed.
* Indicates statistical significance at a 99% confidence level.
** Indicates statistical significance at a 95% confidence level.

[1] Percentage effects calculated as exp(coef) - 1

[2] Percentage effects calculated as exp(coef - code-share coef) within each alliance.

[3] There are very few ATI oneworld tickets in the data (581 tickets out of 230,927 total tickets).