The effects of the Morocco-European Union open skies agreement: A difference-in-differences analysis

1. Introduction

Air traffic relations between countries are typically regulated by bilateral agreements. Such agreements usually regulate the number of carriers a country is allowed to designate and the number of flights and routes flown, while they place restrictions on both fares and on carriers continuing flights to third-country markets. However, air services within the European Union (EU) have been fully liberalized since 1997, following the introduction of several legislation packages promoted by the European Commission aimed at increasing competition in the EU airline market.

Additionally, various open skies agreements have been promoted by the European Commission over the last decade with several non-EU countries within the framework of the European Neighbourhood Policy (ENP). The main goal of the ENP is to increase economic integration between the EU and its southern and eastern neighbours, all of which are considered by the World Bank as middle-income developing countries (with the exception of Israel).

In this paper we use the open skies agreement (OSA) signed between the EU and Morocco in December 2006 to identify the effects of the liberalization of the air transport market in a middle-income developing country. We identify two specific aspects of the impact of the Morocco-EU OSA on Morocco's air traffic. First, we identify the effect of the agreement on the number of seats offered on pre-existing routes. Second, we identify the effect of the deregulation on the probability of new routes being opened up between the participant countries.

We use data at the route level for the period 2003-2010 between North African and European countries. We exploit the fact that Morocco was the only country in North Africa to sign such an agreement and that the pre-liberalization traffic of all North African countries presented a common trend. Our empirical assessment of the effects of the Morocco-EU OSA is made by comparing changes in traffic volume and changes in the number of routes operated between Morocco and European countries with the corresponding changes for the rest of the North African countries and the EU following market liberalization.

Several econometric papers have examined the liberalization of international passenger aviation services.[1] Most focus on the United States, which has signed several OSAs with countries from around the world since the early nineties. Micco and Serebrisky (2006) found that OSAs reduce air transport costs by 9% and increase the share of imports arriving by air by 7%. However, these results only hold for developed and upper middle-income developing countries. Whalen (2007) found a modest increase in fares on routes between the United States and Europe affected by the OSAs, while all the capacity expansion was undertaken by carriers on routes between their hubs. Using data from Northeast Asia to the United States, Zou et al. (2012) found that the lower airfares associated with an open-skies agreement may be counterbalanced by the mutual forbearance strategy promoted by airlines competing in multiple markets. Finally, Cristea et al. (2014) found air traffic to be 17% higher in liberalized markets than in still-regulated markets, while OSAs led to an aggregate decline of 14.4% in quality-adjusted prices.

Evidence of the impact of OSAs outside the US is scarce, given data availability restrictions, especially regarding fares.[2] Previous studies have generally used cross-sectional data and their main variable of interest has been the Air Liberalization Index (ALI) scores computed by the World Trade Organization (WTO). Piermartini and Rousová (2013) found that OSAs increased passenger traffic by 5%, using worldwide data from nearly 2,300 country-pairs for 2005. Cristea et al. (2015) performed a similar analysis with data for 2010 by combining country-pair data and city-pair data. Their results suggest that a one-unit increase in the ALI leads to a 1.8% increase in the number of air passengers and that more liberal agreements are associated with more city-pairs being served by direct flights. Ismaila et al. (2014) also found a positive and statistically significant effect of liberalization on passenger flows using a sample that included 112 country-pairs with Nigeria for 2010. Specifically, a one-unit increase in the ALI raised the level of traffic demand by 8.76%. Finally, some studies have found a

[1] Some studies use analytical or computational models to examine the welfare effects of air transport liberalization policies (Adler et al., 2014; Gillen et al., 2002). Here we focus the attention on studies that follow an econometric approach as it is the one used in this paper.

[2] Various papers have examined the impact of deregulation within the European airline market. Marin (1995) investigated the impact of liberal bilateral agreements on a set of 35 European routes for the period 1982-1989 and found that bilateral agreements lead to greater competition both in terms of prices and frequencies. Schipper et al. (2002) used a sample of 34 European routes with varying degrees of liberalization for the period 1988 to 1992 and found that fares are lower and frequencies are higher on fully liberalized routes. However, the high level of economic integration between the countries of the EU mean these studies were conducted in a very different context to the one examined here.

substantial positive impact on traffic flows in Canada due to more liberal bilateral agreements using country-pair panel data (Dresner and Oum, 1998; Clougherty et al., 2001).

We add to this literature by examining the impact of a specific multilateral OSA with a middle-income developing country. Furthermore, we employ a methodology in a treatment evaluation framework that compares changes between comparable treated and control routes. We check the robustness of our results to differences in the pre-existing characteristics of the treated and control groups by applying a matching procedure.

Previous studies of US international routes have either focused on bilateral agreements while mixing data for developed and developing countries (Micco and Serebrisky, 2006; Cristea et al., 2014) or they have focused on high-income countries or dense routes (Whalen, 2007). Studies providing wide coverage use data for just one year so that they are only able to identity traffic differences between country-pairs or city-pairs subject to different degrees of liberalization (Cristea et al., 2015; Piermartini and Rousová, 2013).

In contrast, we are able to examine the change *per se* in the regulation regime using the logic of the difference-in-differences approach as we work with data before and after the OSA was signed between Morocco and the EU, and we conduct our comparison by focusing on similar routes operated by neighbouring countries that were not affected by the liberalization agreement. Furthermore, we do not only analyse changes in existing routes but also, in line with Cristea et al. (2014, 2015), changes in the probability of new routes being opened up.

Finally, as we have access to data on the market structure at the route level, we are able to determine whether the change in the number of seats offered following the signing of the OSA is related solely to greater competition resulting from new market entrants and/or to the removal of restrictions imposed on incumbent airlines. In this regard, the impact of the OSA between the European Union and Morocco may be strongly influenced by the entry of low-cost airlines as, in contrast to previous studies, our analysis focuses on short-haul or medium-haul routes. In this regard, some few works have analyzed the impact of low-cost airlines on traffic at the route level with contradictory results (Bettini and Oliveira, 2008; Goolsbee and Syverson, 2008; Fageda, 2014). Here, we may provide new insights about the impact of low-cost airlines on route traffic as their entry in the Morocco market was restricted in the pre-liberalization period.

The rest of this paper is organized as follows. In the next section, we outline the policy context of the OSA between the European Union and Morocco and describe the sample and data used in the empirical analysis. We then explain the empirical strategy, present the results of the analysis and perform some robustness checks. The last section is devoted to the concluding remarks.

2. Policy context and data

OSAs lie at the heart of the EU's external aviation policy that seeks the creation of a Common Aviation Area with the EU's neighbours. This strategy forms part of the broader European Neighbourhood Policy (ENP), which aims at achieving the greatest possible degree of economic integration between the EU and its southern and eastern neighbours.[3]

Against this backdrop, the Moroccan government introduced a new tourist master plan known as Vision 2010, later updated and renamed Vision 2020 (Dobruszkes and Mondou, 2013). As part of this plan, the Moroccan government explicitly sought to liberalize international air transport so as to obtain lower airfares and to open up new routes. This objective to promote tourism, together with the ENP driven by the EU, led Morocco and the EU to sign an OSA on 12 December 2006.

This agreement means that any EU or Moroccan airline can operate any route between any EU airport and any Moroccan airport and that they are free to set the flight frequencies, capacities and fares. Additionally, the Moroccan airlines are authorized to carry traffic between any EU airports if these services originate or terminate in Morocco, while the EU airlines are authorized to carry traffic between any Moroccan airport and an airport located beyond, provided that these services originate or terminate in the EU and that these points are located in the countries of the ENP. The agreement

[3] Of the 16 ENP countries, 12 participate as full partners in the ENP and have agreed to ENP action plans. They are Armenia, Azerbaijan, Egypt, Georgia, Israel, Jordan, Lebanon, Moldova, Morocco, Palestine, Tunisia and Ukraine. Algeria is currently negotiating an ENP action plan, while Belarus, Libya and Syria remain outside most of the structures of ENP. All these countries are classified by the World Bank as upper middle-income or lower middle-income countries with the exception of Israel which is classified as a high-income country. Other countries in North Africa, including Mauritania and Sudan, are also classified as lower middle-income countries.

also means the adaptation of aviation legislation in Morocco to EU rules and regulations on safety, competition laws, air traffic management and consumer protection. [4]

Prior to the signing of the OSA, air services between Morocco and European countries were regulated by bilateral agreements, none of which were especially liberal. The Air Liberalization Index (ALI), the standard indicator of liberalization in the air services between country-pairs, is based on several features embodied in these agreements, including traffic rights, flexibility in the setting of prices and capacity, designation of airlines and other elements. The standard ALI runs from 0 to 50, with agreements scoring 50 being deemed the most liberal. The ALI scores for most of the bilateral agreements between Morocco and the largest European countries ranged between 10 and 14 before the OSA.[5] Hence, this multilateral agreement ushered in major changes in the level of regulation in air transport between the countries involved.

We have worldwide data on the number of seats offered by airlines for 2002-2015 at the airport-pair level. These data are provided by RDC aviation (capstats statistics). However, we restrict our analysis to the period 2003-2010 and to routes originating in airports of North African countries (Egypt, Mauritania, Morocco, Sudan, Tunisia and Libya) and terminating in the airports of EU-15 countries plus Norway and Switzerland. This restricted sample seeks to avoid shocks other than the OSA that might distort the identification of the effects of the latter. Data after 2010 may be affected by the political conflicts associated with the Arab Spring, which has had a differential impact on the North African countries in our sample. We select 2003 to guarantee the symmetry of the periods before and after the signing of the OSA. We also exclude the European countries that have acceded to the European Union in the middle of this period, while we opt to focus on North African countries as these are the most similar to Morocco, at least in geographical terms.

Overall, our sample of pre-existing routes (routes with air services in each of the years in the period under consideration) includes 191 routes and 1,501 observations. Routes originating in Algeria, Egypt, Morocco and Tunisia represent about 95% of the

[4] Neighbouring countries that have benefited from an open skies agreement with the EU are Georgia (2011), Israel (2013), Jordan (2010) and Morocco (2006). As for relations with other neighbouring countries, negotiations are on-going with Lebanon, Tunisia and Azerbaijan. In a different context, the European Union has also signed OSAs with Canada (2009) and the United States (2008).

[5] According to data provided by the WTO, in 2006 the ALI scores for Morocco and the countries of Europe were as follows: United Kingdom (14), Germany (12), France and Portugal (11), Belgium, Netherlands and Luxembourg (10), Spain (8), Italy (6), Austria (4) and Sweden (0).

total number of observations, which means the few routes originating in Mauritania, Libya and Sudan should have a very modest effect on our results. We also construct an additional sample comprising potential routes, defined as a link between all the airports in our sample of North African countries to all the airports in our sample of European countries. This expanded sample includes 3,895 routes and 31,160 observations. Again, most of the observations are for the countries identified above in the sample of pre-existing routes.

We consider the airports of the North African countries as being the origin and the airports of Europe as being the destination. Note that the supply between both directions of a route is identical (at least in the context of this analysis), so that the supply, for example, of the Marseille-Casablanca link is the same as that of the Casablanca-Marseille link.

We expect an increase in the number of seats offered on pre-existing routes and an increase in the probability of new routes being opened up due to the liberalization ushered in by the OSA. In a regulated context, incumbent airlines may face capacity restrictions on the routes they operate. Furthermore, they may face restrictions in terms of fare setting, which could condition their profitability. Holding the level of competition on the route constant, the OSA may lead to an increase in the number of seats offered by incumbent airlines because of the lifting of regulations on capacities and fares. They may also adopt a pre-emption strategy, which would involve increasing the capacity on a route so as to impose entry barriers on new entrants once market access is no longer regulated.

Another expected effect of the OSA is the entry of new airlines on the routes affected, including the entry of low-cost airlines or airlines other than the traditional incumbent airlines (e.g., the former flag carriers). We expect the deregulation to be associated with greater levels of competition, which it may lead to a higher number of seats offered. Additionally, the lifting of restrictions to operate on specific routes should also lead to an increase in the number of routes operated. In the regulated context, the former flag carriers tended to monopolize the market and may have been obliged to operate specific routes. With liberalization, a number of new routes might be operated by airlines that have lower costs than those incurred by traditional carriers or the traditional carriers may face fewer restrictions when choosing their route network.

Table 1 shows the descriptive data of the air services supply between the North African and European countries in our sample for the first and last years of the period being analysed. Morocco is the North African country with the highest increase both in the number of seats and in the number of routes offered. This increase in the number of seats and routes seems to be attributable mainly to the low-cost airlines, as their share increased substantially over the period at the expense of that of the former flag carriers. This is in line with the analysis undertaken by Dobruskes et al. (2016), who report a marked increase in traffic in Morocco after 2006 due to the penetration of the low-cost airlines. Egypt and Tunisia seem to have followed a similar trend although at a slower pace. In contrast, the increase in traffic in Algeria does not appear to have been at the expense of the former flag carriers, and the country even reports a reduction in the number of routes offered. The increase in traffic in Libya is also notable, but it is entirely attributable to the former flag carriers. Finally, Mauritania and Sudan contribute just two and three routes, respectively, to the analysis.

<Insert Table 1 here>

While this table provides descriptive evidence in favour of the hypothesis that Morocco has benefitted from the OSA, a multivariate econometric analysis using data at the route level is needed to conclude that the agreement has had a significant and differential impact on air traffic between Morocco and Europe. This analysis is reported in the following sections.

3. Empirical Strategy

As mentioned above, we identify two specific aspects of the impact of the EU-Morocco OSA on Morocco's air traffic. First, we identify the effect of the agreement on the number of seats offered on pre-existing routes. Second, we identify the effect of the deregulation on the probability of new routes being opened up between participant countries.

To identify these two effects, we exploit the experimental environment created by the change in regulations between the EU and Morocco, and the fact that no changes occurred in the regulations between the EU and the other North African countries or between Morocco and the other non-EU European countries.

Thus, in addressing the first of these effects, we estimate the impact of the agreement on the number of seats offered on routes affected by the change in regulation, using as a counterfactual the number of seats offered on routes between the other North African countries and the EU, and, between Morocco and the other non-EU European countries. Specifically, we assess this impact by comparing the change in the number of seats offered on routes affected by the OSA with the change in the number of seats offered on routes that remained unaffected. By comparing these changes, we control for both observable and unobservable differences between routes that are invariant in time.

Our treated routes are all the routes operated between Morocco and EU member countries before the agreement, while our control routes are all the routes operated between the other North African countries and EU members, and, all the routes operated between Morocco and non-EU European countries prior to the agreement. [6] In this way, we control for the evolution in the number of seats out of Morocco before the OSA and the evolution in the number of flights out of Tunisia, Algeria, Egypt, Mauritania, Sudan and Libya to the same EU countries, and the flights from Morocco to Switzerland and Norway. To do so, we estimate the following model:

$$\log(seats)_{it} = \beta_0 + \beta_1 \text{treated}_i + \beta_2 \text{after}_t + \beta_3 OSA_i + \beta_4 X_{it} + \mu_t + \varepsilon_{it} \qquad \textbf{<1>}$$

where our dependent variable is the logarithm of the number of seats offered on route *i* in period *t*; *treated* is a dummy variable that takes a value of 1 when route *i* connects Morocco with one of the EU member states; *after* is a dummy variable that takes a value of 1 from 2007 onwards; *OSA* is a dummy variable that takes a value of 1 when route *i* connects Morocco with a EU member state from 2007 onwards; *X* is a vector of control variables based on route or endpoint features; μ_t are year dummies; and ε_{it} is the error term. We consider 2007 as the first year in which the agreement was in force, given that it was signed in mid-December 2006.

The vector of controls includes different variables that might influence the number of seats offered on a route. Here, we include the standard variables used in gravity models, assuming that the air traffic between two points depends positively on the economic and demographic size of these points and negatively on distance.

[6] We consider all routes that were served by at least one flight per week in the two years prior to the OSA.

Hence, we first include the distance between the points of origin and destination of route *i* as our explanatory variable. The data for this variable are provided by RDC aviation. Given that most of the routes in our sample are not strongly affected by competition from other transportation modes (neither trains nor coaches), we expect a negative sign for the coefficient associated with this variable, as demand between two points is negatively related to distance.

Second, we control for the population of the cities of origin and destination. Here, bigger cities are expected to have a larger supply of seats, given that the increase in population increases the number of people wanting to fly, understood that the proportion of people who travel by plane remains constant within the total population. The data for this variable are expressed at the urban level. For cities with more than 300,000 inhabitants, information is obtained from the United Stations (World Urbanization Prospects). The data for smaller cities are obtained from the National Statistics Agency of the corresponding country.

Third, we control for the economic status of the countries of origin and destination using the Gross National Income (GNI) per capita, on the understanding that demand between richer endpoints should be higher. Furthermore, we include a variable that measures the degree of openness of the origin and destination countries which is measured as the percentage of imports and exports over GDP. The data for these variables are expressed at the country level and are obtained from the World Bank (World Development Indicators). Unfortunately, data at a more disaggregated level are only available for European countries.

We also include a dummy variable that takes a value of 1 if the route connects an EU country with a former colony. This is the case for routes that link airports from Algeria, Morocco and Tunisia to France, routes from Egypt to United Kingdom and routes from Libya to Italy. We expect a higher demand on these routes given the strong links associated with colonization. Furthermore, we include a dummy variable that takes a value of 1 for tourist destinations in North Africa where the population of the main city or town is very small. We expect demand on these routes to be higher than the control variables of population or income per capita might suggest. Note also that air traffic on these routes should be essentially from European cities to the tourist destinations.[7]

Finally, we include two variables that control for the degree of competition in the route: one, the Herfindahl-Hirschman concentration Index (HHI); the other, the share of network carriers in the route considering network carriers former flag carriers and airlines involved in international alliances in the considered period.[8] They are both measured in terms of the number of seats offered on the route. Note that the HHI variable is strongly correlated with the share of network carriers on a route so that a reduction in this index is essentially associated with the entry of low-cost airlines or other non-network airlines. Hence, both variables are highly correlated.

We estimate four specifications of equation (1) that are differentiated by controlling or not for the competition variables. In the first specification, we consider both HHI and share of network carrier as explanatory variables. In the second specification, we do not control for the share of network carriers. In the third specification, we do not control for the HHI. In the last specification, we do not control for any of the competition variables.

These different specifications allow us to untangle whether the OSA has an effect on the number of seats offered on a route while holding the level of competition constant or whether, on the contrary, the OSA affects the number of seats offered as a result of the greater competition on the route.

Recall that the increase in the number of seats due to deregulation may be related to the lifting of the restrictions imposed on incumbent airlines so that they are free to fix capacities and fares or may reflect a pre-emption strategy whereby they seek to impede the entry of new airlines. If this were the case, the impact of the OSA would be relevant even when holding the degree of competition on the route constant. In contrast, the impact of the OSA could be exclusively related to the greater competition resulting from the operation of new airlines on the previously regulated routes. In this case, the effect of the OSA should only be relevant when we do not control for the competition variables.

[7] These tourist destinations are Djerba, Enfidha, Monastir, Tabarka and Tozeur in Tunisia, Hurghada, Luxor, Marsa Alam and Sharm el-Sheikh in Egypt and Essaouira in Morocco. Other major tourist destinations like Marrakech, Fez or Cairo are also big or medium-sized cities.

[8] Network carriers with flights in our sample are: Aegean airlines, Aer Lingus, Air Algerie, Air Europa, Air France, Air Mauritania, Alitalia, Austrian airlines, Brussels airlines, Egyptair, Iberia, KLM, Libyan airlines, Lufthansa, Luxair, Olympic airlines, Portugalia, Royal Air Maroc, SAS, Spanair, Sudan Airways, Swiss, Swissair, TAP, Tunisair.

Another potential explanatory factor for which we cannot control in our model is fares, given the lack of data. In this respect, airline behaviour can be considered as a multistage process (Marín, 1995; Schipper et al., 2002; Winston and Yan, 2015). In the first stage, airlines choose whether to enter the market or not; in the second stage, and having entered the market, they decide on the capacity they wish to offer. In the third stage, the airlines set prices, which makes them the most flexible variable. Hence, our analysis here considers the first two stages of the airlines' decision-making process.

All (continuous) control variables are expressed in logarithms as is usual in gravity models. The year dummies allow us to control for yearly shocks, which are common to all routes. In the same sense, the dummies *treated* and *after* allow us to control for differences between groups and between periods (before and after the agreement), respectively.

The estimate of interest here is β_3, which represents the difference-in-differences effect of the OSA on the number of seats offered. The key identification assumption of the difference-in-differences approach is that the variable of interest would have followed a parallel trend in the absence of deregulation in both the treated and control groups (Meyer, 1995). Hence, the evolution in the number of seats in the control group represents a suitable estimate of the evolution of the number of seats in the treated group in the absence of deregulation.

As this assumption is not testable, we provide evidence that the treated and control groups followed parallel trends before the OSA was signed. Thus, first, we perform an equality of means test of the seats offered on the treated and control routes on a yearly basis. The results are shown in Figure 1. The null hypothesis of equality of means between control and treated groups cannot be rejected for all years of the pre-reform period.

<Insert Figure 1 here>

Second, to identify the effect of the OSA on the probability of new routes being opened up we estimate the following model:

$$P(Air\ services)_{it} = \alpha_0 + \alpha_1 \mathrm{treated}_i + \alpha_2 \mathrm{after}_t + \alpha_3 OSA_i + \alpha_4 X_{it} + \delta_t + \gamma_{it}$$

<**2**>

where the dependent variable in this estimation is a dummy variable that takes a value of 1 when the route has air services. We consider that a route has air services when an airline offers at least one flight per week. The control variables are the same as in equation 1 and their expected signs are the same, since all these variables are demand shifters. The only variables not to be included in equation 2 are the competition variables since they cannot be computed for routes with no air services.

Recall that we estimate the effect of the OSA by comparing changes in the dependent variable in the treated and control groups. In this case, we compare the changes in the probability of the opening up of new routes between Morocco and the EU countries participating in the OSA with the changes in the probability of the opening up of new routes between the other North African countries and the EU, and, between Morocco and non-EU European countries.

Our estimate of interest in this case is α_3, which represents the difference-in-differences effect of the OSA on the probability of the opening up of new routes. The key identifying assumption in this case also holds: Figure 2 presents the equality of means test between the treated and control groups on a yearly basis. The results show that until 2006 we cannot reject the hypothesis that the probability of opening up new routes is equal on treated and on control routes. In 2006, however, the probability increases on those routes affected by the OSA. This can be attributed to the effects of the agreement itself: although it was not signed until December of that year, the airlines might have reacted to it earlier. In this respect, some informal liberalization of air travel regulations between two countries may have occurred prior to the formalisation of the OSA. Thus, our estimate of the effect of the agreement might be an underestimation, as this difference in 2006 is captured for the variable *treated* but not for the OSA itself.

<Insert Figure 2 here>

Note that results of the analysis may be affected by the presence of differences in the pre-existing characteristics of the treated and control groups. Tables 2 and 3 show the mean test differences for all the control variables. Furthermore, we also provide the mean test differences for the previous level of liberalization (as measured by the ALI index). Table 2 shows the differences in the sample of pre-existing routes, while Table 3 shows the differences in the sample of all potential routes. In the first sample, we find differences for the income per capita and openness at the point of origin, for the dummy for tourist destinations and for the ALI index. In the second sample, we find differences for all the variables considered except population and openness at the point of destination. Hence, at the end of the following section we apply a matching procedure and we re-estimate equations 1 and 2 with the observations that have common support as a robustness check.

<Insert Table 2 here>

<Insert Table 3 here>

4. Estimation and results

In this section, we deal with a number of econometric issues and discuss the results of the regressions. The estimates may present heteroscedasticity and temporal and cross-sectional autocorrelation problems. We apply the Breusch-Pagan/Cook-Weisberg test for heteroscedasticity and the Wooldridge test for autocorrelation in panel data. Both tests show that we may have a problem of heteroscedasticity (in some regressions) and autocorrelation, which must be addressed. Hence, the standard errors are robust to heteroscedasticity. Following Bertrand et al. (2004), we allow for an arbitrary variance-covariance structure by computing the standard errors in clusters by route to correct for autocorrelation in the error term both at the cross-sectional and temporal levels.

The data used present a panel structure so that we need to use the techniques typically applied within the framework of panel data models. In this regard, a clear advantage of the fixed effects model is that it allows us to control for omitted variables that are correlated with the variables of interest and which do not change over time. Hence, the fixed effects model is more reliable than other techniques. However, the fixed effect model focuses on the within variation of data and so it cannot capture the effect of time invariant variables, such as distance or the dummies for colonial links and tourist destinations. Hence, we also show the regressions using a pooled model that allows us to examine the influence of these time invariant variables.

Another problem that we must address is the potential endogeneity bias of the HHI variable (in those regressions in which it is included). As our instrument, we use the concentration index for the two airports on the route. This variable is constructed as follows: we calculate the HHI index in terms of the number of airline seats both at the origin and destination airports on the route. Then, we obtain the mean value of the HHI index for both airports on the route. Airline decisions at the airport level refer to all the routes leaving from a given airport, so we would expect this variable to be exogenous and correlated with the HHI at the route level.

Table 4 shows the results of the equation for the number of seats offered on pre-existing routes. In columns 1-2, we present the results when including both competition variables as explanatory variables. In columns 3-4, we present the results when the variable for the share of network carriers is excluded. In columns 5-6, we exclude the HHI index. In the last two columns, both competition variables are excluded.

We find that the Morocco-EU OSA does not have a statistically significant effect on the number of seats offered when we control for the competition variables (except when we use the pooled model that just consider the share of network carriers as explanatory variable for competition). In contrast, the impact of the OSA is substantial when we do not control for the degree of competition on the route. This result remains the same regardless of the estimation technique used.

<Insert Table 4 here>

In terms of magnitude, the increase in the number of seats offered on the treated routes after the signing of the OSA is about 24% higher than that on the control routes when using the route fixed effects method, which is our preferred approach. Thus, we find clear evidence of the fact that the OSA has had a notable impact on the market. This impact is essentially related to stronger market competition due to the entry of non-network carriers and not to a change in the behaviour of the incumbent airlines.

The magnitude of the impact of the OSA is higher than that reported in similar studies conducted to date. Cristea et al. (2015) performed a counterfactual analysis based on their empirical results that suggests that a move to a more liberal environment in the Middle East could lead to an increase in traffic flows of between 7 and 18%, while the results of Piermartini and Rousová (2013) suggest that OSAs could increase worldwide passenger traffic by 5%.

A possible explanation for the more marked impact reported herein might be that the OSA analysed here means that Morocco, to all intents and purposes, forms part of the de-regulated European airline market with its significant presence of low-cost airlines. Indeed, the downward pricing pressure that low-cost airlines exert on the routes they operate is well documented in the literature (e.g., Morrison, 2001; Goolsbee and

Syverson, 2008; Hofer et al., 2008; Oliveira and Huse, 2009). Thus, it would appear that the OSA has had a notable impact on fares (and hence on capacity) precisely because of the entry of low-cost airlines.

Additionally, the potential increase in traffic may be greater when one of the countries party to the agreement is a middle-income developing country. In this regard, the results from our analysis differ from those obtained by Micco and Serebrinsky (2006). The latter failed to find a significant impact of OSAs on air transport costs when considering lower middle-income developing countries, such as Morocco. A possible explanation for this is that Micco and Serebrinsky (2006) focused on cargo markets while our analysis focuses on passenger markets.

The results for the control variables seem to work better in the pooled model than they do in the fixed effects model. Recall that the fixed effects model concentrates on the within-variation of data and the fixed effects may already capture the impact related to bigger cities and richer countries. In any case, the results for the main variable of interest are very similar regardless of the technique used. What is notable is that we do not find a statistically significant effect of the distance variable; however, this result may be explained by the fact that the range of distances for the routes in our sample is not great.

Table 5 shows the results for the probability of the opening up of new routes. Here, we find a positive impact of the OSA. For a route affected by the OSA, the odds of having a service are about 1.5-3.5 greater than the odds for a route unaffected by the OSA. The only paper to conduct a similar analysis is that of Cristea et al. (2015). In their counterfactual analysis for the Middle East, they find that a fully liberalized environment would increase the odds of a flight between any two given cities by a factor of 1.2–1.4. Again, the results of our analysis report an even stronger impact of the OSA between Morocco and EU. In this regard, Dobruskes and Mondou (2013) provide data in which they show that liberalization in Morocco has benefited regional airports at the expense of the economic (Casablanca) and political capitals (Rabat). Note that low-cost airlines, such as Ryanair and Easyjet, which have enjoyed a notorious presence in the Moroccan market since liberalization, do not necessarily operate at the largest airports.

As in the previous regression, the control variables work better in the pooled regression than in the fixed effects regression. The estimated effect for the main variable of interest is higher when we use the fixed effects model but it is high in both cases.

<Insert Table 5 here>

We check the robustness of our results to potential differences in the pre-existing characteristics of the treated and control groups. Essentially, we wish to eliminate any concerns that the evolution in the respective number of seats offered and the respective probabilities of the opening up of a new route might have differed because of pre-existing differences. For example, it might be that the number of seats offered on a route or the probability of a new route being opened is influenced by the income per capita of the countries involved or pre-existing levels of liberalization of air traffic in the two countries.

To overcome this concern we apply matching procedures and re-estimate equations 1 and 2 with the observations that have common support. Matching procedures eliminate the possible bias by pairing observations in the treated and control groups with similar characteristics. That is, following Rosenbaum and Rubin (1983), we first estimate the probability of being treated conditional on the pre-existing characteristics that differ between groups with a logistic model, obtaining the propensity score for each observation. In a second step, we match the observations in the treated and control groups with respect to the propensity score using the first nearest neighbour algorithm. This algorithm matches treated observations with the control that has the closest propensity score. Then, we drop all the observations without common support and re-estimate equations 1 and 2.

Recall that for our first question (that is, the effect of the OSA on the number of seats offered) the treated and control groups differed in terms of the income per capita and openness of the point of origin, the percentage of tourist routes and the degree of liberalization between the countries of origin and destination. Hence, to maintain only those observations with common support, we estimated the probability of being treated conditional on these features. After applying the first nearest neighbour algorithm we obtained a smaller sample comprising the treated and control groups that are closest with respect to the three pre-existing characteristics. Overall, the matching sample contains 53 routes from the treated group and 53 from the control group. The results for the logistic regression and the mean difference between groups in the full and the matching samples are presented in the Appendix, in Tables A.1 and A.2, respectively.

For our second question, (that is, the effect of the OSA on the probability of a new route being opened up), the treated and control groups differ in several characteristics, namely, the distance between the points of origin and destination, the level of population at origin, the income per capita at origin and destination, the openness at origin, the percentage of routes linking up a former colony, the percentage of routes considered as being tourist routes, and the pre-existing level of air liberalization between the countries. Here again, we estimated a logistic regression of the probability of being treated conditional on all quoted characteristics and include observations on common support using the first nearest neighbour algorithm. This sample contains 924 treated and 924 control routes. Results for the logistic regression and the mean difference between groups in the full and the matching samples are presented in the Appendix, in Tables A.3 and A.4, respectively.

Tables 6 and 7 show the results of the regressions using the matching sample. Our results for these additional regressions confirm our previous findings. In fact, we find a stronger effect of the OSA between Morocco and the EU. The results for the fixed effects model indicate an increase of about 42% in the number of seats offered on the treated routes after the signing of the OSA. For a route affected by the OSA, the odds of having a service are about six times greater than the odds for a route unaffected by the OSA. Thus, the previous regressions that did not take into account the differences in pre-existing characteristics of treated and control groups underestimate the impact of the OSA between Morocco and EU.

<Insert Table 6 here>

<Insert Table 7 here>

Finally, we perform a falsification test to check that the effects reported with regard to the number of seats and the probability of new routes being opened up could only be found when the OSA was in place. To do so, we first discard all treated routes from both samples and assign treatment randomly to the control routes. We assign treatment to randomly selected routes maintaining the same proportion between control and treated routes as in the original samples. Thus, we have 37 treated routes from the 139 in the first estimation and 60 from the 193 in the second sample. As observed in Table

8, the results show that the OSA effect is not significant when applied to routes that have not actually been affected by the agreement.

<Insert Table 8 here>

5. Concluding remarks

In this paper, we have shown that the OSA signed between Morocco and EU has had a very marked impact on the air traffic services between the participant countries. We have found that the increase in the number of seats offered is about 20-40% on pre-existing routes, while there has been a notable increase in the number of new routes offered, after controlling for the characteristics that might explain the probability of having air services.

Given that the link between economic development and air traffic is well established in the literature, our results shed light on the importance of promoting policies that liberalize airline markets. In this regard, we provide evidence of the benefits that a liberalized environment may have for middle-income developing countries.

Most previous studies likewise report positive effects of the liberalization of the airline market; however, our estimated magnitudes appear to be higher. It could be the case that the potential benefits of liberalization are stronger when one of the countries party to the agreement is not a high-income country. In addition, Morocco is geographically close to many European countries, which might have facilitated the entry of European low-cost airlines into this market. Indeed, our analysis suggests that the implementation of an OSA between the EU and other neighbouring countries may have strong positive effects in terms of generating more traffic on pre-existing routes and opening up more routes for operation.

While we provide complementary evidence of the potential benefits of the liberalization of international air transport services, the practical advances in the policy arena are still somewhat limited. Significant progress towards a liberalized environment has been achieved in some parts of the world, for example, among the countries belonging to the Association of Southeast Asian Nations. However, the EU has signed OSAs with relatively few countries, while legacy airlines in the US (the most active country in terms of its involvement in OSAs) are bringing considerable pressure to bear on the government to cancel such agreements with countries in the Middle East.[9] From

[9] "Open-Skies Agreements Challenged", *New York Times*, February 6, 2015.

a more general perspective, restrictive bilateral agreements continue to regulate the air services between most countries around the globe. Hence, the results of this study should be informative in guiding policies that seek to eliminate such regulations and which distort airline decisions concerning their route network, capacity and fares.

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TABLE AND FIGURES

Table 1. Data about air traffic between Morocco and the European sample countries

Country	Year	Seats (millions)	Number of routes	Share flag carriers	Share LCCs	Share others	HHI
Algeria	2003	1.8	53	0.73	0.00	0.27	0.44
Algeria	2010	2.7	49	0.62	0.00	0.37	0.33
Egypt	2003	2.1	48	0.85	0.15	0.00	0.21
Egypt	2010	3.1	72	0.47	0.46	0.07	0.09
Lybia	2003	0.23	10	0.98	0.00	0.02	0.2
Lybia	2010	0.57	14	0.99	0.00	0.01	0.24
Mauritania	2003	0.05	3	1.00	0.00	0.00	0.5
Mauritania	2010	0.03	1	1.00	0.00	0.00	1
Morocco	2003	2.3	53	0.95	0.03	0.02	0.41
Morocco	2010	4.7	129	0.49	0.49	0.02	0.21
Sudan	2003	0.07	2	1.00	0.00	0.00	0.53
Sudan	2010	0.02	2	1.00	0.00	0.00	0.5
Tunisia	2003	1.7	56	0.87	0.11	0.03	0.39
Tunisia	2010	2.3	75	0.68	0.28	0.04	0.25

Notes: Flag carriers are Aer Lingus, Air Algerie, Air France, Air Mauritania, Alitalia, Austrian airlines, Brussels airlines, Egyptair, Iberia, KLM, Libyan airlines, Lufthansa, Luxair, Olympic airlines, Portugalia, Royal Air Maroc, SAS, Sudan Airways, Swiss, Swissair, TAP, Tunisair. Low cost are Air Arabia Maroc, Air Arabia Egypt, Air One, Air Berlin, Arkefly, Atlas Blue, Clickair, Condor, Corsair, Excel Airways, First Choice, Germanwings, HapagFly, Jet2, Jet4you, Jetairfly, LTU, Monarch, MyAir, MyTravelAirways, Niki, Norwegian, Nouvelair Tunisie, Primera Air Scandinavia, Ryanair, Thomas Cook, Thomsonfly, Transavia, TUI, Vueling, XL Airways. Other carriers are Aegean, Aeroflight, Aerolloyd, Afriqiyah Airways, Aigle Azur, Air Austral, Air Europa, Air Finland, Air Lib, Air Littoral, Antinea airlines, Belair, Binter Canarias, Bravo Air Congo, Edelweiss Air, Eurofly, HI Hamburg International, Regional airlines, Spanair, The number of routes refers to the total number of routes with air services with at least one flight per week.

Table 2. Mean test differences in characteristics of treated and control groups, offered seats sample. Year 2006

Characteristic	Treated	Control	Difference
Distance	1787 (78)	1942 (82)	156 (141)
Pop at origin	1758 (187)	2534 (395)	775 (649)
Pop at destination	4045 (542)	3525 (306)	-519 (597)
GNI at origin	5130 (0)	9768 (377)	4638*** (609)
GNI at destination	33907 (453)	34471 (309)	563 (573)
HHI	0.765 (0.034)	0.731 (0.021)	-0.0336 (0.0398)
$D^{Ex\text{-}colony}$	0.434 (0.069)	0.38 (0.042)	-0.0499 (0.079)
$D^{Tourist}$	0.019 (0.019)	0.35 (0.04)	0.32*** (0.066)
ALI	10.45 (0.26)	7.31 (0.44)	-3.14*** (0.735)
Share_network	0.56 (0.06)	0.48 (0.04)	-0.07 (0.07)
Openness at origin	73.9 (0)	77.3 (1.24)	3.43* (2)
Open. at destination	72.6 (4.26)	71.9 (2.77)	-0.65 (5.19)

Notes: Standard errors in parenthesis. Statistical significance at 1% (***), 5% (**), 10% (*).

Table 3. Mean differences in characteristics of treated and control groups, probability of new routes sample. Year 2006

Characteristic	Treated	Control	Difference
Distance	1960 (20)	2278 (21)	317*** (17)
Pop at origin	814 (29)	1167 (49)	354*** (89)
Pop at destination	1625 (76)	1559 (41)	-66 (85)
GNI at origin	5130 (0)	8981 (91)	3851*** (163)
GNI at destination	34305 (125)	35271 (93)	965*** (181)
$D^{Ex\text{-}colony}$	0.17 (0.012)	0.14 (0.006)	-0.02* (0.012)
$D^{Tourist}$	0.09 (0.009)	0.27 (0.008)	0.18*** (0.015)
ALI	9.65 (0.11)	5.05 (0.087)	-4.6*** (0.17)
Openness at origin	73.88 (0)	75.9 (0.265)	2.04*** (0.46)
Open. at destination	71.69 (1.13)	73.55 (0.62)	1.86 (1.28)

Notes: Standard errors in parenthesis. Statistical significance at 1% (***), 5% (**), 10% (*).

Table 4. Results of the estimates – Seats offered

Dependent variable	**Log(number of seats)**							
Method	**IV (Pooled)**	**IV (Fixed effects)**	**IV (Pooled)**	**IV (Fixed effects)**	**Pooled**	**Fixed effects**	**Pooled**	**Fixed effects**
Competition variables	**ALL**	**ALL**	**HHI**	**HHI**	**Share_network**	**Share_network**	**None**	**None**
D^{Open_skies}	-0.0545 (0.25)	0.052 (0.099)	-0.078 (0.16)	0.036 (0.1)	0.178** (0.08)	0.119 (0.09)	0.263*** (0.076)	0.237*** (0.09)
Controls								
Treated	0.018 (0.47)	-	0.046 (0.14)	-	-0.374*** (0.14)	-	-0.299** (0.15)	-
After	-0.052 (0.37)	-0.13 (0.19)	-0.08 (0.07)	0.031 (0.18)	11.49* (4.8)	0.41 (0.31)	-	0.48 (0.33)
Log(distance)	0.89 (0.31)	-	0.11 (0.11)	-	-0.05 (0.098)	-	-0.052 (0.11)	-
Log(population at origin)	0.375*** (0.135)	0.76 (1.3)	0.366*** (0.04)	0.83 (1.24)	0.371*** (0.026)	1.26 (1.36)	0.347*** (0.03)	1.378 (1.5)
Log(population at destination)	0.263*** (0.07)	6.07*** (2.25)	0.258*** (0.044)	6.15*** (2.17)	0.333*** (0.03)	6.37*** (2.24)	0.346*** (0.04)	6.305*** (2.4)
Log(GNI at origin)	-0.007 (0.33)	-1.56*** (0.76)	0.007 (0.15)	-1.65** (0.71)	-0.21 (0.13)	-1.795** (0.78)	-0.091 (0.13)	-1.63* (0.84)
Log(GNI at destination)	0.75 (2.4)	0.49 (0.81)	0.902** (0.43)	0.43 (0.72)	-0.45 (0.54)	-0.015 (0.84)	-0.018 (0.56)	-0.171 (0.9)
$D^{Tourist}$	0.4 (0.36)	-	0.37* (0.2)	-	0.418*** (0.12)	-	0.499*** (0.13)	
$D^{Ex\text{-}colony}$	0.47 (0.42)	-	0.45*** (0.13)	-	0.341*** (0.098)		0.11 (0.12)	
Log(HHI)	-1.18 (4.4)	-1.5* (0.87)	-1.51** (0.76)	-1.2*** (0.37)	-	-	-	-
Share_network	-0.15 (2.34)	0.27 (0.46)	-	-	-0.425*** (0.053)	-0.48*** (0.09)	-	-

Log(Op at origin)	0.33 (1.05)	-0.25 (0.27)	0.41 (0.35)	-0.27 (0.26)	0.08 (0.12)	-0.25 (0.27)	0.008 (0.13)	-0.19 (0.28)
Log(Op at destination)	0.009 (0.23)	0.78 (0.66)	0.08 (0.21)	0.85 (0.61)	0.197* (0.12)	0.725 (0.67)	-0.018 (0.12)	0.4 (0.72)
Intercept	-4.48 (34.9)	-	-7.15* (4.3)	-	-	-	6.98 (5.1)	-31.63 (23.11)
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Joint sig. test	25.75***	12.73***	20.56***	13.85***	210521.6***	12.38***	938.02***	10.58***
R^2	0.562	0.187	0.551	0.251	0.985	0.2127	0.9845	0.2165
Wooldridge test	23.88***	23.292***	23.2***	23.2***	21.187***	21.187***	20.22***	20.22***
Breusch-Pagan / Cook-Weisberg test	1.92	16.48***	16.88***	8.12***	2.02	18.22***	6.6**	13.69***
Number of ids	191	191	191	191	191	191	191	191
Number observations	1501	1501	1501	1501	1501	1501	1501	1501

Notes: We apply an instrumental variables procedure (IV) when HHI is included as explanatory variable. Standard errors are in parenthesis. They are robust to heterocedasticity, and they are also clustered at the route level except in the pooled model where we assume an AR-1 process in the error term. Statistical significance at 1% (***), 5% (**), 10% (*).

Table 5. Results of the estimates –Probability of openness of new routes

Dependent variable	$D^{air\_services}$	
Method	**Logit (pooled)**	**Logit (Fixed Effects)**
D^{Open_skies}	0.399*** (0.1)	1.297*** (0.464)
Odds Ratio	1.49*** (0.15)	3.45*** (1.37)
Controls		
Treated	0.365* (0.19)	-
After	0.132 (0.08)	0.39 (1.01)
Log (Distance)	-1.304*** (0.136)	-
Log (Population at origin)	0.888*** (0.067)	5.69 (4.9)
Log (Population at destination)	0.730*** (0.054)	-16.1* (8.28)
Log (GNI at origin)	0.19 (0.21)	10.25** (4.67)
Log (GNI at destination)	0.835* (0.49)	-9.156*** (3.04)
$D^{Tourist}$	2.97*** (0.24)	-
$D^{Ex\text{-}colony}$	1.374*** (0.14)	-
Log (openness at origin)	0.755 (0.39)	3.181*** (1.09)
Log (openness at destination)	1.277*** (0.19)	1.377 (2.6)
Intercept	-29.39*** (5.85)	-
Year fixed effects	YES	YES
Joint significance test	519.37***	257.14***
R^2	0.22	-
Wooldridge test	78.979***	81.179***
Breusch-Pagan / Cook-Weisberg test	17819.92***	10375.37***
Number of ids	3895	299
Number observations	31160	2392

Notes: Standard errors are in parenthesis. They are robust to heterocedasticity and clustered at the route level in the pooled regression and applying bootstrap standard errors in the fixed effects regression. Statistical significance at 1% (***), 5% (**), 10% (*). In the fixed effects regression, 3596 groups (28768 observations) are dropped by Stata because the dependent variable has all positive or all negative outcomes.

Table 6. Results of the estimates – Seats offered: Matching sample

Dependent variable	**Log(number of seats)**							
Method	**IV (Pooled)**	**IV (Fixed effects)**	**IV (Pooled)**	**IV (Fixed effects)**	**Pooled**	**Fixed effects**	**Pooled**	**Fixed effects**
D^{Open_skies}	0.157 (0.52)	0.027 (0.24)	-0.035 (0.15)	0.039 (0.19)	0.116 (0.097)	0.301** (0.124)	0.202*** (0.09)	0.428*** (0.12)
Controls								
Treated	-0.016 (0.23)	-	-0.076 (0.17)	-	-0.17 (0.18)	-	-0.224 (0.22)	-
After	0.273 (0.47)	-0.1 (1.1)	0.042 (0.13)	-0.021 (0.63)	9.01 (9.4)	-2.067*** (0.72)	-	-2.008** (0.85)
Log(HHI)	YES	YES	YES	YES	-	-	-	-
Share_network	YES	YES	-	-	YES	YES	-	-
Intercept	26.56 (54.58)	-	-1.96 (6.9)	-	-	-102.8*** (35.44)	8.964 (9.69)	-107.1*** (37.95)
Other controls	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Joint sig. test	7.6***	6.58***	9.8***	5.49***	61258***	5.65***	385.98***	4.75***
R^2	0.98	0.17	0.995	0.2	0.977	0.2099	0.979	0.2035
Number of ids	106	106	106	106	106	106	106	106
Number observations	836	836	836	836	836	836	836	836

Notes: We apply an instrumental variables procedure (IV) when HHI is included as explanatory variable. Standard errors are in parenthesis. They are robust to heterocedasticity, and they are also clustered at the route level except in the pooled model where we assume an AR-1 process in the error term. Statistical significance at 1% (***), 5% (**), 10%

Table 7. Results of the estimates – Probability of openness: Matching sample

Dependent variable	$D^{air\_services}$	
Method	**Logit (pooled model)**	**Logit (Fixed Effects)**
D^{Open_skies}	0.53*** (0.11)	1.896*** (0.73)
Odds Ratio	1.67*** (0.19)	6.66*** (4.6)
Controls		
Treated	0.13 (0.21)	-
After	-0.173 (0.14)	-1.13 (3.1)
Log (Distance)	-0.58*** (0.25)	-
Log (Population at origin)	0.996*** (0.12)	3.662 (5.34)
Log (Population at destination)	0.635*** (0.07)	-13.15 (11.76)
Log (GNI at origin)	0.943** (0.44)	11.76 (14.84)
Log (GNI at destination)	0.005 (0.83)	-4.28 (4.14)
$D^{Tourist}$	2.893*** (0.389)	-
$D^{Ex\text{-}colony}$	1.279*** (0.195)	-
Log (openness at origin)	1.180** (0.59)	3.746* (2.1)
Log (openness at destination)	1.544*** (0.29)	2 (3.18)
Intercept	-29.5** (9.47)	-
Year fixed effects	YES	YES
Joint significance test	236.95***	93.58***
R^2	0.21	-
Number of ids	1848	155
Number observations	14784	1240

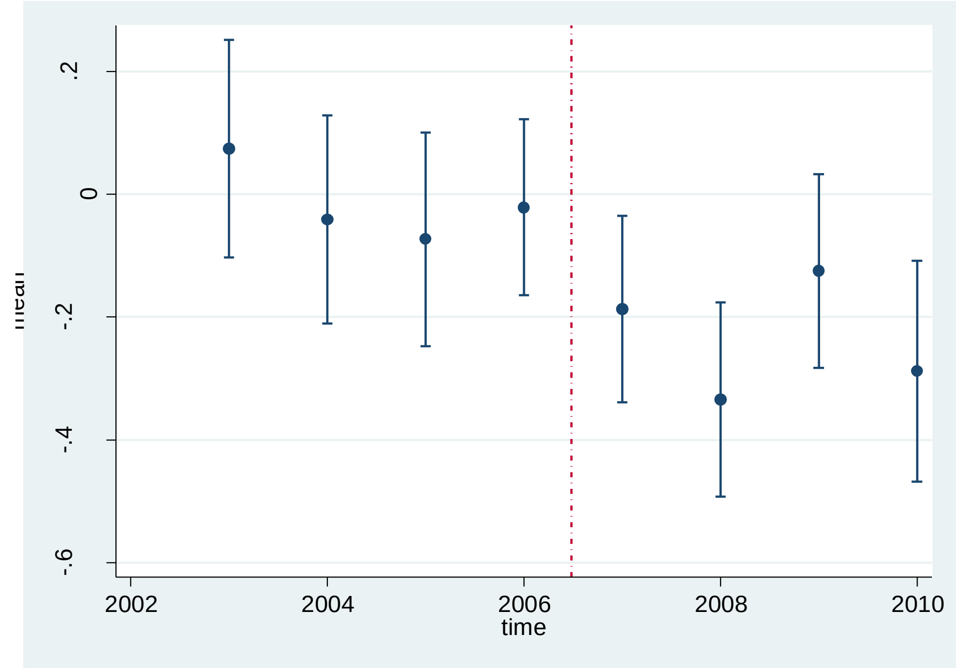
Notes: Standard errors are in parenthesis. They are robust to heterocedasticity and clustered at the route level in the pooled regression and applying bootstrap standard errors in the fixed effects regression. Statistical significance at 1% (***), 5% (**), 10% (*). In the fixed effects regression, 1629 routes (13032 observations) are dropped because the dependent variable has all positive or all negative outcomes.

Table 8. Robustness checks: Falsification tests

Dependent variable	**Log (seats)**		**Probability of openness of new routes**	
Method	**Pooled**	**Fixed Effects**	**Logit (pooled model)**	**Logit (Fixed Effects)**
D^{Open_skies}	-0.028 (0.068)	-0.015 (0.08)	0.0098 (0.23)	-0.017 (3.06)
Treated	-0.11 (0.077)	-	-0.27 (0.4)	-
After	13.28* (7.03)	0.796 (0.31)	-0.09 (0.11)	1.5 (0.998)
Controls	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Joint significance test	181321***	12.23***	359.7***	71.55***
R^2	0.987	0.167	0.24	-
Number of ids	138	138	2905	193
Number observations	1085	1085	23240	1544

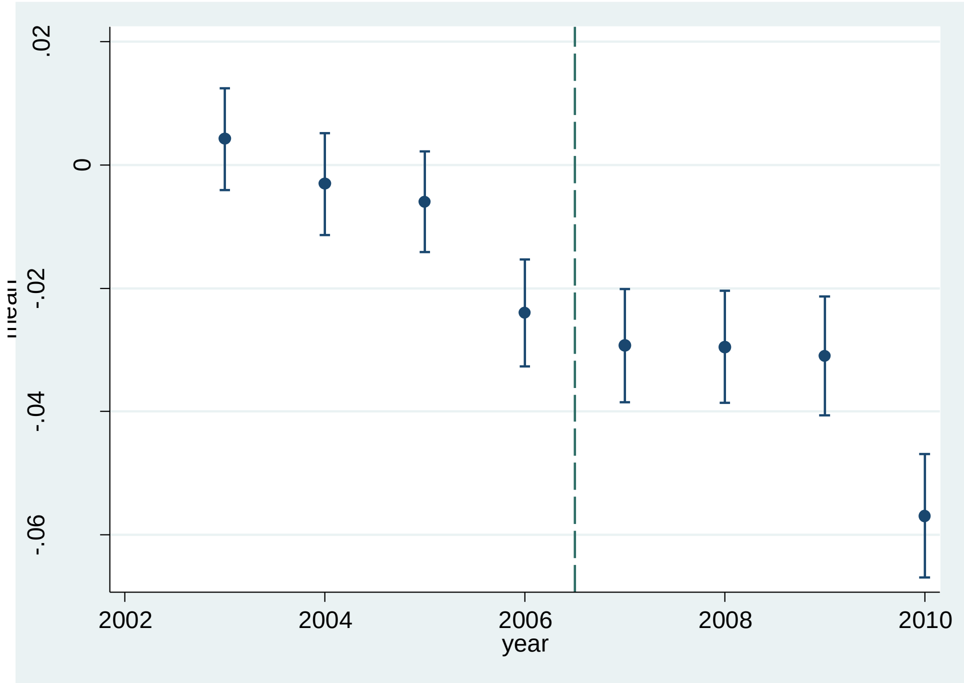
Notes: Standard errors are in parenthesis. Statistical significance at 1% (***), 5% (**), 10% (*).

Figure 1. Mean differences in seats offered by period. Treated and control groups.



Notes: The dot line divides periods in pre and post Openskies. The null hypothesis of equality of means between control and treated groups cannot be rejected for all years of the pre-reform period.

Figure 2. Mean differences in the probability of openness of new routes by period. Treated and control groups.



Notes: The dot line divides periods in pre and post Open skies. The null hypothesis of equality of means between control and treated groups cannot be rejected for 2003-2005 pre-reform period.

Appendix

Table A.1 Seats offered. Logistic regression. Matching Procedure

Dependent variable	Treated
GNI at origin	-0.0025*** (0.0005)
$D^{Tourist}$	-2.2 (1.64)
ALI	0.68 (0.23)
Openness at origin	-0.018 (0.05)
Intercept	9.73*** (3.66)

Notes: Standard errors in parenthesis. Statistical significance at 1% (***), 5% (**), 10% (*).

Table A.2 Seats offered. Mean differences selected variables. Comparison between samples, year 2006

Characteristic	Whole sample	Matching sample
GNI at origin	4638*** (609)	2463*** (161)
$D^{Tourist}$	0.32*** (0.066)	0.38*** (0.07)
ALI	-3.14*** (0.735)	1.04** (0.4)
Openness at origin	2.04*** (0.46)	0.27 (2.2)

Notes: Standard errors in parenthesis. Statistical significance at 1% (***), 5% (**), 10% (*).

Table A.3 Probability of openness of new routes. Logistic regression. Matching Procedure

Dependent variable	Treated
Distance	-0.003***(0.0001)
Pop at origin	-0.0009*** (0.00008)
GNI at origin	-0.0015*** (0.00006)
GNI at destination	-0.00009*** (0.00001)
Tourist	-1.57***(0.23)
Colonial	-1.01*** (0.27)
ALI	0.28*** (0.02)
Op at origin	-0.13***(0.009)
Intercept	27.7*** (1.4)

Notes: Standard errors in parenthesis. Statistical significance at 1% (***), 5% (**), 10% (*).

Table A.4 Probability of openness of new routes. Mean differences selected variables. Comparison between samples, year 2006.

Characteristic	Whole sample	Matching sample
Distance	317*** (37)	123*** (45)
Pop at origin	354*** (89)	62.2 (55.6)
GNI at origin	3851*** (163)	2111*** (84)
GNI at destination	965*** (181)	-226 (199)
Tourist	0.18*** (0.015)	0.27*** (0.018)
Colonial	-0.02* (0.012)	-0.05 ***(0.017)
ALI	-3.14*** (0.735)	-2.66*** (0.22)
Op at origin	2.04***(0.46)	3.27*** (0.57)

Notes: Standard errors in parenthesis. Statistical significance at 1% (***), 5% (**), 10% (*).