# Economic Effects of Air Transport Liberalization in Africa

Megersa A. Abate (Ph.D)*

Swedish National Road and Transport Research Institute

October, 2013

**Abstract**

Although the aviation industry is increasingly becoming important for Africa's economic integration, the ability of airlines to access foreign markets remains hindered by restrictive regulatory policies. Attempts have been made to fully liberalize the intra-African air transport market. Except general assertions on the merits/demerits of liberalization, our empirical understanding of the welfare effects of such polices in Africa remains rudimentary. This study empirically measures the economic effects of air transport liberalization mainly on two supply side variables: fare and departure frequency. The results show up to 40% increase in departure frequency in routes that experienced some type of liberalization compared to those governed by restrictive bilateral arrangements. Furthermore, there is relatively larger increase in the number of departure frequency in routes which experienced partial liberalization compared to fully liberalized ones. While the service quality improving effect of liberalization is substantial, there is no evidence of its fare reducing effect.

Keywords: Air Transport; Liberalization;Yamoussoukro Decision; Bilateral Air Service Agreements

JEL Classification : L93, L51, L9

*I would like to thank Tewodros Tamirat, Mark Smyth, Eyob Estifanos, Abbi Kedir and Charles Schlumberger for helpful comments on earlier drafts of this paper. The usual disclaimer applies. Correspondence address: megersa.abate@vti.se or meg.abera@gmail.com.

# 1 Introduction

For many African countries air transport is a vital corridor for international passenger and freight flows. The presence of an efficient air transport service increases economic competitiveness of African countries by facilitating access to the world market and enhancing regional integration. It also eases labor mobility and tourism. While the virtues of air transport are widely known, non-physical barriers continue to impede air transport service expansion between African countries. These barriers mainly stem from restrictive regulatory arrangements which dictate how the service is rendered. Owing to this trade deterring impact of restrictive regimes, there has been a general move towards liberalization in the world.

Major aviation markets have long embarked on liberal domestic and international regulatory regimes.[1] Following this trend, African countries initiated several liberalization initiatives at the bilateral, regional and continental levels. The Yamoussoukro Decision (YD) of 1999 is the umbrella arrangement which consolidated these liberalization initiatives. If its liberal provisions were fully implemented, the decision would liberalize intra-African air transport market and give African airlines commercial opportunities on equal basis. Although the YD is full of promise, its implementation has not been satisfactory.

A major implementation challenge has been the lack of adequate knowledge on the economic effects of the full implementation of the YD or the lack thereof. Will full liberalization of intra-African air transport market lead to improvement in service quality and reduction in fares? Or will it result in the disappearance of smaller airlines and abuse of market power by big airlines? In order to fully implement the YD these questions have to be thoroughly analyzed. Except general beliefs and assertions on the merits/demerits of liberalization both at the level of policy makers and airlines, so far there has been very limited empirical studies which try to systematically evaluate the impact of liberalization.[2]To this end, assessing economic effects of liberalizing intra-Africa air transport is indispensable.

[1]For a comprehensive review of regulatory reforms see Oum et al (2010) and Borenstein and Rose (2007).

[2]The main existing studies on the impact of liberalization on the continent are: Chingosho (2009); ICAO (2003); Morrison (2004); Schlumberger (2010); UNECA (2001). See Heinz and O'Connell (2013) for a detailed analysis of air transport business models in Africa and Ssamula and Venter (2013) for analysis of airline networks in Africa. None of these studies, however, empirically measure the economic effects of liberalization as in this study

This study evaluates the economic effects of air transport liberalization in Africa. It does so by developing two econometric models to analyze the effects of liberalizing Bilateral Air Transport Services Agreement (BASA). Fare and departure frequency models were estimated to analyze the causal effects of liberalization polices in reducing fare and improving service quality, as would be expected under liberalization. In line with Schipper et al (2002) and Dresner and Tretheway (1992), all the models were estimated by a Two-Stage Least Square 'random effects' method using a panel dataset on 20 intra-African city-pair routes to/from Addis Ababa in the years 2000-2005. These data is unique and describe routes that represent varying degree of liberalization status and distances. These routes can help us see the effect of liberal policies in the presence of a dominant airline (Ethiopian Airlines) and thin market, which is mostly the case in other parts of Africa.

The results show up to 40% increase in departure frequency in routes that experienced some type of liberalization compared to those governed by restrictive bilateral arrangements. We also find that there is a higher increase in the number of departure frequency in routes which experienced partial liberalization compared to fully liberalized ones. Analysis of the effect of liberalization on air fare did not result in a statistically significant effect which rules out welfare gains from reduced fares. The rest of the paper is organized as follows: Section 2 presents an overview of the airline industry in Africa and its regulatory scene; Section 3 and Section 4 present the empirical model and the data; Section 5 presents the main findings; and Section 6 concludes and provides policy implication of the main findings.

# 2 The airline industry in Africa and its regulation: a brief overview

## 2.1 African airlines

The air transport sub-sector in Africa is full of contradictions. There are a number of conditions which could make the aviation industry thriving in the continent. Africa's population size (1.1 billion) and large landmass (30.2 ml km2) presents a favorable environment for air transport industry. The fact that almost a third of African countries (16 out of 54) are landlocked and that alternative modes of transport are under-developed make air transport all the more important.[3] While these conditions are seemingly favorable, decades of economic stagnation and low per-capita incomes in many African countries have made commercial aviation in Africa the least developed in the world.

Africa accounts for a small share (2%) of the global air traffic flow. The majority of African countries depend on few African and foreign airlines for air service. AFRAA (2010) reports that about 65% of the air traffic to and from Africa is carried by foreign airlines. This skewed statistics reflects underlying problems in Africa. Most African countries do not have a competent airline that can operate international services allowing foreign airlines to capitalize on slack demand. The dominance of foreign airlines is also a reflection of African airlines' sever capacity constraint. In 2006 they operated a total of 639 aircrafts, a number which is not more than a total aircraft owned by a major American or European airline (Airclaims, 2006). A case in point, Lufthansa, which flies to 35 African destinations, owns 672 aircrafts (Lufthansa Group, 2013). See Figure 1 which shows major African airline destinations.

Intercontinental passenger flow (45%) constitutes far more than intra-African flow (22%) (AFRAA, 2010). This traffic flow mirrors Africa's trade statistics which shows that the continent trades much more with the rest of the world than with itself (only 11.3% of Africa's trade is within the continent, UNCTAD, 2013). The big market share of intercontinental traffic is also attributed to the route network of African airlines that is characterized by a poor regional networks and greater focus on route development mostly to European capitals (UNECA, 2005) and in recent years to the Middle East and the Far East. The small intra-African air traffic is also too small to sustain the operation of several airlines on a particular route.

The prospects of the African air transport industry are relatively promising. According to Boeing's estimates, a robust international passenger annual growth rate of 6.6 % is expected in the 2011 to 2031 period in Africa, well above the previous long-term industry average rate of 5 % (Boeing, 2012). This forecast is based on sustained GDP growth, the rise of the African middle-class consumer, and urbanization.[4] To the extent that these optimistic outlooks are realized, it is crucial to put in place the right set of regulatory regimes that foster a productive aviation industry and participation of African airlines.

[3] According to the African Development Bank in 2010 the aviation industry in Africa supported about 7 million jobs (including 257,000 direct jobs) which worth USD 67.8 billion of the continent's GDP (AFDB, 2012).

[4] It has been shown that growth in GDP explains about two-thirds of air travel growth (ATAG, 2004).

## 2.2 The regulatory scene of the intra-African air transport market

Like many international industries which have long started operating in the worldwide market in liberal arrangements, the airline industry's regulatory scene has also shifted towards liberalization. This shift had its beginning when the US deregulated its domestic market in the late 1970s. Subsequently, the US started to follow a liberal 'Open Skies' policy in its air transport services negotiations with the rest of the world.[5]In 1993 the EU also created a single market in which member countries' airlines are given freedom of establishment, market access, capacity and tariff (fare) fixing for air transport within its borders.

In Africa, a similar continent-wide package is the 'Yamoussoukro Decision' (YD) which was adopted in 2000 by heads of states to progressively open air transport within the continent. The decision was signed in Yamoussoukro, Ivory Coast and was expected to progressively eliminate all the non-physical barriers relating to: the granting of traffic rights, particularly fifth traffic right, the capacity of aircrafts, tariff regulation, designation of airlines and air freight operations (UNECA, 2002). According to Article '7' of the decision, provisions of the YD take precedence over all the previous BASAs signed between African countries. However, the practice so far has been a negotiated move whereby individual countries negotiate bilaterally based on the YD provisions. Hence, each country has some control on the pace and extent of openness since liberalization is a negotiated move.[6]

Currently, most international air transport services in Africa are conducted under the web of bilateral agreements that put restrictions on entry (market access), capacity (frequency and aircraft type), and foreign ownership of airlines. Besides, traffic rights, airline designation and fares are also subject to restrictive regulatory control. Provisions of these agreements are based on a reciprocal exchange of rights, which are supposed to be exploited by the designated airlines of bilateral partners.

Table 1 presents the main provisions of the YD compared to traditional BASAs and Liberalized BASAs. In terms of fare and capacity regulation, the YD is as open as liberalized BASAs. Traffic right provisions are also very open, but they only cover points

[5] 'Open Skies' policy refers to airline markets where there is an absence of regulatory controls. It could be applied to a bilateral agreement, in which there are no capacity, entry or price regulations on the airlines of the bilateral partners which do, or might, serve the route. Such agreements will typically allow for more competition between the airlines of the partner countries and they make more trade possible (Forsyth, pp. 56, 2001).

[6] Abeyratne (2003) points to the inherent problem of the decision by indicating that the YD resulted in a 'limited open skies regime' since the 'State Parties' have the ultimate discretion on fifth freedom rights.

in Africa (See Figure A1 in the appendix for definition of traffic rights). The YD allows ownership of airlines by third states if they are signatories of the decision which makes it more liberal than traditional BASAs. It is, however, more restrictive than liberalized bilateral regimes which allow flexible airline ownership.

Although the YD is full of promise, its implementation has not been satisfactory. As a result, BASAs are still the main regulatory mechanism through which African countries conduct their air transport service relations (Tamirat, 2006). The institutional and legal frameworks required for the implementation of the YD have not been put in place, making enforcement difficult. These are the absence of an executing agency, competition regulations and dispute settlement mechanisms.[7] Countries with smaller airlines are concerned that full implementation of the YD may lead to disappearance of their airlines as a result of anti-competitive behavior by bigger airlines. This apprehension towards open policy in aviation is akin to one facing regional integration initiatives in Africa (Geda and Kibret, 2008).

## 3 Econometric framework

The basic argument for liberalizing air transport market is the prospect of direct and indirect gains from competition. Such gains, in the form of reduced air fare and improved service quality, have been well documented in the matured aviation markets of North America, Europe, and Australia and to some extent in South East Asia (Cristea et al, 2012; Oum et al 2010; Gillen et al, 2002; Australian Productivity Commission 1998; Brattle Group, 2002). However, in a less matured airline markets like in Africa where airlines operate in a thin market and face capacity and infrastructure constraints, the feasibility of such gains is yet to be tested.

The main objective of liberalizing air transport markets is to maximize benefits associated with the direct and indirect gains from a competitive environment. The empirical model in this paper is based on a proposition that the liberalization of air transport market affects two supply side variables: fare and frequency. We hypothesize that liberalization reduces fare by increasing competition between airlines It also improves service quality by increasing departure frequency, a key quality of service indicator in the aviation

[7] Although it is long overdue, the African Civil Aviation Commission (AFCAC) is currently working on the setting up of these institutional frameworks (AFCAC, 2013).

industry.[8] Most African airlines engage in connecting flight operations due to thin point-to-point intra-African market. This demand problem forces airlines to operate multiple destinations simultaneously which requires the presence of 5th traffic rights to and beyond intermediate points of city-pair routes. As more 5th traffic rights are granted under liberalization, airlines can manage to connect more city-pairs in Africa which in turn leads to improvements in service quality. What follows presents an econometric model of air transport demand followed by models which show the effect of liberalization on fare and departure frequency.

### 3.1 The demand model

A standard air transport demand model includes own price (fare) and service quality as the main explanatory variables (Schipper et al, 2002; Dresner and Tretheway, 1992). It also includes 'gravity' model variables such as the population and GDP of the origin and destination countries of a trip, and the distance between them. The first two are 'generative' variables that capture a catchment area for potential travelers, whereas distance is an 'impedance' variable because social and economic interactions between countries tend to decline with it. Accordingly, a reduced form model for air passenger demand for route $r$ in period $t$ is given as:

$$pass_{rt} = \beta_1 + \beta_2 fare/km_{rt} + \beta_3 freq_{rt} + \beta_4 income_{rt} + \beta_5 pop_{rt} + \beta_6 dist_{rt} + \epsilon_{rt} \qquad (1)$$

where $pass_{rt}$ is the number of round-trip passengers carried in route $r$ during year $t$; $fare/km_{rt}$ is the roundtrip economy fare; $freq_{rt}$ is the number of departure frequency; $income_{rt}$ and $pop_{rt}$ are the product of the per capita income and populations size of the route endpoint countries; $dist_{rt}$ is the great circle distance between airports of the route endpoints in km. All the variables are in logs, allowing the coefficient estimates to be interpreted as elasticity.

The inclusion of fare in the passenger demand equation is justified for obvious reasons. The usage of standard economy fare, however, disregards the fact that airlines offer various fares depending on the type of travelers (e.g. business or leisure). If possible, the lowest available fare should be used to study the response of demand to fare level changes. This

[8] Baltagi et al (1995) attribute the route structure effects of liberal policies as the most remarkable of all. This is due to the fact that air transport is a network industry. Thus having flexibility in terms of route selection, frequency of operation and aircraft capacity choice allows an airline to operate in the most efficient network.

is because it is more likely that a change in the lowest fare affects air travel decision compared to other fare classes (Mallebiau and Hansen, 1995). Unfortunately, our dataset does not contain fares based on classes. Despite the potential measurement bias, the widely available economy fare is used in the literature as a proxy (Shipper et al, 2002; Nero, 1998; Dresner and Tretheway, 1992).[9] Since Addis Ababa is the common end-point of all the routes in the sample, only the population and the income of countries at the other end of a route are considered.[10] We expect these two 'generative' variables to have a positive effect on demand while distance, the 'impedance' variable, is expected to have a negative effect.

The fare and frequency variables pose endogeneity problem because of their simultaneous determination with demand (the dependent variable). For instance, a higher traffic flow between two cities may lead to realization of 'economies of traffic density' that lowers the average cost and ultimately lead to a lower fare.[11] There is, therefore, a feedback effect from the left-hand-side variable, 'pass', to the fare level. As for frequency, airlines are likely to adjust their departure frequencies as a response to an increase in demand, again reversing the causality maintained in our specification. Jorge-Calderon (1997) and Schipper et al. (2002) show that frequency has a positive effect on demand. However, only the latter accounts for the endogeneity of frequency and fare in the demand equation. We follow a similar empirical strategy by Schipper et al. (2002) and estimate separate fare and frequency models.

### 3.2 The fare model

Following Schipper et al (2002), the fare level between two route endpoints is specified by the following log-linear model:

$$fare/km_{rt} = \alpha_1 + \alpha_2 pass_{rt} + \alpha_3 freq_{rt} + \alpha_4 dist_{rt} + \alpha_5 libf_{rt} + \alpha_6 libp_{rt} + \alpha_7 income_{rt} + \zeta_{rt} \quad (2)$$

where $libf_{rt}$ and $libp_{rt}$ are liberalization status dummy variables for fully liberalized and partially liberalized routes based on bilateral air service agreements (BASAs). The

[9] Nero (1998), justifies usage of economy class fares by arguing that they are more linked to costs and other fare categories which are determined as either a 'mark-up' or a 'discount' on economy fare.

[10] This is a common approach in the literature, see for example Oum et al (1993) and Brander and Zhang (1990).

[11] Caves et al (1984, p.p. 475) define 'economies of density' as ' the proportional increase in output made possible by a proportional increase in all inputs, with points served, average stage length, average load factor, and input prices held fixed.' If airlines manage to realize such economies, there is a possibility they may transfer it to consumers in the form of lower fare.

liberalization dummies are expected to have a negative effect on fare.

We assume all variables, except $pass_{rt}$ and $freq_{rt}$ are exogenous. As noted by Dresner and Tretheway (1992), the sign of 'pass' depends on the part of the marginal cost curve on which airlines operate. On the one hand, if they happen to operate in the upward sloping part of the marginal cost, a higher output level (higher number of passengers) leads to higher marginal cost. The reason behind such a positive effect of demand on fare could be the presence of short-run capacity constraint. On the other hand, a negative coefficient of the passenger variable can occur when airlines operate in the declining part of their marginal cost. The negative effect arises due to the presence of excess capacity and/or realization of 'economies of traffic density' (Nero, 1998). We expect a positive sign for 'pass' since most African airlines are faced with capacity constraint. Finally, a negative coefficient is expected for distance, showing that cost per kilometer declines ( and hence fare) with distance as fixed costs incurred at route end points is averaged over longer distance.

### 3.3 The frequency model

We model the number of departure frequency as:

$$freq_{rt} = \lambda_1 + \lambda_2 pass_{rt} + \lambda_3 acsize_{rt} + \lambda_4 dist_{rt} + \lambda_5 libf_{rt} + \lambda_6 libp_{rt} + \lambda_7 operators_{rt} + \upsilon_{rt} \quad (3)$$

where $acsize_{rt}$ and $operators_{rt}$ stand for the average number of seats per flight and the number of airlines in a route, respectively. The main variables of interest are $libf_{rt}$ and $libp_{rt}$. Low point-to-point demand in Africa forces airlines to serve multiple destinations simultaneously. If BASAs allowed fifth traffic right regimes, airlines would supply more service frequency by aggregating passengers from intermediate and beyond points.[12] Accordingly, we expect the liberalization dummies to have positive signs mainly due to the flexible 5th traffic right aspect of liberalized regulatory regimes.

Furthermore, an increase in the number of airlines in a given route implies a higher departure frequency as airlines compete to avail suitable service to consumers. Accordingly, we expect $operators_{rt}$ to have a positive coefficient. Finally, distance and aircraft size are expected to have a negative effect on frequency. Distance is a major 'impedance' variable

[12] Malibaue and Hansen (1995) mention $5^{th}$ traffic operations as sources of disutility since they require multiple stops as compared to non-stop services. However, in the context of Africa the presence of an air-link between city pairs has a greater importance than the disutility entailed in multiples stops.

that forces departure frequency to decrease. Operating a larger aircraft (i.e. increasing the number of seat per flight) effectively results in a decline on total number of departure frequency.

In the econometric framework outlined in Section 3, the fare and frequency variables are assumed to be endogenous in the demand equation. There are several suggestions in the literature to handle this endogeneity problem.[13] The most appropriate methodology to tackle the problem is a two-stage least square (2SLS) estimation in a panel data setting suggested by Dresner and Tretheway (1992) and Schipper et al. (2002). We employ a similar 2SLS procedure. Although the demand, fare and frequency models can be solved simultaneously, each will be estimated separately using a 2SLS. Doing so allows us to gain interesting insights into the effects of the parameters in each equation since they have important economic interpretations (Nero, 1998; Marin, 1995).

## 4 Data

The empirical analysis is based on passenger flows between a panel 20 African city-pair routes to/from Addis Ababa in the period 2000-2005. The routes comprise more than 75% of the air link the city had with African cities in the period.[14] The varying degree of regulatory statuses and flights stages in the sample give a unique opportunity to study the economic effects of liberalization policy.[15] Data on number of passengers, aircraft size, cost and frequency are gathered from statistical publications of Ethiopian Airlines and the Ethiopian Civil Aviation Authority.

The number of passengers in the data includes all passengers who traveled to/from Addis Ababa regardless of their initial origin or final destination, whereas the fare and departure frequency variables apply only to the city pair routes. The fare data is gathered from the Official Airline Guide (OAG, 2007). Information on population, GDP and GDP per capita (both in 2000 USD) are gathered from the World Bank Development Indicators online database (WDI, 2007). Table 2 presents summary statistics of the main variables.

[13] Marin (1995) applies an instrumental variable estimation method to treat the endogeneity of the passenger and the fare variables. Mallebiau and Hansen (1995) estimate the fare and passenger equations independently, treating the two variables as exogenous in each equation, while Adler and Hashai (2005) estimate their passenger demand equation which doesn't contain fare as an explanatory variable. The latter two approaches do not treat the endogeneity problem directly, and hence estimates based on them maybe inconsistent.

[14] Except in its service to Kenya, Egypt, Sudan, South Africa and Djibouti it was the sole operator on its 20 intra Africa routes to/from Addis analyzed in this study.

[15] Flight stage refers to the operation of an aircraft from take-off to its next landing.

Defining aspects of an air transport liberalization policy relevant for an empirical analysis is a challenge. The common approach in the literature is to use dummy variables which show the status of or change in a regulatory regime (Schipper et al, 2002; Dresner and Tretheway 1992; Maillebiau and Hansen, 1995; Nero, 1995 and 1998; Gillen et al, 2002). We use a similar approach and define three regulatory status categories based on BASAs of Ethiopia. Firstly, the relative openness of provisions pertaining to capacity (frequency and aircraft size), 5th traffic rights and fare define the liberalization status of a BASA. In particular, a BASA is categorized as 'liberal' if there is no government interference on the choices of departure frequency and aircraft size or 'restrictive' otherwise. Secondly, a BASA is defined as 'liberal' if it allows 5th traffic right to all intermediate and beyond points in Africa or 'restrictive' otherwise. Thirdly, a BASA is defined as 'liberal' if the fare charged by airlines is invalidated by the disapproval of both bilateral partners or/and if approval of fare by either countries' aeronautical authorities is not mandatory or 'restrictive' otherwise.

Based on the above three categorizations, the regulatory regime of a BASA is classified as: 'fully liberalized', if it attains two or more 'liberal' status; 'restrictively liberalized', if it attains one 'liberal' status; and 'restricted' otherwise. Accordingly, 10 routes fall in the "fully liberalized" category, while the remaining 10 routes are equally divided into the "restrictively liberalized" and "restricted" categories. Table 3 summarizes the provisions of Ethiopia's BASAs relevant to our sample routes.

# 5 Results

Table 4 presents results from a 2SLS random effects passenger demand model (E.q.1).[16] The endogenous fare and frequency variables are instrumented by the two liberalization dummies, 'libf' and 'libp', the number of operators and cost variable.[17] The coefficient of fare is significant at the 10 % level, and its values suggest that the demand for the city-pair routs is price inelastic.[18] This fare insensitiveness of air transport demand is expected given the type of travelers in Africa. The low income levels across the continent implies

[16] The unobserved effects should be tested to check whether they are fixed or random depending on their relation to the explanatory variables. Accordingly, we applied the Hausman specification test to contrast the null hypothesis Ho: corr ($\epsilon_{rt}$, X) = 0 (random effects model) against the alterative H1: corr ($\epsilon_{rt}$, X) $\neq$ 0 (fixed effects model). We failed to reject the null hypothesis, confirming that the random effects model is appropriate.

[17] See Appendix 2 for details of how the cost variable is calculated.

[18] Interestingly, it is in the range for business traveler's elasticity documented by Oum et al (1992). They report the range 0.65 -1.15 as the most common for business travelers.

that air transport is still a luxury service yet to be enjoyed by the mass, implying that air travelers in Africa are price insensitive affluent business and leisure travelers. Although leisure travelers are generally shown to be price sensitive in other markets (see for example, Brons et al, 2002, Ippolito, 1981), lack of adequate alternative modes of transportation within the continent force them opt for air transport regardless of the fare level.

Furthermore, the number of departure frequency between the city-pair routes, as expected, has a significant positive effect on demand at the 1% level. The gravity variables, distance and urban population have significant and expected negative and positive effects on demand, respectively.[19] These results are in line with the gravity model which predicts that the chance for air travel between countries declines with distance and increases with population size. The income variable is not significantly different from zero.

Table 4 also presents results from the fare model (E.q. 2). Again the simultaneity between the fare and passenger variables is handled by the 2SLS 'random effects' estimation method. We used the population size and number of operators in a route as instruments for the two endogenous variables, the number of passengers and departure frequencies. Since most of the BASAs of Ethiopia went from restrictive to full or partial liberalization statuses in the post 2000 period, it can be difficult to net-out the effect of the liberalization policies from other changes in the period. To account for time fixed effect, we estimate two models, with and without year dummies.

The number of passenger has a positive and significant effect. This result confirms the hypothesis that African airlines face a short run capacity constraint which implies that in the event of excess demand, they probably tend to increase fare levels to ration seats or capitalize on short-run demand surges. We also note that in both models distance has the expected negative sign and is highly significant at the 1% level.[20] The negative sign indicates the presence of 'economies of flight length' which accrues to airlines as fixed costs per flight (take-off and landing costs) are distributed over longer distance (see the scatter plot of fair/km against distance in Figure 2 that confirms to this claim).

The main variables of interest in the fare model are the two liberalization dummy variables. We see in Model 1 that full liberalization has a significant, at the 10 % level, negative effect on fare. This result is in line with the hypothesis that a liberalized market

[19] Urban population variable will be used as instrument for passenger in the subsequent models since it is very significant at the 1% level.

[20] A strong and significant negative correlation (-0.9836) between distance and cost is observed, due to this the cost variable is dropped from estimation.

arrangement leads to a lower fare. Although it has the expected negative sign, partial liberalization appears to be insignificant in both models. We note that the coefficients of the two liberalization dummy variables are insignificant in Model '2'. Since Model 1 does not take time specific effects into account, the effect of full liberalization could have been overestimated. Inclusion of the year dummies in Model 2 ensures that unobserved time effects are not absorbed by the liberalization coefficients.

The disparity of the significance level of the full liberalization variable between the two models poses a dilemma as to which model to choose. We opt for the conservative specification, Model 2. This is because in the sample period (2000-2005), and even in the later years, channels through which liberalization policies could reduce the fare levels were mostly non-existent for our sample in particular and in the African air transport market in general. Previous studies on other aviation markets find that liberalization policies lead to lower fare levels as a result of increased competition between existing and/or new airlines in a post liberalization period.[21] To attest the validity of these findings in the context of the African market, we need to answer two basic questions. First, did liberalization bring about entry of new airlines? Second, was fare strictly regulated in the pre-liberalization period to justify a decline in fare, if there was any, after liberalization?

A closer look at our sample sheds light on these questions. Firstly, although multiple designations of airlines were allowed under liberalized BASAs, there were no new entries of airlines. As a result the incumbent airlines were not under any pressure to decrease fare. In fact, Ethiopian Airlines was the sole operator in almost 75% of the city-pair routes. Given such a high level of market dominance (and partly due to the airlines' good reputation), an appealing argument is that the airline was charging a monopoly markup, which effectively rules out the fare decreasing effect of liberalization policies. However, our empirical findings, particularly the negative co-efficient of the two liberalization dummies, suggest otherwise. Secondly, consultation with industry experts revealed that fare levels were not regulated even in routes governed by restrictive BASA. It is, therefore, not surprising to find that a decline in fare levels as a result of liberalization policies given the practice that fare levels were not set based on the regulatory regimes.

Table 4 presents results from the frequency model (E.q. 3). Exogenous variables from the passenger model are used as instrument for the endogenous passenger variable in the

[21] See for example Maillebiau and Hansen (1995) who empirically substantiated this assertion in the North Atlantic Market (routes between USA and Europe) resulted in lower prices by encouraging entry of efficient domestic airlines (Strassmann, 1990; Lijesen ,2002).

frequency model. All the explanatory variables are significant and have the expected sign.[22] The coefficient of passenger numbers reveals that an increase in number of passengers results in less than proportional increase in departure frequency. Schipper et al (2002) also found similar result for intra-European air transport markets. Their explanation indicates that at constant aircraft size, an increase in passenger number is accommodated partly by a frequency increase and partly by an increase in the load factor (passenger carried as a percentage of available seats per flight).[23] Both distance and aircraft size have the expected negative sign and are highly significant at the 1% level.

The two liberalization dummies are the main variables of interest.[24] Both have a significant positive effect on departure frequency, as expected. The estimated coefficient of 0.38 for partial liberalization implies that routes which experienced partial liberalization had 40% higher departure frequency than those routes without such regulatory reform. The equivalent figure for fully liberalized routes is 35%.[25] It is interesting to note that the effect of partial liberalization is larger than full liberalization although greater freedom is enjoyed by airlines in the latter regime. These seemingly contradictory effects can be explained by the diminishing marginal effect of progressive liberalization on departure frequency. Partially liberalized BASAs have proportionally higher impact probably because they contain frequency provisions that are actually operated by airlines. Nevertheless, all frequency provisos in fully liberalized BASAs may not necessarily be operated. Our findings show that there is a potential for substantial improvement in service quality by partially liberalizing restricted BASAs.

[22] Coefficients for time dummies are not reported. But all have positive sign indicating the overall upward trend of air traffic and hence frequency over time.

[23] Ethiopian airlines' average load factor in its intra-African routes was 65% on average during the sample period. As per the prediction of the model, part of any increase in passenger number was accommodated by filling empty seats rather than a significant increase in departure frequency.

[24] As expected both have positive effect on departure frequency. A move from restrictive bilateral regimes to either full or partial liberalization allows airlines to mount departure frequency to meet growing demand and/or to deliver services tailored to the needs of consumers. However, the case for demand increase as a result of a decline in fare level is ruled out because our fare model did not predict a statistically significant impact of liberalization policy. Therefore, possible positive impact of the two liberalization variables comes from the open arrangement which enables airlines to exploit fifth traffic rights to sustain more frequency.

[25] The percentage values are calculated as 100*($e^{0.38}$) and 100* (1- $e^{0.35}$) for partially and fully liberalized routes, respectively.

## 6 Conclusions

This paper has examined the economic effects of progressive air transport liberalization in Africa by studying city pair routes to/from Addis Ababa. Passenger demand, fare and departure frequency models were estimated to analyze the causal effects of liberalization polices in reducing fare and improving service quality, as would be expected under liberalization. We find up to 40% increase in departure frequency in routes that experienced liberalization compared to those governed by restrictive regimes. We also find that there is a higher increase in the number of departure frequency in routes which experienced partial liberalization relative to fully liberalized ones. This diminishing marginal return to liberalization suggests that there are substantial potential gains in service quality from partially liberalizing restricted regimes even before countries fully open their markets. Our analysis of the effect of liberalization on air fare did not result in a statistically significant effect which rules out welfare gains from reduced fares. However, the signs of our liberalization variables do not reveal the presence of market dominance.

The empirical findings of this paper help to clear two competing hypotheses concerning the effect of air transport liberalization policy in Africa. On the one hand, there are group of countries which resist liberalization policies arguing that it may lead to abuse of market dominance by big African airlines. On the other hand, there are countries (usually those with big airlines) and multilateral institutions (UNECA, African Union, World Bank) that promote the full implementation of liberalization policies such as the Yamoussoukro Decision. They argue that more competition in the market improves quality and decreases high fare levels. While we do find the service quality improving effect of liberalization substantial, there is no evidence of its fare reducing effect. Our findings also imply that the fear of market dominance abuse cannot be empirically substantiated.

Aviation policies, like other trade policies, reflect a balance between the interest of consumers and the aviation and tourism industries. Forsyth (2001) argues that this balance has changed in many parts of the world as a result of liberalization and deregulations, reflecting emphasis on consumer interests. In Africa, a similar shift towards consumer interests in shaping aviation policy is yet to happen. The following assertion by the UNECA (2001, p.1) summarizes the reality in most African countries succinctly: "An overriding motivation of the history of the economic regulation of air transport in Africa has been the desire to ensure the protection of national flag carriers. African aviation policies have been based more on the concern of protection of the interests of national airlines rather than the interests of the consumers (passengers and shippers)." The prospect of bright economic future, the rising middle-class consumer in African and most importantly changes in the global aviation market regulation have been challenging this reality.

In sum, our results provide important new insights into the economic effects of liberalization policies in African. The main policy recommendation of this study is liberalization of restrictive service frequency provisions. Doing so will help airlines provide flexible services. In the long run, this also has a potential to elicit competition between African airlines that would reduce fares. It has been proven in other regions of the world that every country should not necessarily own an airline to reap benefits of an efficient air transport service. To the extent that liberalization fosters the aviation industry, many African countries could continue to be both players and beneficiaries of the industry by introducing more competition.

## References

[1] Abeyratne, R. (2003). "Implication of the Yamoussoukro Decision on African Aviation." Air & Space Law xxiii.

[2] Adler, N., and Hashai, N. (2005). "Effects of Open Skies in the Middle East Region." Transportation Research part A 39: 878-894.

[3] AFCAC (2013). Report of AFCAC Air Transport Committee Implementation of the Yamoussoukro Decision. http://www.afcac.org/en/documents/Plenary/2013/wp/wp25.pdf [Accessed: August 12, 2013]

[4] AFDB (2012). Africa's Aviation Industry: Challenges and Opportunities. http://www.afdb.org/en/blogs/afdb-championing-inclusive-growth-across-africa/post/africas-aviation-industry-challenges-and-opportunities-10025/ [Accessed August 28, 2013]

[5] AFRAA (2013). 42nd Annual General Assembly the AG. Secretary General. http://www.afraa.org/index.php/component/docman/doc_download/47-report-of-the-afraa-secretary-general-to-the-42nd-aga. [Accessed: July, 2013]

ATAG (2004). The Economic and Social Benefits of Air Transport. Geneva, Air Transport Action Group.

[6] Baltagi, B., Griffin H. , James M. Rich, Daniel P. (1995). "Airline Deregulation: The cost pieces of the puzzle." International Economics Review 36(1): 245-258.

[7] Boeing. 2012. Current Market Outlook 2012–2031. www.boeing.com/commercial/cmo [Accessed 23 August 201].

[8] Borenstein, S. and Rose, N. (2007), How Airline Markets Work ... Or Do They? Regulatory Reform in the Airline Industry, NBER working paper No 13452

[9] Brander, J., Zhang, A. (1990). "Market Conduct in the airline industry: An empirical investigation." RAND Journal of Economics 21: 567-583.

[10] Brattle, T. G. (2002). The Economic Impact of an EU-US Open Aviation Area. London, European Commission- Directorate-General Energy and Transport.

[11] Caves, D., W.. Christensen, Laurtits R.; and Tretheway, Michael W. (1984). "Economies of Density versus Economies of Scale: Why Trunk and Local Service Airline Costs Differ." Rand Journal of Economics 15: 471-89.

[12] Chingosho, E., (2009). African Airlines in the Era of Liberalization, second ed. Nairobi.

[13] Cristea, A., D. Hummels and B. Roberson ( 2012). Estimating the Gains from Liberalizing Services Trade: The Case of Passenger Aviation, Mimeo, University of Oregon

[14] Doganis, R. (1991). Flying Off Course: The Economics of International Airlines. New York, Rutledge.

[15] Dresner, M. and M. W. Tretheway. (1992). "Modeling and Testing the Effect of Market Structure on Price: The case of International Air Transport." Journal of Transport and Economic Policy 26: 171-84.

[16] ECAA (2007). Statistical Report. Addis Ababa, Ethiopian Civil Aviation Authority.

[17] Forsyth, P. (2001). "Promoting trade in airline services." Journal of Air Transport Management 7: 43-50.

[18] Geda, A. and Haile K.(2008). Regional Economic Integration in Africa: A Review of Problems and Prospects with a Case Study of COMESA, Journal of African Economies, vol. 17, no.3, June, pp. 357-394.

[19] G.Lijesen, M., Nijkamp, Peter Rietveld, Piet (2002). "Measuring competition in civil aviation." Journal of Air Transport Management 8: 189-197.

[20] Gillen, D., Harris, R., Oum T.H (2002). "Measuring the Economic Effects of Bilateral Liberalization: Air Transport." Transportation Research Part E 38: 155-174.

[21] Heinz, S. and O'Connell, J.F. (2013). Air transport in Africa: toward sustainable business models for African airlines. Journal of Transport Geography. 31: 72–83

[22] ICAO (2003). Background to Experiences of Liberalization in Africa. International Civil Aviation Organization.

[23] Jorge-Calderon, J. D. (1997). "A Demand Model for Selected Airline Services on International European Routes." Journal of Air Transport Management 3: 23-35.

[24] Lufthansa Group, (2013). The Fleet. http://investor-relations.lufthansagroup.com/en/fakten-zum-unternehmen/fleet.html)) [Accessed: July, 2013]

[25] Mallebiau, E. H., Mark (1995). "Demand and Consumer Welfare Impacts of International airline Liberalization: the Case of North Atlantic." Journal of Transport and Economic Policy 29: 115-36.

[26] Marin, P. L. (1995). "Competition in European Aviation: Pricing Policy and Market Structure." Journal of Industrial Economics 43(2): 141-159.

[27] Martin, S. (1998). Advanced Industrial Economics. Oxford, Blackwell.

[28] Morrison, J.T. (2004). The Current State of the Airline Industry in Southern Africa. Paper Presented at the 23rd Annual Southern African Transport Conference, 12–15th July 2004.

[29] Nero, G. (1998). "Spatial Multiproduct pricing: Empirical Evidence on intra-European Duopoly Airline Markets." Applied Economics 30: 465-75.

[30] OAG (2007). World Airways Guide (2000-06), Official Airline Guide.

[31] Oum, T., A. Zhang, X. Fu (2010). Air transport liberalization and its impacts on airline competition and air passenger traffic. Transportation Journal, 49 (2010), pp. 24–41

[32] Oum, T. H., Stanbury , W.T., and Tretheway, M.W. (1991). "Airline Deregulation in Canada and its Economic Effects." Transportation Journal 30: 4-22.

[33] Oum, T. H., Waters, W.G., Yong, J.-S (1992). "Concepts of price elasticities of transport demand and recent empirical estimates." Journal of Transport Economics and Policy 1: 139-154.

[34] Oum, T. H., Zhang, A., Zhang, Y (1993). "Inter-firm rivalry and firm specific price elasticites in deregulated airline markets." Journal of Transport Economics and Policy 27: 171-192.

[35] Rodrigue, J.-p. C., Claude Slack, Brian (2013). The Geography of Transport Systems. London, Routledge.

[36] Schipper, Y., Rietveld, P., Nijkamp, P. (2002). "European Airline Reform: An Empirical Welfare Analysis." Journal of Transport Economics and Policy 36(2): 189-209.

[37] Schlumberger, C.(2010). Open Skies for Africa: Implementing the Yamoussoukro Decision (Directions in Development: Infrastructure). World Bank Publications, Washington, DC.

[38] Ssamula, B. and Venter, C. (2013). Journal of Transport Economics and Policy. 47: 279–297

[39] Strassmann, D. L. (1990). "Potential Competition in Deregulated Airlines." The Review of Economics and Statistics 72(4): 629-702.

[40] Tewodros, T. (2006). AFRAA/IATA Regulatory Affairs Forum- Africa. Africa Wings.

[41] UNCTAD (2013). Economic Development in Africa: Report 2013, Intra-African Trade: Unlocking Private Sector Dynamism. Geneva.

[42] UNECA (2001). Sub-regional meeting on the implementation of the Yamoussoukro Decision. Mali, Bamako.

[43] UNECA (2002). Clarification Issues and Articles of the Yamoussoukro Decision. Addis Ababa, United Nation Economic Commission for Africa.

[44] UNECA (2005). Compendium of Air Transport Integration and Cooperation Initiatives in Africa. Addis Ababa, Economic Commission For Africa.

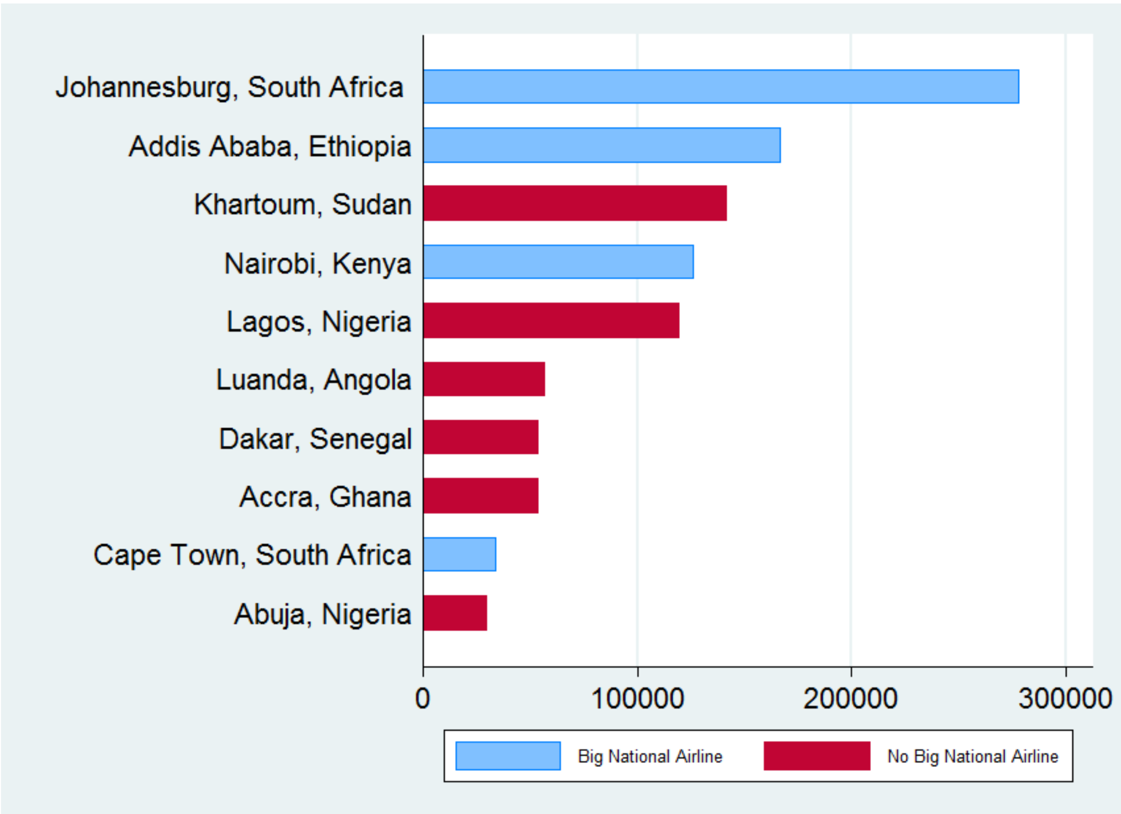
[45] WDI (2007). World Development Indicators, World Bank, Washington D.C.

Table 1: Comparisons of the Yamoussoukro Decision (YD)

| **Provisions** | **Traditional Bilateral** | **Liberalized Bilateral** | **YD** |
|---|---|---|---|
| Airline Designation | One from each contracting States | Multiple | At least one |
| Traffic Right | Limited 3rd , 4th and 5th (Only Specified routes in the BASA) | Full 5th freedom (open market access that allows flying on any route between two States) | Full 5th freedom in Africa, as of 2002 |
| Capacity | Equally shared among both designated airlines | Free choice of aircraft capacity and frequency | Free choice of aircraft capacity and frequency |
| Ownership | Substantially and Effectively owned by nationals or government of the contracting States | More Liberal provision on foreign ownership | Substantially and Effectively owned by nationals or government of the contracting States, or State Parties to the YD |
| Fares | Double Approval | Double Approval | Double Approval |

Source: Own summary based on Doganis (1995) and the YD Articles

Figure 1: Major intercontinental markets in Sub-Saharan Africa by available seats in May 2013




Source: The Wall Street Journal (2013)

Table 2: Descriptive statistics

| Variable | Mean | Std. dev. | Min | Max |
|---|---|---|---|---|
| pax | 25135.4 | 26484 | 4970 | 136066 |
| freq | 481.26 | 406.56 | 104 | 2387 |
| dist | 2907.8 | 1338.87 | 565 | 5239 |
| income | 572.36 | 677.95 | 105 | 3406 |
| Fare | 717.10 | 253.10 | 165 | 1316 |
| fare/km | 0.14 | 0.04 | 0.06 | 0.23 |
| Operators | 1.5 | 0.54 | 1 | 3 |

Table 3: Liberalization status of Ethiopia's Bilateral Air Service Agreements with selected African countries

| | | Provisions | | | | |
|---|---|---|---|---|---|---|
| | | | Capacity Choice | | | |
| Year of Agreement | Bilateral Partner | Multiple Designation | Free Frequency | Free Aircraft Type | Fare Regulation | Free 5th traffic right |
| 1970 | Burundi | Yes | Yes | Yes | DA | Yes |
| 1988 | Chad | No | No | No | DA | Limited |
| 2005 | Congo | Yes | Yes | Yes | DD | Limited |
| 1992 | Cot Devour | Yes | No | Yes | DA | Limited |
| 1998 | Djibouti | No | No | No | DA | No |
| 2005 | DRC | No | No | No | DA | Limited |
| 1995 | Egypt | No | No | Yes | DA | Limited |
| 2005 | Ghana | Yes | Yes | Yes | DD | Yes |
| 2005 | Kenya | Yes | Yes | Yes | DD | Yes |
| 2005 | Malawi | Yes | No | Yes | DA | Yes |
| 2005 | Mali | No | Yes | Yes | DA | Yes |
| 2005 | Nigeria | Yes | Yes | Yes | DD | Yes |
| 2004 | Rwanda | Yes | Yes | Yes | DD | Yes |
| 1997 | South Africa | Yes | Yes | Yes | DA | Yes |
| 1993 | Sudan | No | No | Yes | DA | No |
| 2004 | Tanzania | Yes | Yes | Yes | DD | Yes |
| 2005 | Togo | No | Yes | Yes | DD | Yes |
| 2005 | Uganda | Yes | Yes | Yes | DD | Yes |
| 2005 | Zambia | Yes | Yes | Yes | DD | Yes |
| 1990 | Zimbabwe | No | No | No | DA | Yes |

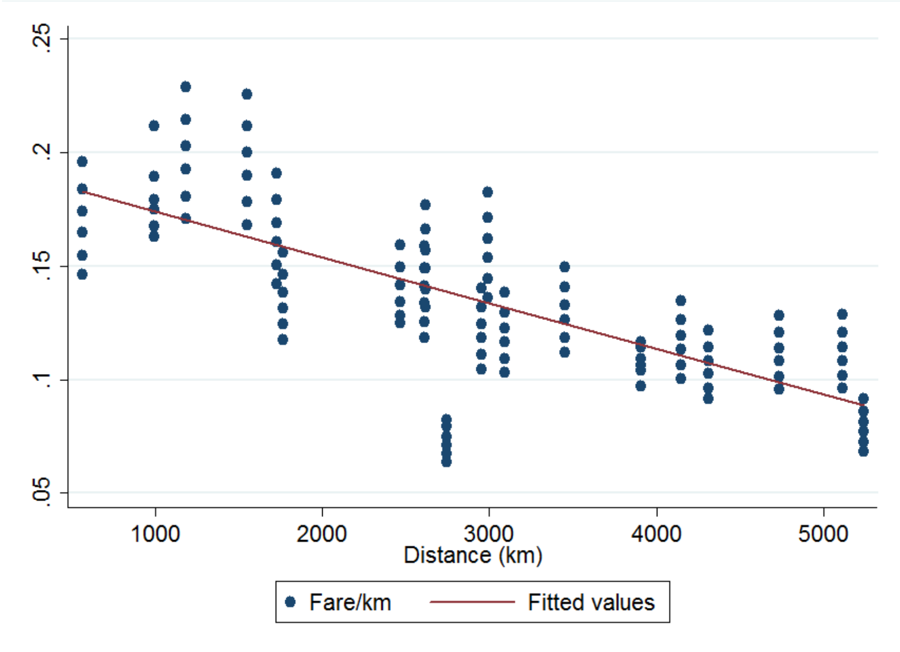
Note. DA- Double Approval, case where a proposed fare would be permitted when both nations approve it. DD- Double Disapproval, A case where a proposed fare would be permitted unless both nations veto it (this the most permissive form of pricing provisions in BASA).
Source: Ethiopian Civil Aviation Authority (ECAA, 2007)

Table 4: 2SLS random effects model results

| | Demand | Fare | | Frequency |
|---|---|---|---|---|
| | | 1 | 2 | |
| Fare/km | -0.719* | | | |
| | (0.399) | | | |
| Distance (*dist*) | -0.400** | -0.258*** | -0.306*** | -0.340** |
| | (0.197) | (0.0780) | (0.0621) | (0.141) |
| Population (*pop*) | 0.264*** | | | |
| | (0.0781) | | | |
| Income | -0.0613 | -0.117** | -0.0536** | |
| | (0.104) | (0.0538) | (0.0226) | |
| Frequency (*freq*) | 0.593*** | -0.0992** | -0.0264** | |
| | (0.0726) | (0.0410) | (0.0106) | |
| Number of passengers (*pass*) | | 0.251*** | 0.0222* | 0.710*** |
| | | (0.0307) | (0.0115) | (0.0737) |
| Full liberalization (*libf*) | | -0.206* | -0.100 | 0.350** |
| | | (0.109) | (0.0833) | (0.171) |
| Partial liberalization (l*ibp*) | | -0.0783 | -0.0304 | 0.380* |
| | | (0.129) | (0.101) | (0.203) |
| Aircraft size(*acsize*) | | | | -0.0483** |
| | | | | (0.0200) |
| Number of operators (operators) | | | | 0.0867 |
| | | | | (0.181) |
| Year Effect | | | Yes | |
| Constant | 2.888** | -0.801 | 0.561 | 2.888** |
| | (1.274) | (0.615) | (0.479) | (1.303) |
| R-squared | 0.86 | 0.17 | 0.65 | 0.83 |
| Observations | 120 | 120 | 120 | 120 |
| Number of Groups | 20 | 20 | 20 | 20 |

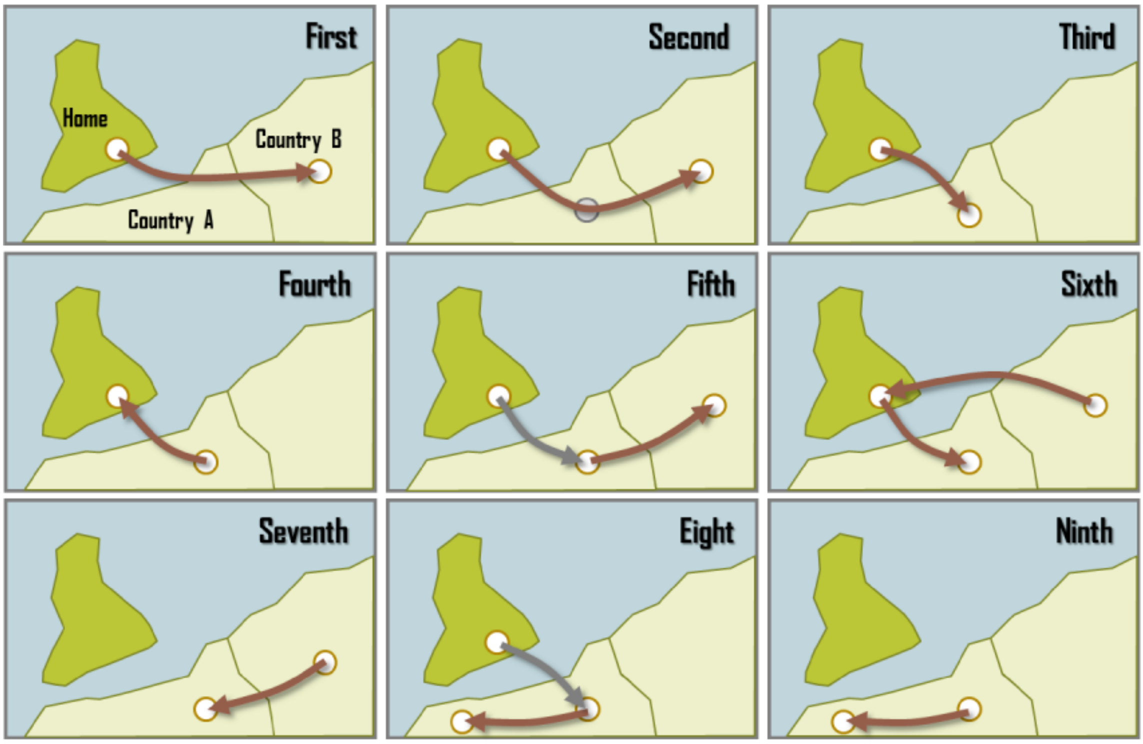
Note: All continues variables are in logs. Standard errors are in parentheses. Significance is marked as *** p<0.01, ** p<0.05, * p<0.1.

Figure 2: Economies of Flight Length (Fare/km vs. Distance)



Appendix 1

Figure A1: Freedoms of the Air (Air Traffic Rights)




Note:

**First Freedom**. The freedom to overfly a foreign country (A) from a home country en-route to another (B) without landing

**Second Freedom**. The right of an airline from one country to land in another country for non-traffic purposes, such as refueling, repairs and maintenance, while en route to another country

**Third Freedom.** The right of an airline from one country to carry traffic from its own country to another country

**Fourth Freedom.** The right of an airline from one country to carry traffic from another country to its own country

**Fifth Freedom**. The right of an airline from one country to carry traffic between two other countries provided the flight originates or terminates in its own country

**Sixth Freedom**. The (unofficial) right of an airline from one country to carry traffic between other countries via its own country. This is a combination of third and fourth freedom

**Seventh Freedom**. The right of an airline to operate flights between two other countries without the flight originating or terminating in its own country

**Eighth Freedom.** The freedom to carry traffic between two domestic points in a foreign country on a flight that either originated in or is destined for the carrier s home country.

**Ninth Freedom**. The freedom to carry traffic between two domestic points in a foreign country. Also referred to as "full cabotage" or "open-skies" privileges. It involves the right of a home country to move passengers within another country (A).

Source: Rodrigue et al (2013)

Appendix 2

Cost is approximated by the average cost of the main operators in a route. Cost is expected to have a positive sign since higher operating cost is reflected as a higher fare. We assume cost symmetry in this study, and cost is calculated using Ethiopian Airlines' operating cost data. Cost is usually estimated by $c^{i}{}_{rt} = cpk_t^i \left(D_r / AFL_t^i\right)^{-\theta} D_r$ for route specific marginal cost where, $cpk_t^i$ is each airline's cost per-kilometer for an average route in Africa, $AFL_t^i$ is each airline's average flight length for the Africa market as a whole and $D_r$ is the distance of the route 'r'. The value of '$\theta$' lies in $0 \prec \theta \prec 1$ range (Oum et al, 1993, Brander and Zhang, 1990). The rationale behind this range suggested in the airline Economics literature is that costs are strictly concave in distance. Therefore, '$\theta$ 'captures economies of 'stage length', whereby the cost per unit distance decreases as fixed terminal costs are spread over more distance units. The value of theta is usually assumed to be 0.5 (Oum et al, 1993).