Aviation contribution to trade

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Trade and Aviation: reality spot

- Aviation is essential for people and freight mobility...
- ... and its importance is increasing over time
- World economy will be growing annually average rate of 3.2% within the following 20 years and the passenger traffic will be enhancing at a rate of 4.7-5.1% in the worldwide
- Air-freight carries nearly 40% of world trade by value and is increasingly important in the movement of high-value/low-bulk products, of express packages and of perishables such as exotic fruit and flowers.
- 25-30% of US international trade by value is moved annually by air and, domestically, airfreight accounts for 56% of the market BUT only 0.4% in terms of weight
Aviation growth and trade

- Aviation is a key factor in the growth process of regional and national economies.

- Four main economic impacts (Percoco 2010, Button & Yuan 2013)
  1. direct/primary (income generated by fixed investments)
  2. indirect/secondary (income generated by chain of suppliers)
  3. induced/tertiary (income generated by spending of employees generated by direct & indirect)
  4. catalytic/perpetuity (driver of productivity growth & attractor of new firms)

- Different relationships between:
  - national economies (aviation system)
  - major cities (inverse relationship?)
  - regional economies
Anecdotal evidence suggests that air transport improves business operations (rapid access to input supplies, interaction by enabling face-to-face meetings, and provides critical input for on-time industries, Baker et al. 2015).

BUT is aviation a determinant of growth or is growth a determinant of aviation?

More developed cities/regions lead to higher aviation activities?

Bi-directional causal relationship (i.e., jointly determined)?

Need to explore the casual link between aviation and growth

Two approaches

1. Granger causality test (Button & Yuan 2013, Mukkala & Tervo 2013, Baker et al. 2015)

2. 2-stage least square/instrumental variables regression (Brueckner 2003, Green 2007, Percoco 2010, Bloning & Cristea 2015)
Methodological issues

- Typical Granger causality test approach

\[ y_{it} = \sum_{k=1}^{p} \gamma^k y_{it-k} + \sum_{k=1}^{p} \beta_i^k x_{it-k} + \epsilon_{it} \]  

- \( \epsilon_{it} \) = error term of a panel model, \( p \) = number of lags, \( \gamma^k \) = autoregressive coefficients, \( \beta_i^k \) = regression coefficient slopes (\( x \) includes aviation)

- Equation (1) implies testing for linear restrictions on coefficients
Methodological issues

- An example of 2SLS/IV approach (Percoco 2010)

\[ G = f(T, X) + \epsilon \]  \hspace{1cm} (2)

- \( G \) = growth, \( T \) = aviation activity, \( X \) = set of controls
- \( T \) is function of some variables

\[ T = \sum_{k=1}^{K} \beta_k Z_k + \nu \]  \hspace{1cm} (3)

- \( Z \) = variables related with \( T \) but not with \( G \)
- Age, education, tourism, centrality (distance between local and national centroids), hub
- First regress Eq. (3) and get predicted \( \hat{T} \), then regress Eq. (2) using \( \hat{T} \).
Empirical evidence on aviation & growth

- Convergence that aviation has a positive impact on growth
- Button et al. (1999) higher high-tech employment if airport located in US metropolitan areas
- Brathen & Halpern (2012) relevance of aviation in Northern Europe remote regions
- Mukkala & Tervo (2013) show Granger causality between aviation and regional growth using data from 86 European regions with focus on large airports
- Brueckner (2003) finds +10% in PAX leads to +1% in service employment
- Percoco (2010) shows +10% in PAX leads to +0.45% in employment in the province with airport and +0.2% in neighbouring provinces (spatial effects)
Trade, growth and aviation

- According to neoclassical growth theory TRADE is a determinant of growth
- If aviation affects TRADE then higher growth
- Use TRADE among the region/country with all commercial partners as a proxy for better business operations
- Aviation can improve business operation through face-to-face meetings, rapid input supplies, rapid deliveries, etc.
- Aviation can also improve tourism
- Question: is Aviation a determinant of TRADE?
Trade and developing countries

- Developing countries can benefit from aviation through ...
- tourism (In Africa according to the World Tourism Organization (UNWTO), market share for global tourism grew from 3% in 1980 to 5% in 2010, whereas in Asia Pacific grew from 8% in 1980 to 22% in 2000.)
- exports of ”exotics” (flowers (from South America), fruits)
- exports of high-value final products (with Western countries brands)
Trade and African countries
Trade and African countries

- Analysis of provisions of air transportation services among Sub-Saharan African countries and their trade
- Aviation have stimulated intra-regional trade?
- Much of sub-Saharan trade is with Europe and America (only about 12% internal)
- Poor infrastructure: 1/3 of Africans living in rural areas are within 2 km of an all-season road (compared to 2/3 in other developing regions)
- 16.8 km of road per 1,000km² in Sub-Saharan Africa (compared to 124km for middle-income countries throughout the World).
- Poor maintenance
Trade and African countries

Potential aviation contribution

Air transportation offers (1) flexibility, (2) relatively low infrastructure costs, (3) interesting mix of mobile and fixed capital for developing public-private partnerships.

- Africa represents less than 2% of the world passenger aviation market, and less 1% of the cargo market
- According to forecasts, African RPK and cargo growth will outpace global trends
Aviation agreements

- Lack of genuine interconnectivity within the African air transportation network despite efforts to improve this (Yaound Treaty 1961, Yamoussoukro Declaration 1988, Banjul Accord for an Accelerated Implementation of the Declaration, 1997)
- Yamoussoukro Decisions of 1999 subsequently committed to deregulate air services (44 signatory countries)
- Slow subsequent progress, but reform can be beneficial where it does occur (Schlumberger, 2010).
- Nairobi-Johannesburg route was fully opened up in 2003, passenger volumes increased 69-fold.
- Domestic South African market was liberalized, passenger volumes increased by 80%, and fares drop by 18%.

Overall little integration of airline networks in Africa.
African airlines

- Over a 1/4 of routes served by only one monopoly carrier
- Of what is carried by African carriers, 80% goes on 20% of the airlines
- Subsidies to flag carrier in many countries $\Rightarrow$ scarce resources to prop up inefficient airlines
- No growth of LCCs
- Shortage of skilled labor, corruption, over staffing, a strong travel agency network that takes 7% commission, thin routes, low Internet penetration, poor and lack of investment opportunities for fleet modernization
- Africa also has a poor safety record: in 2012 African airlines had one accident for every 270,000 flights whereas the industry average was one accident per 5 million flights
- Low utilization of aircraft (6.9h/day vs 9.9 European carriers); Low LFs (69.7% in 2010 vs a global average of 75.2%); Market instability (37 new airlines 2000-2010, 37 failing)
Empirical strategy

- Tinbergen (1962) gravity model framework

\[ T_{ij} = G \left( \frac{M_i^{\beta_1} M_j^{\beta_2}}{D_{ij}^{\beta_3}} \right) \]  \hspace{1cm} (4)

\( T_{ij} \) = trade flows between country \( i \) and \( j \); \( M_i \) = size of economy in country \((i)\); \( D_{ij} \) = distance between country \( i \) and \( j \); \( G \) = constant.

- Log-linear model

\[ \log T_{ij} = \log G + \beta_1 \log M_i + \beta_2 \log M_2 + \beta_3 D_{ij} + \sum_{l=1}^{L} \gamma_l A_{ij} + \sum_{k=1}^{K} \delta_k X_{ij} + \epsilon_{ij} \]  \hspace{1cm} (5)

\( A_{ij} \) = aviation activities; \( X_{ij} \) = set of control variables
The data set

Time period = 1997–2011

TRADEFLOWS_{A→B} = (log) Annual merchandise trade matrix-product groups, imports (exports) in thousands of dollars. Trade is computed as the sum of imports and export of total product

SEATS = (log) Sum of the seats offered on non-stop flights between countries A and B

AIRCINES = (log) Number of airlines operating flights between countries A and B, including cargo airlines

KM = (log) Average distance flown in km

GDP_A = (log) Sum of gross value added by all resident producers in the economy country A

GDP_B = (log) Sum of gross value added by all resident producers in the economy country B
The data set

\[ TOTALTRADE_A = (\log) \text{ Sum of import and export for country } A. \]

These are computed as the total trade of country \( A \) with all the other countries included in the database.

\[ TOTALTRADE_B = (\log) \text{ Sum of import and export for country } B. \]

\[ LOCALCONNECTIONS_A = (\log) \text{ Number of airports in country } A \]

with direct domestic services to the international gateway in the O-D countries (capture the feeder networks that serve the trunk services).

\[ LOCALCONNECTIONS_B = (\log) \text{ Number of airports in country } B \]

\[ LANDLOCK_i = \text{ dummy equal to 1 if country } i \text{ is landlocked} \]
Econometric results

Table 1
Relationship between trade flows and airline service provision.

<table>
<thead>
<tr>
<th></th>
<th>Model I</th>
<th>Model II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log(SEATS)</td>
<td>0.219***</td>
<td>0.199***</td>
</tr>
<tr>
<td>Log(AIRLINES)</td>
<td>0.782***</td>
<td>0.756***</td>
</tr>
<tr>
<td>Log(KM)</td>
<td>−0.886***</td>
<td>−0.890***</td>
</tr>
<tr>
<td>Log(GDP_A)</td>
<td>−0.129***</td>
<td>−0.119***</td>
</tr>
<tr>
<td>Log(GDP_B)</td>
<td>0.028</td>
<td>0.034</td>
</tr>
<tr>
<td>Log(TRADE_A)</td>
<td>0.755***</td>
<td>0.768***</td>
</tr>
<tr>
<td>Log(TRADE_B)</td>
<td>0.594***</td>
<td>0.612***</td>
</tr>
<tr>
<td>Log(LOCAL CONNECTIONS_A)</td>
<td>0.079**</td>
<td>0.081**</td>
</tr>
<tr>
<td>Log(LOCAL CONNECTIONS_B)</td>
<td>0.058*</td>
<td>0.061*</td>
</tr>
<tr>
<td>BOTH COUNTRIES LANDLOCKED</td>
<td>−1.140***</td>
<td></td>
</tr>
<tr>
<td>AT LEAST ONE COUNTRY LANDLOCKED</td>
<td></td>
<td>−0.501***</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>−2.795***</td>
<td>−3.218***</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.634</td>
<td>0.627</td>
</tr>
</tbody>
</table>

*** Significant at 1%.
** Significant at 5%.
* Significant at 10%.

Results

- Coefficients associated to aviation are all positive and highly statistically significant $\implies$ positive impact of aviation on trade in African developing countries
- Negative impact of distance
- The underlying pattern of trade flows may suggest lower flows from lower income countries (negative GDPA coefficients) to higher income countries (positive, although not significant GDPB coefficients)
- Negative signs for landlocked countries, irrespective of the specifications examined, are in line with Limdo and Venabless work
- Larger negative coefficient when two landlocked countries are involved in trade
Extensions

- Test for causality between trade and aviation
- Comparison between developed and developing countries
- Apply relation between trade and aviation to regions (major cities and remote)
- Inclusion of externalities to balance benefits and social costs