

Short communication

Air cargo as an economic development engine: A note on opportunities and constraints

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Abstract

This note examines the role that air cargo plays in economic development and factors that condition its impact. After presenting basic empirical relationships between air cargo and both trade and gross domestic product per capita, we discuss three factors that can enhance air cargo's positive impact: air service liberalization, improving customs quality, and reducing corruption. We then model and assess the effects of these three factors on per capita net inward foreign investment and gross domestic product per capita in 63 countries around the world.

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1. Relationship of air cargo to trade and GDP

Air cargo enables nations, regardless of location, to efficiently connect to distant markets and global supply chains in a speedy, reliable manner. Thus, in the new fast-cycle logistics era, nations with good air cargo connectivity have competitive trade and production advantage over those without such capability. Competitive advantage, as Porter (1990) and others have documented, is fundamental to economic development, the latter typically measured by gross domestic product (GDP), in aggregate or on a per capita basis.

There is an established statistical relationship, in turn, between levels of air cargo volume and both GDP and GDP per capita. Zero-order correlations (not shown) for 95 nations over the 1980–2000 period reveal that by knowing air cargo volume one can predict either GDP and GDP per capita with over 90% accuracy—and vice versa, given mutual causality.

Even though highly interdependent, air cargo tends to lead trade and GDP growth. In the United States, for

example, between 1992 and 2002, GDP expanded by 38%, trade value by 57% and air cargo value by 83% (in constant 2000 dollars). In Hong Kong between 1992 and 2003, air cargo tripled in value, increasing substantially faster than other modes of trade as it pushed Hong Kong's overall trade upward. With its faster trajectory, air cargo's percent of Hong Kong's total trade value rose from 17.7 in 1992 to 30.3 in 2003 (Airport Authority Hong Kong, 2004). When percent changes in values of air cargo, trade, and GDP are annually plotted adjacent to each other over the 1992–2003 period, one observes roughly parallel spikes and troughs. However, growth in air cargo value is more pronounced in upswings (e.g., following recoveries from the 1997–98 Asia financial crisis and 9/11) and it tends to commence just prior to growth in total trade and GDP values.

Examining multiple nations for longer time periods, growth in trade has substantially outperformed GDP growth; likewise, air cargo growth has substantially outperformed trade growth. Between 1980 and 2000, our analysis of World Bank (2002b) trade data shows that GDP grew by 72%, trade by 132% and air cargo by 302% for 68 countries for which 20 years of data are

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available. Even within the highly cyclical aviation sector, when downturns occur, air cargo recovers faster than passenger flows, as it has from the most recent downturn.

Based on such dynamics, air cargo is increasingly being viewed as an important lead indicator of the direction a nation's larger economy will be going. This, together with the substantial role air cargo plays in fostering trade and supply chain competitiveness, has led policymakers around the globe to ask: Is promoting air cargo service a viable economic development strategy? And, if so, what constraints must be overcome to enable the air cargo industry to attain its full economic impact?

2. Conditioning factors: air liberalization, customs quality, and corruption

Air cargo, of course, does not operate in a vacuum. Its economic impact can be contingent on numerous factors, including the country's overall logistics infrastructure as well as the country's broader commercial and policy environment in which the air cargo industry operates (Doganis, 2001). Apropos the latter, major international aviation organizations and trade forums such as the International Civil Aviation Organisation (ICAO) and the Organisation for Economic Cooperation and Development (OECD) routinely stress the importance of aviation liberalization, customs reform, and lower corruption for economic development. To date, however, there is limited comparative statistical analysis documenting the impact of these factors, especially liberalization and customs operations. Rather, evidence is typically anecdotal or case-based, making broader generalizations difficult and recommendations to policymakers less compelling.

We take an initial step toward rectifying this limitation by assembling and analyzing data for 63 nations to model and assess the development impact of these three factors. Our sample includes those countries for which we could gather complete data for all variables in the models.

2.1. Variable measurement and results

For measurement of air liberalization, we selected the number of air service agreements each of the 63 nation sample reported as of 2000 in the ICAO Database of Aeronautical Agreements and Arrangements (International Civil Aviation Organisation, 2004).¹

¹A broad perusal of air services agreement content does reveal that a large majority is focused on combination carrier (primarily passenger service) liberalization. Nonetheless, since approximately half of all the world's air cargo moves in the bellies of passenger aircraft, the

Table 1 presents the basic correlations between this measure of aviation liberalization and four pivotal variables: (1) air freight (TKMs), (2) trade per capita, (3) GDP per capita, and (4) net foreign direct investment per capita.

As would be hypothesized, all four variables are positively and significantly correlated at the 1% probability level with the ICAO indicator of air liberalization. The two economic development measures (GDP per capita and net FDI per capita) show the highest correlation. These two strong correlations should not be surprising, given that air services liberalization likely also reflects the degree of overall economic liberalization in the countries which has been well documented to be an important catalyst of foreign direct investment and economic development (Edwards, 1998; Taylor, 2000; Bacchetta and Jansen, 2003; Bhagwati, 2004).

Moreover, like the relationship between air cargo and GDP, there is likely reciprocal (two-way) causation. Nonetheless, air liberalization, based on its facilitating effects on country connectivity and resulting passenger and cargo flows, facilitates economic development and foreign investment, consistent with the strong positive correlations shown in Table 1.

Whereas these correlations are supportive of the notion that aviation liberalization leads to higher levels of air freight, trade, and economic development, liberalization itself may not be sufficient if other conditions are not present. In many developing countries, customs inefficiencies and corruption play debilitating roles. Customs alone can make or break time-sensitive global supply chains. It is estimated that, on average, 20% of goods transit time and 25% of costs are spent in/on customs clearance (Organisation for Economic Cooperation and Development, 2003). Even though customs' primary purpose is to enforce trade policy, intercept contraband, and levy duties and taxes, constraints such as subjective and nontransparent valuation, prolonged delays, as well as internal Customs Bureau inefficiencies serve as serious barriers to fast-cycle logistics and country attractiveness for foreign manufacturing investment.

To measure a country's customs quality, we used the 2000 World Business Environment Survey (WBES) that was administered by the World Bank to over 10,000 enterprises spanning 80 countries and one territory (World Bank, 2004). The customs quality measure for countries studied was derived from the following straightforward item: "Rate the overall quality and

(footnote continued)

liberalization of air passenger services also often liberalizes air cargo flows. Moreover, in the past decade, an increased number of bilaterals (e.g., the July 2004 China–US Air Services Agreement) give considerable emphasis to all-air cargo carrier rights. For these reasons, we feel that the number of bilateral agreements signed by a country is a suitable measure of that country's air cargo liberalization.

Table 1

Zero-order Pearson correlations between aviation liberalization, freight volume, and per capita measures of trade, GDP, and foreign direct investment, 2000

	Freight (TKMs)	Trade per capita	GDP per capita	Net FDI per capita
Liberalization	+ .468**	+ .440**	+ .713**	+ .718**

Sources: International Civil Aviation Organisation (2004) and World Bank (2002b).

**Significant at the .01 level.

efficiency of services delivered by your Customs agency.” The item was measured on a five-point scale, from 1, very bad, to 5, very good.

Corruption is a more complex issue that undoubtedly also impacts air cargo development and, to a broader extent, country competitiveness, foreign direct investment, and economic growth. Multilateral organizations such as the World Bank (2002a) regularly contend that if widespread corruption remains in a country, other more immediately alterable policy variables will likely have limited development impact. Thus, in the context of this study, a country that liberalizes air services and improves customs practices may see little or no improvement in foreign investment or broader economic development if substantial countrywide corruption persists. It is therefore important to examine both the unique and combined effects of aviation liberalization, customs quality, and corruption.

A challenge, though, is that, given its complexity, the degree of corruption in a country has no direct measure. The most comprehensive and widely used indicator is one developed by Transparency International (2004). Transparency International (TI) produces a composite index based on 16 different surveys of business people and the general public in over 100 countries about their perceptions of corruption there, supplemented by information obtained from country analysts. The composite index, called the Corruptions Perception Index (CPI), ranges from 1 (extremely little corruption) to 10 (totally corrupt). For analysis, the 2000 CPI for each country was applied to our 63-nation sample.²

To determine the specific and combined effects of aviation liberalization, quality of customs and degree of corruption, we used basic structural equation models, regressing all three variables simultaneously and in a step-wise fashion on our two key economic development factors: GDP per capita and foreign direct investment per capita.

Table 2 provides the Pearson (zero-order) correlations between liberalization, customs quality, and corruption on the one hand and GDP per capita and net foreign direct investment per capita on the other. Tables 3 and 4 present the multiple-regression results.

²See Transparency International web site, <<http://www.transparency.org/>>.

Table 2

Matrix of Pearson correlation coefficients

	GDP pc	Net FDI pc
Liberalization	0.713**	0.718**
Customs	0.370**	0.344**
Corruption	−0.821**	−0.810**

Sources: World Bank (2000; 2002b); International Civil Aviation Organisation (2004); Transparency International (2000).

**Significant at the .01 level.

Table 2 shows that each predictor variable correlates with GDP and FDI in a statistically significant manner in the direction expected. Table 3 reveals that each effect is statistically significant in the hypothesized direction. The adjusted R² indicates that, in combination, the three variables account for 77% of the variance in GDP per capita. When entered in a step-wise fashion, the last column of Table 3 shows that aviation liberalization contributes 42% of explained variance in GDP per capita, customs an additional 11%, and corruption still further 26% of the variance in GDP per capita, beyond that of liberalization and customs quality.

Table 4, in the same format as Table 3, documents that foreign direct investment per capita is similarly impacted by aviation liberalization, customs quality, and lower corruption. Once more, all three independent variables are statistically significant in the hypothesized direction with aviation liberalization explaining 28% of the variance in foreign direct investment per capita, quality of customs an additional 23% of the variance (above that of liberalization), and corruption a further 26% of the variance, leading to a total of 78% of the variance in foreign direct investment per capita accounted for by these three factors.

These multiple regression results are consistent with the proposition that aviation liberation, quality of customs, and lower corruption each contribute to greater economic development (as measured by GDP per capita and foreign direct investment). Just as air cargo and GDP per capita are mutually interdependent and causal, however, so too are the economic development measures and policy variables. To determine the exact nature of the strength of the causal relationship in each direction would require time-series data and more

Table 3
Impact of GDP per capita on liberalization, customs, and corruption

Independent variables	<i>b</i>	Standard error	<i>T</i>	Significant level	<i>R</i> ²	<i>R</i> ² change
Liberalization	109.0	24.8	4.4	.000	.415	.415
Customs	3343.6	1137.7	2.9	.005	.521	.106
Corruption	−3000.3	370	−8.3	.000	.782	.261
(Constant)	12147.0	3365.0	3.61	.000		

Adjusted *R*² = .771, *F* = 70.62, *p* = .000, *N* = 63.

Table 4
Impact of FDI per capita on liberalization, customs, and corruption

Independent variables	<i>b</i>	Standard error	<i>T</i>	Significant level	<i>R</i> ²	<i>R</i> ² change
Liberalization	8.8	1.9	4.65	.000	.280	.280
Customs	299.1	87.1	3.43	.001	.506	.226
Corruption	−223.3	27.5	−8.11	.000	.763	.257
(Constant)	622.55	257.64	2.42	.000		

Adjusted *R*² = .775, *F* = 66.47, *p* = .000, *N* = 62.

sophisticated statistical analysis, including additional control variables and specification of time lags between changes in the independent, policy variables, and the change in the dependent, economic development variables.

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