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International air passenger transport in the future

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JOINT TRANSPORT RESEARCH CENTRE

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International Air Passenger Transport in the Future

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INTRODUCTION

World stock markets fell further in mid June (2009) when the World Bank and International Monetary Fund (IMF) both announced that the recovery from the current economic malaise would be longer rather than shorter. The World Bank stated that the world economy would contract 2.9%, compared with a previous forecast of a 1.7% decline. The Bank appears to be more pessimistic than the International Monetary Fund. The IMF is forecasting a global contraction of only 1.3% this year and growth of 2.4% in 2010. Furthermore, the World Bank cut its forecast for the U.S. this year, calling for a 3% drop in the world's largest economy, after predicting a 2.4% contraction in March. Japan's gross domestic product (GDP) is predicated to shrink by 6.8%, more than the previous prediction of a 5.3% decline. The euro area's economy may shrink 4.5%, compared with the previous estimate of a 2.7% contraction. Global trade may drop by 9.7%, compared with a March forecast of a 6.1% decline.

In September 2009 Mr Bernanke told a Federal Reserve Board meeting that the 'recession was technically over'. He hastened to add the recovery will be long and slow. This has been confirmed by IMF analysis that output per capita takes three years to recover after a banking crisis and seven years after output is 10 percent lower than if the banking crisis had not occurred. Output is lower, trade is lower and trade and international air travel go hand in hand.

The forecasts and seemingly dire warnings of these leading financial and economic institutions that the world economies will take some time before starting on the road to recovery is a triple blow to the world's international airlines. First, international aviation is driven in large part by GDP growth and the nature and extent of the economic slowdown has led to substantial reductions in passenger traffic.¹ Secondly, airlines are by their nature cash flow businesses and with fewer passengers now and in the future, there is less cash and this situation over a longer period threatens the survival of a number of carriers.² They have to be creative to survive; British Airways (BA) was asking employees to give some wage free time, Air Canada simply asking for a \$610 million bailout and most if not all carriers are significantly reducing capacity. Thirdly, international airlines have been shifting their

¹ This is not to suggest domestic aviation activity is not responsive to GDP growth, it certainly is, but 'visiting friends and relatives' (VFR) and leisure traffic also constitute a large part of domestic travel.

² Airlines use cash from future customers to finance current production. Most businesses receive payment when the product or service is delivered.

business model as the low cost carriers moved to capture a larger share of the domestic markets; legacy carriers started a few years ago to focus relatively more on long haul particularly high yield traffic, both point to point and connecting, and this is the very traffic that is most affected by the current world economic crisis.³

The objective of this paper is relatively straightforward, suggesting “what international air passenger travel will look like in five, ten or fifteen years and why?” This requires answering two questions; what will be the principal determinants of the growth in international air travel and what impact will each of these drivers have on the growth rate? An imbedded question is does history have anything to teach us or are there new forces at work? Canvassing the current aviation trade press finds two schools of thought, one taking the position that this a deep recession but a recession nonetheless and once world economies start recovering air traffic will go back to the typical growth of 4-5 percent annually. A second school is less sanguine, taking the position that it will not be business as usual when economies stop sinking and move to recovery. Any economic recovery is going to involve fundamental changes in institutions, rethinking policies regarding government participation in economies and changes in economic leadership in the world. There is also the hydra of protectionism most prominent now in the US but certainly being practiced elsewhere, and what will happen to foreign ownership restrictions that prior to 2009 were being seen as hurting rather than helping world airlines. All of this will change international aviation going forward.

The Organization for Economic Cooperation and Development (OECD) in a recent paper (see OECD, 2009) has examined the economic downturn and the implications for the future development of GDP. This ‘development’ refers to the magnitude and makeup of GDP. They distinguish three scenarios on how the economic crisis will affect global growth patterns. First, the crisis is an ‘accident’ due to the breakdown in the financial system and once it is repaired it will be ‘business as usual’. Second, they refer to ‘retrenchment’ describing a scenario of fundamentally changed global trade patterns; changes due to both an unsustainable system that was built on artificial financial foundations and due to policy responses. The ‘accident’ and ‘retrenchment’ scenarios are at each end of the ‘what will the world look like’ spectrum. Somewhere in the middle lies an ‘adjustment’ scenario which is characterized by a weaker outlook for global GDP growth, adjustments in global trade imbalances and weakened financial leverage. International air passenger travel would have different levels of growth and patterns of distribution; networks would change and with it carriers economic fortunes.

To understand where international air passenger travel may be heading in the medium to long term there are three sets of forces that should be investigated. First, what are the factors which have driven the growth in air travel in the past and what will those forces look like in the future? An examination of numerous air travel forecasting models indicates the key drivers as GDP and income growth. Closely linked to these factors are trade growth and

³ It is also the front of the plane traffic which paid the premium yields and accounted for a sizable proportion of overall revenue.

foreign direct investment. There have been policy changes including the increasing liberalization of international aviation agreements, the changing business models of carriers, the expansion of alliances and the growth in long haul aircraft fleets. Given these were so important in the past will they be important in the future and what will they look like? If one believes in a model that an economic recovery will produce a set of world economies which will look much the same as what we saw in 2007-2008 then knowing the expected values and influences of old variables is what is important.

A second set of factors to consider arises from a possible change in world economies. What if the economies of 2010 and 2015 are not going to be the same as what we observed in 2007-2008? There may be new economic leaders, some or even many economies will undergo structural change and trade patterns of the past may be vastly different in the future. For example, there seems to be a consensus that the US economy will not see the levels of consumption it experienced in the post 2000 decade; savings will be higher in the US and spending may be rising in China. A new macroeconomic environment of particular importance will be the emerging role of the BRICs – Brazil, Russia, India and China who if they take over economic leadership will alter international aviation networks considerably.

The third set of influences to be considered in assessing the future of international passenger air travel are those things - events, policies and economic and political environment which are new. What new forces will be at work in the future that will have an impact on international air travel? Certainly environmental issues will be a key factor, and a number of studies have investigated how emission trading schemes or carbon taxes would affect air travel particularly leisure travel. These studies have also investigated how such taxes or trading schemes may impact the structure of the networks and perhaps the industry itself. Other new forces will be technology such as improved engine fuel economy, biofuels, improved air traffic control (ATC) in the European Union (EU) and elsewhere such as free flight and integration under Eurocontrol, levying of airport and country specific taxes (e.g. United Kingdom and France), industry consolidation and the influence all of these would have on fares and service, and network reach and design.

The paper is organized in four main sections. Section two examines the travel demand forecasts of the past, what variables they relied on and what these variables are forecast to be going forward. In section three, we consider what a structural economic change might do to the future of air travel and section four examines how the 'new' forces would impact air passenger travel. A summary and assessment for the future of air passenger travel is contained in section five.

II FORECASTING AIR PASSENGER TRAVEL DEMAND

A number of organizations, airframe manufacturers and agencies have provided forecasts of how they see aviation growing in the future. These forecasts by Airbus, Boeing and ICAO (International Civil Aviation Organization) to name a few are summarized in

Table 1; only values for international air passenger growth are included. All the values are fairly close with ICAO being seemingly more optimistic. These values are presumably reflecting some adjustments for the current economic crisis. Interestingly the Revenue Passenger Kilometres (RPK)/GDP growth ratio is approximately 1.6 for both Boeing and Airbus which is what it has been over the past decade or so. This would seem to imply the airframe manufacturers are among those who take the view that on balance world economies will emerge from the recession in the same structural condition as before; a business as usual view or as the OECD has named it, 'the current crisis is an accident'. In their work the OECD points out that even in the case in which globalization continues there is substantial forgone economic growth; the effects of the slump are large with expected returns to previous growth rates not being realized for up to 5 years. If there is a shift from a globalization regime, such as retrenchment, this implies a whole regime change with significant long run consequences.

A particularly important insight from the OECD work is that even if a globalization regime is retained, the pattern of globalization must change since pre-crisis levels and patterns were not sustainable. Thus a stable, moderate and realigned globalization regime may emerge but all of the forecasts reported in

Table 1 do not reflect moderation or realignment.

Table 1

Forecast Growth in International Air Traffic 2008-2027 by Various Organizations

Organization	EU-North America	Asia Pacific-Europe	Asia Pacific-North America	Sources: Boeing Current Market Outlook
Boeing	4.7	5.7	5.6	
Airbus	4.8	5.9	5.8	
ICAO	4.5	5.8	6.0	
Average 1990-2007	3.6	6.2	3.4	

2008-2027, Airbus, 2007 – (2007-2026) ICAO (2007) Outlook for Air Transport to 2025

In Table 2, reproduced from Boeing's Current Market Outlook 2009, the expected growth in RPK between various regions is presented. It seems quite surprising that traffic growth between Latin America and Asia Pacific and Africa will be so bullish. This reflects the expected growth in GDP in these regions; see

Table 3. GDP growth has traditionally always been a significant driver in traffic growth and it appears there is a view that it will continue to do so – old drivers will be influential in the future. If one looks at the ratio of RPK to GDP across these sets of countries it varies from a low of 1.3 between Latin America and Africa to a high of 2.2 between Asia Pacific and Latin America; will these be the primary nodes of economic activity?

Table 2

Growth in International Air Traffic Boeing 2009-2028

	Africa	Latin America	Middle East	Europe	North America
Asia Pacific	9.2	9.1	6.3	5.5	4.9
North America	7.4	4.7	6.9	4.6	
Europe	5.4	4.3	5.5		
Middle East	6.1	-			
Latin America	5.5	-			

Source:
Boeing

Current market Outlook 2009

The forces which underlie the generation of air passenger travel, business and leisure, go beyond simply macroeconomic factors such as GDP growth, trade development in both merchandise and services, and foreign direct investment. There are also structural parameters such as distance, populations, and activities and ideas of mutual interest. In addition, there are strategic decisions by carriers in pricing, network design, service levels and alliance relationships.⁴ In the past many used trend projections based primarily on GDP growth; Gillen et al. (2007) report the elasticity of demand for air travel with respect to income (per capita GDP) varies from 0.8 to 2.6 depending on what countries are being linked.⁵ The median value was 1.14 and average 1.5 and in many cases trend forecasts were set equal to GDP growth 1:1.⁶ The variance in these estimates occur for many reasons, an important one being exchange rate effects; the large increase in UK tourism abroad in the 2004-2008 period has been attributed in large part to the rise in the value of the pound (£) relative to other world currencies.

⁴ McKnight (2009) makes a distinction between potential demand and passenger traffic. Macro factors generate the potential market while strategic carrier decisions influence how much of this potential market travels and who gets what market share.

⁵ Finance Canada (2008) reports elasticity values of traffic growth with respect to GDP of 1.9 for Europe to 2.88 for China.

⁶ See Swan (2009)

Table 3

Assumed GDP Growth Rates for Boeing Air Traffic Forecasts

Region	GDP Growth
Asia Pacific	4.4
North America	2.4
Europe	1.9
Middle East	3.8
Latin America	3.8
Russia & Central Asia	3.7
Africa	4.9
World	3.1

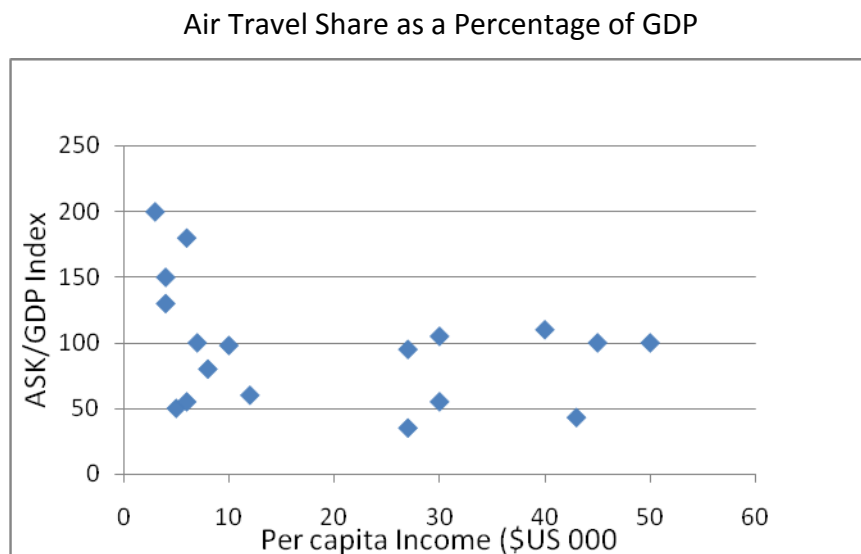
Source: Boeing Current market Outlook 2009

Upon closer examination it is clear the strength of the relationship between international passenger traffic growth and GDP per se has generally been overestimated due to a failure to account for changes in other strategic variables such as prices and network development and Open Skies air service agreements (see below). The measure of passenger growth with growth of GDP could be 1.5 or more.⁷ However the reality is that while higher income countries generate more trips than lower income countries, air travel does not grow increasingly with wealth. Specifically, the air travel share of GDP is independent of income. As

⁷ See Oum et al. (2009)

Figure 1 shows there is no clear relationship between the growth in passenger travel and the growth in income. This lends credibility to the elasticity of 1 value; air travel in general is not a luxury good, as people get richer they do travel more but they do not spend an increasing proportion of their income on air travel.

Figure 1



Source: Swan (2009)

What are the other factors which have been important in the past? *First*, changes in trade regulations, trade liberalization has led to what is termed globalization. Firms take advantage of countries and regions comparative advantage, investing in other countries and increasing the amount of both merchandise trade and trade in services with the creation of international supply chains.⁸ *Second*, changes in regulations, in this case international aviation air service agreements (bilaterals) with the result that fares come down, service expands and potentially there could be new firm entry. This improvement in service quality stimulates demand but the extent of the stimulus will depend upon the degree from which, and to which, markets liberalize. Piermartini and Rousova (2008) examined the impact of liberalizing air transport services on air passenger flows in a sample of 184 countries. They find robust evidence of a positive and significant relationship between the volumes of traffic and the degree of liberalization of the aviation market. An increase in the degree of liberalization from the 25th percentile to the 75th percentile increases traffic volumes between countries linked by a direct air service by approximately 30 per cent. In particular, the removal of restrictions on the determination of prices and capacity and the possibility for airlines other than the flag carrier of the foreign country to operate a service are found to be the most traffic-enhancing provisions of air service agreements. The results are robust to the use of different measures of the degree of liberalization as well as the use of different estimation techniques.

Gillen (2009) examined the case for Canada and estimated that the elasticity of *international* air passenger growth with respect to GDP was 0.45 (a 1% increase in GDP led to a 0.45 % increase in passengers), the elasticity with respect to 5th Freedoms was 0.15 (introducing 5th

⁸ Trade in services tends to be relatively aviation intensive.

freedoms in a bilateral led to a .15 percent increase in numbers of passengers) and if an Open Skies agreement was inked, the elasticity was 0.66. Swan (2008) argues that the Open Skies effect happens only once z9shifting the growth function) and has estimated that such events stimulate passenger growth over the long term by approximately 2 percent on average. However, it may be that such agreements can have direct (shift) and indirect effects as carriers adjust their networks and market structure changes. There can also be continuous effects if multiple trading blocks are liberalizing sequentially.⁹ However, there can be large differences depending on which markets are being considered. In the case of an Asia China Open Skies this would add 10 percent to passenger growth.¹⁰ Korea would experience an estimated 6 percent boost from Open Skies, while Europe will see relatively small gains because of previous liberalization; the changes are marginal (Swan, 2009).

In a recent study, Oum et al. (2009) make an important point that the liberalization of air service agreements leads to expansion in markets but it also leads to more efficient continental and international networks which further stimulates traffic growth. The indirect efficiency effect would reinforce the direct effect of liberalization on opening markets. The degree to which this would occur depends on the extent of liberalization and the way it is done.

In the short to medium term, what changes would drive air traffic growth? Certainly the cycling of GDP around the long term trend is a key factor. This has been fairly regular in the past but over the last few decades the various asset and credit bubbles have increased the amplitude of the swings and the swings take longer to return to the trend. Figure 2 provides a stylized illustration of what appears to be happening currently. Traffic growth moves above and below the trend due to changes in the structure of economies as well as trade. Markets can change at different speeds.

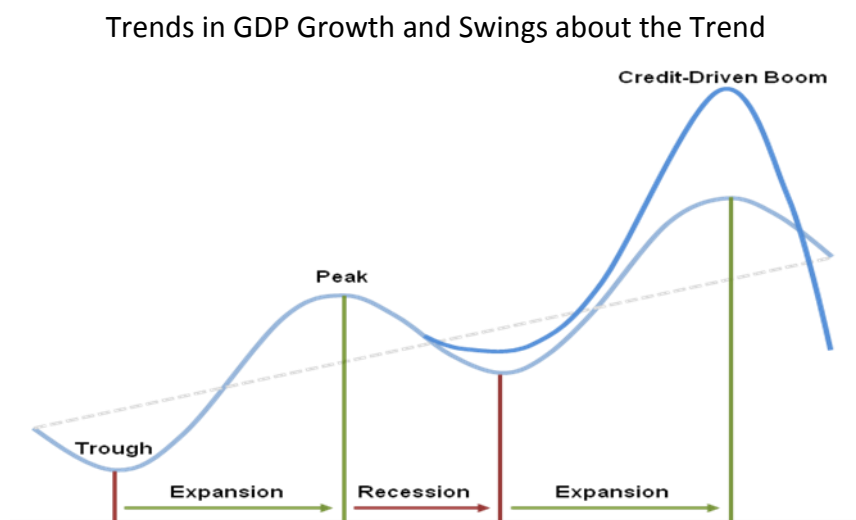
Notteboom and Rodrigue (2009) illustrate the sequence of three different market bubbles—high tech, housing and trade. Each bubble accelerates the demand for international air travel and may increase the rate of growth. For example high technology industries and finance sector, tend to be aviation intensive so a rapid growth in this sector leads to even more rapid growth in air travel than would be expected on average with growth in GDP. What is interesting about the three bubbles is each successive one encompassed a larger and larger population. The tech bubble involved relatively few people since only certain segments participated in this sector. It did certainly have a non proportional impact on international air travel as assembly and manufacturing spread to Southeast Asia. The housing bubble, a consequence of Federal interest rates and financial policies in the US encompassed an entire nation and had consequences across many countries but principally in the US where it originated. The trade bubble was global and was driven in part, perhaps large part, by the housing bubble and the use of re-mortgages to increase consumption and purchase housing

⁹ This is the case with the EU approaching adjacent countries to EU member states and negotiating Open Skies agreements; Middle-East and Mediterranean countries are the first candidates.

¹⁰ This figure would include short haul international between China and Taiwan, Japan and Korea.

as well as a wide range of consumer goods in the US. Trade and the development of international supply chains drove an increase in international air travel.

Figure 2



Source : Notteboom and Rodrigue (2009)

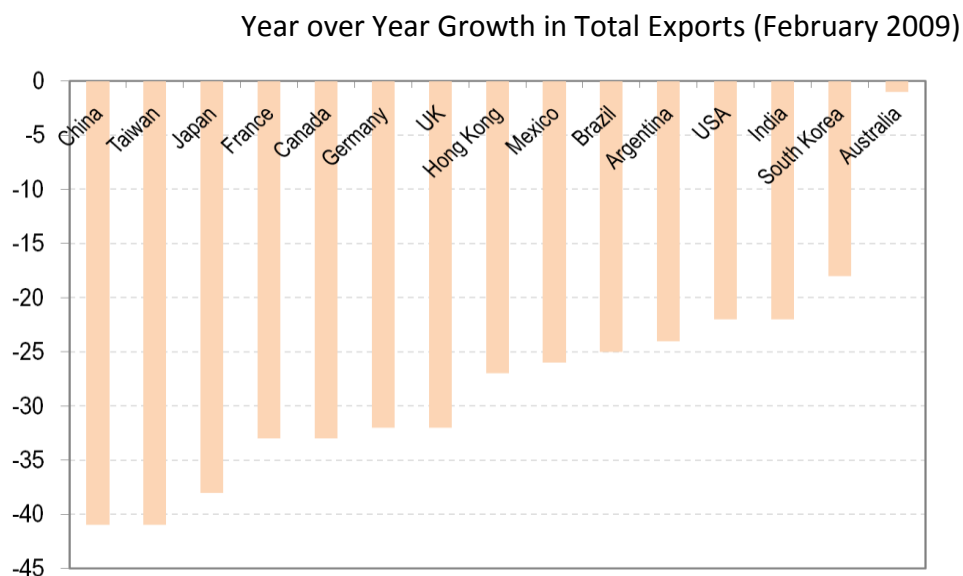
The increasing amplitude in swings about the trend has resulted in higher costs for carriers. On the upswing, available capacity is expanded in increasing amounts and on the downswing this capacity drives fares lower and airline profits decline. The costs of adjustment increase. A second consequence is on consumer confidence which moves in short bursts generally lagging the GDP cycle but they move together. As the amplitude of the cycles about the trend increases it may be consumer confidence will take a longer time to re-establish itself and once it does a more conservative atmosphere may prevail.¹¹ There are the vagaries of war, flus (SARS, Swine) and political disruption. These work through the cycle but again can be more troublesome as the cycle changes. For example, trade improves productivity which has a positive impact on growth. If the bubbles reduce trade, the growth in GDP may slow more than proportionately due to loss of productivity.

In the longer term the growth in GDP and the growth in trade which exceeds GDP growth has driven international air passenger growth. The trend has been consistently upward and tied to growth in GDP but this growth is currently zero or negative in many cases. The growth rates of exports of many countries are also negative as illustrated in Figure 3 for

¹¹ Speculation is that US consumers will save more and spend less while Chinese consumers will do the opposite.

selected countries.¹² International air travel is following its traditional relationship with GDP and is also declining at double digits in some markets.

Figure 3



Source: Notteboom and Rodrigue (2009)

The five fundamental traditional drivers of long term international air passenger growth are GDP growth, political disruption, cost changes (e.g. fuel costs), service quality changes and trade growth. Political disruption would include terrorism, regime frictions such as with Iran and North Korea but also protectionism. While protectionism reduces trade growth (discussed below) it also appears in the form of reductions in foreign direct investment. Foreign ownership of 'strategic assets' such as ports, energy and airlines are either up for review or simply prohibited. Such constraints increase capital costs and reduce trade in the long term. Political disruption and friction also increase costs in the form of security and regulation. These costs make shippers and service providers worse off and lessen trade and air travel. Cost changes particularly fuel costs is a long term threat. In the past growth in real fuel costs was zero or negative. In the future this will not be the case as the real cost of energy will go up and environmental taxes will become a permanent fixture. In the past cost reductions provided a 0.7 percent stimulus to passenger growth (Swan, 2009). It is unlikely this will continue and even advances in engine and fuel technology will not fully offset costs of raw materials inputs and taxes.

Quality changes occurred in the network over the last two to three decades. International networks reorganized with gateway hubs and airline alliances. This increased accessibility and stimulated traffic growth. A significant quality change was the growth in new markets; old markets did not simply get bigger but there were more routes opened and frequencies

¹² Numbers are based on a calculation of annualized GDP growth for first quarter of 2009 based on 4th quarter 2008 data.

grew. Both of these outcomes stimulated traffic growth by one or more percent. In the future the network will not be improving due to higher costs, hence bigger aircraft and less frequency; frequencies were a significant stimulus to traffic growth in the past. As trade growth slows frequencies decline, fewer routes are added (some abandonments may occur) and underserved cities continue to be underserved. All of this adds up to a negative net effect on past forecast traffic growth.

The slowing of trade growth over the longer term will also reduce the previous growth forecasts. As important will be the restructuring of trade as merchandise trade falls and trade in services grows somewhat. In the past trade growth was double that of GDP growth and added one to two percent to forecast air traffic growth. In the short term with recession and trade reductions traffic growth will also be negative. In the longer term increased protectionism, a failure to reduce tariffs and increased costs from security and regulatory barriers will mean zero stimulus from the trend in the future.

The net impact of all of these factors could be traffic growth at 80 percent of what it was in the past; markets forecast to grow or actually growing at 4 percent will grow at 3.2 percent. This, as Swan (2009) contends, could occur with slowing trade growth, slower GDP growth, higher costs from fuel and taxes and a slowdown in route development, this in the business as usual model.

Empirical Evidence on Factors Influencing International Passenger Traffic

In a number of papers there has been an attempt to assess the extent to which air travel is to be affected by current economic conditions. Oum et al. (2008) for example estimate a model in which they include GDP growth, fuel prices and some dummy variables to reflect events such as SARS, 9/11 and Asian financial crises. They use aggregate data from 1980 to 2008 to examine how these factors listed affected total air travel – domestic plus international. They find the elasticity of air travel with respect to GDP is 1.58 but argue this value is inflated because it captures influences which were not included in the model such as increase services and new routes, the changes in air fares which would have been very important for domestic air traffic.

The model estimated in this paper uses data from 1996-2008 to look at international traffic only between eight regions; Africa, Asia, Europe, Middle East, Latin America, North America, South America and Southwest Pacific region. The dependent variable is revenue passenger kilometres. The explanatory variables include GDP growth, foreign direct investment into the region, total trade in merchandise and services, price of jet fuel, dummy variables to capture the influences of events such as SARS and 9/11 and a connectivity variable. The connectivity information was contributed by IATA who construct the index using information on flight frequency, seat per flight, number of destinations and a weighting factor which is designed to measure the importance of the airport. The 'connectivity index' is designed to measure how well a country, or region, is connected to the international air network. It is a measure of the number and economic importance of destinations served, the frequency of service to each destination and the number of onward connections available from each destination.

Connectivity increases as the range of destinations and/or frequency of service increases. The index also reveals how connectivity changes over time. This index provides a measure of service improvements, route extensions and increased frequency. The results are reported in Table 4.

The results differ considerably from the model of Oum et al. (2008) but this model was estimated on only international air passengers whereas their model was estimated on total world air traffic. The model was composed of a panel data set with 8 cross sections (regions) and 12 years for each region. The variables are in logs so the coefficients can be interpreted as elasticities. Note the GDP elasticity is quite low, a mere 0.06 which is sensible in that the amount of international travel will be influenced but only in a small way by domestic growth. Also having trade, foreign investment and connectivity in the equation takes a good deal away from the magnitude of the coefficient. If one estimates essentially the same model as Oum et al. (2008) the estimated elasticity is only 0.31, considerably less than 1.58 of the Oum et al. model. What really matters for International travel is the amount of trade in merchandise and services; the elasticity is 0.83. Thus a drop in trade of 10 percent leads to a drop in international air travel of 8.3 percent. The next most important variable is connectivity in which an increase in connectivity of 1 percent leads to a 0.2 percent increase in international air traffic.

Table 4

Panel Fixed Effects Model		
8 cross section		
12 years; 1996-2007		
Variable (in Logs)	Coefficient	T-Statistic
Constant	-0.2849	-1.34
GDP	0.0652	2.10
Trade	0.8382	3.34
Connectivity	0.2201	2.37
Fuel Price	-0.2785	-3.34
Foreign Direct Investment	0.1306	2.28
Time	0.0884	1.80
9/11 Dummy	-0.1144	1.26
Adjusted R-sq	0.96	
Log Likelihood	168.96	

Over the most recent 3 years in the data the connectivity index has risen on average by 8 percent across the world. Thus boosting traffic growth by 1.6 percent on average. As connectivity declines through route abandonment, industry consolidation and capacity reduction one can expect traffic to shrink accordingly.

The increase in jet fuel prices has a sizeable impact on international air traffic; the elasticity is -0.3, so a 10 percent increase in fuel prices leads to a 3 percent decrease in traffic.

Estimates show the elasticity of fuel prices with respect to increase in world oil prices is about 0.26 for auto fuel; because of differences in taxes this elasticity in aviation would be higher at 0.4 (see Gillen et al, 2006)

Another important factor not previously considered is the magnitude of foreign direct investment (FDI) inbound; that is, foreign investment from outside the region. This is a rough measure of the degree of globalization and as more investment takes place air traffic increases. The elasticity of international air traffic with respect to FDI is 0.13. A time trend variable was inserted to pick up temporal trend effects and it shows a positive gradual increase in international air traffic

What do these estimates indicate regarding future international air traffic growth? Table 2 and

Table 3 provide forecasts of interregional air traffic and growth in GDP accordingly. This model indicates it is not GDP growth we should be looking at but rather trade in goods and services, changes in connectivity and changes in foreign direct investment. As well fuel price increases and the application of fuel surcharges can have an impact. It is unlikely that fuel prices will reach the levels they did in summer 2008 but oil is trending upward over the longer term. The Energy research Institute forecasts fairly steady prices for jet fuel in the next year. The IMF however forecasts a decline in GDP growth by 1.4 percent and an increase in 2010 of 2.5 percent. The IMF also forecasts FDI will fall by near 30 percent to 2010 and trade in goods and services will decline by 11 percent in 2009 and increase in 2010 by only 0.6 percent. These numbers suggest that international air traffic will fall in the near term and be weak in the foreseeable future.

III INDUSTRIAL EVOLUTION OR REVOLUTION

What is unknown is what type of economies will emerge as the current economic crisis plays out; what will be the new macroeconomic and trade world? At present there appears to be both an industrial revolution and a carbon revolution. Together they could well reshape economies and trade into a set of multi-location global centers. The relative power of the US economy will decline with its old infrastructure and old factories and reversion to protectionism. The industrial revolution at the turn of the 18th century sprung from new technologies of transportation and communication and energy. The geography of trade and economic development was much influenced by coal and the geography of coal. This revolution took 100 years. If there will be another industrial revolution based on new technologies, environmental and energy efficiency will be central to competitiveness. Investments will need to be made in 'soft infrastructure' of governance and reducing the friction of politics. How important will be comparative advantage be in driving trade? If economies in the BRIC countries create a set of multi nodal economies where no one country really dominates how will they trade, what do they trade and how does this drive air passenger travel?

There are two schools of thought on the evolution-revolution outcome. Some take the view that what we observe is a 'blip' and those economies will return to normal. This might be regarded, as stated earlier, as the business as usual model. The OECD (2009) characterization is the current situation was an 'accident' in financial markets and once fixed economies would return to their 2007 growth paths. The other school argues that a [fundamental] paradigm shift is taking place and what will emerge is a new macroeconomics and new trade flows. The extent of the change could vary from 'retrenchment' in which trade flows and centres of production are radically altered to a moderate 'adjustment' which would see not a move away from globalization but certainly a tempering of trade and economic growth. There are a number of factors that have come together to generate such an outcome. First,

there is most likely an end of asset inflation and debt derived consumption (at least temporarily). This will drive a re-equilibrium of trade flows, as well as standards of living to some degree. The “normal” of the last few years particularly in the US, which drove so much of what was taking place in globalization and trade flows, was essentially a macroeconomic deception. Personal and government debt may, perhaps will, drive lower levels of consumption and discretionary mobility per capita. Second, energy prices are going to remain high and trend upwards; some analysts argue that oil may be at \$100 by the end of 2010.¹³

A third factor is the aging of the population, an issue that is often neglected. It could well be linked with two macroeconomic forces; an aging population is less mobile – an issue not considered by forecasting models and, second, the retiring population is very likely to be much less wealthy than expected as their two major assets, house and retirement plan, will be worth much less. For many, the expectations behind the quality of life in retirement are going to be readjusted substantially downward. In other cases pension plans may go into default waiting for government bailouts. This is most likely with defined benefit plans and Europe is particularly vulnerable in this regard.

A startling statistic is the US has 4.5 % of the world’s population and spent \$10 trillion annually while India and China have 40 % of the world’s population and spent \$2 trillion annually. There is an \$8 trillion gap and with the US faltering is it reasonable to believe the BRIC countries will make up the difference? The business as usual school must believe this to be the case.

In the US consumer spending rose from 67% of GDP in 1980 to 75% in 2007 while the household savings rate fell from 10% of income in 1980 to near zero in 2007. Household indebtedness went from 67% of income to 132%. These shifts in spending drove trade and resulted in the US having a current account deficit of nearly 6% of GDP by 2006. The financial crisis in 2008 led to the collapse of consumption with more than \$13 trillion in consumer wealth lost. However, the collapse has endured due to a shift to greater savings, up to 5% of income now. Some of this spending has been replaced by the fiscal stimulus in the US as well as elsewhere. But this offset is minor since it serves to stabilize not to replace consumer spending and secondly much of the spending is national with requirements for domestically produced goods and services mandated. This rise in protectionism will exacerbate the lack of global growth whereas the US consumer had been its heart and soul for the past several years.¹⁴

Many take the position that the new US model will be more based more on export growth and less on consumption. This is in contrast to what fueled the boom previously and it is unlikely that growth in exports will compensate for the consumer sector. There are requirements that resources be shifted into production in tradable products and productivity to improve, particularly in export sectors. The externality of the US led economic crisis on

¹³ Peak oil will assert itself, remains to be seen if this will be gradually or suddenly.

¹⁴ In Japan in the 1990s demand was suppressed for a long period after the bubble.

the rest of the world notably Europe will work against such export led recovery. The resulting sluggish economy will see protectionism as a necessary condition to succeed. We see this increased protectionism in the US across many sectors and the financial and economic crisis has led to shift left in the political spectrum with a future of big government, parochialism and greater focus on domestic markets and less on developing trade.

The underlying causes of the economic recession and the current state of world economies leads some to a conclusion that the new macro economy is not going to look like the old macro economy (OECD, 2009). Centers of production will differ and trade patterns will change. Greater domestic production and consumption particularly in the US will lead to greater regional and domestic air travel with a relative decrease in international air travel. If airlines fail, consolidate and reduce service and capacity to survive, all of this will mean even less international air travel.

Growth in GDP and trade will continue to be important drivers of RPK from traditional factors. Industry behaviour in pricing, route development and network restructuring will have important but second order effects. Unknown is what will world economies will look like in the future and when economies will show positive growth? This is what the world looks like now (IMF, 2009); see Table 5. What is notable looking in the table is the value of 2009 figures in comparison to values in other economic downturns. The 2009 values are orders of magnitude larger for every indicator.

These figures underlie what we are seeing in terms of double digit decreases in international air travel, except for the Middle East; it appears no major international airport or gateway has been spared with even Dubai showing zero growth for the first period of 2009.

Below (see Figure 4) is an indication of what the IMF thinks may happen in various regions of the world and when such changes might occur (in the figures years are on the horizontal axis and growth in GDP on the vertical axis). The key indices to watch are the ratios of government deficit to GDP, private savings to GDP (in March 2009 the US recorded the highest savings rate since 1946) and current account to GDP.

Both the benign and downside scenarios illustrated in Figure 4 are bad news for international aviation as GDP growth will be slow to recover in all regions and in both the US and Asia turn down again in a few years. Industry restructuring is inevitable but the final outcome is highly dependent on regulations, domestic competition law enforcement and foreign ownership restrictions. Increased concentration may lead to higher fares and reduced route development both of which will diminish traffic growth.

Table 5

Global Recessions: Selected Indicators of Economic Activity
(Percent change, unless otherwise indicated)

Variable	1975	1982	1991	Projected 2009	Average (1975, 1982, 1991)
Output					
Per capita output (PPP ¹ weighted)	-0.13	-0.89	-0.18	-2.50	-0.40
Per capita output (market weighted)	-0.33	-1.08	-1.45	-3.68	-0.95
Other macroeconomic indicators					
Industrial production	-1.60	-4.33	-0.09	-6.23	-2.01
Total trade	-1.87	-0.69	4.01	-11.75	0.48
Capital flows ²	0.56	-0.76	-2.07	-6.18	-0.76
Oil consumption	-0.90	-2.87	0.01	-1.50	-1.25
Unemployment ³	1.19	1.61	0.72	2.56	1.18
Components of output					
Per capita consumption	0.41	-0.18	0.62	-1.11	0.28
Per capita investment	-2.04	-4.72	-0.15	-8.74	-2.30

Note: The 1991 recession lasted until 1993, using market weights; all other recessions lasted one year.

¹PPP = purchasing power parity.

²Refers to change in the two-year rolling window average of the ratio of inflows plus outflows to GDP.

³Refers to percentage point change in the rate of unemployment.

Source: IMF 2009

IV NEW FORCES INFLUENCING PASSENGER AIR TRAVEL

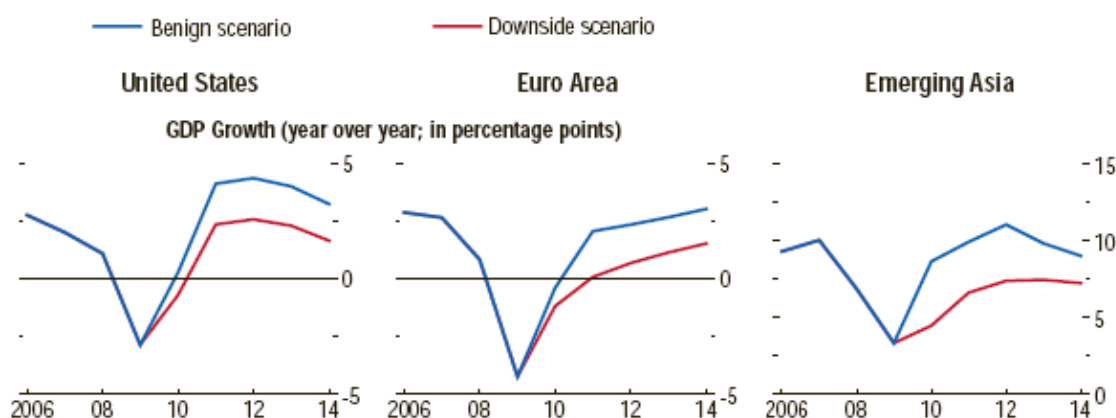
The most influential new factors which will affect air traffic growth will be environmental taxes, regulations and emission trading schemes. As governments link their carbon strategy with their economic and energy strategy there will be direct impacts on the aviation sector as well as indirect effects as economies and industry in general restructure but also as the airline industry restructures. The introduction of carbon taxes or emissions trading will lead to changes in market structure which will affect fares, service and carrier profits. An issue of considerable debate is how much of the tax or cost of emissions permits will be passed through to consumers. If the emissions cost become a profits tax, this will result in some failures and potential consolidation. If it is fully passed through there will be some reduction in demand.

Gillen and Forsyth (2008) analyze outcomes under differing market structures assuming single price equilibrium and linear demands. Under competitive market conditions the cost pass through is 100 percent, with fares rising by the amount of the tax or permit cost allowance in the long run; in the short run fares rise by less and airlines incur losses. Long run

equilibrium output is lower and fares are higher; in competitive markets traffic loss in the future may be from 0.7 to 1 percent.

On monopoly routes the pass through is 50 percent with profit falling and exit taking place from marginal routes. The impact on the long term passenger forecast for these routes is minor. One would expect in the absence of government restrictions that such markets would evolve to be more competitive and therefore have a higher pass through. In oligopoly, which would characterize the majority of international routes, if they were liberalized there would be incomplete pass through, lower profits and less output. Growth is constrained. If the international routes have restrictive bilaterals, this is equivalent to the outcome with a slot constrained airport. Fares are set in the market on the basis of bilateral restrictions therefore any increase in costs due to allowances or carbon taxes will be a profit tax and fares will not change; any increases in costs are paid out of rents arising from bilateral restrictions. If rents are monopoly rents there is a 50% pass through but if rents are scarcity rents there is no pass through. In oligopoly in the long run there will be lower growth, lower growth than without the charge, firms will adjust to higher costs with exit from some routes. The route exit effect will reinforce the higher cost effect in reducing future air passenger growth, perhaps as much as 1 percent.

Figure 4



Another view with respect to cost pass through is provided by two studies commissioned by the UK Department of Environment, Food and Rural Affairs in 2007, and 2008. These studies examined the impact of the EU Emissions Trading Scheme (ETS) on ticket prices and airline profits, respectively. What is notable in these studies is the claim there may be more than 100 percent pass through under some circumstances. Specifically the report claims cost pass through could run between 80 and 150% and the key determinants are the level and elasticity of demand, the objective function of the airline (profit, sales or market share), the market structure and the type of rivals (business model) participating in the market. In the majority of cases the pass through is at or near 100 percent, a finding consistent with the literature. In cases where the pass through exceeds 100 percent the demand elasticity is

assumed to be constant and inelastic.¹⁵ A greater than 100 % pass through is not possible on the average of fares provided firms are profit maximizing to begin with and even in the case of differential pricing (yield management) no one price would be increased greater than the amount of the emissions charge with profit maximizing firms.¹⁶ The study also found, correctly in my view, that the method of allocation of the emission permits would have no effect on the magnitude of the pass through.

The second key issue is what amount is passed through; how much ticket prices will rise will depend on the cost of the permits or the level of the carbon tax? Scheelhaase and Grimme (2007) report that short haul LCC fares would rise by 2.6% while short haul legacy carriers fares would rise by 1.15% based on an assumed value for emission permits of €15, €20 and €30; the reality is there will be a range of fare increases which correspond to a range of permit prices. Their long haul calculations of fare increases were airline specific; 3.3 % for Lufthansa and 3.5% for Emirates. Trucost in a 2004 study calculated the following for expected price increases: see

¹⁵ There are two issues to consider; first, the analysis did not consider whether the route was slot constrained and second, is it reasonable to think that sensitivity to price would remain unchanged with a greater than 100 percent pass through. Finally an assumed constant inelastic demand implies a monopoly market would not be in equilibrium when the emissions charge is imposed.

¹⁶ In cases in which there is a predicted greater than 100% pass through, firms cannot be profit maximizing in the first place and it is not clear what objective function would generate this result.

Table 6. Oxera (2003) calculate that on average with CO2 at €50/ton fares would go up 3.08 % and passenger demand would fall by 3.02%.

Table 6

Impact of Cost Increase from EU ETS on Fares and Demand

Source: developed based on Trucost (2004)

Airline	Price Rise (€)	Fall in Demand (%)
Air France	2.43	2.43
Alitalia	6.33	7.60
Austrian	3.05	3.66
BA	0.45	0.45
Easyjet	3.45	5.17
Finnair	2.33	3.50
Iberia	3.35	4.01
KLM	0.83	1.00
Lufthansa	1.71	1.71
Ryanair	3.33	4.99
SAS	0.72	0.86
Swiss	1.82	2.73
Virgin Atlantic	2.98	4.46

Albers et al. (2009) examine whether the EU ETS will result in a change in network configuration. In their analysis they estimate that with a 100% cost pass through fares would increase by from 1 % to 3.8 % (long haul flights) with the result that demand would fall by up to 3 % but in most cases it was approximately 2 % of countries long haul travel, primarily tourism. **In their work they estimated that the 25 richest countries** (by GDP per capita) account for 51% of world GDP, 15% of world population, 45% of world tourism GDP, 69% of international passenger volume and 70% of total passenger volume. The GDP impact of a 10 percent fuel tax would range from 0.03 percent for the US, 0.1 percent for Australia and a 0.12 percent for South Africa.

An important sector which has a considerable impact on international passenger aviation traffic is the global investment and financial sector. The banking crisis has resulted in numerous bank and investment house failures. Profits collapse in a financial crisis as credit becomes more expensive which means as firms have less to invest, the economy slows. Centres of activity migrate and with them the centres of finance; the exodus of personnel from the financial sector in London is a good example of the consequences of such shifts.¹⁷ The Global Financial Centres (GFC) Index released in September 2009 indicated the top ten global financial centres had not changed from 2007 but they all had lost in ratings. A change in ratings illustrates some new dynamics in play. The top global financial centres have not

¹⁷ British Airways has suffered considerably with the drop in premium traffic much of it generated from London's financial district.

changed since last year (London, New York, Hong Kong, Singapore, Zurich, Frankfurt, Geneva, Chicago, Tokyo and Sydney) but all except Singapore have lower ratings from the previous year¹⁸. Also new centres have emerged in China, the Middle East and Africa. Osaka has dropped 33 points in ranking while Bahrain and Johannesburg have gained 59 and 48 points respectively. The GFC index provides some support for the notion of shifts in paths of international passengers. What is needed is information on shifts in direct foreign investments as well.

V SUMMARY

This paper had the objective of trying to understand “what international air passenger travel will look like in five, ten or fifteen years and what were the underlying drivers”. This required answering two questions; to identify what will be the more important determinants of international passenger travel in the future and secondly to translate the impact of these factors into expected changes in future passenger growth. Identifying the drivers was relatively successful in determining which are most relevant and how large each of the effects would be on traffic growth was less successful.

Three groups of factors were identified; the ‘old’ variables which have been identified as driving air traffic growth, the new variables which may result from industrial revolution rather than evolution and the ‘new’ forces such as those resulting from the carbon strategy being adopted in the EU and which will be followed elsewhere.¹⁹

Among the established key factors is, of course GDP growth. Some believe that even with a retained globalization regime growth recovery is 5 years away. However the return will not be business as usual for two important reasons; first, protectionism is growing and not just in merchandise trade. Restrictions on financial intermediation will prevent pre-crisis types of economic interactions from returning (OECD, 2009). Second, the crisis was a consequence of global imbalances, which have since been moderated. Global restructuring means those countries which were large exporters (China and German) will have to adjust. Exporting overcapacity will be absorbed by domestic demand, reduced output or changes in exchange rates.

The new forces of change both contribute to and deter traffic growth. Carbon taxes and cap and trade systems will reduce growth but not to a significant degree unless the number of permits is reduced or the carbon tax is increased. In the short to medium term neither is

¹⁸ The report states that a change in rating of 1-10 points is considered insignificant, between 10-30 is a signal of changing competitiveness and >30 signifies major change.

¹⁹ These include carbon taxes or cap and trade.

likely to occur. New air traffic control governance in conjunction with new hard and soft technologies, such as free flight and EU integration under Eurocontrol, will have a positive impact on growth without necessarily having an offset from emissions increases.

Boeing in its Economic Outlook (2009) forecasts economic growth of 3.1 %, a forecast growth in passengers of 4.1% and a growth in revenue passenger km of 4.9%; this implies a ratio of 1.6 of RPK to GDP. This scenario is based on what appears to be a model of industrial 'evolution' – the economic order will repeat itself in the recovery - and is predicated on lower fares, point to point service and higher frequency.²⁰ Boeing's forecast of these optimistic growth rates are based on a trend of increasing growth in RPK.

The trend that is observed in traffic growth has been driven by growth in GDP (more countries getting richer) and increasing competition and liberalization which reduces average fares and expands service in terms of route development and frequencies. The point of diminishing returns may have begun to set in for OECD countries which have liberalised aviation markets to a degree with growth tapering to a trend GDP growth. However if we do have an industrial revolution taking place, how new economic and carbon/energy strategies will affect international air traffic growth is difficult to establish. It is not just GDP but the composition of GDP, it is not simply air service agreement liberalization but the type of liberalization and what the starting point is, it is a shift from trade in merchandise to trade in services and a shift from globalization to regionalism and regional trade pacts. Globalization is heavily based upon liquid capital markets. It is made to happen by consumers and traders. Traders depend on cheap reliable transportation for people and merchandise. The current crisis has revealed that globalization means integration and integration can be fragile, as has become clear. Going forward it may be that a more risk averse world wishes for less integration. Protectionism may exacerbate such a shift.

Swan (2009) has pointed out that expenditures on air travel are on average 1 % of GDP in developed and developing countries. This is for all air travel not just international air travel. Oum et al. (2009) develop a set of forecasts for both intra and inter regional travel. Their model is based on measured impacts of GDP, liberalization and exogenous events (e.g. wars) on air travel growth in the past. Interestingly they forecast that inter regional air travel growth will generally exceed intra regional growth. The implication being that past influences will continue into the future and it is just a matter of when a recovery starts to take place.²¹

Notteboom and Rodrigue (2009) have examined what is happening in liner shipping. They make the point that the current set of circumstances has no contemporary 'frame of reference', international aviation like shipping is facing a global and persistent decline and as they say this can lead to unintended consequences. In their view liner shipping will undergo a paradigm shift rather than a contemporary recovery. International aviation has come

²⁰ The Boeing forecast was the only one that is current. Airbus last available forecast is from 2007.

²¹ Their models were estimated on all traffic rather than separately for intra and inter regional traffic separately.

through boom and bust cycles and has weathered the vagaries of war, pandemic and financial crisis but international aviation like shipping will more likely than not undergo a paradigm shift as well.

While fuel prices and changes to air service agreements will have an impact on international aviation, the most important impact will come from industry and economic re-organization. The shifts in trade flows and the potential for a reduced pace or even decline in globalization and a shift to regionalization will affect trade flows and hence international aviation. The persistence of the current economic malaise, some have suggested a four to five year horizon before growth will recover, will lead to a number of firms failing.²² Consolidation will take place with some capacity reductions either directly or through alliances where the alliance will manage the capacity. This will lead to higher fares and less route expansion. Both will result in a reduction in international air travel. There is the prospect of LCC entry into international markets but this is dependent on liberalization of air service agreements continuing and on an expenditure elasticity of one. In the past the US was a major force for liberalizing international air markets, it is unclear whether this will continue; the US economy is weak and there is less to be obtained from more liberalized markets and the US is moving to economic protectionism which also lowers the return from liberalized air service agreements.

Trade is not the cause of the current economic crisis but it may be one of its casualties. Trade increased with globalization which created international supply chains – complex international networks for the manufacture of goods; goods cross borders many times from inception to final consumption. A decrease in demand is amplified across all borders because of these supply chains. This decrease may also lead to increased protectionism. It is these combination of factors which may make international aviation as we know it also a casualty.

Pre-crisis growth and trade patterns were inflated by global imbalances and therefore expectations of future trade growth should be moderated. Global economic activity in the future may well be less trade intensive; moderate growth and moderate trade. This moderation may be a consequence of protectionism or exchange rate adjustments.²³ In either case international passenger traffic is likely to decrease but more importantly there will be a shift in paths from pre-crisis periods. How this will play out is an open question. The old GDP elasticities of RPK demand were based on established patterns of trade and non sustainable growth rates so extrapolating from pre crisis information is likely misleading. As economies begin to recover the consensus is that recovery will be slow. This may lead to industry restructuring as marginal carriers cannot continue with the losses. This restructuring, may well lead to reductions in competition so gains made from liberalization of air service agreements will be tempered and international air travel will be further impacted.

²² Although governments in many jurisdictions seem intent on protecting favored or flag carriers.

²³ Hummels (2009) also argues rising energy costs which increase the cost of transportation, environmental initiatives, and changing channels of trade in merchandise will underlie the shift to moderation.

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