China's airline industry deregulation: assessing the impact on the operational performance of dominant carriers

Ioannis Koliousis

Coventry Business School,
Coventry University,
Coventry, CV1 5DL, West Midlands, UK
Email: yannis.koliousis@coventry.ac.uk

Abstract: This paper analyses the operational efficiency of the big three Chinese airline carriers post deregulation from the managerial perspective, using empirical data and by means of parametric methods in order to further understand the potential this market has for its dominant carriers. The analysis uses financial and operational data for the three dominant carriers in the Chinese airline industry and estimates the effect deregulation has had over a period from 1994–2012 to the dominant carriers. This analysis validates that the Chinese airline industry operational efficiency as measured by revenue and cash flow generation ability is positively associated with the load factor within a period that includes deregulatory initiatives. This finding highlights that the airlines have reacted positively post deregulation and have reasonably coped with competitive forces. Thus a further airline industry convergence is expected, on a global scale. This convergence will positively affect the Chinese airline industry, which in turn will benefit the passengers in terms of technology innovation, prices and welfare status.

Keywords: deregulation; airline industry; China; airline competition; operational efficiency; managerial efficiency; impact.

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Biographical notes: Ioannis Koliousis has experience in the fields of operations and supply chain management, shipping and energy. He has consulting experience from the operational to the strategic level and has participated in different capacities in industry led projects as well as in cornerstone EU funded research projects and regularly advises senior leadership on these topics. He is currently a Lecturer in Operations and Supply Chain Management at Coventry University where he also serves as an Associate Course Director for the Business Management Program. He holds a BSc in Maritime Studies (GR), an MSc in Decision Sciences (GR), an MEng in Supply Chain Management (USA) and a PhD in Transport Strategy and Regulation (GR), for which he was awarded the highly competitive Herakletous-II Fellowship (GR).

1 Introduction

The development of the aviation industry has been shaped primarily by government policies instead of market forces. Governments used to promote national air-carriers by providing subsidies, regulating all aspects of the airline market or directly owning airline firms. The result of this approach resulted in high fares, lowered innovation and decreased efficiency of operations. In 1978, the USA became the first country to deregulate its domestic airline industry through the Airline Deregulation Act, which partially shifted control of the industry to market forces. The enactment of the Act eliminated price and entry regulations of the domestic airline industry and provided for ultimate closure of its regulatory agency, the Civil Aeronautics Board (CAB).

Airline deregulation has been a monumental event, since its effects are still evident today. Passengers have been particularly benefited due to lower airfares, an effect of the intense competition. For many airlines, this transition has been a costly experiment, since deregulation assisted not only in the establishment of very successful companies, such as low-cost carriers and the change in carriers' route structures, but also led to the demise of historical air-carriers which failed to adjust in a timely manner to the new environment. The case of Chinese Airline Industry deregulation is considered a unique case since the approach to deregulation differs from that in western markets (USA and Europe); airlines are not allowed to serve any mainland China route they plan because this is still a centrally controlled market. Thus, as a result, Chinese carriers have enjoyed high yields and low input prices in the domestic market which led to high profitability.

This paper analyses the operational efficiency of the Big Three Chinese Airlines post deregulation from the managerial perspective, using empirical data and by means of parametric methods. Literature has focused on analysing what the optimal frontier is for these deregulated companies, thus attempting to understand the efficiency of these companies. This study changes the perspective, analysing the empirical data for these companies. The Chinese Airline industry is considered to be very important since the incumbent carriers serve a significant amount of people and airports internally in China, but most importantly because of the increasing growth of the trade from and to China. This growth helps the Chinese air transport market grow even bigger in terms of passengers moving in and out of China, in terms of network development and in terms of revenues for these companies. These are the main reasons this paper focuses on the Chinese Airline market deregulation, in order to further understand the potential this market has for its dominant carriers.

The paper is structured as follows: Sections 2 and 3 analyse the relevant literature and describe both the global competition as well as the Chinese airline industry case. Section 4 analyses the expected impact of deregulation on the Chinese airline market and Section 5 concludes and discusses potential implications.

2 Literature review

2.1 Introduction

Many researchers have focused on analysing the impact of deregulation in the airline industry and the impact on airline competition. Based on our analysis, the Chinese airline deregulation literature falls into three broad streams. The first stream focuses on the economic rationale for liberalisation (Kahn, 1971; Goetz and Vowles, 2009; Wang et al., 2014a); the second stream focuses on analysing the spatial characteristics of deregulation (Wang et al., 2016; Shaw et al., 2009) and lastly the third stream focuses on the policy issues and the evolution of deregulation from the institutional viewpoint (Zhang and Round, 2008; Eaton, 2013; Lei and O'Connell, 2011). This paper, as will be described below, goes beyond the state-of-the-art by extending the first stream and more precisely by focusing on the specific case of analysing the managerial efficiency of the Chinese airlines' post deregulation.

With regards to analysing the efficiency, post deregulation, Morrison and Winston (1989) argue that entry regulations in the airline industry reduce competition among incumbents suggesting that a 16% cost increase should be attributed to these regulations including crown ownership of carriers (ownership of carriers by the government). The authors argue that entry regulations transfer rents to the organised input suppliers (aircraft manufacturers, labour unions, etc) and additionally, services are unresponsive to customer needs leading to great inefficiencies. Similarly, Douglas and Miller (Douglas and Miller, 1974) discussed about price regulations and how they lead to quality competitions, flexibility and inefficiencies. With regards to the rate-of-return regulations, Averch and Johnson (1962) advocate that this is a fairer basis for economic regulation. Excessive capital accumulation in rate of return regulatory intervention, also called 'gold plating', guide regulations based on a fair rate of return on the capital employed which incentivises firms to increase the value of the assets by investing more on capital input. It is noted that these arguments apply where market failure is observed. If there is no market failure, in principle, there is no economic need for any economic regulation. For example studies have shown the impact of regulation on the airline industry, on the road transport (highway trucking), on the intercity bus and taxicab industries to name but a few. Empirical longitudinal evidence from similar transport sub-sectors (e.g., Kugler and Pica, 2005; Scarpetta and Nicoletti, 2003; Alesina et al., 2005; Koliousis, 2016; Koliousis, et al., 2013) suggests that where there is no economic regulation, the market seems to work more competitively and to produce better outputs [as also suggested by the theory of contestable markets, e.g., by Baumol et al. (1982)]. Therefore, it is easily understood that economic regulation is a cause of market failure, although protecting the market itself, the incumbents and the public good is what was originally intended.

To the best of our knowledge, the specific sub-topic of airline industry managerial efficiency post deregulation has been relatively under-researched and many scholars are primarily focusing on the technical efficiency aspects of the deregulation in the global airline industry. Powell (2012) studied the productivity at the aggregate US airline industry level from 1978 to 2009 as well as the individual US airline passenger level from 1995 to 2010. Similarly, Ajayi et al. (2010) examined the operational efficiency of US airlines after deregulation using non-parametric order analysis and found that operational efficiency, post deregulation, was improved for all market players. Other studies investigated airline productivity using theoretical, non-parametric models and focused primarily on the technical aspects of efficiency, without focusing on the business side. The impact of deregulation on the business side of transport companies has been analysed at the transport industry level (Dempsey, 2008) studying the financial performance of the airline industry incumbents.

In the case of Chinese Airline deregulation, the literature illustrates primarily how deregulation of the sector evolves. For example, some researchers (Zhang, 1998; Wang et al., 2016) focus on the economic aspects and on the main driving forces of air deregulation. Zhang et al. (2014) consider that the Chinese approach to deregulation differs from that in western markets (USA and Europe) where airlines were allowed to serve any route. Thus, as a result, Chinese carriers have enjoyed higher yields and lower input prices in the domestic market which led to high profitability, which observation was also backed up by Wang et al. (2014b).

As per the literature review above, these studies are descriptive and do not focus specifically on the managerial efficiency using empirical data and parametric methods. This paper focuses specifically on this gap that is to analyses the managerial efficiency of Chinese Airlines post deregulation, using empirical data and using parametric methods.

3 Comparative airline industries analysis

3.1 The US airline deregulation

Until 1978, operating and investment decisions in the passenger airline industry in the US were regulated by the CAB. The latter had imposed rules on limiting routes, entry/exit regulations as well as controlling prices, inter-carrier agreements, mergers and acquisition activities and consumer issues, resulting in airlines competing only on cabin crew and food quality as well as frequency of flights. The industry structure was reversed with the introduction of the 1978 Airline Deregulation Act which adopted market based approaches in airline market operations and investments. Deregulation provoked a shift in the US airline industry, nevertheless it is regarded as partial deregulation due to the fact that infrastructure and foreign ownership is still subject to government control. According to the Air Transport Association (ATA, 2010), in 2010 approximately 100 certificated passenger airlines operated close to ten million flight departures per year in the US and carry about one-third of the world's total air passengers. US airlines enplaned 720 million passengers in 2010, 630 million of whom flew domestically.

Pre-deregulation productivity was mainly driven by technological innovations primarily in speed and capacity, such as the introduction of jet and wide-body airplanes. Deregulation shifted airlines' focus on productivity improvements and cost efficiency due to increased competition. Productivity improvements stemmed mainly from the adoption of innovative technologies like web check-in, from capacity optimisation like reassignment of aircrafts to more efficient routes and from replication of low cost carriers' (LCCs) cost leadership strategies like the reduction of aircraft turnaround time. Passenger carriers' strategy also shifted to increased yields and capacity discipline, instead of focusing on market share and revenues. Entry of new carriers was also facilitated by the Act; new innovative LCCs contributed to increased fare competition, forcing incumbent carriers ['network legacy carriers' (NLCs)] to focus on reducing operating costs and improving their productivity. As a consequence, travellers in the US have benefited significantly, since airfares in 2010 correspond to approximately 50% of those prevalent prior to deregulation in real terms, while air travel growth is also significantly higher than prior to 1978.

According to ATA (2010), revenue passenger miles (RPMs) have tripled and available seat miles (ASMs) have increased by more than 150% since 1978. The average load factor exceeded 80% or 20% higher than the load factor prevalent in early 1980s reflecting higher productivity due to optimised fleet management and adoption of yield management techniques. Productivity measured by ASMs per real dollar of operating expense increased by over 50% since 1978, from 5 ASMs/USD in the early 1980s (in real 2010 terms) to nearly 9 ASMs/USD in 2010. Deregulation has led to a significant increase in asset utilisation and similarly, fuel efficiency improved by 73% in ASMs per gallon of fuel since deregulation took place. Labour productivity has also improved, with ASMs per employee increasing by 108% since 1978. Deregulation has also resulted in a change in the mix of international versus domestic capacity. In 1978, only 19% of US passenger airline output was flown on international routes, whereas this proportion has increased to almost 30% in 2010, demonstrating the benefits from deregulation which can be gained by market expansion. Average Fare paid per passenger-mile has decreased by more than 50% in real terms. The entry of LCCs intensified competition and led NLCs to devote resources in improving their cost structure. Industry cost containment was evident by the lower increase of operating costs (increased by 61% from \$67 billion in 1978 to \$108 billion in 2010 in real terms) compared to the increase in ASMs. Efficiencies in a number of figures were experienced, indicatively in both labour related and non-labour related expenses (except for fuel costs), in average unit cost per ASM (CASM). LCCs became catalysts in driving cost structure changes in the US, although CASM appears to converge for LCCs and NLCs.

Despite the improved industry revenues, profitability of US airline industry has become more volatile and cyclical since deregulation. More specifically, the industry posted losses totalling more than \$13 billion for five consecutive years in the early 1990s, turned to profits in late 1990s and experienced substantial variation in the following years. Air transport is also no longer a Universal Obligation Service, since deregulated airlines are no longer obliged to serve less profitable routes with preset capacity or frequency, affecting residents of smaller cities. Environmental and safety concerns are also raised by proponents of re-regulation.

3.2 The EU deregulation experience

The European aviation industry was still subject to significant national control and influence in the early 1980s. Regulatory intervention included price controls on fares, on flying frequencies and on airport access conditions as well as regulation on capacity restrictions and strict labour related guidelines. National flag carriers were predominantly state-owned and dominated in certain routes in the intra-European airline market. International carriage was also subject to regulations where State based bilateral agreements effectively eliminated competition. Additionally, essential infrastructure like airports and technical bases were also state owned.

The European Commission introduced in 1997 the Single European Air Transport Market thus effectively removing barriers to entry, route limitations, or even capacity limitations, flying frequencies and fares, with the so called Airline Packages. Based on the current rules (European Commission, 2008) the airline carriers are now required to apply for a valid permit, based on quality qualifications, in any EU MS. Air carriers may enter all intra-European routes with the only restriction being that the majority of shares (50%+1) be owned by EU member states nationals (even at the entity level). This policy intervention allowed competition to enter, especially from LCCs, with many of the routes being served by two or more carriers (although there are routes with only one service provider). As the airports play a significant role, EC has mandated that all airports base their service provision fully on non-discriminatory terms. At the same time, airports were also liberalised during this period as part of the airline sector deregulation and currently, the EC is focusing (European Commission, 2011) on further improving the competition through releasing restrictions on slot allocation and ground handling as well as improving environmental standards and noise levels.

During this initiative, EU member States have adopted various regulatory decisions which entail country specific or sector specific differences, however, the EC adopted specific legislative actions which aimed for an EU wide regulation and at the same time promotion of fair and effective competition. For the EU Member States, their role has been to deregulate and liberalise monopolies (from the supply side) as well as to apply the general competition law, especially on the network industries and to reduce direct and indirect subsidies and state aid. The most important deregulation initiative so far has been the reduction of 'cabotaged' services, in other words, the reduction of the exclusion of an operator from a MS 'A' to provide services to MS 'B' for route from MS 'C' to MS 'D'.

4 China's passenger airline industry

4.1 Overview

The Chinese airline industry being one of the world's fastest growing markets and the second largest air travel market, behind only that of the US in terms of total scheduled departing seats, has attracted significant interest both from a policy perspective and from major international carriers (European Commission, 2015). Although China's civil aviation sector is regulated by the state, the latter gradually attempts to open both its domestic and international markets to more competition. The 2008 Olympic Games in Beijing and the 2010 World Expo in Shanghai provided major impetus to the development of an efficient and modern aviation industry and to the massive infrastructure investments necessary in the Chinese aviation sector. China's airline industry's current characteristics and regulatory status have been evolved through three distinct stages phases:

- *Before 1980s*: Central planning. During this period, China's civil aviation operated under a four-tier administration system, typical of a centrally planned economy, embodying both government and enterprise functions. Zhang (1998) comments that this resulted in the industry experiencing losses despite the government's subsidies. Most airlines were controlled by the Government, except the Southwest Airlines. The Civil Aviation Administration of China (CAAC) was established as early as 1949 and operated under the Central Military Commission until 1954 controlling the Chinese air transport industry.
- *1980s–1990s*: Transition period. An 'open door' policy was adopted, focusing on embracing international rules and practices. The CAAC came under the direct supervision of the State Council. In 1987, CAAC's administrative and regulatory role was separated from its commercial airlines and airport operating role, resulting in the establishment of six airlines owned by the state. Regional airlines were also established by local governments. All airlines were tightly regulated by CAAC in terms of market entry, route entry, frequency, pricing and services provision. Until 1996, airlines competed only on the basis of standards of service.

- *1997–2000s*: Initial deregulation attempts. During the 1990s, the airline industry experienced a number of challenges caused by both internal and external industry dynamics, resulting in changing the rules regarding airfares, entry-exit and privatisations.

Table 1 presents the dynamics of the Chinese airline market, in terms of airport cities serviced by the Big three carriers, the number of routes serviced by the Big 3 and the flight distribution for the Big three carriers.

Table 1 Competition dynamics in the Chinese airline market

Carrier	*% Airport cities*			*% Air routes*			*% Flights*		
	1994	*2004*	*2012*	*1994*	*2004*	*2012*	*1994*	*2004*	*2012*
Air China (CA)	44.0	50.0	52.6	12.1	21.5	16.1	10.3	13.6	13.0
Air China Group	44.0	50.0	57.3	12.1	21.5	28.9	10.3	13.6	19.4
China Southern (CZ)	53.0	65.6	65.5	27.3	47	35.2	17.1	28	23.8
China Southern Group	53.0	67.2	67.3	34.2	56.5	41.8	21.3	35.1	30.4
China Eastern (MU)	29.0	56.6	61.4	13.1	31.2	29.1	10.9	20.3	16.4
China Eastern Group	29.0	56.6	69.6	13.1	31.2	31.5	10.9	20.3	21.0
Big three airlines	63.0	82.8	85.4	45.0	73.1	61.6	38.3	61.9	53.2
Big three groups	63.0	82.8	87.1	49.5	78.5	73.5	42.4	67.1	70.9
Other airlines	90.0	80.3	83.0	79.3	53.3	62.6	57.6	21.8	29.1

Source: Wang et al. (2016)

4.2 Latest deregulation initiatives

The main deregulation initiatives CAAC has introduced lie along three major restrictions as follows:

1 Airfares: CAAC was the responsible body for regulating airfares. In 1992, the State Council allowed airfares to vary within a range of 10% of the set price. However, airlines responded by changing fares simultaneously. In 1997 price discrimination tactics on foreign passengers were lifted and all passengers buying tickets in China paid the same price. In the same year, airlines were also allowed to adopt price discrimination strategies within a ticket class (e.g., economy) in order to utilise more efficiently their capacity, marking the beginning of airfare deregulation. This resulted in a price war and consequently in heavy losses for the industry. CAAC responded by prohibiting discounts higher than 20% of the normal price, however the rule was circumvented. In 2000, CAAC introduced a new rule (‘revenue pooling’), whereby revenues from specific routes were aggregated and reallocated, representing a protective mechanism. Similarly, this rule was not enforced in practice and was abandoned in 2002. In 2004, CAAC imposed a new benchmark price at 0.75 CNY/km, considering airlines’ average cost and market demand, allowing airlines to offer prices within a specified price floor (45% lower than benchmark price) and price ceiling (25% higher than benchmark ceiling). Nevertheless, airlines did not strictly abide by this rule too. Practically, although CAAC’s intention was not

to grant full pricing freedom at that point, airfares were deregulated without a formal deregulation act codifying the rules as was the case in the USA.

2 Entry-exit Regulations: according to the 'Regulation on Operation of Chinese Civil Aviation Domestic Routes and Flights' issued by CAAC in 1997, airlines needed to obtain CAAC's approval for entry or exit on a route or change the number of flights on any route. This requirement has been loosened since 2004. In 2006, more freedom was allowed by the 'Regulation on the Operation on the Domestic Routes', allowing airlines to service a route without prior CAAC's approval. However, routes with high traffic volume and routes linking busy airports are still under control. Thus, entry and exit require prior approval.

3 Privatisation: In 1994, foreign investors were allowed to invest in existing airlines, construct airports and establish aviation enterprises with Chinese partners under specific restrictions though:

   a their investment not exceeding 35% of registered capital (49% in case of airports)

   b their voting rights not exceeding 25% of overall voting rights.

   In 1997, the first privatisation took place via the listing of China Eastern Airlines, followed by China Southern Airlines, Air China and other regional airlines. Following China's accession to the WTO, the 'New Regulation for Foreign Investment in Civil Aviation Industry' came into effect in 2002, encouraging foreign investments by raising the threshold of registered capital investment from 35% to 49%, albeit no single foreign company should own more than 25%. The reforms resulted in private airlines being established, primarily as LCCs.[1] In 2004, CAAC also lifted code-sharing restrictions between China and US, allowing Chinese carriers to become members of global alliances (e.g., Air China – Star Alliance). In 2006, the 'CAAC Guidelines on Deepening the Civil Aviation Reform' has attempted to introduce a more deregulated environment.

According to China Civil Aviation Statistics (2014), as of December 2012, 46 airline companies (including ten cargo airlines) operate in China, generating 61.1 billion ton-kilometres and carrying 320 million passengers, registering an increase of 5.8% and 9.2% respectively over 2011. China's airports handled 678 million passengers in 2012 with Beijing Capital International Airport (PEK) passenger traffic expected to become the second busiest airport in the world (80 million passengers) and Shanghai Pudong International Airport (PVG) ranking in the third place globally in respect to air cargo. Additionally, China's 12 busiest airports saw an increase of more than 1,200 slots daily through enlarging their capacity, improving efficiency and optimising airspace. For instance, the flight regularity rate has risen 6% at PEK and the average taxiing time for each outbound flight at the airport has been shortened by six minutes.

As described above, significant steps have been taken to deregulate the industry with profound effects. For instance, the government has approved the establishment of 114 start-up general aviation airlines in 2012, 50 of which plan to offer business aviation services, reflecting the local industry dynamics. Additionally, changes in the computerised reservation system (CRS) will allow foreign airlines leverage distribution partners enabling access to their fares and content across a wider network of travel agents. However, the government continues to play a significant role in the industry, evidenced among others by its controlling stake in local airlines.

The European approach differs to the Chinese deregulatory approach. In Europe airlines were allowed to serve any route (especially with the abolishment of the cabotaged routes as presented above). The Chinese airlines enjoyed high yields, low input prices in the domestic market and thus high profitability (Wang et al., 2016) which in turn supported their international operations. The European case is presented as an ‘a contrario case’ in order to recognise the institutional reorganisation and the difference in policy initiatives. Furthermore, fundamental differences like institutional approaches, economical factors such as low per capita income, geographical details like the distances flown, affect the deregulatory deployment at a different level, nevertheless it seems that contribute to the strengthening of the industry itself.

The following section describes the expected impact of adopting wider deregulation measures in the Chinese airline industry.

5 Analysis

5.1 Research question

As discussed above, since the 1997 deregulation, the Chinese passenger airline industry has undergone tremendous changes. Among other changes, the improvement of business practices are the most important and lead to substantial improvements in cost efficiency and productivity. Business process improvements and upgrades included computer reservation systems, frequent flyer programs, code-sharing alliances and mergers. The Chinese airline industry trend followed the deregulation patterns of their global competitors since the 1997 relaxation of regulations. As per the literature review above, the US airline industry deregulation initiatives generated a wealth of benefits to airline passengers and the industry as a whole. Likewise, we expect that further deregulation in the China Airline industry will both improve asset utilisation and industry’s profitability and will lead to Chinese airlines’ performance converge that of their US counterparts in the medium-term due to the, expected, operational improvements.

In order to understand and estimate this impact, our analysis applies a linear regression model that measures the effect of Chinese Airlines’ operational key performance indicators (KPIs) on their revenue and cash flow generation ability. The hypothesis which we will test is the following:

- Load factor is positively associated with both revenue and cash flow generation ability.

The cash flow generation ability will be proxied by earnings before interest, taxes, depreciation, amortisation and restructuring or rent costs (EBITDAR) in this study. Hence, this paper quantifies the relationship between operational and financial indicators and forecasts the impact of further deregulation in the Chinese airline industry.

5.2 Data collection

The main variables used in this analysis were collected primarily from public databases and the primary data used to populate the database, cover practically all major deregulated airline companies in the USA, in the EU-27 member states and in China. The panel consists of firms that were involved in major privatisation efforts since the mid-1970s and the initial data collected focused on airline output, on corporate financial information and on regulatory pertinent information. More precisely, this extensive panel of aggregate data was collected from a number of public and private databases, including the US Department of Transportation's Bureau of Transportation Statistics – BTS (US DoT)[2], MIT's Airline Data Project[3] as well as from the S&P capital IQ database for the period 1994–2012. The main KPIs used in this analysis are Load Factor[4] and operating margin per ASM[5] and the reason for selecting these KPIs are primarily compatibility, normalisation and comparability among all participating companies.

More precisely, in order to clean and normalise the database, a rigorous process was adopted. The sample selection criteria included the following requirements:

- The airlines operate either in regional or in international lines.
- The airline industry was deregulated by the government in terms of entry/exit barriers, of price/rate regulation, of releasing the state ownership (or majority ownership or 'golden shares') of the main incumbent or through obligatory separation (vertical disintegration) between infrastructure and operations.
- Financial data are available, pre and post privatisation for at least one year, in a comparable and usable form.
- The state owns (post-privatisation) not more than 25% of the share capital of the company.

The final comparable panel data comprise of 41 firm-year observations for a period from 1994–2012. The Annex lists the firms and the panel data descriptive statistics that were included in the final sample. Financial and accounting data were also crossed-checked through the Bloomberg Database.

5.3 Analysis and results

As stated above, in order to analyse this hypothesis, data were collected from BTS (US DOT), MIT's Airline Data Project and from S&P Capital IQ database for the period 1994-2012. The main KPIs that have been used in the analysis are Load Factor and Operating Margin per ASM. The reason for selecting these two KPIs is mainly due to comparability issues; the data obtained were complete based on the selection criteria stated above for a significant period and were usable for the proposed econometric models. Additionally, the data included both regional and international financial and operational data, aggregated at a global basis for all participating airline companies. Further detailed analysis at the regional or local level could not be performed, since operational data at this level were considered confidential.

To estimate the effect of the convergence of load factor on the industry's revenues, we used panel data of the main Chinese airline companies derived from S&P Capital IQ for the period 1998–2012 and developed the following regression model:

$$Revenues = a + b * Load\ Factor\ (\%) + \varepsilon$$

Table 2 Regression analysis: effect of load factor on revenues

Model summary[a]				
Model	*R*	*R square*	*Adjusted R square*	*Std. error of the estimate*
1	.923[b]	.851	.847	9,904.2

ANOVA[b]						
Model		*Sum of squares*	*df*	*Mean square*	*F*	*Sig.*
1	Regression	19619097871.9	1	19619097871.9	200.001	.000[a]
	Residual	3433317469.4	35	98094784.8		
	Total	23052415341.4	36			

Coefficients[a]							
Model	*Unstandardised coefficients*		*Standardised coefficients*	*t*	*Sig.*	*95% confidence interval for B*	
	B	*Std. error*	*Beta*			*Lower bound*	*Upper bound*
(Constant)	–200,747.6	17,102.7		–1.738	.000	–35,468.0	–166,027.2
Load_Factor	3,420.5	241.8	.923	14.142	.000	2,929.5	3,911.6

Note: [a]Dependent variable: revenue. [b]Predictors: (Constant), load_factor.

Table 3 Regression analysis: effect of load factor and % operating margin per ASM on EBITDAR

Model summary[a]				
Model	*R*	*R square*	*Adjusted R square*	*Std. error of the estimate*
1	.947[b]	.897	.890	2106.4

ANOVA[a]						
Model		*Sum of squares*	*df*	*Mean square*	*F*	*Sig.*
1	Regression	1044967634.0	2	522483817.0	117.751	.000[b]
	Residual	119804679.0	27	4437210.3		
	Total	1164772313.1	29			

Coefficients[a]							
Model	*Unstandardised coefficients*		*Standardised coefficients*	*t*	*Sig.*	*95% confidence interval for B*	
	B	*Std. error*	*Beta*			*Lower bound*	*Upper bound*
(Constant)	–42,533.7	4,348.1		–9.782	.000	–51,455.5	–33,612.0
Operating margin per ASM (%)	458.1	45.4	.622	10.082	.000	364.9	551.4
Load factor (%)	704.2	60.1	.723	11.714	.000	580.8	827.5

Notes: [a]Dependent variable: EBITDAR. [b]Predictors: (Constant), load factor (%), % operating margin per ASM.

Table 2 presents the regression model and results. As showed, reported t-statistics and significance values indicate that all the components of the regression equation are statistically significant at any confidence level.

In order to estimate the effect of both the Load Factor and Operating Margin per ASM on profitability and cash flow generation capacity (EBITDAR), we developed the following model:

$$EBITDAR = a + b_1 * Load\ Factor\ (\%) + b_2 * Operating\ Margin\ per\ ASM\ (\%) + \varepsilon$$

As shown in Table 3, all components of the regression equation are statistically significant at any confidence level.

5.4 Discussion of results and limitations: expectation of Chinese airline industry convergence

From the results of the two models presented above, we see that the load factor is positively associated with both the revenues and the cash generating capacity for the Big Three Airliners. Both models have high R^2 (0.851 and 0.897 respectively), which indicates good fitness of the data on the regression. Additionally, all of the components of the regression equation are statistically significant at any confidence level, which significantly substantiates the results and the recommendations.

We can safely deduce that the improvement of the operational practices, as discussed above, will significantly improve the revenues and the cash flow generating capacity. In order to further understand this expectation, we present an analogy with the US Airline industry. This effect is expected to strengthen in case current projections of future China's airline industry developments materialise. More precisely, in case the Chinese airline companies' load factor convergences to the US industry average (as presented in Table A1) this will result in an average increase in revenues per airline (Model 1) in the range of CNY 18,359 million. In case the Chinese airline industry converges to the US Airline median, the increase in the per-airline revenue will be in the range of CNY 19,908 million. Similarly, in order to estimate the effect of the Load Factor and Operating Margin per ASM on profitability and cash flow generation capacity (Model 2), in case the Chinese Airline market convergences to the US Airline industry average (median), this will result in an average increase in EBITDAR per airline of CNY 3,779 million (CNY 4,098 million).

The results of the models suggest that the Chinese airline industry has proven resilient to the market opening, which in turn has cautiously supported their operational efficiency. The main premise of this paper is that the airline carriers will eventually adapt to the global competition and will embrace more initiatives to improve their competitive edge. This is expected to be related to changes in the geography of competition in terms of routes and of airports. Spatial competition will lead to mergers of companies so as to better serve specific markets and customer segments. To this respect, trunk routes will attract more companies compared to thin routes, however following the experience from the USA airline industry, this is expected to result in moderate price wars which in turn will favour the customers. Similarly, improved service levels will lead to higher frequencies, again favouring the passengers. Core airports will see significant expansion whereas peripheral airports will fight for market share, reducing air related fees significantly. Furthermore, the network formation and deployment will also be upgraded by adopting global industry patterns like hub-and-spoke networks instead point-to-point/linear networks.

The deregulatory initiatives adopted in China have significantly supported the financial and operational health of the incumbents, embracing the lessons learned from the USA's 1978 Airline Deregulation Act. In the three years after the deregulation, US airlines experienced substantial losses in their financial performance. Around this time, the competition was moved from price wars to soft actions including the development of computer reservation systems, frequent flyer programs, code-sharing alliances and mergers. The Chinese post 1997 deregulatory consolidation is expected to be followed by soft actions and by forming stronger and more robust Chinese based alliances and code sharing schemes.

With respect to the analysis' limitations, it should be noted that deregulation isn't the only driver that affects operating margins and revenues. Nevertheless, based on the two regression models developed and used, the positive relationship between these two is supported by a high R2 (0.851 and 0.897 respectively) which is considered satisfactory. Additionally, contextual and case specific limitations didn't allow for the usage of other variables like passenger demand and economic indicators (especially at the regional level) mainly because of information availability and of data validation reasons.

6 Conclusions

Based on the previous analysis, this study evaluated the relationship between operational performance and revenues as well as between operational performance and cash generating capacity. More precisely, by applying linear regression models we measured the effect of the load factor on the revenue and on the cash flow generation ability of the Big Three Chinese Airline Carriers. This analysis helps predict the impact of further improvements of the operational practices that further deregulation might bring. The deregulation initiatives will enable the Chinese Airline Industry converge to its global competitors and improve the financial standing.

As deregulation experience has shown, the industry's profit volatility, the risk of bankruptcies and the reduction of wages are primarily affected by the global instead of by the local competition dynamics. Hence, as a general remark, we advocate that airlines need to become more competitive and adjust to the evolving economic and social requirements. The gradual opening of the Chinese airline market will also have an impact. Furthermore, this analysis argues that the Chinese airline industry will benefit from further deregulation, improving its performance in key aspects in case it converges to the European and to the US market. According to the study results, the Chinese airline industry has so far proven resilient to the market opening, which in turn has cautiously supported the incumbents' operational efficiency. We expect that the Big Three Airlines will adapt to the spatial competition and that will adopt merger strategies so as to improve their quality of the product offerings at lower costs.

This study focused on analysing the operational efficiency from the managerial perspective of the Chinese Airline Industry. Future research needs to be targeted towards including more attributes to the models developed as well as towards examining the impact of the Chinese airline industry's deregulation activities on the safety and quality of services, on the industry structure, on the structure and profitability of ancillary industries to name but a few spillover effects. The airline industry deregulation process is still under development and the next set of decisions and regulations may involve more fundamental questions for example whether a much more liberal approach to the market and competition should be adopted, or whether the more centralised state capitalist approach currently used in China can be seen as a permanent and stable structure within which to organise such a dynamic transport sector.

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Notes

1 By the end of the 2000, 11 low-cost airlines had been established.

2 http://www.transtats.bts.gov.

3 http://web.mit.edu/airlinedata/www/default.html.

4 The number of RPMs expressed as a percentage of ASMs, which represents the proportion of airline output that is actually consumed.

5 Defined as total operating profit yield per ASM divided by total operating revenue yield per ASM. Data collected for a five year period (2007–2011).

Appendix

Data and descriptive statistics

Table A1 US airline industry KPIs (Period: 2000–2011)

Descriptive statistics			
	N	*Minimum*	*Maximum*
Revenue passenger miles (rpm '000s) (all carriers – all airports)	12	851,746,234	1,100,386,799
Available seat miles (ASM '000s) (all carriers – all airports)	12	1,173,046,921	1,371,702,489
RASM ($ cents)	12	9.13	14.31
CASM ($ cents)	12	9.52	13.91
Load factor [passenger-miles as a proportion of available seat-miles in percent (%)] (all carriers – all airports)	12	70	82
Descriptive statistics			
	Mean	*Median*	*Std. deviation*
Revenue passenger miles (rpm '000s) (all carriers – all airports)	993,275,459	1,021,952,302	91,144,610
Available seat miles (ASM '000s) (all carriers – all airports)	1,288,644,661	1,297,722,286	65,490,677
RASM ($ cents)	11.60	11.82	1.773
CASM ($ cents)	11.50	11.69	1.469
Load factor [passenger-miles as a proportion of available seat-miles in percent (%)] (all carriers – all airports)	77.17	78.26	3.904

Source: US DOT – BTS, MIT's Airline Data Project and authors' calculations

Table A2 Chinese airlines' KPIs

China southern (Period: 1997–2012)						
Descriptive statistics						
	N	*Minimum*	*Maximum*	*Mean*	*Median*	*Std. deviation*
Revenue (CNY millions)	16	11,849.4	99,514.0	40,294.2	31,133.5	29,162.5
EBITDAR (CNY millions)	13	4,166.0	18,901.0	8,541.3	6,492.0	4,963.7
Load factor (%)	13	58.7	81	69.7	70.1	7.05
Operating margin per ASM (%)	13	-6.70	11.35	3.71	3.56	0.05

Source: S&P Capital IQ database and authors' calculations

Table A2 Chinese airlines' KPIs (continued)

Air China (Period: 2001–2012)						
Descriptive statistics						
	N	*Minimum*	*Maximum*	*Mean*	*Median*	*Std. deviation*
Revenue (CNY millions)	12	22,276.4	99,147.0	51,246.7	46,354.9	27,236.7
EBITDAR (CNY millions)	9	–9,764.8	9,862.0	2,802.6	2,963.4	4,662.0
Load factor (%)	12	62.4	81.5	74	75.4	6.27
Operating margin per ASM (%)	12	–18.12	15.59	5.81	8.18	9.11
China Eastern (Period: 1994–2012)						
Descriptive statistics						
	N	*Minimum*	*Maximum*	*Mean*	*Median*	*Std. deviation*
Revenue (CNY millions)	19	6,068.5	86,972.9	29,207.5	13,999.1	26,625.9
EBITDAR (CNY millions)	19	–4,407.1	16,794	8,013.5	6,233.6	6,838.7
Load factor (%)	19	59	77.9	67.5	67.9	5.93
Operating margin per ASM (%)	19	–29.64	9.24	0.17	2.13	10.49

Source: S&P Capital IQ database and authors' calculations