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# Competition and countervailing power: Evidence from the China Eastern and Shanghai Airlines merger☆

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ABSTRACT

This paper examines the motives and effects behind the horizontal merger between China Eastern and Shanghai Airlines in 2009. We develop testable hypotheses, incorporating into a unified framework the two merging airlines, their domestic and international competitors, and relevant airports along the supply chain. We employ an event study methodology and show that domestic competitors gain whereas international competitors lose. Our results suggest that the sources of gain for the merging firms are market power in domestic markets and efficiency improvement in international markets. Further, as a hub for the merged airline, Shanghai Airport experienced positive abnormal returns. Our results do not support the hypothesis that the merged airline gains countervailing power towards airports. Our event study findings are robust to alternative estimation periods and samples, and are consistent with analyst forecasts and long-run operating performances.

## 1. Introduction

This paper analyzes the market power, efficiency and countervailing market effects of the 2009 China Eastern and Shanghai Airlines merger. Unique to the study is how the merger affects domestic and international competitors and upstream airports. The analysis investigates these effects in an event study and through the lens of the merger's expected impact on the affected companies' wealth. In contrast to post-merger studies based on limited and oftentimes proprietary data not publicly available, having this information is timelier and more useful to policy makers evaluating a proposed merger's effect. The global air passenger market significantly contributes to the global economy. Annual growth in air passenger traffic was 8.1% in 2017, with an estimated 4 billion passengers, which is expected to reach 7.8 billion by 2027 and support an estimated 380 million jobs. [1,2] Further, defined by those travelling to, from, and within the country, China's aviation market in 2022 will replace the US as the world's largest aviation market.[3] In 2018, China ranked 2nd behind the US with 4.9 billion available seats. China Eastern in 2017 ranked 8th in 110.8 million passengers served and ranked 8th in 2018 in passenger kilometers flown. Moreover, in 2017 Shanghai's Pudong International Airport ranked 10th based on aircraft movements (Airport Council International, 2017).[4]

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[1] IATA 20-Year Air Passenger Forecast, source: http://www.iata.org/pressroom/pr/Pages/2017-10-24-01.aspx.

[2] World Travel & Tourism Council, source: https://www.wttc.org/-/media/files/reports/economic-impact-research/2017-documents/globaleconomic- impact -andissues-2017.pdf.

[3] Global Business Travel Association (GBTA): www.gbta.org/foundation/pressreleases/Pages/rls_042116.aspx.

[4] Aircraft movement 2017, source: https://aci.aero/data-centre/annual-traffic-data/aircraft-movements/2017-aircraft-movements-annual-traffic-data.

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A focus in the economics literature has been the continuing effects of transportation deregulation in the US, initiated in the late 1970s and affecting all intercity transport modes. Economic deregulation of US airlines had significant impacts on virtually all aspects of the domestic and international airline markets (Morrison and Winston 1995). Similarly, significant deregulation in China's aviation market in the mid-1990s spawned a series of competitive responses, including the China Eastern – Shanghai Airlines (CE-SA) merger (Wang et al., 2016). The economic significance of China's growing presence in the global aviation market highlights the importance of gaining deeper insights on the economic effects of China's aviation deregulation and specifically on the competitive effects that the CE-SA merger had on domestic and international airline markets and on airline relationships with hub airports.

Our event methodology approach exploits the fact that, at the time of the merger announcement, domestic or foreign stock markets listed major domestic and international airlines that the merger directly or indirectly affected. Further, railways are potential substitutes for airlines. At the time of the merger, Shanghai Stock Exchange also listed Guangshen Railway, with passenger transport as its major business and which operates several railway lines in southern China, including routes from Guangzhou to Shanghai. Further, we exploit the unique setting in China where, beginning in 1998, the Shanghai Stock Exchange listed Shanghai Airport, followed by Guangzhou, Shenzhen and Xiamen airports.[5]

Our event study analysis has two important findings. First, we show that two of the merged firm's rivals, Air China and Guangshen Railways, experience significantly positive abnormal returns, consistent with theory that an increase in the merged firm's market power leads to higher fares inducing some travelers to substitute to lower-fare alternatives. We also present evidence that international competitors of the merged firm experience significantly negative abnormal returns, consistent with predictions from theory that an increase in a merged firm's efficiency, in international markets in this study, generates a competitive advantage for the firm. Prior to the merger, Shanghai Airlines internationalized its route structure, and this enabled the new China Eastern to have an expanded scope of operations and international presence without large development costs. We find that increased market power and efficiency gain are both important profit drivers after the merger.

Second, and unique to this study, we find that there are significantly positive abnormal returns for Shanghai Airport, the hub of China Eastern and Shanghai Airlines but not a hub for other airlines. Our evidence suggests that the merger enabled hub airports to extract a part of the gain from the merged airline. In other words, the merger does not substantially increase the countervailing power of China Eastern and Shanghai Airlines against its hub airport.[6] Our empirical results are consistent with various robustness checks. The results of the event study are robust to the use of different estimation periods. The results are also robust to alternative samples, including relevant airlines, railway and airports listed abroad.

Complementing the event study approach, we employ analyst forecasts as an additional source of information on how the capital market reacts to the merger. Consistent with the event study results, China Eastern and Air China have higher consensus predicted stock prices after the merger announcement. Finally, in addition to examining capital market reactions, we analyze long-run operating performance after the merger. China Eastern (which absorbed Shanghai Airlines as a brand) shows the largest performance gains in terms of size and productivity compared to other industry players. This finding is consistent with efficiency improvements also driving the merger. Our long-run results are consistent with our short-run event analyses, which suggests that an event study of an announced merger can provide policy makers with indications of the likely longer-term effects.

Section 2 provides the background information. Section 3 discusses alternative motives for the merger. Section 4 discusses the methodology and data. Section 5 reports the empirical results. Section 6 concludes.

## 2. Institutional background and literature

This section provides the institutional context for the China Eastern and Shanghai Airline merger and related literature.

### 2.1. Institutional background

On June 8, 2009, China Eastern and Shanghai Airlines simultaneously announced the notice of trading suspension, claiming that they were undergoing a material reorganization. Investors interpreted the announcement as confirmation of the conjecture that China Eastern would acquire Shanghai Airlines as its subsidiary, and thus began the largest horizontal merger in the Chinese aviation industry in recent years. One month later, the two airlines' boards of directors announced the merger plan, according to which China Eastern and Shanghai Airlines would exchange stock with each other at a 1:1.3 ratio. With the approval of the regulatory authorities, including the China Securities Regulatory Commission (CSRC), Civil Aviation Administration of China (CAAC) and the State-owned Assets Supervision and Administration Commission (SASAC), the merger encountered little resistance.

The Rules on Notification of the Concentrations of Business Operators in China, required China Eastern and Shanghai Airlines to notify the Ministry of Commerce (MOFCOM) before launching the merger.[7] Based on the China Eastern Airlines December 2009 merger plan, the MOFCOM granted the company unconditional approval on September 16, 2009 as MOFCOM concluded that the merger would not generate anticompetitive effects. On February 25, 2010, the Shanghai Stock Exchange delisted Shanghai Airlines. With the merger completed on schedule, the new China Eastern Airlines began operations before the end of 2010.

China Eastern is one of China's largest airlines with its headquarters in Shanghai. According to its 2008 income statement, China Eastern's operating revenue reached RMB 41.84 billion (or USD 6.15 billion). The target of the merger, Shanghai Airlines also has its headquarters in Shanghai and in 2008 generated over RMB 13.37 billion (or USD 1.97 billion) in revenues. However, the two airlines had suffered huge financial losses before the merger. China Eastern's profitability had been consistently weak as it had intermittently recorded net losses since its listing in 1997 on the Shanghai Stock Exchange. Further, Shanghai Airlines started to record consecutive net losses since 2007. The global financial crisis and losses from fuel hedging, respectively, further damaged their businesses. The 2008 financial statements of China Eastern and Shanghai Airlines recorded a net loss of RMB 14 billion and RMB 1.3 billion, respectively. After the merger, the new China Eastern reported a large increase in profits, which significantly reduced the company's financial stress.

### 2.2. Literature review

To our knowledge, this is the first paper that provides an event study

[5] Zhang and Yuen (2008) suggest that the Chinese government encourages airports to be publicly listed to improve their efficiency.

[6] We use the term countervailing power to represent the bargaining power of airlines against airport throughout the paper.

[7] The merger review is triggered if both of the following criteria are satisfied: (1) combined revenues of all parties exceed RMB 10 billion worldwide or RMB 2 billon in China, and (2) individual revenues of at least two parties exceed RMB 400 million in China. Source: State Council Regulation on the Notification Thresholds for Concentrations between Undertakings (2008) State Council Order No. 529.

on the effects of an airline merger along the merged firm's supply chain that includes the merged firm's domestic and international competitors and upstream airports. Knapp (1990) conducts an event study for nine airline mergers proposed in 1986, in which positive abnormal returns for both merging airlines and rival portfolios support the market power hypothesis. Singal (1996) examines 27 airline mergers during 1985–88 and finds support for the market power hypothesis. Using data on the 1986 Northwest-Republic Airlines merger, Hergott (1997) event study finds a rise in market power of the merging airlines through increasing concentration at the airport level. Zhang and Aldridge (1997), which examines the potential merger between Air Canada and Canadian Airlines International for the period 1992–93, do not find any impact on US airlines. Flouris and Swidler (2004) finds that the acquisition of Trans World Airlines by American Airlines in 2001 had negative impacts on American Airlines shareholders.

We extend this literature in two aspects. First, we include domestic and international competitors in our analysis. We find a geographical dimension in the competition effects. Market power and productive efficiency hypotheses hold in domestic and international markets, respectively. This is an important result for its competitive implications. Understanding where market power or efficiency drives a merger provides important information for decision-makers in formulating and implementing policy. Second, existing studies do not include the stock price reaction of upstream airports, which identifies the effect of an airline merger along the supply chain. We adopt Fee and Thomas's (2004) framework to analyze whether airlines experience any source of gain from enhanced countervailing power towards these upstream airports. Importantly, our results indicate that airports are not neutral players and our study highlights an important policy implication that the impacts of airline mergers extend well beyond the fare and service quality effects provided to airline passengers.[8]

Further, our study contributes to the empirical literature on the vertical structure between airport and airlines, analyzing the relationship between airport market power and countervailing power of airlines discussed by Starkie (2002) and formally illustrated in Haskel et al. (2013). More generally, Zhang and Czermy (2012) surveys the theoretical and empirical literature on the relationship between airport charges and fare-setting behaviors of downstream airlines with market power. These studies argue for a 'vertical structure' approach whereby downstream airlines have market power that might restrain the exercise of airports' market power in setting airport charges. Yet the empirical research on the actions of downstream airlines on upstream airports is still growing and far from commensurate with the economic importance of airports in the global travel market. Bel and Fageda (2010) and Bottasso et al. (2017) find that airlines with higher countervailing power (measured by market shares) have lower aeronautical charges in European and UK airports, respectively. However, Van Dender (2007) and Choo (2014) do not find evidence on countervailing power of dominant airlines for US airports.[9] Our study differs from those works in exploiting the fact that an airline merger is an exogenous shock to the downstream market structure for identifying countervailing power and for discussing the distribution of wealth effects between airlines and airports when airline competition decreases.

Finally, this paper contributes to the growing literature on the Chinese airline market and its deregulation. Zhang and Round (2009) finds no significant airfare increase for a sample of markets served by the merged China Eastern and China Southern, at least until two years after the 2002 merger. Zhang (2012) focuses on the airfares that China Eastern charged on its Shanghai-Beijing, Shanghai-Guangzhou and Shanghai-Shenzhen routes. The study finds that, relative to the other six control routes of China Eastern, airfares on those three routes were not significantly higher after the same 2002 merger until 2007. Yan et al. (2019) shows that there are productivity gains and cost reductions for Air China, China Eastern and China Southern after the same 2002 merger. More closely related to our work on the 2009 merger between China Eastern and Shanghai Airlines, Zhang (2015) finds that average airfares on seven domestic Shanghai-based routes of China Eastern increased 22% two years after the merger, suggesting that the merger increased China Eastern's market power. Ma et al. (2020) finds a 2% increase in airfares only on routes China Eastern and Shanghai Airlines served after they merged. With a focus on the firm's supply chain and geographic sources of gain, our research extends Ma et al. (2020) work and contributes to the literature by analyzing the impact of these factors on market power and efficiency.

## 3. Hypotheses

This section establishes testable hypotheses along the supply chain in the Chinese aviation industry. Stock price movements of merging airlines are of course silent on the motives behind the merger. Instead, we analyze how each of the three motives (market power, efficiency and countervailing power) affects domestic and international competitors and upstream suppliers (airports), and generates testable hypotheses that inform on the extent to which each motive is a driver of the merger decision.[10] These results comprise the baseline for our analysis.

### 3.1. Competitors

The merger's impact on stock prices of rival firms depends on whether market power or productive efficiency drives the merger (Eckbo, 1983). If market power motivates the merger then a decrease in the total number of firms and its effect on capacity after the merger will increase the market power of the remaining firms, enabling them to charge higher fares and potentially giving them a higher incentive to collude with rivals. In this case, we expect the stock prices of rival firms to increase in response to the merger.

The China Eastern and Shanghai Airlines merger may mitigate competition with other major airlines. At the route-level, China Eastern admitted in the merger report of China Eastern and Shanghai Airlines in December 2009 that for years it had faced fierce competition from the other two major airlines on specific routes between hub airports.[11] For example, China Eastern competes with Air China on the Shanghai-Beijing route and with China Southern on the Shanghai-Guangzhou/Shenzhen route. The merger can potentially mitigate competition because the merging airlines have overlapping route structures.[12]

Moreover, collusion among airlines in China is not uncommon. Anecdotal evidence reports that Air China, China Southern and China Eastern periodically held talks to prevent airfares from competitively sliding down to train fare levels.[13] Zhang and Round (2011) provides evidence of airfare collusion between China Eastern and China

[8] Previous studies examine the impact on route-level airfares after the airline merger, and find airfare typically increases after the merger. See Borenstein (1990), Kim and Singal (1993), among many others.

[9] The differing results may reflect the fact that commercial airports in the US are public whereas in Europe, 47% of the airports are either fully or partially privatized (Airports Council International (Europe), "The Ownership of Europe's Airports, 2016".

[10] Considering that the downstream customers of airlines are primarily passengers, we do not have capital market information for them.

[11] Merger report (Dec 2009): http://static.sse.com.cn/disclosure/listedinfo/announcement/c/2009-12-31/600115_20091231_4.pdf.

[12] Ma et al. (2020) document that there are 112 domestic routes only served by these two airlines.

[13] Chen, Y. (2006). Price Union Suspected to have Pushed up Airfare in this Low Season. Information Time, 27/3/2006.

Southern, and that collusion is more likely to happen when demand is high.[14] However, after enacting the Anti-Monopoly Law in 2008, firms have less incentive to collude because of the punishment. An effect of the law is that mergers are now a more attractive way to gain market power. For example, Zhang (2015) and Ma et al. (2020) find that China Eastern and Shanghai Airlines increased airfares after the merger.

Further, Shanghai is a railway hub serving as a junction of some of the busiest railway lines in Eastern China, including Beijing-Shanghai and Guangzhou-Shanghai. Railways, especially high speed railways (HSRs), are potential substitutes for airline passengers.[15] When planning a trip, a traveler's choice set generally includes railways in addition to the airlines between city pairs.[16] We expect that, as a competitor of the merging airlines, railways can also benefit from the spillover effects of increasing market power after the merger. This leads to the following hypothesis.

**Hypothesis 1A.** *The rival airlines and railways experience positive abnormal returns after the merger announcement if market power primarily drives the merger between China Eastern and Shanghai Airlines.*

Alternatively, if productive efficiency motivates the merger, this suggests that there are cost savings after the merger. Reduced costs lower airfares in the product market, which in turn imposes airfare pressure on the rival airlines and railways. If rivals of the merged airline cannot replicate these cost savings, their profits will decline. Thus, we expect the stock price effect for the rival airlines and railways to be negative.

The merger between China Eastern and Shanghai Airlines may achieve cost reductions through scale economies, scope economies or elimination of inefficient operations and facilities. In the merger report of China Eastern and Shanghai Airlines (Dec. 2009), China Eastern identified the merger's aims were to achieve synergies by integrating the route composition, rearranging flight timetables, establishing a uniform information system, enhancing operations management, optimizing the distribution and marketing channels, sharing customer resources and reducing financial costs.[17] To this point, the load factors, which measure capital utilization in transporting passengers and freight, fluctuated in the 60%–70% range before the merger (see Fig. 1). The load factor of the merged airline rose to 70% or above, consistent with the merged airline more efficiently using its passenger and cargo capacity to generate revenue.

Even though the two merging airlines have headquarters in Shanghai and numerous overlapping routes, each separately possesses comparative advantages. China Eastern, for example, has more aircrafts, flies on more routes, and, as one of China's big three airlines, enjoys a larger market share. Shanghai Airlines, on the other hand, proactively internationalized its route structure before the merger. Beginning in 2000, Shanghai Airlines gradually launched several Shanghai-based international routes (passenger and cargo) and established its dominance in these sub-markets. As a part of its international blueprint, Shanghai Airlines built code-sharing reciprocal business relationships with other

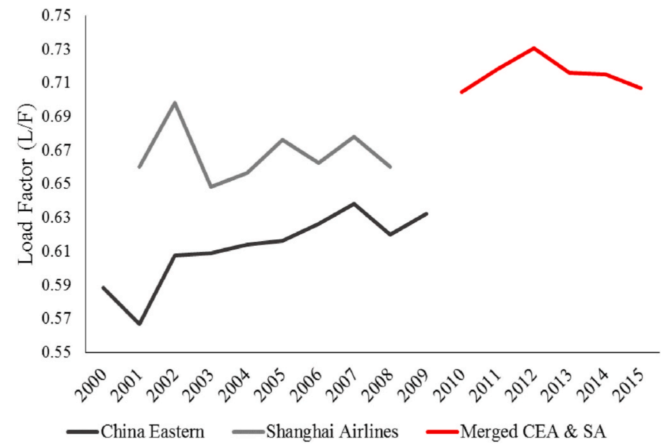



**Fig. 1.** Load factors before and after the merger.
Note: This figure depicts yearly load factors for China Eastern and Shanghai Airlines before the merger and the "New China Eastern" after the merger. Load factor = RTK/ATK, with RTK being revenue tonne kilometer and ATK being available tonne kilometer. Source: Annual reports of China Eastern and Shanghai Airlines, various years.

international airlines.[18] Table 1 reports Shanghai Airlines pre-merger international route innovations that provided the new China Eastern with an expanded scope of its product portfolio.

The merger between China Eastern and Shanghai Airlines is expected to affect the competition in international markets, i.e. China-Foreign country-pair market. On one hand, Clougherty (2000, 2002) finds that a domestic airline merger increases the market share of merging airlines in international country-pair markets. He suggests that such positive effects result from the merger-induced lower average cost per passenger and increased density economies. This channel can be at work in this merger. Because China Eastern acquires international routes through the merger rather than having to incur the fixed costs in building these routes, the merger generated cost savings to the merged firm and provided the merged CE-SA firm a comparative advantage over its rivals. Further, the merger between China Eastern and Shanghai Airlines allows

**Table 1**
Internationalization of shanghai airlines (2004–2008).

| Year | International/Interregional Routes | Code Sharing |
|---|---|---|
| 2004 | Osaka(P), Seoul(P) | Lufthansa, ANA, Korean Air |
| 2005 | Hong Kong(C), Frankfurt(C) | |
| 2006 | Hong Kong(P), Singapore(C), Los Angeles(C) | United, Tai Airways |
| 2007 | Haneda(P), Gimpo(P), Busan(P), Ho Chi Minh City-Singapore(C), Anchorage-Chicago(C) | Air Canada, Air New Zealand |
| 2008 | Copenhagen(P), Bangkok(P), Bombay(CHT), Taiwan(CHT), Saipan(CHT), Izumo(CHT) | |

Note: This table presents the international/interregional routes opened by Shanghai Airlines and Code-sharing services provided since 2004 until 2008. P in parenthesis stands for passenger route. C stands for cargo route. CHT stands for chartered route. Shanghai Airlines became an official member of Star Alliance in 2006 but switched to Sky Team with China Eastern after the merger in 2011. Sources: media coverage and airlines' website. The code sharing information is from Baidu Encyclopedia. The route information is from "Management Discussion and Analysis" of Shanghai Airline's annual reports, various years. See http://xinpi.cnstock.com/Search.aspx?stockcode=600591 for a list of these annual reports.

[14] Shanghai hosted the 2010 World Expo one year after the merger. Demand was predicted to be high during the Expo-period and the following periods thanks to the advertising effect by the Expo for the Shanghai city. Zhang et al. (2013) provides evidence that the Expo increased passenger transportation by 20%.

[15] The existing literature recognizes the competitive relationship and substitution pattern between airlines and railways, especially between HSR and airlines. See Fu et al. (2012), Wei et al. (2017) and Zhang et al. (2017), among many others.

[16] These railway expresses are usually slower but cheaper than flights. For instance, Express T100, being one of the most popular options for train passengers, takes about 16 h from Guangzhou to Shanghai overnight and charges less than 380 RMB per sleeper ticket. On the other hand, flights from Guangzhou to Shanghai take about 2 h and costs no less than 500 RMB.

[17] See section 3.2 on page 1-1-27 in the Dec-2009 version merger plan.

[18] Before the merger, Shanghai Airlines was a member of Star Alliance. After the merger, it quitted from the alliance and joined China Eastern in Sky Team.

the merged airline to join SkyTeam. Joining the international alliance can reduce airfares by coordinating pricing between alliance partners (Brueckner and Whalen 2000) and improving product quality offered (Clougherty and Zhang, 2009). As a result, membership in the alliance can increase the merged airline's competitiveness in the international airline markets. On the other hand, the merger between China Eastern and Shanghai Airlines would reduce competitiveness if the merged airline lost scale economies through market power induced reductions in output (Clougherty and Zhang, 2005). These effects produce the following hypothesis.

**Hypothesis 1B.** *The rival airlines and railways experience negative abnormal return after the merger announcement if productive efficiency primarily drives the merger between China Eastern and Shanghai Airlines.*

Overall, the market reactions of competing airlines and railway helps to identify whether the market power effect dominates the productive efficiency effect. Given the respective comparative advantages of the merging airlines, we expect *Hypothesis 1A* and *Hypothesis 1B* are more likely to hold in domestic and international markets, respectively.

### 3.2. Airports

Recent literature suggests that the vertical structure approach is useful for analyzing airport-airline relationships as the airline markets mostly exhibit imperfect competition (Zhang and Czermy, 2012). Following Haskel et al. (2013), we consider airports to be strategic upstream players that bargain with the airlines in setting their charges and we employ the implications of Haskel et al. (2013) model to develop the following two hypotheses.

Shanghai has two airports, Hongqiao Airport (domestic based service) and Pudong International Airport (international based service), both of which the Shanghai Airport Authority (SAA) controls. Chinese airports, including SAA, are regulated by Civil Aviation Administration of China. According to the Civil Aviation Airport Charges Reform Implementation Plan, airports levy fixed charges on airlines, such as rental fees for office and ticket counter, and variable charges based on number of passengers such as landing, taxi, gates and security fees.[19] Further, the government regulates aeronautical charges while the airport has more discretion in setting the non-aeronautical charges.[20] Thus, under this regulatory environment, SAA's discretion over non-aeronautical charges provides an opportunity for it to exercise a non-linear pricing structure.

Given no competition between the two Shanghai airports (due to the common ownership) and no third option, the merged airline is in a disadvantageous bargaining position, making it difficult to negotiate lower airport charges from Shanghai Airports Authority. Potentially, SAA can raise its profit by using non-linear pricing to extract some (or all) of the increased profits of the merged airline. This yields the following hypothesis.

**Hypothesis 2A.** *Shanghai Airports experience positive abnormal returns after the merger announcement and extract part of the increased profits of the new China Eastern.*

Table 2 reports the market shares of major airlines at their hub airports from 2006–08. If China Eastern and Shanghai Airlines had merged during this period, the new (merged) China Eastern would account for as much as 50% and 30% post-merger market shares of passenger and cargo operations, respectively.

We expect the new China Eastern, as the unique dominant airline, to have a stronger post-merger position to bargain for lower charges with Shanghai Airports (Starkie 2002; Haskel et al., 2013; Bottasso et al., 2017) to the extent that Shanghai Airports experience competition from other airports and other modes.[21] If the merged airline experiences a substantial gain in countervailing power against Shanghai Airports, the drop in profits of Shanghai Airports from losing bargaining power against the merged airline may offset the rise in profits extracted from the merged airline. Although SAA's concentration in Shanghai suggests that the new merged airline would not have sufficient leverage to fully offset a rise in airport charges, this possibility gives us the following hypothesis.

**Table 2**
Market shares of major airlines in their base airports (2006–2008).

| Year | China Eastern | Shanghai Airlines | The new China Eastern | Air China | China Southern |
|---|---|---|---|---|---|
| *A. Passenger Market* | | | | | |
| 2006 | 35.7% | 14.4% | 50.1% | 38.3% | 53.2% |
| 2007 | 33.9% | 14.6% | 48.5% | 39.1% | 50.7% |
| 2008 | 32.1% | 14.5% | 46.6% | 39.8% | 49.0% |
| *B. Cargo Market* | | | | | |
| 2006 | 19.4% | 9.5% | 28.9% | 45.8% | 42.1% |
| 2007 | 17.5% | 9.5% | 27.0% | 44.2% | 39.7% |
| 2008 | 17.6% | 9.0% | 26.6% | 45.9% | 37.0% |

Note: This table reports the market shares of major airlines in their base airports during 2006–2008. Panel A shows the shares in passenger market and Panel B shows the shares in cargo market. Source: Merger Report of China Eastern and Shanghai Airlines (Dec. 2009). The market shares of the "New China Eastern" is simply the sum of China Eastern and Shanghai Airlines.

**Hypothesis 2B.** *Shanghai Airports experience negative abnormal returns after the merger announcement and the new China Eastern gains substantial countervailing power against Shanghai Airports.*

## 4. Empirical methodology

### 4.1. Method

An event study analyzes the impact that an 'event' has on firm value. Researchers (e.g. Eckbo, 1983; Fee and Thomas, 2004) have used event study methodology to study the competitive effects of a merger. To assess the impact of a merger, the methodology compares the reaction of a firm's stock price against the expected normal return at the time of a merger announcement. Specifically, we estimate the following system of equations:

$$\begin{cases} R_{1,t} = \alpha_{10} + \alpha_{11}R_{m,t} + \alpha_{12}R_{m,t-1} + \alpha_{13}R_{m,t+1} + \sum_{k=-4}^{4}\beta_{1k}D_k + \varepsilon_{1,t} \\ \vdots \\ R_{i,t} = \alpha_{i0} + \alpha_{i1}R_{m,t} + \alpha_{i2}R_{m,t-1} + \alpha_{i3}R_{m,t+1} + \sum_{k=-4}^{4}\beta_{ik}D_k + \varepsilon_{i,t} \\ \vdots \\ R_{N,t} = \alpha_{N0} + \alpha_{N1}R_{m,t} + \alpha_{N2}R_{m,t-1} + \alpha_{N3}R_{m,t+1} + \sum_{k=-4}^{4}\beta_{Nk}D_k + \varepsilon_{N,t} \end{cases} \tag{1}$$

The system of equations includes *N* firms that the merger potentially affects. The variable $R_{i,t}$ is the daily return of firm *i* on date *t* and $\varepsilon_{i,t}$ is the disturbance term of firm *i* on date *t*. To estimate the normal return, we adopt a capital asset pricing (CAPM) framework, which relates the stock return of a firm to the market portfolio and an idiosyncratic component. $R_{m,t}$, $R_{m,t-1}$ and $R_{m,t+1}$ are the daily returns of market portfolio on date *t*, *t-1* and *t+1*, respectively. The market returns capture aggregate factors

[19] SAA Annual Reports (2009, 2010).

[20] Document 157, Civil Aviation Administration of China (2007). http://www.caac.gov.cn/XXGK/XXGK/ZFGW/201801/t20180111_48508.html

[21] Regulatory oversight typically requires merged airlines to sell some gates and/or reduce presence significantly at airports where both have a large presence (e.g., Delta-NWA merger in 2008) in order to weaken the market power of the merged airlines. We do not find any evidence that China's regulatory authority required similar actions in the China Eastern-Shanghai Airlines merger.

that drive the stock returns of those N firms.

The dummy variable $D_k$ equals one on the date that is $k$ days away from the date of the merger announcement (June 8, 2009).[22] The set of dummy variables tracks the return of those $N$ firms over the period four days before and after the merger announcement. Equation-specific coefficients $\beta_{ik}$ capture the reaction of firm $i$ to the merger announcement during these 9 days. If the coefficient is significantly positive (negative), then the stock price of firm $i$ is higher (lower) than the expected normal return. In other words, the coefficient $\beta_{ik}$ is the abnormal return (AR) for firm $i$ on day $k$. It is noteworthy that the set of dummy variables $D_{-4}, \ldots, D_{-1}$ captures whether investors anticipate the merger announcement. Insignificant coefficients of $D_{-4}, \ldots, D_{-1}$ from zero suggest that the merger announcement provides new information to investors.

In our empirical analysis, we focus on the cumulative abnormal return (CAR[-j,+j]) of firm $i$ by summing up all of its ARs over the event window of [-j, +j]. In our context, CAR may be more meaningful than AR because the CSRC imposes a stock price limit (±10% for normal stocks) for the Chinese stock markets, which restricts the within-day stock price from conveying all investor information. In fact, when China Eastern and Shanghai Airlines delivered their merger announcement, the stocks of both companies traded under the condition of special treatment (ST) because they suffered from financial losses for two consecutive years. Under the ST, the CSRC imposed more rigorous limits on the companies' stock price fluctuations (±5%).

To test our hypotheses, positive and negative CARs for rival airlines in domestic and international markets and for railways support Hypotheses 1A and 1B, respectively. Further, a positive (negative) CAR for Shanghai Airports Authority and no significant CAR for other sample Chinese airports support Hypothesis 2A (2B).

### 4.2. *Estimation and data*

The sample errors of different daily return equations can be positively correlated because our sample firms may share common input and output markets. Following Binder (1985), we address this cross-equations contemporaneous correlation in error terms by employing the Seemingly Uncorrelated Regression (SUR) model to estimate the system of equations.[23]

We apply Dimson (1979) approach, which includes lead, contemporaneous and lagged market returns in the CAPM model to mitigate the issue of non-synchronous trading. Our approach is different from Duso et al. (2007) which uses Scholes and Williams (1977) two-step single equation approach to correct for non-synchronous trading. Our multivariate approach, allowing for event clustering driven by a common event, provides several advantages. First, Brown and Warner (1985) finds that adjusting for event clustering is important for statistical inference of AR. Second, Brown and Warner (1985) do not find that the non-synchronous trading correction procedures of Dimson (1979) and Scholes and Williams (1977) produce significantly different results for event studies. Third, Dimson (1979) approach is more easily applied to a multivariate framework For these reasons we adopt Dimson (1979) approach, which gives (1) as our set of estimating equations.

The estimation period includes the trading days ranging from December 1, 2008 (120 days before the merger announcement) to December 2, 2009 (120 days after the announcement). Along with the event day (June 8, 2009), total trading days included in the sample for stocks range between 239 and 241 depending on the different holiday schedules. The daily stock prices in our sample firms are from WIND database (http://www.wind.com.cn/en). We include four groups of listed firms in our empirical analysis: merging airlines, domestic competitors, international competitors and airports.

First, the merging airlines are China Eastern Airlines and Shanghai Airlines. Second, there are four domestic competing airlines, namely Air China, China Southern Airlines, Hainan Airlines and Shandong Airlines.[24] When the China Eastern-Shanghai Airlines merger occurred, there was no established high speed rail (HSR) from Shanghai.[25] For domestic competing railways, the only listed railway firm was Guangshen Railway, which did not have any important announcements during our event window. With passenger transport as its major business, Guangshen Railway operates several non-HSR railway lines in southern China, including some from Guangzhou to Shanghai.[30] Thus, we include Guangshen Railway as the rival railway.[26] Third, airports include Beijing airport, Shanghai airports (SAA), Guangzhou airport, Shenzhen airport, Xiamen airport and Haikou airport. Fourth, there are thirteen international competing airlines, which are also used in Yan et al. (2019). By the time of the merger between China Eastern and Shanghai Airlines, these airlines were all operating flights from/to mainland China. Thus, they are potential competitors for the merging airlines in the international market. In sum, we construct a panel dataset with twenty-five trading stocks listed in various stock exchanges. See Table 3 for details of stocks and market portfolios.

Table 3 reports descriptive statistics for the daily returns in our sample period. We compute the return as $R_t = (P_t - P_{t-1})/P_{t-1}$, where $P_t$ is stock price on date t and we adjust daily stock prices for stock splits and dividend payments before computing the daily return. All stocks and market portfolios show slightly positive average returns over the baseline window. Further, the standard deviations of stocks listed in Hong Kong and New York Stock Exchanges are larger than those listed in Mainland China, suggesting that the stock price limits in Shanghai or Shenzhen Stock Exchange are binding constraints on the stock returns.

## 5. Empirical results

This section presents three sets of results, namely domestic competitors, international competitors and airports. Apart from discussing the event study results, we supplement the discussion with information from operational statistics. Table 4 reports the estimates of CAR[0,+2], CAR[0,+4] and CAR[-4,-1], with the full empirical results of Equation (1) reported in Appendix A. We focus on these three estimates of CAR because CAR averages out idiosyncrasies on some days over the event windows.

Before discussing the results of our hypothesis tests, we discuss three results that one expects from a well-specified event study. First, the CAR [-4,-1] is insignificant in most cases. The absence of a significant reaction of our sample firms before the merger announcement is consistent with the event providing new information content to investors. Second, the first two columns in Table 4 report significantly positive abnormal returns for China Eastern and Shanghai Airlines after the merger

[22] Because the exchanges suspended stock trading for China Eastern and Shanghai Airlines, we set the day when trading resumed (13 July 2009) as 0, and so on afterwards.

[23] Cameron and Trivedi (2005, Chapter 6). We examine the correlation matrix of residuals after the SUR estimation. According to Breusch-Pagan test of independence, we reject the null hypothesis that the errors are uncorrelated, which justifies our application of the SUR model. The results are available upon request.

[24] We do not include Spring Airlines, a major low-cost carrier in China, because it was not listed until 2015, which is beyond the end of our sample period. Further, we do not include foreign airlines into our analysis because they have negligible market shares in China's domestic routes.

[25] High-speed railway from Shanghai to Beijing came into service in 2011 and high-speed railways from Shanghai to Guangzhou came into service in 2014. Prior to the merger, stock markets did not list China Railway Corporation and there was no HSR company listed in the stock exchange.

[26] In 2009, Daqin Railway Co., Ltd and China Railway Tielong Container Logistics Co., Ltd. had affiliations with China Railway Corporation. Daqin Railway specialized in railway transportation of coal and Tielong specialized in railway transportation of containers. Neither firm is a competitor of the merging airlines.

**Table 3**
Background information and descriptive statistics.

| Firm | Trading Code | Market Capitalization[a] | Listed Exchange | Daily Return | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Obs | Mean | Min | Max | S.D |
| **Airlines** | | | | | | | | |
| Air China | 601111.SH | 86004.56 | Shanghai | 241 | 0.004 | −0.091 | 0.101 | 0.035 |
| China Eastern | 600115.SH | 33602.05 | Shanghai | 241 | 0.002 | −0.100 | 0.100 | 0.031 |
| China Southern | 600029.SH | 35562.07 | Shanghai | 241 | 0.003 | −0.100 | 0.101 | 0.033 |
| Hainan Airlines | 600221.SH | 18957.46 | Shanghai | 241 | 0.003 | −0.100 | 0.101 | 0.035 |
| | 900945.SH | 10853.25 | Shanghai[b] | 241 | 0.004 | −0.086 | 0.102 | 0.026 |
| Shandong Airlines | 200152.SZ | 1269.40 | Shenzhen[b] | 241 | 0.006 | −0.091 | 0.100 | 0.032 |
| Shanghai Airlines | 600591.SH | 7718.04 | Shanghai | 241 | 0.002 | −0.100 | 0.101 | 0.028 |
| **Railway** | | | | | | | | |
| Guangshen Railway | 601333.SH | 11249.55 | Shanghai | 241 | 0.001 | −0.060 | 0.085 | 0.023 |
| **Airports** | | | | | | | | |
| Guangzhou airport | 600004.SH | 29598.08 | Shanghai | 241 | 0.001 | −0.083 | 0.069 | 0.022 |
| Shanghai airport | 600009.SH | 13048.68 | Shanghai | 241 | 0.001 | −0.064 | 0.063 | 0.023 |
| Shenzhen airport | 000089.SZ | 4654.77 | Shenzhen | 241 | 0.001 | −0.063 | 0.076 | 0.023 |
| Xiamen airport | 600897.SH | 2266.69 | Shanghai | 241 | 0.001 | −0.075 | 0.072 | 0.024 |
| **International Airlines** | | | | | | | | |
| **U.S. & Canada** | | | | | | | | |
| United | UAL.N | 461.83 | New York | 241 | 0.002 | −0.232 | 0.196 | 0.07 |
| Continental | CAL.N | 1095.60 | New York | 241 | 0.002 | −0.192 | 0.231 | 0.058 |
| Delta | DAL.N | 4467.77 | New York | 241 | 0.002 | −0.311 | 0.191 | 0.055 |
| AA | AMR.N | 1145.51 | New York | 241 | 0.001 | −0.237 | 0.197 | 0.061 |
| Air Canada | AC.TO | 122.81 | Toronto | 241 | 0.001 | −0.298 | 0.331 | 0.07 |
| **Asia-Pacific** | | | | | | | | |
| Cathy Pacific | 0293.HK | 5421.06 | Hong Kong | 239 | 0.003 | −0.08 | 0.109 | 0.029 |
| ANA | C6L.SG | 68999.30 | Tokyo | 241 | −0.001 | −0.059 | 0.057 | 0.017 |
| Korean | 9202.T | 1973.43 | Korean | 241 | 0.001 | −0.17 | 0.092 | 0.027 |
| Singapore | 003490.KS | 10888.58 | Singapore | 241 | 0.001 | −0.08 | 0.1 | 0.023 |
| Qantas | QAN.AX | 3693.69 | Australian | 241 | 0.001 | −0.183 | 0.086 | 0.029 |
| **Europe** | | | | | | | | |
| Air France-KLM | AF.PA | 3855.66 | Euronext-Paris | 241 | 0.001 | −0.095 | 0.114 | 0.032 |
| British | BAY.L | 2347.65 | London | 241 | 0.002 | −0.206 | 0.121 | 0.037 |
| Lufthansa | LHA.F | 5473.50 | Frankfurt | 241 | 0.000 | −0.082 | 0.079 | 0.023 |
| **Market portfolios** | | | | | | | | |
| HS300 Index | | | Shanghai & Shenzhen | 241 | 0.003 | −0.071 | 0.067 | 0.021 |
| HSI Index | | | Hong Kong | 239 | 0.002 | −0.055 | 0.087 | 0.023 |
| S&P500 Index | | | New York | 241 | 0.002 | −0.089 | 0.071 | 0.02 |
| TSX300 Index | | | Toronto | 241 | 0.002 | 0.018 | −0.054 | 0.059 |
| Nikki 225 Index | | | Tokyo | 241 | 0.001 | 0.018 | −0.056 | 0.052 |
| KOPSI Index | | | Korea | 241 | 0.002 | 0.018 | −0.061 | 0.079 |
| CAC40 Index | | | Euronext-Paris | 241 | 0.001 | 0.018 | −0.055 | 0.087 |
| ASX200 Index | | | Australia | 241 | 0.001 | 0.014 | −0.043 | 0.046 |
| FSTE100 Index | | | London | 241 | 0.001 | 0.015 | −0.053 | 0.062 |
| DAX Index | | | Frankfurt | 241 | 0.001 | 0.019 | −0.051 | 0.076 |

Note: This table presents the basic information and market capitalization of all the stocks used in the event study estimation, and the summary statistics for all the market returns and stock returns used in the baseline estimation ([-120, +120] window). The daily return is calculated as $R_t = (P_t - P_{t-1})/P_{t-1}$. The discrepancy of the number of observations comes from the different holiday arrangements of different stock exchanges.

[a] The market capitalization is calculated based on the number of outstanding shares on June 30, 2009. The currency is RMB for Chinese stocks (both listed in mainland and abroad), and USD for others.

[b] These stock shares, which are also called B shares, are priced in RMB and settled in USD or HKD.

announcement. In particular, the CAR[0,+2] for China Eastern and Shanghai Airlines reaches 12.3% and 13.5%, respectively, suggesting that investors expected each would benefit from the merger. Further, CAR[0,+4] for China Eastern and Shanghai Airlines reaches 16% and 19.3%, respectively.[27] The positive stock price reactions for the two merging airlines is consistent with much of the previous literature using event studies to analyze mergers (e.g. Eckbo, 1983; Fee and Thomas, 2004). Further, the stock price reactions are consistent with theoretical expectations that firms do not enter mergers unless they expect these to be profit maximizing. Third, all coefficients of market returns, $R_{mt}$, are significantly positive, consistent with the prediction of the CAPM model (see Appendix A). Overall, the base results support the use of our empirical specification.

In the remaining part of this section, we discuss the CAR results for the rival airlines and airports to test the validity of our hypotheses.

### 5.1. Domestic competitors (airlines and railway)

The middle six columns in Panel A report estimates for the domestic competitors. These estimates provide evidence supporting the market power hypothesis. More specifically, the 6.3% CAR[0,+2] for Air China is statistically significant at a 10% level, suggesting that investors expected Air China to benefit from the merger. Consistent with our market power results, Zhang et al. (2013) reports that China Eastern and Air China dominated the Beijing-Shanghai routes with a combined market share of over 90% (measured in revenue passenger kilometers (RPK)) in

[27] The persistence of abnormal returns over those days may reflect the regulatory limitation that on the Shanghai and Shenzhen Stock Exchanges the stock price can only fluctuate within the [-5%,5%] interval (Although the estimated abnormal returns can be larger than 5%, the raw returns of both stocks are kept below the upper bound of price limit for those days). As a result, the stock prices fail to reflect the news efficiently on the day of the merger announcement.

**Table 4**
Cumulative abnormal return.

Panel A: Domestic Stocks

| Variables | Merging Airlines | | Rival Airlines | | | | | Railway | Airports | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | China Eastern | Shanghai Airlines | Air China | China Southern | Hainan Airlines | Hainan Airlines | Shandong Airlines | Guangshen | Shanghai | Guangzhou | Shenzhen | Xiamen |
| | SH | SH | SH | SH | SH | SH (B) | SZ | SH | SH | SH | SZ | SH |
| CAR[0,+2] | 0.123*** | 0.135*** | 0.063* | 0.020 | −0.001 | 0.020 | −0.011 | 0.075*** | 0.077*** | 0.029 | 0.041 | −0.002 |
| | [0.001] | [0.000] | [0.092] | [0.567] | [0.976] | [0.559] | [0.780] | [0.003] | [0.004] | [0.212] | [0.123] | [0.942] |
| CAR[0,+4] | 0.160*** | 0.193*** | 0.010 | −0.020 | −0.020 | −0.001 | −0.054 | 0.060* | 0.049 | 0.013 | 0.010 | 0.011 |
| | [0.001] | [0.000] | [0.832] | [0.671] | [0.742] | [0.985] | [0.287] | [0.067] | [0.156] | [0.658] | [0.773] | [0.774] |
| CAR[-4,-1] | −0.039 | 0.025 | −0.064 | −0.037 | −0.017 | −0.046 | 0.027 | −0.014 | −0.029 | −0.020 | −0.023 | −0.050 |
| | [0.504] | [0.637] | [0.206] | [0.495] | [0.771] | [0.303] | [0.560] | [0.628] | [0.346] | [0.477] | [0.461] | [0.151] |

Panel B: International Stocks

| Variables | North America | | | | | Asia-Pacific | | | | | Europe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | United | Continental | Delta | AA | Air Canada | Cathy | ANA | Korean | Singapore | Qantas | Air France-KLM | British | Lufthansa |
| CAR [0,+2] | −0.137 | −0.141* | −0.065 | −0.072 | 0.011 | −0.003 | −0.008 | −0.018 | 0.052* | 0.003 | −0.062 | −0.046 | −0.035 |
| | [0.174] | [0.092] | [0.378] | [0.417] | [0.927] | [0.946] | [0.776] | [0.664] | [0.075] | [0.931] | [0.139] | [0.384] | [0.233] |
| CAR [0,+4] | −0.281** | −0.170 | −0.100 | −0.101 | 0.054 | −0.023 | −0.016 | −0.039 | 0.028 | −0.015 | −0.077 | −0.054 | −0.059 |
| | [0.032] | [0.116] | [0.299] | [0.381] | [0.724] | [0.656] | [0.640] | [0.464] | [0.460] | [0.765] | [0.155] | [0.436] | [0.122] |
| CAR[-4,-1] | −0.003 | 0.054 | 0.082 | 0.055 | −0.002 | −0.049 | −0.005 | −0.023 | 0.006 | 0.049 | −0.025 | −0.007 | −0.006 |
| | [0.980] | [0.577] | [0.343] | [0.593] | [0.989] | [0.296] | [0.860] | [0.637] | [0.860] | [0.278] | [0.616] | [0.905] | [0.864] |

Note: SH and SZ denote Shanghai and Shenzhen Stock Exchange, respectively. Standard errors of coefficients in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

2010. Air China would benefit from the merger between China Eastern and Shanghai Airlines if the merger rationalized Shanghai Airlines' overlapping routes with China Eastern.

Panel A reports CAR estimates for the rival railway next to those for rival airlines. Also consistent with the market power hypothesis, Guangshen Railway shows a significant CAR of 7.5% over the [0,+2] window.[28] This result is consistent with the explanation that the merged airline would exert its market power to increase fares, leading some consumers to substitute cheaper rail for air. This quantity effect from consumer switching led to a rise in the railway's stock price. Further, if the merged airline gains synergies from greater international exposure (as we argue below), these synergies also increase the demand for railway as a segment of international travel.

Overall, our results support Hypothesis 1A for domestic markets. However, our results suggest the strategic interaction among China Eastern, Shanghai Airlines and other airlines is not strong enough to generate additional significant result on domestic competitors' CARs.

### 5.2. International competitors

Panel B reports estimates for the international competitors. Most of these competitors have negative abnormal returns clustered around the merger announcement. Specifically, United Airlines and Continental Airlines have significantly negative CARs during the [0,+2] and [0,+4] windows, respectively.[29] The weak responses of other North American and European airlines to the merger announcement can be attributed to the lower passenger volume on the US-China routes relative to the transatlantic routes, which are the focus of those North American and European airlines.[30]

An exception is Singapore Airlines, which exhibits a significantly positive response. Two factors are consistent with these results. First, Singapore Airlines was the largest strategic partner of China Eastern in the international market.[31] Second, there was news on June 15, 2009, that Brussels Airlines would join Star Alliance, effective in December 2009 with expected positive implications for members of Star Alliance, including United Airline, Air Canada, ANA, Singapore Airline and Lufthansa.[32]

We suggest the competitive effect (i.e. negative stock price responses) on the two US airlines and the positive spillover effect (i.e. positive stock price response) on Singapore Airline are driven by the efficiency gain of the merged airline in the international market. Fig. 2 (a) plots the revenue decomposition for China Eastern, Air China and China Southern from 2005 to 2017. There is a positive shift in the percentage of revenue generated from international and Hong Kong, Macao and Taiwan (HMT) routes for China Eastern after 2009, which is consistent with the timing of the merger with Shanghai Airlines. Also, such a positive shift is not observed for Air China and China Southern. Fig. 2B depicts the source of a rise in revenue from international and HMT routes. The contribution mostly comes from international flights rather than HMT flights, consistent with the argument that Shanghai airlines developed a competitive international market presence prior to the merger.

Fig. 3 depicts the yearly load factors on domestic routes, international routes and routes connecting HMT. In 2010 (1 year after the merger), China Eastern's overall load factor increased 11%. Among these three routes, the load factor on domestic routes increased 9%

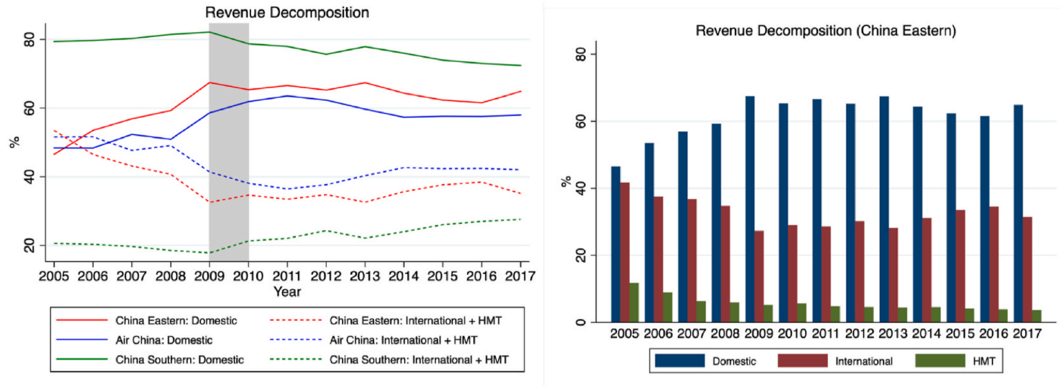
[28] The Hong Kong and New York Stock Exchanges also list Guangshen Railway. We also included those stocks in the event study and found similar results.

[29] In June 2008, United Airlines and US Airways signed an alliance pact that led to their eventual merger in May 2010. However, we do not find significant news over the short event window used in our study, thus we believe our results are not driven by the merger between United Airlines and US Airways.

[30] The transatlantic air passenger volume was 60 million in 2007 (Air passenger transport in Europe in 2007; Eurostat 2009), whereas the weekly seats in the China–US market was about 30 thousand (or equivalently 1.5–1.6 million in a year) according to Table 4 of Lei et al. (2016).

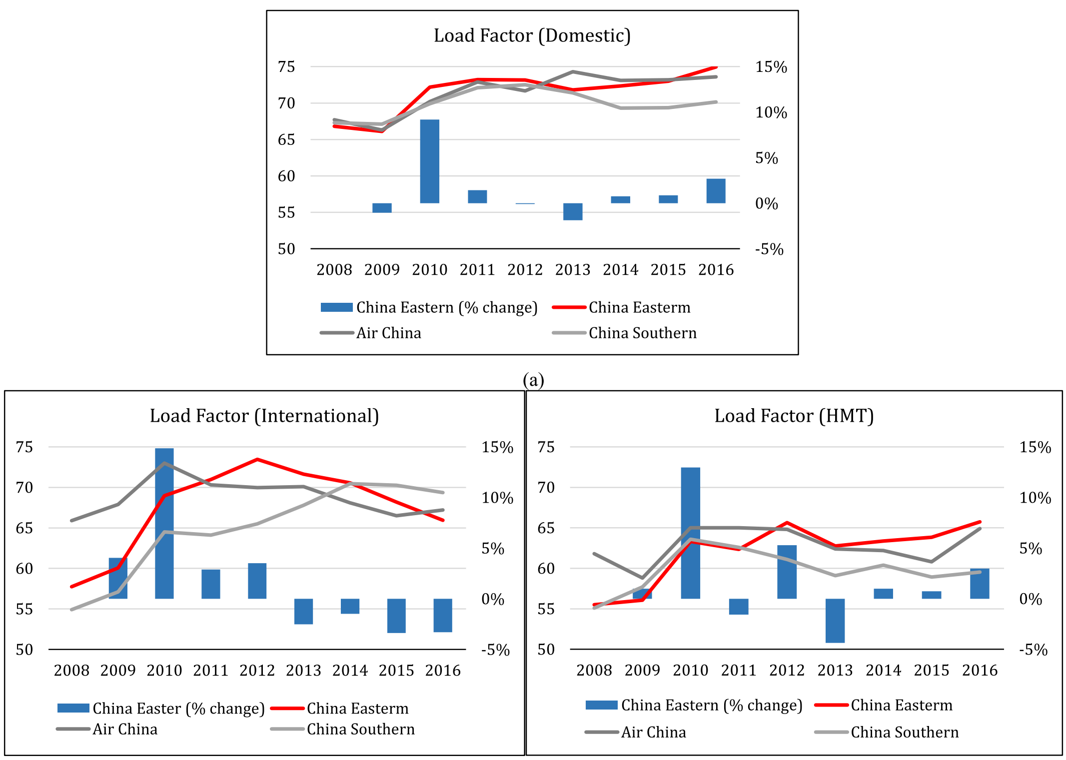
[31] Singapore Airlines also tried to acquire China Eastern in 2008. Although the proposal was eventually vetoed, the partnership between Singapore Airlines and China Eastern never ceased.See http://www.knowledgeatwharton.com.cn/article/1585/for a media coverage of this acquisition attempt

[32] https://web.archive.org/web/20090626031723/http://company.brusselsairlines.com/en/news/detail.aspx?uri=tcm%3A141-19321.




(a) (b)

**Fig. 2.** Revenue decomposition.
Note: The left figure decomposes the revenues of major business for the Big 3 Chinese airlines into two groups: revenues generated from domestic routes (solid lines) and revenues generated from international and HMT routes (dashed lines). Sources: Annual reports of these airlines from 2005 to 2017. The right figure decomposes the revenues of major business for China Eastern into three groups based on which routes these revenues come from: domestic (blue), international (red) and HMT (green). Sources: Annual reports of these airlines from 2005 to 2017. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)




(b) (c)

**Fig. 3.** Load Factors (%; by sub-routes).
Note: These three figures plot the absolute levels and yearly changes of load factors for three major airlines in domestic, international and HMT (Hong Kong, Macau and Taiwan) routes. Source: CSMAR database.

while load factors on the international and HMT routes increased 15% and 13%, respectively. Again, this is consistent with the fact that Shanghai Airlines has advantages in serving non-domestic routes and implies that China Eastern performed better on those routes than their competitors after the acquisition.

Overall, these event study results and operating performances support Hypothesis 1B for international markets.

### 5.3. Airports

The last four columns in Panel A report estimates for the airports in the sample. The CAR[0,+2] for Shanghai Airport is statistically significant at 7.7%. These results suggest that Shanghai Airport will benefit from the merger between China Eastern and Shanghai Airline. However, we do not find any significant pattern in the abnormal returns for the other airports. This suggests that these other airports will not benefit from the merger, which may reflect a lack of strategic interaction between those airports and the merging airlines.

Our results are consistent with our hypothesis that Shanghai Airports Authority extracts increased profits from the merged airline. The positive CAR for SAA indicates that it did not suffer a significant loss in bargaining power with the merged airline and potentially benefited

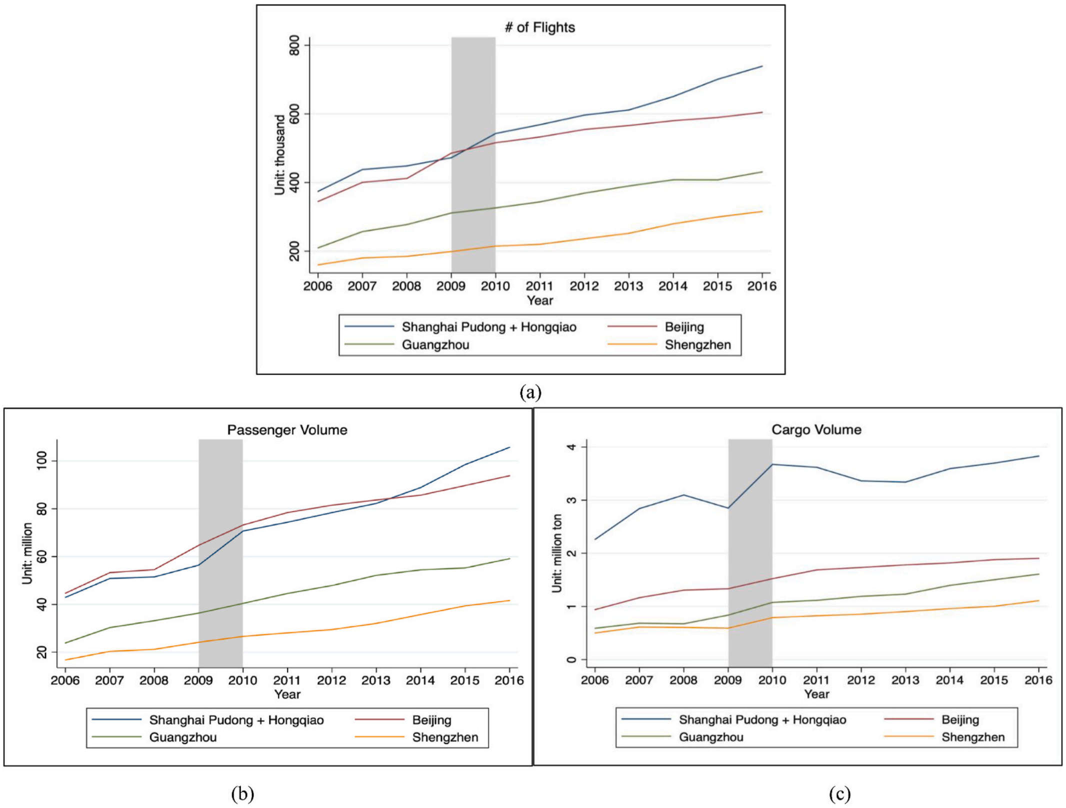



**Fig. 4.** Airport traffic.
Note: These three figures plot three operational metrics for the 4 biggest hub airports in China: Beijing, Shanghai, Guangzhou and Shenzhen from 2006 to 2016. These measures include passenger volume, cargo volume and number of flights (in and out). Source: WIND database.

from the increased profit of the merged airline through non-linear pricing. An interpretation of the results is that lack of competition allows SAA to maintain bargaining power against the new China Eastern (See the next subsection for supporting evidence).

Fig. 4 depicts three measures of airport performance, namely number of flights (in and out), passenger volume and cargo volume. Given the data available, we examine Beijing, Shanghai, Guangzhou and Shenzhen Airports from 2006 to 2016. The figures indicate that Shanghai Airport enjoyed a positive shift in air traffic right after 2009, which was not observed in the other airports. Such a rise in airport traffic is consistent with our positive abnormal returns estimated in the event study analysis.

Overall, this finding suggests that the new China Eastern did not substantially acquire countervailing power due to common ownership, of the two Shanghai airports, which supports Hypothesis 2A.

### 5.4. Robustness checks

First, we find that the results of the event study are robust to the use of estimation periods and samples (including the domestic competitors and airports listed abroad).[33] Second, we employ analyst forecasts as an additional source of information to explore how the capital market reacts to the merger. The benefit of using analyst forecasts is that they are more likely to contain private information that is unavailable or hard for investors to obtain.[34] Among the results in Fig. 5, the consensus predicted airfares for China Eastern, Air China and China Southern started to rise two months before the merger announcement. Overall, the results from analyst forecasts are generally consistent with those from the event study.

## 6. Conclusion

China Eastern and Shanghai Airlines announced plans to merge on June 8, 2009, the largest horizontal merger in Chinese airline industry. This paper examines the effects of the merger and the objectives motivating the merger. Based on a unified framework comprising the merged airline's supply chain, we develop testable hypotheses related to the two merging airlines, their domestic and international competitors, and relevant airports. Our analysis finds that the merger benefitted Air China and Shanghai Airports, consistent with increasing market power in domestic markets, but do not suggest that the merged airline gained countervailing power against its hub airport. At the same time, post-merger internationalization improves the competitiveness of the merged firm in international markets, which is confirmed by the negative stock price responses of United Airlines and Continental Airlines. The event study results are robust to a series of specification checks and are consistent with analyst forecasts.

Consistently, the long-run operating performance changes indicate that efficiency improvements play a role in explaining the wealth effect from the merger. Table 5 shows the changes in 3-year average operating

[33] See the Appendix B.
[34] Previous studies have employed analyst forecasts to assist in an event study in evaluating horizontal mergers. For example, Harford (2005) takes analyst forecasts along with traditional industry benchmarks as a proxy for expected performance absent the merger.

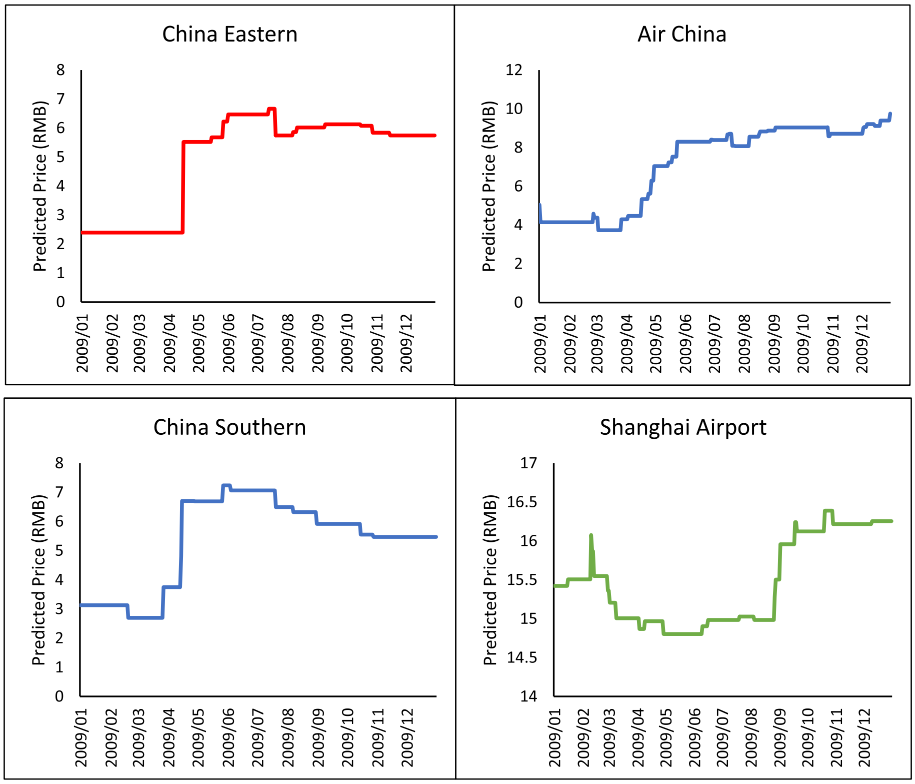



**Fig. 5.** Analyst forecasts.
Note: These figures show the consensus price predictions by stock analysts for relevant firms in 2009. Source: WIND Database.

performance for China Eastern, Air China and China Southern airlines three years before and after the merger (pre: 2007–2009; post: 2010–2012). Panel A documents a 61% increase in Available Seat Kilometers (ASK) and a 76% increase in Revenue Passenger Kilometers (PRK) for China Eastern after the merger, both of which are higher than the two rival airlines. The number of employees increased 40% after China Eastern acquired Shanghai Airlines, which suggests the realization of potential scale and scope economies after the merger. Panel B shows productivity changes for the three airlines. China Eastern uses 13% fewer employees per million ASK and 20% fewer employees per million RPK after the merger. Moreover, China Eastern's passenger load factor is 13.86% higher on average three years after the merger than before. These results are consistent with Shanghai Airport Authority's positive abnormal returns after the merger announcement. As the hub for China Eastern, Shanghai Airport enjoys greater passenger flows and input demands due to the rapid growth of the merged airline. These changes in productivity of China Eastern are more substantial than the two rival airlines, thus the China Eastern efficiency gains are likely to be merger specific rather than reflecting an industry wide trend (e.g. more efficient aircraft) that other major competitors could replicate.

Retrospectively, the MOFCOM approved the merger despite what seemed to be a high combined market share of China Eastern and Shanghai Airlines operating in the Shanghai Airport.[35] Nonetheless, our results conditionally support the MOFCOM's decision if there is a sufficient efficiency gain from international markets. In general, our results highlight implications on horizontal merger analysis in that it should account for the sources of gain across geographical markets (domestic and international airline markets) and for the pass-through of gains to upstream airports.

**Table 5**
Long-run operating performance changes.

| Panel A: Size | ASK | RPK | # of Employees |
|---|---|---|---|
| China Eastern | 61.06% | 76.13% | 40.29% |
| Air China | 26.59% | 33.41% | 50.92% |
| China Southern | 43.45% | 43.14% | 35.88% |
| **Panel B: Productivity** | **Load Factor** | **Employees per mil ASK** | **Employees per mil RPK** |
| China Eastern | 13.86% | −12.98% | −20.47% |
| Air China | 6.15% | 19.32% | 13.33% |
| China Southern | 6.78% | 1.99% | −4.94% |

Note: This table reports the percentage changes in long-run operating performances for three major airlines: China Eastern, Air China and China Southern. ASK is Available Sear Kilometer and RPK is Revenue Passenger Kilometer. Load factor = RTK/ATK, with RTK being revenue tonne kilometer and ATK being available tonne kilometer. The number is computed as the percentage changes of 3-year average before and after the merger (pre: 2007–2009; post: 2010–2012). Let $OP^{after}$ and $OP^{before}$ be operational performance after and before the merger, respectively. Then the average percentage changes in long-run operating performance is $\%\Delta OP = \left(\frac{OP^{after}}{OP^{before}} - 1\right)*100\%$. Sources: We collect measures of long-run operational performance from the CSMAR database (http://www.gtadata.com) and airlines' websites.

## Credit author statement

Chun-Yu Ho.: Conceptualization, Methodology, Writing- Original draft preparation.

Patrick McCarthy: Writing - Review & Editing, Visualization, Supervision.

[35] See http://news.carnoc.com/list/135/135638.html for anecdotal evidence of the market share of those two airlines at airport level.

[35] See http://news.carnoc.com/list/135/135638.html for anecdotal evidence of the market share of those two airlines at airport level.

Yanhao Wang: Formal analysis, Software, Validation.

## Appendix A. Coefficient Estimates for the Event Study

We report the coefficient for the event study reported in Table 5.

Panel A: Domestic Stocks

| Variables | Merging Airlines | | Rival Airlines | | | | | Railway | Airports | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | China Eastern | Shanghai Airlines | Air China | China Southern | Hainan Airlines | Hainan Airlines | Shandong Airlines | Guangshen | Shanghai | Guangzhou | Shenzhen | Xiamen |
| | SH | SH | SH | SH | SH | SH (B) | SZ | SH | SH | SH | SZ | SH |
| Panel A: Model | | | | | | | | | | | | |
| Rm,t | 0.662*** | 0.532*** | 1.095*** | 0.889*** | 0.895*** | 0.667*** | 0.986*** | 0.832*** | 0.783*** | 0.797*** | 0.782*** | 0.759*** |
| | (0.0862) | (0.0774) | (0.0749) | (0.0791) | (0.0867) | (0.0642) | (0.0695) | (0.0438) | (0.0456) | (0.0399) | (0.0449) | (0.0513) |
| Rm,t-1 | 0.174** | 0.123 | 0.119 | 0.178** | 0.103 | 0.106 | 0.00811 | −0.0155 | 0.00755 | −0.00815 | −0.0200 | 0.000792 |
| | (0.0863) | (0.0776) | (0.0749) | (0.0790) | (0.0868) | (0.0642) | (0.0696) | (0.0439) | (0.0456) | (0.0399) | (0.0449) | (0.0514) |
| Rm,t+1 | −0.0460 | −0.133* | −0.0787 | −0.117 | −0.185** | −0.0628 | −0.0274 | −0.120*** | −0.0338 | −0.0479 | −0.0545 | −0.0296 |
| | (0.0863) | (0.0775) | (0.0750) | (0.0792) | (0.0868) | (0.0643) | (0.0696) | (0.0439) | (0.0456) | (0.0399) | (0.0449) | (0.0513) |
| D-4 | −0.0183 | −0.0119 | −0.0274 | −0.00631 | 0.0130 | −0.0126 | −0.0150 | 0.00499 | 0.00435 | −0.00205 | −0.000674 | 0.00472 |
| | (0.0288) | (0.0260) | (0.0252) | (0.0272) | (0.0296) | (0.0222) | (0.0235) | (0.0148) | (0.0154) | (0.0137) | (0.0153) | (0.0175) |
| D-3 | −0.0122 | −0.00358 | −0.0214 | −0.00279 | −0.0240 | −0.0191 | −0.0105 | −0.0198 | −0.00747 | −0.00465 | −0.00341 | −0.0180 |
| | (0.0287) | (0.0259) | (0.0250) | (0.0270) | (0.0295) | (0.0221) | (0.0234) | (0.0148) | (0.0153) | (0.0137) | (0.0152) | (0.0174) |
| D-2 | −0.0216 | −0.00553 | −0.00670 | −0.0197 | −0.00936 | −0.0152 | −0.00290 | 0.00556 | −0.0198 | −0.0131 | −0.0217 | −0.0222 |
| | (0.0287) | (0.0259) | (0.0251) | (0.0271) | (0.0295) | (0.0221) | (0.0234) | (0.0148) | (0.0153) | (0.0137) | (0.0152) | (0.0174) |
| D-1 | 0.0134 | 0.0457* | −0.00844 | −0.00834 | 0.00305 | 0.00103 | 0.0559** | −0.00514 | −0.00622 | 0.000215 | 0.00313 | −0.0149 |
| | (0.0286) | (0.0259) | (0.0250) | (0.0270) | (0.0294) | (0.0221) | (0.0234) | (0.0147) | (0.0153) | (0.0136) | (0.0152) | (0.0173) |
| D0 | 0.0545*** | 0.0494** | 0.00279 | 0.00153 | −0.0161 | 0.00130 | 0.00192 | 0.0447*** | 0.0121 | 0.00686 | 0.00405 | −0.0156 |
| | (0.0204) | (0.0216) | (0.0215) | (0.0204) | (0.0265) | (0.0202) | (0.0226) | (0.0145) | (0.0152) | (0.0134) | (0.0151) | (0.0172) |
| D1 | 0.0418** | 0.0485** | 0.0733*** | 0.0302 | 0.0290 | 0.0286 | 0.000936 | 0.0135 | 0.00909 | 0.000940 | 0.0139 | 0.00131 |
| | (0.0204) | (0.0216) | (0.0215) | (0.0204) | (0.0265) | (0.0201) | (0.0226) | (0.0145) | (0.0152) | (0.0134) | (0.0151) | (0.0172) |
| D2 | 0.0266 | 0.0370* | −0.0130 | −0.0114 | −0.0142 | −0.00947 | −0.0138 | 0.0165 | 0.0559*** | 0.0213 | 0.0225 | 0.0122 |
| | (0.0204) | (0.0216) | (0.0215) | (0.0204) | (0.0265) | (0.0202) | (0.0226) | (0.0146) | (0.0152) | (0.0134) | (0.0151) | (0.0172) |
| D3 | 0.0642*** | 0.0677*** | −0.0326 | −0.0314 | 0.00250 | 0.00212 | −0.0151 | −0.0132 | −0.0126 | −0.0170 | −0.0208 | −0.00117 |
| | (0.0203) | (0.0215) | (0.0216) | (0.0205) | (0.0266) | (0.0202) | (0.0226) | (0.0146) | (0.0152) | (0.0135) | (0.0151) | (0.0172) |
| D4 | −0.0271 | −0.00965 | −0.0202 | −0.00872 | −0.0208 | −0.0235 | −0.0283 | −0.00146 | −0.0158 | 0.00125 | −0.00984 | 0.0145 |
| | (0.0204) | (0.0215) | (0.0216) | (0.0205) | (0.0266) | (0.0202) | (0.0227) | (0.0146) | (0.0153) | (0.0135) | (0.0152) | (0.0173) |

Note: SH and SZ denote Shanghai and Shenzhen Stock Exchange, respectively. Standard errors of coefficients in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Panel B: International Stocks.

| Variables | North America | | | | | Asia-Pacific | | | | | Europe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | United | Continental | Delta | AA | Air Canada | Cathy | ANA | Korean | Singapore | Qantas | Air France-KLM | British | Lufthansa |
| Panel A: Model | | | | | | | | | | | | | |
| Rm,t | 1.918*** | 1.529*** | 1.798*** | 1.610*** | 0.689*** | 0.748*** | 0.359*** | 0.705*** | 0.760*** | 1.390*** | 1.088*** | 1.320*** | 0.827*** |
| | (0.188) | (0.152) | (0.132) | (0.155) | (0.229) | (0.0652) | (0.0534) | (0.0819) | (0.0561) | (0.0964) | (0.0801) | (0.116) | (0.0537) |
| Rm,t-1 | 0.405** | 0.225 | 0.265** | 0.361** | 0.116 | 0.0932 | −0.0979* | 0.0451 | −0.0326 | 0.285*** | 0.0225 | 0.105 | 0.0447 |
| | (0.187) | (0.151) | (0.130) | (0.154) | (0.229) | (0.0665) | (0.0531) | (0.0825) | (0.0563) | (0.0964) | (0.0806) | (0.117) | (0.0542) |
| Rm,t+1 | 0.00783 | −0.0715 | 0.0733 | 0.0944 | −0.319 | −0.0303 | −0.0264 | 0.172** | 0.0118 | −0.0375 | 0.0176 | 0.0250 | 0.0489 |
| | (0.186) | (0.151) | (0.130) | (0.154) | (0.227) | (0.0653) | (0.0530) | (0.0821) | (0.0562) | (0.0957) | (0.0822) | (0.117) | (0.0547) |
| D-4 | 0.0335 | 0.0919* | 0.0526 | 0.0993* | −0.0273 | −0.0262 | 0.00608 | −0.0227 | −0.0115 | 0.0126 | 0.0284 | 0.0156 | 0.00857 |
| | (0.0591) | (0.0489) | (0.0435) | (0.0518) | (0.0695) | (0.0235) | (0.0154) | (0.0241) | (0.0169) | (0.0227) | (0.0244) | (0.0308) | (0.0171) |
| D-3 | 0.0287 | −0.0181 | 0.0713* | 0.00226 | 0.0401 | 0.0290 | 0.00317 | 0.000409 | −0.00370 | 0.0122 | −0.0210 | −0.0100 | 0.00477 |
| | (0.0582) | (0.0483) | (0.0430) | (0.0511) | (0.0688) | (0.0232) | (0.0153) | (0.0240) | (0.0168) | (0.0227) | (0.0243) | (0.0307) | (0.0170) |
| D-2 | −0.0491 | −0.0398 | −0.0266 | −0.0432 | −0.00621 | −0.0390* | −0.00357 | 0.0165 | −0.00256 | 0.0118 | −0.0179 | −0.0172 | −0.00865 |
| | (0.0582) | (0.0483) | (0.0430) | (0.0511) | (0.0689) | (0.0232) | (0.0153) | (0.0240) | (0.0169) | (0.0226) | (0.0243) | (0.0308) | (0.0170) |
| D-1 | −0.0160 | 0.0203 | −0.0153 | −0.00315 | −0.00851 | −0.0126 | −0.0111 | −0.0169 | 0.0237 | 0.0127 | −0.0140 | 0.00433 | −0.0106 |
| | (0.0582) | (0.0482) | (0.0429) | (0.0511) | (0.0686) | (0.0232) | (0.0153) | (0.0240) | (0.0169) | (0.0226) | (0.0242) | (0.0307) | (0.0170) |
| D0 | −0.0750 | −0.0867* | −0.0405 | −0.0647 | 0.000508 | −0.0178 | −0.00117 | −0.000865 | 0.0238 | −0.00188 | −0.0185 | −0.0284 | −0.00108 |
| | (0.0581) | (0.0480) | (0.0427) | (0.0510) | (0.0678) | (0.0232) | (0.0152) | (0.0237) | (0.0169) | (0.0225) | (0.0241) | (0.0305) | (0.0170) |
| D1 | −0.00470 | 0.00191 | 0.0210 | 0.0215 | 0.0306 | 0.00210 | −0.00554 | −0.0200 | 0.0379** | 0.0147 | −0.0539** | −0.00776 | −0.00969 |
| | (0.0581) | (0.0480) | (0.0427) | (0.0510) | (0.0678) | (0.0233) | (0.0153) | (0.0238) | (0.0169) | (0.0226) | (0.0241) | (0.0305) | (0.0170) |
| D2 | −0.0576 | −0.0561 | −0.0459 | −0.0288 | −0.0203 | 0.0130 | −0.000839 | 0.00304 | −0.00968 | −0.00942 | 0.0105 | −0.0100 | −0.0245 |
| | (0.0581) | (0.0480) | (0.0427) | (0.0510) | (0.0678) | (0.0233) | (0.0153) | (0.0238) | (0.0168) | (0.0226) | (0.0241) | (0.0305) | (0.0170) |
| D3 | −0.0681 | −0.00614 | 0.00966 | −0.0187 | −0.0170 | −0.0204 | 0.00154 | −0.0299 | −0.00496 | 0.00931 | −0.0346 | −0.0263 | −0.0137 |
| | (0.0581) | (0.0480) | (0.0427) | (0.0510) | (0.0679) | (0.0233) | (0.0153) | (0.0238) | (0.0168) | (0.0226) | (0.0241) | (0.0305) | (0.0170) |
| D4 | −0.0759 | −0.0234 | −0.0443 | −0.0101 | 0.0602 | −0.000201 | −0.0101 | 0.00862 | −0.0190 | −0.0279 | 0.0194 | 0.0189 | −0.0102 |
| | (0.0583) | (0.0482) | (0.0428) | (0.0511) | (0.0681) | (0.0232) | (0.0152) | (0.0237) | (0.0169) | (0.0225) | (0.0242) | (0.0306) | (0.0171) |

Note: Standard errors of coefficients in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

## Appendix B. : Robustness checks for the event study

*Alternative estimation period*

We extend the estimation period from [-120, +120] to [-200, +200], and report the results in Table A1. For CAR[0,+2], China Eastern, Shanghai Airlines, Air China, Guangshen Railway, Shanghai Airport and Singapore Airlines are positive and Continental Airlines is negative. These results are consistent with our baseline findings, which indicates that our baseline results are robust to alternative sample length.

*Inclusion of Stocks Listed Abroad*

Instead of using stocks listed only in mainland China, we expand our sample to include stocks listed in Hong Kong and New York Exchanges. The summary statistics of addition airlines, railway and airport stocks are reported in the table below.

| Firm | Trading Code | Market Capitalization* | Listed Exchange | Daily Return | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Obs | Mean | Min | Max | S.D |
| **Airlines – Listed abroad** | | | | | | | | |
| Air China | 0753.HK | 46555.18 | Hong Kong | 239 | 0.006 | −0.128 | 0.221 | 0.044 |
| China Eastern | 0670.HK | 10969.53 | Hong Kong | 239 | 0.007 | −0.085 | 0.413 | 0.047 |
| | CEA.N | 1418.47 | New York | 241 | 0.007 | −0.179 | 0.526 | 0.060 |
| China Southern | 1055.HK | 14106.72 | Hong Kong | 239 | 0.006 | −0.145 | 0.430 | 0.049 |
| | ZNH.N | 1834.53 | New York | 241 | 0.005 | −0.176 | 0.302 | 0.051 |
| **Railway – Listed abroad** | | | | | | | | |
| Guangshen Railway | 0525.HK | 3548.89 | Hong Kong | 239 | 0.002 | −0.071 | 0.162 | 0.028 |
| | GSH.N | 17712.28 | New York | 241 | 0.002 | −0.122 | 0.153 | 0.035 |
| **Airports – Listed abroad** | | | | | | | | |
| Beijing airport | 0694.HK | 23516.73 | Hong Kong | 239 | 0.002 | −0.110 | 0.175 | 0.038 |
| Haikou airport | 0357.HK | 11005.50 | Hong Kong | 239 | 0.006 | −0.100 | 0.153 | 0.035 |

Foreign investors mainly trade the stocks of Chinese airlines listed overseas because capital account restrictions limit their access to stocks in the mainland China stock exchanges. China has been restricting the capital flows to stabilize the exchange rate of RMB. It is not until 2002 when "Qualified Foreign Institutional Investor (QFII) scheme" was initiated that licensed foreign investors can invest yuan-denominated A shares listed in mainland China. Still, QFII funds are subject to rigorous quota management of foreign exchange. By the time when the merger happened, there were only less than 100 foreign institutes granted with QFII licenses and their total quotas amounts to less than 20 billion USD. Foreign investors, mainly consisting of institutional investors, are more rational when analyzing a merger relative to mainland China where individual stock investors represent a higher proportion of investors. Including Hong Kong and New York stocks of Chinese airlines in the estimation allow us to test whether our main results are robust to investor heterogeneities.

Table A2 reports the results. China Eastern (listed in Shanghai, Hong Kong and New York), Shanghai Airlines, Air China, Guangshen Railway (listed in Shanghai and Hong Kong), Shanghai Airport and Singapore Airlines have positive CAR[0,+2], but Continental Airlines has a negative CAR[0,+2]. These results are consistent with our baseline findings, which indicates that our baseline results are robust to the inclusion of foreign investors. Further, China Eastern is part of HS300 Index, which raises a concern that China Eastern's inclusion will generate a correlation between the error term and the market return. Given that the results using the HSI and New York indices are consistent and that China Eastern's return is a small part of the overall market return suggests that this will not substantively affect the results.

**Table A1**

Panel A: Alternative Estimation Period (Domestic Stocks).

| Variables | Merging Airlines | | Rival Airlines | | | | | Railway | Airports | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | China Eastern | Shanghai Airlines | Air China | China Southern | Hainan Airlines | Hainan Airlines | Shandong Airlines | Guangshen | Shanghai | Guangzhou | Shenzhen | Xiamen |
| | SH | SH | SH | SH | SH | SH (B) | SZ | SH | SH | SH | SZ | SH |
| Panel A: Model | | | | | | | | | | | | |
| Rm,t | 0.837*** | 0.799*** | 1.159*** | 0.942*** | 1.004*** | 0.890*** | 1.089*** | 0.781*** | 0.809*** | 0.817*** | 0.721*** | 0.693*** |
| | (0.0634) | (0.0587) | (0.0529) | (0.0552) | (0.0600) | (0.0516) | (0.0495) | (0.0312) | (0.0405) | (0.0395) | (0.0360) | (0.0394) |
| Rm,t-1 | 0.108* | 0.0603 | 0.118** | 0.110** | 0.0794 | 0.105** | 0.0194 | −0.0525* | 0.0187 | −0.105*** | −0.125*** | −0.0748* |
| | (0.0635) | (0.0589) | (0.0530) | (0.0552) | (0.0601) | (0.0517) | (0.0496) | (0.0313) | (0.0406) | (0.0396) | (0.0361) | (0.0395) |
| Rm,t+1 | 0.00394 | −0.101* | −0.0672 | −0.0695 | −0.149** | −0.0882* | 0.00587 | −0.0701** | −0.0668* | −0.0485 | −0.0226 | −0.00834 |
| | (0.0635) | (0.0588) | (0.0530) | (0.0552) | (0.0601) | (0.0516) | (0.0495) | (0.0312) | (0.0405) | (0.0395) | (0.0360) | (0.0395) |
| D-4 | −0.0175 | −0.0111 | −0.0276 | −0.00556 | 0.0129 | −0.0113 | −0.0142 | 0.00404 | 0.00423 | 0.000976 | 0.00170 | 0.00618 |
| | (0.0300) | (0.0278) | (0.0251) | (0.0264) | (0.0285) | (0.0247) | (0.0233) | (0.0146) | (0.0190) | (0.0185) | (0.0170) | (0.0187) |
| D-3 | −0.0167 | −0.0104 | −0.0229 | −0.00459 | −0.0266 | −0.0237 | −0.0111 | −0.0198 | −0.00852 | −0.00534 | −0.00245 | −0.0171 |
| | (0.0299) | (0.0277) | (0.0250) | (0.0263) | (0.0285) | (0.0246) | (0.0232) | (0.0146) | (0.0189) | (0.0185) | (0.0169) | (0.0187) |
| D-2 | −0.0204 | −0.00499 | −0.00671 | −0.0183 | −0.00877 | −0.0153 | −0.00119 | 0.00591 | −0.0209 | −0.0111 | −0.0193 | −0.0206 |
| | (0.0299) | (0.0277) | (0.0250) | (0.0263) | (0.0285) | (0.0246) | (0.0232) | (0.0146) | (0.0189) | (0.0185) | (0.0169) | (0.0187) |
| D-1 | 0.0146 | 0.0472* | −0.00793 | −0.00824 | 0.00391 | 0.00330 | 0.0586** | −0.00646 | −0.00657 | 0.000391 | 0.00255 | −0.0157 |
| | (0.0299) | (0.0277) | (0.0250) | (0.0263) | (0.0284) | (0.0246) | (0.0232) | (0.0146) | (0.0189) | (0.0184) | (0.0169) | (0.0186) |
| D0 | 0.0496** | 0.0517** | 0.00276 | 0.000486 | −0.0164 | 0.00181 | 0.00385 | 0.0434*** | 0.0116 | 0.00593 | 0.00289 | −0.0167 |
| | (0.0206) | (0.0214) | (0.0205) | (0.0192) | (0.0246) | (0.0220) | (0.0216) | (0.0145) | (0.0188) | (0.0184) | (0.0169) | (0.0186) |
| D1 | 0.0449** | 0.0422** | 0.0731*** | 0.0294 | 0.0286 | 0.0291 | 0.00249 | 0.0122 | 0.00875 | 0.000769 | 0.0135 | 0.000759 |

(continued on next page)

**Table A1** (*continued*)

| Variables | Merging Airlines | | Rival Airlines | | | | | Railway | Airports | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | China Eastern | Shanghai Airlines | Air China | China Southern | Hainan Airlines | Hainan Airlines | Shandong Airlines | Guangshen | Shanghai | Guangzhou | Shenzhen | Xiamen |
| | SH | SH | SH | SH | SH | SH (B) | SZ | SH | SH | SH | SZ | SH |
| | (0.0207) | (0.0214) | (0.0205) | (0.0192) | (0.0246) | (0.0220) | (0.0216) | (0.0145) | (0.0188) | (0.0184) | (0.0169) | (0.0186) |
| D2 | 0.0264 | 0.0373* | −0.0133 | −0.0116 | −0.0145 | −0.0108 | −0.0122 | 0.0166 | 0.0548*** | 0.0211 | 0.0231 | 0.0125 |
| | (0.0206) | (0.0214) | (0.0205) | (0.0192) | (0.0246) | (0.0221) | (0.0216) | (0.0145) | (0.0188) | (0.0184) | (0.0169) | (0.0186) |
| D3 | 0.0664*** | 0.0671*** | −0.0316 | −0.0296 | 0.00476 | 0.00483 | −0.0112 | −0.0135 | −0.0137 | −0.0163 | −0.0205 | −0.00149 |
| | (0.0206) | (0.0214) | (0.0205) | (0.0193) | (0.0246) | (0.0221) | (0.0216) | (0.0146) | (0.0188) | (0.0184) | (0.0169) | (0.0186) |
| D4 | −0.0194 | −0.00709 | −0.0190 | −0.00969 | −0.0194 | −0.0177 | −0.0246 | −0.00488 | −0.0150 | 0.000335 | −0.0133 | 0.0113 |
| | (0.0206) | (0.0214) | (0.0205) | (0.0193) | (0.0246) | (0.0221) | (0.0216) | (0.0146) | (0.0188) | (0.0184) | (0.0169) | (0.0186) |
| Panel B: CARs | | | | | | | | | | | | |
| CAR[0,+2] | 0.121*** | 0.131*** | 0.063* | 0.018 | −0.002 | 0.020 | −0.006 | 0.072*** | 0.075** | 0.028 | 0.040 | −0.004 |
| | [0.001] | [0.000] | [0.078] | [0.583] | [0.957] | [0.600] | [0.876] | [0.004] | [0.021] | [0.383] | [0.177] | [0.913] |
| CAR[0,+4] | 0.168*** | 0.191*** | 0.012 | −0.021 | −0.017 | 0.007 | −0.042 | 0.054* | 0.047 | 0.012 | 0.006 | 0.006 |
| | [0.000] | [0.000] | [0.793] | [0.628] | [0.759] | [0.884] | [0.391] | [0.100] | [0.271] | [0.773] | [0.880] | [0.880] |
| CAR[-4,-1] | −0.040 | 0.021 | −0.065 | −0.037 | −0.018 | −0.047 | 0.032 | −0.016 | −0.032 | −0.015 | −0.017 | −0.047 |
| | [0.506] | [0.710] | [0.195] | [0.488] | [0.747] | [0.342] | [0.491] | [0.579] | [0.405] | [0.685] | [0.608] | [0.208] |

Note: SH and SZ denote Shanghai and Shenzhen Stock Exchange, respectively. Panel A - Standard errors of coefficients in parentheses. P-values for the joint significance test beside major columns. Panel B – P-values of F-test for the sum of ARs equal to zero in brackets of CARs. ***p < 0.01, **p < 0.05, *p < 0.1.

Panel B: Alternative estimation period (international stocks)

| Variables | North America | | | | | Asia-Pacific | | | | | Europe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | United | Continental | Delta | AA | Air Canada | Cathy | ANA | Korean | Singapore | Qantas | Air France-KLM | British | Lufthansa |
| Panel A: Model | | | | | | | | | | | | | |
| Rm,t | 1.676*** | 1.409*** | 1.309*** | 1.313*** | 0.793*** | 0.900*** | 0.470*** | 0.315*** | 0.797*** | 0.947*** | 0.846*** | 1.173*** | 0.700*** |
| | (0.140) | (0.104) | (0.0993) | (0.114) | (0.130) | (0.0458) | (0.0322) | (0.0472) | (0.0385) | (0.0664) | (0.0516) | (0.0729) | (0.0399) |
| Rm,t-1 | 0.217 | 0.111 | 0.226** | 0.141 | 0.0715 | −0.0703 | −0.0383 | 0.0172 | −0.0317 | 0.0351 | 0.0741 | 0.219*** | 0.0766* |
| | (0.142) | (0.105) | (0.101) | (0.115) | (0.132) | (0.0461) | (0.0322) | (0.0473) | (0.0387) | (0.0663) | (0.0519) | (0.0735) | (0.0401) |
| Rm,t+1 | 0.181 | 0.150 | 0.0203 | 0.289** | −0.101 | −0.114** | 0.0235 | 0.0577 | −0.0299 | 0.0208 | 0.0139 | −0.0338 | 0.0575 |
| | (0.141) | (0.105) | (0.100) | (0.115) | (0.131) | (0.0453) | (0.0323) | (0.0473) | (0.0387) | (0.0664) | (0.0519) | (0.0734) | (0.0401) |
| D-4 | 0.0414 | 0.0992* | 0.0517 | 0.112** | −0.0190 | −0.0118 | 0.00314 | −0.0244 | −0.0117 | 0.0239 | 0.0275 | 0.0110 | 0.00771 |
| | (0.0682) | (0.0515) | (0.0492) | (0.0567) | (0.0621) | (0.0247) | (0.0164) | (0.0217) | (0.0164) | (0.0242) | (0.0252) | (0.0324) | (0.0193) |
| D-3 | 0.0183 | −0.0245 | 0.0619 | −0.00654 | 0.0390 | 0.0232 | 0.00202 | −0.00473 | −0.00458 | 0.0235 | −0.0253 | −0.0123 | 0.00238 |
| | (0.0678) | (0.0512) | (0.0489) | (0.0563) | (0.0619) | (0.0246) | (0.0164) | (0.0217) | (0.0164) | (0.0242) | (0.0252) | (0.0324) | (0.0192) |
| D-2 | −0.0540 | −0.0418 | −0.0249 | −0.0453 | −0.0113 | −0.0356 | −0.00442 | 0.00613 | −0.00204 | 0.00525 | −0.0161 | −0.0140 | −0.00800 |
| | (0.0678) | (0.0512) | (0.0489) | (0.0563) | (0.0619) | (0.0246) | (0.0164) | (0.0217) | (0.0164) | (0.0241) | (0.0252) | (0.0324) | (0.0192) |
| D-1 | −0.0198 | 0.0192 | −0.0194 | −0.00411 | −0.00821 | −0.0163 | −0.0132 | −0.0150 | 0.0217 | 0.0108 | −0.0115 | 0.00553 | −0.0104 |
| | (0.0678) | (0.0512) | (0.0488) | (0.0563) | (0.0618) | (0.0246) | (0.0164) | (0.0217) | (0.0164) | (0.0241) | (0.0252) | (0.0323) | (0.0192) |
| D0 | −0.0818 | −0.0902* | −0.0442 | −0.0692 | 0.00113 | −0.0133 | −0.00342 | −0.00437 | 0.0247 | 0.000156 | −0.0220 | −0.0308 | −0.00310 |
| | (0.0676) | (0.0511) | (0.0488) | (0.0562) | (0.0613) | (0.0246) | (0.0164) | (0.0214) | (0.0164) | (0.0240) | (0.0252) | (0.0322) | (0.0192) |
| D1 | −0.00890 | 0.000607 | 0.0192 | 0.0201 | 0.0295 | 0.00374 | −0.00722 | −0.0240 | 0.0380** | 0.00847 | −0.0520** | −0.00649 | −0.00965 |
| | (0.0676) | (0.0511) | (0.0488) | (0.0562) | (0.0612) | (0.0246) | (0.0164) | (0.0214) | (0.0164) | (0.0241) | (0.0251) | (0.0322) | (0.0192) |
| D2 | −0.0643 | −0.0599 | −0.0504 | −0.0331 | −0.0232 | 0.00549 | −0.00356 | 0.0145 | −0.0109 | −0.00277 | 0.0123 | −0.00862 | −0.0234 |
| | (0.0676) | (0.0511) | (0.0488) | (0.0563) | (0.0613) | (0.0246) | (0.0164) | (0.0214) | (0.0163) | (0.0241) | (0.0251) | (0.0322) | (0.0192) |
| D3 | −0.0730 | −0.00850 | 0.00928 | −0.0208 | −0.0165 | −0.0130 | −0.00130 | −0.0288 | −0.00530 | 0.0165 | −0.0329 | −0.0266 | −0.0127 |
| | (0.0676) | (0.0511) | (0.0488) | (0.0562) | (0.0613) | (0.0246) | (0.0164) | (0.0214) | (0.0163) | (0.0241) | (0.0251) | (0.0322) | (0.0192) |
| D4 | −0.0758 | −0.0197 | −0.0480 | −0.00666 | 0.0665 | −0.00233 | −0.0122 | 0.00831 | −0.0204 | −0.0252 | 0.0189 | 0.0161 | −0.0114 |
| | (0.0676) | (0.0511) | (0.0489) | (0.0563) | (0.0613) | (0.0246) | (0.0164) | (0.0214) | (0.0164) | (0.0240) | (0.0252) | (0.0323) | (0.0193) |
| Panel B: CARs | | | | | | | | | | | | | |
| CAR[0,+2] | −0.155 | −0.149* | −0.075 | −0.082 | 0.007 | −0.004 | −0.014 | −0.014 | 0.052* | 0.006 | −0.062 | −0.046 | −0.036 |
| | [0.186] | [0.092] | [0.373] | [0.400] | [0.944] | [0.924] | [0.619] | [0.708] | [0.068] | [0.888] | [0.158] | [0.412] | [0.279] |
| CAR[0,+4] | −0.304** | −0.178 | −0.114 | −0.110 | 0.057 | −0.019 | −0.028 | −0.034 | 0.026 | −0.003 | −0.076 | −0.056 | −0.060 |
| | [0.045] | [0.122] | [0.298] | [0.385] | [0.677] | [0.725] | [0.453] | [0.474] | [0.477] | [0.958] | [0.181] | [0.436] | [0.163] |
| CAR[-4,-1] | −0.014 | 0.052 | 0.069 | 0.056 | 0.001 | −0.040 | −0.012 | −0.038 | 0.003 | 0.063 | −0.025 | −0.010 | −0.008 |
| | [0.918] | [0.613] | [0.480] | [0.621] | [0.996] | [0.412] | [0.705] | [0.381] | [0.917] | [0.190] | [0.614] | [0.880] | [0.830] |

Note: Panel A - Standard errors of coefficients in parentheses. P-values for the joint significance test beside major columns. Panel B – P-values of F-test for the sum of ARs equal to zero in brackets of CARs. ***p < 0.01, **p < 0.05, *p < 0.1.

**Table A2**

Panel A: Inclusion of Stocks Listed Abroad (Airline Stocks).

| Variables | Merging Airlines | | | | Rival Airlines | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | China Eastern | China Eastern | China Eastern | Shanghai Airlines | Air China | Air China | China Southern | China Southern | China Southern | Hainan Airlines | Hainan Airlines | Shandong Airlines |
| | SH | HK | NY | SH | SH | HK | SH | HK | NY | SH | SH (B) | SZ |
| Panel A: Model | | | | | | | | | | | | |

(continued on next page)

**Table A2** (*continued*)

| Variables | Merging Airlines | | | | Rival Airlines | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | China Eastern | China Eastern | China Eastern | Shanghai Airlines | Air China | Air China | China Southern | China Southern | China Southern | Hainan Airlines | Hainan Airlines | Shandong Airlines |
| | SH | HK | NY | SH | SH | HK | SH | HK | NY | SH | SH (B) | SZ |
| Rm,t | 0.694*** | 0.715*** | 1.129*** | 0.538*** | 1.114*** | 1.338*** | 0.898*** | 0.922*** | 1.200*** | 0.888*** | 0.661*** | 1.026*** |
| | (0.0847) | (0.111) | (0.165) | (0.0759) | (0.0723) | (0.0757) | (0.0775) | (0.105) | (0.122) | (0.0856) | (0.0626) | (0.0674) |
| Rm,t-1 | 0.160* | 0.280** | −0.365** | 0.136* | 0.153** | −0.0439 | 0.189** | 0.271** | −0.330*** | 0.106 | 0.102 | 0.0166 |
| | (0.0849) | (0.112) | (0.163) | (0.0761) | (0.0724) | (0.0764) | (0.0775) | (0.106) | (0.121) | (0.0857) | (0.0627) | (0.0676) |
| Rm,t+1 | −0.0654 | −0.358*** | −0.153 | −0.140* | −0.0815 | 0.00580 | −0.123 | −0.307*** | 0.0676 | −0.185** | −0.0581 | −0.0393 |
| | (0.0848) | (0.112) | (0.169) | (0.0759) | (0.0724) | (0.0764) | (0.0776) | (0.105) | (0.125) | (0.0857) | (0.0627) | (0.0675) |
| D-4 | −0.0172 | −0.0526 | −0.0476 | −0.0121 | −0.0284 | −0.0346 | −0.00633 | −0.0623 | −0.0354 | 0.0130 | −0.0125 | −0.0151 |
| | (0.0288) | (0.0449) | (0.0575) | (0.0260) | (0.0252) | (0.0308) | (0.0272) | (0.0428) | (0.0438) | (0.0296) | (0.0222) | (0.0235) |
| D-3 | −0.0128 | 0.0175 | 0.0170 | −0.00360 | −0.0218 | −0.00751 | −0.00282 | 0.0376 | 0.0255 | −0.0237 | −0.0189 | −0.0115 |
| | (0.0286) | (0.0445) | (0.0568) | (0.0259) | (0.0250) | (0.0305) | (0.0270) | (0.0424) | (0.0433) | (0.0295) | (0.0221) | (0.0234) |
| D-2 | −0.0214 | 0.0103 | 0.0120 | −0.00580 | −0.00749 | −0.0151 | −0.0198 | −0.0171 | −0.0146 | −0.00928 | −0.0150 | −0.00330 |
| | (0.0287) | (0.0444) | (0.0568) | (0.0259) | (0.0251) | (0.0304) | (0.0271) | (0.0423) | (0.0433) | (0.0295) | (0.0221) | (0.0234) |
| D-1 | 0.0138 | −0.0408 | −0.0271 | 0.0458* | −0.00828 | −0.0210 | −0.00810 | −0.0360 | −0.0456 | 0.00311 | 0.00108 | 0.0562** |
| | (0.0286) | (0.0445) | (0.0568) | (0.0259) | (0.0250) | (0.0305) | (0.0270) | (0.0424) | (0.0432) | (0.0294) | (0.0221) | (0.0234) |
| D0 | 0.0577*** | 0.0197 | 0.0477 | 0.0508** | 0.00312 | 0.0176 | 0.00180 | −0.0286 | −0.0170 | −0.0160 | 0.00136 | 0.00195 |
| | (0.0195) | (0.0225) | (0.0290) | (0.0213) | (0.0215) | (0.0292) | (0.0204) | (0.0237) | (0.0243) | (0.0264) | (0.0201) | (0.0224) |
| D1 | 0.0353* | 0.0124 | 0.0414 | 0.0475** | 0.0734*** | −0.0110 | 0.0305 | 0.00143 | −0.0365 | 0.0291 | 0.0287 | 0.000926 |
| | (0.0195) | (0.0226) | (0.0289) | (0.0213) | (0.0215) | (0.0293) | (0.0204) | (0.0240) | (0.0243) | (0.0264) | (0.0201) | (0.0224) |
| D2 | 0.0391** | 0.0428* | 0.0565* | 0.0412* | −0.0131 | −0.0332 | −0.0114 | 0.00469 | 0.0384 | −0.0140 | −0.00928 | −0.0143 |
| | (0.0195) | (0.0225) | (0.0289) | (0.0213) | (0.0215) | (0.0293) | (0.0204) | (0.0239) | (0.0243) | (0.0264) | (0.0201) | (0.0224) |
| D3 | 0.0586*** | 0.0505** | 0.0199 | 0.0650*** | −0.0326 | −0.00429 | −0.0312 | −0.0452* | −0.0328 | 0.00252 | 0.00227 | −0.0149 |
| | (0.0195) | (0.0224) | (0.0288) | (0.0212) | (0.0216) | (0.0293) | (0.0205) | (0.0239) | (0.0243) | (0.0265) | (0.0202) | (0.0224) |
| D4 | −0.0318 | 0.0264 | −0.0665** | −0.0139 | −0.0192 | −0.0257 | −0.00809 | −0.0245 | −0.0306 | −0.0208 | −0.0236 | −0.0271 |
| | (0.0195) | (0.0225) | (0.0288) | (0.0212) | (0.0216) | (0.0292) | (0.0205) | (0.0236) | (0.0245) | (0.0265) | (0.0202) | (0.0225) |
| Panel B: CARs | | | | | | | | | | | | |
| CAR[0,+2] | 0.132*** | 0.075* | 0.146*** | 0.140*** | 0.063* | −0.027 | 0.021 | −0.023 | −0.015 | −0.001 | 0.021 | −0.011 |
| | [0.000] | [0.055] | [0.004] | [0.000] | [0.090] | [0.600] | [0.557] | [0.587] | [0.723] | [0.984] | [0.552] | [0.770] |
| CAR[0,+4] | 0.159*** | 0.152*** | 0.099 | 0.191*** | 0.012 | −0.057 | −0.018 | −0.092* | −0.079 | −0.019 | −0.001 | −0.053 |
| | [0.000] | [0.003] | [0.131] | [0.000] | [0.812] | [0.389] | [0.690] | [0.087] | [0.158] | [0.747] | [0.990] | [0.290] |
| CAR[-4,-1] | −0.038 | −0.066 | −0.046 | 0.024 | −0.066 | −0.078 | −0.037 | −0.078 | −0.070 | −0.017 | −0.045 | 0.026 |
| | [0.516] | [0.462] | [0.690] | [0.642] | [0.192] | [0.201] | [0.496] | [0.361] | [0.422] | [0.777] | [0.309] | [0.576] |

Note: SH and SZ denote Shanghai and Shenzhen Stock Exchange, respectively. Panel A - Standard errors of coefficients in parentheses. P-values for the joint significance test beside major columns. Panel B - P-values of F-test for the sum of ARs equal to zero in brackets of CARs. *** p<0.01, ** p<0.05, * p<0.1.

Panel B: Inclusion of stocks listed abroad (railway and airport stocks)

| Variables | Railways | | | Airports | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Guangshen | Guangshen | Guangshen | Shanghai | Beijing | Guangzhou | Shenzhen | Xiamen | Haikou |
| | SH | HK | NY | SH | HK | SH | SZ | SH | HK |
| Panel A: Model | | | | | | | | | |
| Rm,t | 0.823*** | 0.616*** | 1.116*** | 0.768*** | 1.211*** | 0.789*** | 0.797*** | 0.740*** | 0.617*** |
| | (0.0414) | (0.0361) | (0.0580) | (0.0440) | (0.0636) | (0.0387) | (0.0435) | (0.0496) | (0.0825) |
| Rm,t-1 | −0.0325 | 0.0286 | −0.193*** | 0.00675 | −0.0254 | −0.0174 | −0.0309 | 0.000574 | 0.208** |
| | (0.0415) | (0.0342) | (0.0559) | (0.0441) | (0.0642) | (0.0387) | (0.0435) | (0.0497) | (0.0834) |
| Rm,t+1 | −0.119*** | 0.0732** | −0.00303 | −0.0361 | 0.106* | −0.0521 | −0.0668 | −0.0321 | −0.166** |
| | (0.0415) | (0.0357) | (0.0538) | (0.0440) | (0.0640) | (0.0387) | (0.0435) | (0.0496) | (0.0828) |
| D-4 | 0.00564 | 0.0408** | 0.0245 | 0.00449 | 0.0331 | −0.00160 | −0.0000738 | 0.00478 | 0.0117 |
| | (0.0148) | (0.0196) | (0.0235) | (0.0154) | (0.0247) | (0.0137) | (0.0153) | (0.0174) | (0.0317) |
| D-3 | −0.0195 | 0.0210 | 0.0184 | −0.00705 | 0.0267 | −0.00441 | −0.00377 | −0.0175 | 0.00387 |
| | (0.0148) | (0.0195) | (0.0233) | (0.0153) | (0.0244) | (0.0137) | (0.0152) | (0.0174) | (0.0313) |
| D-2 | 0.00610 | −0.0150 | −0.0112 | −0.0197 | −0.0215 | −0.0129 | −0.0217 | −0.0221 | −0.0129 |
| | (0.0148) | (0.0195) | (0.0233) | (0.0153) | (0.0243) | (0.0137) | (0.0152) | (0.0174) | (0.0312) |
| D-1 | −0.00506 | −0.0290 | −0.0239 | −0.00626 | 0.0106 | 0.000225 | 0.00322 | −0.0150 | 0.000499 |
| | (0.0147) | (0.0195) | (0.0233) | (0.0153) | (0.0244) | (0.0136) | (0.0152) | (0.0173) | (0.0313) |
| D0 | 0.0447*** | 0.0138 | 0.00543 | 0.0121 | 0.0204 | 0.00685 | 0.00393 | −0.0156 | −0.00643 |
| | (0.0145) | (0.0193) | (0.0230) | (0.0151) | (0.0242) | (0.0134) | (0.0151) | (0.0172) | (0.0306) |
| D1 | 0.0136 | 0.00901 | −0.00651 | 0.00919 | −0.0635*** | 0.00103 | 0.0140 | 0.00135 | −0.0372 |
| | (0.0145) | (0.0193) | (0.0230) | (0.0151) | (0.0243) | (0.0134) | (0.0151) | (0.0172) | (0.0307) |
| D2 | 0.0168 | 0.0353* | 0.0580** | 0.0561*** | −0.0347 | 0.0214 | 0.0222 | 0.0123 | −0.0528* |
| | (0.0145) | (0.0193) | (0.0230) | (0.0151) | (0.0242) | (0.0134) | (0.0151) | (0.0172) | (0.0307) |
| D3 | −0.0131 | 0.00806 | 0.00437 | −0.0128 | −0.0192 | −0.0171 | −0.0209 | −0.00145 | 0.0245 |
| | (0.0146) | (0.0193) | (0.0230) | (0.0151) | (0.0242) | (0.0134) | (0.0151) | (0.0172) | (0.0306) |
| D4 | −0.00177 | 0.0106 | 0.0165 | −0.0160 | −0.00338 | 0.00109 | −0.00949 | 0.0141 | −0.0157 |
| | (0.0146) | (0.0193) | (0.0230) | (0.0151) | (0.0241) | (0.0135) | (0.0151) | (0.0172) | (0.0305) |
| Panel B: CARs | | | | | | | | | |
| CAR[0,+2] | 0.075*** | 0.058* | 0.057 | 0.077*** | −0.078* | 0.029 | 0.040 | −0.002 | −0.096* |
| | [0.003] | [0.083] | [0.154] | [0.003] | [0.064] | [0.209] | [0.126] | [0.947] | [0.069] |
| CAR[0,+4] | 0.060* | 0.077* | 0.078 | 0.049 | −0.100* | 0.013 | 0.010 | 0.011 | −0.088 |
| | [0.066] | [0.077] | [0.133] | [0.153] | [0.065] | [0.659] | [0.775] | [0.783] | [0.202] |

(*continued on next page*)

(*continued*)

Panel B: Inclusion of stocks listed abroad (railway and airport stocks)

| Variables | Railways | | | Airports | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Guangshen | Guangshen | Guangshen | Shanghai | Beijing | Guangzhou | Shenzhen | Xiamen | Haikou |
| | SH | HK | NY | SH | HK | SH | SZ | SH | HK |
| CAR[-4,-1] | −0.013 | 0.018 | 0.008 | −0.028 | 0.049 | −0.019 | −0.022 | −0.050 | 0.003 |
| | [0.666] | [0.650] | [0.868] | [0.356] | [0.318] | [0.498] | [0.468] | [0.154] | [0.959] |

Note: SH and SZ denote Shanghai and Shenzhen Stock Exchange, respectively. Panel A - Standard errors of coefficients in parentheses. P-values for the joint significance test beside major columns. Panel B - P-values of F-test for the sum of ARs equal to zero in brackets of CARs. *** p<0.01, ** p<0.05, * p<0.1.

Panel C: Inclusion of stocks listed abroad (international competitor stocks)

| Variables | North America | | | | | Asia-Pacific | | | | | Europe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | United | Continental | Delta | AA | Air Canada | Cathy | ANA | Korean | Singapore | Qantas | Air France-KLM | British | Lufthansa |
| Panel A: Model | | | | | | | | | | | | | |
| Rm,t | 1.904*** | 1.536*** | 1.765*** | 1.603*** | 0.744*** | 0.694*** | 0.356*** | 0.689*** | 0.748*** | 1.400*** | 1.071*** | 1.306*** | 0.817*** |
| | (0.186) | (0.150) | (0.130) | (0.153) | (0.224) | (0.0613) | (0.0526) | (0.0794) | (0.0541) | (0.0933) | (0.0790) | (0.113) | (0.0526) |
| Rm,t-1 | 0.286 | 0.118 | 0.176 | 0.285* | 0.158 | 0.0985 | −0.0898* | 0.0189 | −0.0218 | 0.329*** | 0.0161 | 0.125 | 0.0524 |
| | (0.184) | (0.149) | (0.129) | (0.152) | (0.225) | (0.0629) | (0.0523) | (0.0801) | (0.0546) | (0.0931) | (0.0796) | (0.114) | (0.0531) |
| Rm,t+1 | 0.00103 | −0.0651 | 0.0656 | 0.121 | −0.314 | −0.0216 | −0.0298 | 0.167** | 0.0157 | −0.0510 | 0.00646 | 0.0167 | 0.0626 |
| | (0.184) | (0.149) | (0.129) | (0.152) | (0.222) | (0.0612) | (0.0521) | (0.0794) | (0.0543) | (0.0925) | (0.0810) | (0.115) | (0.0535) |
| D-4 | 0.0398 | 0.0980** | 0.0574 | 0.104** | −0.0286 | −0.0280 | 0.00591 | −0.0216 | −0.0118 | 0.0117 | 0.0283 | 0.0148 | 0.00866 |
| | (0.0590) | (0.0489) | (0.0435) | (0.0518) | (0.0695) | (0.0235) | (0.0154) | (0.0241) | (0.0169) | (0.0227) | (0.0244) | (0.0308) | (0.0171) |
| D-3 | 0.0286 | −0.0179 | 0.0710* | 0.00191 | 0.0420 | 0.0299 | 0.00314 | 0.000239 | −0.00359 | 0.0113 | −0.0213 | −0.0102 | 0.00463 |
| | (0.0582) | (0.0483) | (0.0430) | (0.0511) | (0.0688) | (0.0232) | (0.0153) | (0.0240) | (0.0168) | (0.0226) | (0.0243) | (0.0307) | (0.0170) |
| D-2 | −0.0509 | −0.0414 | −0.0275 | −0.0443 | −0.00573 | −0.0393* | −0.00358 | 0.0162 | −0.00275 | 0.0116 | −0.0179 | −0.0167 | −0.00846 |
| | (0.0582) | (0.0483) | (0.0430) | (0.0511) | (0.0688) | (0.0232) | (0.0153) | (0.0240) | (0.0169) | (0.0226) | (0.0243) | (0.0308) | (0.0170) |
| D-1 | −0.0149 | 0.0216 | −0.0145 | −0.00239 | −0.00940 | −0.0118 | −0.0110 | −0.0174 | 0.0241 | 0.0136 | −0.0140 | 0.00439 | −0.0103 |
| | (0.0582) | (0.0482) | (0.0429) | (0.0511) | (0.0686) | (0.0232) | (0.0153) | (0.0240) | (0.0169) | (0.0226) | (0.0242) | (0.0307) | (0.0170) |
| D0 | −0.0755 | −0.0870* | −0.0409 | −0.0651 | 0.000599 | −0.0189 | −0.00123 | −0.000616 | 0.0233 | −0.00224 | −0.0187 | −0.0288 | −0.00116 |
| | (0.0580) | (0.0478) | (0.0426) | (0.0509) | (0.0669) | (0.0231) | (0.0151) | (0.0236) | (0.0166) | (0.0223) | (0.0240) | (0.0303) | (0.0170) |
| D1 | −0.00503 | 0.00176 | 0.0209 | 0.0214 | 0.0311 | 0.00137 | −0.00556 | −0.0201 | 0.0382** | 0.0152 | −0.0538** | −0.00757 | −0.00968 |
| | (0.0580) | (0.0478) | (0.0426) | (0.0509) | (0.0669) | (0.0232) | (0.0151) | (0.0238) | (0.0166) | (0.0224) | (0.0240) | (0.0303) | (0.0170) |
| D2 | −0.0574 | −0.0558 | −0.0458 | −0.0288 | −0.0203 | 0.0153 | −0.000697 | 0.00322 | −0.00952 | −0.00900 | 0.0107 | −0.00990 | −0.0245 |
| | (0.0580) | (0.0478) | (0.0426) | (0.0509) | (0.0669) | (0.0232) | (0.0151) | (0.0238) | (0.0165) | (0.0224) | (0.0240) | (0.0303) | (0.0170) |
| D3 | −0.0687 | −0.00661 | 0.00943 | −0.0191 | −0.0174 | −0.0205 | 0.00143 | −0.0288 | −0.00518 | 0.00849 | −0.0345 | −0.0264 | −0.0135 |
| | (0.0580) | (0.0478) | (0.0426) | (0.0509) | (0.0670) | (0.0232) | (0.0151) | (0.0237) | (0.0165) | (0.0224) | (0.0240) | (0.0303) | (0.0170) |
| D4 | −0.0756 | −0.0227 | −0.0441 | −0.00913 | 0.0606 | 0.000341 | −0.0101 | 0.00879 | −0.0189 | −0.0281 | 0.0191 | 0.0185 | −0.00986 |
| | (0.0582) | (0.0479) | (0.0428) | (0.0511) | (0.0672) | (0.0231) | (0.0151) | (0.0236) | (0.0165) | (0.0223) | (0.0241) | (0.0305) | (0.0171) |
| Panel B: CARs | | | | | | | | | | | | | |
| CAR[0,+2] | −0.138 | −0.141* | −0.066 | −0.072 | 0.011 | −0.002 | −0.007 | −0.017 | 0.052* | 0.004 | −0.062 | −0.046 | −0.035 |
| | [0.171] | [0.090] | [0.375] | [0.413] | [0.922] | [0.955] | [0.775] | [0.671] | [0.070] | [0.918] | [0.138] | [0.380] | [0.232] |
| CAR[0,+4] | −0.282** | −0.170 | −0.100 | −0.101 | 0.055 | −0.022 | −0.016 | −0.038 | 0.028 | −0.016 | −0.077 | −0.054 | −0.059 |
| | [0.031] | [0.114] | [0.296] | [0.381] | [0.718] | [0.666] | [0.636] | [0.481] | [0.452] | [0.757] | [0.153] | [0.428] | [0.125] |
| CAR[-4,-1] | 0.003 | 0.060 | 0.086 | 0.059 | −0.002 | −0.049 | −0.005 | −0.023 | 0.006 | 0.048 | −0.025 | −0.008 | −0.005 |
| | [0.982] | [0.536] | [0.319] | [0.567] | [0.990] | [0.291] | [0.859] | [0.639] | [0.861] | [0.287] | [0.611] | [0.901] | [0.873] |

Note: Panel A - Standard errors of coefficients in parentheses. P-values for the joint significance test beside major columns. Panel B – P-values of F-test for the sum of ARs equal to zero in brackets of CARs. ***p < 0.01, **p < 0.05, *p < 0.1.

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