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Airline industry equities under external uncertainty shocks

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ABSTRACT

We gauge the impact of news and other relevant external uncertainties facing airline firms via an equity market lens. Using local projections, we establish that rising investors' fear shocks have long-lasting negative effects on airline industry equity returns, while increasing geopolitical, climate policy, and fuel cost uncertainties have comparatively short-lived impacts. Our results are robust to several alternative model specifications, including a pre-pandemic subsample. Based on our findings, we provide a promising avenue for future research in airline financial management.

1. Introduction

Equity financing, through the issuance of shares on the stock exchange, is a way in which airline firms may raise capital for growth and recovery purposes without increasing their debt burden. For potential investors, the returns on the airline industry stock index signals how well such firms are performing financially. An atmosphere of heightened uncertainty from the external environment can impact the airline industry's finances. As investors interpret good and bad news for the aviation sector, they accordingly rebalance their portfolio of assets, which affects airline equity returns. The external developments pertinent to the airline industry include uncertainties on both the supply-side (operational costs) and demand-side (passenger numbers) forces of the market. They include risk factors such as fuel costs, geopolitical tensions, climate change, infectious disease outbreaks, and general market conditions.

While conflicting evidence exists about whether airfares respond rapidly to market changes (Pal and Mitra, 2022), as asset returns are expected to reflect all available information, including developments in the real economy (Mahadeo et al., 2022) and breaking news, airline equity returns are a useful avenue for providing timely evidence on this front. Hence, we view the impact of external uncertainties on the airline industry through an equity market lens to highlight the role of external shocks in the performance of airline firms.

In a larger body of research involving tourism, a related travel-intensive industry, fuel prices (see Becken, 2011) and their volatilities (see Shahzad and Caporin, 2020), as well as economic policy uncertainty and geopolitical risk (see, *inter alia*, Tiwari et al., 2019; Demiralay, 2020) all have important implications for the sector. As airlines serve as a main mode of transportation for domestic and international tourists (Cho et al., 2023), studies on the airline industry also show that oil price changes have spillover effects on airline stocks (Yun and Yoon, 2019) and political conflicts lower air travel demand (Cho et al., 2023). In related work, Kang et al. (2021) investigate the impact of oil price increases, jet fuel volatility, and economic policy uncertainty on the US airline industry, finding these factors have significant adverse effects on real airline stock returns.

Here, we extend the line of work that considers the impact of increases in geopolitical risk and fuel (oil and jet) prices uncertainty on airline returns, to also gauge the role of rising investors' fear and exploit the availability of novel news-based uncertainty indices that are applicable to the aviation sector, such as climate policy and infectious disease outbreaks. In fact, COVID-19 has been labelled the biggest devastation to hit the aviation and tourism sectors (Liu et al., 2021), and an abundance of research exists linking climate change to travel and transport (Burns and Cowlishaw, 2014). Airline equities are also subject to the highs and lows of the overall stock market uncertainty, which must also be accounted for. Indeed, the inclusion of a comprehensive dataset of relevant external uncertainties in modelling the performance of airline equity returns will provide robust results on the vulnerabilities the industry faces.

2. Methods

We estimate the impulse response functions of airline returns to increases in relevant external uncertainty shocks (i.e., climate policy,

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geopolitical risk, infectious diseases, stock market activity, and fuel cost) using local projections (see Jordà, 2005).[1] Following recent refinements in this method (see Stock and Watson, 2018), we work with "long-differences" specifications. Piger and Stockwell (2023) show long-differences is superior to the levels specification when working with externally identified shocks, reducing the bias and increasing the precision of confidence intervals. Moreover, the accuracy of the results is independent of whether the underlying data are stationary/non-stationary. Our specification is defined as:

$$y_{t+h} - y_{t-1} = c + \beta_h^+ \epsilon_t^+ + \sum_{p=1}^{n} \theta_p^h \Delta y_{t-p} + \alpha' X_t + \mu_{t+h} \quad (1)$$

where $y_{t+h} - y_{t-1}$ is the long-difference of airline returns; β_h^+ is the cumulative response h-periods ahead for airline returns to a positive one standard deviation shock in a given external uncertainty, ϵ_t^+, that took place at time t; Δy_{t-p} are lags of airline returns to allow for some persistence in this series, which can also be varied to address autocorrelation issues; and X_t is a vector of control variables. In each local projection estimation of airline returns to a rise in a given uncertainty shock (ϵ_t^+), the counterpart series of a fall in uncertainty in a given shock (ϵ_t^-),[2] as well as all other sources of external uncertainties, are admitted in the control vector (X_t) to appropriately saturate the model for all other external market forces. Additionally, the control vector also contains a dummy variable to account for the effects of the 2008 Global Financial Crisis (GFC). For all external uncertainties, we follow Ready (2018) and work with the shock components identified from the residuals of their ARMA(1,1) univariate processes, for which the external uncertainty data are seasonally adjusted to remove potential seasonal effects from the response functions of airline equity returns.

3. Data

Nominal airline industry equity returns are computed as the log-difference times 100 of the S&P 500 Airlines Index,[3] while real airline returns are obtained by deflating nominal returns using the CPI (2015 = 100).[4] We consider both nominal and real returns for robustness purposes, as the former is typically of interest to investors and the latter to economists (for further context, see Hamilton, 2011).

We use the geopolitical risk index of Caldara and Iacoviello (2022), the climate policy uncertainty index of Gavriilidis (2021), and the infectious disease equity market volatility tracker of Baker et al. (2019) as potentially important external uncertainties affecting airline industry equities. All three uncertainty indices[5] are constructed using the text-based analysis methodologies consistent with the seminal work of Baker et al. (2016), rising (falling) with the (in)frequency of their corresponding topics' coverage in the popular press.

We also consider stock and oil market uncertainties, to account for the financial environment relevant to the airline equity market. Stock market uncertainty is proxied using the VIX[6] - this volatility index is widely regarded as the investors' fear gauge that underlies the S&P 500 market, doing well to reflect periods of market turbulence and tranquillity (see Mahadeo et al., 2022). For oil market uncertainty, as asset returns volatility is a proxy for uncertainty in that market (see Bloom et al., 2007), we use squared returns – the most popular approximation of unobserved volatility in financial markets – to estimate volatility in the oil market using WTI price[7] returns data. It is straightforward to compute and it is readily shown that the squared returns is an unbiased estimator for the variance of that series (see Giles, 2008).

The period under investigation is 1990m2–2023m1 (396 months), determined by the availability of the airline industry equities and VIX data. For the GFC dummy, dating of the 2008 Great Recession in the US is based on the NBER data, which extends from 2008M1 to 2009M6.[8] As a robustness exercise, we follow Pal and Mitra (2022) and compare our results using oil prices with jet fuel prices.[9] Because jet fuel price data are available from 1990m4, analyses where this series is substituted for oil prices has a slightly later start date. Jet fuel returns volatility is estimated in the same manner as oil returns volatility (i.e., as squared returns).

4. Results and discussion

Fig. 1 summarises our findings from five alternative model specifications involving nominal (Panels A to C) and real (Panels D and E) airline returns, various lag length selections (zero lags, lags based on the autocorrelation function, and 12 lags), and different fuel price measures (oil/jet fuel prices). The clearest and most pronounced result across all specifications is that positive VIX shocks reduce airline equity returns over the entire one-year forecast horizon, implying that rising investors' fear is the most important uncertainty for the airline industry via the equity financing channel.

Considering the first of the newspaper-based uncertainty indices, as theoretically and empirically expected (see Demiralay, 2020; Cho et al., 2023), an unanticipated rise in geopolitical risk adversely affects airline equity performance, but the effect is only robust in relatively short (i.e., within the first month) forecast periods. This suggests that investors either have short-lived memories or assume that geopolitical tensions will quickly abate. Interestingly, climate policy uncertainty increases have a positive and statistically significant contemporaneous (within one month) effect on airline returns. Perhaps investing in a fossil fuel-intensive industry appears guilt-free in an environment where climate policy actions are more apprehensive than usual. As escalating climate-policy uncertainty positively affects the returns of brown energy-intensive sectors such as airlines, green transitioning should progressively insulate such firms from future climate-policy-related uncertainties. Surprisingly, uncertainty shocks related to infectious diseases do not appear to have statistically meaningful effects on airline equity returns. However, this result is driven by the fact that the COVID-19 pandemic occurs in only a few periods in our sample, when the infectious diseases uncertainty index suffered a sizeable and long-lasting increase, while previous movements in this series were comparatively mild and transitory.

With reference to the impact of fuel price uncertainty shocks on airline returns, the response functions vary over the forecast horizon. In the relatively short run (within the first three months), rising fuel price uncertainty reduces airline returns. The implications of these results are related to those derived from climate policy uncertainty increases, with the possibility for airlines to reduce their initial exposure to price uncertainty increases by accelerating their green transition and reducing their dependence on fossil fuels. As the time horizon expands, an increase in fuel price uncertainty positively affects airline returns, but the sign and statistical significance of this finding is not robust across all specifications. A negative initial impact of rising fuel price uncertainty on airline equity returns can plausibly turn positive if investors deem airlines are able to effectively mitigate risks. For example, fuel price volatility due to lower fuel prices can be brought about by negative demand side shocks related to poor economic conditions. If airlines are able to manage such uncertainty by lowering prices to increase demand in bad economic times, investors may perceive such a dynamic pricing strategy as effective risk mitigation and revenue management. This ultimately attracts an optimistic investor sentiment, positively impacting airline stock returns.

[1] Replication codes accompany this article as supplementary material.
[2] Such that $\epsilon_t = \epsilon_t^+ + \epsilon_t^-$.
[3] See Bloomberg terminal - ticker S5AIRLX.
[4] See https://fred.stlouisfed.org/series/CPALTT01USM661S.
[5] See https://www.policyuncertainty.com/.
[6] See https://fred.stlouisfed.org/series/VIXCLS.
[7] See https://fred.stlouisfed.org/series/DCOILWTICO. WTI prices are relevant here, given the focus on the US airline equity market.
[8] See https://fred.stlouisfed.org/series/USREC.
[9] See https://fred.stlouisfed.org/series/WJFUELUSGULF.

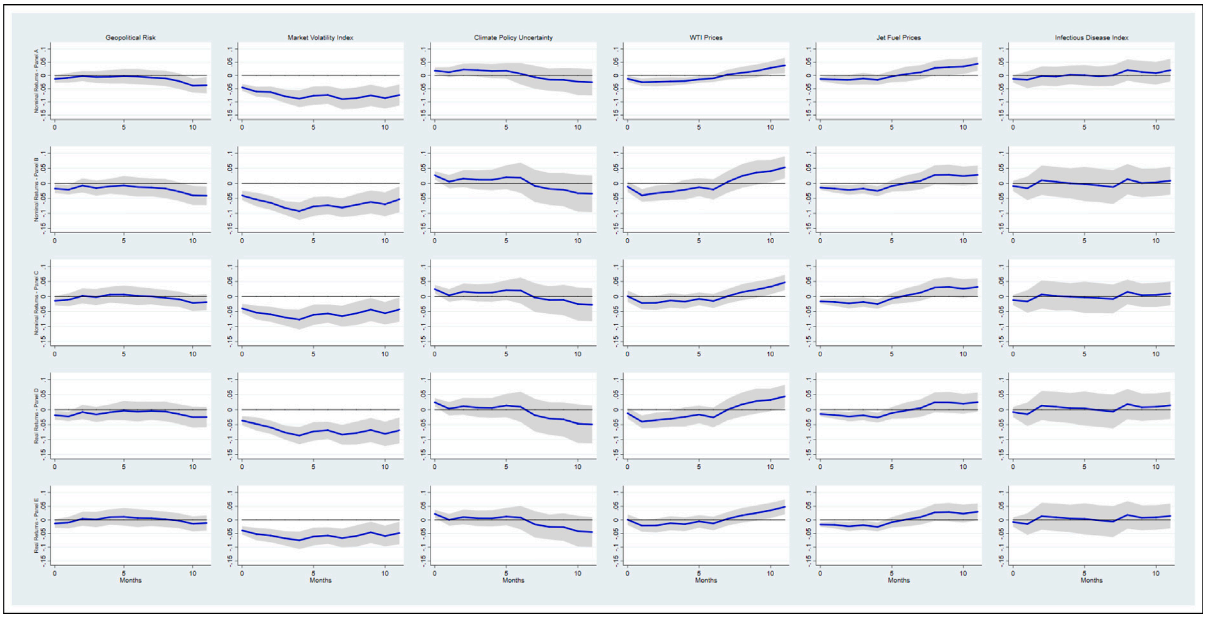

Fig. 1. Cumulative responses of airlines returns to a positive one standard deviation shock in external uncertainties, for the first 12 months for the long-differences specification (the response multiplied by 100 gives the basis points), estimated from a sample range: 1990m2–2023m1 (1990m4–2023m1 for specifications using jet fuel in place of WTI oil prices). The cumulative responses are displayed along with the 90% confidence intervals. Panels A to C report nominal airline returns, while D and E report real airline returns. Lag order sensitivity for control variables: no lags in Panel A; lags determined by the autocorrelation function in Panels B and D; and 12 lags (standard for monthly frequency) in Panels C and E.

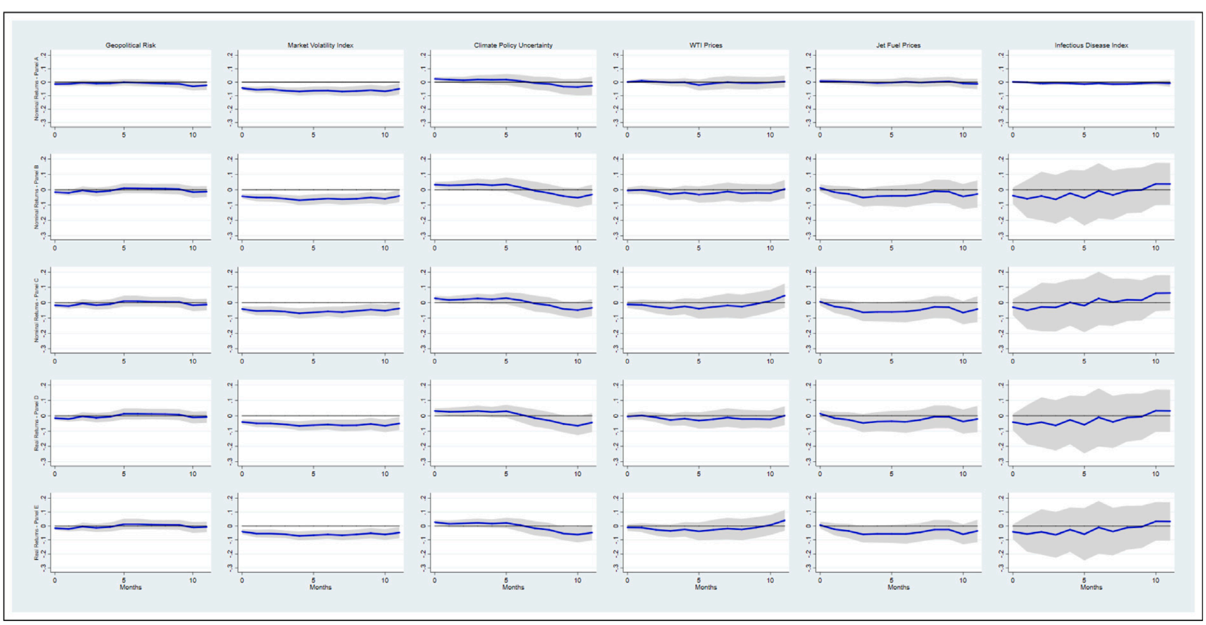

Fig. 2. Cumulative responses of airline returns to positive one standard deviation shocks, based on percent changes of external uncertainties (as opposed to shocks identified from ARMA(1,1) univariate models). For all other details, refer to the caption of Fig. 1.

5. Robustness analysis

Apart from the alternative specifications involving nominal and real airline returns, and different lag lengths and control variables, we carry out two additional checks. The first repeats the analysis with a sample which uses the percent changes in uncertainty regressors (Fig. 2), as an alternative to following Ready (2018) and working with shocks from residual components of ARMA(1,1) models. The second robustness check repeats the main analysis but with a truncated subsample that terminates in 2019m12, to determine whether our results are robust to the exclusion of the COVID-19 pandemic and the infectious diseases tracker regressor (Fig. 3). Figs. 2 and 3 show that the results of these exercises are qualitatively consistent with our main findings (Fig. 1).

6. Conclusion and future research

We provide useful insights into the external uncertainties facing airline firms through an equity market lens. On one hand, an increase in investors' fear on the stock market, as measured by positive VIX shocks, are particularly important and have longer-lasting negative effects on the airline industry. On the other hand, a rise in uncertainties based on newspaper coverage (geopolitical risk and climate policy) and

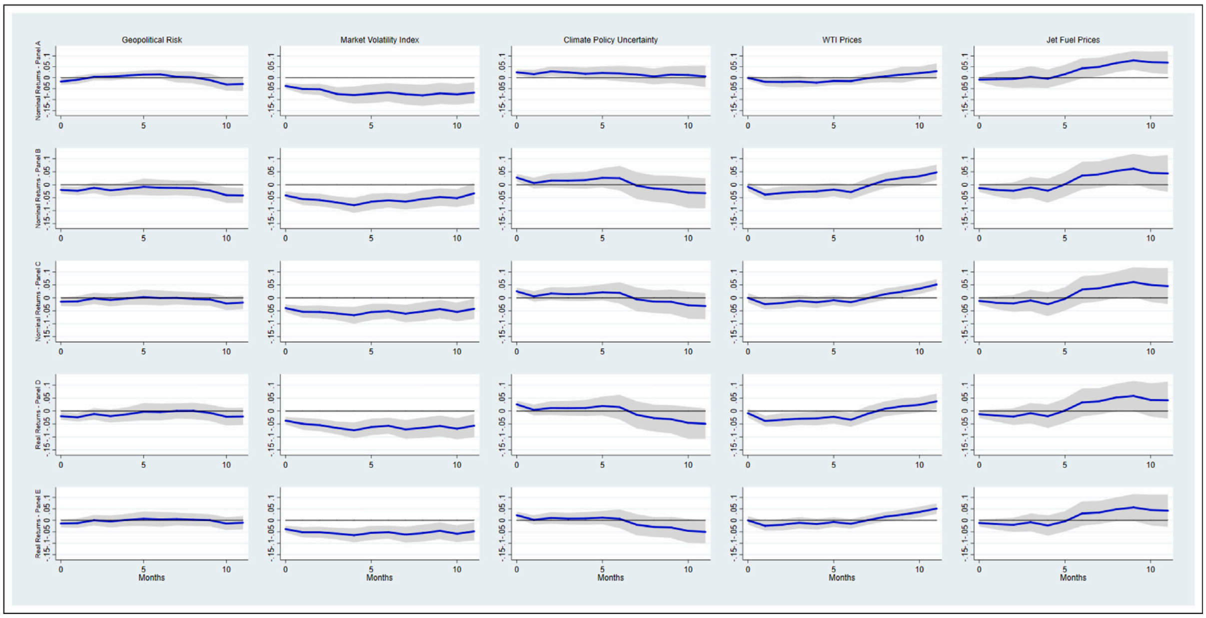

Fig. 3. Cumulative responses of airline returns to positive one standard deviation shocks in external uncertainties, based on a sub-sample that excludes the COVID-19 pandemic and the infectious diseases tracker regressor, terminating in 2019m12. For all other details, refer to the caption of Fig. 1.

fuel costs have shorter-lived implications. We also find that our main results, which includes the COVID-19 sample and the infectious disease equity market volatility tracker index, are robust to the exclusion of the pandemic period and the infectious disease tracker. As we have established here that rising investors' fear shocks have unambiguous adverse effects for airline returns over the forecast horizon, a promising avenue for related future research in airline financial management is to estimate the effects of the novel newspaper-based uncertainty shocks on airline returns in times of high and low investors' fear regimes. For instance, Mahadeo et al. (2022) suggests that practitioners view VIX values $\geq$ 20 to be turbulent conditions. Consequently, one can assess whether news impacts airline equities differently in stable/unstable states of market fear.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.econlet.2024.111994.

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