

Dynamic Risk Management

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Understanding Risk Management

Rationale for corporate risk management: financial constraints

- Financing constraints render firms effectively risk averse
 - See Froot, Scharfstein, and Stein (1993)
- Empirical prediction
 - More financially constrained firms are more likely to manage risk

Evidence on size pattern does not support theory

- “The actual corporate use of derivatives, however, does not seem to correspond closely to the theory.” – Stulz (1996)

Risk Management – Theory

Rethinking risk management

- We theoretically and empirically challenge the notion that financial constraints and risk management should be positively related.

Basic theoretical insight

- **Financing risk management trade-off**
 - Collateral constraints link availability of financing and risk management
 - When net worth is low, firms use net worth for investment at expense of risk management
- Prediction: **More financially constrained firms hedge less**
- **New: Hedging of stochastic input price**

Risk Management – Evidence

Revisiting evidence

- **Evidence on fuel price risk management** by airlines
 - More constrained airlines hedge less both ...
 - in cross-section and ...
 - within airlines over time
 - Risk management drops substantially as airlines approach distress
- **New: Exploit within-airline variation in financing and risk management**
- Anecdotal evidence: American Airlines 2009 10-K
 - “[a] deterioration of the Company’s financial position could negatively affect the Company’s ability to hedge fuel in the future.”

Risk Management – State of Literature

Perceived tension between theory and practice

- “[Nance, Smith, and Smithson (1993)] find that smaller firms are less likely to hedge. This fact is generally inconsistent with our model if one believes that smaller firms are more likely to be liquidity constrained ...” – Froot/Scharfstein/Stein (1993)
- “... theory predicts an inverse relationship between firm size and delta-percentage; smaller mines might engage in greater risk management so as to avoid having to seek costly external financing.” – Tufano (1996)

Risk Management – State of Literature (Cont'd)

Abridged review of literature

- Empirical literature
 - **Studies typically use single cross section of categorical data**
 - Exception: Tufano (1996) – gold mining firms
 - Main relatively robust empirical pattern
 - Positive relation between hedging and size
 - Some evidence of positive relation between hedging and dividend yields
 - Surprisingly neither carefully documented nor explored in detail
- Theoretical literature
 - Froot/Scharfstein/Stein (1993) – hedging due to financial constraints
 - Holmström/Tirole (2000) – incomplete insurance of liquidity shocks
 - Rampini/Viswanathan (2010, 2013) – financing vs. hedging trade-off

Model of Commodity Price Risk Management

Firm (“Airline”)

- Discrete time, infinite horizon
- Risk neutral, limited liability, discount future payoffs at $\beta < 1$, maximize expected discounted value of dividends
- **Neoclassical production function** with two inputs
 - **Capital** k (“aircraft”); depreciates at rate δ ; no adjustment costs
 - **New: Input** x' (“fuel”) at stochastic price p' (“fuel price”)
 - Cash flows $\hat{A}'k^{\hat{\alpha}}x'^{\phi}$ with productivity $\hat{A}' > 0$
 - Decreasing returns $\hat{\alpha} + \phi < 1$
- Markov process $\Pi(s, s')$ where state s' affects $p' = p(s')$ and $\hat{A}' = \hat{A}(s')$

Model (Cont'd)

Outside investors

- Risk neutral, discount future payoffs at $R^{-1} > \beta$; let $R \equiv 1 + r$

Complete markets

- Allow dynamic risk management with ...
 - state-contingent claims Rb'
 - forward purchases of input amount x'_f at price p'_f in state s'

Model (Cont'd)

Limited enforcement

- Firm can default on ...
 - state-contingent promises to pay Rb' and ...
 - promise to take delivery on forward purchases $p'_f x'_f$...
 - in which case counterparty keeps inputs x'_f

Collateralize all promises (repayment) and forward purchases

- Promises cannot exceed fraction θ of resale value of (depreciated) capital

$$\theta k(1 - \delta) \geq \underbrace{Rb'}_{\text{financing}} + \underbrace{(p'_f - p')x'_f}_{\text{risk management}}$$

- Endogenous, state-contingent collateral constraints
 - Related Kiyotaki/Moore (1997)

Model (Cont'd)

Commodity price risk

- Firms can purchase (or sell) inputs on spot market ...
 - so forward purchases do *not* affect production decision
- **Commodity price affects cash flow $A'k^\alpha$**
 - $A' \equiv \widehat{A}'^{\frac{1}{1-\phi}}(1-\phi)\phi^{\frac{\phi}{1-\phi}}p'^{-\frac{\phi}{1-\phi}}$ and $\alpha = \widehat{\alpha}/(1-\phi)$
 - High input price implies low cash flow/net worth next period

Equivalent problem

- Noncontingent debt and hedging with short sale constraints
 - Down payment of $\varphi \equiv 1 - R^{-1}\theta(1 - \delta)$ per unit of capital

Firm's Problem

Dynamic program

- Firm solves

$$V(w, s) \equiv \max_{\{d, k, w', h'\} \in \mathbb{R}_+^{2+S} \times \mathbb{R}^S} d + \beta E[V(w', s') | s] \quad (1)$$

subject to budget constraints

$$w \geq d + \underbrace{\varphi k}_{\text{investment}} + \underbrace{R^{-1} E[h' | s]}_{\text{risk management}} \quad (2)$$

$$A'k^\alpha + (1 - \theta)k(1 - \delta) + h' \geq w', \quad (3)$$

and **short sale constraints**

$$h' \geq 0. \quad (4)$$

Financing Risk Management Trade-off

Absence of risk management (Proposition 3)

- **Severely constrained firms** (i.e., firms with sufficiently low net worth) **do not engage in risk management**
- Even mature firms abstain from risk management with positive probability

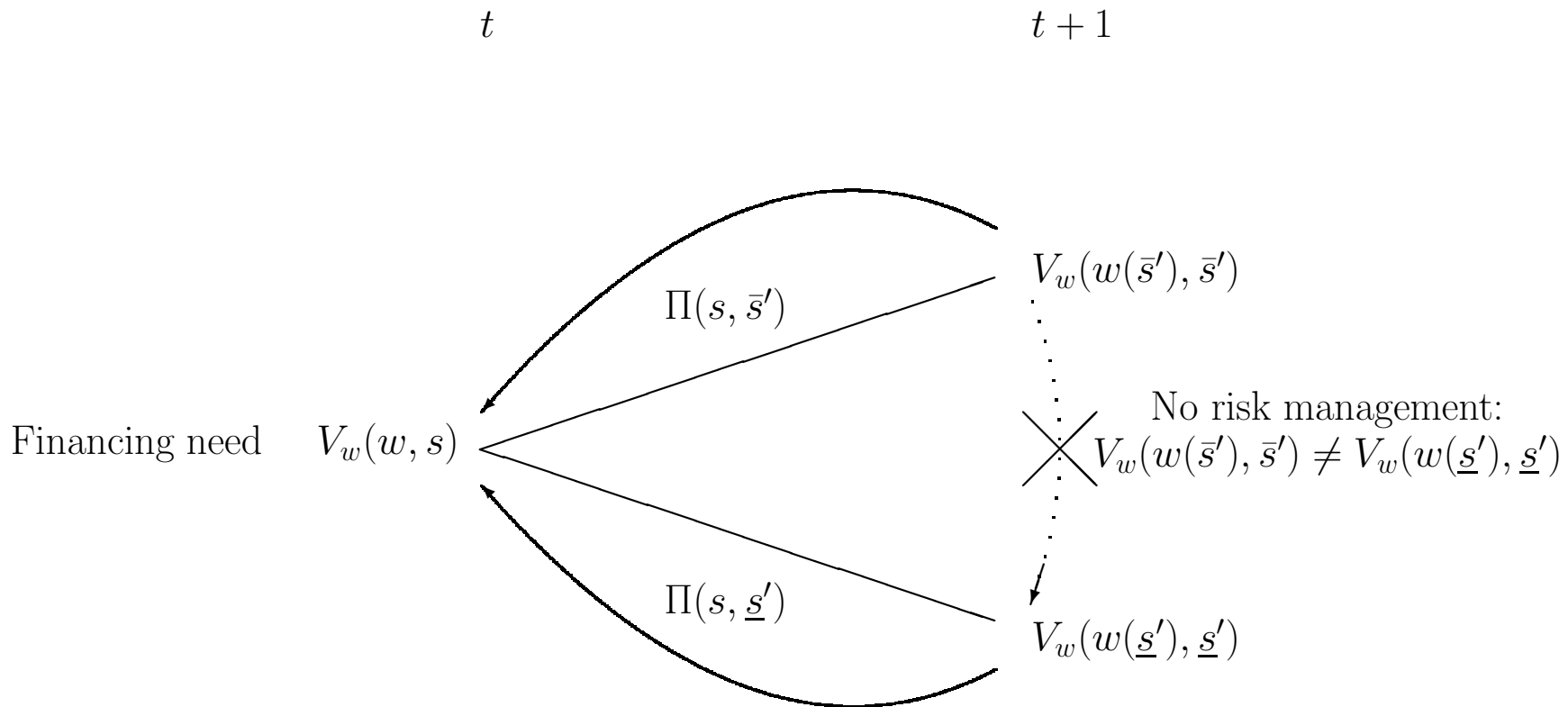
Intuition

- **Financing needs for investment override hedging concerns**
 - Low net worth \Rightarrow limited investment \Rightarrow high marginal return on capital

Financing Risk Management Trade-off (Cont'd)

Basic trade-off

- Financing need can override hedging concern



Model: Implications

Two key empirical predictions

- **Cross section**

- More constrained firms engage in less risk management and may not engage in risk management at all

- **Within firms over time**

- As firms' financial conditions deteriorate (improve), they reduce (increase) the extent of risk management and may stop hedging completely (may initiate risk management)

Empirical Lab: Airline Fuel Price Risk Management



Data: U.S. Airlines

Why airlines?

- **Fuel major cost** and source of cash flow risk
 - 20% of costs on average and as high as 30% or more
- Hand-collected **data** on airline fuel price risk management
 - **Fraction of next year's expected fuel expenses hedged**
 - Source: Airlines' SEC 10-K filings, Item 7(A) "Quantitative and Qualitative Disclosures about Market Risk"
- **Focus on one industry** holds constant other characteristics

Evidence from Airlines' 10-K Filings

Evidence from Southwest Airlines' 2010 10-K

- Southwest Airlines explicitly pledges aircraft as collateral to counterparties
 - “The Company ... had agreements with counterparties in which cash deposits and/or **pledged aircraft** are required to be posted whenever the net fair value of derivatives associated with those counterparties exceeds specific thresholds.”
- Agreements with two counterparties to post **aircraft as collateral**
 - Pledge up to \$810 million (or 9% of net value of aircraft) as collateral
 - Pledge 20 Boeing 737-700s for up to \$400 million to one counterparty

Data on Fuel Price Risk Management by Airlines

Summary statistics and extent of fuel hedging

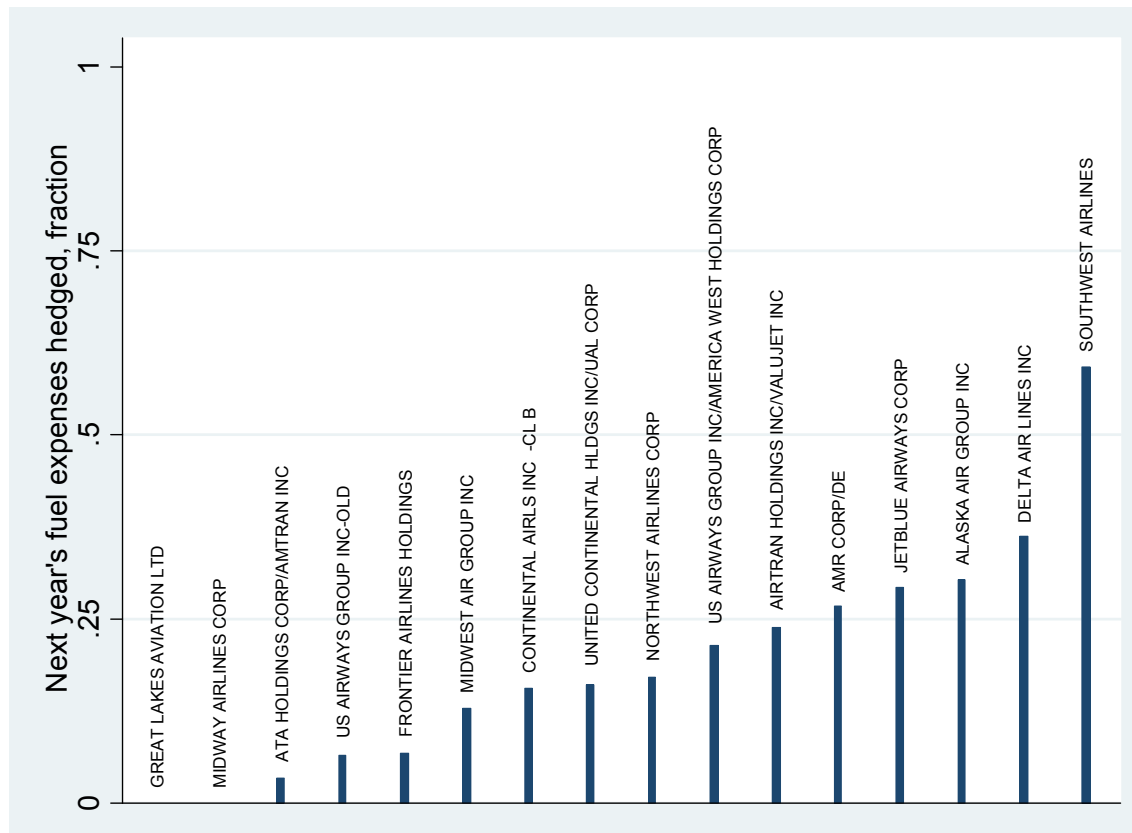
- Panel data from Compustat
 - 23 airlines, 1996 to 2009, (up to) 15 years, 270 airline-year observations
 - Average fraction of expected fuel expenses hedged **20%** (std. dev. 24%)

	N	Mean	SD	10th	50th	90th
Fraction of next year's fuel expenses hedged	244	0.381	0.388	0.000	0.240	1.000
Fraction for airlines without fuel pass through	184	0.199	0.238	0.000	0.115	0.500
Fuel pass through agreement in place	270	0.222	0.417	0.000	0.000	1.000
Fuel used, gallons	239	899	1038	29	367	2730
Fuel cost, per gallon	250	1.286	0.751	0.612	0.946	2.224
Fuel expense, total, \$M	263	1056	1601	23	326	3034
Fuel expense/total operating expense	263	0.198	0.090	0.109	0.171	0.334
Net worth (bv) \$B	270	0.458	2.837	-0.309	0.177	2.973
Net worth to total assets (bv)	265	0.189	0.291	-0.112	0.209	0.502
Net worth (mv) \$B	260	1.583	2.574	0.032	0.531	4.830
Net worth to total assets (mv)	260	0.324	0.245	0.041	0.260	0.706
Credit rating	157	2.401	0.861	1.000	2.000	4.000
Operating income to lagged assets ratio	260	0.118	0.136	-0.016	0.102	0.301

Fuel Price Risk Management by Airlines

Substantial variation in cross section

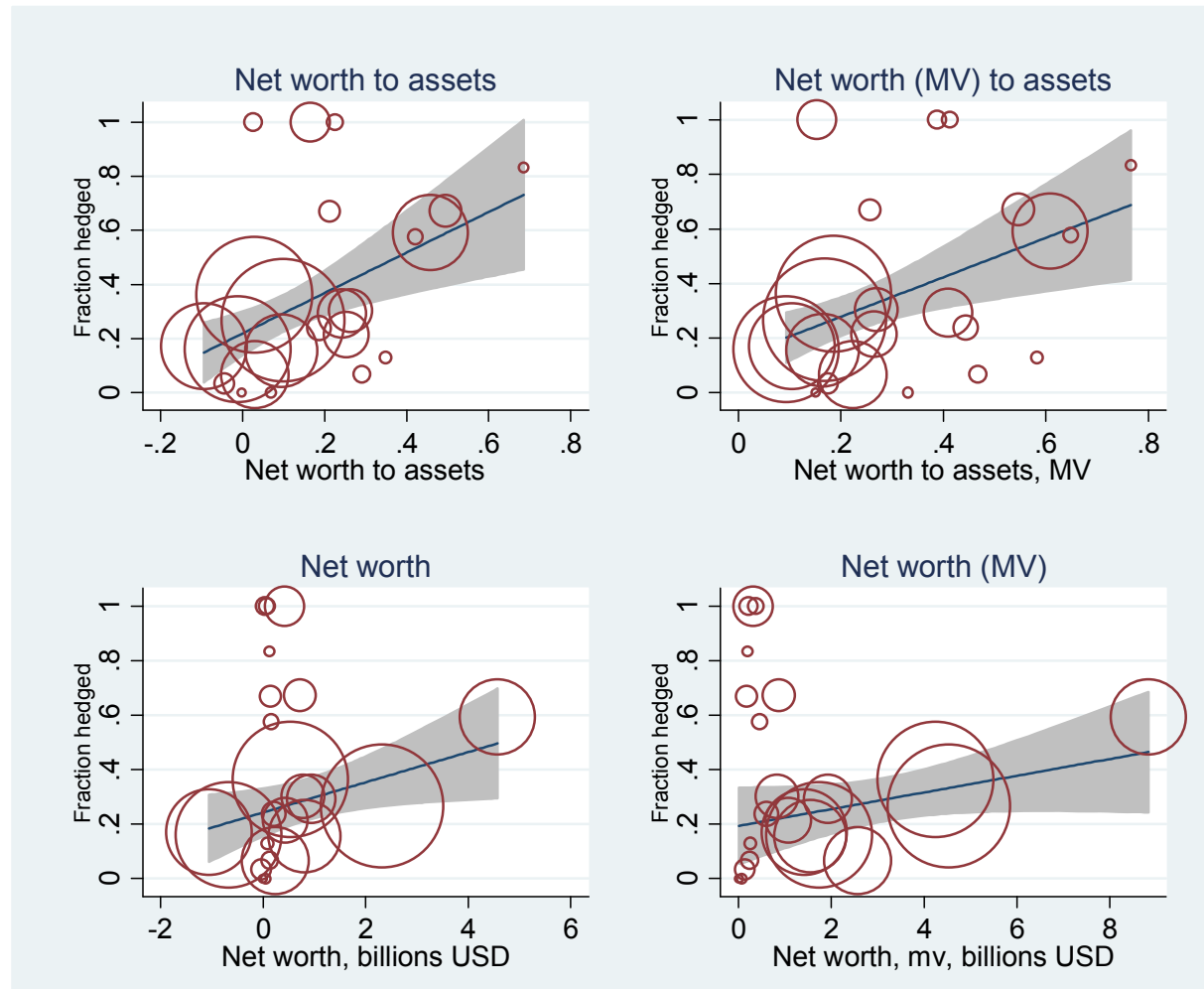
- Fraction of next year's expected fuel expenses hedged varies by airline
 - Figure displays airlines without fuel pass through agreements



Evidence on Financing Risk Management Trade-off

Fuel hedging and net worth: Cross-sectional evidence

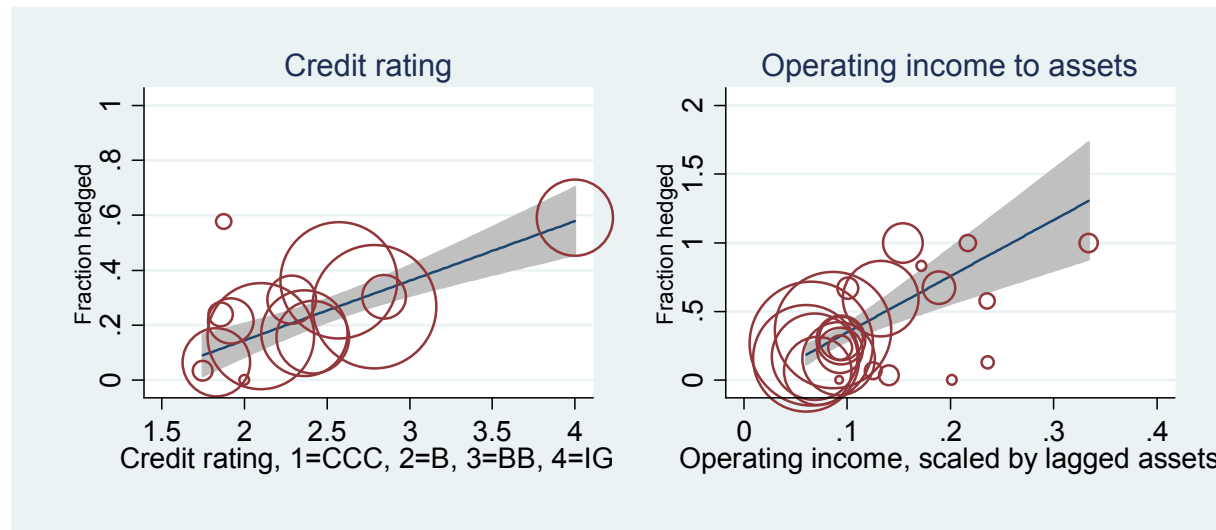
- Strong positive relation between hedging and net worth



Evidence on Financing Risk Management Trade-off (Cont'd)

Fuel hedging and net worth: Cross-sectional evidence

- Strong positive relation between hedging and credit rating/operating income



Fuel Hedging and Net Worth: Cross Section

Cross section

- Strong positive relation between net worth and risk management

Dependent variable: Fraction of next year's fuel expenses hedged

Measure of net worth	Net worth to total assets (bv) (1)	Net worth to total assets (mv) (2)	Net worth (bv), \$B (3)	Net worth (mv), \$B (4)	Credit rating (5)	Credit rating dummies (6)
Panel A: WLS estimation						
	0.749** (0.123)	0.725** (0.103)	0.055* (0.020)	0.031 (0.018)	0.217** (0.017)	
Rating = BB-, BB, or BB+						-0.326** (0.069)
Rating = B-, B, or B+						-0.495** (0.073)
Rating = CCC+ or worse						-0.442* (0.158)
Observations	23	23	23	23	14	14
R-squared	0.358	0.317	0.199	0.127	0.748	0.798

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% significance level, respectively

Fuel Hedging and Net Worth: Airline Fixed Effects

Within airline variation: firm and year fixed effects

- Strong positive relation between net worth and risk management **within airlines**

Dependent variable: Fraction of next year's fuel expenses hedged

Measure of net worth	Net worth to total assets (bv) (1)	Net worth to total assets (mv) (2)	Net worth (bv), \$B (3)	Net worth (mv), \$B (4)	Credit rating (5)	Credit rating dummies (6)
Panel A: WLS estimation						
	0.383* (0.139)	0.673* (0.271)	0.020** (0.005)	0.038** (0.010)	0.176** (0.028)	
Rating = BB-, BB, or BB+						-0.215* (0.074)
Rating = B-, B, or B+						-0.356** (0.071)
Rating = CCC+ or worse						-0.550** (0.110)
Observations	242	240	244	240	145	145
R-squared	0.656	0.664	0.665	0.691	0.645	0.647

**,* ,+ Coefficient statistically different than zero at the 1%, 5%, and 10% significance level, respectively

Fuel Hedging and Net Worth: First Differences

First differences of net worth and fraction hedged

- Positive relation between net worth and risk management (except: bv)

Dependent variable: Δ Fraction of next year's fuel expenses hedged

Measure of net worth	Δ Net worth to total assets (bv) (1)	Δ Net worth to total assets (mv) (2)	Δ Net worth (bv), \$B (3)	Δ Net worth (mv), \$B (4)	Δ Credit rating (5)
	-0.137 (0.198)	0.623+ (0.316)	-0.008 (0.015)	0.046+ (0.027)	0.136* (0.052)
Observations	210	208	212	208	125
R-squared	0.228	0.260	0.227	0.279	0.288

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% significance level, respectively

Fuel Hedging and Net Worth: IV

Instrumental variables estimation

- Operating income as an instrument for firm net worth

Dependent variable	Fraction of fuel expenses hedged (1)	Net worth to total assets (bv) (2)	Net worth to total assets (mv) (3)	Fraction of next year's fuel expenses hedged (4)	(5)
Panel A: Pooled cross section time series regressions					
Operating income to lagged assets	2.842** (0.504)	2.296** (0.542)	2.111** (0.648)		
Net worth to total assets (bv)				1.308** (0.198)	
Net worth to total assets (mv)					1.339** (0.325)
Observations	240	260	260	240	240
R-squared	0.417	0.413	0.506	0.181	0.315
Panel B: Airline fixed effects					
Operating income to lagged assets	1.246* (0.505)	0.726+ (0.354)	1.176** (0.215)		
Net worth to total assets (bv)				1.433** (0.408)	
Net worth to total assets (mv)					1.053* (0.421)
Observations	240	260	260	240	240
R-squared	0.650	0.629	0.854	0.422	0.646
Panel C: Airline first differences					
Operating income to lagged assets	0.942 (0.564)	0.454 (0.350)	0.488** (0.082)		
Net worth to total assets (bv)				1.454 (0.879)	
Net worth to total assets (mv)					1.852+ (1.077)
Observations	208	237	237	208	208
R-squared	0.252	0.299	0.328	0.092	0.092

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% significance level, respectively

Hedging around Distress

Distressed airlines

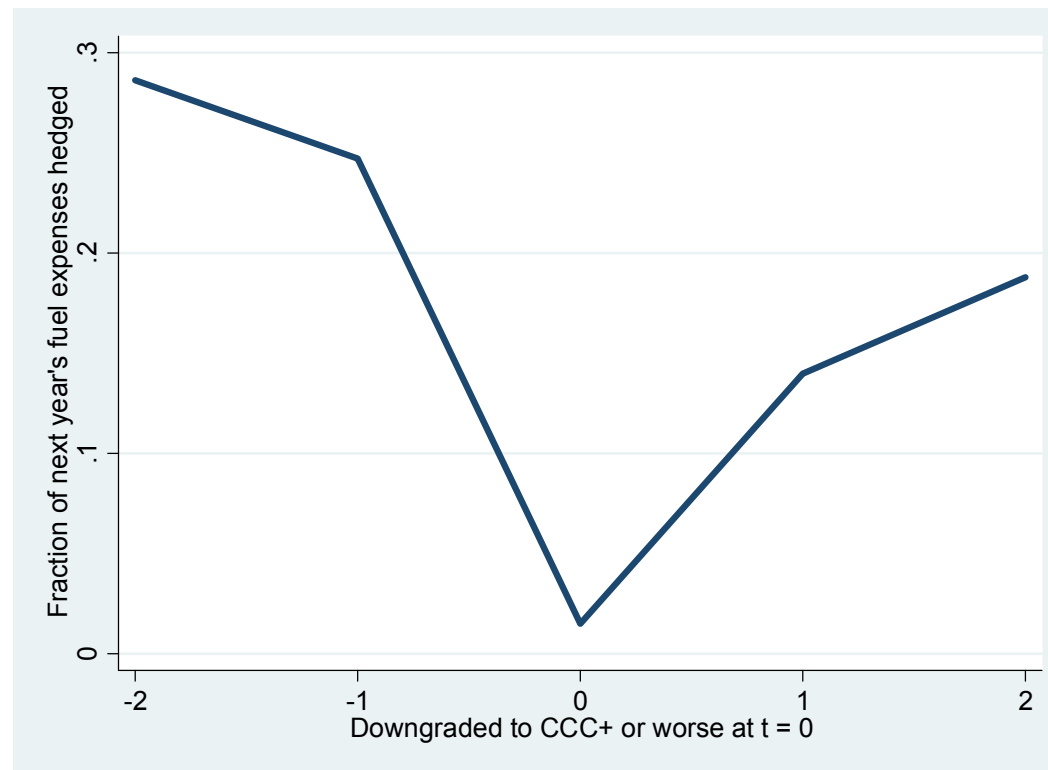
- Sample of 10 distressed U.S. airlines

	Year entering distress
US AIRWAYS GROUP INC/AMERICA WEST HOLDINGS CORP	2001
US AIRWAYS GROUP INC-OLD	2001
UNITED CONTINENTAL HLDGS INC/UAL CORP	2002
ATA HOLDINGS CORP/AMTRAN INC	2003
DELTA AIR LINES INC	2004
US AIRWAYS GROUP INC-OLD	2004
FLYI INC/ATLANTIC COAST AIRLINES INC	2004
NORTHWEST AIRLINES CORP	2005
FRONTIER AIRLINES HOLDINGS	2008
AIRTRAN HOLDINGS INC/VALUJET INC	2008

Hedging around Distress (Cont'd)

Fuel hedging around airline distress

- Dramatic decline in hedging as airlines approach distress; slow recovery



Hedging around Distress (Cont'd)

Fuel hedging around airline distress

- Dramatic decline in hedging as airlines approach distress; slow recovery

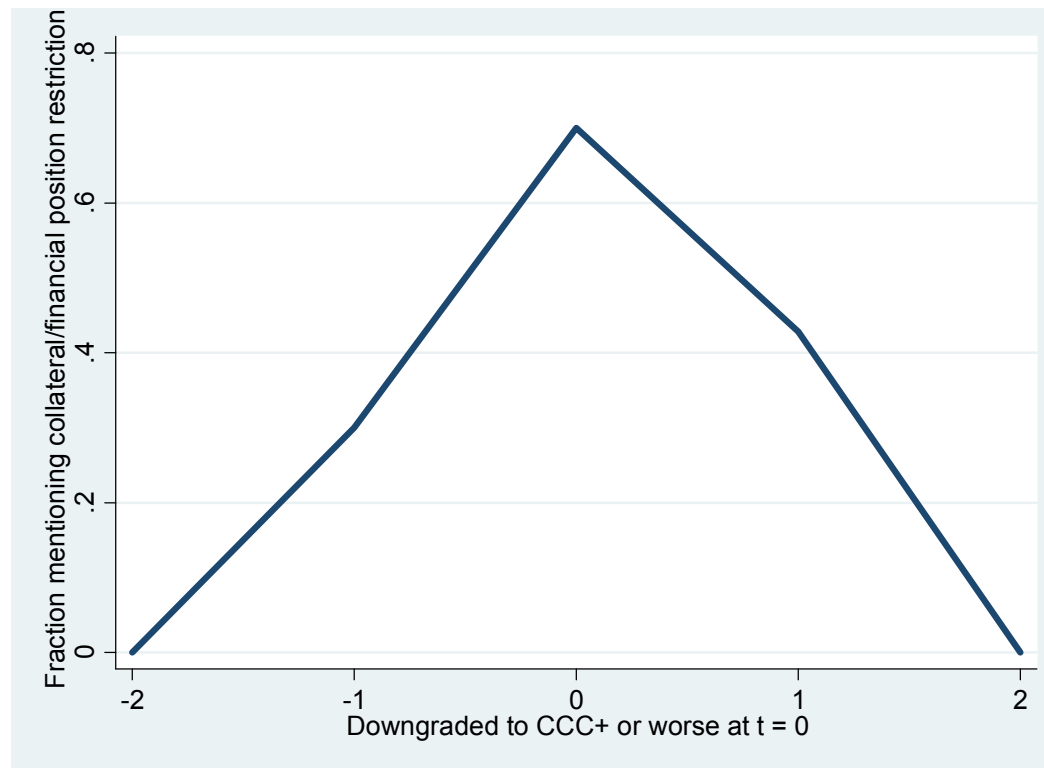
	Dependent variable: Fraction of next year's fuel expenses hedged	
	WLS	FE
	(1)	(2)
Two years before distress	-0.223 (0.132)	-0.140+ (0.080)
One year before distress	-0.274+ (0.144)	-0.127 (0.092)
Year entering distress	-0.526** (0.100)	-0.386** (0.090)
One year after distress	-0.421** (0.121)	-0.228* (0.108)
Two years after distress	-0.358** (0.100)	-0.177+ (0.093)
Observations	244	244
R-squared	0.228	0.711

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% significance level, respectively

Evidence from 10-K Filings of Airlines in Distress

Collateral/financial position concerns

- Fraction mentioning collateral/financing as impediment to hedging



Evidence from 10-K Filings of Airlines in Distress (Cont'd)

Net worth affects hedging

- America West Airlines is downgraded to CCC- and cuts their hedging to just 3% of expected fuel expenses. Their 2001 10-K filing states:

“In order to execute additional hedging transactions, we anticipate that we will have to provide **cash collateral or other credit support**, which we may not be able to provide in a cost-effective manner.”

Filings before distress never mention collateral as impediment to hedging.

- Evidence from practitioners

“The authors have knowledge of several airline bankruptcies and, in every case, financial officers **recognized the advantage of a hedge**, and understood that they were not in a position to make the appropriate trades in the marketplace.” – Morrell and Swan (2006)

Robustness

Excluding distressed firm-year observations

- Results are robust to excluding distressed firm-year observations

Dependent variable: Fraction of next year's fuel expenses hedged

Measure of net worth	Net worth to total assets (bv) (1)	Net worth to total assets (mv) (2)	Net worth (bv), \$B (3)	Net worth (mv), \$B (4)	Credit rating (5)	Operating income lagged assets ratio (6)
			<u>Cross section, firm-mean regressions</u>			
	0.984** (0.108)	0.708** (0.121)	0.068** (0.022)	0.031 (0.018)	0.254** (0.030)	3.774** (0.956)
			<u>Airline fixed effects</u>			
	0.392* (0.152)	0.502+ (0.248)	0.018* (0.007)	0.035** (0.006)	0.154** (0.032)	0.742* (0.350)
			<u>Airline first differences</u>			
	0.797+ (0.416)	0.508 (0.404)	0.095* (0.039)	0.040 (0.032)	0.185* (0.076)	0.838 (0.620)

**,* ,+ Coefficient statistically different than zero at the 1%, 5%, and 10% significance level, respectively

Robustness (Cont'd)

Results are robust to different specifications

- **Distress, not bankruptcy** (Tables A1)
 - Hedging drops as early as 2 years before bankruptcy.
- **Reverse causality?** (Figure 6)
 - Do airlines that hedge have high net worth because fuel prices rise?
 - No - similar estimates in subsamples in which fuel prices rise/fall
- **Excluding Southwest** (Table A2)
 - Results are robust, albeit statistical significance is reduced in a few cases
- **Excluding airlines with fuel pass through agreements** (Table A3)
 - Results are similar and (in part) statistically stronger
- **Adjusting assets for leased capital** (Table A4)
 - Results are similar and often stronger
- **OLS** (Panel B of Tables 3/4/5)
 - Results are similar, albeit statistical significance somewhat reduced.

Alternative Hypotheses

Alternative hypotheses not consistent with evidence

- Risk shifting?
- Fixed costs or economies of scale?
- Reluctance of counterparties to trade?

Alternative Hypotheses: Risk Shifting?

Risk shifting not consistent with evidence

- Does bondholder shareholder result in risk shifting?
- 70% of airlines entering distress **mention collateral** concerns in 10-Ks
- 65% state **no use of derivatives for trading or speculation** in 10-Ks
 - “[Southwest Airlines] does not purchase or hold any derivative financial instruments for trading purposes.”
- Risk shifting predicts **speculation and discontinuous hedging policy - no evidence of either!**
 - Strong correlation even excluding distressed firm-year observations
- No other evidence of risk shifting (Andrade/Kaplan (1998), Rauh (2009))
 - Text search of mentions of “sufficient” and “liquidity” in 10-Ks
 - BBB– or better: 0%; BB–, BB, BB+: 24%; B+ or worse: 55%

Alternative Hypotheses: Risk Shifting? (Cont'd)

Risk shifting not consistent with evidence (Cont'd)

- Risk shifting suggests bondholders should require hedging
- Instead we find **bondholders of airlines in distress limit risk management**
 - Consistent with our theory
- Delta Air Lines 2005 10-K:

“In December 2005, the Bankruptcy Court authorized us to [hedge] up to 30% of our monthly estimated fuel consumption, with hedging allowed in excess of that level if we obtained **approval of the Creditors Committee** or the Bankruptcy Court. In February 2006, we received approval of the Creditors Committee to hedge up to 50% of our estimated 2006 ... fuel consumption ...”
- United Airlines 2002 10-K:

“The terms of the DIP Financing **limit United’s ability to post collateral** in connection with fuel hedging.”

Other Alternative Hypotheses

Alternative hypotheses not consistent with evidence

- **Fixed costs or economies of scale?**
 - Not consistent with evidence on intensive and extensive margin of hedging (and within-airline variation)
- **Reluctance of counterparties to trade?**
 - Requires that collateral is critical, consistent with our theory
 - Not consistent with strong net worth hedging correlation excluding distressed observations

Conclusion

Remarkable support for financing risk management trade-off

- Strong, positive correlation between net worth and hedging ...
 - robust and consistent in cross section and time series

Reconsideration of financing risk management relation warranted

- Dynamic risk management theory – Rampini/Viswanathan (2010, 2013)

Evidence from Airlines' 10-K Filings (Cont'd)

Aircraft as collateral to counterparties

- Detailed information from Southwest Airlines' 2010 10-K

(in millions)	Counterparty (CP)						Total
	A	B	C	D	E	Other	
Fair value of fuel derivatives	\$ 114	\$ (238)	\$ (3)	\$ 79	\$ 189	\$ 1	* \$142
Cash collateral held by CP	(60)	125	—	—	—	—	65
Aircraft collateral pledged to CP	—	113	—	—	—	—	113
If credit rating is investment grade, fair value of fuel derivative level at which:							
Cash is provided to CP	0 to (300) or >(700)	0 to (125) or >(535)	>(75)	>(75)	>(75)	>(75)	
Cash is received from CP	>40	>150	>200	***	>125	***	>250
Aircraft is pledged to CP	(300) to (700)	(125) to (535)	N/A	N/A	N/A	N/A	
If credit rating is non-investment grade, fair value of fuel derivative level at which:							
Cash is provided to CP	0 to (300) or >(700)	0 to (125) or >(535)	**	**	**	**	
Cash is received from CP	**	**	**	**	**	**	
Aircraft is pledged to CP	(300) to (700)	(125) to (535)	N/A	N/A	N/A	N/A	

* Sum of counterparties with fair value of fuel derivatives <\$5M and no risk of the Company posting collateral.

** Cash collateral is provided at 100 percent of fair value of fuel derivative contracts.

*** Thresholds may vary based on changes in credit ratings within investment grade.

Robustness: Hedging around Bankruptcy

Airline bankruptcies

- Sample of 7 U.S. airline bankruptcies

	<u>Year entering bankruptcy</u>
UNITED CONTINENTAL HLDGS INC/UAL CORP	2002
US AIRWAYS GROUP INC-OLD	2002
US AIRWAYS GROUP INC-OLD	2004
ATA HOLDINGS CORP/AMTRAN INC	2004
DELTA AIR LINES INC	2005
NORTHWEST AIRLINES CORP	2005
FRONTIER AIRLINES HOLDINGS	2008

Robustness: Hedging around Bankruptcy (Cont'd)

Distress is critical, not bankruptcy

- Sample includes 7 U.S. airlines that file for bankruptcy
- Hedging drops as early as 2 years before bankruptcy

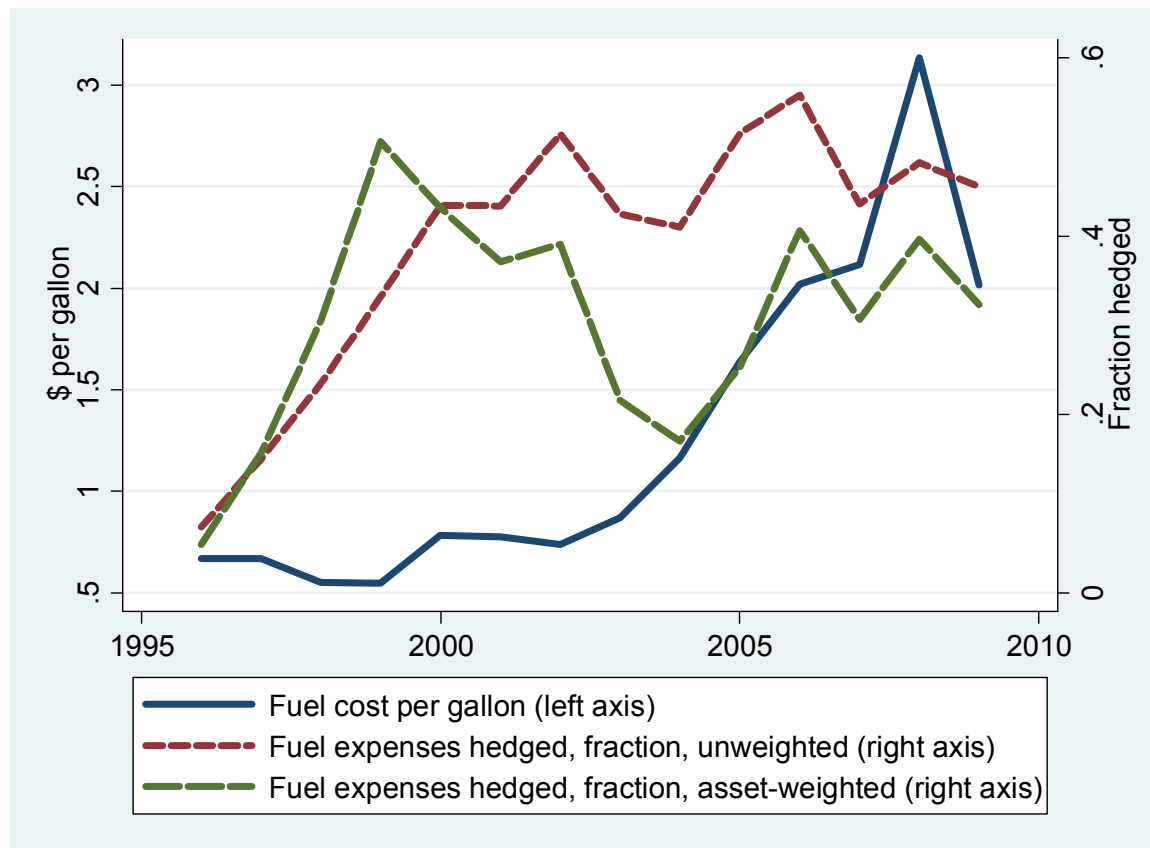
	Dependent variable: Fraction of next year's fuel expenses hedged	
	WLS	FE
	(1)	(2)
Two years before bankruptcy	-0.351** (0.124)	-0.268** (0.067)
One year before bankruptcy	-0.450** (0.090)	-0.279* (0.102)
Year filing for bankruptcy	-0.563** (0.098)	-0.384** (0.105)
One year after bankruptcy	-0.319* (0.117)	-0.197 (0.143)
Two years after bankruptcy	-0.379** (0.108)	-0.236+ (0.118)
Observations	243	243
R-squared	0.210	0.703

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% significance level, respectively

Robustness: Reverse Causality?

Evolution of fuel cost and hedging in the time series

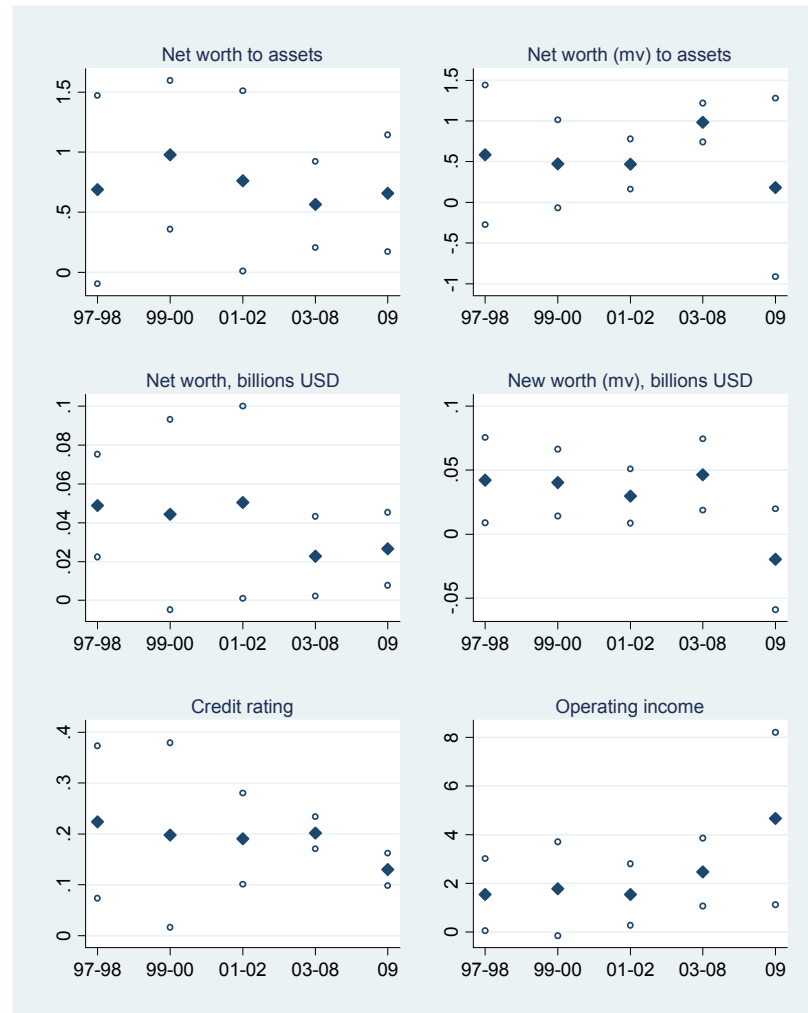
- Data includes periods with rising and falling fuel prices



Robustness: Reverse Causality? (Cont'd)

Reverse causality? – No

- Relation between hedging and net worth stable whether fuel prices rise/fall



Robustness: Southwest Airlines?

Excluding Southwest Airlines

- Results are robust to excluding Southwest Airlines

Dependent variable: Fraction of next year's fuel expenses hedged

Measure of net worth	Net worth to total assets (bv) (1)	Net worth to total assets (mv) (2)	Net worth (bv), \$B (3)	Net worth (mv), \$B (4)	Credit rating (5)	Operating income lagged assets ratio (6)
			<u>Cross section, firm-mean regressions</u>			
	0.670** (0.212)	0.653* (0.232)	0.029 (0.022)	0.001 (0.026)	0.198** (0.061)	3.645** (0.922)
			<u>Airline fixed effects</u>			
	0.286* (0.114)	0.464 (0.274)	0.018** (0.004)	0.030* (0.012)	0.175** (0.034)	1.332* (0.513)
			<u>Airline first differences</u>			
	-0.171 (0.218)	0.451 (0.339)	-0.015 (0.013)	0.033 (0.027)	0.141* (0.056)	1.380** (0.450)

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% significance level, respectively

Robustness: Fuel Pass Through Agreements?

Excluding airlines with fuel pass through agreements

- Results are robust to excluding airlines with fuel pass through agreements

Dependent variable: Fraction of next year's fuel expenses hedged

Measure of net worth	Net worth to total assets (bv)	Net worth to total assets (mv)	Net worth (bv), \$B	Net worth (mv), \$B	Credit rating	Operating income lagged assets ratio
	(1)	(2)	(3)	(4)	(5)	(6)
			<u>Cross section, firm-mean regressions</u>			
	0.646** (0.185)	0.678** (0.131)	0.063** (0.019)	0.053** (0.007)	0.221** (0.016)	3.582* (1.639)
			<u>Airline fixed effects</u>			
	0.405* (0.154)	0.848** (0.232)	0.020** (0.005)	0.037** (0.011)	0.175** (0.029)	1.559* (0.651)
			<u>Airline first differences</u>			
	-0.119 (0.234)	0.671+ (0.362)	-0.007 (0.010)	0.041 (0.025)	0.134* (0.053)	1.079 (0.796)

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% significance level, respectively

Robustness: Adjusting for Leased Capital

Total assets adjusted for leased capital

- Results are stronger with total lease adjusted assets

Dependent variable: Fraction of next year's fuel expenses hedged			
Measure of net worth	Net worth to total assets (bv) (1)	Net worth to total assets (mv) (2)	Operating income lagged assets ratio (3)
Panel A: Lease adjusted assets as in Rampini and Viswanathan (2013)			
	<u>Cross section, firm-mean regressions</u>		
	1.246** (0.181)	0.939** (0.148)	5.917** (1.834)
	<u>Airline fixed effects</u>		
	0.609** (0.199)	0.915* (0.331)	2.420** (0.660)
	<u>Airline first differences</u>		
	-0.205 (0.335)	0.951+ (0.465)	1.325 (0.855)
Panel B: Lease adjusted assets as in Rauh and Sufi (2012)			
	<u>Cross section, firm-mean regressions</u>		
	1.064** (0.172)	0.799** (0.134)	2.957* (1.344)
	<u>Airline fixed effects</u>		
	0.542* (0.198)	0.825* (0.347)	2.238** (0.715)
	<u>Airline first differences</u>		
	-0.127 (0.307)	0.757+ (0.413)	2.200** (0.738)

**,*,+ Coefficient statistically different than zero at the 1%, 5%, and 10% significance level, respectively