

How to do an empirical study in finance?

Illustrated study:

The post-merger performance of acquiring firms: A Re-examination of an Anomaly (Agrawal, Jaffe & Mandelker)

by

Duong Nhu Hung

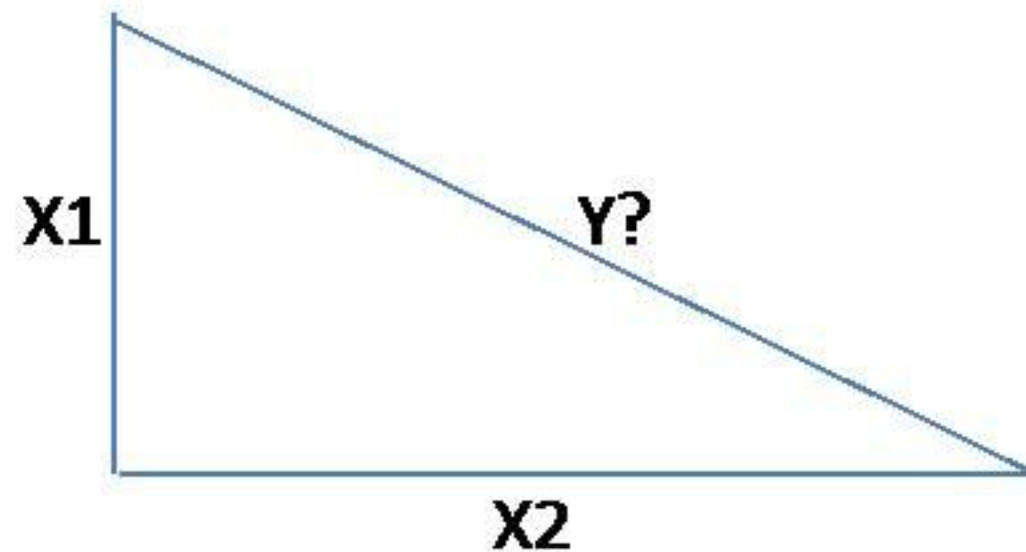
University of Economics and Law

4/2014

Agenda

- What is an empirical study?
- How to do a good empirical study?

Empirical research vs. Theorem



- Theorem: $X_1^2 + X_2^2 = Y^2$
- Empirical study:
 - $Y_i^2 = c + \beta_1 * X_{1i}^2 + \beta_2 * X_{2i}^2 + \varepsilon$
 - Randomly generate 100 X_1 , X_2 , Y
 - Y_i are measured with random errors (0%, 1%, 10%)

Group: GROUP01 Workfile: UNTITLED::Untitled\



c	Object	Print	Name	Freeze	Default	▼	Sort	Transpose	Edit+/-	Smpl+/-	Title	Sample
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obs	X1	X2	Y0	Y1	Y10
1	15.69929	24.94770	29.47635	29.77112	29.47635
2	91.31888	90.80589	128.7822	128.7822	115.9040
3	5.783199	17.27183	18.21432	18.03218	16.39289
4	96.66450	26.94556	100.3498	101.3533	90.31485
5	95.95519	39.15329	103.6358	104.6722	103.6358
6	39.09227	75.41982	84.94913	85.79863	84.94913
7	75.69197	13.35565	76.86123	76.09262	76.86123
8	87.94275	44.60080	98.60608	97.62002	108.4667
9	68.41032	91.40696	114.1718	113.0301	102.7546
10	74.78645	91.86540	118.4579	118.4579	118.4579
11	16.09635	40.09437	43.20476	43.63681	43.20476
12	25.43259	71.57404	75.95828	75.19869	83.55410
13	25.98451	55.24961	61.05501	61.66556	54.94951
14	71.07335	0.665685	71.07647	71.78723	71.07647
15	54.94317	21.23934	58.90553	58.31648	58.90553

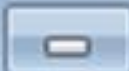
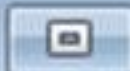
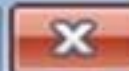
0% error

$$Y_i^2 = c + \beta_1 * X_{1i}^2 + \beta_2 * X_{2i}^2 + \varepsilon$$

Equation: EQ05 Workfile: UNTITLED::Untitled\				
View	Proc	Object	Print	Name
Freeze	Estimate	Forecast	Stats	Resids
Dependent Variable: Y0^2				
Method: Least Squares				
Date: 04/10/14 Time: 12:05				
Sample: 1 100				
Included observations: 100				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.46E-12	2.97E-13	4.893587	0.0000
X1^2	1.000000	5.34E-17	1.87E+16	0.0000
X2^2	1.000000	4.77E-17	2.10E+16	0.0000
R-squared	1.000000	Mean dependent var	7466.983	
Adjusted R-squared	1.000000	S.D. dependent var	4423.340	
S.E. of regression	1.51E-12	Akaike info criterion	-51.57277	
Sum squared resid	2.21E-22	Schwarz criterion	-51.49462	
Log likelihood	2581.639	Hannan-Quinn criter.	-51.54114	
F-statistic	4.26E+32	Durbin-Watson stat	1.916247	
Prob(F-statistic)	0.000000			

1% error

$$Y_i^2 = c + \beta_1 * X_{1i}^2 + \beta_2 * X_{2i}^2 + \varepsilon$$

Equation: EQ04 Workfile: UNTITLED::Untitled\   

View

Proc

Object

Print

Name

Freeze

Estimate

Forecast

Stats

Resids

Dependent Variable: Y1^2
Method: Least Squares
Date: 04/10/14 Time: 12:02
Sample: 1 100
Included observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-21.72878	25.22336	-0.861455	0.3911
X1^2	1.004652	0.004530	221.7940	0.0000
X2^2	0.999939	0.004048	247.0469	0.0000

R-squared	0.999184	Mean dependent var	7461.466
Adjusted R-squared	0.999168	S.D. dependent var	4434.225
S.E. of regression	127.9302	Akaike info criterion	12.57039
Sum squared resid	1587515.	Schwarz criterion	12.64854
Log likelihood	-625.5194	Hannan-Quinn criter.	12.60202
F-statistic	59421.04	Durbin-Watson stat	1.787688
Prob(F-statistic)	0.000000		

10% error

$$Y_i^2 = c + \beta_1 * X_{1i}^2 + \beta_2 * X_{2i}^2 + \varepsilon$$

Equation: EQ03 Workfile: UNTITLED::Untitled\

ViewProcObjectPrintNameFreezeEstimateForecastStatsResids

Dependent Variable: Y10^2
Method: Least Squares
Date: 04/10/14 Time: 11:42
Sample: 1 100
Included observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-227.3870	303.7449	-0.748612	0.4559
X1^2	0.996396	0.084602	11.77738	0.0000
X2^2	1.114543	0.037358	29.83373	0.0000

R-squared0.960906

Adjusted R-squared0.960100

S.E. of regression2049.881

Sum squared resid4.08E+08

Log likelihood-902.9246

F-statistic1192.110

Prob(F-statistic)0.000000

Mean dependent var8855.615

S.D. dependent var10262.28

Akaike info criterion18.11849

Schwarz criterion18.19665

Hannan-Quinn criter.18.15012

Durbin-Watson stat1.591426

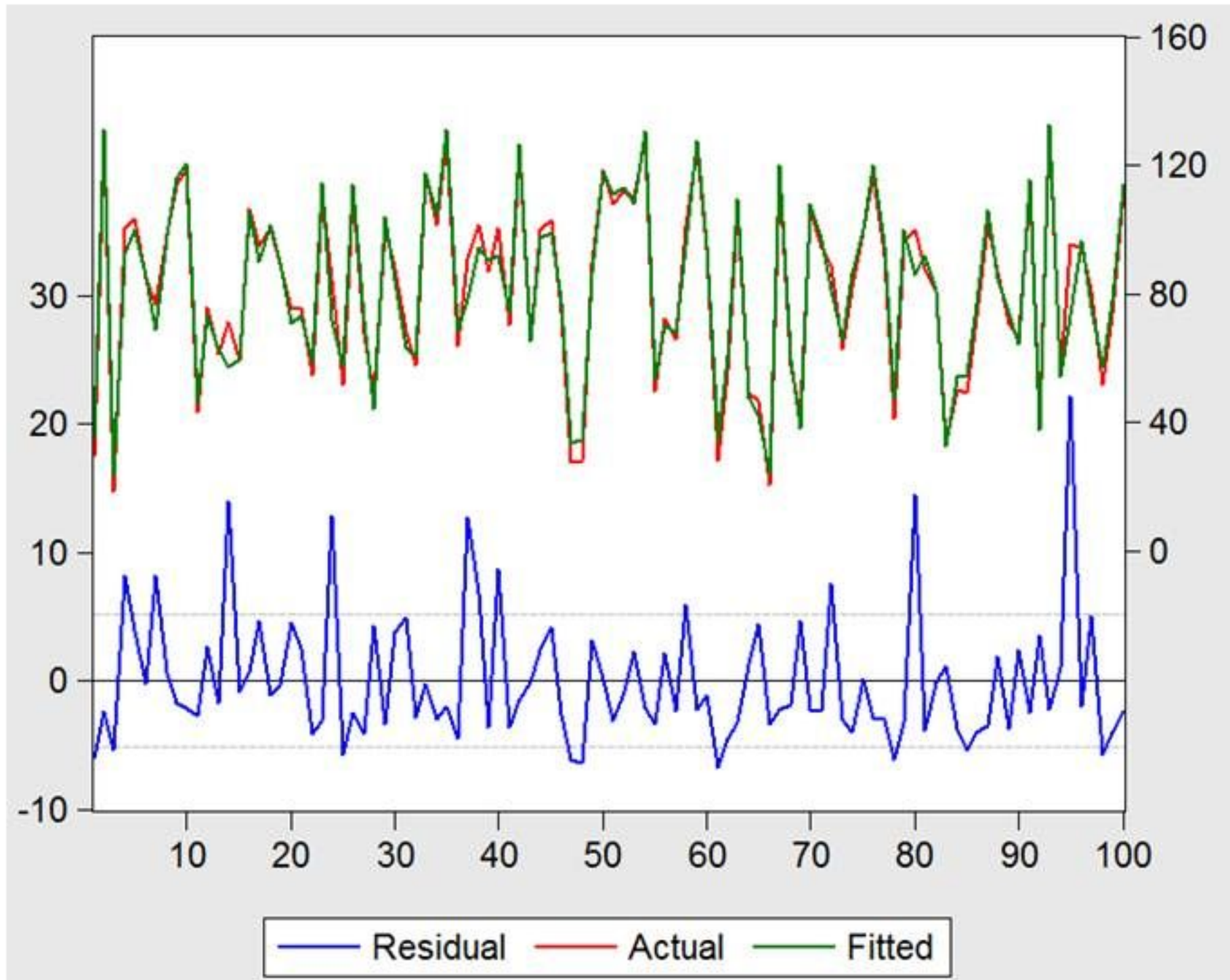
Misspecified model

$$Y_i = c + \beta_1 * X_{1i} + \beta_2 * X_{2i} + \varepsilon$$

Equation: EQ01 Workfile: UNTITLED::Untitled\				
View	Proc	Object	Print	Name
Freeze	Estimate	Forecast	Stats	Resids
Dependent Variable: Y0				
Method: Least Squares				
Date: 04/10/14 Time: 12:00				
Sample: 1 100				
Included observations: 100				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.144768	1.479501	5.505077	0.0000
X1	0.682197	0.019594	34.81678	0.0000
X2	0.668916	0.018104	36.94828	0.0000
R-squared	0.966818	Mean dependent var		81.76930
Adjusted R-squared	0.966134	S.D. dependent var		28.08293
S.E. of regression	5.168040	Akaike info criterion		6.152405
Sum squared resid	2590.738	Schwarz criterion		6.230560
Log likelihood	-304.6202	Hannan-Quinn criter.		6.184036
F-statistic	1413.133	Durbin-Watson stat		2.181348
Prob(F-statistic)	0.000000			

Misspecified model

$$Y_i = c + \beta_1 * X_{1i} + \beta_2 * X_{2i} + \varepsilon$$



Empirical research (wiki)

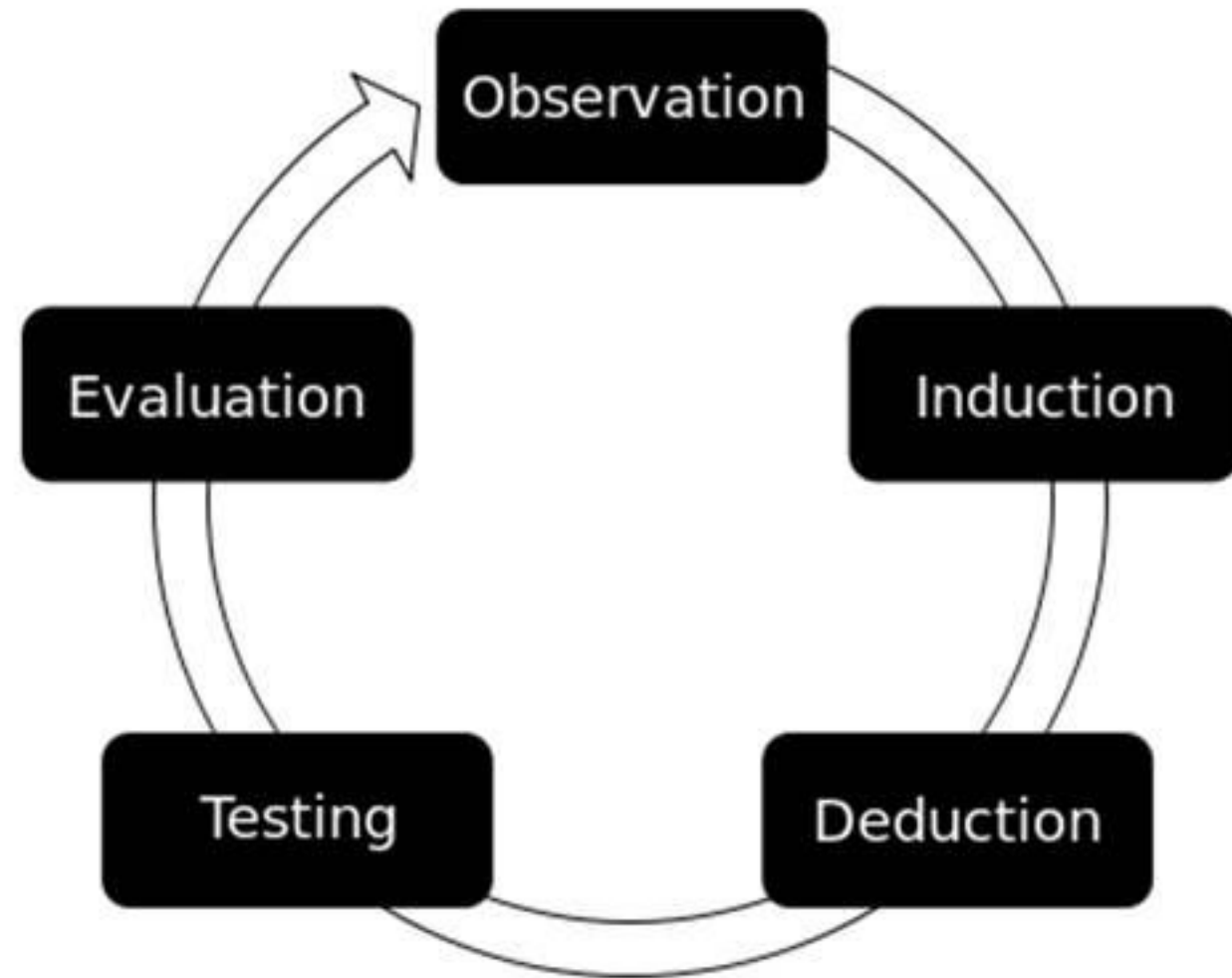
- Empirical research = observable data + formulate hypotheses + test theories → conclusions
 - the outcome of empirical research is **never proof**. It can only support a hypothesis, reject it, or do neither
 - empirical evidence refers to **objective evidence** that appears the same regardless of the observer
 - Temperature: 20oC vs. Cool
 - **Statistical formulas** such as regression, t-test, chi square, and various types of ANOVA (analyses of variance) are fundamental in empirical research

Requirements for a good empirical study

- Significant objectives
- Good methodology
 - Good model (well specified)
 - Good measures of data (reliable measurements)
- Reliable data
- Solid tests

empirical cycle

- A.D. De Groot's empirical cycle:
 - **Observation:** The collecting and organization of empirical facts; Forming hypothesis.
 - **Induction:** Formulating hypothesis.
 - **Deduction:** Deducting consequences of hypothesis as testable predictions.
 - **Testing:** Testing the hypothesis with new empirical material.
 - **Evaluation:** Evaluating the outcome of testing



How to start a good study?

- **With the good studies in the past!**
 - Journal reputation
 - Author reputation

Top Ten Journals Finance

Based on ISI Impact Factors

- [Journal of Finance: American Finance Association](#) – (Rank #1, 2008 ISI)
- [Journal of Financial Economics: University of Rochester \(NY\)](#) – (Rank #2, 2008 ISI)
- [Journal of Accounting and Economics: Elsevier](#) – (Rank #3, 2008 ISI).
- [Review of Financial Studies: Oxford University Press](#) – (Rank #4, 2008 ISI)
- [Journal of Accounting Research: Wiley-Blackwell](#) – (Rank #5, 2008 ISI)
- [The Accounting Review: American Accounting Association](#) – (Rank #6, 2008 ISI)
- [World Bank Economic Review: Oxford University Press](#) – (Rank #7, 2008 ISI)
- [Accounting, Organizations, and Society: Elsevier](#) – (Rank #8, 2008 ISI)
- [Journal of Corporate Finance: Elsevier](#) – (Rank #9, 2008 ISI)
- [Review of Accounting Studies: Springer](#) – (Rank #10, 2008 ISI)

Top Five Journals in Economics

Based on ISI Impact Factors

- Journal of Economic Literature (JEL): American Economic Association (AEA) -- (Rank #1, 2009 ISI)
- Quarterly Journal of Economics: Oxford University Press -- (Rank #2, 2009 ISI)
- Journal of Financial Economics (JFE): University of Rochester (NY) -- (Rank #3, 2009 ISI)
- Econometrica: The Econometric Society -- (Rank #4, 2009 ISI)
- Journal of Economic Geography: Oxford University Press -- (Rank #5, 2009 ISI)

Step 1: Identification of a research area

- **Areas:**
 - Performance of M&A
 - Performance of IPOs
 - ...

Step 2: Literature Review

- <http://scholar.google.com> or Google.com
- www.ssrn.com
- Subscribed journals
 - Jstor, Elsevier,...

Sample searched

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The Performance of Stock-Price Driven Acquisitions (Published as 'Market Valuation and Acquisition Quality: Empirical Evidence')

[Christa H. S. Bouwman](#)
Case Western Reserve University - Department of Banking & Finance ; Wharton Financial Institutions Center

[Kathleen P. Fuller](#)

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Introduction sample

- ... takeover activity comes in waves and that announcement-day returns are significantly positive for target shareholders while bidder shareholders returns vary depending on the mode of acquisition, method of payment and type of target. Moreover, post-acquisition returns to acquiring shareholders are higher for cash offers and tender offers than for stock offers and mergers (**Christa Bouwman, Kathleen Fuller, Amrita Nain**)

Reference

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The Post-Merger Performance of Acquiring Firms: A Re-examination of an Anomaly

ANUP AGRAWAL, JEFFREY F. JAFFE, AND GERSHON N.
MANDELKER

Step 3: Research gap identification

mergers. Some conclude that these firms experience significantly negative abnormal returns over one to three years after the merger (for example, Langetieg (1978), Asquith (1983), and Magenheim and Mueller (1988)). These findings led Jensen and Ruback (1983, p. 20) to remark: “These post-outcome negative abnormal returns are unsettling because they are inconsistent with market efficiency and suggest that changes in stock prices during takeovers overestimate the future efficiency gains from mergers.” Ruback (1988, p. 262)

- **Vs.**

However, a conclusion of underperformance is not clearly warranted based on prior research. First, the results are not all one-sided. Langetieg (1978) finds that post-merger abnormal performance is not significantly different

underperformance in the three years following acquisitions. Recently, using a multifactor benchmark, Franks, Harris, and Titman (1991) also do not find significant underperformance over three years after the acquisition.

Research gap cont.

Furthermore, recent studies typically examined post-merger returns as part of a larger study focusing on announcement period returns. Hence, they generally do not provide thorough analyses of the long-run performance of acquirers. In particular, one problem with prior studies is that they do not properly adjust for the firm size effect.¹ Evidence in Dimson and Marsh (1986) suggests that an adjustment for firm size is important in studies of long-run performance. This adjustment is likely to be particularly important in a study of mergers since acquirers are usually large firms. In addition, none of the previous studies allows for month-to-month shifts in beta. The resulting bias can be significant when abnormal returns are cumulated over a long period.

Implications

A finding of underperformance has three important implications. First, the concept of efficient capital markets is a major paradigm in finance. Systematically poor performance after mergers is, of course, inconsistent with this paradigm. Second, much research on mergers examines returns surrounding

Step 4: Research objective

The purpose of this paper is to provide a thorough analysis of the post-merger performance of acquiring firms. We present evidence on two issues. First, after adjusting for the firm size effect as well as beta risk, our results indicate that stockholders of acquiring firms experience a statistically significant wealth loss of about 10% over five years after the merger completion date. This finding is based on a nearly exhaustive sample of mergers over 1955 to 1987 between NYSE acquirers and NYSE/AMEX targets. The result is robust to a variety of specifications and does not seem to be caused by changes in beta. Second, we test whether the market is slow to adjust to the merger event. Under this hypothesis, the long-run performance would reflect

Step 5: Data collection

Our database of mergers and tender offers was obtained by a two-step process.² First, a list of all the firms that disappeared from the files of the Center for Research in Security Prices (CRSP) over the interval from January 1955 to December 1987 was prepared. Second, the *Wall Street Journal Index* was consulted to determine which of these firms disappeared due to tender offers or mergers. An event was classified as a tender offer if the acquiring firm purchased at least 60 percent of the target firm's shares by tender offer and later bought the remaining shares through a clean-up merger. The sample consists of 937 mergers and 227 tender offers.³ This represents nearly the entire population of acquisitions of NYSE and AMEX firms by NYSE firms over the period 1955 to 1987.⁴

Step 6: Good methodology

How to measure the performance?

- Calculate returns surrounding events
 - Abnormal return (AR) = Actual returns \square Benchmark returns
 - Cumulative Abnormal Returns (CAR) = sum of AR
- Benchmark returns
 - CAPM: $R_b = R_f + \text{beta} \cdot (R_m - R_f)$
 - Dimson and Marsh (1986): the measured performance is influenced by size

Research methodology

We employ two alternative methodologies, each of which adjusts for both beta risk and market capitalization. For both methods, we form the following set of size control groups. At the end of each calendar year, all stocks on the NYSE are ranked according to their market capitalization and allocated to 10 decile portfolios.⁷ For each month over the following year, the return on each decile portfolio is computed as the equally weighted average return across all securities in the portfolio.⁸

Improved methodology

- Dimson and Marsh (1986):
 - $\varepsilon_{it} = R_{it} - R_{st} - (\beta_i - \beta_s) * (R_{mt} - R_{ft})$

R_{st} = the equally weighted average return during month t on the control portfolio of all firms in the same size decile as firm i , based on the market value of equity at the end of the previous year.¹⁰

β_i = the beta of security i . We estimate β_i using monthly data over the period from month $+1$ to month $+60$ after the merger completion.^{11,12}

β_s = the beta of the control group. We estimate β_s over months $+1$ to $+60$ relative to the completion month.

R_{mt} = the return on the market index. We report results using the NYSE value-weighted index. Results are similar with the NYSE equally weighted index.

R_{ft} = the risk-free rate in month t , as measured by the yield on a one-month Treasury bill.

Average AR & CAAR

The average abnormal return (AAR) over all stocks in month t is:

$$\text{AAR}_t = \frac{1}{N_t} \sum_{i=1}^{N_t} \epsilon_{it},$$

where N_t is the number of securities in the sample with a return in event month t . The cumulative average abnormal return (CAAR) from event month t_1 to t_2 is:

$$\text{CAAR}_{t_1}^{t_2} = \sum_{t=t_1}^{t_2} \text{AAR}_t$$

Table I

Post-Merger Performance of Acquiring Firms After Adjustment for Firm Size and Beta Risk

The abnormal return for firm i in month t is computed as in (1):

$$\epsilon_{it} = R_{it} - R_{st} - (\beta_i - \beta_s)(R_{mt} - R_{ft}),$$

Months After Merger Completion	Average Abnormal Return (AAR)	Cumulative Average Abnormal Return (CAAR)	Percent of Positive CARs (%)
1–12	–1.53% (–0.98)	–1.53% (–0.98)	46.56% (–1.90)
13–24	–3.41 (–2.00) ^b	–4.94 (–2.10) ^b	47.67 (–1.26)
25–36	–2.44 (–1.73)	–7.38 (–2.72) ^a	46.39 (–1.91)
37–48	–1.29 (–0.54)	–8.67 (–2.62) ^a	44.98 (–2.61) ^a
49–60	–1.59 (–0.07)	–10.26 (–2.37) ^b	43.97 (–3.03) ^a

^{a, b} Statistical significance in 2-tailed tests at the 1% and 5% levels, respectively.

Step 7: test test test
(robustness test)

Table II

Post-Merger Performance of Acquiring Firms Over Different Decades

Months After Merger Completion	Mergers Completed During									
	1955–59 ($N = 51$)		1960–69 ($N = 299$)		1970–79 ($N = 247$)		1980–87 ($N = 168$)		1975–84 ($N = 290$)	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
1–12	–2.4% (–0.86)	–2.4% (–0.86)	–1.8% (–0.56)	–1.8% (–0.56)	0.0% (–0.42)	0.0% (–0.42)	–2.8% (–0.73)	–2.8% (–0.73)	–0.9% (–0.30)	–0.9% (–0.30)
13–24	–4.0 (–1.06)	–6.4 (–1.36)	–4.1 (–1.14)	–5.9 (–1.21)	0.7 (0.55)	0.7 (0.09)	–7.6 (–3.53) ^a	–10.4 (–3.02) ^a	–3.4 (–1.50)	–4.2 (–1.27)
25–36	–5.0 (–2.09) ^b	–11.4 (–2.32) ^b	–4.4 (–1.79)	–10.3 (–2.02) ^b	0.1 (0.07)	0.8 (0.11)	–2.0 (–1.12)	–12.4 (–3.11) ^a	0.3 (–0.07)	–4.0 (–1.07)
37–48	–7.3 (–2.66) ^a	–18.7 (–3.34) ^a	–2.0 (–1.07)	–12.3 (–2.28) ^b	0.8 (0.91)	1.6 (0.55)	–1.4 (0.36)	–13.8 (–2.51) ^b	1.0 (1.66)	–3.0 (–0.10)
49–60	–4.5 (–0.94)	–23.2 (–3.41) ^a	–2.8 (–1.07)	–15.1 (–2.52) ^b	2.5 (2.03) ^b	4.1 (1.40)	–5.6 (–1.17)	–19.4 (–2.77) ^a	0.2 (1.50)	–2.8 (–0.58)

The last two columns of Table II show the post-merger performance over the 1975–1984 time period of the recent paper by Franks, Harris, and Titman (1991). We find no abnormal performance during this time period, a result consistent with that of Franks, Harris, and Titman.¹⁷ A breakdown (not reported) of our 33-year sample period into five-year subperiods (1955 to 1959, 1960 to 1964, etc.) shows that 1975 to 1979 is the only five-year period when the post-merger performance is significantly positive.¹⁸ This period constitutes one half of Franks, Harris, and Titman's sample. Over the remainder of their sample period, 1980 to 1984, the post-merger performance is significantly negative. Thus, the performance over the combined period, 1975 to 1984, is insignificant. We conclude that Franks, Harris, and Titman's results are specific to their sample period.

Table III

Post-Merger Performance of Acquiring Firms in Conglomerate and Non-Conglomerate Mergers

Months After Merger Completion	Conglomerates ($N = 686$)		Non-Conglomerates ($N = 79$)	
	AAR	CAAR	AAR	CAAR
1–12	–1.5% (–0.92)	–1.5% (–0.92)	–1.5% (–0.42)	–1.5% (–0.42)
13–24	–2.9 (–1.63)	–4.4 (–1.80)	–8.0 (–2.01) ^b	–9.5 (–1.71)
25–36	–1.9 (–1.21)	–6.3 (–2.17) ^b	–7.7 (–2.91) ^a	–17.2 (–3.08) ^a
37–48	–1.3 (–0.52)	–7.6 (–2.13) ^b	–1.2 (–0.17)	–18.4 (–2.75) ^a
49–60	–1.0 (–0.20)	–8.6 (–1.82)	–7.1 (–1.51)	–25.5 (–3.14) ^a

^{a, b} Statistical significance in 2-tailed tests at the 1% and 5% levels, respectively.

Conclusion

with an adjustment for firm size. We find that stockholders of the acquiring firms suffer a statistically significant wealth loss of about 10% over the five years following the merger completion. This finding is robust to a variety of specifications and does not seem to be caused by changes in beta following the merger. Therefore, we conclude that the efficient-market anomaly of negative post-merger performance highlighted in Jensen and Ruback (1983) is not resolved. This conclusion runs contrary to Franks, Harris, and Titman's (1991) results which, as we show, are specific to their sample time period and are also due to their mixing of tender offers with mergers.

How to do a joint research?

- You:
 - Literature reviews
 - Development of Hypothesis/ research model
- CEFR can help:
 - Collect relevant data
 - Help you analyze the data/ test the model
- Both
 - Interpret the findings
- **Principles: share work + share costs**