

Nota Bene: **Turbocharging Your Investment Portfolio**

Limits to Arbitrage

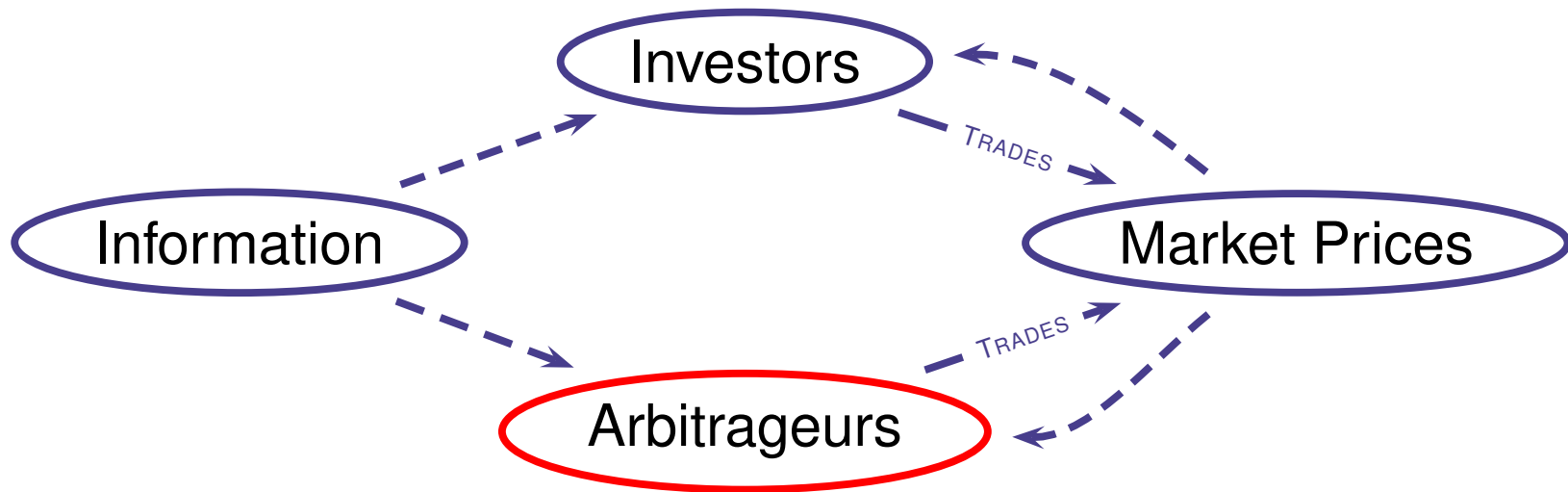
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Kellogg *Nota Bene*

10 May, 2004

Limits to Arbitrage



- You have now seen evidence of a set of anomalies that appear pretty profitable.
- Next we'll ask the question: if investors do understand the mispricing, how easy is it for them to profit from it?
 - What are the *Limits to Arbitrage*?

Limits to Arbitrage – *An Example*

- As a way of illustrating some of the arguments behind the “Limits to Arbitrage” ideas, we’re going to look at a pretty obvious mispricing from internet boom of the late ’90s.
- This example involves a catalog distributor of computers and computer peripherals called *PC Mall*, and an *equity carve-out* they undertook in December, 1998.
- This case is documented in Mitchell, Pulvino and Stafford (2001, 2002); the latter is a systematic analysis of 82 US equity-carve outs undertaken in 1985-2000.
 - This paper won the prestigious Smith-Breeden award for the best paper in the *Journal of Finance* in 2002.

PC-Mall and Ubid

- By the late 1990s, *PC Mall* was a successful catalog distributor of computers and computer peripherals, was publically traded (ticker MALL), and had opened several retail outlets.
- In early 1998 PC Mall began selling computer equipment over the Internet.



Welcome to **PC Mall**

Please select your homepage



Consumer
Home & Home Office
Shop for Technology &
Home Entertainment products
▶ [click here](#)



Small Office
From 1 - 20 Employees,
we'll help your business
evolve
▶ [click here](#)



Small Business
From 21 - 50 Employees,
we'll help your business
evolve
▶ [click here](#)



Medium Business
From 51 - 999 Employees,
we'll help your business
evolve
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Companies with 1000 +
employees and complex
IT needs
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1-800-555-MALL

Ubid's Operating Performance

- Also in early 1998, MALL developed the *Ubid* website, devoted to selling factory excess and refurbished goods through an auction format.
- The Ubid subsidiary generated \$2.1 million in sales in its first quarter of operation.
- By 1998-Q3 (only their third quarter of operation), Ubid sales had increased to \$15.3 million, a growth rate of 637% and 127% over the first and second quarters.



The Brand Name Marketplace

Auctions

Superstore Buy Now! Great Prices

Help | MyPage

Register

New User? New User Tutorial

Computers & Office

Consumer Electronics

Music, Movies & Games

Jewelry & Gifts

Travel & Events

Home & Garden

Sports, Toys & Hobbies

Apparel

Collectibles

Everything Else

Sign In

Bid on Brand Names starting at \$1 Check out last minute Auction Deals! Auctions Closing this Hour!

Quick Search

Search input field with Go button

All Categories

Browse Categories

Computers & Office

- Desktops
Laptops
PDAs & Handheld PCs
Monitors
Drives
...and more

Consumer Electronics

- Digital Cameras
Video
Home Audio
Portable Electronics
Car & Mobile Audio
...and more

Music, Movies & Games

Heuer & Lambet Men's Titanium Watch Bidding Starts at \$1

IBM 17 Inch FST CRT Bidding Starts at \$1



Sony VAIO PCV-RZ46G Pentium 4 3.2GHz 1GB



Kodak EasyShare DX4630 5.0 Megapixel Digital



Polaroid PDV-0750 Portable DVD Player 7-in LCD



Hewlett Packard Pavilion ZD7168CL P4 3.06GHz 512MB



Rousseau TRIAD Two-Tone White/Champagne Watch



Dell P1110 Flat FD Trinitron 21-Inch CRT Blowout! 1800 X 1440 Res

Summer's Coming! Digital Music MP3s & Minidiscs FREE Case! on select MiniDiscs Bid Now! uBid Auctions

The Decision to Carve-Out UBid

- Based on the high market prices of other Internet retailers at the time, MALL did not believe that its stock price accurately reflected the potential of its *Ubid* Internet business.
 - MALL's share price suggested that the market viewed it like a mail-order firm, rather than a hot internet auction market site like Ebay!
- To raise the market's awareness of the Internet portion of their business, MALL decided to “carve-out” the Internet subsidiary.

The Decision to Carve-Out UBid

- On July 6, 1998, they announced their plans to sell approximately 20% of Ubid's equity in an initial public offering.
- They planned to distribute the remaining 80% of Ubid to the shareholders of MALL in a tax-free spin-off six months after the Ubid IPO.

The Ubid IPO

- The Ubid IPO took place after the close of trading on December 3, 1998.
- Ubid sold 1.817 million shares for \$15 per share.
 - This was the top of the expected range of \$14 to \$15 set by Merrill Lynch & Co., the lead underwriter of the equity carve-out.
- Ubid received proceeds of \$25.4 million, after subtracting \$1.9 million in underwriting fees.

Ubid Post-IPO Performance

- On the first day that Ubid was publicly traded, December 4, 1998, its shares opened at \$38, more than double the IPO price.
- The shares traded above \$60 before closing the first day at \$48, giving Ubid a market cap of \$439 million.
- By December 9, the price of Ubid had fallen to \$35.69, and MALL was trading at \$22.75
 - This gave Ubid and MALL market capitalizations of \$326.54M and \$232.96M, respectively.

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- Lets figure out what's going into the MALL market cap!

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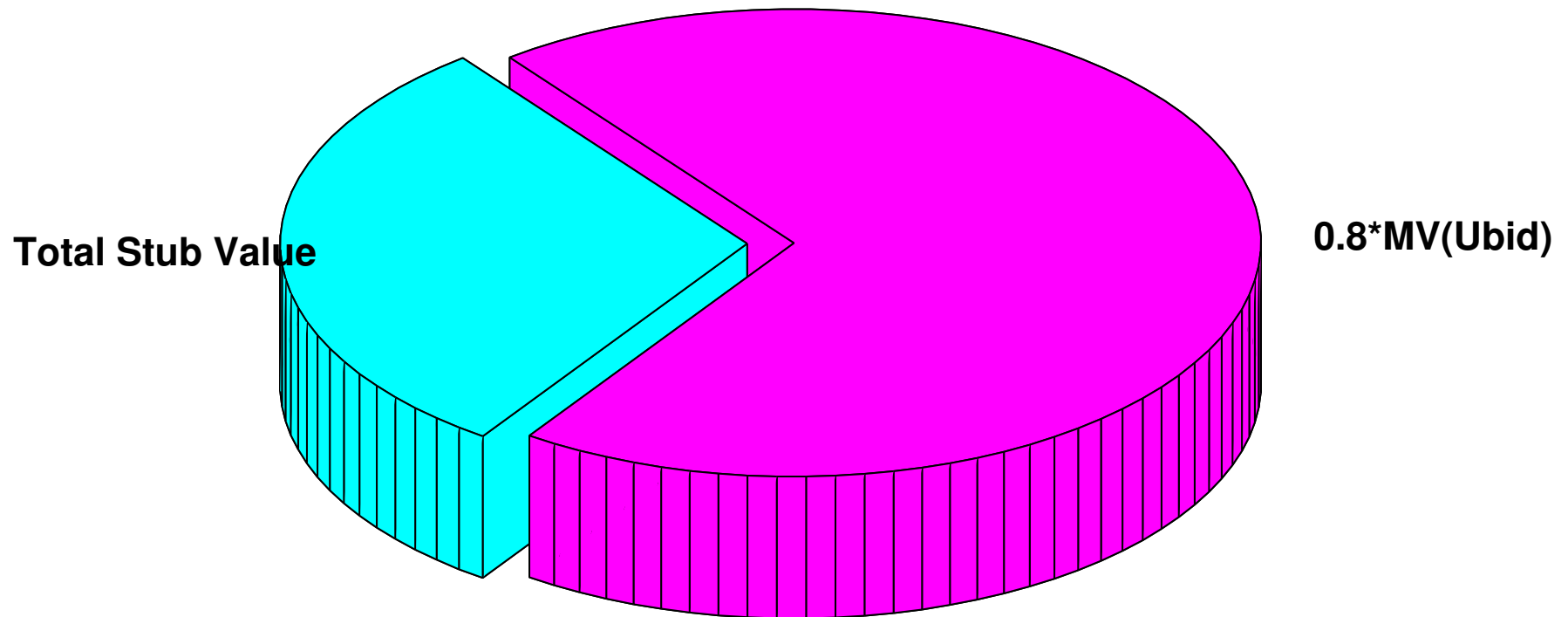
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 - The value of its holdings of Ubid.
 - and the value of its ongoing business, which we label the *Stub Value*
- In an efficient market, MALL's value should reflect the combined value of both of these components.

Calculating MALL's Stub Value:



PC Mall Stub-Value Calculation

<i>N(MALL)</i>	10.24M	<i>MV(MALL)</i>	\$232.96M
<i>N(UBID)</i>	9.15M	<i>MV(UBID)</i>	\$326.54M
<i>N(UBID) in MALL</i>	7.33M	<i>% UBID in MALL</i>	80%
<i>P(MALL)</i>	\$22.75/shr	<i>MV(UBID) × 0.8</i>	\$261.59M
<i>P(UBID)</i>	\$35.69/shr	<i>Stub Value</i>	\$(28.63M)
		<i>Stub/shr</i>	\$(2.80)

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Calculations:

$$MV(MALL) = N(MALL) \times P(MALL) = 10.24M \times \$22.75 = \$232.96M$$

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$$\% \text{ UBID in MALL} = \frac{N(\text{UBID}) \text{ in MALL}}{N(\text{UBID})} = \frac{7.33M}{9.15M} = 80\%$$

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Calculations:

$$\text{Stub} = \text{MV(MALL)} - \underbrace{\text{MV(UBID)} \times 0.8}_{\text{Value of MALL's holdings of UBid}} = 232.96 - 261.59 = \text{\$(28.63M)}$$

Value of MALL's holdings of UBid

Arbitraging the Negative Stub Value

- Any mispricing should create a profit opportunity
- Again, the idea behind efficient markets is that arbs will trade on this mispricing.
- Via competition the arbitrageurs will eliminate any mispricing.
- But, in this case, where there is fairly severe and obvious mispricing, could an arbitrageur eliminate this mispricing?

Arbitraging the Negative Stub Value

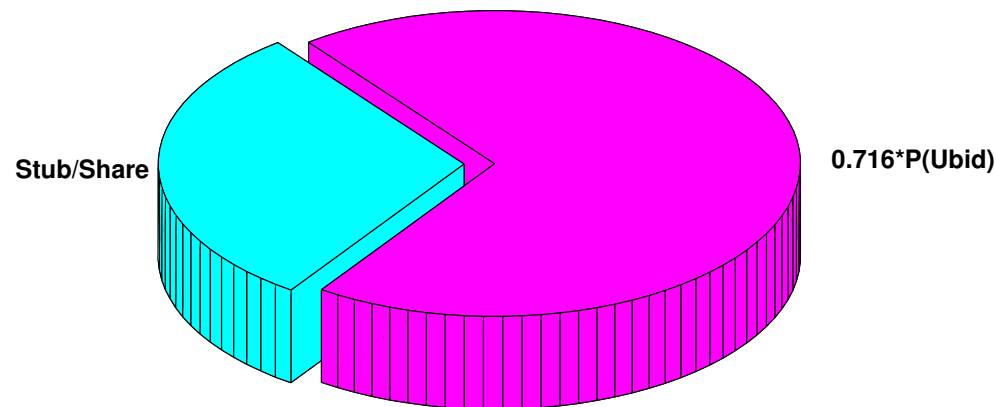
- To see this, let's examine the “arbitrage” transaction in detail:
- MALL intended to distribute the remaining Ubid shares to MALL shareholders on a *pro-rata* basis in 5 months.
- Given the deal parameters, each MALL share would receive:

$$\frac{N(UBID) \text{ in } MALL}{N(MALL)} = \frac{7.33M}{10.24M} = 0.716$$

shares of Ubid in 5 months.

Capturing the Negative Stub Value

Value of One Share of MALL:



Implementing the Arbitrage:

Buy 1 Shar. MALL	\$22.75
Short 0.716 Shr. UBID	\$(25.55)
Total Cost	\$(2.80)

- Buying One Share of MALL costs \$22.75
- Shorting 0.716 Shares of UBID brings in $0.716 \times \$35.69 = \25.55
- In 5 months, you receive 0.716 shares of UBid, which you use to cover your short position.
- After 5 months, you are left with the “stub,” and the \$2.80 (plus interest).

Margin Requirements:

Margin for Ubid Short	\$12.77
Margin for MALL Purchase	\$11.38
Total time 0 Margin	\$24.15

- Given initial margin requirements of 50% (the legal minimum in US), you are required to post \$24.15 in cash or marginable securities on initiation of the position:
 - To buy MALL, you can get a broker loan for \$11.37; you must post the remaining \$11.38;
 - To short 0.716 shares of UBID, you must post 1/2 of the value of these 0.716 shares, 12.77 ($=25.55/2$)

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Arbitrage Portfolio Final Cashflows

Cover Ubid Short	0
Sell Mall at P(T)	\$0 (?)
Repay Loan	\$(11.70)
Withdraw Short Proceeds	\$25.55
Withdraw Margin	\$13.04
Total	\$26.88

- Thus, even taking into account margin requirements, this transaction gives an annualized rate of return of 29%.
 - *assuming zero stub value for MALL.*

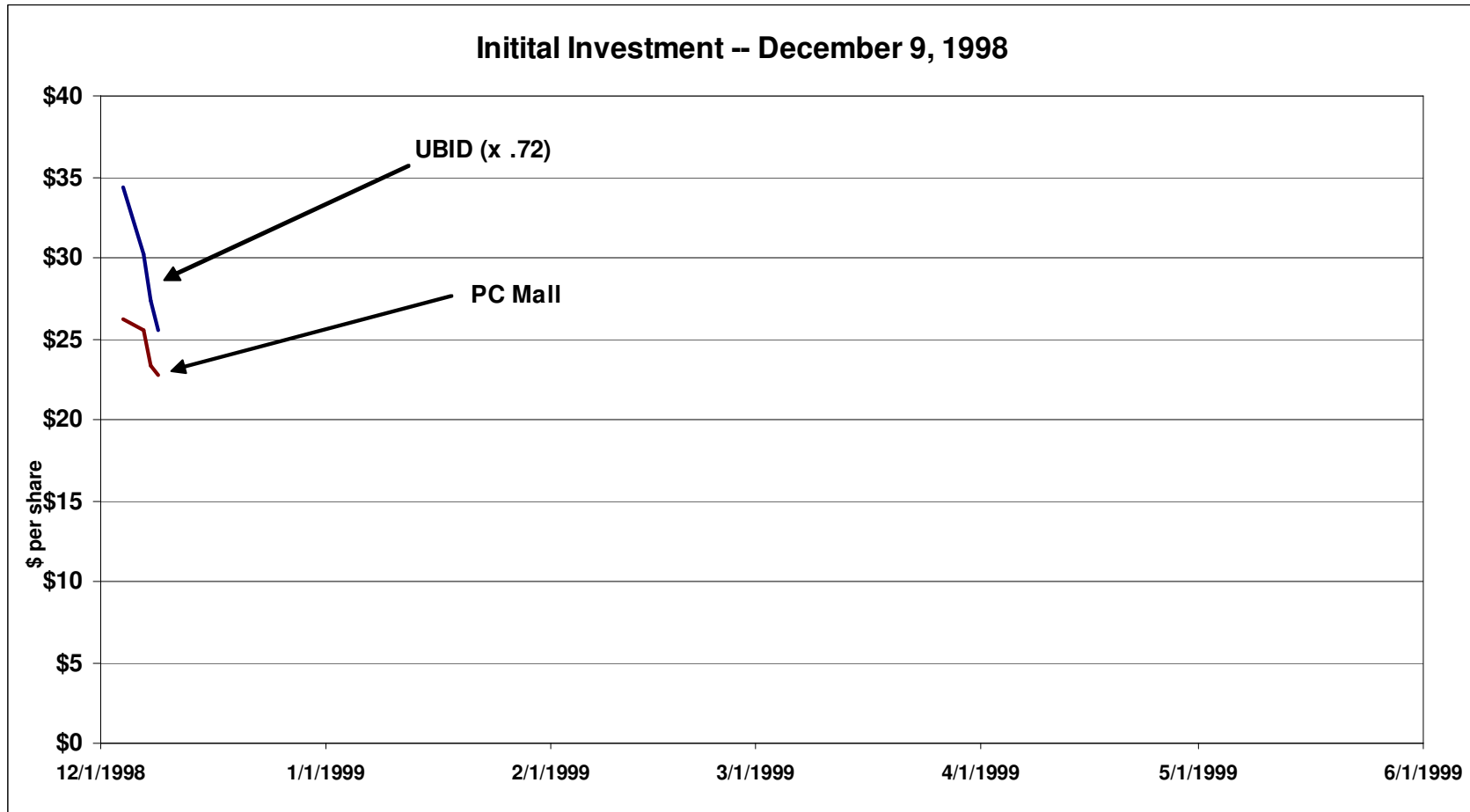
Arbitrage Portfolio Final Cashflows

Cover Ubid Short	0
Sell Mall at P(T)	\$6.50 (?)
Repay Loan	\$(11.70)
Withdraw Short Proceeds	\$25.55
Withdraw Margin	\$13.04
Total	\$33.38

- If MALL is worth \$6.50/share after the spinoff, you will get \$33.38, a profit of \$9.23 on an initial investment of \$24.15.
- The 5 month return would be 38.2%
- The annualized rate of return would be of **117.5%**, *risk-free!*

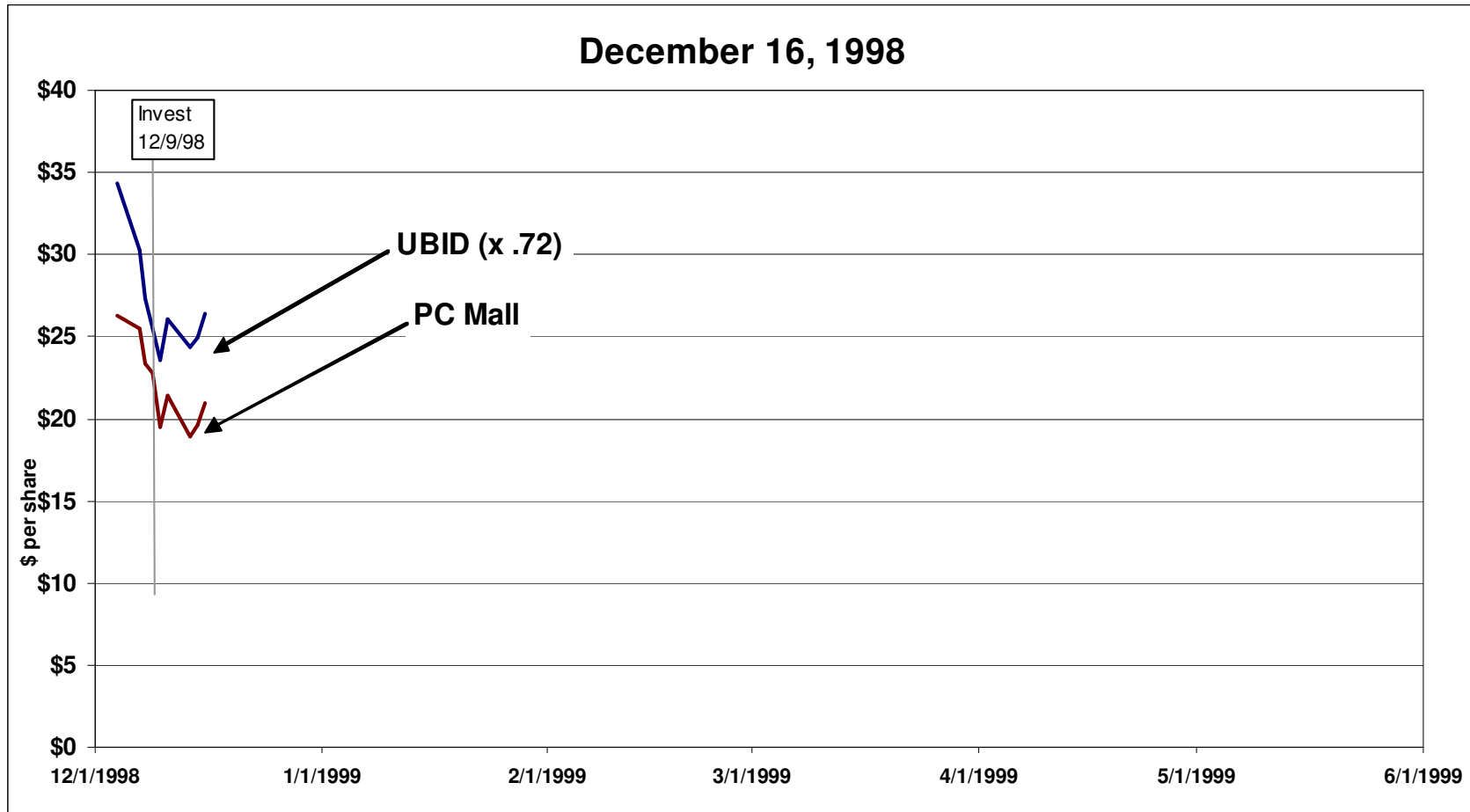
PC Mall-UBid Prices

$P(\text{UBID}) = \$35.6875$; $P(\text{MALL}) = 22.75$; $\text{STUB}/\text{SHARE} = (2.80)$.



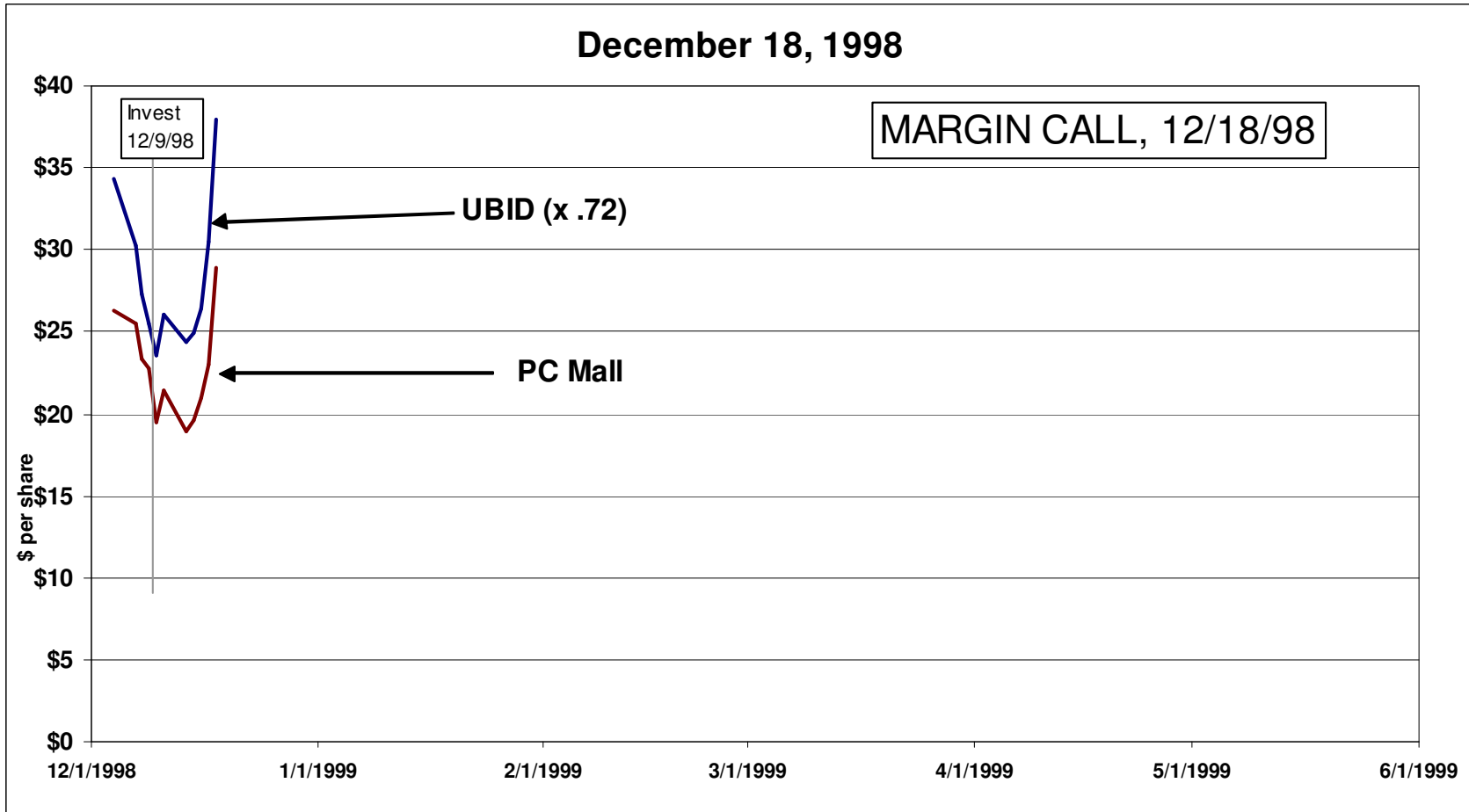
PC Mall-UBid Prices

$P(\text{UBID}) = \$36.9375$; $P(\text{MALL}) = 21$; $\text{STUB}/\text{SHARE} = (5.43)$



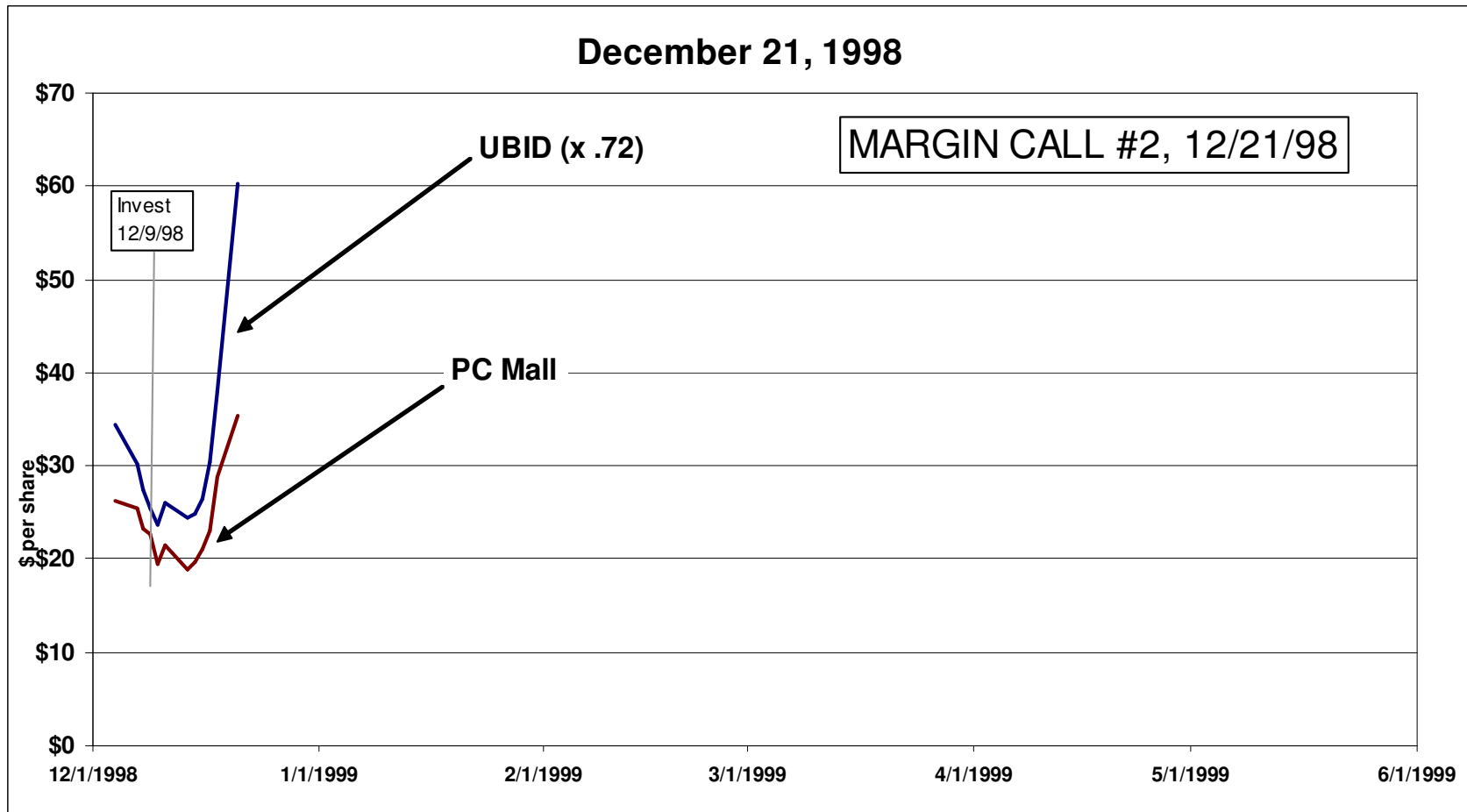
PC Mall-UBid Prices

$P(\text{UBID}) = 53.125$; $P(\text{MALL}) = 28.875$; $\text{STUB}/\text{SHARE} = (9.13)$



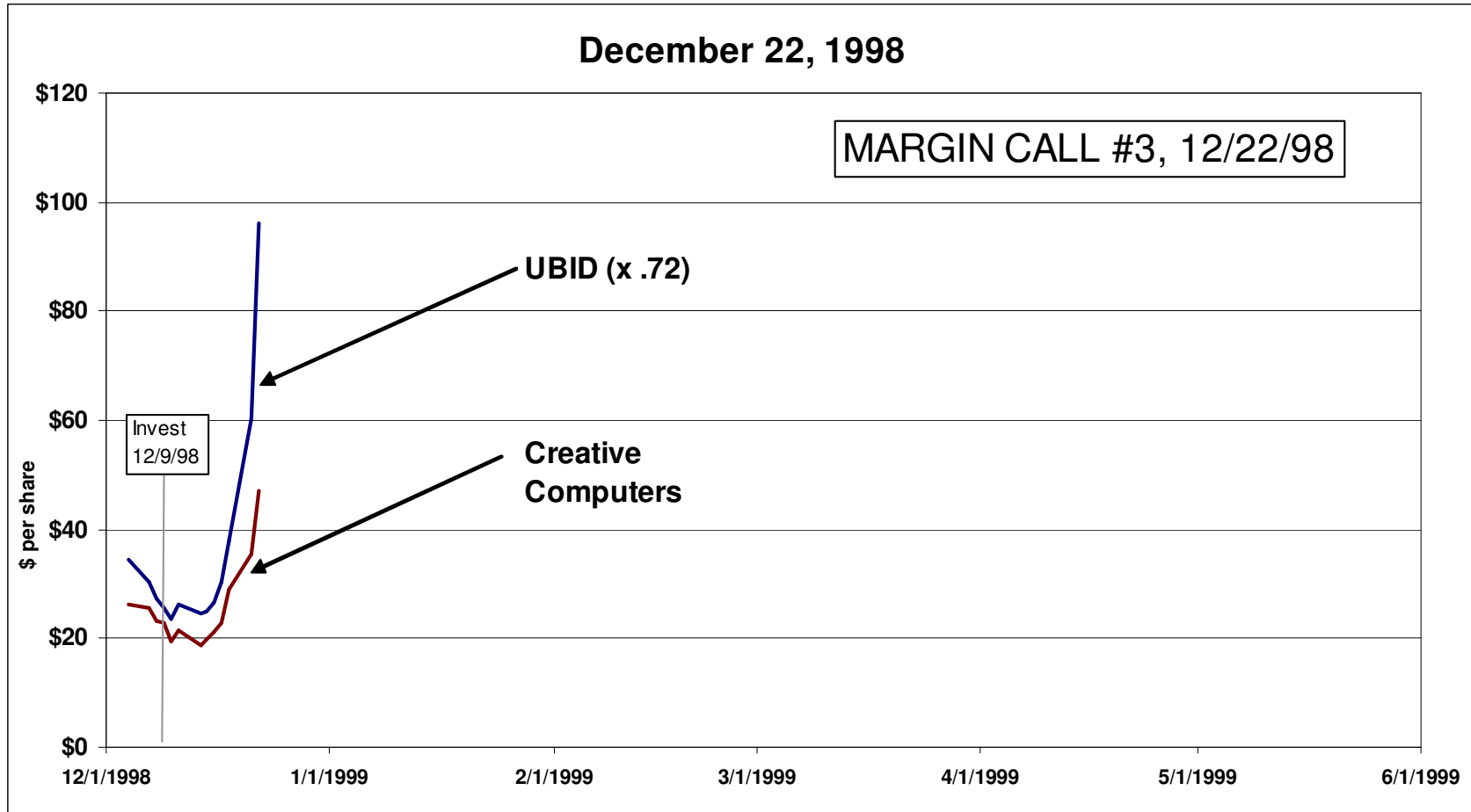
PC Mall-UBid Prices

$P(\text{UBID}) = 84.125$; $P(\text{MALL}) = 35.375$; $\text{STUB}/\text{SHARE} = (24.81)$



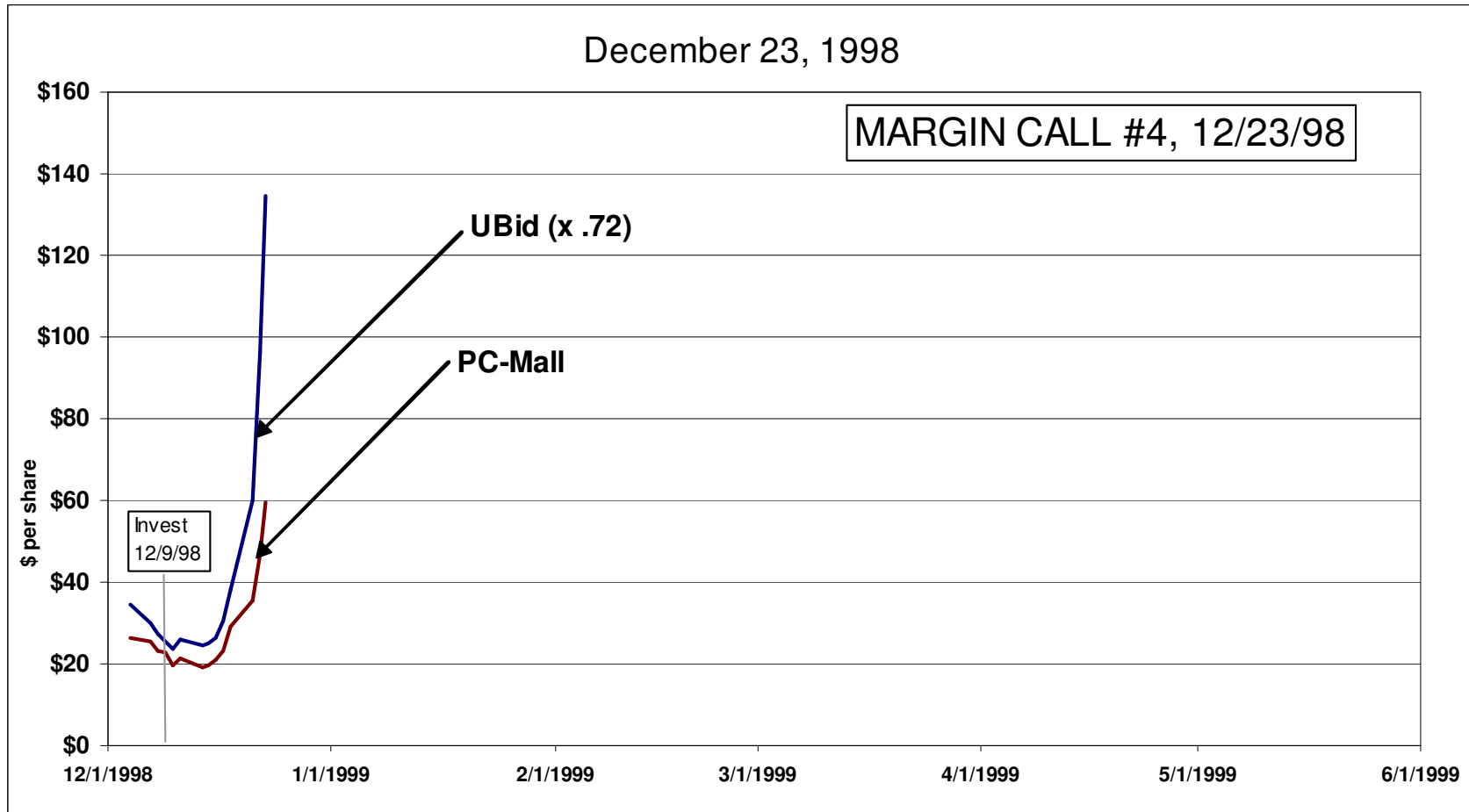
PC Mall-UBid Prices

$P(\text{UBID}) = 134.5$; $P(\text{MALL}) = 46.92$; $\text{STUB}/\text{SHARE} = (49.30)$



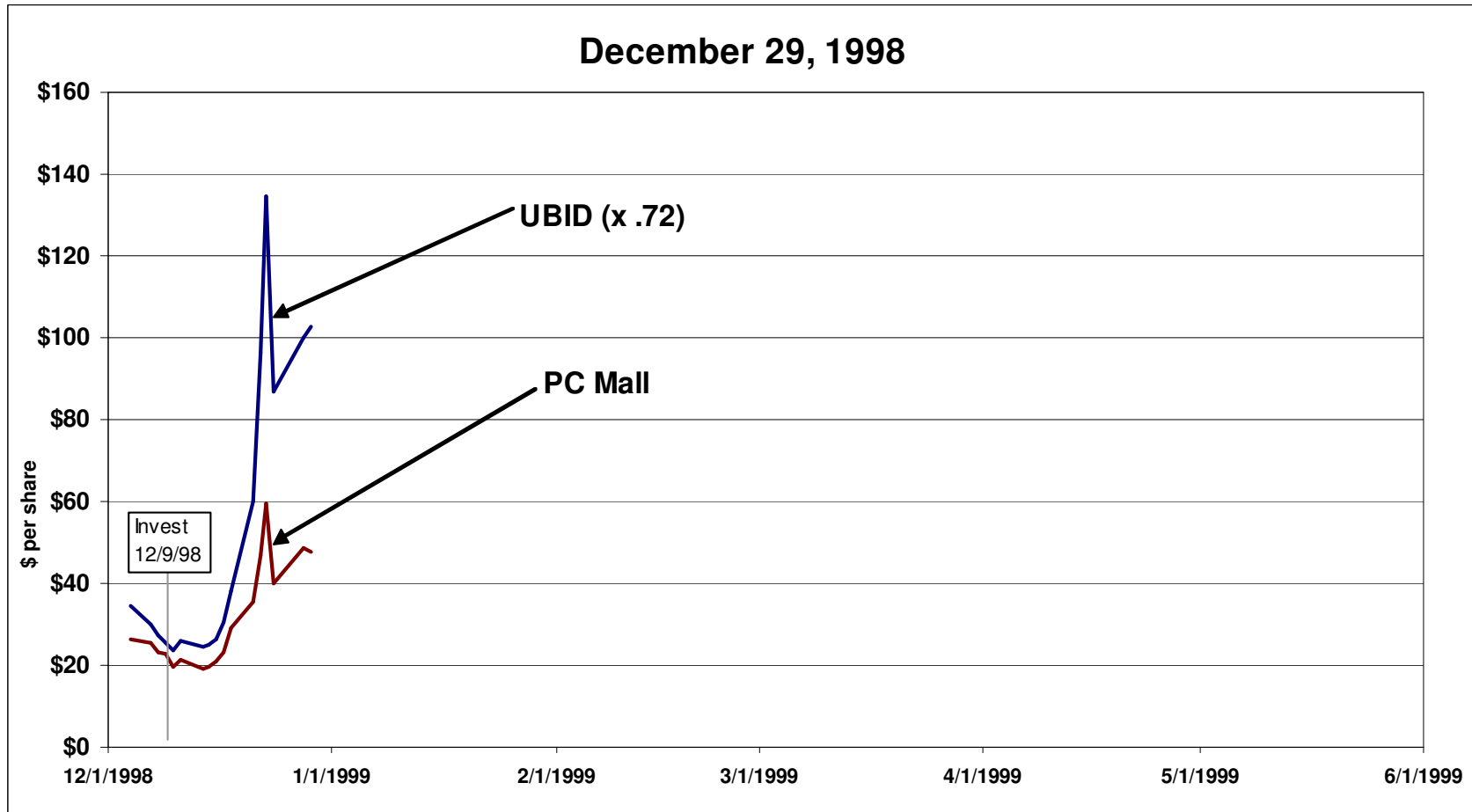
PC Mall-UBid Prices

$P(\text{UBID}) = \$188$; $P(\text{MALL}) = 59.688$; $\text{STUB}/\text{SHARE} = (74.808)$



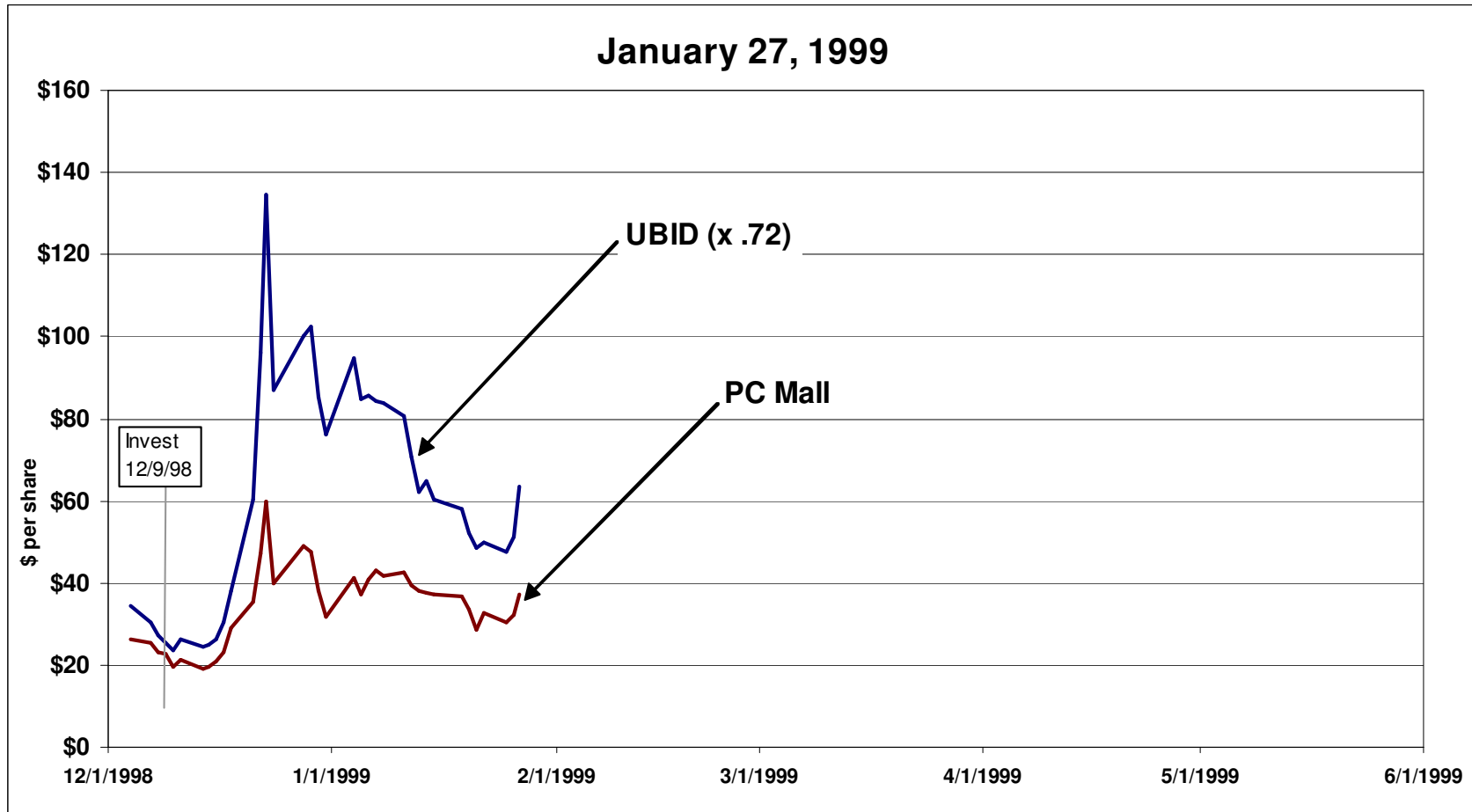
PC Mall-UBid Prices

$P(\text{UBID}) = \$143.5$; $P(\text{MALL}) = 47.625$; $\text{STUB}/\text{SHARE} = (55.04)$



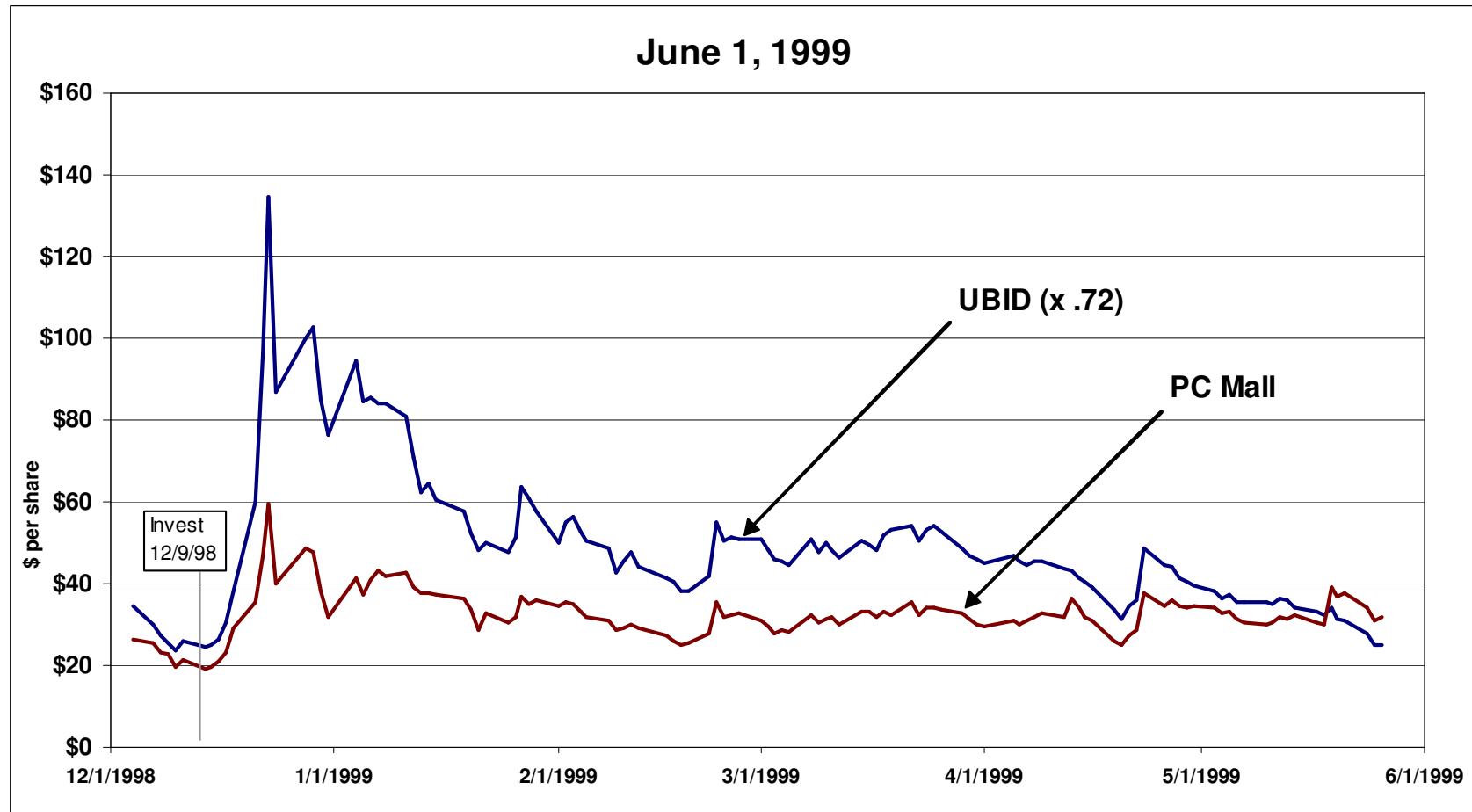
PC Mall-UBid Prices

$P(\text{UBID}) = \$89.938$; $P(\text{MALL}) = 37$; $\text{STUB}/\text{SHARE} = (27.34)$



PC Mall-UBid Prices

$P(\text{UBID}) = \$35.375$; $P(\text{MALL}) = 31.875$; $\text{STUB}/\text{SHARE} = +6.57$



PC Mall-UBid: Profits

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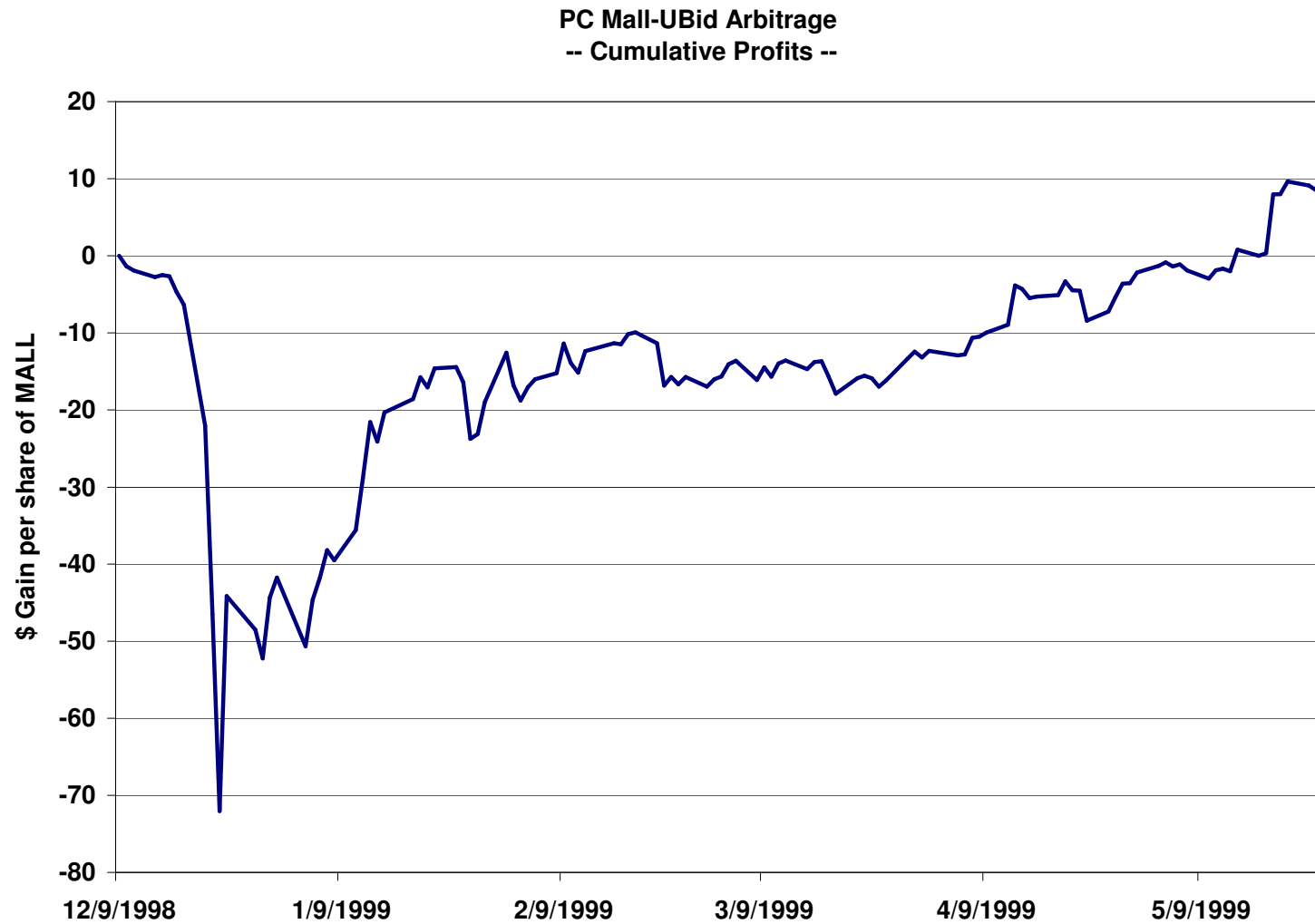
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 - Agency Problems
 - Long Term Capital Management

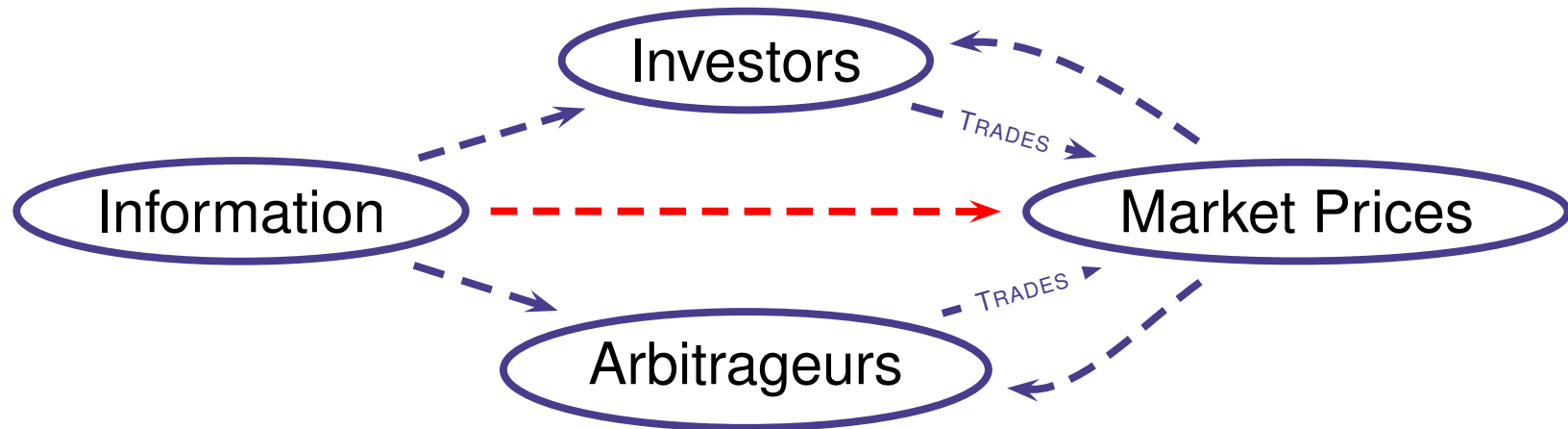
PC Mall-UBid: Costs of Shorting



Conclusions

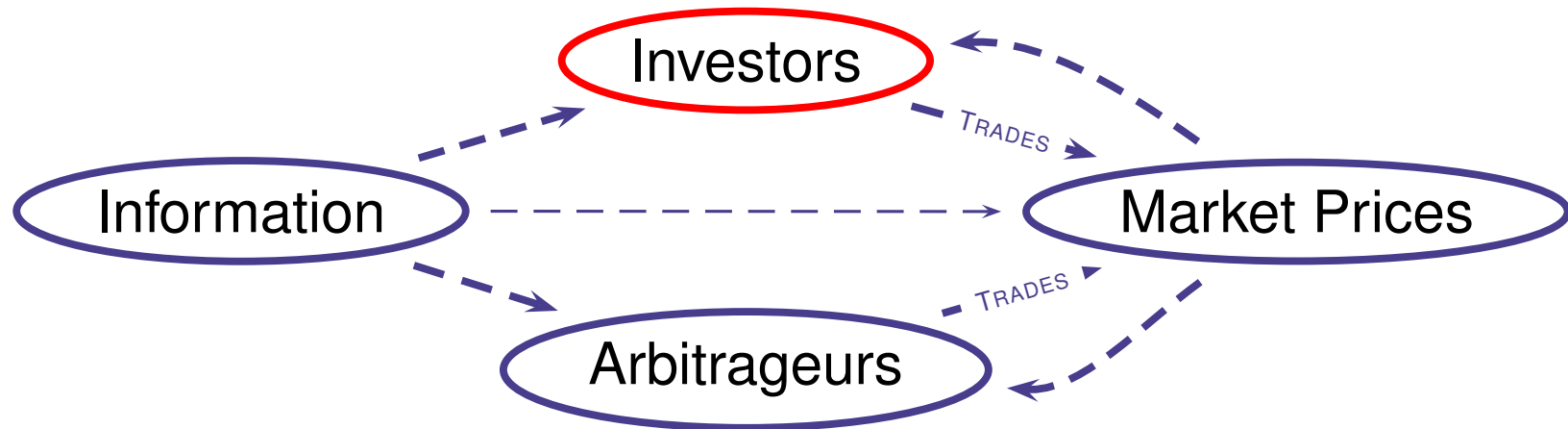
- This seems like a pretty clear mispricing situation.¹
 - Why were investors buying UBid instead of MALL?
 - *Ex-post*, investors who bought UBid lost dramatically.
 - UBid no longer trades.
- However, on December 9, the “right” trade (ex-post) was to buy UBid in anticipation of greater future mispricing.
- Assuming that agency problems make it difficult to raise additional capital, large bets on this mispricing are risky.
- It is the *limits of arbitrage* that allow even obvious mispricings like this one to persist.

Behavioral Finance:



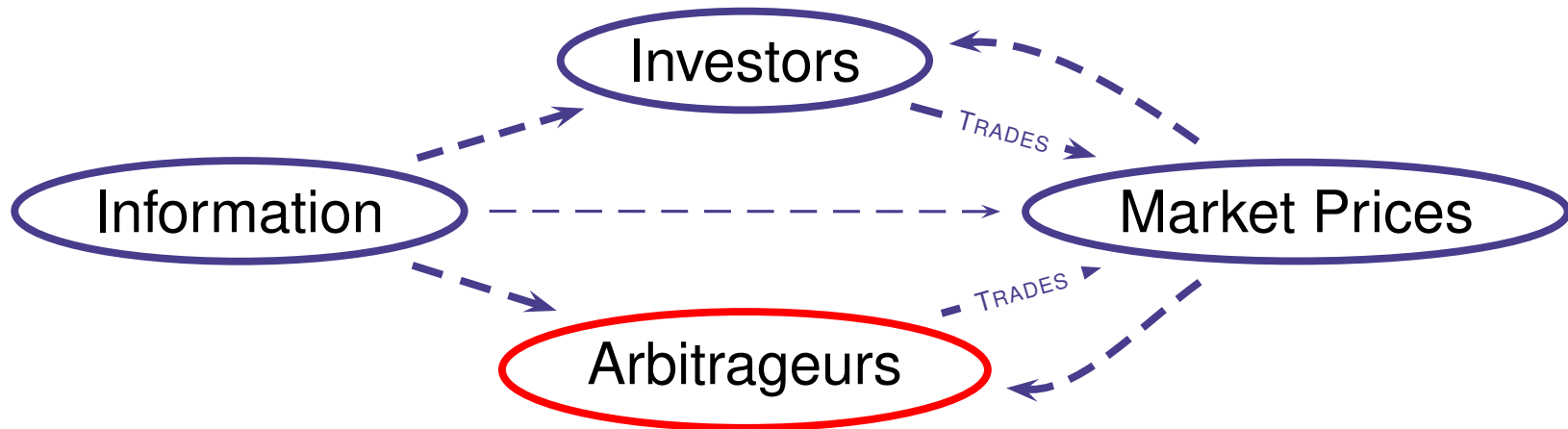
- The recent behavioral finance literature had helped to refine our understanding of how prices are formed in capital markets:
 - Investors don't always behave in as standard economic models.
 - This can sometimes cause prices to deviate from full information values.

Behavioral Biases:



- It is costly to acquire information and process it.
- Individuals make systematic mistakes in the way they process information.
- These biases are manifested in individual trading behavior.

Limits to Arbitrage:



- While this mispricing does create profit opportunities, these opportunities can pose risk and/or require substantial capital.
 - *Agency problems* make it difficult for arbitrageurs to acquire capital.
 - Mispricing may widen in the short horizon.

Open Issues:

- There are important outstanding issues involved in the interpretation of this evidence:
 1. Will the observed returns patterns persist?
 - Size, value, momentum, accruals evidence
 2. Why didn't mutual funds exploit, to a greater extent than they did, the anomalies we see in the data?
 - Did hedge funds?
- Policy Issues:
 - Is there a role for government regulation?
 - Biases of lawmakers; agency problems.
 - Education

References

Mitchell, Mark, Todd Pulvino, and Erik Stafford, 2001, Strategic capital management, Harvard Business School Case #9-02-026.

———, 2002, Limited arbitrage in equity markets, *Journal of Finance* 57, 551–584.

Notes

¹For potential arguments with this conclusion, see Mitchell, Pulvino, and Stafford (2002).