

How are stock prices affected by the
location of trade?

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Abstract

We examine pairs of large “Siamese twin” companies whose stocks are traded around the world but have different trading and ownership habitats. Twins pool their cash flows, so, with integrated markets, twin stocks should move together.

However, the difference between the prices of twin stocks appears to be correlated with the markets on which they are traded most, i.e., a twin's relative price rises when the market on which it is traded relatively intensively rises.

We examine several explanations of this phenomenon including:

- the discretionary use of dividend income by parent companies;
- differences in parent expenditures;
- voting rights;
- currency fluctuations;
- ex-dividend date timing issues; and
- tax-induced investor heterogeneity.

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We conjecture that:

- (a) country-specific sentiment shocks might affect share intensity,
- (b) investors are rational, but markets are segmented by frictions other than international transactions costs, such as agency problems.

The Purposes of this Study

This paper provides a stark example in which the location of trade and ownership appears to influence prices.

We show that the stock prices of three of the world's largest and most liquid multinational companies are strongly influenced by locational factors.

Specifically, we test whether location matters by examining Siamese-twin company stocks, or pairs of corporations whose charter fixes the division of current and future equity cash flows to each twin.

The twins each have their own stock, with its own distinct trading habitat.

We examine three examples of Siamese twins:

Royal Dutch Petroleum and
Shell Transport and Trading, PLC;
Unilever N.V. and Unilever PLC; and
SmithKline Beecham.

Twin charters imply that the twins' stock prices should move in lockstep, in a ratio given by the proportional division of cash flows.

Surprisingly, the stock prices of twins do not behave in this manner.

The main contribution of this paper

Showing how that the relative price of twin stocks is highly correlated with the relative stock-market indexes of the countries where the twins' stocks are traded most actively.

For example, when the U.S. market moves up relative to the U.K. market, the price of Royal Dutch (which trades relatively more in New York) tends to rise relative to the price of its twin Shell (which trades relatively more in London).

Similarly, when the dollar appreciates against the pound, the price of Royal Dutch tends to increase relative to that of Shell.

A Close-Ended Fund Puzzle

A similar sort of phenomenon occurs with closed-end country funds, which invest in emerging markets but are financed by issuing shares on developed country markets.

It is well known that the prices of these shares differ from the net asset values of the fund portfolios.

In particular, Closed-end fund share prices comove most strongly with the stock market on which they trade, while net asset values comove most strongly with their local stock markets.

Royal Dutch Petroleum and Shell Transport and Trading, PLC:

Royal Dutch and Shell are independently incorporated in the Netherlands and England, respectively.

The structure has grown out of a 1907 alliance between Royal Dutch and Shell Transport by which the two companies agreed to merge their interests

on a **60 : 40** basis

while remaining separate and distinct entities.

Royal Dutch Petroleum and Shell Transport and Trading, PLC:

All cash flows, adjusting for corporate tax considerations and control rights, are electively split in the proportion of 60 : 40.

There is considerable public information about the relative pricing of Royal Dutch and Shell, and switch trades seek to take advantage of price disparities.

Royal Dutch Petroleum and Shell Transport and Trading, PLC

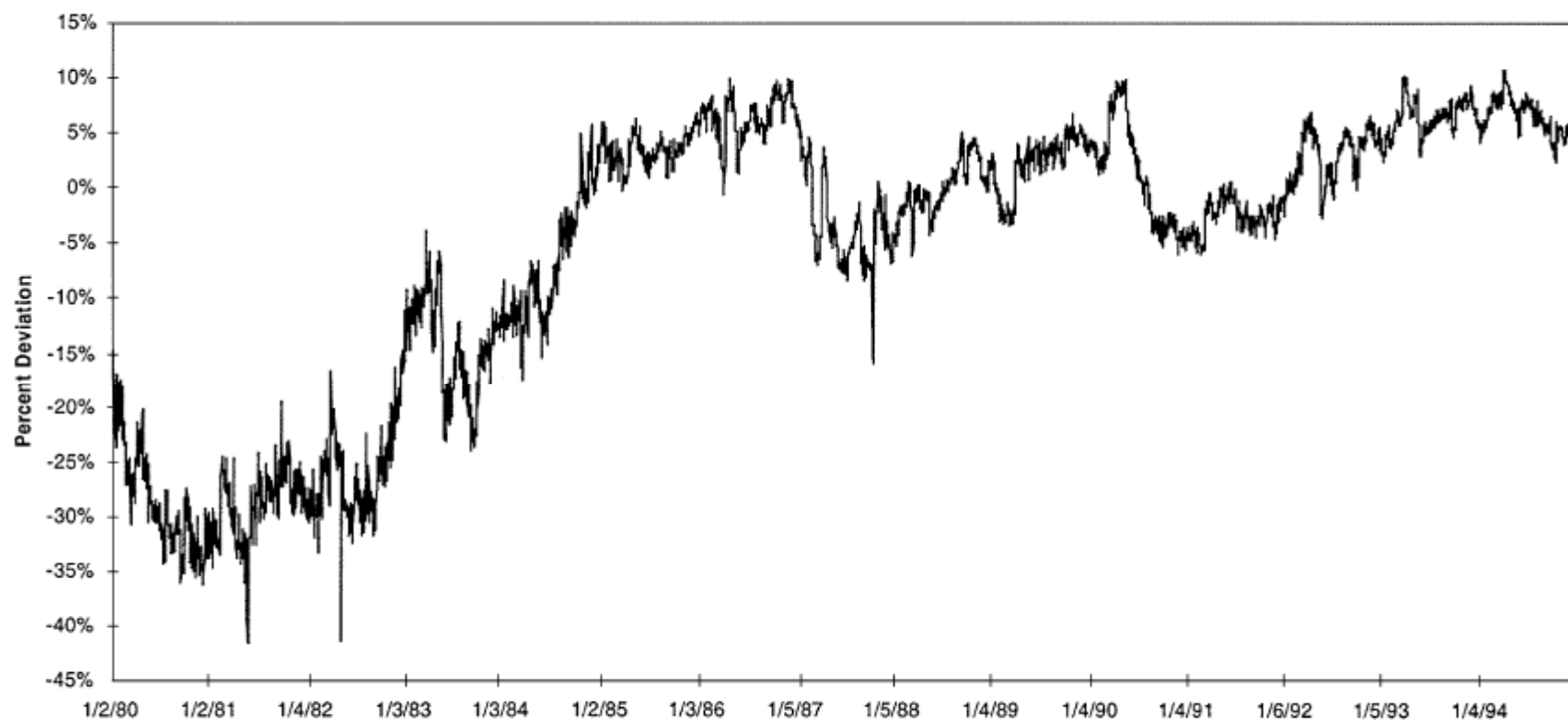


Fig. 1. Log deviations from Royal Dutch/Shell parity. Note: This figure shows on a percentage basis the deviations from theoretical parity of Royal Dutch and Shell shares and ADRs traded on the NYSE. Data are from the Center for Research in Security Pricing (CRSP).

Unilever N.V. and Unilever PLC

are independently incorporated in the Netherlands and England, respectively.

In 1930, the two companies established an equalization agreement of cash flows in that the two companies act as a single group company and use the same board of directors.

In the case of liquidation, all assets are to be pooled and divided evenly among shareholders.

The intent of the agreement is to make the shares as similar as possible, as if all shareholders held shares of a single company.

Unilever N.V. and Unilever PLC

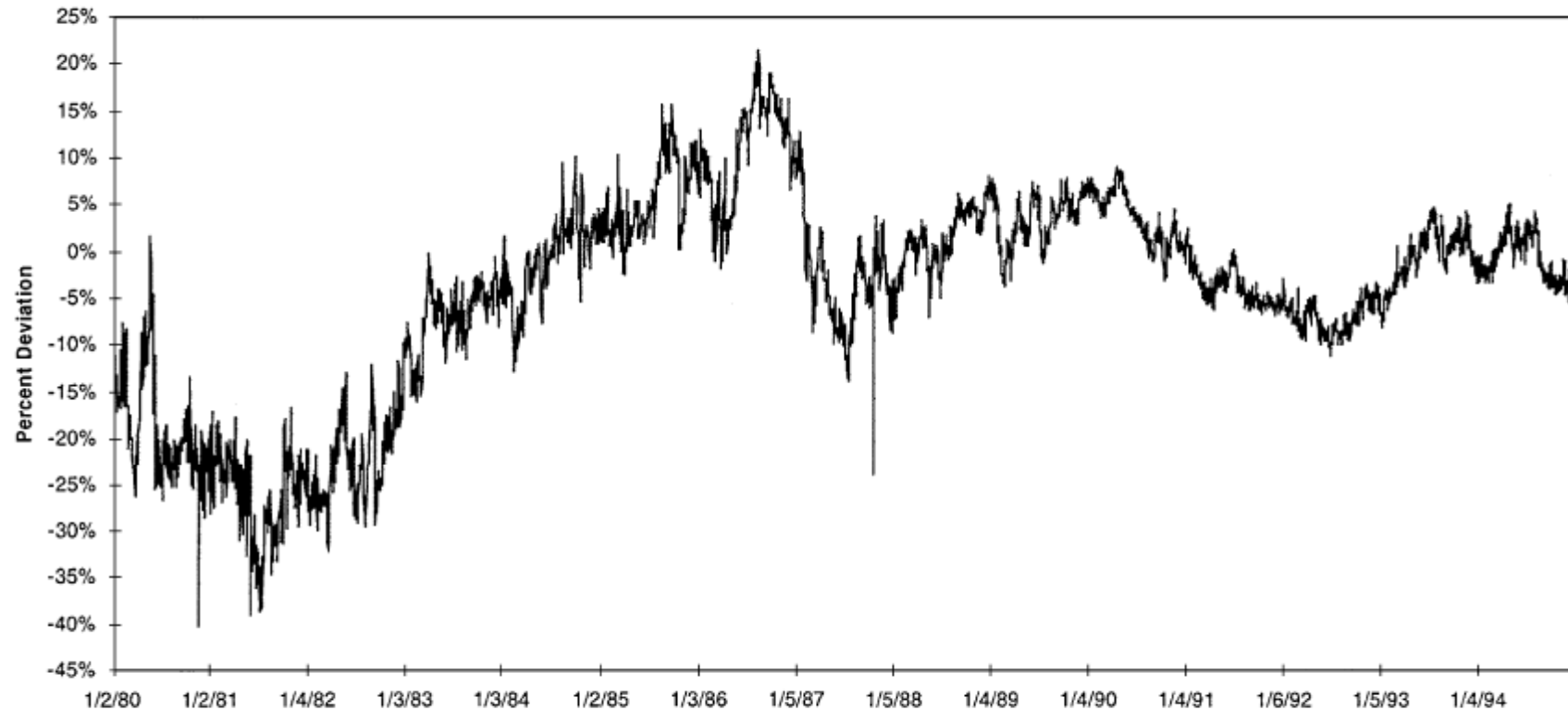


Fig. 2. Log deviations from Unilever N.V./Unilever PLC parity. Note: This figure shows on a percentage basis the deviations from theoretical parity of Unilever N.V. and PLC shares and ADRs traded on the NYSE. Data are from the Center for Research in Security Pricing (CRSP).

SmithKline Beckman and Beecham Group merged to form SmithKline Beecham on July 26, 1989.

The former holders of Beecham (a U.K. company) received class A ordinary shares while former holders of SmithKline Beckman (a U.S. corporation) received Equity Units (class E shares) comprised of 5 shares of SmithKline Beecham B ordinary shares and one preferred share of SmithKline Beecham Corporation.

The equity units receive their dividends from SB Corp., a wholly owned American subsidiary. The dividends are equalized, so that one class E share provides the same dividend flow as one class A share

SmithKline Beecham

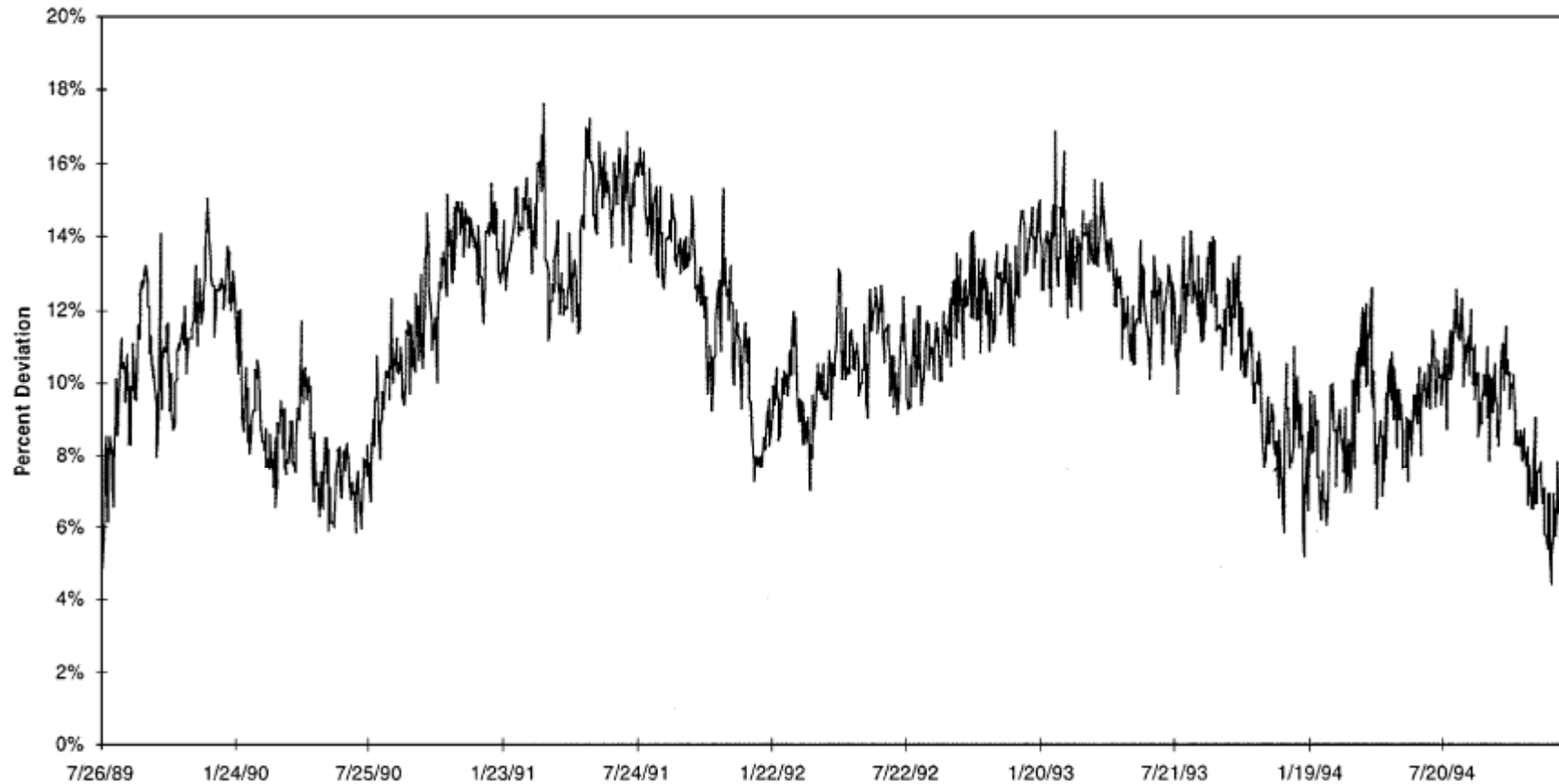


Fig. 3. Log deviations from SmithKline Beecham parity. Note: This figure shows on a percentage basis the deviations from theoretical parity of SmithKline Beecham H and E shares traded on the NYSE. Data are from the Center for Research in Security Pricing (CRSP).

Unit Root Test of Twin Price Disparities

$$\Delta P_{A-B,t} = \alpha + \delta t + \beta P_{A-B,t-1} + \gamma(\Delta P_{A,t-1} - \Delta P_{B,t-1}) + \varepsilon_t, \quad (2)$$

where $P_{A-B,t}$ is the difference in the logs of twin prices, and Δ is the first-difference operator. The null hypothesis of a unit root in price differentials is given by $\beta = 0$. Naturally, this null hypothesis is unlikely to be true: it is hard to accept the notion that the price differential contains a unit root, so that over sufficient time, the probability that the differential becomes arbitrarily large equals one. However, we use Eq. (2) to get a point estimate of the rate at which price differentials decay. We also investigate the multivariate comovement of price disparities and market indexes. In particular, we test whether price disparities are cointegrated with some linear combination of stock indexes.

$$\Delta P_{A-B,t} = \alpha + \delta t + \beta P_{A-B,t-1} + \gamma(\Delta P_{A,t-1} - \Delta P_{B,t-1}) + \varepsilon_t$$

To measure the relative co-movement of twin prices, we regress the twins' log return differential on U.S., U.K., and Dutch market index log returns plus the relevant log currency changes.

Equation 1 is shown as follows:

$$r_{A-B,t} = \alpha + \sum_{i=-1}^1 \beta_i S\&P_{t+i} + \sum_{j=-1}^1 \delta_j FTSE_{t+j} + \sum_{k=-1}^1 \lambda_k DI_{t+k} \\ + \sum_{l=-1}^1 \gamma_l gl/\$_{t+l} + \sum_{m=-1}^1 \nu_m gl/£_{t+m} + \varepsilon_t$$

Specification 3 is analogous to specifications 1, except that a lagged dependent variable is added to the right-hand side.

This allows us to estimate the short-run versus long-run effects of a change in the market indicators on the twin price disparity

$$r_{A-B,s} = \alpha + \theta r_{A-B,s-1} + \beta r_{S\&P,s} + \delta r_{FTSE,s} + \lambda r_{DI,s} + \gamma gl/\$s + \nu gl/£s + \varepsilon_{A-B,s}$$

The coefficient β can be interpreted as the short-run response of the return differential to a shock to the S&P 500, and $\beta/(1 - \theta)$ can be interpreted as the long-run response. If prices tend to revert toward parity, then we should find that long-run responses are smaller than short-run responses, so that $\theta < 0$.

Distribution of share ownership and trading volume across markets

Panel A: Ownership (average 1980–1992)

Company	Percent owned in		
	U.S.	U.K.	Netherlands
Royal Dutch	33%	4%	34%
Shell	3%	96%	< 1%
Unilever N.V.	16%	10%	46%
Unilever PLC	< 1%	99%	< 1%

Panel B: Trading volume (average 1991–1995)

Company	Percent of average daily volume traded in		
	U.S.	U.K.	Netherlands
Royal Dutch	70%	NA	30%
Shell (ADR)	32%	68%	NA
SmithKline	83%	17%	NA

Co-integration and unit root tests

Cointegration and unit root tests

Augmented Dickey-Fuller tests of log price differentials and log prices

Variable	Coefficient	P-value	Results
$P_{RD,t} - P_{Shell,t}$	- 0.0034	0.2926	Fail to reject unit root
$P_{UNV,t} - P_{Uplc,t}$	- 0.0042	0.8729	Fail to reject unit root
$P_{SKA,t} - P_{SKE,t}$	- 0.0052	0.6212	Fail to reject unit root
Dutch index	- 0.0002	0.9845	Fail to reject unit root
FTSE index	- 0.0006	0.4106	Fail to reject unit root
S&P index	- 0.0007	0.6735	Fail to reject unit root

Variables are relative log prices of twin stocks, e.g., $P_{RD,t} - P_{Shell,t}$ is the log price of Royal Dutch relative to that of Shell. Index variables are stock market total return indexes. Coefficients are estimates of β from the augmented Dickey-Fuller regression, $\Delta P_{A-B,t} = \alpha + \delta t + \beta P_{A-B,t-1} + \gamma(\Delta P_{A,t-1} - \Delta P_{B,t-1}) + \varepsilon_t$.

Empirical Evidence Analysis

Tables 2-4 report estimates of Eq. (1) for Royal Dutch/Shell, Unilever N.V./PLC, and SmithKline Beecham, respectively.

Cumulative present value of dividends on Royal Dutch shares relative to those of Shell

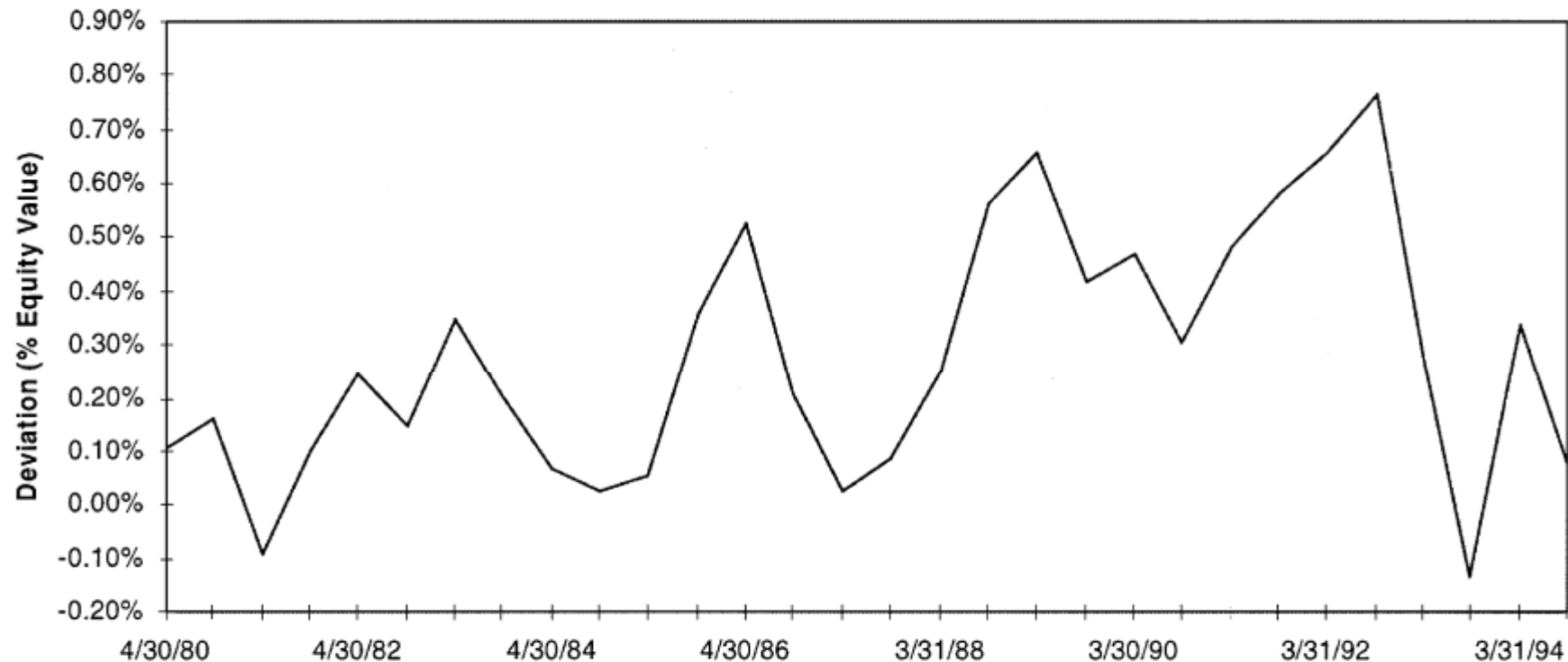


Fig. 4. Cumulative present value of dividends on Royal Dutch shares relative to those of Shell. Note: This figure shows, on a present value basis, the cumulative dividends for Royal Dutch relative to Shell as a percentage of the average stock price. Dividends of Royal Dutch are converted into a common currency and cumulated using short term interest rates.

Taxation of different investor classes in different countries (1993)

Taxation of different investor classes in different countries, 1993^a

Country	Investor class	Tax rate on royal dutch dividends	Tax rate on shell dividends	Preference	Difference in annual return from tax differential ^b
UK	Private investors	20%	20%	Indifferent	–
	Companies	33%	20%	Shell	– 0.64%
	Pension funds	15%	–	Shell	– 0.74%
Nether	Private investors	25%	25%	Indifferent	–
	Companies	25%	25%	Indifferent	–
	Pension funds	–	25%	Royal Dutch	1.23%
US ^c	Private investors	15%	15%	Indifferent	–
	Companies	15%	15%	Indifferent	–
	Pension funds ^d	15%	15%	Indifferent	–

Conclusions:

Three possible sources of segmentation

The first source is tax-induced investor heterogeneity.

This explanation seems incomplete.

It does not explain correlations of twin price differentials with the U.S. market, since during the bulk of our sample all major U.S. investor groups faced equivalent tax treatment on twin stocks, and it does not explain why U.S. holdings of the cheap stock did not grow and why holdings of the expensive stock did not shrink.

The second possible source of segmentation is noise.

Market-wide noise shocks from irrational traders, which infect locally traded stocks more than foreign traded stocks, can explain the co-movements.

Indeed, this story suggests that the portion of market movements that is correlated with fluctuations in twins' relative prices is attributable to noise.

The main problem with this story -here and more generally- is that the source of noise or persistent irrationality is difficult to identify.

Third, institutional inefficiencies might explain co-movements.

By virtue of higher liquidity or inclusion in domestic-market indexes, one twin may be classified as a 'domestic' stock. (Note that causality here could easily run the other way, suggesting the possibility of multiple equilibria.)

Classification as 'domestic' or 'foreign' appears to be important in practice, and could help resolve informational asymmetries and agency problems in the investment process.

The Questions for Arbitrager and Mr. Market

Finally, there is the question of how arbitrage disciplines the price gap.

In a frictionless world, it is clear that arbitrage would occur -any single investor could finance sufficiently large long positions to drive prices to parity.

But lack of disciplinary arbitrage does not explain why there are deviations in the first place.

What causes the price deviations?

Further Studies in Twins Stocks

- Cross-listed Chinese A-Share, B-Share, H Share, ADR, and GDR
- Possible factors that cause price disparity
 1. Transaction cost
 2. Currency risk
 3. Liquidity premium
 4. Tax difference
 5. Stock exchange effect (the characters of traders)
 6. Noise trader risk
 7. Firm's characteristics