
UNBUNDLING AND MEASURING TUNNELING*

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Managers and controlling shareholders can extract (“tunnel”) wealth from firms in many different ways. We develop a framework for analyzing what we see as the four main types of “tunneling” transactions: cash flow tunneling, asset tunneling “out,” asset tunneling “in,” and equity tunneling. We develop a simple model of how each type of tunneling affects accounting and share price metrics, develop implications for asset pricing models, and illustrate our approach with several case studies. Our framework can help regulators design more effective antitunneling rules, help investors and analysts evaluate tunneling risk, and help shareholders provide evidence on harm from tunneling in litigation.

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I. INTRODUCTION

In the United States and the United Kingdom, the misalignment of managerial incentives is often viewed as the main corporate governance issue that arises from the separation of ownership and control in public firms. But in much of the rest of the world, the dominant concern is the risk that “insiders” (managers and controlling shareholders) will extract firm value, disproportionate to their economic ownership—a practice known as “self-dealing” or “tunneling.”¹ Many papers document tunnel-

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1. The term “tunneling” emerged in the late 1990s in the Czech Republic in the aftermath of mass privatization. The first academic use of the term, to our knowledge, is Simon Johnson, Rafael La Porta, Florencio Lopez-de-Silanes & Andrei Shleifer, *Tunneling*, 90 AM. ECON. REV. 22 (2000).

ing of various sorts, sometimes in developed markets,² but more often in developing markets.³ Others study how tunneling affects share prices and control premia.⁴

Some types of tunneling are simple (e.g., executives' personal use of a corporate jet),⁵ others are complex (e.g., equity transactions with off-balance-sheet entities). In the United States, Enron is the poster child for complex tunneling. Enron's insiders used a variety of transactions to tunnel wealth, but veiled these transactions in complexity and scant disclosure to camouflage their impact on reported performance and their tunneling aspects.⁶

In this Article, we "unbundle" tunneling into four main types and assess the impact of each tunneling type on reported financial performance and share price.⁷ We do so as part of a symposium honoring Professor Larry Ribstein. Understanding the uses and abuses of organizational forms is very much in the spirit of Larry Ribstein's work on limited

2. Papers studying tunneling in the United States include Vladimir Atanasov, Audra Boone & David Haushalter, *Is There Shareholder Expropriation in the United States? An Analysis of Publicly Traded Subsidiaries*, 45 J. FIN. & QUANTITATIVE ANALYSIS 1 (2010); Thomas W. Bates, Michael L. Lemmon & James S. Linck, *Shareholder Wealth Effects and Bid Negotiation in Freeze-out Deals: Are Minority Shareholders Left Out in the Cold?*, 81 J. FIN. ECON. 681 (2006); Conrad S. Ciccotello, C. Terry Grant & Gerry H. Grant, *Impact of Employee Stock Options on Cash Flow*, 60 FIN. ANALYSTS J. 39 (2004); Elizabeth A. Gordon, Elaine Henry & Darius Palia, *Related Party Transactions and Corporate Governance*, 9 ADVANCES FIN. ECON. 1 (2004).

3. Selected examples include Vladimir Atanasov, *How Much Value Can Blockholders Tunnel? Evidence from the Bulgarian Mass Privatization Auctions*, 76 J. FIN. ECON. 191 (2005) (Bulgaria); Vladimir Atanasov, Bernard Black, Conrad Ciccotello & Stanley Gyoshev, *How Does Law Affect Finance? An Examination of Equity Tunneling in Bulgaria*, 96 J. FIN. ECON. 155 (2010) (Bulgaria); Jae-Seung Baek, Jun-Koo Kang & Inmoo Lee, *Business Groups and Tunneling: Evidence from Private Securities Offerings by Korean Chaebols*, 61 J. FIN. 2415, 2416 (2006) (Korea); Marianne Bertrand, Paras Mehta & Sendhil Mullainathan, *Ferretting Out Tunneling: An Application to Indian Business Groups*, 117 Q. J. ECON. 121 (2002) (India); Simeon Djankov, Rafael La Porta, Florencio Lopez-de-Silanes & Andrei Shleifer, *The Law and Economics of Self-Dealing*, 88 J. FIN. ECON. 430 (2008) (multiple countries); Henk Berkman, Rebel A. Coleb & Lawrence J. Fuc, *Through Loan Guarantees to Related Parties: Evidence from China*, 33 J. BANKING & FIN. 141 (2009) (China); Guohua Jiang, Charles M. C. Lee & Heng Yue, *Tunneling through Intercorporate Loans: The China Experience*, 98 J. FIN. ECON. 1 (2010) (China).

4. See, e.g., Ronen Barak & Beni Lauterbach, *Estimating the Private Benefits of Control from Partial Control Transfers: Methodology and Evidence*, INT'L J. CORP. GOVERNANCE 683 (2011), available at <http://ssrn.com/abstract=965668> (Israel); Alexander Dyck & Luigi Zingales, *Private Benefits of Control: An International Comparison*, 59 J. FIN. 537 (2004) (multiple countries); Tatiana Nenova, *The Value of Corporate Voting Rights and Control Benefits: A Cross-Country Analysis*, 68 J. FIN. ECON. 325 (2003) (multiple countries).

5. See David Yermack, *Tailspotting: Identifying and Profiting from CEO Vacation Trips* (New York Univ., Law & Econ. Research Paper Series, Working Paper No. 12-07), available at <http://ssrn.com/abstract=2022813>.

6. See, e.g., BETHANY MCLEAN & PETER ELKIND, *THE SMARTEST GUYS IN THE ROOM: THE AMAZING RISE AND FALL OF ENRON* 305, 308 (2003); Expert Report of Bernard Black, *In re Enron Securities Litigation* (2006), available at <http://papers.ssrn.com/abstract=1528457>.

7. The unbundling metaphor is drawn from Acemoglu and Johnson (2005), who seek to unbundle property rights institutions from contracting institutions. Daron Acemoglu & Simon Johnson, *Unbundling Institutions*, 113 J. POL. ECON. 949 (2005).

liability companies, his skepticism about broad generalizations, and the value he placed on empirical evidence.⁸

Tunneling can take place through a wide variety of transactions. Tunneling is often not voluntarily disclosed, and the disclosure required by law or accounting rules is often insufficient to let investors assess the nature and extent of tunneling. Most empirical research is therefore limited to indirect measures. Moreover, theory has lagged behind the empirical efforts. The available models do not distinguish between different forms of tunneling, and model tunneling in a highly stylized way, in which a single parameter captures the extent of tunneling.⁹

We use the tunneling terminology we developed in prior work and divide tunneling into three broad types: cash flow tunneling, asset tunneling, and equity tunneling.¹⁰ We further divide asset tunneling into asset tunneling “in” (overpaying for major assets) and “out” (selling major assets for below market value). Tunneling includes both transactions which benefit controlling shareholders at the expense of minority shareholders and transactions which benefit managers at the expense of shareholders.

Cash flow tunneling removes a portion of the current year’s cash flow, but does not affect the remaining stock of long-term productive assets, and thus does not directly affect the firm’s value to all investors, including the controller. Examples include transfer pricing (sale of outputs to an intermediary controlled by insiders for below-market prices or purchase of inputs at above-market prices), excessive executive salaries or perquisites, and small-scale sales or purchases of assets which do not significantly affect the firm’s cash-generating capacity. Cash flow tunneling can repeat year after year, but the fraction of the firm’s pretunneling cash flow which is extracted can change over time.

Asset tunneling “out” involves the transfer of major long-term (tangible or intangible) assets from the firm for less than market value. It includes, for example, underpriced asset sales to affiliated firms and loans to affiliated firms.¹¹ Asset tunneling “out” may also affect the profitabil-

8. See, e.g., Larry E. Ribstein, *Introduction to the “Uncorporation,”* 2005 U. ILL. L. REV. 1; Larry E. Ribstein, *Market vs. Regulatory Responses to Corporate Fraud: A Critique of the Sarbanes-Oxley Act of 2002*, 28 J. CORP. L. 1 (2002); Larry E. Ribstein, *The Uncorporation and Corporate Indeterminacy*, 2009 U. ILL. L. REV. 131; Bruce H. Kobayashi & Larry E. Ribstein, *Nevada and the Market for Corporate Law*, 35 SEATTLE U. L. REV. 1165 (2012) (empirical study of Nevada corporate law).

9. See, e.g., Rui Albuquerque & Neng Wang, *Agency Conflicts, Investments, and Asset Pricing*, 63 J. FIN. 1 (2008); Mike Burkart, Denis Gromb & Fausto Panunzi *Why Higher Takeover Premia Protect Minority Shareholders*, 106 J. POL. ECON. 172 (1998); Rafael La Porta, Florencio Lopez-De-Silanes, Andrei Shleifer & Robert Vishny, *Investor Protection and Corporate Valuation*, 57 J. FIN. 1147 (2002); Andrei Shleifer & Daniel Wolfenzon, *Investor Protection and Equity Markets*, 66 J. FIN. ECON. 3 (2002).

10. Vladimir Atanasov, Bernard Black & Conrad Ciccotello, *Law and Tunneling*, 37 J. CORP. L. 1 (2011).

11. As we discuss below, loans to insiders can be seen as combining asset tunneling and equity tunneling). See *infra* Part II.E.

ity of the firm's remaining assets, if the transferred assets had synergy with the remaining assets.

Asset tunneling "in" involves the firm acquiring major assets for more than market value usually by buying assets from affiliated firms or equity in these firms. Asset tunneling differs from cash-flow tunneling because the asset transfers have a permanent effect on the firm's future cash-generating capacity, the firm's profitability based on its posttunneling assets, or both.

Equity tunneling increases the controller's share of the firm's value at the expense of minority shareholders, but does not directly change the firm's productive assets or cash flows. Examples of equity tunneling include dilutive offerings, freeze-outs of minority shareholders, loans to insiders (which will not be repaid in bad states of the world), equity-based incentive compensation which exceeds a market level, and insider trading.

An analogy may help to illustrate the differences between forms of tunneling. If one describes a firm as a grove of apple trees, which grow better together than apart, cash flow tunneling can be seen as stealing some of this year's crop of apples, asset tunneling "out" involves stealing some of the trees (potentially making the remaining trees less valuable), asset tunneling "in" involves overpaying for additional trees, and equity tunneling involves stealing claims to ownership of the grove.¹²

Insiders can engage in more than one form of tunneling. To use a Russian example, insiders at Gazprom engaged in cash flow tunneling (selling Gazprom's gas to insider-controlled intermediaries for below-market prices, and purchasing overpriced services from insider-affiliated third parties), asset tunneling "out" (selling Gazprom's gas fields and pipelines to related parties for low prices), asset tunneling "in" (buying television stations and newspapers, which had previously been critical of the government), and equity tunneling (selling Gazprom shares to themselves, or causing the government to do so, for low prices).¹³

We develop a simple equilibrium model to predict how different types of tunneling should affect share prices and financial metrics. Different types of tunneling impact different financial metrics in different ways. To oversimplify, equity tunneling and asset tunneling "out" principally affect items on the balance sheet. Cash flow tunneling principally affects the income statement and statement of cash flows. Asset tunneling "in" increases assets more than profits or cash flow and thus affects both the balance sheet and "ratio" variables, such as return on assets, that depend on balance sheet values. Asset tunneling ("in" or "out") di-

12. Compare the simpler stock versus flow analogy offered by Gilson and Gordon. Using our tunneling terminology, they argue that that equity tunneling harms minority shareholders more than cash flow tunneling because it extracts the present value of a stream of income, rather than just this year's flow. Ronald J. Gilson & Jeffrey N. Gordon, *Controlling Controlling Shareholders*, 152 U. PA. L. REV. 785 (2003).

13. We provide a case study of tunneling by Gazprom in Part V.C *infra*.

rectly affects the company's future operations and profitability, while equity and cash flow tunneling do not.

We also distinguish between realized tunneling and expected future tunneling. Both affect value and financial metrics, but in different ways. For example, expected future asset tunneling "in" will affect the firm's market value but not its assets or profitability. Realized asset tunneling "in," in contrast, will suppress profitability and ratio variables such as sales/assets.

For example, if Gazprom sells gas to an intermediary for half the world price (cash flow tunneling), this will affect earnings, and thus share price, but may leave the price-to-earnings (P/E) ratio largely unaffected. In contrast, the risk that Gazprom will sell gas fields to insiders at low prices (asset tunneling "out") will affect price but not current earnings and thus will directly impact P/E.

The risk of future asset and equity tunneling can be decomposed into a probability and a magnitude similar to models of debt default risk.¹⁴ For example, if the controllers are expected to freeze out minority shareholders with probability π_f , and a freezeout, if it occurs, will be at an expected discount to intrinsic value d_f , one can model the *ex ante* impact of freezeout risk on the value of minority shares as a function of π_f and d_f . These parameters can be estimated using data on the incidence of freeze-out transactions and the average discounts paid in freeze-outs.¹⁵

Tunneling probabilities and magnitudes can be seen as factors in determining asset values. Consider the classic present value formula:

$$Value_0 = \sum_t C_t / (1 + r_t)^t \quad (1)$$

Conventional asset pricing research takes the cash flows C_t as given and focuses on how systematic risk affects the expected rate of return r_t in the denominator. In contrast, we take the expected rate of return as largely given and focus on how firm-level tunneling affects cash flows.¹⁶ As we will show, however, asset and equity tunneling risks can be modeled as pricing factors that affect equilibrium rates of return in a manner similar to classic asset pricing factors. Moreover, if asset and equity tunneling risks are significant, asset pricing research which ignores tunneling will misestimate the classic asset pricing factors. Cross-country variation

14. See, e.g., Robert C. Merton, *On the Pricing of Corporate Debt: The Risk Structure of Interest Rates*, 29 J. FIN. 449 (1974).

15. As we discuss below, the firm's intrinsic value and hence d_f will not be directly observable. See *infra* Part III.E. All types of tunneling will combine to cause observed share prices to be lower than intrinsic no-tunneling values. Thus, a freezeout or equity offering can be at market price, yet at a large discount from intrinsic value.

16. Tunneling risk may have systematic components and thus also affect expected rate of return. Separating its systematic and unsystematic components is beyond the scope of this Article.

in tunneling risk may help to explain why country-level asset pricing models outperform a global model.¹⁷

Our framework and tunneling case studies are aimed at several constituencies. Understanding how different forms of realized and expected tunneling affect share prices and financial metrics can help investors and analysts to better evaluate tunneling risk, can assist shareholders in providing evidence in litigation that challenges specific tunneling transactions, and can help regulators in deciding where to focus reform efforts. Our U.S. case studies illustrate the weaknesses in U.S. tunneling rules and provide evidence that insiders can in fact exploit these weaknesses for personal gain. Our analytic framework also provides testable predictions on what should happen to financial metrics following “natural experiments” when tunneling laws are changed.

This Article proceeds as follows. Part II provides a taxonomy of tunneling types. Part III presents a simple two-period model of how different types of tunneling affect financial metrics. Part IV extends the model to an infinite time horizon. In Part V we provide three case studies that illustrate different forms of tunneling: two are from the United States (Coca-Cola Enterprises (“Bottling”) and Biglari Holdings), and one is from Russia (Gazprom). Part VI discusses some implications of our analysis, and Part VII concludes.

II. BACKGROUND: MAIN FORMS OF TUNNELING

This Part introduces the main types tunneling—cash flow tunneling, asset tunneling (“in” or “out”), and equity tunneling; summarizes which transactions and activities fall within each type; and discusses mixed types, which do not cleanly fit our typology.¹⁸

A. Cash Flow Tunneling

Cash flow tunneling can be loosely defined as self-dealing transactions which divert what would otherwise be operating cash flow from the firm to insiders. The central stylized attributes of cash flow tunneling are: (1) it can potentially recur indefinitely, but may or may not do so in fact; (2) it leaves the firm’s long-term productive assets unchanged; (3) it leaves ownership claims over the firm’s assets unchanged; and (4) if limited in extent, it may not significantly affect the firm’s long-term cash-generating ability.

Examples of cash flow tunneling include: transfer pricing arrangements where the controlling shareholder, or a company in which the controller has a larger ownership stake than in the “main” firm, sells inputs to the firm at above-market prices or purchases the firm’s outputs at be-

17. John M. Griffin, *Are the Fama and French Factors Global or Country Specific?*, 15 REV. FIN. STUD. 783 (2002).

18. Some of this Part overlaps with Atanasov, Black & Ciccotello (2011), *supra* note 10.

low-market prices; above-market current compensation to managers (we treat equity-based compensation as a form of equity tunneling); payments to insiders for services at above-market rates; and loans to insiders at below-market rates (we treat the risk of nonrepayment as equity tunneling). Table 1 (Panel A) lists example categories of cash flow tunneling transactions.

Sales or purchases of replaceable assets, including inventory or receivables, at off-market prices, can also be classified as cash flow tunneling. As the scale of an asset transaction increases, the transaction will at some point slide from cash flow tunneling into asset tunneling.

Transactions between a firm and its controlling shareholders can sometimes benefit the firm—so-called “propping.”¹⁹ We do not directly discuss propping here, nor the argument that tunneling and propping transactions within business groups may reflect efficient risk-sharing in an inefficient capital market.²⁰

B. Asset Tunneling “Out”

Asset tunneling out involves self-dealing transactions which remove significant, productive assets from the firm for less than fair value.²¹ Asset tunneling “out” can include both tangible and intangible assets, which can be on or off the balance sheet. Tangible assets often fall within the property, plant, and equipment (“PPE”) or investments lines on a balance sheet. One common form involves investing in an affiliate on more favorable terms than the affiliate could obtain from outside investors.²² Intangible asset tunneling out can include providing trade secrets or other intellectual property to related parties at a discount and diverting business opportunities to related parties.²³ Within business groups, equity investments in affiliates or loans to affiliates can involve both asset tunneling out from the investing firm and propping of the investee firm.

We treat asset tunneling “out” as separate from cash flow tunneling for several reasons. First, asset tunneling out diverts all future cash flows associated with significant assets in a single transaction. In contrast, diverting cash flows is an ongoing process which can be modified or even stopped in the future. Second, if there is synergy between different aspects of a firm’s business, asset tunneling out may reduce the value of the

19. Yan-Leung Cheung, P. Raghavendra Raub & Aris Stouraitisc, *Tunneling, Propping, and Expropriation: Evidence from Connected Party Transactions in Hong Kong*, 82 J. FIN. ECON. 343 (2006); Eric Friedman, Simon Johnson & Todd Mitton *Propping and Tunneling*, 31 J.COMP. ECON. 732 (2003).

20. Randall Morck & Massao Nakamura, *Business Groups and the Big Push: Meiji Japan's Mass Privatization and Subsequent Growth*, 8 ENTER. & SOC. 543, 566–67 (2007).

21. Compare our definition to Johnson, La Porta, Lopez-de-Silanes & Shleifer, *supra* note 1, at 22, who combine asset tunneling “out” and cash flow tunneling into a single category which they term “self-dealing transactions.”

22. See, e.g., Baek, Kang & Lee (2006), *supra* note 3.

23. Our case study of Biglari Holdings, provides an example of the shuffling of business opportunities between Biglari-controlled entities. See *infra* Part V.C.

firm's remaining assets. Cash flow tunneling is closer to being purely redistributive. Unless large in scale, it may have little impact on a firm's future operating performance, if the cash flow tunneling were to cease. Third, as we discuss below, asset tunneling "out" and cash flow tunneling have different effects on financial metrics, and need to be addressed through different legal and accounting rules. One can crudely think of asset tunneling "out" as impacting the balance sheet first and the income statement only indirectly. In contrast, cash flow tunneling affects the income statement and statement of cash flows directly, but often only indirectly affects the balance sheet. Table 1 (Panel B) provides examples of asset tunneling "out" transactions.

TABLE 1: MAIN FORMS OF TUNNELING

PANEL A: CASH FLOW TUNNELING

Transaction Type	Details and Variations
Transfer Pricing	Overpaying for inputs Undercharging for outputs
Executive compensation	Excessive cash compensation Excessive “perks”
Other payments to insiders	Excessive payments for services Loans at below-market interest rates
Small scale asset purchases and sales	Overpaying for purchases Undercharging for sales

PANEL B: ASSET TUNNELING “OUT”

Transactions involving tangible assets	Sales of assets to related parties at discounts Granting use of PPE to related party at below-market rent/lease rates
Transactions involving intangible assets	Providing trade secrets and other intellectual property to related parties for below fair value
Investments in affiliates	Loans to affiliates on favorable terms
Diverting business opportunities to related parties	

PANEL C: ASSET TUNNELING “IN”

Transactions involving tangible assets	Purchasing long-term assets to company at inflated prices
Transactions involving intangible assets	Acquiring intellectual property from related parties for more than fair value.
Investments in affiliates	Equity investments in affiliates

PANEL D: EQUITY TUNNELING

Equity dilution	Issuance of shares or securities convertible into shares for less than fair value Repurchases of shares for more than fair value Excessive equity-based executive compensation
Freezeouts	Freezeout of minority shareholders for less than fair value Going dark/delisting
Insider trading	Insider buys (sells) shares in market for less (more) than fully informed market price
Sales of control	Sales of control with preferential terms for controlling shareholders Excessive golden parachutes

C. Asset Tunneling “In”

Asset tunneling “in” involves self-dealing through purchase of overpriced assets. The assets can again be tangible or intangible.²⁴

Asset tunneling “in” might seem a close cousin to asset tunneling “out,” and indeed we treated it as such in prior work.²⁵ But it has quite different impacts on financial metrics. For example, asset tunneling “out” reduces the value of the firm’s remaining assets, but need not distort the post-tunneling return on assets, turnover, or other asset-based metrics. In contrast, asset tunneling in directly inflates the balance sheet and thus suppresses ratio measures with assets in the denominator. As we discuss below, the legal and accounting rules needed to address asset tunneling “out” and “in” also differ. Table 1 (Panel C) contains examples of asset tunneling “in.”

D. Equity Tunneling

The core characteristic of equity tunneling is that it rearranges ownership claims over the firm’s assets, to the detriment of minority shareholders, without directly affecting the firm’s assets or operations. Two central forms of equity tunneling are offerings of shares (or securities convertible into shares) to insiders for below fair value and going-private transactions, often called freezeouts.

Insider trading is also a form of equity tunneling because it transfers value from uninformed investors to insiders without directly affecting firm value. So are jumbo stock option or restricted stock grants to executives, which exceed a market level of incentive compensation. Repurchases of shares from insiders for more than fair value can also be seen as equity tunneling. Such a repurchase dilutes the value of the minority shares. Sales of control at a premium which reflect the value of future expected tunneling to the purchaser of control can be understood as a form of equity tunneling. Table 1 (Panel D) provides examples of equity tunneling transactions.

E. Mixed Forms of Tunneling

Some types of tunneling will not fall neatly into one of the categories above. For example, a loan to insiders can have elements of cash-flow tunneling (if the loan is at a below-market interest rate), asset tunneling “out” if large in scale (the firm loses access to the loaned funds and may have to either replace them or forgo promising investments), and equity tunneling (the loan can be understood as giving the insiders a

24. Our case studies of Coca-Cola Enterprises and Biglari Holdings, below, provide examples of tangible and intangible asset tunneling “in,” respectively. See *infra* Parts V.A, V.C.

25. Atanasov, Black & Ciccotello (2011), *supra* note 10.

put option, which they will exercise in the bad states of the world by not repaying the loan).

Going dark (ceasing to be publicly traded) directly affects the value of minority shares (a form of equity tunneling) and facilitates other future tunneling efforts by making it harder for the public or outside shareholders to observe the insiders' actions.

A lease of company assets from a related party for more than fair value will look like cash-flow tunneling if the lease term is short relative to the life of the asset. If the lease term is long relative to asset life, the transaction looks more like asset tunneling "in." Accounting rules struggle with the distinction between short-term "operating" leases and long-term "capital" leases. Our effort to create a taxonomy of tunneling will do no better than the accountants. An assets-for-equity transaction can involve both asset and equity tunneling.

III. HOW TUNNELING IMPACTS FINANCIAL METRICS: TWO-PERIOD MODEL

In this Part we develop a simple, two-period model for how different types of tunneling affect share prices and financial metrics. For cash flow tunneling, we assume that minority shareholders do not observe the level of tunneling at each firm. They do, however, correctly estimate the level of cash flow tunneling on average across all firms, and how that average level depends on observable firm characteristics, the insiders, and the market. For asset and equity tunneling, we similarly assume that investors do not know tunneling probabilities and magnitudes at each firm, but get these estimates right, on average, including how average tunneling levels depend on observable firm characteristics.

We develop a two-period model here and extend it to infinite time in Part IV. We assume: (1) an all-equity firm, (2) zero-growth (we relax this assumption in Part IV), (3) all earnings are returned to investors as dividends, and (4) zero taxes. As measures of operating performance, we use return on assets ("ROA"—defined as earnings before interest and taxes divided by book value of assets ("EBIT"/assets)), operating margin (EBIT/sales), and turnover (sales/assets). With our assumptions of zero debt and zero taxes, EBIT equals net income, ROA equals return on equity ("ROE," defined as net income divided by book value of equity), and Tobin's q (market value of assets/book value of assets) equals market to book ratio (market value of equity/book value of equity).

The firm has one share, minority shareholders have fractional ownership α_0 at $t = 0$, and the controlling shareholder holds the remaining fractional ownership $(1 - \alpha_0)$. At $t = 0$, the firm has assets A_0 , return on assets with no tunneling ROA_0 , and no-tunneling cost of capital K_0 . The firm's "intrinsic" or "no-tunneling" per share value which will be the same for all shareholders, is:

$$IV_{no-tun} = \frac{ROA_0 * A_0}{K_0} \quad (2)$$

A. Cash Flow Tunneling

Assume that during the period which ends at $t = 0$, investors estimate that the controller has diverted a fraction d_{cf} of the firm no-tunneling income, investors expect this fraction to remain constant over time, and cash flow diversion is limited enough so that it does not affect the firm's cost of capital. The per share value of minority shares at $t = 0$ will then be:

$$MV_{0,CF tun} = \frac{(1 - d_{cf}) * ROA_0 * A_0}{K_0} \quad (3)$$

Under our assumption that the firm pays out all post-tunneling earnings as dividends, cash flow tunneling affects the market price of minority shares, as well as the firm's reported earnings, profitability, and dividends, but not its balance sheet. To first order cash flow tunneling may also not have a large effect on sales. Cash flow tunneling will then have a similar effect on a variety of financial metrics with share price or profits in the numerator and sales or assets in the denominator—they will drop by a factor $(1 - d_{cf})$. In contrast, cash flow tunneling will not affect the P/E ratio, because it has a similar effect on both the numerator and the denominator. Thus, markers for a firm with significant cash flow tunneling, relative to its peers, will be suppressed Tobin's q and ROA, but a normal P/E ratio.

Some forms of cash flow tunneling, such as purchase of overpriced inputs, will affect cost of goods sold ("COGS"), and thus gross margin, defined as gross profit/sales, where gross profit=(sales-COGS). A firm which engages in more of this form of transfer pricing than its competitors will have suppressed gross margin. For firms which sell commodities, transfer pricing can also be detected by computing sales per unit of output. For example, an oil company which sells to an intermediary,

controlled by insiders, at a discount to fair market value will have lower sales per barrel of oil sold than its competitors.²⁶

Other forms of cash flow tunneling, such as excess executive cash compensation or purchase of overpriced services from affiliates, affect SG&A, and thus reduce operating margin, but do not affect gross margin. Although our model assumes an all equity firm, if we relax this assumption, loans to insiders at a below-market interest rate affect net income but not operating margin. We summarize the effects of different types of tunneling on financial metrics in Table 2.

Given sufficient data about a firm's financial metrics, one can potentially isolate which types of tunneling are occurring. For example, transfer pricing is potentially important in the Coke example below, though we find instead evidence principally for asset tunneling "in." In contrast, a major form of tunneling by Chinese parent firms from publicly traded subsidiaries appears to be through loans by the subsidiary to the parent.²⁷ Bertrand, Mehta, and Mullainathan report that for firms within Indian business groups, EBITDA/assets underresponds to shocks to industry profitability. This is consistent with the group moving profits from high-profit firms to low-profit firms. The effect is concentrated in nonoperating expenses, suggesting that tunneling is mostly through non-routine transactions rather than, say, transfer pricing.²⁸

Some forms of cash flow tunneling will affect sales while others will not. For example, Gazprom's sales of gas at low prices to intermediaries will suppress both its gross margin and its sales. In contrast, in our case study of Coca-Cola ("Coke") and its bottling affiliate, Coca Cola Enterprises ("Bottling"), if Bottling overpaid Coke for cola syrup, that would reduce Bottling's margins but would not directly affect its sales.

If cash flow tunneling is significant in scale, it can also affect the firm's cost of capital. In particular, if investors expect the level of cash flow tunneling to have a systematic component, the cost of equity capital could rise.²⁹ In either case, equation (3) will understate the effect of cash flow tunneling on minority share prices.

26. An example from prior work by one of us, Bernard Black, Reinier Kraakman & Anna Tarassova, *Russian Privatization and Corporate Governance: What Went Wrong?*, 52 STAN. L. REV. 1731, 1736–37 (2000) ("Bank Menatep (controlled by kleptocrat Mikhail Khodorkovski) acquired Yukos, a major Russian oil holding company, in 1995. For 1996, Yukos' financial statements show revenue of \$8.60 per barrel of oil—about \$4 per barrel less than it should have been [based on world oil prices].") (footnote omitted).

27. Jiang, Lee & Yue (2010), *supra* note 3.

28. Bertrand, Mehta & Mullainathan (2002), *supra* note 3, at 143.

29. Simon Johnson, Peter Boone, Alasdair Breach & Eric Friedman, *Corporate Governance in the Asian Financial Crisis*, 58 J. FIN. ECON. 141 (2000) (providing evidence that tunneling rose during the East Asian financial crisis at firms in countries affected by the crisis).

Table 2. Impact of Types of Tunneling on Valuation Metrics

The table relies on the following definitions and assumptions. Unprimed (primed) amounts reflect expected discounts and probabilities before (after) an initial asset or equity tunneling event: d_{ef} = fraction of net income expropriated through cash flow tunneling (expected to recur indefinitely), d_a (d'_a) = fraction of assets subject to asset tunneling, d_{syn} (d'_{syn}) = expected effect of future asset tunneling on ROA and operating margin, d_{eq} (d'_{eq}) = fractional reduction in minority equity share due to equity tunneling. We denote pre-tunneling probability of asset and equity tunneling by $\pi_{a,pre}$ and $\pi_{e,pre}$ respectively, and the corresponding measures of future probability, following an initial tunneling event, as $\pi_{a,post}$ and $\pi_{e,post}$.

	Gross Margin (Gross Profit/Sales)	Operating Margin (EBIT/Sales)	Turnover (sales/assets)	Return on Assets (EBIT/Assets)	EBITDA/Assets	Tobin's q or market/book	P/E ratio
Cash flow tunneling							
transfer pricing	Decrease ~ $f(d_{ef})$	Decrease ~ d_{ef}	Decrease ~ $f(d_{ef})$	Decrease ~ d_{ef}	Decrease ~ d_{ef}	Decrease ~ d_{ef}	No effect to first order
excess insider compensation	No effect	Decrease ~ d_{ef}	No effect	Decrease ~ d_{ef}	Decrease ~ d_{ef}	Decrease ~ d_{ef}	No effect to first order
Asset tunneling							
Ex. Ante (risk of future event)	No effect	No effect	No effect	No effect	No effect	Decrease ~ $f(\pi_{a,pre}, d_a, d_{syn})$	Decrease ~ $f(\pi_{a,pre}, d_a, d_{syn})$
Realized cheap sale of assets	Decrease ~ $f(d_{syn})$	Decrease ~ d_{syn}	Decrease ~ $f(d_{syn})$	Decrease ~ d_{syn}	Decrease ~ d_{syn}	Decrease ~ $f(\pi_{a,post}, d'_a, d'_{syn})$	Decrease ~ $f(\pi_{a,post}, d'_a, d'_{syn})$
Realized overpriced purchase of assets	Decrease ~ $f(d_{syn})$	Decrease ~ $f(d_{as}, d_{syn})$	Decrease ~ $f(d_{as}, d_{syn})$	Decrease ~ $f(d_{as}, d_{syn})$	Decrease ~ $f(d_{as}, d_{syn})$	Decrease ~ $f(\pi_{a,post}, d'_a, d'_{syn})$	Decrease ~ $f(\pi_{a,post}, d'_a, d'_{syn})$
Equity tunneling							
Ex. Ante (risk of future event)	No effect	No effect	No effect	No effect	No effect	Decrease ~ $f(\pi_{e,pre}, d_{eq})$	Decrease ~ $f(\pi_{e,pre}, d_{eq})$
Realized equity dilution	No effect	No effect	No effect	No effect	No effect	Decrease ~ $f(\pi_{e,post}, d'_{eq})$	Decrease ~ $f(\pi_{e,post}, d'_{eq})$
Realized freezeout	No effect	No effect	No effect	No effect	No effect	Not meaningful	Not meaningful

B. Asset Tunneling “Out”

We next put aside cash flow tunneling and explore how the expected probability and magnitude of asset tunneling out affects minority share prices and financial metrics. We again assume that at $t = 0$, the firm has assets A_0 , no-tunneling return on assets ROA_0 , no-tunneling cost of capital K_0 , and, thus, intrinsic “no-tunneling” per share value given by equation (2).

Assume that at $t = 0$, investors expect the controller to engage in asset tunneling “out” during the next period with probability $\pi_{a,pre}$. Here, we add the “pre” subscript to allow the expected probability of future tunneling to change to a new value $\pi_{a,post}$ at $t = 1$ after the controller does or does not in fact tunnel assets. We assume for simplicity that if assets are tunneled, they are simply stolen (zero purchase price). Let d_a be the proportion of the firm’s assets which are diverted via asset tunneling, if it occurs. Tunneling of assets out of the firm can also reduce synergy and thus reduce the profitability of the firm’s remaining assets by a fraction d_{syn} . This loss of synergy aside, we assume for simplicity that the tunneled assets earn the same ROA that is earned by the firm as a whole.

We assume that to first order, asset tunneling does not affect investors’ required rate of return K_0 . The per-share value of minority shares at $t = 0$ with anticipated future asset tunneling will then be:

$$MV_{0,asset\ tun\ out} = \frac{(1 - \pi_{a,pre} d_a) * (1 - \pi_{a,pre} d_{syn}) * ROA_0 * A_0}{K_0} \quad (4)$$

At time $t = 1$, asset tunneling “out” either has or has not occurred, both for this firm and other firms in the market. Investors will update their expectations about future asset tunneling to a new probability of future tunneling $\pi_{a,post}$ and new expected magnitudes d'_a and d'_{syn} . The value of minority shares at $t = 1$ will be:

$$MV_{1,asset\ tun\ out} = \frac{(1 - \pi_{a,post} d'_a) * (1 - \pi_{a,post} d'_{syn}) * ROA_1 * A_1}{K_0} \quad (5)$$

Here, we assume for simplicity no change in cost of capital K_0 . One can model investor updating of the firm’s cost of capital to reflect large scale tunneling by allowing K_0 to vary with the expected probability and magnitude of asset tunneling. ROA at time 1 (ROA_1) will equal $ROA_0 *$

$(1-d_{syn})$ if asset tunneling “out” occurs and ROA_0 otherwise. Assets at time 1 (A_1) will equal $A_0 * (1-d_a)$ if asset tunneling “out” occurs and A_0 otherwise. Note that if asset tunneling “out” occurs, share prices will be affected by both the parameters for actual past tunneling d_{syn} and d_a , and the parameters for future expected tunneling $\pi_{a,post}$, d'_a , and d'_{syn} .

Expected asset tunneling “out” affects the market price of minority shares, but it does not affect the firm’s earnings, profitability, dividends, or balance sheet until it occurs. It will thus have a similar effect on a variety of financial metrics with share price in the numerator and sales or assets in the denominator. At $t=0$, these metrics will drop, relative to no-tunneling levels, by a factor $(1 - \pi_{a,pre} * d_a) * (1 - \pi_{a,pre} * d_{syn})$. In contrast, expected asset tunneling “out” will not affect financial metrics which depend only on the income statement, the balance sheet, or both, such as earnings, operating margin, and ROA.

Markers for a firm with significant risk of future asset tunneling (or, as we will see below, equity tunneling), relative to its peers, will be suppressed Tobin’s q and P/E, but normal ROA.

An interesting implication from our analysis is that if the tunneled assets have no synergies with other assets and generate similar ROA, then asset tunneling “out” will not reduce Tobin’s q . Indeed, if the asset tunneling “out” is not expected to be repeated, expected tunneling will reduce *ex ante* but not *ex post* Tobin’s q , and Tobin’s q will rise.

C. Asset Tunneling “In”

We model asset tunneling “in”—the firm’s purchase of assets at inflated prices— as the firm replacing a fraction d_a of its productive assets with new assets that generate zero ROA and previously had synergy d_{syn} with the remaining assets. Even though the acquired assets have no value, the firm’s accountants will assume the transaction was at fair value, and record the new assets as having value $= d_a * A_0$. If the apparent market value of the acquired assets is, say, $A_{in} < (d_a * A_0)$ the accountants will still assume the purchase was at fair value, and record the firm as having acquired “goodwill” equal to the difference between purchase price and apparent value $((d_a * A_0) - A_{in})$. Thus, asset tunneling “in” will cause net income to fall, but assets will not change. Hence ROA will fall.

Under these assumptions, equation (4) will provide the value of minority shares at $t = 0$ for both asset tunneling “out” (with a fraction d_a of the assets sold at zero price) and asset tunneling “in” (with a fraction d_a of the assets replaced with zero-value assets). Similarly, equation (5) will provide the value of minority shares at $t = 1$ for both asset tunneling “out” and asset tunneling “in.” The expressions for ROA_1 and A_1 , however, will differ from their asset tunneling “out” counterparts. For asset tunneling in, $ROA_1 = ROA_0 * (1 - d_a) (1 - d_{syn})$ if asset tunneling “in” occurs between $t = 0$ and $t = 1$ and ROA_0 otherwise.

Under the assumption that the new unproductive assets replace existing assets, A_t will equal A_0 whether asset tunneling “in” occurs or not. If we allowed for leverage and for the firm to use debt to acquire the assets, then asset tunneling “in” will increase total assets but not book value of equity.

Realized asset tunneling “in” will affect different financial metrics in varying ways. For example, our Coke-Bottling case study involves apparent asset tunneling “in,” with Bottling using borrowed funds to overpay Coke for bottling plants. This artificially inflated Bottling’s assets and thus its depreciation and amortization charges. The joint effect of lower numerator and higher denominator will severely suppress ROA. The excess depreciation or amortization of the overpriced assets will suppress EBIT and thus operating margin (EBIT/sales), but less severely than EBIT/assets since only the numerator will be directly affected. Asset turnover (sales/assets) will also be suppressed. But gross margin ((sales-COGS)/sales) and EBITDA/sales may not be affected, and P/E will be affected only through the effect of asset tunneling “in” on synergy.

We thus see important differences between the effects of different types of tunneling on financial metrics:

- Cash flow tunneling will affect ROA and operating margin but not P/E;
- Expected future asset tunneling “out” or “in” will affect P/E but not ROA or operating margin;
- As we discuss below, expected asset tunneling “out” or “in” will increase apparent cost of capital;
- Realized asset tunneling “out” will affect ROA and P/E only through its effect on synergy;
- Realized asset tunneling “in” will strongly reduce ROA and, less strongly, reduce operating income and operating margin, even if it does not affect synergy; and
- All three forms of tunneling will affect shares prices and thus Tobin's q .

D. Equity Tunneling

We next assume no cash flow or asset tunneling and explore how minority share prices and financial metrics depend on the probability and expected magnitude of equity tunneling. We consider two types of equity tunneling, equity dilution and freezeout. At the cost of additional complexity, one could model other types of equity tunneling where the effect of tunneling depends on future states of the world such as loans to insiders (which will not be repaid in bad future states), or stock option grants to insiders (which will dilute minority shareholders in good future states). We again assume that at $t = 0$, the firm has assets A_0 , no-tunneling return on assets ROA_0 , no-tunneling cost of capital K_0 (not af-

ected by tunneling), and thus “no-tunneling” per share value given by equation (1).

We assume that at $t = 0$, investors expect insiders to engage in equity tunneling during the next period with probability $\pi_{eq,pre}$. As we did for asset tunneling, we allow the expected probability of future tunneling to change to a new value $\pi_{eq,post}$ at $t = 1$ after the controller does or does not in fact conduct equity tunneling. We capture the degree of equity tunneling, if it occurs, by assuming that equity tunneling will reduce minority shareholders’ fractional ownership by a factor $(1 - d_{eq})$, with additional shares issued for no payment.

The equilibrium per share value of minority shares at $t = 0$ with expected equity tunneling is:

$$MV_{0,eq\ tun} = \frac{(1 - \pi_{eq,pre} d_{eq}) * ROA_0 * A_0}{K_0} \quad (6)$$

At time $t = 1$ an equity tunneling transaction will have occurred or not, both for this firm and other firms in the market, and investors will update their expectations of future equity tunneling accordingly. If a freezeout occurs, minority shareholders receive the freezeout price, which we assume is at a discount $d_{eq,obs}$ (for observed) to the prefreezeout market price. The realized discount will generally be less than the discount to intrinsic value d_{eq} because the prefreezeout market price was already reduced by anticipation of possible equity tunneling. The minority shareholders will receive in the freezeout a per share amount:

$$MV_{freezeout} = (1 - d_{eq,obs}) * MV_{0,eq\ tun} = (1 - d_{eq,obs}) \frac{(1 - \pi_{eq,pre} d_{eq}) * ROA_0 * A_0}{K_0} \quad (7)$$

The freezeout discount $(1 - d_{eq})$ or $(1 - d_{eq,obs})$ appears twice—minority shareholders receive a discount to an already discounted price. Note that the freezeout will be at a discount to intrinsic value even if the observed discount $d_{eq,obs}$ is zero.

For equity dilution let d'_{eq} be shareholders’ expectation for future equity tunneling at $t = 1$. The per share value of minority shares at $t = 1$ if equity tunneling has not occurred will be given by:

$$MV_{1,eq\ tun}^{no\ dilute\ by\ t=1} = \frac{(1 - \pi_{eq,post} d'_{eq}) * ROA_1 * A_1}{K_0} \quad (8)$$

This is similar to equation (6), with d'_{eq} replacing d_{eq} and $\pi_{eq,post}$ replacing $\pi_{eq,pre}$. The per share value of minority shares if dilution occurs between $t = 0$ and $t = 1$ at level $d_{eq,obs}$ will be:

$$MV_{1,tun}^{dilute\ by\ t=1} = (1 - d_{eq,obs}) \frac{(1 - \pi_{eq,post} d'_{eq}) * ROA_1 * A_1}{K_0} \quad (9)$$

Here, for simplicity, we assume that shares are issued only to insiders, at zero price. More generally, realized dilution will depend on a combination of discount of issuance price to market value and the number of shares issued.³⁰ Similar to freezeouts, the post-dilution market price is discounted twice, once to reflect the dilution which has occurred and again in anticipation of future dilution. Our Biglari Holdings case study, presented below, provides an example of double dilution. Note that the sale of equity to insiders will be dilutive even if the sale is at market value.

A central aspect of equity tunneling, which distinguishes it from cash flow and asset tunneling, is that it operates directly on ownership claims and largely bypasses the financial statements.³¹ It thus does not affect financial-statement-based metrics such as operating margin and ROA. Anticipated *future* equity tunneling affects share price and thus market-based metrics such as Tobin's q and P/E. The effect of a *realized* dilutive equity offering is more complex. If the offering leaves unchanged the expected probabilities and magnitudes of future tunneling, it will affect share price and thus P/E, but not Tobin's q , assuming that the firm can reinvest any cash it receives for shares at the same rate of return that it earns on its existing assets.

E. Unified Equation

We now present a simple, unified equation for how firm market value depends on the expected level of cash flow tunneling and the expected probability and magnitude of asset and equity tunneling. All terms are defined above. We assume that a single probability $\pi_{a,pre}$ and magnitude d_a can be used to address both asset tunneling "out" and asset tunneling "in." The per share value of minority shares at time $t = 0$ will be:

$$MV_{0,min} = \frac{(1-d_{cf})(1-\pi_{a,pre}d_{syn})(1-\pi_{a,pre}d_a)(1-\pi_{eq,pre}d_{eq}) * ROA_0 * A_0}{K_0} \quad (10)$$

The central takeaway from Equation (10), compared to its narrower predecessors, is the compound effect of multiple forms of tunneling on the value of minority shares. We provide a numerical example below.

At time $t = 1$, asset and equity tunneling either will or will not have occurred for this firm and other firms in the market. Investors will up-

30. We develop a more elaborate formula for the effect of an equity offering on minority share value, with separate components for fraction of previously outstanding shares issued, discount to market value, and fractional participation by minority shareholders in Atanasov, Black & Ciccotello (2011), *supra* note 10.

31. This is only approximately true for an actual equity offering, which brings capital into the firm. It can be made true by assuming that the firm does not need the extra capital, and promptly pays it out as a prorata dividend to all shareholders.

date their expectations accordingly. If a freezeout occurs, minority shareholders will receive the freezeout price at a discount $d_{eq,obs}$ to the prefreezeout market price. This is a per share amount equal to:

$$MV_{freezeout} = (1 - d_{eq,obs}) * MV_{0,tun} \quad (11)$$

The realized discount $d_{eq,obs}$, comes on top of the “anticipation” discounts from all three types of tunneling. Indeed, a controller could pay market price in the freezeout, or even a premium, and still freeze out the minority at a large discount to intrinsic value.

If there is no freezeout, the per share value of minority shares at $t = 1$ will be:

$$MV_{1,tun} = \gamma_1 * \frac{(1 - d_{cf})(1 - \pi_{a,post} d'_{syn})(1 - \pi_{a,post} d'_a)(1 - \pi_{eq,post} d_{eq}) * ROA_1 * A_1}{K_0} \quad (12)$$

Here $\gamma_1 = (1 - d_{eq,obs})$ if a dilutive equity offering occurs and 1 otherwise; ROA_1 will be reduced relative to its no-tunneling level by a factor $(1 - d_{syn})$ if asset tunneling “out” occurs, by a factor $(1 - d_{syn}) * (1 - d_a)$ if asset tunneling “in” occurs, and will be ROA_0 otherwise; and A_1 will be reduced relative to its no-tunneling level by a factor $(1 - d_a)$ if asset tunneling “in” occurs, and will be A_0 otherwise.

Note that tunneling, in whatever form, need not result in unfairness to minority shareholders. That depends on the price they paid for their shares. Our equilibrium framework assumes implicitly that diversified shareholders correctly assess tunneling risks and pay appropriate prices, at least on average.

The unified expression for MV_0 in equation (10) lets us estimate how tunneling affects a firm’s apparent cost of capital in a two-period setting.³² Our model assumes that tunneling will not affect the firm’s actual cost of capital K_0 . Expected future asset tunneling and equity tunneling will still increase the firm’s *observed* cost of capital, defined as $K_{0,obs} = E_0 / MV_0$, by reducing MV_0 . In our zero-leverage model, $K_{0,obs}$ is also the inverse of the P/E ratio. The relationship between observed and actual cost of capital at $t = 0$ is:

$$K_{0,obs} = \frac{K_0}{(1 - \pi_{a,pre} d_{syn})(1 - \pi_{a,pre} d_a)(1 - \pi_{eq,pre} d_{eq})} \quad (13)$$

32. We discuss the effect of tunneling on cost of capital in an infinite horizon setting in Part IV, *infra*.

F. *A Numerical Illustration*

To illustrate the effects of different types of tunneling on financial metrics we present a simplified example. Take six firms with identical pretunneling values $A_0 = 1$, $ROA_0 = 10\%$, and $K_0 = 10\%$. The first firm has zero tunneling risk and will serve as a benchmark. The second firm experiences constant cash flow tunneling with $d_{cf} = 0.25$. The third (fourth) firm faces only asset tunneling “out” (“in”) risk with parameters $d_a = 0.5$, $d_{syn} = 0.1$, and $\pi_{a, pre} = 0.5$. The fifth firm faces only equity tunneling risk with parameters $d_{eq} = 0.5$ and $\pi_{eq, pre} = 0.5$. The sixth firm faces a combination of cash flow tunneling, asset tunneling “out,” and equity tunneling with the same parameters for each tunneling type as firms 2, 3, and 5. We assume that equity tunneling is through dilution.

Figure 1a presents the values for Tobin’s q , ROA, and P/E ratio (the inverse of observed cost of capital) for the six firms before and after asset and equity tunneling, assuming that realized asset and equity tunneling does not change investor estimates of the probability and magnitude of further tunneling of this type. Figure 1b presents the values for Tobin’s q and P/E ratio, assuming that once asset or equity tunneling occurs the probability of further tunneling of this type drops to zero. Figure 1b does not include ROA results, because they are the same as in Figure 1a.

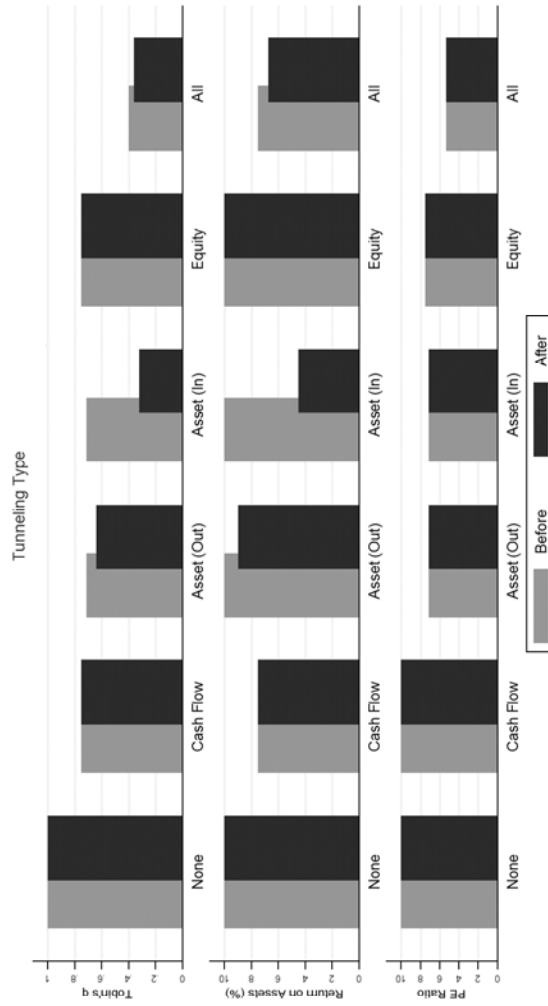


Figure 1a. Effects of Different Types of Tunneling on Financial Metrics (constant probabilities of asset and equity tunneling)

The figure presents Tobin's q , ROA, and P/E ratio before and after the indicated type of tunneling for six firms that all have $A_{0,t}=1$, $ROA_{0,t}=10\%$, and $K_{0,t}=10\%$. The first firm has no tunneling. The second firm (cash flow tunneling) has $d_{c,t}=0.25$. The third firm (asset tunneling out) has $d_{a,t}=0.5$, $d_{a,t,pre}=0.1$, and $\pi_{a,t,pre}=0.5$. The fourth firm (asset tunneling in) has $d_{a,t}=0.5$, $d_{a,t,pre}=0.1$, and $\pi_{a,t,pre}=0.5$. The fifth firm (equity tunneling) has $d_{e,t}=0.5$, $d_{e,t,pre}=0.5$, and $\pi_{e,t,pre}=0.5$. The last firm (cash flow tunneling, asset capital cut, and equity tunneling through dilution, with $d_{c,t}=0.25$, $d_{c,t,pre}=0.5$, $d_{a,t,pre}=0.1$, $\pi_{a,t,pre}=0.5$, $d_{e,t,pre}=0.5$, and $\pi_{e,t,pre}=0.5$). We assume that realized asset or equity tunneling does not change the probability of additional tunneling of this type.

Consider first the effects of tunneling on ROA. As Figure 1a shows, cash flow tunneling reduces ROA. So does realized asset tunneling. But realized asset tunneling “in” has a much larger impact on ROA than asset tunneling “out.” Asset tunneling “out” affects ROA only through lost synergies. Conversely, equity tunneling does not affect ROA (either before or after tunneling).

Consider next the P/E ratio. Cash flow tunneling leaves P/E ratios unaffected. In contrast, expected asset and equity tunneling have large negative effects. The pre- and post-tunneling P/E ratios are identical, but this is driven by our assumption that tunneling probabilities remain the same after tunneling occurs. These ratios would fall if one tunneling event caused investors to increase their expectations of future tunneling. If we instead assume, unrealistically, that if asset or equity tunneling occurs, it will not occur again, all firms’ post-tunneling P/E ratios will equal the ratio for the no-tunneling firm. This is shown in Figure 1b.

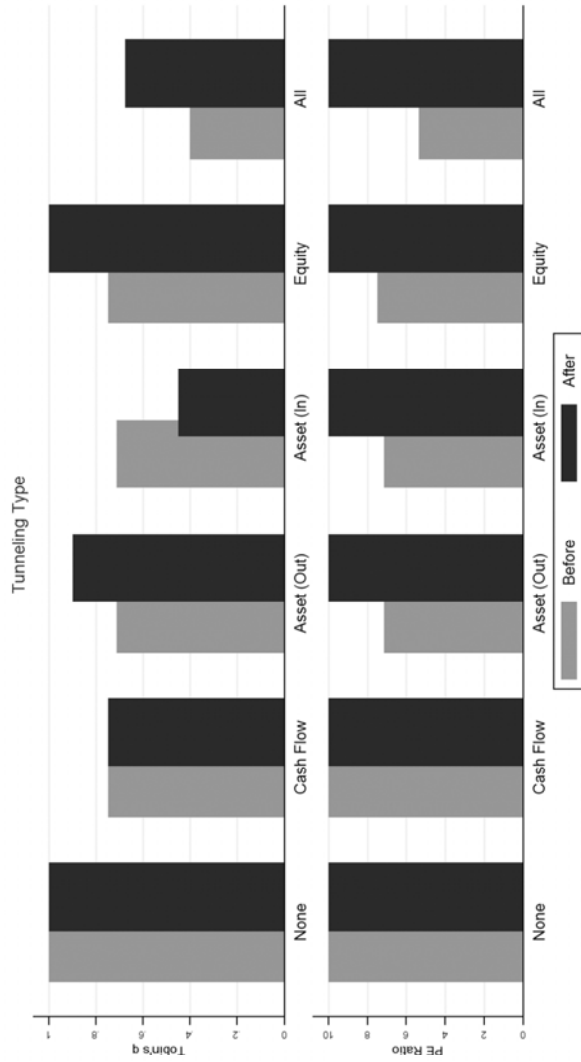


Figure 1b. Effects of Different Types of Tunneling on Financial Metrics (zero probability of more than one asset and equity tunneling event)

The figure presents Tobin's q and P/E ratio before and after the indicated type of tunneling for the same six hypothetical firms as in Figure 1a. We assume that once asset or equity tunneling occurs, the probability of additional tunneling of this type drops to zero. Figure 1b does not include an ROA graph, because this graph will be identical to Figure 1a.

The effects of tunneling on Tobin's q are especially striking. Firm 6, which is at risk for cash flow tunneling, asset tunneling "out," and equity tunneling has a pretunneling Tobin's q that is only 40% of the no-tunneling level. If we assume constant tunneling expectations (Figure 1a), then post-tunneling Tobin's q does not change as a result of an equity tunneling event, declines slightly after asset tunneling "out" due to lost synergy, but drops sharply for asset tunneling "in" to around 30% of the no-tunneling level. If we instead assume that asset or equity tunneling will occur only once, then Tobin's q will rise after equity tunneling and asset tunneling "out," but will still fall after asset tunneling "in."

IV. MODEL EXTENSION: INFINITE TIME HORIZON

Our two-period model generates rich predictions about the impact of various tunneling techniques on financial metrics, but it needs to be generalized to infinite horizon both to allow for recurring tunneling risk over an extended period of time and to illustrate its implications for asset pricing models. In this Part we develop one such generalization.

A. Infinite Horizon with Growth and Constant Tunneling Expectations

In this Section we extend the two-period model developed above to an infinite horizon/continuous time framework with constant growth at a rate g . We assume investors expect the fraction of cash flow tunneled to remain constant at d_{cf} , and assign constant equity and asset tunneling discounts and annual probabilities. To simplify the notation, let $\delta_{eq} = \pi_{eq} * d_{eq}$; $\delta_{syn} = \pi_a * d_{syn}$; and $\delta_a = \pi_a * d_a$. The per share market value of minority shares is a straightforward extension of Equation (10) to an infinite time horizon. At any given point in time such as $t = 0$, the observed cost of capital $K_{0, obs}$ is:

$$K_{0, obs} = \frac{K_0}{(1 - \delta_{syn})(1 - \delta_a)(1 - \delta_{eq})} \quad (14)$$

This is similar to the familiar formula for a growing perpetuity with growth rate g_{econ} , except that it also includes the negative "growth factors" due to tunneling, δ_{eq} , δ_a , and δ_{syn} . Equation (14) can be reduced to a closed form expression:

$$\begin{aligned} MV_0 &= [ROA_0 * A_0 * (1 - d_{cf})] * \left[\frac{1}{(K_0 - g_{econ} + \delta_{eq} + \delta_a + \delta_{syn} + (\text{interaction terms}))} \right] \quad (15) \\ &= CF_0 * \left[\frac{1}{(K_0 - g_{econ} + K_{tun})} \right] \end{aligned}$$

Here $CF_0 = ROA_0 * A_0 * (1 - d_{cf})$ is the pretunneling cash flow observed by minority shareholders, and $K_{unn} = [\delta_{eq} + \delta_a + \delta_{syn} + (\text{interaction terms among } \delta_{eq}, \delta_a, \delta_{syn}, \text{ and } g_{econ})]$. The interaction terms are likely to be small as long as each of δ_{eq} , δ_a , δ_{syn} , and g_{econ} are well below 1. Equation (15) is similar to the standard Gordon model with an apparent cost of capital K_{total} , which equals the no-tunneling cost of capital K_0 , plus K_{unn} . K_{unn} derives partly from countrywide tunneling risk and partly from firm-level risk. It (or its components, if separately observable) can be understood as similar to an asset pricing factor.

It will often be possible to empirically estimate the effect of equity and asset tunneling on apparent cost of capital. One can (1) observe firms' reported cash flows, (2) use standard methods to estimate firms' apparent cost of capital K_{total} ,³³ and (3) develop a no-tunneling estimate of cost of capital K_0 , based on a standard asset pricing model. The difference between K_{total} and K_0 offers an estimate of the effect of tunneling risk on apparent cost of capital.

A complication arises, however. If one estimates K_{total} using standard asset pricing factors and ignores the impact of tunneling risk, omitted variable bias could affect the coefficient estimates on the standard factors. To avoid this bias one needs to simultaneously estimate the effects of standard asset pricing factors and tunneling risk on apparent cost of capital.

Is the omitted variable bias in standard asset pricing models likely to be important in practice? There is reason for concern. Tunneling risk is likely to be correlated with firm size.³⁴ Market value, and hence market/book ratio, is directly affected by tunneling risk. Hence, firms' loadings on these two factors are likely to be misestimated, especially for countries or firms with high tunneling risk. Cross-country estimates of the private benefits of control suggest that tunneling risk may be large in many countries.³⁵

The effect of tunneling risk on apparent cost of equity capital has an analogy in debt markets. Default risk affects both cash flows and systematic risk, yet it is often observed and analyzed primarily as a higher promised yield on debt—a spread between the yield on corporate bonds and the yield on similar duration Treasuries. The realized yield across all states of the world—the true cost of debt capital—will be lower than the promised yield due to defaults. Similarly, tunneling risk implies a higher apparent cost of capital, but investors' realized return across all states of the world will be lower than this apparent cost.

The second form of Equation (15), in which $MV_0 = CF_0 / K_{total}$, can be interpreted as a price/earnings or price/cash flow ratio. One thus sees

33. See, e.g., Luzi Hail & Christian Leuz, *International Differences in the Cost of Equity Capital: Do Legal Institutions and Securities Regulation Matter?*, 44 J. ACCT. RES. 485, 489 (2006).

34. Atanasov, Black, Ciccotello & Gyoshev (2010), *supra* note 3 (providing evidence from Bulgaria that larger firms have lower equity tunneling risk).

35. Dyck & Zingales (2004), *supra* note 4, at 552; Nenova (2003), *supra* note 4, at 329.

that P/E ratio is directly increased by asset and equity tunneling, but is not directly affected by cash flow tunneling.

B. Value Effects of Realized Asset or Equity Tunneling

If asset or equity tunneling occurs, the infinite time expression in Equation (15) will remain the same, but the values will change to reflect investors' new expectations. Below, we assume equity tunneling through dilution, and let K'_{tun} denote the contribution of expected future tunneling to apparent cost of capital *following* a tunneling event. Realized equity tunneling will reduce minority shareholders' share of observed cash flows by a factor $(1 - d_{eq, realized})$. It will also affect expectations about future tunneling. The change in market value due to realized equity tunneling will be:

$$\Delta MV(\text{equity tunneling}) = CF_0 \left\{ [1 - d_{eq, realized}] \left[\frac{1}{(K_0 - g_{econ} + K'_{tun})} \right] - \left[\frac{1}{(K_0 - g_{econ} + K_{tun})} \right] \right\} \quad (16)$$

Per share market value (and financial metrics based on market value) will fall due to dilution. It will also rise (fall) if the realized tunneling causes investors to decrease (increase) their expectations for the likelihood and magnitude of future tunneling. There will be a *tendency* (but no certainty) for realized equity tunneling to reduce market value and related metrics.

A similar formula can be developed for realized asset tunneling. The change in market value due to asset tunneling "out" will be:

$$\Delta MV(\text{asset tun out}) = CF_0 \left\{ [(1 - d_{a, obs})(1 - d_{syn, obs})] \left[\frac{1}{(K_0 - g_{econ} + K'_{tun})} \right] - \left[\frac{1}{(K_0 - g_{econ} + K_{tun})} \right] \right\} \quad (17)$$

Per share market value will fall to reflect reduced assets and loss of synergy. It will rise (fall) if the realized tunneling causes investors to decrease (increase) their expectations for the likelihood and magnitude of future asset tunneling. There will again be a tendency for realized asset tunneling to reduce market value and related metrics.

V. THREE CASE STUDIES ILLUSTRATING THE TUNNELING FRAMEWORK

In this Part, we illustrate the use of our tunneling framework with three case studies. Two are in the United States: Coca Cola and its partially owned bottling subsidiary, Coca Cola Enterprises; and Biglari Holdings and its Chairman, Sardar Biglari. The third case study is in an emerging market (Gazprom in Russia).

A. Coca Cola and Coca-Cola Enterprises

A variety of transactions from 1987 to 1996 between Coke and Bottling illustrate the potential for cash flow and the likely reality of asset

tunneling “in,” enforced by a parent company (Coke) against a partly owned subsidiary (Bottling).³⁶ Bottling’s principal business is to bottle and distribute Coke products. Coke initially owned 100% of Bottling, but sold 51% to the public through an IPO in late 1986.³⁷ Coke chose to hold just under 50% of Bottling so that it could retain control, yet would not be required to include Bottling in its consolidated financial statements. Coke claimed not to control Bottling, in order to deconsolidate its results from Coke’s consolidated financial statements.³⁸ This was a thin pretense even apart from Coke’s near majority stake. A majority of Bottling’s directors were Coke or Bottling executives, large investors in Coke, or consultants to Coke.³⁹ But Coke’s auditors accepted the pretense.

Once the spinoff had occurred, Coke’s managers had incentives to shift profits from Bottling to Coke, thus boosting Coke’s performance at Bottling’s expense. Improved performance by Coke would presumably benefit Coke’s managers, perhaps through incentive compensation. As we discuss below, there is evidence that Coke engaged in extensive asset tunneling “in” at Bottling, especially during Roberto Goizueta’s tenure as Coke’s CEO which lasted from 1981 until he died in 1997. In contrast, there is little evidence that Coke engaged in cash flow tunneling from Bottling.

Bottling buys syrup from Coke. In 1993 (the year of Bottling’s first electronically available proxy statement) these purchases accounted for \$1.2 billion (40%) of Bottling’s cost of goods sold.⁴⁰ While there is no market price for Coke syrup, we can evaluate Bottling’s profit margins relative to its peers and to the pre-IPO margins reported in the IPO prospectus, to see if there is evidence of cash flow tunneling.

36. This case study draws in part on a detailed analyst report on Coke’s transactions with Bottling. Albert Meyer, Dwight Owsen & John Brozovsky, *What is KO Worth: An Unconventional and Critical Analysis of the Quality of Coca-Cola Earnings* (1999) (unpublished manuscript) (on file with authors). The transactions we describe also led to a shareholder lawsuit, which was dismissed on procedural grounds. See *In re Coca-Cola Enters., C.A. No. 1927-CC, 2007 WL 3122370*, at *2 (Del. Ch. Oct. 17, 2007) *aff’d sub nom. Int’l Bhd. Teamsters v. Coca-Cola Co.*, 954 A.2d 910 (Del. 2008). For more general discussion of tunneling between U.S. parents and their subsidiaries, see Atanasov, Boone & Haushalter (2010), *supra* note 2.

37. Richard W. Stevenson, *Coca-Cola to Sell 51% of Bottler*, N.Y. TIMES (Sept. 9, 1986), <http://www.nytimes.com/1986/09/09/business/coca-cola-to-sell-51-of-bottler.html>.

38. See CONSOLIDATION OF ALL MAJORITY-AWARD SUBSIDIARIES, Statement of Financial Accounting Standards No. 94 (Fin. Acct. Standards Bd. 1987) and THE EQUITY METHOD ACCOUNTING TO INVESTMENTS OTHER THAN COMMON STOCK, Accounting Principles Board Opinion No. 18 (1971). Under these accounting rules, if one company (parent) owns between 20% and 50% of a second company (sub), parent can account for sub using the equity method, unless parent controls sub. Consolidation is required if parent owns 50% or more of sub.

39. Meyer, Owsen & Brozovsky (1999), *supra* note 36.

40. Coca-Cola Enterprises, Proxy Statement for Annual Meeting of Share Owners to be held April 13, 1994 (Mar. 8, 1994), available at <http://www.sec.gov/Archives/edgar/data/804055/0000950144-94-000572.txt>.

Coke also repeatedly sold tangible assets (bottling plants) and intangible assets (franchise rights) to Bottling.⁴¹ The asset tunneling “in” question is whether Bottling overpaid for these assets. The purchase prices far exceeded the value of the tangible assets. The excess of the purchase price over the value of tangible assets was recorded as franchise rights. This intangible asset accumulated to the extent that by 1997 almost two-thirds of Bottling’s total assets were intangible franchise rights obtained through post-IPO purchases of bottling plants from Coke.⁴²

Our discussion above of asset tunneling “in” indicates that overpriced sales of assets by Coke to Bottling would both reduce Bottling’s net income (via amortization expense for the franchise rights) and increase its assets, leading to reduced ROA. Is there evidence that this happened?

Table 3 compares Bottling’s financial metrics to a peer group of four other bottling firms from 1987–1996. The peer group is imperfect, as three of the four are Pepsi bottlers, but these are the only publicly traded bottlers, and thus the only comparison firms with available data. Bottling actually has a higher gross margin than its peers. Thus, there is no evidence that Coke engaged in cash flow tunneling by, say, overcharging for syrup. Bottling’s depreciation and amortization charges, however, are far higher than its peers, and its operating margin is lower. This pattern is consistent with Bottling having bought bottling plants from Coke for greater than fair market value, and thus is consistent with asset tunneling “in.”

There are other differences between Bottling and its peers that unbundling tunneling can help to explain. Bottling has a lower Tobin’s q ratio and a higher P/E ratio relative to peers. Asset tunneling “in” can explain this pattern. Tobin’s q is depressed by Bottling’s purchase of Coke assets at above market values, and investor expectation of future purchases. These factors both inflate Bottling’s assets (the denominator for Tobin’s q) and reduce its market value (the numerator). The P/E ratio, on the other hand, is not affected to the same degree, because asset tunneling “in” will reduce both price per share and earnings per share. In contrast, if Bottling had been at high risk for equity tunneling, both Tobin’s q and P/E would have been depressed.

41. Based on news stories and Bottling’s annual proxy statements and annual reports on Form 10-K, we are aware of purchases of specific bottling plants from Coke in 1988, 1991, 1993, 1996, 1997, and 2001. See, e.g., *Coca-Cola Enterprises to Buy 2 Bottlers*, L.A. TIMES (May 28, 1997), http://articles.latimes.com/1997-05-28/business/fi-63061_1_coke-enterprises. There may have been purchases which were not specifically disclosed.

42. Meyer, Owsen & Brozovsky (1999), *supra* note 36.

TABLE 3. VALUATION AND OPERATING RATIOS FOR COCA COLA ENTERPRISES AND PEERS

Means and median valuation ratios for Bottling and peers (Pepsi Bottling Group, Pepsiamericas, Cott Corporation of Quebec, and Pepsi Gemex SA) for 1987-1996. EBIT/assets (EBITDA/assets) are annual (amount before extraordinary items/year-end assets). Price/earnings ratio is (year-end share price)/(fully diluted earnings per share for the year). Tobin's q = (year-end market value of equity + book value of total liabilities)/(year-end assets). Intangibles are balance sheet item for "other long-term assets." Significant differences at 5% level in means (2-sample t -test with unequal variances) and medians (χ^2 test) are in **boldface**.

Metric	Mean			Median		
	Bottling	Peers	Prob. (equal means)	Bottling	Peers	Prob. (equal medians)
Gross Margin (%)	46.4	33.8	0.006	46.2	38.2	0.003
(D&A)/Sales (%)	6.8	3.3	0.000	6.9	3.6	0.000
Operating Margin (EBIT/Sales) (%)	7.8	9.2	0.246	7.2	11.4	0.114
EBITDA/Assets (%)	10.6	13.8	0.049	10.7	14.0	0.044
EBIT/Assets (%)	5.7	10.5	0.004	5.1	12.0	0.007
Intangibles/ Long-Term Assets (%)	72.8	39.2	0.000	72.2	41.4	0.000
Tobin's q	1.1	2.2	0.194	1.1	1.5	0.013
Price/Earnings Ratio	38.6	22.2	0.051	37.8	18.2	0.029

The magnitude of apparent asset tunneling "in" at Bottling is large. Bottling's average ROA (EBIT/Assets) is 5.7%, versus 10.5% for its peers. A 4.8% lower ROA for roughly \$7 billion in average Bottling assets over 1987-2006, implies that Bottling needed an increase in EBIT of \$320 million per year to match the ROA of its peers. Suppose that Coke had paid this extra amount to Bottling—that Coke paid generously for bottling services to compensate for the high price it charged to Bottling for bottling plants. This would increase Bottling's operating margin from 7.8% to 14.2%, and its gross margin from 46% to 53%.⁴³ These margins would be much larger than the average operating and gross margins for peer companies of 9% and 34%, respectively.

But this understates the prices Coke would need to pay Bottling for bottling services to justify the prices paid by Bottling for bottling plants. To estimate what Bottling would have had to charge for the output from those plants, one must estimate their fractional contribution to Bottling's sales, operating margin, and gross margin. Bottling's 1994 10-k annual report states that from 1986 until 1993 it has purchased assets from Coke

43. These calculations assume that sales would rise by \$280 million, while costs would not change.

totaling \$5.6 billion. Bottling's assets at the end of 1993 were roughly \$8.6 billion, thus these purchases were about 65% of Bottling's assets. If we assume that this percentage is representative of the 1987–1996 period and that the purchased assets have the same productivity as the original Bottling assets, then the \$320 million of extra EBIT a year would need to come from only 65% of Bottling's sales. This would drive the implied operating (gross) margin on these sales to around 18% (56%), far above the levels of the peer companies.

We can assess the magnitude of apparent asset tunneling “in” in another way, by assessing how much less Bottling would have needed to pay, for Bottling's profitability to be comparable to its peers.

In order for Bottling's average EBIT to be the same as its peers it would need to have only \$3.9 billion average assets, instead of actual average assets of \$7 billion. This implies that Bottling paid close to twice as much as it should have to acquire bottling plants from Coke. Bottling's accountants recorded that overpayment as an intangible asset, called “franchise rights.”

B. Biglari Holdings

Our second U.S. case study involves Biglari Holdings (“BH”). BH operates restaurant chains and also serves as an investment vehicle for its chairman and CEO, Sardar Biglari.⁴⁴ In 2005, Mr. Biglari, via the hedge fund he runs, the Lion Fund, acquired a significant equity stake in Western Sizzlin', a restaurant chain. The following year, he took control of the Western Sizzlin' board and was appointed Chairman. He acquired a significant stake in another restaurant chain, Steak 'n Shake, in 2007. As he had at Western Sizzlin', he succeeded in replacing most existing directors with his associates and in 2008 was appointed Chairman and CEO of Steak 'n Shake. Biglari arranged for Steak 'n Shake to acquire Western Sizzlin' in 2009, and to acquire the general partner of the Lion Fund in 2010; he renamed the resulting company Biglari Holdings. Since taking control of BH, Biglari has engaged in multiple forms of tunneling, which we discuss below, while portraying himself as a champion of shareholder interests.

1. Cash Flow Tunneling

The BH board awarded Biglari an extraordinary compensation plan in 2010, relative to BH's size. They have kept the plan in force despite strong opposition from shareholders in a 2013 “say on pay” vote in which

44. The discussion in text is based on the complaint in *Verified Shareholder Derivative Complaint Demand for Jury Trial, Taylor vs. Biglari*, 971 F. Supp. 2d. 847 (S.D. Ind., 2013.), and various press releases and public filings from 2005 to the present by BH (former name, Steak 'n Shake). One of us (Black) was an expert witness for the plaintiff in *Taylor v. Biglari*, in which the plaintiffs sought unsuccessfully to block the dilutive offering discussed below.

Biglari's pay was approved by fewer than 30% of the shareholders other than Biglari.⁴⁵ Under the plan, Biglari receives, in addition to a base salary of \$900,000, 25% of any increase in the book value of BH over 6% annually (before Biglari's compensation) up to a maximum of \$10 million. Thus, if BH's book value increases by 10% annually, Biglari will earn 1% of its book value in addition to his regular salary.

Suppose for example, that BH's book value increases by 14%—strong but not extraordinary performance. Biglari will then earn 2% of book value plus \$900,000. After his bonus, BH's book value will have increased by 12%. Biglari would have kept for himself more than \$1 for every \$6 that BH gained after his compensation. If the increase in book value came from earnings, Biglari would receive around 17% of the firm's income after his compensation. For a corporate executive, this is extraordinary compensation. Apparently, Biglari can earn his bonus simply by causing BH to issue new shares—the bonus is tied to an increase in total book value not book value per share.⁴⁶

2. *Asset Tunneling "Out"*

In 2010 Biglari sold Biglari Capital Corp ("BCC"), the general partner of the Lion Fund, to BH for \$4.2 million, as part of his effort to persuade shareholders to approve his compensation plan—since he would be running both the fund and the restaurant business.⁴⁷ In 2013 Biglari arranged to buy it back for \$1.7 million. The compensation plan remained in effect. Yet, in the roughly three years that BH had owned it, BCC had generated about \$6 million in cash. How can a business that generates \$2 million per year in cash with negligible capital investment be worth only \$1.7 million? If one applies a reasonable multiple of (say) ten times cash flow, BCC's value would be around \$20 million, plus any accumulated cash not paid to BH. Thus, Biglari bought BCC from BH at a discount to intrinsic value of more than 90%.

3. *Equity Tunneling*

In 2013 BH announced a plan to issue shares via a rights offering at a 38% discount to market value. The discount would benefit Biglari and harm shareholders who do not participate in the offering—it would di-

45. See 2013 Say on Pay Results, Semler Brossy, (April 10, 2013), available at www.semlebrossy.com/sayonpay.

46. This compensation plan would have been even richer, had shareholders not revolted when it was first adopted. The plan as originally approved by the BH board contained a lower hurdle rate of a 5% increase in book value, and no upper limit on Biglari's compensation.

47. See Proxy Statement for Special Meeting of Shareholders to be held on November 5, 2010, Biglari Holdings Inc. (Sept. 29, 2010), available at www.sec.gov/Archives/edgar/data/93859/000092189510001420/def14a07428_11052010.htm (stating that BCC's "asset management business is a cornerstone of [BH's] long-term strategy to maximize shareholder value creation").

lute nonparticipating shareholders by around 6%.⁴⁸ Note that Biglari had increased the chances that smaller shareholders would not participate by previously causing BH to undergo a twenty-to-one reverse stock split. Biglari had previously conducted a similar dilutive offering at Western Sizzlin', and BH advised shareholders to expect future similar offerings.

The effective dilution from the rights offering exceeds 6%, because the 38% discount is relative to *market price*, not the no-tunneling value of BH shares. The BH shares were already trading at a "Biglari discount."

The benefit to Biglari (and harm to other shareholders) will be reduced to the extent that other shareholders buy shares in the offering, but any offset will be partial. First, the terms of the offering make participation by small shareholders difficult. Second, even if there was pro-rata participation by all shareholders, Biglari would still be buying shares at less than their intrinsic value and thus their value *to him*. This will dilute the economic interest of all other shareholders.

4. *Takeover Protection Through Asset Tunneling "In"*

Biglari has also put in place a set of extraordinary takeover protections that effectively ensure that he cannot be replaced. These protections operate by locking in asset tunneling "in" if he were replaced. First, in 2013 he caused BH to enter into a license agreement for the term "Biglari Holdings" which is free as long as Biglari controls BH, but requires BH to pay Biglari over \$100 million (based on current revenues) for the license if someone acquires BH. Putting aside the value of BH's stake in Cracker Barrel this is over 50% of BH's market value for a trademark which has no value to the restaurant chains run by BH. When Biglari took back ownership of the Lion Fund he also arranged for BH's investable assets to be managed by the Lion Fund at hedge fund compensation levels for a minimum of five years *after* he is replaced at BH.

5. *Effects of Tunneling on BH Metrics*

In Table 4, we compare BH's gross margin, operating margin, ROA, and P/E ratio to twenty-seven peer restaurant firms from 1996–2012.⁴⁹ BH was controlled by Biglari during the last five years of this pe-

48. The offering was one new share for each five shares owned, at a 38% percent discount to the pre-announcement market price. BH would thus issue new shares equal to 20% of the previously outstanding shares, but raise new equity equal to only 12.4% of its prior market value. Thus, each old share will be worth $(112.4/120) = 0.937$ as much as before, for a 6.3% loss in value.

49. We winsorize the P/E ratio at the 95% level (P/E of 62). We use the peers selected by Bloomberg for its "relative value" (RV) analysis (as of Nov. 2013): AFC Enterprises, BJ's Restaurants, Bob Evans Farms, Brinker International, Buffalo Wild Wings, CEC Entertainment, Cheesecake Factory, Cracker Barrel Old Country, Darden Restaurants, Del Frisco's Restaurant Group, Denny's Corp, DineEquity, Domino's Pizza, Jack In The Box, Krispy Kreme Doughnuts, Luby's, McDonald's Corp, Nathan's Famous, Panera Bread Company, Papa John's Intl, Red Robin Gourmet Burgers, Ruby Tuesday, Ruth's Hospitality Group, Sonic Corp, Texas Roadhouse, Wendy's, and Yum! Brands.

riod. This lets us both compare BH to its peers and compare BH to itself during versus pre-Biglari. During the pre-Biglari period BH is indeed similar to the peer group on gross margin, operating margin, and ROA. BH has a lower P/E than the peer mean, but this is driven by some high outliers among the peer group. The median P/E ratio is similar for BH and peers.

BH's results change dramatically after Biglari assumes control. The main cash flow tunneling technique at BH is excessive executive compensation. This should reduce operating margin and ROA but will not affect gross margin. This is exactly what we find. If anything, BH's gross margin is better than its peers under Biglari's management. In contrast, both operating margin and ROA are significantly lower than peers in the Biglari period. The difference is large—BH's operating margin is only 4.5% vs. 10.5% for peers and BH's ROA is only 2.1% vs. 7.9% for peers.⁵⁰

TABLE 4. COMPARISON OF BIGLARI HOLDINGS TO PEER RESTAURANT FIRMS

Sample is Biglari Holdings (BH) and 27 other restaurant firms from 1996 to 2012 identified as peers by Bloomberg. Biglari becomes CEO of Biglari Holdings in the summer of 2008. Return on Assets in year t is calculated as $\text{Net Income}_t / ((\text{Total Assets}_t + \text{Total Assets}_{t-1}) / 2)$. PE ratios are winsorized at 95% (PE of 62). Significant differences at 5% level in means (2-sample t -test with unequal variances) and medians (χ^2 test) in **boldface**.

Metric	Period	Mean BH	Mean Peers	Prob. (equal means)	Median BH	Median Peers	Prob. (equal medians)
Gross Margin (%)	pre-2008	47.9	47.2	0.927	29.0	48.0	0.370
	2008-2012	72.9	54.7	0.000	72.9	67.3	0.009
Operating Margin (%)	pre-2008	9.4	10.0	0.355	9.7	8.9	0.681
	2008-2012	4.5	10.5	0.011	5.3	8.5	0.020
Return on Assets (%)	pre-2008	7.4	6.9	0.603	6.7	8.2	0.535
	2008-2012	2.1	7.9	0.027	3.0	7.1	0.037
Price/Earnings	pre-2008	17.2	22.7	0.004	16.5	16.7	0.744
	2008-2012	25.9	17.6	0.398	22.4	15.6	0.257

There is no apparent discount in BH's P/E ratio, which is slightly higher than peers in the post 2008 period, but the difference is not statistically significant. We saw a similar lack of discount in Bottling's P/E ratio of Bottling in Section A. One explanation is that market participants expect cash flow tunneling to decline over time. Another is that investors underestimate the risks of future equity and asset tunneling. This is consistent with the only analyst report on BH we could find, which touts

50. Beginning in 2011 BH has held a large position in Cracker Barrel. The BH results shown in Table 4 are similar if we back out both the income and assets attributable to this holding.

the stock as a good value that is available at significant discount and does not mention Biglari's tunneling efforts.⁵¹

C. Gazprom

Measured by reserves, Gazprom is the largest oil and gas company in the world with reserves in 2006 of 196 billion barrels of oil and gas equivalents.⁵² It was formally created in 1992 to hold all of Russia's natural gas reserves plus many of its gas pipelines, and it has since acquired significant oil reserves. Its largest shareholder is the Russian government, which owns about 38% of Gazprom shares. Examples of specific tunneling transactions are described below.

1. Cash Flow Tunneling

In 2001 Gazprom agreed to deliver gas to the Yamal-Netetsk Oblast as payment in kind for \$200 million in taxes.⁵³ The gas was then exported at world market prices for an estimated value of \$5.5 billion.⁵⁴ In substance, the gas was never delivered to Yamal-Netetsk. Instead Gazprom simply sold it for \$5.5 billion, delivered the \$5.5 billion to someone (we'd be surprised if Yamal-Netetsk Oblast received all or even most of it), and recorded the sale price as \$200 million. Including this profit would have increased Gazprom's operating margin from 29% (reported) to 52% in 2001.⁵⁵

2. Asset Tunneling "Out"

Over the period from 1997 through at least 2001 Gazprom engaged in multiple transactions with a private company called Itera, to Itera's great advantage. For example, in 2001 Gazprom sold to Itera a 32% stake in a major gas, producing subsidiary, Purgas, for \$1,200 (this is not a typo). Public complaints led to Gazprom's auditor, PriceWaterhouse-Coopers ("PwC") estimating the value of the stake at \$400 million and

51. See the initial coverage analyst report *SNS: An Opportunistic Holding Company Available at a Discount*, BGB Securities, Apr. 7, 2010. SNS was the ticker for BH before it changed its name from Steak 'n Shake to Biglari Holding. See also Michael Lewis, *Biglari Restaurant Ops Look Strong and Cheap*, MOTLEY FOOL (Aug. 16, 2013), available at <http://www.fool.com/investing/general/2013/08/16/biglari-restaurant-ops-looks-strong-and-cheap.aspx>.

52. Our analysis is as of 2006. Information on Gazprom is taken from its public filings. GAZPROM, <http://www.gazprom.com> (last visited July 7, 2014). See also Black, Kraakman & Tarassova, *supra* note 26.

53. William F. Browder, *Gazprom and Itera: A case Study in Russian Corporate Misgovernance*, CARNEGIE ENDOWMENT FOR INT'L PEACE, (Mar. 18, 2002), available at <http://carnegieendowment.org/2002/03/18/gazprom-and-itera-case-study-in-russian-corporate-misgovernance/nrl> (summary provided by Carline McGregor).

54. *Id.*

55. See GAZPROM, *Management's Discussion and Analysis of Financial Condition and Results of Operations 14* (2004), www.gazprom.com/t/posts/48/297688/2-2sdfdf.pdf.

determined that the deal was “advantageous to Itera.”⁵⁶ PwC announced that it “could not determine whether the Gazprom managers were beneficiaries of Itera.”⁵⁷ Some sources estimate the total value of gas reserves transferred from Gazprom to Itera for minimal consideration through this and other transactions, at \$30 billion.⁵⁸

3. Equity Tunneling

In 1994 the partial privatization of Gazprom was structured so that one-third of the shares were bought at closed auction.⁵⁹ Russian Prime Minister Viktor Chernomyrdin, a former Gazprom CEO, was rumored, but never proven, to be a major buyer. In 1995 the partial privatization of Gazprom was structured so that Gazprom had a right of first refusal for any shares to come onto the market and could refuse to register as a shareholder anyone who bought shares without Gazprom’s approval.⁶⁰ The approval and first refusal rights suppressed Gazprom’s market price and enabled Gazprom and its insiders to buy shares at depressed prices.⁶¹

Hermitage Capital Management, an investment fund that specialized in Russia, estimated that between 1997 and 2001, Gazprom “lost” 10% of its gas reserves with market value at Western prices of around \$200 billion.⁶² To achieve that staggering dilution, Gazprom engaged in a number of joint ventures with obscure counterparties likely controlled by insiders. In a number of cases Gazprom’s stake was diluted through an equity offering by the joint venture in which Gazprom did not participate.

Beginning in 2000, the Russian Government began to crack down on these thefts, including appointing a new CEO, Alexei Miller, to replace former CEO Rem Vyakhirev.⁶³ In the aggregate Miller reportedly recovered “billions of dollars worth of (Gazprom) assets” and succeeded in “regaining control of subsidiaries.”⁶⁴ In the Miller era, however, cash flow tunneling continued, including “inordinately high payments to obscure intermediaries for basic supplies.”⁶⁵ For example, Ukrainian pipeline transmission prices for gas sales to Western Europe increased by about 1% between 2003 and 2004, but Gazprom reported increased costs

56. *Gazprom: Russian’s Enron?*, BLOOMBERG BUSINESSWEEK, FEB. 17, 2002, <http://www.businessweek.com/stories/2002-02-17/gazprom-russias-enron>.

57. *Id.*

58. Craig Mellow, *Putin’s Problem*, INSTITUTIONAL INVESTOR, Apr. 2000, at 44, 50.

59. See Michael Freedman & Heidi Brown, *Energy Tsar*, FORBES, July 7, 2006, <http://www.forbes.com/forbes/2006/0724/094.html>.

60. Peter Fuhrman, *Robber Baron*, FORBES, Sept. 11, 1995, at 208, 212.

61. *Id.*

62. See John McMillan & James Twiss, *Gazprom and Hermitage Capital, Shareholder Activism in Russia*, Stanford Business School Case #IB36 (2002).

63. See Alexey Miller CEO, *OAQ Gazprom*, WORLD OF CEOs, available at <http://www.worldofceos.com/dossiers/alexey-miller>.

64. Freedman & Brown (2006), *supra* note 59.

65. *Id.*

of about 35%.⁶⁶ Gazprom's financial ratios improved dramatically over 1999–2006 as asset tunneling “out” declined. Its market/book ratio increased eighteen-fold from 0.1 in 1999 to 1.77 in 2006, while its P/E ratio doubled from 5 in 2000 to about 10 in 2006. These ratios approached the ratios of a sample of major oil and gas firms around the world (e.g., Exxon-Mobil, Total, BP, Royal Dutch/Shell, Petrobras, and PetroChina) which had market/book ratios between 2 and 3 and P/E ratios between 9 and 15.⁶⁷

Gazprom's market value per barrel of oil equivalent (“BOE”), a common valuation metric for oil and gas companies, increased even more dramatically over this period. Gazprom's value per BOE increased more than 50 times from \$0.026 in 1999 to \$1.39 in 2006. Even so, by this measure Gazprom remained well below the multiples for the peer companies which (in 2008) ranged from \$5.40 for Petrobras (an emerging market peer) to \$11–23 for Western peers (for example, \$23 for Exxon-Mobil). The larger discount in the market value of Gazprom's reserves, relative to its P/E ratio, is consistent with both ongoing cash flow tunneling and with investors seeing some continued risk of asset and equity tunneling.

VI. DISCUSSION: IMPLICATIONS FOR PRACTICE AND RESEARCH

A. Implications for Investment Analysis

Standard equity valuation models typically ignore the impact of tunneling on firm value. Our model and case studies show that tunneling risk can be a major driver of value in both emerging and developed markets. We believe that it would be valuable for investors and analysts to explicitly incorporate estimates for tunneling probabilities and magnitudes into their valuation models. In many settings they should devote effort to analyzing tunneling risk comparable to the effort to estimate profitability, growth, and cost of capital. Our framework can help practitioners extend classic equity valuation models to include tunneling and thus make better investment decisions. Conversely, qualitative approaches to tunneling can lead to either over or under valuation depending on whether the qualitative discounts are larger or smaller than justified by firm- and country-level tunneling risks.

We also can see room for professional analysis of tunneling risk in a form similar to credit ratings. Rating agencies could develop estimates of the magnitude and probability of various tunneling forms similar to estimates in credit markets of probability of default and loss given default

66. *Id.*

67. For a list of peer companies and supporting calculations for Gazprom and peers, see Vladimir A. Atanasov, Bernard S. Black & Conrad C. Ciccotello, *Tunneling Risk and Firm Valuation: A Study of the Oil and Gas Industry* (Northwestern University, Law & Economics Research Paper No. 09-34, 2014), available at <http://ssrn.com/abstract=1443463>.

for corporate bonds. An analyst report on Russian oil and gas firms prepared by Troika Dialog in August 2004⁶⁸ provides an example of equity research that addresses nonstandard risks (including political risk for Yukos, a Russian oil company, which at the time was on the brink of being expropriated by the Russian State). Troika's target price for Yukos was several times smaller than the price that its analysts calculated using discounted cash flow analysis. Even so, this target price exceeded the *ex post* realized value of Yukos to shareholders after the actual government takeover.

B. Implications for Political Risk

We do not directly address political risk here. As the Yukos example above suggests, however, our framework for assessing the risk of tunneling by insiders carries over to the risk of government extraction of value. The beneficiary of the tunneling is different, but the risks are the same.

C. Implications for Asset Pricing

As we developed in Part IV, asset pricing researchers need to account for tunneling risk in order to consistently estimate classic factor models in high-tunneling-risk environments. Failure to do so can lead to attributing effects to classic factors like book-to-market ratio or firm size which in fact are driven by correlation of these factors with omitted asset or equity tunneling risk factors.

Some tunneling risks are firm specific. In standard asset pricing models, firm specific risks should affect expected cash flows, but not cost of capital. However, if the effect of tunneling risks on expected cash flows is not expressly included in a cash flow model—and today it usually is not—those risks will lead to incorrect factor loadings in a model for cost of capital, and to an apparent cost of capital which exceeds true cost.

An example of the value of this perspective: A body of research finds that the correlation between firm share prices and market prices, measured by the R^2 from regressing firm share returns on market returns, is higher in emerging markets. Researchers attribute this to poorer information about firm financial performance in these markets.⁶⁹ But higher R^2 could also reflect the importance of tunneling risk, which may be correlated across firms in a given market.

68. Troika Dialog, *Russian Oil Sector: Post-Oligarch Era* (2004), http://ir.gazprom-neft.com/fileadmin/user_upload/documents/troika-2004-08-05-eng.pdf.

69. See, e.g., Randall Morck, Bernard Yeung & Wayne Yu, *The Information Content of Stock Markets: Why Do Emerging Markets Have Synchronous Stock Price Movements?*, 58 J. FIN. ECON. 215 (2000); Randall Morck, Bernard Yeung & Wayne Yu, *R Squared and the Economy* (Nat'l Bureau of Econ. Research, Working Paper No. 19017, 2013), available at <http://www.nber.org/papers/w19017.pdf> (surveying R-squared literature).

D. Implications for Corporate Governance Research

Our tunneling framework can inform research on the causal effects of tunneling on asset prices and other firm outcomes. Credible studies are likely to use a shock-based design—typically a legal or other institutional reform that affects tunneling (although sometimes governments have enacted rules that facilitate tunneling).⁷⁰ If the researchers have firm-level data before and after the shock and can identify firms that are affected (or more affected) by the shock (treated firms), as well as unaffected or less affected control firms, they can use a differences-in-differences (“DiD”) research design to assess whether firm metrics move in the direction predicted by our model. Event studies can also be useful if the reforms can be attributed to a limited time window.

In many cases, a DiD design can provide evidence of a causal effect of a legal shock on an outcome, such as firm market value or profitability, but not on the specific channels which explain the outcome. Moreover, legal shocks that affect tunneling may be accompanied by other reforms or concurrent macroeconomic events. Our framework for unbundling the effects of different forms of reforms on financial results can help researchers to identify the causal chain, Shock \rightarrow Δ (specific types of tunneling risks) \rightarrow Δ (financial metrics). For example, a legal reform that affects freezeouts should affect share prices (and thus metrics that depend on share price), but should not directly impact accounting performance.⁷¹

E. Implications for Tunneling Disclosure

One implication of our Coke and Bottling case study is that under current U.S. disclosure rules, it is nearly impossible to detect asset tunneling “in.” One needs both large scale tunneling and a long time series. This has implications for disclosure rules—the detail disclosed by Coke and Bottling about these very large scale transactions was astonishingly thin. It has implications for accountants’ review of related party transactions. Bottling’s accountants simply assumed that Bottling had purchased bottling plants at fair value. They assigned the large excess of the purchase price over tangible asset value to intangible franchise rights, and never asked if that value was plausible—what would Bottling’s future cost of syrup have to be to make these purchases fair to Bottling?

70. See Vladimir Atanasov & Bernard Black, *Shock-Based Causal Inference in Corporate Finance Research*, CRITICAL FIN. REV. (forthcoming 2015), working paper, available at <http://ssrn.com/abstract=1718555>.

71. For our own efforts to specify specific causal channels for the effect of legal reforms on tunneling risk, see Atanasov, Black & Ciccotello (2011), *supra* note 10; Bernard S. Black, Woochan Kim, Hasung Jang & Kyung Suh Park, *Why Does Corporate Governance Affect Firm Value: Evidence on a Self-Dealing Channel from a Natural Experiment in Korea*, J. BANKING & FIN. (forthcoming 2014), working paper, available at <http://ssrn.com/abstract=844744>.

Accountants can plausibly address those questions, but under our current rules they are not expected to.⁷²

F. *Implications for Shareholder Litigation*

Lack of disclosure also often means lack of an effective remedy. Shareholder efforts to challenge Coke's tunneling from Bottling failed in the courts. So did a shareholder effort to block BH's dilutive share offering. Suits like these might fare better, if shareholders can rely on our analysis of how to assess the impact of specific types of tunneling on financial metrics.

Our framework can sometimes also help defendants in shareholder lawsuits by providing a method for assessing damages. A case in point is the shareholder litigation in Tyco.⁷³ In that case the plaintiffs argued that actions by Tyco's ex-CEO, Dennis Kozlovski, which in our framework involved modest, nonrecurring cash flow tunneling, caused billions of dollars in losses to Tyco's shareholders. Any reasonable analysis of the magnitude of the apparent cash flow tunneling would suggest that actual shareholder losses were far smaller. The Tyco share price drop when Kozlovski's actions were disclosed could reflect investors raising their estimates of the probability that financial irregularities or other tunneling would also be found. We would expect those share price drops to reverse as it gradually became clear that no other shoe would drop.

G. *Implications for Regulators*

Our framework for understanding the effects of tunneling can assist regulators in identifying loopholes in their rules that tunnelers can exploit. The United States, for example, relies heavily on independent directors to police tunneling. If this line of defense fails—perhaps because a determined tunneler can install a compliant board—large scale tunneling can take place, as our U.S. case studies illustrate. In related work, we identify the principal weaknesses in U.S. controls over tunneling.⁷⁴ Our framework for analyzing different forms of tunneling and which rules can respond to each form can help regulators to design narrow reforms that target the gaps in regulation, instead of passing blunt, wide ranging reforms, such as the Sarbanes-Oxley Act that Larry Ribstein so despised. These broad reforms may result in unintended adverse consequences for capital markets.⁷⁵

72. Compare the proposal by Bernard Black & Reinier Kraakman, *A Self-Enforcing Model of Corporate Law*, 109 HARV. L. REV. 1911 (1996), that accountants be required to report, as part of their annual audit, on whether any related-party transactions were at fair market value.

73. See Floyd Norris, *Tyco to Pay \$3 Billion in Settlement*, N.Y. TIMES, May 16, 2007, at C5.

74. See Atanasov, Black & Ciccotello (2011), *supra* note 10.

75. See Larry E. Ribstein, *Market vs. Regulatory Responses to Corporate Fraud: A Critique of the Sarbanes-Oxley Act of 2002*, 28 J. CORP. L. 1 (2002).

VII. CONCLUSION

Larry Ribstein's research extolled the value of organizational transparency, informed private enforcement of property rights, and limited public enforcement that respects and supplements private incentives. In that spirit, we examine tunneling—the extraction of firm wealth by insiders. We first unbundle tunneling focusing on what is being transferred: cash flow, assets, or equity. We then develop methods for assessing the impact of each form of tunneling on a variety of financial metrics. The result is a more granular understanding of how insiders can tunnel wealth from firms and how their tunneling affects observed financial metrics.

Our decomposition of tunneling has a number of uses, including: (1) facilitating empirical analysis of the impact of tunneling on firm value with applications to equity analysis and shareholder litigation, (2) facilitating the creation of measures of tunneling risk, (3) providing a framework for incorporating tunneling risk into asset pricing models, and (4) guiding legal reform to close loopholes that allow tunneling. It illustrates the types of accounting disclosures that investors need—and today often lack—to assess tunneling levels and to challenge tunneling in the courts.