Cheap-Stock Tunneling Around Preemptive Rights

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Abstract

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Keywords: Controlling shareholder, tunneling, equity issuance, equity issue, equity tunneling, preemptive rights, minority shareholders, public shareholders, rights offers, rights issues, private firms

JEL Classifications: G14, G18, G32, G34, G38, K22

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Abstract

Preemptive rights are thought to protect minority shareholders from cheap-stock tunneling by a controlling shareholder. We show that preemptive rights, while making cheap-stock tunneling more difficult, cannot prevent it when asymmetric information about the value of the offered shares makes it impossible for the minority to know whether these shares are cheap or overpriced. Our analysis can help explain why sophisticated investors in unlisted firms and regulators of listed firms do not rely entirely on preemptive rights to address cheap-stock tunneling, supplementing them with other restrictions on equity issues.

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1 Introduction

Corporate insiders may engage in tunneling—transactions to transfer value from outside shareholders to themselves.[1] Reducing tunneling is corporate law's most basic function, as fear of tunneling undermines entrepreneurs' ability to raise capital from outside investors *ex ante* (Shleifer and Vishny 1997). Preemptive rights are the oldest and most widely-used tool for preventing one of the main forms of tunneling, "cheap-stock tunneling:" an equity issue to the insiders at a low price that economically dilutes the interest of outside shareholders. To defend against cheap-stock tunneling, preemptive rights give all shareholders the right to participate pro rata in equity offerings. In listed firms, preemptive rights are implemented via "rights issues" in which a firm distributes to all shareholders pro rata rights to buy additional shares (Holderness 2017; Massa et al., 2016).

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[1] For example, Johnson et al. 2000; Bertrand et al. 2002; Baek et al. 2006; Cheung et al. 2006; Jiang et al. 2010. For a typology of tunneling mechanisms, see Atanasov et al. 2014.

The conventional view is that preemptive rights are effective against cheap-stock tunneling. According to the leading comparative corporate law treatise (Kraakman et al. 2017, p. 182), "preemptive rights ... discourage controlling shareholders from acquiring additional shares from the firm at low prices." Similarly, La Porta et al. (1998) included preemptive rights as one of six elements in their famous anti-director rights index because "in the absence of preemptive rights, insiders may expropriate minority shareholders by offering shares to related parties, or even to themselves, at below-market prices" (Djankov et al. 2008, p. 454). Around the world, issues featuring preemptive rights ("preemptive-right issues") are quite common because many non-U.S. jurisdictions grant preemptive rights as a default whose waiver can require super-majority shareholder approval, regulator review, or both (Kraakman et al 2017). And although preemptive rights are no longer the default in the U.S., the logic of preemptive rights still has currency in U.S. law: U.S. courts have rejected cheap-stock tunneling claims by minority stockholders on the grounds that the controlling shareholder had voluntarily offered pro rata participation in the issue, an offer often made by controllers precisely to cut off minority remedies (Fried 2018b). (Henceforth, we will refer to insiders with the ability to approve (and set the price of) preemptive-right issues as "controllers," and other shareholders as "the minority."[2])

This paper shows, however, that preemptive rights provide only partial protection against cheap-stock tunneling when the controller knows that the shares are cheap but the minority, with inferior information, believes that the shares could be either cheap or overpriced. The crux of the matter is that cheap-stock tunneling is not all the minority needs to worry about when deciding whether to exercise their preemptive rights: They also need to worry that the controller might have set the offer price high, either because the controller hopes to sell overpriced shares to others or because the controller expects to privately benefit from the issue proceeds. While it should be clear that preemptive rights cannot solve these two other problems, our novel insight in this paper is that the mere possibility of their presence partially undermines preemptive rights even in the domain where these rights are thought to be effective: cheap-stock tunneling.[3] If the minority cannot figure out whether the offer is cheap or overpriced, the minority is damned if it participates in the issue and damned if it does not (at least probabilistically). In equilibrium, we show that some minority shareholders will not exercise their preemptive rights when the price is in fact (and unbeknownst to them) cheap and thus cheap-stock tunneling will occur. We

[2]Under the corporate, securities, and stock-exchange listing rules that might apply to a particular firm, an equity issue by that firm must be approved by the board of directors; shareholder approval may also be required, depending on the circumstances (Kraakman et al. 2017). In our terminology, a "controller" is a party that controls enough board seats and shares to obtain all necessary approvals for the issue at the board and shareholder levels. By contrast, it is not necessary for a "controller" to have sufficient votes to waive preemptive rights for all shareholders, as we are precisely interested in what happens when the minority does have preemptive rights but does not control the decision whether to issue new stock, and at what price.

[3]For the avoidance of doubt, the minority's losses from cheap-stock tunneling around preemptive rights–the focus of our analysis–are above and beyond their losses from purchasing overpriced shares or the diversion of issue proceeds.

explain this mechanism first in an extended numerical example (section 3) and then in a general model (sections 4 and 5).

In our model, preemptive rights are not completely useless, as they do prevent the most extreme forms of cheap-stock tunneling. Our analysis provides an additional reason, however, why both sophisticated investors in unlisted firms and regulators of listed firms supplement preemptive rights with other mechanisms to reduce cheap-stock tunneling, such as caps on equity issues, director fiduciary duties, supermajority voting requirements, or even issue-veto rights (see Bengtsson 2011 for VC contracts; Ventoruzzo 2013 for regulations in France, Germany, and Spain; Huang 2014 for regulations in the PRC; and Charltons 2016 for regulator vetoes in Hong Kong). Finally, our analysis sheds light on minority-shareholder and controller behavior around equity issues, particularly rights issues by listed firms with controllers (see infra section 6.3).

We assume that minority shareholders and the controller are sophisticated, risk-neutral, and neither liquidity constrained nor otherwise unable to exercise their rights; all of the effects we identify require only information asymmetry. We thus abstract from the additional problems that would arise if preemptive rights were procedurally unworkable or if minority shareholders were unsophisticated, risk-averse, or liquidity constrained, in which case the controller might well maximize cheap-stock tunneling profits by setting the price so far below the value of the shares that the underpricing would be plain to any rational observer. Nor do we consider the possibility that the controller itself is liquidity constrained, which could also lead the controller to set the price obviously low, but for a different reason: namely, the controller wants the firm to raise a certain amount of capital (for business reasons or to increase private benefits) and wishes to induce the minority (or other outsiders) to contribute the needed capital.

Our paper proceeds as follows. Section 2 situates our paper in the literature. Section 3 illustrates the main idea of the present paper with an extended numerical example involving an unlisted firm. Section 4 describes and solves the basic model in general form where asymmetric information pertains to the value of the assets in an unlisted firm. Section 5 modifies the model such that the asymmetric information pertains to the controller's private benefits from the issue. Section 6 discusses how the analysis would be affected by combining the two sources of information asymmetry, adding concerns about voting power, or listing the firm's shares. Section 7 concludes.

2 Related Literature

Our paper is the first to model the interactions of a controller and minority shareholders around an equity issue in which the controller has superior information, and to evaluate how preemptive rights

change this interaction. The paper most closely related to ours is Atanasov et al. (2010), which derives formulas for the accounting and stock price impact of expected and actual equity tunneling and low-price freezeouts in connection with an empirical study of investor-protection reforms in the Bulgarian stock market. Atanasov et al. (2010) take as given the probabilities of, and discounts applied in, such tunneling (and freezeouts), which we model explicitly. They then show that the *ex ante* stock price will be higher if there are preemptive rights or safeguards against low price freezeouts, and higher still if there are both. Although they do not focus on cheap-stock tunneling *per se*, they note, consistent with our results, that minority shareholders will not use preemptive rights to participate in a discounted offering if the risk of a subsequent low-price freezeout is high.

More broadly, our paper is connected to the literature on equity issues under asymmetric information. Most theoretical work in this area assumes that managers seek to maximize value for all existing shareholders (cf. Stein 2003), and derives implications for the choice between debt and equity financing (e.g., Myers and Majluf 1984), as well as between different methods of equity issues, in particular between rights issues and underwritten offers (e.g., Heinkel and Schwartz 1986; Eckbo and Masulis 1992). By contrast, we model the conflict of interest between different groups of shareholders, while assuming that financing takes the form of a preemptive-right issue. In our model, managers are under the control of a controlling shareholder, and seek to maximize that controlling shareholder's benefit at the expense of other investors. In this context, we ask if and to what extent preemptive rights–or equivalently, limiting a listed firm to the rights-issue method–protect the minority from cheap-stock tunneling, an issue outside the purview of models that assume managers seek to benefit all current shareholders.

Our focus on the insider-outsider conflict is more closely connected to recent *empirical* work on equity issues by listed firms. In particular, Holderness (2017) points out that announcement returns tend to be negative for issues that do not require shareholder approval, but positive for those that do, suggesting that agency conflicts are of first-order importance in equity issues. Importantly, Holderness (2017) finds that announcement returns tend to be negative even for rights issues that do not require shareholder approval. This finding is consistent with our main conclusion: that preemptive rights by themselves do not protect a less-informed minority from expropriation via issue mispricing (although obviously such negative announcement returns is also consistent with other forms of expropriation, such as issue proceeds being diverted or used for empire building (Fried and Spamann 2018)).[4]

Two papers focus specifically on equity issue choices of controlled listed firms when the controller's

[4]Our analysis assumes that the controller has enough votes to unilaterally obtain any required shareholder approval for a preemptive-right issue. From the perspective of our model, the finding in Holderness (2017) that shareholder approval affects the quality of preemptive-rights issues indicates that insiders do not always have unilateral power to effect such issues, and must sometimes obtain some minority support.

interests diverge from those of other stockholders. Cronqvist and Nilsson (2005) find empirically, and Wu et al. (2016) show theoretically, that controllers tend to use rights issues rather than underwritten offers to third-party investors, and suggest that this choice is due to controllers' desire to preserve voting control and private benefits. Unlike us, however, they do not consider the possibility of expropriating the minority through the issue.

3 A Numerical Example

Consider an unlisted firm with 100 shares and $100 of assets in place. Half the stock (50 shares) is owned by a controlling shareholder; the remaining 50 shares are owned by minority shareholders who own one share each. Thus, barring tunneling, each share is worth $1. Applicable law permits the firm to issue 100 additional shares at a price set by the board, which acts in accordance with the controller's wishes. The proceeds of any equity issue will increase the firm's assets by an equal amount.

3.1 Cheap-stock tunneling with full information

As an example of straightforward cheap-stock tunneling, consider an issue of 100 additional shares for price zero only to the controller (directly, or indirectly via related parties). The firm will still have assets worth only $100 because no new assets enter the firm. However, the amount of shares outstanding will now be double, namely 200, and hence each share will be worth only $0.50. The minority, who will not receive any new shares, will thus lose half the value of its pre-issue stake. By contrast, the controller, who will now own 150 shares or 75% of the firm, will see the value of her stake increase to $75. $25 of value will have changed hands.

Under full information, preemptive rights would effectively protect the minority against the foregoing cheap-stock tunneling. If each minority stockholder had the right to participate in the issue at the same price as the controller, each minority shareholder could (and would) also buy one new share at price zero, concomitantly lowering the amount of new stock that the controller can "purchase." The amount of stock outstanding would still double to 200 shares but, as each shareholder's holding would increase proportionally, nobody would gain or lose from the issue, which would be tantamount to a simple stock split.

3.2 Asymmetric information about the value of assets in place

Realistically, however, minority shareholders are likely to know less than the controller about the value of the firm's assets in place, especially in an unlisted firm where there are no or minimal mandatory

disclosure requirements. And the controller may wish to use its superior information about the value of firm assets to expropriate value from the minority via an issuance of shares. In our example, although the assets in place appear to be worth $100, they might well be worth less. To simplify, assume they might actually be worth $0. Perhaps there have been hidden business losses of $100 or the controller has already tunneled out the $100 that was previously there. The controller would know if this is the case, but outsiders would not. Imagine that there is a 50-50 chance that the firm is of either type ($100 firm or $0 firm).

At price zero, it would still be safe to buy the new stock. Now imagine, however, that the controller sets a price of $0.37 per share. At that issue price, the stock would be vastly overpriced if the firm's pre-issue assets were worthless: Assuming full subscription of the issue, each post-issue share would be worth only half the issue price, namely $(\$0 + 100 \times \$0.37)/200 = \$0.185$ (initial value plus money raised, divided by post-issue share count). On the other hand, the stock would be considerably underpriced if the firm's pre-issue assets were actually worth $100: in that case, each post-issue share would be worth almost twice the issue price, namely $(\$100 + 100 \times \$0.37)/200 = \$0.685$.

Not knowing which type of firm they are dealing with, what should minority shareholders do? If they buy, they might end up vastly overpaying. If they don't buy, they might end up getting economically diluted by cheap-stock tunneling.[5] Of course, the controller would not want to overpay or get diluted either, so the controller's participation decision would reveal the firm type and hence the right course of action – if the controller's decision were known, which is often not the case.[6] In fact, controllers have good reason to keep the minority in the dark. By doing so, they force minority shareholders to choose one of the two responses just mentioned, each of which will benefit the controller in one type of firm: minority shareholders who do not buy allow the controller of the $100 firm to buy cheap stock at the expense of those non-buying shareholders (their loss is the controller's gain), whereas minority shareholders who do buy increase the value of the shares in the $0 firm through their overpayment (this benefits all other shareholders, including the controller).

Nevertheless, minority shareholders must choose. Whether participation is better or worse in expectation for a minority shareholder depends on the controller-set issue price and minority shareholders' subjective probability assessments, given that price, about firm type and other minority shareholders' responses. For example, in the above numerical example, a minority shareholder will be approximately indifferent between participating or not at a price of $0.37 per share if that share-

[5] Here and elsewhere, we speak of "they...getting economically diluted" (etc.) in a loose way. In our model, minority shareholders are atomistic, and *individual* minority shareholders might actually *gain* in the issue: this will happen if they, like the controller, subscribe to more than their pro rata share. See the main text, two paragraphs down.

[6] No jurisdiction appears to require the controller of an unlisted firm to disclose this decision (Fried 2018a).

holder expects controllers of both \$100 firms and \$0 firms to set that price and 16 other minority shareholders to participate, because in that case the expected value of purchasing such a share is $\frac{1}{2}\frac{\$100+100\times\$0.37}{200} + \frac{1}{2}\frac{\$0+17\times\$0.37}{100+17} - \$0.37 \approx 0$. (This takes into account that the controller will snap up every remaining share if and only if the price is low.) As we show in general form below, this price and participation decision is in fact the only equilibrium behavior in this example.

Importantly, minority shareholders in both types of firms lose even though the issue price is fair in expectation, i.e., averaged across both types of firms:

- In the \$100 firm, minority shareholders lose because the value of their existing equity drops from \$1 per share to \$0.685 per share. Again, for such a firm the issue is underpriced at \$0.37 per share, and minority shareholders lose as the controller snaps up a *disproportionate* number of new shares at this low price. True, participating minority shareholders also buy at the low price, and profit from each share purchased. But for minority shareholders as a group, participating shareholders' gains are more than offset by their and non-participating shareholders' losses from dilution of their existing shares. These are losses through cheap-stock tunneling that occur in spite of preemptive rights.

- In the \$0 firm, it is now participating minority shareholders' turn to lose, as the shares they buy at \$0.37, increasing their proportional interest, are overpriced. The controller gains at participating minority shareholders' expense. Again, non-participating minority shareholders gain as well, but for minority shareholders as a group, these gains are more than offset by the losses of the participating minority shareholders.

In either case, the ultimate intuition is simple: the controller knows when to buy and when not to buy and thus always does the profitable thing, whereas the minority is unsure and hence buys some and only some in either case. Thus the controller extracts value from some minority shareholders either way, whether it is a \$100 firm (through cheap-stock tunneling) or a \$0 firm (through the sale of overpriced stock).

The underlying source of minority shareholders' losses illustrates the crucial difference between our setting and the standard problem of equity issue with asymmetric information (e.g., Myers and Majluf 1984). In both the standard equity issue and our settings, the equilibrium issue price is "fair" for buyers: in expectation, those buying shares do not profit or lose from buying the issued shares. However, only in our setting do outside shareholders also already own shares of the firm. And these *existing* shares, in expectation, decline in value as a result of the issue. In the \$100 firm, the drop in share value is $\$1 - \$0.685 = \$0.315$ (which is not offset by the much smaller gain in the value of the existing shares

of the \$0 firm, $\frac{\$0+17\times\$0.37}{100+17} - \$0 = \$0.054$). This is precisely the type of loss that preemptive rights are supposed to protect against. But the protection fails because the minority can never be sure that this is what is going on in any given issue. As a result, minority shareholders in our example collectively lose $50 \times \$0.315 - 17 \times (\$0.685 - \$0.37) = \$10.40$ of the \$100 firm, *or over 40% of what they could have lost if they had no preemptive rights*, in which case the controller could have issued stock to herself at price zero and appropriated \$25.

3.3 Asymmetric information about the controller's ability to divert issue proceeds

Things get even worse for minority shareholders if the asymmetric information pertains to the controller's ability to divert some of the issue proceeds, or to obtain non-pecuniary private benefits from the issue. For example, the issue proceeds might or might not be used to purchase overpriced assets or securities from the controller.[7] In principle, such lopsided self-dealing transactions can occur even without a new issue of stock, but often they require what only a stock issue can deliver: fresh cash. Alternatively, the controller may simply enjoy running a larger firm. All that matters is that the controller derives a benefit from the issue that is not shared with the minority.

To be sure, a controller's ability to benefit disproportionately from the proceeds of the issue is likely to depend on the minority's ability to monitor the firm and applicable legal restrictions on self-dealing. But such disproportionate benefits from an issue could be substantial even if the minority is able to prevent lopsided self-dealing between the controller and the firm. Pecuniary benefits may be generated not by explicit self-dealing transactions between the firm and another party, but rather via transfers of value among different types of securities already issued by the firm (Fried 2018b). For example, a pro rata issuance of common stock may disproportionately benefit the controller if it, but not the other shareholders, holds (or has guaranteed) a loan to the firm whose value is increased by the equity issue. And non-pecuniary benefits are and will always be beyond the reach of the law, as they are undetectable. Thus, even if the minority knows there will be no self-dealing transactions, there is likely to be asymmetric information over the extent of private benefits from the issue. In situations where lopsided self-dealing transactions may occur, the asymmetry is likely to be more severe.

We now construct an example along these lines. Imagine that it is known to all with certainty that the value of the firm's initial assets (say, a machine) is \$100, but that there is a 50-50 chance that the controller, after having the firm issue new 100 shares, can divert all issue proceeds into her own pockets.

[7] Such transactions appear common in Hong Kong listed firms (Fong and Lam 2014; Kim et al. 2015).

(Equivalently, there might be a 50-50 chance that the project into which the firm will invest the issue proceeds is worthless in cash flow terms but generates a non-pecuniary psychic benefit to the controller equal to the money invested. Our analysis would be exactly the same. For concreteness and simplicity, however, we will speak of diversion of the cash proceeds throughout.) The controller knows whether it will divert; minority shareholders do not.

If all knew the controller can divert these funds, no outside stockholder would be willing to buy the new stock at a price equal to the pre-issue pro-rata value of \$1 per share, as the post-issue value would be only half that: $\frac{\$100+\$0}{200} = \$0.50$. But any stockholder, new or old, would be willing to buy at the post-issue value of \$0.50: while the issue proceeds themselves would be diverted, a new share would still represent a 1/200 claim on the initial pool of assets worth \$100, and hence would be worth \$0.50. Of course, this issue-related diversion would be at the expense of the initial minority shareholders. Meanwhile, the controller would gain by appropriating the issue proceeds, which would more than offset her losses on her existing stock. Regardless of who buys the shares (the controller, existing minority investors, or new investors), and after subtracting any amounts paid to buy stock in the issue, the controller would own shares and diverted funds worth \$75, while the minority would be left with \$25. In separate work, we show in general form that this outcome is the only possible equilibrium in this example with full information (Fried and Spamann 2018).

With asymmetric information, however, the controller with the ability to divert can do even better, and controllers without the ability to divert gain by the mere possibility that some controllers can divert. The reason is similar to the previous example with asymmetric information about initial asset value. For prices between \$0.50 and \$1, minority shareholders do not know if the stock is over- or under-priced. If they buy, and if diversion ensues, they will have overpaid. But if they do not buy, and there was not going to be any diversion, the controller expropriates through cheap-stock tunneling. Whatever minority shareholders do, they will lose some of the time. Now, however, things are even worse for the minority than in the no-diversion setting discussed in section 3.2 because the controller's purchase decision, even if known and credible, is no longer revealing about the type of firm/controller. The reason is that from the controller's perspective, the issue cannot be overpriced in either scenario. In the no-diversion scenario, the shares are worth \$1. In the diversion scenario, the controller receives a "rebate," so to speak, on the full price of the stock, reducing its effective price (to the controller) to zero. Thus, even if the minority were to know the controller's purchase decision, they could not figure what to do.

As before, minority shareholders' purchase decisions and the controller's price choice are interdependent. We show below in general form that in our example, the only equilibrium is for both types of

controllers to set a price of \$2/3 and for 1/3 of the minority shareholders to participate, with the controller buying the rest of the stock. In our example, this means that the controller who can divert ends up with \$77.78, even more than the \$75 this controller could have obtained if minority shareholders had full information about the diversion ability: this controller is making a gain from the sale of overpriced stock on top of the gain from diverting issue proceeds. More interestingly and importantly, however, the mere possibility that some controller may divert proceeds enables even a no-diversion controller to tunnel out \$5.56 through an issue of cheap stock despite the minority having preemptive rights.

In all of the preceding examples, the problem is not that minority shareholders do not have preemptive rights or that they are worthless, but that the controller will set the price such that minority shareholders will be indifferent between exercising their rights or not. Preemptive rights will prevent the controller from doing the worst (issue at price zero), but this does not mean that cheap-stock tunneling disappears. We now explore these issues more systematically and formally.

4 Asymmetric information about value of assets in place

4.1 Model Setup

Consider an (unlisted) firm with two types of stockholders: a controlling stockholder, and a continuum of atomistic minority stockholders who do not coordinate their actions. (Qualitatively, nothing would change if we modeled the minority as a single, coordinated block.) There is initially one share divided into infinitesimally small increments. Collectively, minority stockholders initially own fraction $\alpha \in (0,1)$ of the stock. The firm is risky: with unconditional probabilities ρ and $1-\rho$, the value of assets in place, v, is either $1-\delta_a$ or 1, respectively.[8] The controller observes the realization of v; the minority does not.

The firm now issues a quantity $q > 0$ of new stock at price $p > 0$ per share. The controller chooses p, whereas q is exogenous.[9] Existing shareholders have preemptive rights, i.e., they are guaranteed an allotment proportional to their existing stake if they wish to subscribe to the new issue. We denote Δ as the fraction of minority shareholders' preemptive rights that is exercised.[10] To the extent some

[8] Technically, what matters is the *expected* value of the assets in place that will be available for pro rata distribution to all shareholders. Anticipated future diversion depresses that expected value, including anticipated future diversion through an equity issue as modeled here or in the next section. Hence asymmetric information about the probability of future asymmetric information is enough to generate the effect we model here!

[9] The assumption of an exogenous q can be justified by the fact that there are typically legal constraints on the number of additional shares that can be issued mid-stream by firms (such as stock exchange rules and/or charter provisions not easily amended by the controller). It may also be justified by the controller's need to retain a fraction of the stock high enough to preserve control, combined with her liquidity constraints. If the controller could freely choose q and were not concerned about preserving her voting rights, she would choose q as large as possible, as the minority's loss is increasing in the size of the issue.

[10] We do not restrict Δ to lie in $[0,1]$, but it will be seen that only $\Delta \in (0,1)$ is consistent with equilibrium (see footnote 31).

existing shareholders do not subscribe, we assume that others can pick up the remaining shares.[11] In particular, the controller will want to purchase any leftover shares when the firm value is high.

To focus on the effect of interest, we assume that the firm invests the issue proceeds in a zero NPV project.[12] That is, the social value of the firm's use of the issue proceeds is exactly equal to pq. For example, the firm might just invest the receipts in treasury securities or some diversified portfolio. Note that with zero NPV investments, the following holds:

Lemma 1. *In the absence of private benefits diverted from the issue, participating in the issue is profitable if and only if the issue price is less than the realized per-share value of the assets in place ($p < v$), and breaks even when they are equal ($p = v$).*

Proof. See Appendix. □

The lemma would be self-evident except that for existing shareholders, there is an attenuating effect to overpaying or underpaying for new shares: to the extent investors overpay (underpay), the value of their existing shares goes up (down). But the latter effect is always smaller than the former because the latter effect is shared with all other existing shareholders, while the former effect is borne by the investor alone. Buying into a firm at a price above (below) pro rata value is a losing (winning) proposition, even taking into account the technical complication just mentioned.

Timeline of the model. The timeline of the model is as follows, with two variants of period 2:

1. The controller privately observes realization of the value of assets in place and then announces p. (Equivalently, the controller might observe the realization of the investment opportunities of the firm – nothing would change in substance.)

2. Both minority shareholders and the controller announce their participation decision, i.e., whether they will buy their allotted shares:

   (a) variant 1: the controller announces first;

   (b) variant 2: the controller announces second or contemporaneously.

[11] We do not explicitly include new outside investors (i.e., other than the existing shareholders) in our model, but the optimality condition for minority shareholders' purchase decision would be the same for an outside investor; in this sense, our model thus applies fully to listed firms as well (see section 6.3 below).

[12] Allowing for investment at a loss or profit would enhance the realism of the model but not the economic insight. This reflects a key difference to the well-known model of Myers and Majluf (1984), which also involves asymmetric information about the value of the existing assets in the firm. In Myers and Majluf, the high type firm, whose stock will be underpriced in equilibrium, would not conduct the equity offering unless it is compensated for the underpricing by a sufficiently large positive NPV from the growth opportunity to be financed by the offering. By contrast, in our model, the controller of the high type firm profits from cheap-stock tunneling, and hence does not require a positive NPV project. Focusing on zero NPV projects helps to emphasize this important difference.

3. The firm is liquidated and proceeds distributed pro rata according to share ownership.

We now describe the perfect Bayesian equilibria (PBE) for each variant.

4.2 Variant 1: controller announces first

If the controller has to announce her (binding) participation decision up front, all parties receive zero net payoffs (i.e., relative to the pre-issue status quo) in all PBE of the model. The reason is that all parties have a strategy that ensures they obtain at least zero, and the game is zero sum. The minority can guarantee a zero payoff by mimicking the controller, while the controller is guaranteed zero by setting $p = v$.[13]

4.3 Variant 2: controller does not announce first

If the controller need not announce first, then there is a unique equilibrium price equal to a weighted average of 1 and $1 - \delta_a$ and some minority shareholders buy and some do not (a possibly stochastic decision at the individual level) because they are unable to tell if true firm value is low and hence the price too high, or if the true firm value is high and hence the price a bargain. Obviously, the controller only participates if it is a bargain. In expectation, the controller gains and the minority loses. Ex post, the controller always gains and at least some minority lose.

Concretely, we have

Proposition 1. *If there is asymmetric information about the value of the assets in the firm and the controller does not need to announce first, then there exist only pooling perfect Bayesian equilibria in which the controller always sets the price* $p^* \equiv 1 - \frac{\delta_a \rho(1+q)}{1+\rho q+\alpha q(1-\rho)^2/(1+\rho q)} \in (1-\delta_a, 1)$ *and buys if and only if* $v = 1$*, and a fraction* $\Delta^* \equiv \frac{1-\rho}{1+\rho q} \in (0,1)$ *of the minority rights are exercised; the purchase decisions of individual members of the minority as well as minority shareholders' off-equilibrium beliefs and purchases are not unique.*[14]

[13] Even if the price is high (above post-issue share value) and the minority follows the controller and buys, the minority would not lose anything because the controller equally overpays (and hence firm value grows proportionally). If the price is low and the controller does not buy, the minority misses an opportunity by not buying, but at least it does not lose anything.

Thus, there is an infinity of PBE in which the controller announces some price-participation combination and the minority mimics. The only price-participation combinations that cannot be part of these equilibria are those involving ($p < v_l$, not buy) and ($p > v_h$, buy). The only non-mimicking that can occur in equilibrium is when the controller sets $p = v_l$ and does not buy, or when the controller sets $p = v_h$ and does buy; the controller would do so in equilibrium only when these are actually the realized values. In any event, the controller and the minority both receive zero payoffs in any of these equilibria.

[14] These formulas reflect (a) the normalization of the initial outstanding stock to 1, such that the value per share and the value of the firm coincide and q is both the number of new shares issued and the ratio of new stock to old stock, and (b) the normalization of the high asset value to 1. If either the initial number of shares or the high asset value differ from 1, the right hand side of the price formula must be divided by the former and multiplied by the latter to obtain the correct price per share. In either case, q must be input as a ratio.

Proof. See Appendix. □

The intuition for the proof is that by pooling on an intermediate price in the range $(1-\delta_a, 1)$, the two types of controllers can force minority shareholders into at least one of two decisions that are bad for them: buying overpriced stock if the value of assets in place is low, or allowing the controller to cheap-stock-tunnel if the value of assets in place is high. The closer the price is to 1, the higher the losses from buying overpriced stock; and vice versa for prices closer to $1-\delta_a$. In equilibrium, minority shareholders balance the two risks and buy intermediate amounts that decline with the price. This allows both types of controllers to earn a positive profit, dominating the zero profit they would get by revealing their type through separation.

How does this situation compare to one without preemptive rights? In that latter case, the worst that can happen to the minority is that the controller issues q shares at price zero to herself. This would increase the controller's stake to $\frac{1-\alpha+q}{1+q}$ while not affecting the value of the firm. The minority's stock, worth αv before the issue, would be worth $\frac{\alpha}{1+q}v$ after the issue, for a loss of $L^{NPR}(v) \equiv \alpha v \frac{q}{1+q}$. (On the other hand, with preemptive rights and no asymmetric information and no diversion of issue proceeds, the minority loses nothing from an issue.)

The most interesting case with asymmetric information is "the high type" ($v=1$), as here actual cheap-stock tunneling occurs despite preemptive rights. Some tedious algebra shows that the minority loses (and the controller gains[15]) $L_h^{PR} \equiv \frac{\delta_a \alpha q(1+q)\rho^2}{(1+\rho q)^2+\alpha q(1-\rho)^2} = \frac{\delta_a (1+q)^2\rho^2}{(1+\rho q)^2+\alpha q(1-\rho)^2} L^{NPR}(1)$ from participating less than pro rata in the issue of what turns out to be cheap stock. To repeat the explanation given above, the reason for the minority not to participate fully is that they are concerned about falling into the opposite trap, which is to buy overpriced stock. This intuition can be seen in the comparative statics for ρ. As the fraction of low value firms ρ increases, the probability of buying overpriced stock increases as well, and hence minority shareholders are more reluctant to participate – and lose more from non-participation in the (rarer) case that the firm is, in fact valuable. In the limit as $\rho \to 1$ or $q \to \infty$, the minority loses a fraction δ_a of what it would have lost without preemptive rights. In that limiting case, when $\delta_a = 1$ (minority shareholders fear that the firm is worthless) minority shareholders lose as much as if they did not have preemptive rights (intuitively, nobody would want to buy worthless stock, so preemptive rights are irrelevant in this limiting case). At the other extreme, the minority's losses in the "high type" firm tend to zero as $\rho \to 0$ (or, obviously, as $q \to 0$): when minority shareholders are virtually sure that the firm is valuable ($\rho \approx 0$), they risk little by exercising their preemptive rights, avoiding cheap-stock tunneling.

[15] In our simple model with zero NPV investments, minority losses from the issue (if any) are equal to the controller's gain from the issue.

On the other hand, more tedious algebra shows that minority shareholders of the low value firm ($v = 1 - \delta_a$) lose $L_l^{PR} \equiv \frac{\delta_a \alpha q (1-\alpha)(1-\rho)^2}{(1+\rho q)^2 + \alpha q (1-\rho)^2}$. The source of these losses is not cheap-stock tunneling but the purchase of overpriced stock. In expectation—i.e., before the firm's type is revealed—this (at that point, merely probabilistic) loss is exactly offset by the (then still possible) gain of purchasing underpriced stock in the valuable firm.

Naturally, in both high and low value firms, the minority's loss, and the controller's gain, increases in the value difference δ_a, which measures the value relevance of the information asymmetry in this model. The minority's total expected losses from stock issues, $\rho L_l^{PR} + (1-\rho) L_h^{PR}$, also tend to be larger when the information asymmetry itself—as measured by the entropy—is larger, i.e., when ρ takes on intermediate values, and tend to zero if $\rho \to 0$ or $\rho \to 1$.

5 Asymmetric information about controller's private benefits from the issue

We now consider asymmetric information about the controller's private benefits from the issue.

These issue-related private benefits should not be confused with private benefits that have arisen or will arise regardless of the size of the new issue (i.e., even if qp were zero). The case of asymmetric information about issue-*unrelated* private benefits is merely a variant of the previous model (asymmetric information about the value of assets in place), and the mimicking defense would continue to work: we can reinterpret δ_a as the fraction of the initial assets possibly diverted by the controller, either before or after the issue.[16]

By contrast, the issue-related benefits on which we focus in this section derive specifically from the amount of issue proceeds. It has different implications that we now analyze in more detail. In theory and practice, the first and second type could be combined, such as when private benefits scale proportionally with firm size (see section 6.1 below). To emphasize the conceptual difference, however, we here build a model only with the second type.

As before, we consider an issue $q > 0$ of new stock at price $p > 0$ set by the controller, where atomistic minority stockholders initially own fraction $\alpha \in (0,1)$ of the one initial share outstanding and have preemptive rights. However, we now fix the value of the firm's initial assets at $v = 1$, and instead introduce asymmetric information about whether some of the issue proceeds will accrue to the controller in private benefits rather than to the corporation to be shared among all shareholders: with probability

[16] Cf. footnote 8 above.

ρ, a fraction $\delta_i \in (0,1)$ of the issue proceeds benefits only the controller. This can be thought of as describing different kinds of controllers: those that can obtain private benefits, who comprise a fraction ρ of the population of controllers, and those who cannot, who comprise a fraction $1-\rho$. Alternatively, it can be thought of as describing the same individual controller who may or may not have an opportunity to divert issue proceeds. In either case, the parameters ρ and δ_i are common knowledge, but only the controller herself knows her type.

As we already said in motivating our example in section 3.3 above, the private benefits δ_i can take various forms and, importantly, do not need to be pecuniary.[17] What matters is that the controller and the minority shareholders derive different payoffs from the issue. This could be because the controller diverts some of the cash, as in having the corporation use the proceeds to make a payment to the controller for an overpriced asset. But it could also be because the firm will invest the issue proceeds pq in a way that yields less than pq in present value of cash flows to the firm but an offsetting private benefit to the controller, such as the ability to run a larger firm or schmooze with the stars at an event sponsored by the firm. In either case, we continue to assume that the *social* value (i.e., including the controller's private benefits) of the investment of the issue proceeds is exactly pq, even though less than pq accrue to the firm. From now on, we will refer to the private benefits as diversion for simplicity, but the reader should keep in mind the broader interpretation.

We begin by formalizing an important observation about differential reservation prices that we mentioned informally in the introduction.

Lemma 2. *If the controller diverts a fraction δ_i of the issue proceeds into her own pockets, participating in the issue is strictly profitable for the controller if and only if $p < \frac{1}{1-\delta_i}$, i.e., even for prices above the pro-rata value of the assets in place before the issue (which equals 1). By contrast, other shareholders, regardless of whether they owned any stock before the new issue, find participation profitable only for prices below the pro-rata value of the assets in place before the issue: Given that a total q new shares will be issued, atomistic shareholders find participation strictly profitable if and only if $p < \frac{1}{1+\delta_i q} \equiv \underline{p}$; non-atomistic shareholders (other than the controller) have even lower break-even prices.*

Proof. See Appendix. □

Lemma 2 formalizes the intuition that the controller's and outside shareholder's valuations of the new stock diverge when the controller can divert some of the issue proceeds. For outside shareholders, the value of a new share is only the post-issue pro-rata value of the firm *net of* the funds diverted by

[17] Nor do the private benefits need to accrue to the controller instantaneously. Of particular interest, the private benefits could consist of the possibility to extract value through a follow-on equity issue in the future.

the controller. By contrast, for the controller, the value of a new share is the value to outsiders *plus* the private benefits obtained from the issue. Without private benefits, a price equal to the pre-issue pro-rata value of the firm's assets would be break-even for both the controller and outsiders, as the issue proceeds would proportionally increase the value of the firm, such that the pro-rata value of the firm would be the same pre-issue and post-issue. With private benefits, outsiders do worse while the controller does better, because some of the issue proceeds flow only to the controller. The last point holds even if the controller is the only buyer of the new stock because the controller appropriates some of the value of the minority's pre-issue stock: as long as $p < \frac{1}{1-\delta_i}$, the issue proceeds *net of* private benefits do not increase the value of the firm proportionally to the amount of new stock issued. That said, the controller obviously prefers paying a lower price for her stock if she is the only buyer, and would like it even better if the minority bought the stock at a higher price.

As a consequence of lemma 2, the mimicking defense no longer works when the controller derives private benefits from the issue. Since the controller and outside stockholders no longer have the same valuation for the stock, it is not safe for outside stockholders to buy when the controller does – outside stockholders might be overpaying, while the controller is not. Thus, even if the controller publicly and credibly pre-commits to participate in the issue, outside stockholders will not know if the price is high or low *from their perspective*. Outside stockholders are thus caught between a rock and a hard place. They can participate at the risk of overpaying if the controller is able to divert some of the proceeds, or they can decline to participate at the risk of letting the controller snap up stock on the cheap. Both types of controllers benefit from the outside stockholders' dilemma. Controllers with private benefits exploit the minority's fear of cheap stock tunneling to trick the minority into buying stock at a price above the value of the stock to the minority. Controllers without private benefits exploit the minority's fear of the latter to trick the minority into not buying at a price below pro rata firm value. As a result, the minority loses money in expectation. Proposition 2 formalizes and quantifies this intuition.

Proposition 2. *If there is asymmetric information about the controller's ability to divert a fraction δ_i of the issue proceeds into her own pockets, then regardless of whether the controller announces first, there exist only pooling perfect Bayesian equilibria in which the controller always sets the price $p^{**} \equiv \frac{1}{1+\rho\delta_i q} \in \left(\underline{p}, 1\right)$ and buys as much stock as she can, and a fraction $\Delta^{**} \equiv \frac{1-\rho\delta_i}{1+\rho\delta_i q} \in (0,1)$ of the minority rights are exercised; the purchase decisions of individual members of the minority as well as minority shareholders' off-equilibrium beliefs and purchases are not unique.*

Proof. See Appendix. □

The proof of proposition 2 is analogous to that of proposition 1. The main difference is that the

controller who can divert will derive a positive profit even with symmetric information and hence with separation. However, that controller does better still by pooling with the no-benefit controller because such pooling lures enough minority shareholders into buying shares above value to offset the fact that the controller, too, has to overpay in that case, relative to a price of $\underline{p}$.

To compare this situation to one with symmetric information, we first need to establish an appropriate benchmark. Even with complete information, the controller's ability to divert issue proceeds obviously harms the minority. Specifically, when minority shareholders have preemptive rights and complete information but the controller can divert issue proceeds, the controller optimally sets $p = \underline{p}$ and appropriates $L^{PR}_{PB,info} = \alpha\delta_i \underline{p} q = \frac{\alpha\delta_i q}{1+\delta_i q}$ (Fried and Spamann 201).[18] The controller can appropriate, and the minority loses, even more, however, if the minority does not know if the controller is able to divert proceeds. In that case, tedious algebra shows the controller's gain and the minority's loss to be $L^{PR}_{PB,no} \equiv \frac{\alpha\delta_i q\left(1+\rho^2\delta_i q\right)}{(1+\rho\delta_i q)^2}$. If all controllers are able to divert, i.e., $\rho = 1$, then there is no asymmetric information and the expression collapses to $L^{PR}_{PB,info}$. But as ρ decreases, $L^{PR}_{PB,no}$ increases, up to $\alpha\delta_i q = (1+\delta_i q)\, L^{PR}_{PB,info}$ as $\rho \downarrow 0$. The reason is that uninformed minority shareholders now have to contend with the possibility that the stock is actually cheap, and thus some minority shareholders will buy at a price that they would reject if they knew for sure that the controller can divert. This gives the controller a profit from selling overpriced stock on top of the profit from diverting the issue proceeds.

Minority shareholders' need to balance these risks is the reason why the controller *without* the ability to divert still has the ability to cheap-stock-tunnel, pocketing a gain of $L^{PR}_{NPB,no} \equiv \frac{\alpha\rho^2\delta_i^2 q^2}{(1+\rho\delta_i q)^2} = \frac{\rho^2\delta_i^2 q(1+q)}{(1+\rho\delta_i q)^2} L^{NPR}(1)$ from the issue, as can be verified by tedious algebra. It is worth emphasizing that in the limit as $q \to \infty$, $L^{PR}_{NPB,no}$ approaches $L^{NPR}(1)$.[19] The fascinating upshot is that the mere *possibility* that some controllers are able to divert issue proceeds may enable even those who cannot to cheap-stock tunnel essentially as much as if the minority had no preemptive rights.

The crucial role of information asymmetry can be seen by inspecting the total expected losses of the minority, net of the losses they would incur with symmetric information. These are $\rho\left(L^{PR}_{PB,no} - L^{PR}_{PB,info}\right) + (1-\rho)\, L^{PR}_{NPB,no} = \frac{\alpha\delta_i^2 q^2(1-\rho)\rho}{(1+\rho\delta_i q)(1+\delta_i q)}$. They are increasing in the value relevance of the information, δ_i, and tend to be larger when the information asymmetry itself—as measured by the entropy—is larger, i.e., when ρ takes on intermediate values, tending to zero as $\rho \to 0$ or $\rho \to 1$.

[18] The reason why $\underline{p}$ is the equilibrium price with symmetric information is as follows. The controller's gain is the sum of diverted funds and dilution of the minority. If the minority participates, which, by Lemma 2, it does up to $\underline{p}$, dilution is constant at zero and diversion increases in p, so a higher p is better for the controller. As the price increases further above $\underline{p}$, dilution is constant too (at its maximum), whereas the controller is paying more money for the stock, only some of which reverts back to the controller through diversion.

[19] While the infinite limit is theoretical, real world controllers of listed firm have engaged (or attempted to engage in) very large stock issues. For example, certain listed firms in Hong Kong sought to increase outstanding stock by a factor of 20, only to be blocked by a securities regulator (Charltons 2016).

6 Discussion: Real-world complications and extensions

For clarity of exposition of the main effect, the model above contained certain simplifications. We now comment on how additional realism would affect the outcomes. In general, added realism only aggravates the minority's problem.

6.1 Double-Asymmetry Scenario

In our setting, minority shareholders' losses from cheap-stock tunneling (and buying overpriced stock) are caused by information asymmetry regarding either (a) the value of assets in place (pre-issue) or (b) the extent of issue-related private benefits. For clarity, we considered each information-asymmetry scenario separately and independently. In each, the minority loses, with losses increasing in the degree of information asymmetry.

But in the real world, there may well be asymmetric information about both (a) and (b), creating more information asymmetry about the value of the issued shares than in each of the considered scenarios separately. The expected losses to minority shareholders will, accordingly, be larger.

To see why, start with either of the two considered scenarios and its equilibrium issue price. If the other source of information asymmetry is added, the expected loss from buying overpriced stock at that initial issue price will now rise as the second cause of possible loss is added to the first. To maintain equilibrium, the issue price must decline so as to "rebalance" the expected loss from buying overpriced stock and the expected gain from buying cheap stock, which will thus both be larger than before. As a result, assuming constant participation rates, the controller would thus extract more from both cheap-stock tunneling and overpriced issues than under either of the two considered scenarios.[20]

6.2 Voting Rights

In our analysis, we set aside the possibility that the controller or the minority might desire to maintain a certain fraction of the voting rights for control or blocking purposes, respectively. For example, if certain transactions require more than 80% approval, the minority might want to preserve or obtain a 20% voting interest, and, conversely, the controller might want to preserve or obtain an interest exceeding 80%. Ignoring voting rights is proper if the current issue involves non-voting shares, or if there is otherwise no possibility that the current issue can meaningfully alter control rights, in particular

[20] Changes in participation rates will reduce these gains for one type of controller and increase them for the other type, but we conjecture that all types of controllers will be better off with more sources of information asymmetry. In any event, if they can credibly disclose some information, they can never be worse off with more (potential) sources of information asymmetry.

because the controller's and minority's holdings are not close to any relevant thresholds. Otherwise, voting rights would need to be taken into account (cf. Wu et al. 2016).

In some circumstances, the controller's need to remain above a certain voting threshold will protect the minority. This will be the case if (1) the controller is sufficiently close to the relevant threshold that not participating would push the controller below that threshold, (2) the controller values being above the threshold after the issue, and (3) the only threat to the minority emanates from the possibility that the controller may overprice the issue and not participate (as in our first model). Under conditions (1) and (2), the threat (3) is not credible. Importantly, however, the mere proximity of the controller to the voting threshold (condition 1) is not enough to protect the minority. First, the controller may not care about the threshold after the issue (i.e., condition 2 may fail). In particular, the controller may have short-term plans for the firm such as a post-issue liquidation or sale that do not require it remaining above the threshold after the issue. Second, the threat to the minority may not involve controller non-participation (i.e., condition 3 may fail). In particular, if the minority's problem emanates exclusively from the controller's private benefits from the issue proceeds (section 5), then the controller always participates anyway.

In other circumstances, the controller's possibility to *climb above* a certain voting threshold will aggravate the minority's problem. Since the minority never fully participates out of fear of overpaying, the participating controller will increase her percentage of the shares in the underpricing case. This may be valuable to the controller and a loss to the minority. In fact, the controller may set the price higher to induce lower minority participation if she does participate, and to make the minority overpay more when she does not participate.

How the minority would react to this additional threat, or to control considerations generally, would depend on the composition of the shareholder base. If minority shareholders are highly dispersed (in the limit, atomistic as in our model), then individual shareholders will not take into account the effect of their purchase decisions on the overall voting power of the minority. By contrast, large minority shareholders might strategically buy more aggressively to prevent the loss of certain blocking rights. Even they, however, would need to balance such aggressive buying against the risk of overpaying; they will not defend their blocking rights at all cost.[21]

[21] For a recent example of a large insider of U.S. listed firm deliberately setting the offer price high to discourage outsider participation and thereby enable the insider to increase its equity voting power, see Fried (2018a).

6.3 Listing the Firm's Shares

Thus far, we have analyzed the minority's dilemma around equity issues in an unlisted firm. We now discuss how our analysis would be affected by listing the firm's stock, which would subject the firm to enhanced disclosure requirements (Kraakman et al. 2017) and enable continuous (and potentially anonymous) trading of its stock. In this setting, preemptive rights are typically implemented by a rights issue in which the rights are sometimes tradable (Massa et al. 2016). Our bottom line is that listing may alleviate the asymmetric-information problems we have been discussing, but will certainly not fix them (and might even exacerbate them). Indeed, evidence from listed firms is broadly consistent with what our model would predict: in rights issues by controlled firms, minority shareholders tend to purchase less than their pro rata share (Fong and Lam 2014); controllers sometimes increase their percentage ownership and other times decrease it (Fong and Lam 2014; Larrain and Urzua I 2013); and controllers reduce their percentage ownership when the stock is overpriced (Larrain and Urzua I. 2013).

6.3.1 Enhanced Disclosure

Enhanced disclosure has an unambiguously positive effect on the minority's position by reducing information asymmetry. As our model shows, the less the information asymmetry, the less the minority loses from cheap-stock tunneling and the purchase of overpriced shares.[22] But enhanced disclosure will not solve the minority's problem, as no disclosure regime can fully eliminate information asymmetry. Even in the U.S., where disclosure requirements for listed firms are relatively stringent (Kraakman et al. 2017), insiders know more than outsiders, as evidenced by the returns of executives trading directly or indirectly in their own firms' shares (e.g., Cohen et al 2012; Baker and Wurgler 2002).[23]

6.3.2 Trading

As a preliminary matter, we note an indirect effect of trading in the firm's stock: to the extent trading reveals and aggregates information, it may reduce information asymmetry, and hence minority losses, just like increased disclosure. However, we now turn to the direct effects of trading.

Minority's ability to trade The minority's ability to trade would not affect the minority's position directly if third-party buyers are sophisticated, as sophisticated third parties would buy the stock only at a discount reflecting the anticipated losses from the issue. If these buyers are unsophisticated and

[22] The expressions for the minority's expected losses from the issue are increasing in the information asymmetry regarding the value of the assets in the firm or the controller's ability to obtain private benefits from the issue (δ_a and δ_i, respectively).

[23] The asymmetry is likely to be particularly acute in a firm with a controller, which has the power to operate the firm in ways designed to obscure its value, as did the controller of Dole Food Corporation before freezing out public investors (Potter Anderson Corroon 2015).

pay above value, the old minority might lose less or even gain from trading, but only by shifting loss to the new minority. Similarly, if the minority receives tradable rights, buyers of those rights would face the same dilemma as the sellers.[24]

Controller's ability to trade Trading by the controller has various and mostly ambiguous effects on the controller's propensity and ability to use its superior information to expropriate value via a mispriced issue. However, an important caveat is that the controller may face trading constraints as a result of insider trading and similar laws (Fried 2014).

Trading as a substitute If the controller conducts an issue solely to exploit its superior information about the value of assets in place, the controller might use open market trades as a substitute for a stock issue: the controller could directly buy shares when the market underestimates the firm's prospects and otherwise sell. This would obviate the need for the issue. However, insider-trading restrictions imposed on the controller trading directly in the market tend to be more onerous than those imposed on the controller trading with the minority indirectly via the firm (Fried 2014). The controller may therefore choose to rely exclusively on a stock issue to circumvent tighter legal restrictions on direct insider trading, or to conduct a stock issue and engage in only limited open market trading. Of course, when the issue would be conducted at least in part to exploit information asymmetry over the controller's private benefits from the issue, trading cannot substitute for the issue.

Trading as a complement Trading can also be a complement for the controller exploiting its superior information in a stock issue, potentially exacerbating the problem we identify. To begin, the controller's ability to trade could undermine the effectiveness of any ex ante disclosure of the controller's participation decision (by enabling the controller to offset that participation via hedging or sales), and hence the minority's ability to protect itself by mimicking the controller's decision when the information asymmetry pertains (at least in part) to the value of assets in place (cf. supra section 4.2).[25] In addition, when the asymmetric information relates (at least in part) to private benefits from the issue, the issue itself increases information asymmetry about the value of the firm's shares, potentially boosting the

[24] In fact, rights are often not easily tradable, and when there is a market for such rights it is often highly illiquid and characterized by severe underpricing (Massa et al. 2016).

[25] To be effective in a listed firm, the controller's disclosure must cover not only its participation in the issue but also a commitment to abstain from offsetting market transactions (Fried 2018a). However, we know of no jurisdiction that requires disclosure of such a commitment and only one jurisdiction (the PRC) that imposes even a simple participation-disclosure requirement directly on controllers of listed firms, at least for certaint types of issues: the PRC (Chen and Huang 2017). In other major markets–including the U.S, the U.K., Hong Kong, Japan, Singapore, and Germany–there is no obligation on the controller *itself* to disclose its intended participation in an equity issue by a listed firm. However, a *firm* is typically required to reveal any underwriting arrangement in connection with the rights issue, including an arrangement with the controller.

controller's ability to profit from informed trading directly in the market. This extra profit, in turn, could provide an additional incentive to undertake such an issue. Of course the controller would still need to reckon with restrictions on trading by informed insiders.

7 Conclusion

In this paper, we have presented a model that shows how preemptive rights, widely used to prevent cheap-stock tunneling by controlling shareholders, can be substantially undermined by asymmetric information. In particular, asymmetric information about either the value of assets in place or the extent to which the issue disproportionately benefits the controller enables the latter to cheap-stock tunnel around preemptive rights. Importantly, these disproportionate benefits could be purely non-pecuniary. Moreover, the mere possibility that the controller *might* get such disproportionate benefits, either financial or non-pecuniary, enables cheap-stock tunneling even by a controller who knows it will not.

Our analysis can explain why, in unlisted firms, sophisticated investors such as VCs typically negotiate blocking rights on subsequent equity issues alongside the right to participate pro rata in future issues. It can also help explain why regulators of listed firms do not rely exclusively on preemptive rights to protect minority investors, but rather impose a range of other measures on issues (such as fiduciary duties for directors and, in some jurisdictions, a regulator veto on issues).

As we have explained, some amount of asymmetric information and disproportionate benefit is inevitable even in the most robust disclosure regimes, such as that of the U.S. However, forcing the controller of unlisted and listed firms to disclose her participation decision up front, as at least one regime (the PRC) requires for certain issues by listed firms, would go at least some way towards alleviating the problem we discuss.[26] Requiring majority-of-minority (MoM) approval would (in our model) totally eliminate the problem, but of course come with its own costs.[27] A less effective (but less costly) approach would be to require majority or super-majority shareholder approval, as this would give the minority some protection when insiders lack sufficient voting power to ensure approval.[28] Future work should consider the trade-offs involved in these various approaches, which presumably differ as a function of the firm's anticipated capital needs. Such work might also consider if better protective mechanisms could be designed. In the meantime, courts and others should be cognizant that the ability to participate pro rata in an equity issue does not suffice to protect the minority from cheap-stock tunneling.

[26] Fried (2018a). For listed firms, the controller should also be required to commit to refrain from offsetting market transactions, cf. supra note 25.

[27] The PRC has mandated minority veto rights over certain equity issues (Chen et al. 2013). For evidence that mandatory minority veto rights can curb controller tunneling, see Fried et al. (2018).

[28] For evidence on the effects of such shareholder-approval requirements, see Holderness (2017).

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Appendix

A Proof of Lemma 1

If a shareholder owning $\gamma < 1$ of the existing stock purchases q' of the new stock and others purchase q'', the value of the shareholder's investment, net of the purchase price, is

$$W \equiv (\gamma + q')\, v_s - pq',$$

where

$$v_s \equiv \frac{v + (q' + q'')\, p}{1 + q' + q''}$$

is the value of a share after the issue. Now

$$\frac{dW}{dq'} = \frac{v - p}{1 + q' + q''} \left(1 - \frac{\gamma + q'}{(1 + q' + q'')} \right).$$

It follows that $\frac{dW}{dq'} \lesseqgtr 0$ if and only if $v - p \lesseqgtr 0 \Leftrightarrow v \lesseqgtr p$ (because for $\gamma \in (0, 1)$ and $q', q'' \geq 0$, $1 - \frac{\gamma + q'}{1 + q' + q''} > 0$).

B Proof of Proposition 1

The proof proceeds in three steps:

1. If equilibria of the type described in proposition 1 exist, they have unique equilibrium price p^* and minority participation Δ^*;
2. Such equilibria do exist, which we show by examples;
3. Other types of equilibria do not exist.

The proof uses the fact that, by the law of large numbers, atomistic minority shareholders' actual purchases always equal their expected purchases, i.e., aggregate purchases are non-stochastic even if individual shareholders' purchases are random.

B.1 Unique equilibrium price p^* and participation Δ^*, given existence of type of equilibrium

If there is an equilibrium in which both types of controllers pool on a single price $p^* \in (1-\delta_a, 1)$ and the minority participates only partially, then at the equilibrium price p^*

1. both controller types' first order conditions must hold:[29] given respective expected profits of the high and low type for $p \in (1-\delta_a, 1)$,[30]

$$\pi_h(p) \equiv \frac{\alpha q}{1+q}(1-\Delta(p))(1-p)$$
$$\pi_l(p) \equiv \alpha(1-\alpha) q \frac{\Delta(p)(p-1+\delta_a)}{1+\alpha q \Delta(p)},$$

respectively, these are

$$\frac{d\pi_h}{dp}(p^*) \propto -(1-\Delta(p^*)) - \Delta'(p^*)(1-p^*) = 0$$
$$\frac{d\pi_l}{dp}(p^*) \propto \frac{\Delta(p^*)}{1+\alpha q \Delta(p^*)} + \frac{\Delta'(p^*)(p^*-1+\delta_a)}{(1+\alpha q \Delta(p^*))^2} = 0,$$

which together imply

$$p^* = 1 - \delta_a \frac{1-\Delta(p^*)}{1+\alpha q \Delta(p^*)^2}; \tag{1}$$

2. minority shareholders must be indifferent between participating or not (since some minority shareholders buy and some do not), i.e., the expected marginal profit from purchasing a new share must be zero:

$$\rho \frac{1-\delta_a+\alpha\Delta(p^*)qp^*}{1+\alpha\Delta(p^*)q} + (1-\rho)\frac{1+qp^*}{1+q} - p^* = 0, \tag{2}$$

[29] The minority's expected participation must be continuous and differentiable at any equilibrium point, for otherwise one of the two types of controllers would do better by a slight deviation in the direction of the discontinuity.

[30] The profit expression for the high type follows from the fact that by Lemma 1, the high type will snap up not only her alloted $(1-\alpha)q$ shares but also the $(1-\Delta(p))\alpha q$ shares alloted to the minority that minority shareholders do not buy, such that the value of the stock following the issue will be $\frac{1+qp}{1+q}$. The controller makes a trading gain on her $(1-\alpha)q + (1-\Delta(p))\alpha q = (1-\alpha\Delta(p))q$ purchased shares, partially offset by a loss on the value of her $(1-\alpha)$ existing shares:

$$(1-\alpha\Delta(p))q\left(\frac{1+qp}{1+q} - p\right) - (1-\alpha)\left(1 - \frac{1+qp}{1+q}\right) = \frac{1-p}{1+q}[1-\Delta(p)]\alpha q = \pi_h(p).$$

The profit expression for the low type follows from the fact that by Lemma 1, the low type will not purchase any shares, and hence the only change in her position will be the increase in the value of her existing shares. The increase happens because a fraction Δ of the minority exercises in ignorance of the overpricing, increasing the value of a share from $1-\delta_a$ to $\frac{1-\delta_a+\Delta(p)\alpha qp}{1+\Delta(p)\alpha q}$. The controller's gain is thus

$$(1-\alpha)\left(\frac{1-\delta_a+\Delta(p)\alpha qp}{1+\Delta(p)\alpha q} - (1-\delta_a)\right) = \frac{1-\alpha}{1+\Delta(p)\alpha q}\Delta(p)\alpha q(p-1+\delta_a) = \pi_l(p).$$

where the probability weights ρ and $1-\rho$ follow from the fact that in a pooling equilibrium, the conditional probability of facing either type of controller given p^* equals the unconditional probability.

Equations 1 and 2 set up a system of two equations in two unknowns that has a unique solution for $\Delta \in [0,1]$, namely $\Delta^* = \frac{1-\rho}{1+\rho q}$ and thus $p^* = 1 - \frac{\delta_a \rho (1+q)}{1+\rho q + \alpha q (1-\rho)^2/(1+\rho q)}$.[31]

B.2 Existence of type of equilibrium

There exist off-equilibrium minority participation rates $\Delta(p)$ and minority beliefs $\theta(p)$ (about the probability of facing a low type) that sustain the type of equilibrium identified above (controller pooling on p^* and equilibrium minority participation Δ^*). One class of examples [32] is participation rates

$$\Delta^*(p) \equiv \begin{cases} 1 & \text{if } p \leq 1-\delta_a \\ 0 & \text{if } p \geq 1 \\ \max\left\{0, \min\left\{1, \overline{\Delta^*}(p)\right\}\right\} & \text{if } p \in (1-\delta_a, 1), \end{cases}$$

where $\overline{\Delta^*}(p) \equiv \Delta^* + (p^* - p)\frac{1-\Delta^*}{1-p^*}$, and beliefs

$$\theta^*(p) \equiv \begin{cases} 1 & \text{if } p \leq 1-\delta_a \\ 0 & \text{if } p \geq 1 \\ \frac{(1+\alpha q \Delta^*(p))(1-p)}{(1+\alpha q \Delta^*(p))(1-p)+(1+q)(p-1+\delta_a)} & \text{if } p \in (1-\delta_a, 1) \end{cases}.$$

As required, $\Delta^*(p^*) = \Delta^*$, $\theta^*(p^*) = \rho$, and $\theta^*(p) \in [0,1]\ \forall p$; individual minority shareholders' purchase decisions that aggregate to $\Delta^*(p^*)$ are optimal given other minority shareholders' purchases and $\theta^*(p)$ (indifference for $p \in [1-\delta_a, 1]$ and, by Lemma 1, strict for other prices); and p^* is optimal for both controllers given $\Delta^*(p)$: (1) for $p \notin (1-\delta_a, 1)$, both controllers' profits are zero, whereas they are positive at p^*, and (2) for $p \in (1-\delta_a, 1)$, the first order conditions hold at p^* (by construction of p^* and inspection of $\pi_h'(p^*)$and $\Delta'(p^*)$), the profit functions are concave for all $p\, s.t.\, \Delta^*(p) = \overline{\Delta^*}(p)$, and where $\Delta^*(p)$ deviates from $\overline{\Delta^*}(p)$, one controller's profit is zero and the other's is declining in the

[31] One need not consider solutions $\Delta \notin [0,1]$ because (1) $\Delta > 1$ could happen only if the controller did not participate, which, given Lemma 1, would imply that the price is too high, and (2) inversely, $\Delta < 0$ would require selling to the controller, which, given Lemma 1, would imply that the price is too low; no individual shareholder would want to be part of this group (recall that aggregate purchases are non-stochastic with atomistic shareholders, such that $\Delta \notin [0,1]$ would, in equilibrium, be known to any individual shareholder before making the decision).

[32] The plural conveys that the collective $\Delta^*(p)$ masks an infinite number of individual strategies, including a common individual participation probability or a partition of minority shareholders into a fraction $\Delta^*(p)$ that always participates given p, and a remainder $1-\Delta^*(p)$ that never does given p.

direction of the deviation.

B.3 No other types of equilibria

Other types of equilibria are not possible.

1. There cannot be a separating equilibrium, or pooling on more than one price or on a price $p \notin (1-\delta_a, 1)$.

   (a) A separating equilibrium reveals the controller's type. This enables minority shareholders to buy if and only if the price is advantageous, ensuring that controllers earn zero profits. But for any minority reaction $\Delta(p) : (1-\delta_a, 1) \to [0,1]$, at least one of the two controller "types"' profit functions is positive at all $p \in (1-\delta_a, 1)$. This means that at least one of the two controller types could profitably deviate from any candidate separating equilibrium.

   (b) Pooling on two or more prices would be possible only if minority purchases rose with the controller's price announcement, as equation 1's right hand side increases in Δ. That, however, would contradict the higher price being optimal for the controller with $v = 1$, whose profits are decreasing in both p and Δ.

   (c) Pooling prices $p \notin (1-\delta_a, 1)$ are ruled out for analogous reasons as separating equilibria since at such prices minority shareholders can guarantee a zero payoff for themselves (and hence for the controller) by always participating (for $p \leq 1-\delta_a$) or never participating (for $p \geq 1$).

2. Full participation or abstention by all minority shareholders is not compatible with a pooling equilibrium (for which $p \in (1-\delta_a, 1)$, as per the previous argument). Suppose, to the contrary, that in the candidate pooling equilibrium, all (no) minority stockholders participate. Then the controller with the high (low) valuation earns zero profits in this equilibrium. If any minority stockholders did not participate (did participate) anywhere else on $p \in (1-\delta_a, 1)$ (i.e., off equilibrium), the controller with the high (low) valuation would deviate to there because that would guarantee some positive profit (by simple inspection of the profit expressions above). Thus, to sustain the candidate equilibrium, all (no) minority stockholders must participate for all $p \in (1-\delta_a, 1)$. This in turn means that the controller with the low (high) valuation would want to choose p as high (low) as possible. But since the interval of possible prices is open (with a discontinuous change in minority participation at the boundary), there is no maximum (minimum), and hence no equilibrium.[33]

[33] Even if prices were restricted to discrete increments, full participation or abstention would only be possible if the

C Proof of Lemma 2

If the controller purchases q' of the new stock and others (minority shareholders and/or third parties) purchase q'', the value of the controller's investment, net of the purchase price and inclusive of private benefits, is

$$W_C^{PB} \equiv (1-\alpha+q')\, v_s^{PB} - pq' + \delta_i p\,(q'+q''),$$

where

$$v_s^{PB} \equiv \frac{1+(1-\delta_i)\,(q'+q'')\,p}{1+q'+q''}$$

is the value of a share to any shareholder after the issue and diversion of fraction δ_i of the issue proceeds to the controller. Now

$$\frac{dW_C^{PB}}{dq'} = \frac{1-(1-\delta_i)\,p}{1+q'+q''}\left(1-\frac{1-\alpha+q'}{1+q'+q''}\right),$$

which entails $\frac{dW_C^{PB}}{dq'} \lesseqgtr 0$ if and only if $1-(1-\delta_i)\,p \lesseqgtr 0 \Leftrightarrow \frac{1}{1-\delta_i} \lesseqgtr p$ (because for $\alpha \in (0,1)$ and $q', q'' \geq 0$, $1-\frac{1-\alpha+q'}{1+q'+q''} > 0$).

A non-controlling shareholder, new or old, values the purchase differently because that shareholder does not obtain the private benefits δ. Denoting any prior stake of the non-controlling shareholder $\gamma \geq 0$, the value of the non-controlling shareholder's investment, net of the purchase price and given others' purchases q'', is

$$W_{NC}^{PB} \equiv (\gamma+q')\, v_s^{PB} - pq'.$$

Now

$$\frac{dW_{NC}^{PB}}{dq'} = \frac{(1-p)\,(1-\gamma+q'') - p\delta_i\,(\gamma+q'+(q'+q'')\,(q'+q''+1))}{1+q'+q''},$$

which entails $\frac{dW_{NC}^{PB}}{dq'} \lesseqgtr 0$ if and only if $p \gtreqless \frac{1-\gamma+q''}{1-\gamma+q''+\delta_i(\gamma+q'+(q'+q'')(q'+q''+1))} \equiv \underline{p}_{\gamma,q'}$. The latter expression is decreasing in γ and q' – outside shareholders' reservation declines with their holdings and issue purchases. The most willing to buy is an atomistic shareholder, for whom the expression converges to

$$\underline{p} \equiv \lim_{\gamma,q'\to 0} \underline{p}_{\gamma,q'} = \frac{1}{1+\delta_i q''}.$$

minimum price increment were at least $\frac{\rho\delta(1+q)}{1+q(\rho+\alpha(1-\rho))}$, which tends to be very large (considering that we have normalized firm value to 1).

D Proof of Proposition 2

The proof of proposition 2 is very similar to the proof of proposition 1, and we merely note the differences to that proof. One difference is, of course, that both types of controllers now purchase identical quantities of stock in the issue (the maximum amount available), such that the purchase is not revealing to the minority and hence it makes no difference if the controller announces first or not (and since both do better than in a separating equilibrium, it would not be in either type's interest to reveal their type by this or any other means).

D.1 Equilibrium price p^{**} and participation Δ^{**}

The profit function for the controller without private benefits for $p \in \left(\underline{p}, 1\right)$ is the same as that in proposition 1 for the high type controller, π_h. The profit function for the controller with private benefits for $p \leq \frac{1}{1-\delta_i}$ is

$$\pi^{PB}(p) \equiv W_C^{PB}(p) - (1-\alpha) = \frac{\alpha q}{1+q}\left\{1 - (1-\delta_i)\, p - \left[1 - (1+\delta_i q)\, p\right] \Delta(p)\right\}$$

such that the two controller types' first order conditions $\pi_h'(p^{**}) = 0$ and

$$\frac{d\pi^{PB}}{dp}(p^{**}) \propto -(1-\delta_i) + \Delta(p^{**})(1+\delta_i q) - \Delta'(p^{**})\left[1 - p^{**}(1+\delta_i q)\right] = 0$$

now imply

$$p^{**} = \frac{1 + q\Delta(p^{**})}{1+q}. \tag{3}$$

The minority indifference condition (a/k/a zero marginal profit condition for share purchases) is now

$$\begin{aligned} 0 &= \rho \frac{1 + (1-\delta_i)\, q p^{**}}{1+q} + (1-\rho)\frac{1 + q p^{**}}{1+q} - p^{**} \\ \Leftrightarrow p^{**} &= \frac{1}{1+\rho\delta_i q} \end{aligned} \tag{4}$$

Equations (3) and (4) uniquely determine

$$\Delta^{**} \equiv \Delta(p^{**}) = \frac{1-\rho\delta_i}{1+\rho\delta_i q}.$$

D.2 Existence

Off-equilibrium minority purchase fractions and beliefs that can sustain the above equilibrium now include

$$\Delta^{**}(p) = \begin{cases} 1 & \text{if } p \leq \underline{p} \\ 0 & \text{if } p \geq 1 \\ \max\left\{0, \min\left\{1, \overline{\Delta^*}(p)\right\}\right\} & \text{if } p \in \left(\underline{p}, 1\right), \end{cases}$$

where $\overline{\Delta^*}(p) \equiv \Delta^{**} + (p^{**} - p)\frac{1-\Delta^{**}}{1-p^{**}}$, and

$$\theta^{**}(p) \equiv \begin{cases} 1 & \text{if } p \leq \underline{p} \\ 0 & \text{if } p \geq 1 \\ \frac{1-p}{\delta_i q p} & \text{if } p \in \left(\underline{p}, 1\right) \end{cases}.$$

That these sustain the equilibrium can be verified in the same way as for the analogous functions in proposition 1. The only difference is that the profits of the controller with private benefits are positive even for $p \leq \underline{p}$, and that $\pi^{PB}(p)$ has a different functional form than $\pi_l(p)$ (see above). However, $\pi^{PB}(p)$ is still concave for all p *s.t.* $\Delta^{**}(p) = \overline{\Delta^{**}}(p)$, and π^{PB} is strictly lower at other p, regardless of where the kinks of $\Delta^{**}(p)$ are located: for lower p, this follows because (1) $p < \underline{p} \Rightarrow \Delta^{**}(p) = 1 \Rightarrow \frac{d\pi^{PB}}{dp} > 0$, (2) $p = \underline{p} \Rightarrow \frac{\partial \pi^{PB}}{\partial \Delta} = 0$, (3) $\Delta = 1 \Rightarrow \frac{\partial \pi^{PB}}{\partial p} > 0$; and for higher p, this follows because (1) $\Delta = 0 \Rightarrow \frac{\partial \pi^{PB}}{\partial p} < 0$ and (2) $p = 1 \Rightarrow \frac{\partial \pi^{PB}}{\partial \Delta} < 0$.

D.3 No other types

The argument ruling out separating equilibria differs from proposition 1 because only the controller without private benefits would not obtain positive profits in a separating equilibrium. It turns out, however, that this is enough to rule out separation. Assume there were a separating equilibrium. As just mentioned, the controller *without* private benefits would earn zero profits in such an equilibrium. But $\pi^{NPB} > 0$ if $p < 1$ and $\Delta < 1$. To rule out a profitable deviation by that controller, the minority would thus have to buy with certainty for all prices less than one. But then the controller *with* private benefits would maximize her profits by setting a price above $\underline{p}$, since her profits π^{PB} are increasing in p if $\Delta > \frac{1-\delta_i}{1+\delta_i q}$, as we just established would have to be the case in this candidate equilibrium for all $p < 1$. This means that $\underline{p}$ cannot be the separating equilibrium price for the controller with private benefits. Neither can any higher price, however, because by Lemma 2, minority shareholders are unwilling to buy

at $p > \underline{p}$ if they know the controller diverts private benefits, as they would in a separating equilibrium.

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