Financing Through Asset Sales*

Alex Edmans  
LBS, Wharton, NBER,  
CEPR, and ECGI

William Mann  
UCLA

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Abstract

Most research on firm financing studies the choice between debt and equity. We model an alternative source – non-core asset sales – and identify three new factors that drive a firm’s choice between selling assets and equity. First, equity investors own a claim to the cash raised. Since cash is certain, this mitigates the information asymmetry of equity (the “certainty effect”). In contrast to Myers and Majluf (1984), even if non-core assets exhibit less information asymmetry, the firm issues equity if the financing need is high. This result is robust to using the cash for an uncertain investment. Second, firms can disguise the sale of a low-quality asset as instead motivated by operational reasons – dissynergies – and thus receive a higher price (the “camouflage effect”). Third, selling equity implies a “lemons” discount for not only the equity issued but also the rest of the firm, since its value is perfectly correlated. In contrast, a “lemons” discount on assets need not lead to a low stock price, as the asset is not a carbon copy of the firm (the “correlation effect”).

Keywords: Asset sales, financing, pecking order, synergies.

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*aedmans@london.edu, william.mann@anderson.ucla.edu. We thank Zehao Hu, Devin Reilly, and Jan Starmans for excellent research assistance and Kenneth Ahern, Ilona Babenko, Ginka Borisova, Christine Dobridge, Xavier Gabaix, Christopher Hennessy, Anzhela Knyazeva, Pablo Kurlat, Larry Lang, Gustavo Manso, Chris Mayer, Erwan Morellec, Stew Myers, Gordon Phillips, Julio Riutort, Michael Roberts, Lynn Selhat, Myron Slovin, Krishnamurthy Subrahmaniam, Marie Sushka, James Thompson, Neng Wang, Jun Yang, and conference/seminar participants at Chicago, Columbia, HBS, Houston, Lausanne, Philadelphia Fed, Utah, Wharton, Arizona State Winter Finance Conference, Chile Corporate Finance Conference, EFMA, Florida State/Sun Trust Conference, LBS Summer Symposium, UBC Summer Conference Early Ideas Session, and WFA for helpful comments. AE gratefully acknowledges financial support from the Goldman Sachs Research Fellowship from the Rodney L. White Center for Financial Research, the Wharton Dean’s Research Fund, and the Dorinda and Mark Winkelman Distinguished Scholar award.
One of a firm’s most important decisions is how to raise financing. Most research on this topic focuses on the choice between debt and equity. For example, the pecking-order theory of Myers (1984), motivated by Myers and Majluf (1984, “MM”), posits that managers issue securities with least information asymmetry, while the market timing theory of Baker and Wurgler (2002) suggests that managers sell securities that are most mispriced. However, another major source of financing is relatively unexplored: selling non-core assets – divisions, physical capital, or financial investments. Asset sales are substantial in practice: Securities Data Corporation records $131bn of asset sales by non-financial firms in the U.S. in 2012, versus $81bn in seasoned equity issuance. Figure 1 compares the time series of seasoned equity issuance with asset sales.

While some asset sales may be motivated by operational reasons, financing is a key driver of many others. Empirically, asset sales are used to fund investment and R&D (shown by Hovakimian and Titman (2006) and Borisova and Brown (2013) respectively), to recapitalize firms in response to regulatory or investor concerns (as with banks worldwide since the financial crisis¹), and to address one-time cash needs (BP

Figure 1: Seasoned equity issuance and asset sales volume. Seasoned equity is all US non-IPO equity issuance. Asset sales are completed, domestic M&A transactions labeled “acquisition of assets” or “acquisition of certain assets,” where the acquisition technique field includes at least one out of Divestiture, Property Acquisition, Auction, Internal Reorganization, Spinoff, and none out of Buyout, Bankrupt, Takeover, Restructuring, Liquidation, Private, Tender, Unsolicited, Failed. Source: SDC.

¹In September 2011, BNP Paribas and Société Générale announced plans to raise $96 billion and $5.4 billion respectively through asset sales, to create a financial buffer against contagion from other French banks. Bank of America raised $3.6 billion in August 2011 by selling a stake in a Chinese
targeted $45bn in asset sales to cover the costs of the Deepwater Horizon disaster). In each of these cases, the firms could presumably have met their financing needs through issuing securities, yet chose to sell assets. Indeed, Hite, Owers, and Rogers (1987) examine the stated motives for asset sales and note that “in several cases ... selling assets was viewed as an alternative to the sale of new securities.” On the one hand, asset sales are a source of funds like security issuance, and should be considered alongside security issuance in a financing decision. On the other hand, unlike security issuance, asset sales can have real effects by reallocating physical resources and changing the firm’s boundaries. Thus, the role of asset sales in financing requires special investigation.

We build a model that allows asset sales to be undertaken not only to raise capital, but also for operational reasons (dissynergies). It studies the conditions under which asset sales are preferable to equity issuance, how financing and operational motives interact, and how firm boundaries are affected by financial constraints. We analyze a firm that comprises a core asset and a non-core asset, and has a financing need which it can meet by selling either equity or part of the non-core asset. The firm’s type is privately known to its manager and comprises two dimensions. The first is quality, which determines the assets’ standalone (common) values. Firms with high-quality core assets may have high- or low-quality non-core assets. We analyze both possibilities, labeling them the positive- and negative-correlation cases, respectively. The second is synergy, which captures the additional (private) value lost when the non-core asset is separated from its current owner.

It may seem that asset sales can already be analyzed by applying the general principles of MM’s security issuance model to assets, removing the need for a new theory. Such an extension would suggest that asset sales are preferred to equity issuance if and only if they exhibit less information asymmetry. Our model identifies three new forces that also drive the financing choice and may outweigh this simple intuition.

The first new force is the certainty effect, which represents an advantage to selling equity. It arises because new shareholders obtain a stake in the firm’s entire balance sheet, which includes not only the core and non-core assets in place (whose value is uncertain), but also the cash raised. Since the value of this cash is certain, this mitigates the information asymmetry of assets in place. In contrast, an asset purchaser does not share in the cash raised, but rather bears the full information asymmetry construction bank, and $755 million in November 2011 from selling its stake in Pizza Hut. More generally, Borisova, John, and Salotti (2013) find that over half of asset sellers state financing motives. Campello, Graham, and Harvey (2010) report that 70% of financially constrained firms increased asset sales in the financial crisis, versus 37% of unconstrained firms. Maksimovic and Phillips (1998) find a significant increase in asset sales upon bankruptcy.
associated with the asset’s value. Thus, the certainty effect is quite different from simply reducing the information asymmetry of the assets in place, which would benefit both asset purchasers and equity investors equally. Unlike in MM, even if the firm’s overall assets exhibit more information asymmetry than the non-core asset alone, the manager may sell equity if enough cash is raised that the certainty effect dominates. Contrary to conventional wisdom, equity is not always the riskiest claim: if a large amount of financing is raised relative to the size of the firm, equity becomes relatively safe. Indeed, small firms typically have high financing needs relative to assets in place; Frank and Goyal (2003) and Fama and French (2005) find that small firms tend to issue equity.

The certainty effect implies that the source of financing depends on the amount required. Formally, a pooling equilibrium is sustainable where all firms sell assets (equity) if the financing need is sufficiently low (high). In standard financing models, the choice of financing depends only on the characteristics of each claim (such as its information asymmetry (MM) or misvaluation (Baker and Wurgler (2002))) and not the amount required – unless one assumes exogenous limits such as debt capacity.

The certainty effect applies to any use of funds whose expected value is uncorrelated with firm quality: retaining it on the balance sheet, repaying debt, or financing a risky investment with expected return independent of firm quality. We also consider the case in which the expected investment return is correlated with firm quality, and thus exhibits information asymmetry. It may appear that an uncertain investment return should weaken the certainty effect, but this intuition is incomplete due to a second consideration. Since investment is positive-NPV, it increases the value of the capital that investors are injecting: the certain value to which they have a claim is now higher. If the minimum investment return (earned by the low-quality firm) is large compared to the additional return generated by the high-quality firm, the second consideration dominates – somewhat surprisingly, the certainty effect can strengthen when cash is used to finance an uncertain investment. Thus, equity is more common when growth opportunities are good for firms of all quality, i.e. the minimum investment return is high. For example, a positive industry shock will improve investment opportunities for all firms in the industry and should make equity issuance more likely. In contrast, if the additional return generated by the high-quality firm over the low-quality firm is large, asset sales become preferable. In almost all cases, it remains robust that asset (equity) sales are used for low (high) financing needs.

In addition to pooling equilibria, we may have a semi-separating equilibrium in which firms sell assets if synergies are below a threshold and equity otherwise. The
threshold synergy level is different for high- and low-quality firms and, due to the certainty effect, depends on the amount of financing required – financial and operational motives interact. If this amount is high, the information asymmetry of equity is low, making it more (less) attractive to high (low) quality firms. Conventional wisdom is that greater financing needs force firms to sell more assets. Here, greater financing needs lead to high-quality firms selling fewer assets and instead substituting into equity issuance. Greater financing needs also reduce (increase) the quality and price of assets (equity) sold in equilibrium, and result in a less (more) positive market reaction.

The second new force is the camouflage effect, which represents an advantage to selling assets. It arises if firms have the option not to raise financing and instead to forgo a growth opportunity. If the growth opportunity is low, high-quality firms will not issue equity, since the value of investment does not outweigh the adverse selection discount. However, they will sell assets if they are sufficiently dissynergistic, not to finance investment but for operational reasons. Asset sales by high-quality firms allow low-quality firms to pool with them: they can camouflage an asset sale driven by overvaluation (the asset is of low quality and has a low common value) as instead being driven by operational reasons (it is dissynergistic and only has a low private value). This camouflage leads low-quality firms to prefer asset sales to equity issuance: indeed, they will sell assets even if they are synergistic. In the 1980s, many conglomerates shed non-core assets, stating a desire to refocus on the core business, but outsiders did not know if the true motivation was that the non-core assets were low-quality. In contrast, where growth opportunities are high, equity also provides camouflage as it can be undertaken for the operational reason of wishing to finance investment. Thus, we again get the prediction that positive industry shocks will encourage equity issuance.

The third new force is the correlation effect, which also represents an advantage to selling assets. An equity issuer suffers an Akerlof (1970) “lemons” discount – the market infers that the equity is low-quality from the firm’s decision to issue it. The firm suffers not only a low price for the equity issued, but also a low valuation for the rest of the company, because it is perfectly correlated with the issued equity. An asset seller similarly receives a low price on the assets sold, but critically this need not imply a low valuation for the company as it need not be a carbon copy. Formally, in the negative-correlation model, the parameter values that support the equity-pooling equilibrium are a strict subset of those that support asset-pooling. For example, to cover the costs of Deepwater Horizon, BP is selling its mature fields and refocusing on high-risk exploration. The New York Times reported that analysts perceived this
sale as a bet on a major new find that would displace the existing fields. The sale conveyed negative information about the mature fields but a positive signal about the growth prospects of the rest of the firm.

An implication of the correlation effect is that conglomerates issue equity less often, and sell assets more often, than firms with closely related divisions. In addition, under negative correlation, asset sales (equity issuance) lead to positive (negative) market reactions, as found empirically (see below). The analysis also highlights a new benefit of diversification: a non-core asset is a form of financial slack. While the literature on investment reversibility (e.g., Abel and Eberly (1996)) models reversibility as a feature of the asset’s technology, here an investment that is not a carbon copy of the firm is “reversible” in that it can be sold without negative inferences on the rest of the firm.

Our paper can be interpreted more broadly as studying at what level to issue claims: the firm level (equity issuance) or the asset level (asset sales). Our effects also apply to other types of claim that the firm can issue at each level. All three effects apply to parent-company risky debt (or general securities issued against the firm’s balance sheet, as analyzed by DeMarzo and Duffie (1999)) in the same way as parent-company equity: Since parent-company debt is also a claim to the entire firm, it benefits from the certainty effect and is positively correlated with firm value; issuing debt cannot be camouflaged as stemming from operational reasons. Like asset sales, the issuance of asset- or division-level debt or equity (e.g., an equity carve-out) benefits from the correlation effect as it need not imply low quality for the firm as a whole, but not the certainty effect as investors do not own a claim to the cash they invest, which resides at the parent company level.


Existing theories generally consider asset sales as the only source of financing and do not compare them to equity, e.g., Shleifer and Vishny (1992), DeMarzo (2005), He (2009), and Kurlat (2013). Milbradt (2012) and Bond and Leitner (2014) show that selling an asset will affect the market price of the seller’s remaining portfolio under mark-to-market accounting. We show that such correlation effects are stronger for

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3See the articles “With Sale of Assets, BP Bets on More Deep Wells” (July 20, 2010) and “BP to Sell Oil Assets in Gulf of Mexico for $5.6 billion” (September 10, 2012).
equity: while a partial asset sale may imply a negative valuation of the remaining unsold non-core assets, it need not imply a negative valuation of the firm. Nanda and Narayanan (1999) also consider both asset sales and equity issuance under information asymmetry, but do not feature the certainty, camouflage, or correlation effects.4

Since a partial asset sale can be interpreted as a carve-out, our paper is also related to the carve-out literature. Nanda (1991) also notes that non-core assets may be uncorrelated with the core business and that this may motivate subsidiary equity issuance. In his model, correlation is always zero and the information asymmetry of core and non-core assets is identical. Our model allows for general correlations and information asymmetries, as well as synergies, enabling us to generate the three effects.5

Finally, while we show that the MM pecking order insight cannot be naturally extended to the choice between asset sales and equity, Nachman and Noe (1994) show that the original pecking order (between debt and equity) only holds under special conditions. Fulghieri, Garcia, and Hackbarth (2013) demonstrate that these conditions are particularly likely to be violated for younger firms with larger investment needs and riskier growth opportunities, where equity is indeed preferred to debt empirically.

This paper is organized as follows. Section 1 outlines the general model. Sections 2 and 3 study the positive and negative correlation cases, respectively. Section 4 discusses empirical implications and Section 5 concludes. The Appendix contains proofs and other peripheral material.

1 The Framework

The model consists of two types of risk-neutral agent: firms, which raise financing, and investors, who provide financing and set prices. The firm is run by a manager, who has private information about the firm’s type $\theta = (q, k)$. The type $\theta$ consists of two

4Leland (1994) allows firms to finance cash outflows either by equity issuance (in the core analysis) or by asset sales (in an extension), but not to choose between the two. In Strebulaev (2007), asset sales are assumed to be always preferred to equity issuance, which is a last resort. Other papers model asset sales as a business decision (equivalent to disinvestment) and do not feature information asymmetry. In Morellec (2001), asset sales occur if the marginal product of the asset is less than its (exogenous) resale value. In Bolton, Chen, and Wang (2011), disinvestment occurs if the cost of external finance is high relative to the marginal productivity of capital. While those papers take the cost of financing as given, this paper microfounds the determinants of the cost of equity finance versus asset sales.

5Empirically, Allen and McConnell (1998) study how the market reaction to carve-outs depends on the use of proceeds. Schipper and Smith (1986) show that equity issuance leads to negative abnormal returns, but carve-outs lead to positive returns. Slovin, Sushka, and Ferraro (1995) find positive market reactions to carve-outs, and Slovin and Sushka (1997) study the implications of parent and subsidiary equity issuance on the stock prices of both the parent and the subsidiary.
dimensions. The first is the firm’s quality \( q \in \{H, L\} \), which measures the standalone (common) value of its assets. The prior probability that \( q = H \) is \( \pi \in (\frac{1}{2}, 1) \). The second dimension is a synergy parameter \( k \sim U[k, \bar{k}] \), where \(-1 < k \leq 0, \bar{k} \geq 0\), and \( k \) and \( q \) are uncorrelated. This parameter measures the additional (private) value lost if the current owner sells the asset.

The firm comprises two assets, or equivalently two lines of business. The core business has value \( C_q \), where \( C_H > C_L \), and the non-core business has value \( A_q \). Where there is no ambiguity, we use the term “assets” to refer to the non-core business. We consider two specifications of the model. The first is \( A_H > A_L \), so that the two assets are positively correlated. The second is \( A_L > A_H \), so that they are negatively correlated. (If \( A_H = A_L \), the non-core asset exhibits no information asymmetry and so it is automatic that firms will raise financing by selling it.) In both cases, we assume:

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C_H + A_H > C_L + A_L, \tag{1}
\]

i.e., \( H \) has a higher total value even if \( A_H < A_L \). In MM, the key driver of financing is information asymmetry. The distinction between the two cases of \( A_H > A_L \) and \( A_H < A_L \) shows that it is not only the information asymmetry of the non-core asset that matters (\(|A_H - A_L|\)), but also its correlation with the core asset (\(sign(A_H - A_L)\)).

We consider an individual firm, which must raise financing of \( F \).\(^7\) In the initial analysis, the cash raised remains on the firm’s balance sheet. This modeling treatment nests any financing need that increases expected firm value by \( F \), such as replenishing capital, repaying debt, or financing an uncertain investment whose expected value is uncorrelated with \( q \). The initial analysis also treats the financing decision as exogenous. In MM, the firm has the option not to raise financing and instead to forgo investment; their goal was to show that information asymmetry can deter investment by hindering financing. Since this effect is now well-known, our initial focus is instead the choice between asset sales and equity issuance to meet a given financing need. Section 2.2 gives firms the choice of whether to raise financing; it also allows the cash to be used to finance an investment whose return is correlated with \( q \) and thus exhibits information asymmetry.

\(^6\)He (2009) considers a different multiple-asset setting where the value of each asset comprises a component known to the seller, and an unknown component. The (known) correlation refers to the correlation between the unknown components; here it refers to the correlation between the total values of the assets (which are known to the seller). His model considers asset sales but not equity issuance.

\(^7\)The amount of financing \( F \) does not depend on the source of financing: \( F \) must be raised regardless of whether the firm sells assets or equity. In bank capital regulation, equity issuance leads to a greater improvement in capital ratios than asset sales and so \( F \) does depend on the source of financing. We do not consider this effect as it will be straightforward: it will encourage \( H \) towards the source that reduces the amount of financing required, and thus force \( L \) to follow in order to pool.
asymmetry.

The firm can raise $F$ by selling either non-core assets or equity. It cannot sell the core asset as it is essential to the firm (Appendix B relaxes this assumption) and it has exhausted other sources of finance such as risk-free debt capacity. As will be made clear later, the same certainty, camouflage, and correlation effects that drive the choice between equity and asset sales will also drive the choice between risky debt and asset sales. We therefore do not model risky debt issuance separately.

We specify $F \leq \min (A_L, A_H)$, so that the financing can be raised entirely through either source.\(^8\) If the amount of financing exceeds the non-core assets available, the firm would mechanically be forced to use equity and so the source of financing would automatically depend on the amount of financing required. In our equilibria, firms use a single source of financing. Appendix C studies the conditions under which the off-equilibrium path belief ("OEPB"), that a firm that uses multiple sources is of quality $L$, satisfies the Cho and Kreps (1987) Intuitive Criterion ("IC"). The restriction could alternatively be motivated by the transactions costs of using multiple sources. We abstract from differences between asset sales and equity issuance in taxes, transactions costs, liquidity, bargaining power, and other frictions, because they will affect the financing choice in obvious ways: the firm will lean towards the financing source that exhibits fewest frictions. Firms cannot raise financing in excess of $F$; this assumption can be justified by forces outside the model such as agency costs of free cash flow.

The non-core asset is perfectly divisible so partial asset sales are possible; we do not feature nonlinearities as they will mechanically lead to the source of financing depending on the amount required. If a firm sells non-core assets with a true value of $1$, its fundamental value falls by $1 + k$. Thus, the case of $k > (\leq) 0$ represents synergies (dissynergies), where the asset is worth more (less) to the current owner than a potential purchaser, even in the absence of information asymmetry. That $k \leq 0$ allows for asset sales to be motivated by operational reasons (dissynergies) rather than only financing reasons.\(^9\) Synergies may stem from transactions costs being lower within a firm than in a market (Coase (1937)), monitoring advantages (Alchian and

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\(^8\)Some of the analysis in the paper will derive bounds on $F$ for various equilibria to be satisfied. We have verified that none of these bounds are inconsistent with $F \leq \min (A_L, A_H)$.

\(^9\)One may wonder why the firm will have dissynergistic assets to begin with. Firms may acquire assets when they are synergistic, but they may become dissynergistic over time. One may still wonder why the firm has not yet disposed of the dissynergistic asset. First, the firm may retain it due to the transactions costs of asset sales: only if it is forced to raise financing and so would have to bear the transactions costs of equity issuance otherwise, would it consider selling assets. Second, the market for assets is not perfectly frictionless, and so not all assets are owned by the best owner at all times. Our model allows for $k = 0$ in which case there are no dissynergies.
Demsetz (1972)), economies of scope (Panzar and Willig (1981)), a reduction in hold-up problems (Grossman and Hart (1986)), or firm-specificity. In addition to synergies, $k > 0$ can also arise if investment in assets is costly to reverse (e.g. Abel and Eberly (1996)) and so firm value falls by more than the value of the asset sold.

Formally, a firm of quality $q$ issues a claim $X \in \{E, A\}$, where $X = E$ represents equity and $X = A$ assets. Investors are perfectly competitive and infer $q$ based on $X$. Thus, they price both the claim being sold and the firm’s stock at their expected values conditional upon $X$. The price received for the claim affects the firm’s fundamental value. The manager’s objective function places weight $\omega$ on the firm’s stock price and $1 - \omega$ on its fundamental value. The manager’s stock price concerns can stem from a number of sources introduced in earlier work, such as takeover threat (Stein (1988)), reputational concerns (Narayanan (1985), Scharfstein and Stein (1990)), or expecting to sell his shares before fundamental value is realized (Stein (1989)).

A useful feature of the framework is that only quality $q$, and not synergy $k$, directly affects the investor’s valuation of a claim and thus the price paid. This allows our model to incorporate two dimensions of firm type – quality and synergy – while retaining tractability. We sometimes use the term “$H$” or “$H$-firm” to refer to a high-quality firm regardless of its synergy parameter, and similarly for “$L$” or “$L$-firm”. “Capital gain/loss” refers to the gain/loss resulting from the common value component of the asset value only, and “fundamental gain/loss” refers to the change in the firm’s overall value, which consists of both the capital gain/loss and any loss of (dis)synergies. For equity issuance, the capital gain/loss equals the fundamental gain/loss.

We solve for pure strategy equilibria.\textsuperscript{10} We use the Perfect Bayesian Equilibrium (“PBE”) solution concept, where: (i) Investors have a belief about which firm types issue which claim $X$; (ii) The price of the claim being issued equals its expected value, conditional on investors’ beliefs in (i); (iii) Each manager issues the claim $X$ that maximizes his objective function, given investors’ beliefs; (iv) Investors’ beliefs satisfy Bayes’ rule. In addition to the PBE, beliefs on claims $X$ issued off the equilibrium path satisfy the IC.

We first analyze the positive correlation version of the model ($A_H > A_L$) and then move to negative correlation ($A_L > A_H$).

\textsuperscript{10}Mixed strategy equilibria only exist for the type that is exactly indifferent between the two claims. Since synergies are continuous, this type is atomistic and so it does not matter for posterior beliefs whether we specify this cutoff type as mixing or playing a pure strategy.
2 Positive Correlation

We set $\omega = 0$ in the positive correlation model for ease of exposition, so that the manager maximizes fundamental value. There is a nontrivial role for $\omega > 0$ only under negative correlation, in which case a trade-off exists to being inferred as $L$: market valuation falls, but the firm receives a high price if it sells assets. With a positive correlation, there is no such trade-off: being inferred as $L$ worsens both market and fundamental values. Allowing for general $\omega$ only adds additional terms to the inequalities, but does not affect their directions or the set of sustainable equilibria.

Section 2.1 studies the core model in which firms are forced to raise capital (e.g. to meet an exogenous liquidity need). In Section 2.2, we extend the model to give firms the choice of whether to raise capital, and allow the capital to finance an investment whose expected value exhibits information asymmetry.

2.1 Mandatory Capital Raising

We first consider pooling equilibria ($PE$), which are of two types: an asset-pooling equilibrium ($APE$) and an equity-pooling equilibrium ($EPE$). We then move to semi-separating equilibria ($SSE$). The analysis studies the conditions under which the different equilibria are sustainable, to predict when firms will use each financing channel.

2.1.1 Pooling Equilibrium, All Firms Sell Assets

We consider a pooling equilibrium in which all firms sell assets, supported by the OEPB that an equity issuer is of quality $L$. Assets are valued at

$$\mathbb{E}[A] = \pi A_H + (1 - \pi) A_L.$$  

(2)

If equity is sold (off the equilibrium path), it is valued at $E_L$, where

$$E_q \equiv C_q + A_q + F$$

is the value of equity for a firm of quality $q$. The $F$ term arises because the cash raised enters the balance sheet, and so new shareholders own a claim to it.
The fundamental values of $H$ and $L$ are respectively given by:

$$C_H + A_H - F \frac{(1 - \pi) (A_H - A_L) + k A_H}{\mathbb{E}[A]}, \quad (3)$$

$$C_L + A_L + F \frac{\pi (A_H - A_L) - k A_L}{\mathbb{E}[A]}, \quad (4)$$

$L$ enjoys a capital gain of $F \frac{\pi (A_H - A_L)}{\mathbb{E}[A]}$ by selling low-quality assets at a pooled price, but loses the synergies from the asset. If

$$1 + \bar{k} \leq \frac{\mathbb{E}[A]}{A_L}, \quad (5)$$

then even the $L$-firm with the greatest synergies, type $(L, \bar{k})$, is willing to sell assets, since the capital gain exceeds the synergy loss. This inequality is necessary and sufficient for all $L$-firms not to deviate.

$H$ suffers a fundamental loss of $F \frac{\pi (A_H - A_L)}{\mathbb{E}[A]}$, and thus may deviate to equity. If he does so, his fundamental value becomes:

$$C_H + A_H - F \frac{C_H - C_L + A_H - A_L}{C_L + A_L + F}. \quad (6)$$

The no-deviation ("ND") condition is that $(6) \leq (3)$. This condition is most stringent for type $(H, \bar{k})$. Thus, no $H$-firms will deviate if:

$$F \leq F^{APE, ND, H} \equiv \frac{\mathbb{E}[A]}{A_H (1 + \bar{k}) - \mathbb{E}[A]} (C_H + A_H) - A_H (C_L + A_L)(1 + \bar{k}). \quad (7)$$

Condition (7) is equivalent to the "unit cost of financing" being lower for assets, i.e.,

$$\frac{A_H (1 + \bar{k})}{\mathbb{E}[A]} \leq \frac{C_H + A_H + F}{C_L + A_L + F}, \quad (8)$$

where the numerator on each side is the value of the claim being sold by the firm, and the denominator is the price that investors pay for that claim.

Three forces determine $H$’s incentives to deviate. The first is whether assets or equity exhibit greater information asymmetry ($\frac{A_H}{\mathbb{E}[A]}$ versus $\frac{C_H + A_H}{C_L + A_L}$). This effect is a natural extension of the MM principle that high-quality firms issue safe claims. Indeed, without synergies ($\bar{k} = 0$), if $\frac{A_H}{\mathbb{E}[A]} > \frac{C_H + A_H}{C_L + A_L}$, i.e., assets exhibit sufficiently greater information asymmetry, $H$ will deviate to equity: for any $F$, (8) is violated and so an $APE$ is unsustainable.
The second force is synergies. For an APE to hold, firms must be willing to sell assets despite the synergy loss. Thus, we require the maximum synergy level to be small. If \( 1 + \bar{k} > \frac{(C_H + A_H)[\mathbb{E}[A]]}{(C_L + A_L)A_H} \), then again (8) is violated and so the APE is unsustainable for any \( F \).

The third force is the amount of financing \( F \). This is unique to a model of asset sales and arises because an equity investor has a claim to the cash raised but an asset purchaser does not. Since the value of cash is certain, it mitigates the information asymmetry of equity: the certainty effect. As \( F \) rises, the right-hand side (“RHS”) of (8) becomes dominated by the term \( F \) (which is the same in the numerator and the denominator as it is known) and less dominated by the unknown assets-in-place terms \( C_q \) and \( A_q \) (which differ between the numerator and denominator), so the RHS falls towards 1. Thus, there is an upper bound on \( F \) to prevent deviation, given by (7). If \( F \) exceeds this bound, the certainty effect is sufficiently strong that \( (H, \bar{k}) \) deviates to equity. In particular, even if \( \frac{A_H}{\mathbb{E}[A]} < \frac{C_H + A_H}{C_L + A_L} \) and \( \bar{k} = 0 \), i.e., assets are safer than equity and there are no synergies, a high \( F \) can lead to (8) being violated. The MM result, that firms issue claims whose underlying assets exhibit the least information asymmetry, need not hold. Similarly, the analysis contradicts conventional wisdom that equity is the riskiest claim. If the amount of financing raised is sufficiently large, equity is relatively safe. Note that \( F \) refers to the amount of financing required relative to the size of the existing assets in place. If the values \( A_L, A_H, C_L, \) and \( C_H \) all doubled, then the upper bound \( F^{APE,ND,H} \) in condition (7) would also double. Thus, asset sales are easier to sustain when the amount of financing required is small relative to assets in place.

One interesting case is a single-segment firm, which corresponds to \( C_q = A_q \), i.e., core and non-core assets are one and the same. Since the information asymmetry of the firm equals that of the non-core asset, the certainty effect will push the information asymmetry of equity lower, and so the APE is never sustainable for any \( F \).

Note that the certainty effect would also apply to risky debt, since debt is also a claim on the entire balance sheet. Thus, even if risky debt exhibits more information asymmetry than the non-core asset, it may be preferred if \( F \) is large.

We now verify that the OEPB, that an equity issuer is of type \((L, \bar{k})\), satisfies the IC. This is the case if \((L, \bar{k})\) would issue equity if inferred as \( H \), i.e.:

\[
F \leq F^{APE,IC} \equiv \frac{A_L(C_H + A_H)(1 + \bar{k}) - \mathbb{E}[A](C_L + A_L)}{\mathbb{E}[A] - A_L(1 + \bar{k})}.
\] (9)

If \( F \) is large, \( L \) will not deviate to equity even if he is inferred as \( H \), since the certainty
effect reduces the gains from doing so. Thus, we have another upper bound on $F$.

Lemma 1 below summarizes the equilibrium. The proof shows that, if and only if $1 + \bar{k} < \frac{E[A]}{\sqrt{A_H A_L}} (> 1)$, the IC condition is stronger than the ND condition and thus is the relevant condition for an APE to hold. (All proofs are in Appendix A.)

**Lemma 1.** (Positive correlation, pooling equilibrium, all firms sell assets.) Consider a pooling equilibrium where all firms sell assets ($X = A$) and a firm that issues equity is inferred as $(L, \bar{k})$. The prices of assets and equity are $\pi A_H + (1 - \pi) A_L$ and $C_L + A_L + F$, respectively. The equilibrium is sustainable if the following conditions hold:

- (i) $1 + \bar{k} \leq \frac{E[A]}{A_L}$,
- (ii) $F \leq F_{APE}$, where

$$
F_{APE} = \begin{cases} 
F_{APE, IC} \equiv \frac{A_L (C_H + A_H) (1 + \bar{k}) - E[A] (C_L + A_L)}{E[A] - A_L (1 + \bar{k})} & \text{if } 1 + \bar{k} \leq \frac{E[A]}{\sqrt{A_H A_L}} \\
F_{APE, ND, H} \equiv \frac{E[A] (C_H + A_H) - A_H (C_L + A_L) (1 + \bar{k})}{A_H (1 + \bar{k}) - E[A]} & \text{if } 1 + \bar{k} \geq \frac{E[A]}{\sqrt{A_H A_L}}.
\end{cases}
$$

(10)

2.1.2 Pooling Equilibrium, All Firms Sell Equity

We now consider the alternative pooling equilibrium in which all firms issue equity, supported by the OEPB that an asset seller is of quality $L$. The analysis is similar to the APE and the equilibrium is summarized in Lemma 2 below.

**Lemma 2.** (Positive correlation, pooling equilibrium, all firms sell equity.) Consider a pooling equilibrium where all firms sell equity ($X = E$) and a firm that sells assets is inferred as $(L, \bar{k})$. The prices of assets and equity are $\pi A_H + (1 - \pi) A_L$ and $C_L + A_L + F$, respectively. This equilibrium is sustainable if the following conditions hold:

- (i) $1 + \bar{k} \geq \max \left( \frac{E_L}{E[E]}, \frac{A_L}{A_H} \right)$,
- (ii) $F \geq F_{EPE}$, where

$$
F_{EPE} = \begin{cases} 
F_{EPE, IC} \equiv \frac{A_L (C_H + A_H) (1 + \bar{k}) - E[A] (C_L + A_L)}{A_H - A_L (1 + \bar{k})} & \text{if } 1 + \bar{k} \geq \frac{A_H A_L}{E[A]} \\
F_{EPE, ND, H} \equiv \frac{A_L (C_H + A_H) - A_H (C_L + A_L) (1 + \bar{k})}{A_H (1 + \bar{k}) - E[A]} & \text{if } 1 + \bar{k} \leq \frac{A_H A_L}{E[A]}.
\end{cases}
$$

(12)

In part (i), the condition $1 + \bar{k} \geq \frac{E_L}{E[E]}$ ensures that $(L, \bar{k})$ does not deviate to asset sales in order to get rid of a dissynergistic asset. The condition $1 + \bar{k} \geq \frac{A_L}{A_H}$ ensures that $(H, \bar{k})$ would make a fundamental loss from deviating to asset sales – i.e. his capital loss outweighs the gain from getting rid of a dissynergistic asset – otherwise he would
automatically deviate. In Lemma 1, the two analogous conditions are the same as each other, and so there is only one term on the RHS of Lemma 1, part (i).

In contrast to Section 2.1.1, $H$’s ND condition in (12) now imposes a lower bound on $F$. This also results from the certainty effect. If $F$ is high, equity exhibits little information asymmetry. Thus, $H$ suffers a small loss from equity issuance, and so will not deviate. The IC condition also involves a lower bound for a similar reason.

Appendix B shows that the certainty effect is robust to allowing firms to sell the core asset (in addition to the non-core asset and equity). The intuition is as follows. One of the assets (core or non-core) will exhibit more information asymmetry than the other; since equity is a mix of both assets, its information asymmetry will lie in between. Even though equity is never the safest claim, it may still be issued due to the certainty effect: an EPE can be sustained.

2.1.3 Semi-Separating Equilibria

In a SSE, the financing choice depends on the synergy parameter $k$: there is a cutoff $k_q^*$ where any firm below (above) the cutoff sells assets (equity). $H$ and $L$ can use different cutoff rules, so separation will be along both type dimensions. In the limit case of $\bar{k} = k = 0$, there is no synergy parameter to separate along, and so this subsection considers the case where $\bar{k}$ is strictly greater than $k$.

The equilibria are summarized in Lemma 3 below.

**Lemma 3.** (Positive correlation, synergies, semi-separating equilibrium): Consider a semi-separating equilibrium where quality $q$ sells assets if $k \leq k_q^*$ and equity if $k > k_q^*$, and define $F^* \equiv \frac{C_H A_L - C_L A_H}{A_H - A_L}$. We have the following cases:

(i) If $F < F^*$, then $k_H^* > 0$ and $k_H^* > k_L^*$.
(ii) If $F > F^*$, then $k_H^* < 0$ and $k_H^* < k_L^*$.
(iii) If $F = F^*$, then $k_L^* = k_H^* = 0$.

A separating equilibrium is sustainable if both (a) $k$ is sufficiently low or $\bar{k}$ is sufficiently high, and (b) $F$ is sufficiently close to $F^*$; specific conditions are given in Appendix A. The prices of assets and equity are given by:

\[
\mathbb{E}[A|X = A] = \pi \frac{k_H^* - k}{\mathbb{E}[k_q^*] - k} A_H + (1 - \pi) \frac{k_L^* - k}{\mathbb{E}[k_q^*] - k} A_L, \tag{13}
\]

\[
\mathbb{E}[E|X = E] = \pi \left( \frac{\bar{k} - k_H^*}{\bar{k} - \mathbb{E}[k_q^*]} \right) (C_H + A_H) + (1 - \pi) \left( \frac{\bar{k} - k_L^*}{\bar{k} - \mathbb{E}[k_q^*]} \right) (C_L + A_L) + F, \tag{14}
\]
where
\[ \mathbb{E}[k^*_q] = \pi k_H^* + (1 - \pi) k_L^*. \]

Lemma 3 states that it is the relative importance of operational motives (the absolute values of \( k \) and \( \bar{k} \)) compared to certainty effect-adjusted information asymmetry (the distance of \( F \) from \( F^* \)) that governs whether a SSE is sustainable. In a SSE, both claims are issued and one claim will be associated more with \( L \). If \( F \) is very low or very high, information asymmetry is strong, and so issuing the claim associated with \( L \) leads to a large capital loss. If synergies are too weak to offset this loss, firms pool. In contrast, if \( F \) is close to \( F^* \) and \( k \) or \( \bar{k} \) is extreme, synergy motives are strong, and so firms of the same quality issue different claims depending on \( k \).

In addition, Lemma 3 gives conditions under which \( k_H^* > k_L^* \), i.e. \( H \) prefers asset sales. The condition that \( F < F^* \) requires certainty effect-adjusted information asymmetry to be higher for equity, which in turn requires \( F \) to be low. \( H \) dislikes information asymmetry as it increases his capital loss; conversely, \( L \) likes information asymmetry. If \( F < F^* \), equity is less attractive to \( H \) than \( L \), and so \( H \) chooses a higher cutoff (\( k_H^* > k_L^* \)). Indeed, when \( F < F^* \), we have \( k_H^* > 0 \): \( H \) sells assets even if they are mildly synergistic, due to their lower information asymmetry. The different cutoffs in turn affect the valuations. If \( k_H^* > k_L^* \), \( H \) is more willing to sell assets than \( L \), and so the asset price (13) is higher than in the APE (2).

Due to the certainty effect, changes in \( F \) alter the cutoffs and thus the quality of assets and equity sold, in turn affecting their prices. If \( F > F^* \), the certainty effect is sufficiently strong that equity is more attractive to \( H \) (\( k_H^* < k_L^* \)). More \( H \) firms sell equity, increasing (decreasing) the quality and price of equity (assets) sold. Indeed, when \( F > F^* \), we have \( k_H^* < 0 \): \( H \) retains assets even if they are mildly dissynergistic, due to their higher information asymmetry. Now, the equity price (14) is higher than in the EPE (11). Thus, just as in the PEs, increases in \( F \) have real effects on firm boundaries. Here, they lead to more \( H \)-firms retaining assets, even if they are dissynergistic. Financing and operational motives interact – financial constraints affect the cutoff level of synergy required for a firm to sell assets, and greater financial constraints reduce the quality of assets sold in the real assets market.

2.1.4 Comparing the Equilibria

We now analyze the conditions under which each equilibrium is sustainable. The results are given in Proposition 1 below:

**Proposition 1.** (Positive correlation, comparison of equilibria.)
(i) If $1 + \bar{k} \leq \frac{E[A]}{A_L}$ or $1 + \bar{k} \geq \max \left( \frac{A_L}{A_H}, \frac{E[H]}{E[L]} \right)$, at least one pooling equilibrium is sustainable. If both inequalities hold:

   (ia) An asset-pooling equilibrium is sustainable if $F \leq F^{APE}$.

   (ib) An equity-pooling equilibrium is sustainable if $F \geq F^{EPE}$.

   (ic) $F^{APE} \geq F^{EPE}$. For $F^{EPE} \leq F \leq F^{APE}$, both pooling equilibria are sustainable.

(ii) For $F > F^*$, if $1 + \bar{k} \leq \frac{A_L}{A_H}$, then a SSE is sustainable in which relatively more $H$ than $L$ firms sell assets ($k^*_H > k^*_L$). For $F < F^*$, if $1 + \bar{k} \geq \frac{E[H]}{E[L]}$, then a SSE is sustainable in which relatively more $L$ than $H$ firms sell assets ($k^*_H < k^*_L$).

Part (i) of Proposition 1 states that pooling equilibria are sustainable if synergies are weak. Intuitively, deviation from a PE leads to being inferred as $L$; if synergies are not strong enough to outweigh the capital loss, deviation is ruled out and so the PE holds. When the amount of financing required increases, firms switch from selling assets (APE) to equity (EPE), since the certainty effect strengthens. Thus, the type of claim issued depends not only on the inherent characteristics of the claim (its information asymmetry) but also the amount of financing required. In standard theories, the type of security issued only depends on its characteristics (e.g., information asymmetry or overvaluation), unless one assumes exogenous limitations on financing such as limited debt capacity. Here, there are no limits as $F$ can be fully raised by either source.

It may seem that, since financing is a motive for asset sales, greater financing needs should lead to more asset sales. This result is delivered by investment models where financial constraints induce disinvestment. Here, if $F$ rises sufficiently, the firm may sell fewer assets, since it substitutes into an alternative source of financing: equity. The amount of capital required therefore affects firm boundaries. In the case in which all assets are synergistic, then asset sales reduce total surplus. Surprisingly, greater financial constraints may improve real efficiency as firms retain their synergistic assets.

Part (ii) reiterates the results of Lemma 3: if synergies are sufficiently strong relative to information asymmetry, a SSE is sustainable. Combining all parts of Proposition 1 together, if we fix synergies such that $1 + \bar{k} \leq \frac{E[A]}{A_L}$ and $1 + \bar{k} \geq \max \left( \frac{A_L}{A_H}, \frac{E[H]}{E[L]} \right)$, as $F$ rises, we move from an APE, to a region in which both PEs hold, then to an EPE.\footnote{Eventually, when $F$ becomes extreme, we have a SSE where all $H$-firms sell equity but $L$-firms sell either assets or equity depending on $k$. When $F$ is very high, $L$-firms make little capital gain from equity, and so those with highly dissynergistic assets sell them.}

In addition, in a neighborhood around $F^*$ we also have a SSE, so three equilibria (APE, EPE, and SSE) can be sustained. The change in equilibrium as $F$ changes illustrates that $H$ prefers assets (equity) if $F$ is low (high).
2.2 Voluntary Capital Raising

This section gives firms the choice of whether to raise capital, and also allows the capital raised to finance a positive-NPV investment. These extensions naturally go together since, if given the choice not to raise capital, a $H$-firm would never issue equity unless the capital raised could be used productively. The analysis will generate two results. First, it shows that the certainty effect of Section 2.1 continues to hold when the cash raised is used to finance an investment whose expected value exhibits information asymmetry.\footnote{Since all agents are risk-neutral, only expected values matter. Thus, the model of Section 2.1 is unchanged if we simply make the investment volatile, so that its payoff is a random variable with an expected value independent of $q$ and so does not exhibit information asymmetry.} Second, it demonstrates the camouflage effect: low-quality firms will prefer to raise capital via asset sales than equity issuance, as they can disguise the capital raising as being motivated by operational reasons rather than overvaluation.

All firms can either do nothing, or instead raise capital of $F$ to finance an investment with expected value $R_q = F (1 + r_q)$, where $r_H \geq 0$ and $r_L \geq 0$: since there are no agency problems, only positive-NPV investments are undertaken (as in MM). We allow for both $r_H \geq r_L$ and $r_H < r_L$. The former is more common as high-quality firms typically have superior investment opportunities, but $r_H < r_L$ can occur as a firm that is currently weak may have greater room for improvement. Intuitively, it would seem that, if $r_H \geq r_L$, the uncertainty of investment will exacerbate the uncertainty of assets in place, weakening the certainty effect and making equity less desirable. However, we will show that this need not be the case.

We now have $E_q = C_q + A_q + F (1 + r_q)$ and continue to assume $E_H > E_L$: i.e. even if $H$ has weaker growth opportunities, its total value remains higher. We also assume that:

$$\frac{C_H + A_H}{C_L + A_L} > \max \left( \frac{A_H (1 + k)}{E [A]}, \frac{E [A]}{A_L (1 + k)} \right)$$

$$\min \left( \frac{C_H + A_H}{E [C + A] (1 + k)}, \frac{E [C + A] (1 + k)}{C_L + A_L} \right) > \frac{A_H}{A_L}.$$  \tag{15} \tag{16}

Inequalities (15) and (16) both limit the information asymmetry of assets relative to that of equity. If these conditions do not hold in the model of Section 2.1, where no investment is undertaken, then the results of that section are trivial. If (15) is violated, the numerator of either $F^{APE,ND,H}$ or $F^{APE,IC}$ is negative, and an $APE$ is never sustainable for any $F$; if (16) is violated, then the numerator of either $F^{EPE,ND,H}$
or $F^{EPE,IC}$ is negative, and an EPE is automatically sustainable for any $F$. In that section, these extreme cases did not need to be described separately as they led to the APE upper bounds becoming negative (and thus never satisfied) or the EPE lower bounds becoming negative (and thus trivially satisfied). However, when cash is used for investment, if these cases are coupled with a strong investment opportunity, the equilibrium conditions change directions rather than merely becoming trivial. Thus, we analyze the effect of relaxing (15) and (16) in Appendix D.

Lemma 4 gives conditions under which an APE is sustainable.

Lemma 4. (Positive correlation, pooling equilibrium, all firms sell assets, voluntary capital raising.) Consider a pooling equilibrium where all firms sell assets ($X = A$) and a firm that issues equity is inferred as $L$.\footnote{The OEPB regarding the inference for an inactive firm is irrelevant as it does not affect the value of such a firm.}

The prices of assets and equity are $\pi A_H + (1 - \pi) A_L$ and $C_L + A_L + F(1 + r_L)$, respectively. The equilibrium is sustainable if the following conditions hold:

(i) $1 + \bar{k} \leq \frac{E[A]}{A_L(1+r_L)}$, the analogous condition to when cash remains on the balance sheet (Lemma 1).

(ii) $1 + \bar{k} \leq \frac{E[A](1+r_H)}{A_H}$, a new condition not in Lemma 1.

(iii) $F \left[ A_H(1 + \bar{k})(1 + r_L) - E[A](1 + r_H) \right] \leq E[A] (C_H + A_H) - A_H (C_L + A_L)(1 + \bar{k})$, $H$’s ND condition.

(iv) $F \left[ E[A](1 + r_L) - A_L(1 + \bar{k})(1 + r_H) \right] \leq A_L (C_H + A_H)(1 + \bar{k}) - E[A] (C_L + A_L)$, the IC condition.

Compared to Lemma 1, $H$’s ND condition is looser if and only if $\frac{r_H}{r_L} > \frac{A_H(1+\bar{k})}{E[A]}$ and the IC condition is looser if and only if $\frac{r_H}{r_L} > \frac{E[A]}{A_L(1+\bar{k})}$.

Part (i) ensures that $L$ firms do not deviate to equity issuance. This condition implies $1 + \bar{k} \leq \frac{E[A]}{A_L}$ – the condition in Lemma 1, part (i), that ensures that $L$ does not deviate to doing nothing – since if $L$ does not deviate to fairly-priced equity, he will not deviate to inaction and lose the investment opportunity. Part (ii) is a new condition that ensures that $H$’s investment return is sufficiently high to deter him from deviating to doing nothing.

Part (iii) is $H$’s ND condition, preventing deviation to equity issuance. We first consider the case of $\frac{1+r_H}{1+r_L} < \frac{A_H(1+\bar{k})}{E[A]}$, i.e., the information asymmetry of investment is not too high. Then, the LHS of condition (iii) is positive and we again have an upper
bound on $F$:

$$F \leq F^{APE, ND, H, I} = \frac{\mathbb{E}[A](C_H + A_H) - A_H(C_L + A_L)(1 + \bar{k})}{A_H(1 + \bar{k})(1 + r_L) - \mathbb{E}[A](1 + r_H)}$$

(17)

In the core model (equation (7)), the denominator is $A_H(1 + \bar{k}) - \mathbb{E}[A]$. If $r_L > r_H$, the denominator of (17) is greater than in the core model, and so it is harder to support an APE. This is intuitive: $L$’s superior growth options counterbalance its inferior assets in place and reduce the information asymmetry of equity. One may think that the reverse intuition applies to $r_H \geq r_L$, but as long as $\frac{r_H}{r_L} < \frac{A_H(1 + \bar{k})}{\mathbb{E}[A]}$, the denominator of (17) is still higher than in the core model. The intuition is incomplete, because using funds to finance investment has two effects, as shown by the following decomposition of the investment returns:

$$R_L = F(1 + r_L)$$

$$R_H = F(1 + r_L) + F(r_H - r_L).$$

The first, intuitive effect is the $F(r_H - r_L)$ term which appears in the $R_H$ equation only. The value of investment is greater for $H$, increasing information asymmetry. However, there is a second effect, captured by the $F(1 + r_L)$ term common to both firms. This term increases the certainty effect: since the investment is positive-NPV, the certain component of the firm’s balance sheet is now higher ($F(1 + r_L)$ rather than $F$). While investors do not know firm quality, they do know that the funds they provide will increase in value, regardless of quality.\(^{14}\) Due to this second effect, $r_H \geq r_L$ is not sufficient for the upper bound to relax. Only if $\frac{A_H(1 + \bar{k})}{\mathbb{E}[A]} < \frac{r_H}{r_L}$ does the first effect dominate, loosening the upper bound. Finally, if $\frac{A_H(1 + \bar{k})}{\mathbb{E}[A]} < \frac{1 + r_H}{1 + r_L}$, i.e., investment exhibits extremely high information asymmetry, then the LHS of condition (iii) is negative and so the inequality is satisfied for any $F$.

Another way to view the intuition is as follows. Equityholders obtain a portfolio of assets in place ($C + A$) and the new investment ($R$); $F$ determines the weighting of the new investment in this portfolio. $H$ cooperates with asset sales if his capital loss from selling assets, $\frac{A_H(1 + \bar{k})}{\mathbb{E}[A]}$, is less than the weighted average loss on this overall equity portfolio. If both the assets in place and the new investment exhibit at least as much information asymmetry as non-core assets, i.e., $\frac{A_H(1 + \bar{k})}{\mathbb{E}[A]} \leq \frac{C_H + A_H}{C_L + A_L}$ and $\frac{A_H(1 + \bar{k})}{\mathbb{E}[A]} \leq \frac{1 + r_H}{1 + r_L}$,

\(^{14}\)Note that equity issuance does not become more likely simply because the firm is worth more due to its growth opportunities, which attracts investors. The growth opportunities are fully priced into the equity issue and are not a “freebie.”
then the loss on the equity portfolio is greater regardless of the weights – hence, \( H \) cooperates regardless of \( F \). Deviation is only possible if the investment is safer than non-core assets, i.e., \( \frac{A_H(1+r_H)}{E[A]} > \frac{1+r_H}{1+r_L} \). In this case, the weight placed on the new investment (\( F \)) must be low for the weighted average portfolio loss to remain higher, and so for deviation to be ruled out. Regardless of the specific values of \( r_H \) and \( r_L \), in all cases the \( APE \) requires \( F \) to be below an upper bound, as in Section 2.1.\(^{15} \) The analysis of condition (iv), the IC condition, is similar.

Lemma 5 gives conditions under which the \( EPE \) is sustainable; the analysis and comparison to Section 2.1 are very similar. The \( EPE \) holds as long as \( r_H \) is sufficiently high (and so no firm deviates to no issuance), and \( F \) is above a lower bound.

**Lemma 5.** (Positive correlation, pooling equilibrium, all firms sell equity, voluntary capital raising.) Consider a pooling equilibrium where all firms sell equity (\( X = E \)) and a firm that issues assets is inferred as \( L \). The prices of assets and equity are \( A_L \) and \( E \), respectively. The equilibrium is sustainable if the following conditions hold:

(i) \( 1 + k \geq \max \left( \frac{A_L(1+r_H)}{A_H E[1+r_q]} \frac{E_L}{E[E]} \right) \), the analogous condition to when cash remains on the balance sheet (Lemma 2).

(ii) \( 1 + r_H \geq \frac{E_H}{E[E]} \), a new condition not in Lemma 1.

(iii) \( F \left[ A_H(1+k)E[1+r_q] - A_L(1+r_H) \right] \geq A_L(C_H + A_H) - A_H E[C + A](1 + k) \), \( H \)'s ND condition.

(iv) \( F \left[ A_H(1 + r_L) - A_L E[1 + r_q](1 + k) \right] \geq A_L E[C + A](1 + k) - A_H(C_L + A_L) \), the IC condition.

Compared to Lemma 2, the ND condition is looser if and only if \( \frac{E[r_q]}{r_L} < \frac{A_H(1+k)}{A_L} \) and the IC condition is looser if and only if \( \frac{E[r_q]}{r_L} < \frac{A_H}{A_L(1+k)} \).

Similarly, a \( SSE \) (where firms sell either assets or equity) continues to hold if \( r_H \) is sufficiently high. Moreover, we now have additional semi-separating equilibria, where some \( H \) firms choose to do nothing. Proposition 2 below compares all the equilibria.

**Proposition 2.** (Positive correlation, comparison of equilibria, voluntary capital raising.)

(i) The equilibria of Section 2.1 are sustainable under the following conditions:

   (ia) An asset-pooling equilibrium is sustainable under the conditions in Lemma 4.

   (ib) An equity-pooling equilibrium is sustainable under the conditions in Lemma 5.

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\(^{15}\)For \( \frac{A_H(1+E)}{E[A]} \leq \frac{1+r_H}{1+r_L} \), the upper bound is infinite, so the ND condition is satisfied for any \( F \).
A semi-separating equilibrium, in which quality \( q \) sells assets if \( k \leq k^*_q \) and issues equity if \( k > k^*_q \), is sustainable under the conditions of Lemma 3, plus the additional condition \( 1 + r_H \geq \frac{E_H}{E_L} \).

(ii) If \( 1 + r_H \leq \frac{E_H}{E_L} \), a semi-separating equilibrium is sustainable in which \( H \) sells assets if \( k \leq k^*_H \) and does nothing if \( k > k^*_H \), and \( L \) sells assets if \( k \leq k^*_L \) and issues equity if \( k > k^*_L \), where \( k^*_L \geq 0 \). A rise in \( r_H \) increases both \( k^*_H \) and \( k^*_L \).

(iia) If \( 1 + r_H \leq \frac{E_H}{E_L} \), then \( k^*_H = k \) (all \( H \)-firms do nothing) and \( k^*_L = 0 \). The price of assets is \( A_L \) and the price of equity is \( C_L + A_L + F(1 + r_L) \).

(iib) If \( 1 + r_H \leq \min \left( \frac{E_H}{E_L}, \frac{E_H}{A_L} (1 + k) \right) \), then \( k^*_H = k \) (all \( H \)-firms do nothing) and \( k^*_L = 0 \). The price of assets is \( A_L \) and the price of equity is \( C_L + A_L + F(1 + r_L) \).

(iii) If \( r_H = r_L = 0 \), then we have the same equilibria as in parts (iia) and (iib) above, except that \( L \)-firms with \( k > k^*_L \) either issue equity or do nothing.

Part (i) of Proposition 2 shows that the equilibria of the core model are sustainable if \( r_H \) is sufficiently high. Intuitively, \( H \) is only willing to sustain the losses from raising capital if the capital can be put to a sufficiently productive use. This part demonstrates that the core model’s results continue to hold when there is information asymmetry over the use of the cash raised. It remains the case that an \( APE(\text{EPE}) \) is sustainable for low (high) \( F \). As in the core model, the source of financing depends on the amount of financing required.

In addition to demonstrating robustness, this extension also generates a new prediction. As \( r_H \) falls and \( r_L \) rises (the information asymmetry of investment falls), the upper bound on the \( APE \) tightens and the lower bound on the \( EPE \) loosens. Thus, the source of financing also depends on the use of financing. If growth opportunities are good regardless of firm quality (\( r_L \) is high, for example in good macroeconomic conditions or in an industry that has experienced a positive shock), then they are more likely to be financed using equity. The use of financing also matters in models of moral hazard (uses subject to agency problems will be financed by debt rather than equity) or bankruptcy costs (purchases of tangible assets are more likely to be financed by debt rather than equity); here it matters in a model of pure adverse selection. Note that our predictions for the use of equity differ from a moral hazard model. Under moral hazard, if cash is to remain on the balance sheet, equity is undesirable due to the agency costs of free cash flow (Jensen (1986)). Here, equity is preferred due to the certainty effect.
Part (iia) shows that if $r_H$ is moderate (if $\frac{E_H}{E_L} > 1 + r_H > \frac{A_H(1+k)}{A_L}$), $H$-firms with synergistic assets will not raise capital, since the return on investment is insufficient to outweigh the loss from capital raising. However, $H$-firms with sufficiently dissynergistic assets will sell them, so not so much to finance investment but for operational reasons: the gain from getting rid of dissynergies, when added to the (minor) return on investment, outweighs the capital loss from asset sales. As before, $L$ sells either equity or assets (depending on its level of synergy), not so much to finance investment, but to exploit overvaluation. In this equilibrium, we have $k_L^* > 0$: $L$ prefers to sell assets rather than equity, and indeed will sell assets even if they are synergistic. The reason is the *camouflage effect*. Since the growth opportunity is low, the only reason to issue equity is if it is low-quality. No $H$-firms issue equity, and so equity issuance reveals the firm as $L$ and leads to a price of $E_L$. In contrast, asset sales may be undertaken either because the asset is low-quality (low common value, sold by $L$) or because it is dissynergistic (low private value, sold by $H$), and so the asset price exceeds $A_L$. This high price induces $L$ to sell assets ($k_L^* > 0$). Markets in which $H$ sells assets due to negative $k$ are deep, similar to the notion of “market depth” in Kyle (1985). The liquidity traders in Kyle are analogous to high-quality asset sellers: they are selling assets for reasons other than them having a low common value. The presence of such traders allows informed agents, who do have assets with a low common value, to profit by selling them. An increase in $r_H$ augments $k_H^*$, because $H$ is more willing to sell assets for operational reasons. Thus, assets provide even better camouflage, and so $k_L^*$ rises also.

Note that, for any semi-separating equilibrium, there may be said to be “camouflage” in that multiple types pool into the same action. We define the camouflage effect quite specifically, as an economic concept focused on the choice between asset sales and equity issuance, rather than the technical concept of multiple types pooling (which occurs in any semi-separating equilibrium). Specifically, the camouflage effect arises when low-quality firms are willing to sell assets, even if they are synergistic (formally, $k_L^* > 0$), because asset sales can be disguised as being motivated by operational reasons. This disguise arises because, while both asset sales and equity issuance can arise from the operational reason of wishing to exploit a growth opportunity, asset sales have the additional operational reason of being motivated by synergies. As a result, when growth opportunities are moderate, high-quality firms will only voluntarily sell assets, not equity, and so low-quality firms also prefer to sell assets.\textsuperscript{16}

\textsuperscript{16}In contrast, we do not claim that the semi-separating equilibria of Lemma 3 exhibit a camouflage effect: even though multiple firm types pool on the same action, this is similar to any semi-separating equilibrium and does not arise from $H$ voluntarily selling assets due to operational reasons. Capital raising is mandatory, and so even when $H$ prefers to sell assets ($k_H^* > 0$), it is because assets exhibit
Just like the certainty effect, the camouflage effect in our paper also applies to the choice between asset sales and risky debt. In the absence of a profitable growth opportunity, the issue of risky debt signals that the debt is overvalued, since it cannot be camouflaged as stemming from an operational reason, unlike an asset sale.

The SSE in part (ic), where all firms sell either assets or equity, exhibits greater real efficiency than the one in part (iia) since all firms are undertaking profitable investment. It is easier to satisfy the condition for part (ic) \(1 + r_H > \frac{E_H}{E_L}\) if \(F\) is high. Thus, a greater scale of investment opportunities (high \(F\)) encourages \(H\) to invest, even if the per-unit productivity of investment \(r_H\) is unchanged. The certainty effect reduces the per-unit cost of financing, whereas scale effects typically considered in the literature (e.g., limited supply of capital) increase the per-unit cost of financing. Thus, a higher \(F\) has beneficial real consequences by allowing firms to take profitable investment opportunities.

Part (iib) shows that if \(r_H\) is low and dissynergies are not severe \(1 + r_H < \frac{A_H}{A_L} (1 + k)\), even \(H\)-firms with the most dissynergistic assets do nothing. Information asymmetry \(\frac{A_H}{A_L}\) is so strong that the capital loss from asset sales is high relative to the growth opportunity \(r_H\) and the dissynergy motive \(k\). Since no \(H\)-firms sell assets, asset sales do not offer camouflage. Thus, \(k_L^* = 0\): \(L\)-firms will only sell assets if and only if they are dissynergistic, not to enjoy a camouflage effect.

Part (iii) shows that, if \(r_H = r_L = 0\), even \(L\) has no reason to issue equity: it cannot exploit overvaluation since there is no camouflage, and it is unable to invest the cash raised profitably. Thus, low-quality firms with sufficiently synergistic assets \(k > k_L^*\) are indifferent between selling equity and doing nothing. Indeed, there exists an equilibrium where all \(L\)-firms with \(k > k_L^*\) do nothing, and so the equity market shuts down. Absent an investment opportunity, the only reason to sell equity is if it is low-quality, and so the “no-trade” theorem applies. In contrast, asset sales may be motivated by operational reasons and so the market continues to function.

Comparing across the three parts of Proposition 2, when the investment opportunity is non-existent (part (iii)) the equity market can completely shut down, as in MM. When \(r_H\) is moderate (part (ii)), only low-quality firms issue equity; only when it is high (part (ic)) do firms of both quality issue equity. Thus, increases in \(r_H\) encourage equity issuance. Investment opportunities allow \(L\) to camouflage equity issuance as being motivated by operational reasons (the desire to finance growth). Without growth opportunities, only asset sales can be justified by operational reasons and thus offer camouflage.

less informational asymmetry than equity rather than assets being dissynergistic.
Eisfeldt and Rampini (2006) present a model showing that operational motives for asset sales are procyclical, and empirically find that asset sales are indeed procyclical. This procyclicality may arise not only because operational motives rise in booms, but also because \( L \) is able to camouflage asset sales as being operationally-motivated in booms. In our model, an increase in operational motives can reflect either a rise in \( r_H \) (greater incentive to sell assets to finance growth) or a fall in \( k \) (greater incentive to sell assets to get rid of dissynergies). Both of these changes make the inequality required for (iia), \( 1 + r_H > \frac{A_H (1+k)}{A_L} \), easier to satisfy – they encourage \( H \) to sell assets, and thus \( L \) to sell assets also, to take advantage of the camouflage.

### 3 Negative Correlation

We now turn to the case of negative correlation, i.e., \( A_L > A_H \). This section demonstrates the correlation effect: firms prefer asset sales to equity issuance, because even if the market infers that the asset sold is low-quality, this need not imply that the firm as a whole is of low quality, since it is not a carbon copy of the asset.

Since \( A_L > A_H \), we now use the term “high (low)-quality non-core assets” to refer to the non-core assets of \( L (H) \). Note that negative correlation only means that high-quality firms are not universally high-quality, as they may have low-quality non-core assets. It does not require the values of the divisions to covary negatively with each other through time (e.g., that a market upswing helps one division and hurts the other). The market may know the correlation of the asset with the core business (even if it does not observe quality) simply by observing the type of asset traded. For example, the value of BP’s exploration activities is likely to be negatively correlated with the mature fields that comprise the bulk of the firm, since the former may displace the latter. The results of this section extend to a model in which the correlation of assets is unknown to all agents; we only require that the average correlation is negative.

In this section, we return to the case of general stock price concerns \( \omega \) because, with negative correlation, there is now a trade-off involved in selling assets: being inferred as \( H \) maximizes the firm’s stock price, but being inferred as \( L \) maximizes sale proceeds and thus fundamental value. Thus, without stock price concerns, no pooling equilibrium is sustainable.

Since neither investment opportunities \( r_q \) nor synergies \( k \) affect the sustainability of any equilibria in this section, but only add additional terms to the expressions, we return to the core model where capital raising is mandatory the funds raised remain on the balance sheet, and for simplicity consider the case of no synergies (\( \mathcal{K} = \bar{K} = 0 \).
Without synergies, there are only two firm types (H and L), and so all separating equilibria are fully- rather than semi-separating – each type issues a different claim. We start by deriving the conditions under which a (fully) separating equilibrium (SE) exists, then turn to the two pooling equilibria APE and EPE. (Appendix E introduces synergies to this analysis, reports the analogous expressions for the pooling and (fully) separating equilibria, and derives conditions for the semi-separating equilibria.)

3.1 Separating Equilibrium

We consider a separating equilibrium in which H sells assets and L issues equity.\footnote{There is no “reverse” separating equilibrium where H issues equity and L sells assets, because L will deviate: he will enjoy a capital gain from selling lowly-valued equity at a high price, and also an increase in his market value.}

Lemma 6 gives the conditions for this equilibrium to be satisfied:

\textbf{Lemma 6. (Negative correlation, separating equilibrium.)} Consider a separating equilibrium in which H sells assets and L sells equity (\(X_H = A\), \(X_L = E\)). The prices of assets are given by \(A_H\) and \(C_L + A_L + F\), respectively. The stock prices of asset sellers and equity issuers are \(C_H + A_H + F\) and \(C_L + A_L\), respectively. This equilibrium is sustainable if

\[
\omega \leq \omega^{SE} \equiv \frac{F(A_L - A_H)}{A_H} + (C_H - C_L) - (A_L - A_H). \tag{18}
\]

Since both assets and equity are sold at their fair value, there are no capital gains or losses. If L deviates, his fundamental value will fall from \(C_L + A_L\) to

\[
C_L + A_L + \frac{F(A_H - A_L)}{A_H}.
\]

Crucially, the third term is negative, since \(A_L > A_H\): L suffers a capital loss, which offsets the fact that his market value rises from being inferred as H. Thus, he will not deviate only if his stock price concerns \(\omega\) are sufficiently low (i.e., satisfy (18)).

H will not deviate as his stock price will fall to \(C_L + A_L\), and his fundamental value will fall as he will be issuing underpriced equity rather than selling a fairly-priced asset. H’s assets are correctly assessed as “lemons,” and so the market timing motive for financing (e.g., Baker and Wurgler (2002)) does not exist. However, H is still willing to sell assets despite receiving a low price. Since the assets being sold are not perfectly correlated with the rest of the firm, their low price does not imply a low value for the firm. This correlation effect is absent in a standard model of security issuance, because
both debt and equity are positively correlated with firm value. The issuance of debt may imply that debt is low-quality, and so the remainder of the firm is also low-quality.

The upper bound $\omega^{SE}$ is increasing in $F$ – but the role of $F$ is different from in Section 2. The certainty effect is not relevant in $SE$, as equity is issued at a fair price, rather than a pooled price. Here, a greater $F$ means that, if $L$ deviates to selling assets, his capital loss is sustained over a larger base, deterring deviation: we label this the “base effect.” Thus, the $SE$ can be sustained with higher stock price concerns $\omega$.\(^{18}\)

### 3.2 Pooling Equilibrium, All Firms Sell Assets

As in Section 2.1.1, we consider an $APE$, supported by the OEPB that an equity issuer is of quality $L$. Lemma 7 gives the conditions for this equilibrium to be satisfied:

**Lemma 7.** *(Negative correlation, pooling equilibrium, all firms sell assets.)* Consider a pooling equilibrium where all firms sell assets ($X_H = X_L = A$) and a firm that sells equity is inferred as $L$. The prices of assets and equity are $\pi A_H + (1 - \pi)A_L$ and $C_L + A_L + F$, respectively. The stock prices of asset sellers and equity issuers are $E[C + A]$ and $C_L + A_L$, respectively. This equilibrium is sustainable if

$$\omega \geq \omega^{APE} \equiv \omega^{APE,ND} \equiv \frac{F\left(\frac{A_L}{E[A]} - 1\right)}{\pi((C_H - C_L) - (A_L - A_H)) + F\left(\frac{A_L}{E[A]} - 1\right)}.$$  \((19)\)

$H$ will not deviate, as he is making a capital gain from selling low-quality assets. By deviating, $L$ avoids the capital loss from selling highly-valued assets at a pooled price, but suffers a low stock price. Thus, he will only cooperate if his stock price concern $\omega$ is high, i.e., satisfies equation (19). This lower bound is relatively loose: it is easy to rule out a deviation to equity. Issuing equity not only leads to a low price (of $C_L + A_L + F$) on the equity being sold (as in MM), but also implies a low valuation (of $C_L + A_L$) for the rest of the firm, because the equity being sold is a carbon copy of the firm. The second effect is absent in MM, since the manager only cares about fundamental value and not the stock price.

The bound is increasing in $F$, so again the amount of financing required affects the choice of financing and thus firm boundaries. As in Section 3.1, $F$ operates here

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\(^{18}\)This separating equilibrium is also featured in Nanda and Narayanan (1999), where core and non-core assets are always negatively correlated and $\omega = 0$. (If assets are positively correlated, there is no information asymmetry in their model.) Thus, no pooling equilibria are sustainable in the absence of transactions costs. They assume that the transactions costs of asset sales are higher than for equity issuance, which sometimes supports an $EPE$ but never an $APE$: the opposite result to our paper.
through the base effect: higher $F$ means that $L$’s capital loss is off a higher base and increases his incentive to deviate, and so a higher $\omega$ is required to maintain indifference. The IC condition is trivially satisfied. $L$ will indeed deviate to equity if revealed $H$: his stock price will rise and he will receive a capital gain by selling equity for a high price (compared to his current loss on assets).

### 3.3 Pooling Equilibrium, All Firms Sell Equity

We finally consider an $EPE$, supported by the OEPB that an asset seller is of quality $L$. Lemma 8 gives the conditions for this equilibrium to be satisfied:

**Lemma 8.** (Negative correlation, pooling equilibrium, all firms sell equity.) Consider a pooling equilibrium where all firms sell equity $(X_H = X_L = E)$ and a firm that sells assets is inferred as $L$. The prices of assets and equity are given by $A_L$ and $\pi (C_H + A_H) + (1 - \pi) (C_L + A_L) + F$, respectively. The stock prices of asset sellers and equity issuers are $C_L + A_L$ and $E[E[C + A]]$, respectively. This equilibrium is sustainable if

$$\omega \geq \omega_{EPE} \equiv \omega_{EPE, IC} \equiv \frac{F \left( \frac{A_L}{A_H} - \frac{E_L}{E[E]} \right)}{(1 - \pi)((C_H - C_L) - (A_L - A_H)) + F \left( \frac{A_L}{A_H} - \frac{E_L}{E[E]} \right)}.$$  \hspace{1cm} (20)

$L$ will automatically not deviate as he is enjoying a capital gain by selling low-quality equity at a pooled price. By deviating, $H$ avoids the capital loss from equity but suffers a low stock price from being inferred as $L$. He will cooperate if:

$$\omega \geq \omega_{EPE, ND} \equiv \frac{F \left( \frac{E_H}{E[E]} - \frac{A_H}{A_L} \right)}{\pi ((C_H - C_L) - (A_L - A_H)) + F \left( \frac{E_H}{E[E]} - \frac{A_H}{A_L} \right)}.$$  \hspace{1cm} (21)

Compared with (19) (the ND condition in the $APE$), the $EPE$ condition in (21) is harder to satisfy. In the $APE$, deviation to equity leads to a low price of $C_L + A_L$ not only on the equity sold, but also on the rest of the firm. Here, deviation to assets leads to a low price of $C_L + A_L$ on the firm, but a high price of $A_L$ on the asset sold, since it is not a carbon copy.

Unlike in Section 3.2, the IC condition is non-trivial, since $L$ would suffer a capital loss if he deviated to asset sales and was inferred as $H$. The IC condition (equation (20)) is stronger than the ND condition. If it is violated, the only “reasonable” OEPB is that an asset seller is of quality $H$. Under this OEPB, while deviation to asset sales
leads to a low asset price of \( A_H \), as the market correctly infers that they are “lemons”, it does not imply a low price on the rest of the firm, which is valued at \( C_H + A_H \): the correlation effect. \( H \) will now deviate, as it will break even on the asset sale (compared to its current loss from issuing equity), and also receive a high stock price (compared to its current pooled stock price).

3.4 Comparing the Pooling Equilibria

We now analyze conditions under which each equilibrium is sustainable. The results are given in Proposition 3 below:

**Proposition 3.** (Negative correlation, comparison of equilibria.) A separating equilibrium is sustainable if \( \omega \leq \omega^{SE} \), an asset-pooling equilibrium is sustainable if \( \omega \geq \omega^{APE} \), and an equity-pooling equilibrium is sustainable if \( \omega \geq \omega^{EPE} \), where \( \omega^{SE} \), \( \omega^{APE} \), and \( \omega^{EPE} \) are given by (18), (19), and (20), respectively, and \( \omega^{APE} < \omega^{SE} < \omega^{EPE} \). Thus, if:

(i) \( 0 < \omega < \omega^{APE} \), only the separating equilibrium is sustainable,

(ii) \( \omega^{APE} \leq \omega \leq \omega^{SE} \), both the separating and asset-pooling equilibria are sustainable,

(iii) \( \omega^{SE} < \omega < \omega^{EPE} \), only the asset-pooling equilibrium is sustainable,

(iv) \( \omega^{EPE} \leq \omega < 1 \), both the asset-pooling and equity-pooling equilibria are sustainable.

The correlation effect encourages firms to sell assets, which manifests in two ways in Proposition 3. First, a separating equilibrium is sustainable, whereas it was unattainable in the positive correlation model without synergies. Second, the range of \( \omega \)'s over which the \( EPE \) is sustainable is a strict subset of that over which the \( APE \) is sustainable. Asset sales are more common than equity issuance, even though assets may exhibit greater information asymmetry than equity. If \( \frac{A_L}{A_H} > \frac{C_H + A_H}{C_L + A_L} \), the MM principle would suggest that equity should be preferred, but assets are preferred due to the correlation effect.

The preference for asset sales points to an interesting benefit of diversification. Stein (1997) notes that an advantage of holding assets that are not perfectly correlated is “winner-picking”: a conglomerate can increase investment in the division with the best investment opportunities at the time. Our model suggests that another advantage is “loser-picking”: a firm can raise finance by selling a low-quality asset, without implying a low value for the rest of the firm. Non-core assets are a form of financial slack and may be preferable to debt capacity. Debt is typically positively correlated with firm
value, and so a debt issue may lead the market to infer that both the debt being sold and the remainder of the firm are low-quality. (Cash remains the best form of slack.)

The analysis also points to a new notion of investment reversibility. Standard theories (e.g., Abel and Eberly (1996)) model reversibility as the real value that can be salvaged by undoing an investment, which in turn depends on the asset’s technology. Here, reversibility depends on the market’s inference of firm quality if an investment is sold, and thus the correlation between the asset and the rest of the firm.

Appendix B considers the case when the firm can sell the core asset. Since the core (non-core) asset is positively (negatively) correlated with firm value, this extension allows the firm to choose the correlation of the asset that it sells, whereas the analysis thus far has considered either positive or negative correlation. Appendix B shows that a pooling equilibrium in which all firms sell the non-core asset is easier to sustain than both one in which all firms sell equity, and one in which all firms sell the core asset. This is because the non-core asset is negatively correlated with firm value, whereas equity and the core asset are both positively correlated. Thus, the correlation effect continues to apply when firms can choose the correlation of the assets they sell.

4 Implications

This section briefly discusses the main implications of the model. While a subset is consistent with existing empirical findings, most are new and untested, and would be interesting to study in future research. In addition, the model generates other implications that may not be immediately linkable to an empirical test due to the difficulties for an empiricist to observe variables such as synergies. However, even in these cases, the model provides implications for managers when choosing how to raise capital, as they will be able to estimate synergies. Note that empirical analysis should focus on asset sales that are primarily financing-motivated.

The first set of empirical implications concerns the determinants of financing choice. One determinant is the amount of financing required: Proposition 1 shows that equity is preferred for high financing needs, due to the certainty effect, while asset sales are preferred for low financing needs. For example, large oil and gas companies typically expand by adding individual fields, which require low $F$; indeed, this industry exhibits an active market for asset sales. In contrast, small firms typically have high financing needs relative to assets in place. Indeed, Frank and Goyal (2003) and Fama and French (2005) find that small firms tend to issue equity. A related implication is that equity issuances should represent a larger percentage of firm size than financing-motivated
A second determinant of financing choice is the use of funds. Both the certainty and camouflage effects predict that the probability of equity issuance is increasing in growth opportunities. Starting with the former, Proposition 2 shows that the certainty effect is stronger when financing an investment opportunity that is attractive regardless of firm quality \((r_L)\) is high). Moving to the latter, Proposition 2 also shows that, if growth opportunities are low, only asset sales can provide camouflage, since high-quality firms have operational reasons to sell assets but not to issue equity. If growth opportunities are high, equity also provides camouflage. Not only do high-quality firms start to issue equity to take advantage of the growth opportunity, but low-quality firms issue equity to a greater extent, as they can pool with high-quality equity issuers. Both the certainty and camouflage effects predict that, along the cross-section, firms where growth opportunities are known to be good should raise equity. For example, a positive industry shock (such as the invention of fracking for the energy sector, or an increase in processing speed for the computer sector) will improve investment opportunities for all firms within this industry and should make equity issuance more likely. Over the time series, in a strong macroeconomic environment, even low-quality firms will have good investment projects and so the model predicts that equity is again preferred, as found by Choe, Masulis, and Nanda (1993). Covas and den Haan (2011) show that equity issuance is procyclical, except for the very largest firms. A separate prediction from the certainty effect is that equity is more likely to be used for purposes with less information asymmetry, such as paying debt or replenishing capital.

A third determinant of financing choice is firm characteristics. Single-segment firms are more likely to issue equity; firms with negatively-correlated assets prefer asset sales due to the correlation effect. Thus, conglomerates are more likely to sell assets than firms with closely-related divisions, and more likely to sell non-core assets than core assets (see Appendix B). Indeed, Maksimovic and Phillips (2001) find that conglomerates are more likely to sell peripheral divisions rather than main divisions. While consistent with the correlation effect, this result could also stem from operational reasons: peripheral divisions could be more likely to be dissynergistic. Maksimovic and Phillips also find that less-productive divisions are more likely to be sold. This result is consistent with the idea that conglomerates can sell poorly-performing divisions without creating negative inferences on the rest of the firm, although they do not study the market reaction to such sales.

A second set of empirical implications concerns the market reaction to financing. In the negative correlation case, and in the positive correlation case with synergies where
\( k^*_H > k^*_L \) (which arises under low \( F \)), asset sales lead to a positive stock price reaction and equity issuance leads to a negative stock price reaction. Indeed, Jain (1985), Klein (1986), Hite, Owers, and Rogers (1987), and Slovin, Sushka, and Ferraro (1995), among others, find evidence of the former; a long line of empirical research beginning with Asquith and Mullins (1986) documents the latter. Under positive correlation and high \( F \), we have \( k^*_L > k^*_H \), and so equity issuance leads to a positive reaction. While most existing theories do not predict a positive reaction to equity issuance, Holderness (2013) finds a positive reaction in some countries. However, it is not clear whether these correspond to the cases in the model as he does not study the size of the equity issue or the correlation structure of the issuer. Separately, the model also predicts that equity issuance for conglomerates (where negative correlation is likely) will typically lead to a more negative reaction than for single-segment firms.

We now move to implications that concern synergy motives for asset sales, which may be harder to test given the difficulty in estimating these motives. First, firms are more willing to sell assets in deep markets where others are selling for operational reasons, providing camouflage. One potential way to estimate the potential for (dis)synergies is to compare across industries. For example, in the oil and gas industry, asset sales frequently involve self-contained plants with little scope for synergies. In consumer-facing industries with the potential for cross-selling multiple products to the same customer base, operational motives should be stronger. A second is to look across the business cycle: Eisfeldt and Rampini (2006) argue that operational motives are stronger in booms. A more general implication of the model is that there will be multiplier effects: economic conditions that increase operational motives for asset sales will also increase overvaluation-motivated asset sales. Eisfeldt and Rampini (2006) present a model showing that operational motives for asset sales are procyclical, and empirically find that asset sales are indeed procyclical. This procyclicality may arise not only because operational motives rise in booms, but also because \( L \) is able to camouflage asset sales as being operationally-motivated in booms.

Second, the aforementioned link between the source of financing and the amount required will be stronger where there is less scope for synergies. With weak synergies, only pooling equilibria are sustainable, and so when \( F \) is high (low), all firms sell equity (assets). With strong synergies, we have a semi-separating equilibrium, and so even when \( F \) is high (low), some firms are selling assets (equity). Separately, with weak synergies, firms will issue the same type of claim for a given financing requirement; with strong synergies, we should observe greater heterogeneity across firms in financing choices.
Third, equity issuers are likely to have synergistic assets, and asset sellers are likely to be parting with dissynergistic ones. Moreover, high-quality firms are more likely to sell synergistic assets if their financing needs are low, whereas low-quality firms are more likely to do so if their financing needs are high.

5 Conclusion

This paper has studied a firm’s choice between financing through asset sales and equity issuance under asymmetric information. A direct extension of MM would imply that firms will issue the claim that exhibits the least information asymmetry. While information asymmetry is indeed relevant, we identify three new forces that drive the firm’s financing decision, and may outweigh information asymmetry considerations.

First, investors in an equity issue share in the cash raised, but purchasers of non-core assets do not. Since the value of cash is certain, it mitigates the information asymmetry of equity: the certainty effect. Thus, low (high) financing needs are met through asset (equity) sales: the amount of financing required affects the choice of financing, and consequently firm boundaries. This result is robust to using the cash to finance an uncertain investment. Where synergies are strong, there is a trade-off between information asymmetry and operational motives. We thus have a semi-separating equilibrium where firms sell assets if synergies are below a threshold, and issue equity otherwise. Due to the certainty effect, financial and operational motives interact – an increase in financing needs encourages high-quality firms to substitute into equity, and reduces the quality and price of assets sold in equilibrium.

Second, the choice of financing may also depend on operational motives (synergies). When firms have discretion over to raise financing, and growth opportunities are low, high-quality firms will not issue equity but may still sell assets if they are dissynergistic. This allows low-quality firms to pool with them, disguising their capital raising as being motivated by operational reasons rather than overvaluation. This camouflage effect leads low-quality firms to sell assets even if they are synergistic.

Third, a disadvantage of equity issuance is that the market attaches a low valuation not only to the equity being sold, but also to the remainder of the firm, since both are perfectly correlated. In contrast, an asset sold need not be a carbon copy of the firm. This correlation effect can lead to asset sales being preferred to equity.

In sum, our model predicts that equity issuance is preferred when the amount of financing required is high, if growth opportunities are good, and for uses about which there is little information asymmetry (e.g., repaying debt or replenishing capital).
Asset sales are preferred if the firm has non-core assets that exhibit little information asymmetry or are dissynergistic, if other firms are currently selling assets for operational reasons, and if the firm is a conglomerate.

The paper suggests a number of avenues for future research. On the empirical side, it gives rise to a number of new predictions, particularly relating to the amount of financing required and the purpose for which funds are raised. On the theoretical side, a number of extensions are possible. One would be to allow for other sources of asset-level capital raising, such as equity carve-outs. Since issuing asset-level debt or equity does not involve a loss of (dis)synergies, a carve-out is equivalent to asset sales in the core model where synergies are zero, but it would be interesting to analyze the case in which synergies are non-zero and the firm has a choice between asset sales, carve-outs, and equity issuance. Another restriction of the model is that, even where firms can choose whether to raise capital, they raise a fixed amount $F$ (as in MM and Nachman and Noe (1994)), since there is a single investment opportunity with a known scale of $F$. An additional extension would be to allow for multiple investment opportunities of different scale, in which case a continuum of amounts will be raised in equilibrium.
References


A Proofs

Proof of Lemma 1

The IC condition (9) is stronger than the ND condition (7) if and only if

\[
\frac{A_L(C_H + A_H)(1 + \bar{k}) - \mathbb{E}[A](C_L + A_L)}{\mathbb{E}[A] - A_L(1 + \bar{k})} < \frac{(C_H + A_H)\mathbb{E}[A] - (C_L + A_L)A_H(1 + \bar{k})}{A_H(1 + \bar{k}) - \mathbb{E}[A]}
\]

This yields \(1 + \bar{k} < \frac{\mathbb{E}[A]}{\sqrt{A_H A_L}}\). Note that the RHS is always greater than one since \(\pi > \frac{1}{2}\).

Proof of Lemma 2

\(F_{EPE,IC}^{EPE,ND,H}\) is greater than \(F_{EPE,ND,H}^{EPE,IC}\) if and only if

\[
\frac{A_L\mathbb{E}[C + A](1 + \bar{k}) - A_H(C_L + A_L)}{A_H - A_L(1 + \bar{k})} > \frac{A_L(C_H + A_H) - A_H\mathbb{E}[C + A](1 + \bar{k})}{A_H(1 + \bar{k}) - \mathbb{E}[A]}
\]

which becomes

\[
1 + \bar{k} > \frac{A_H A_L}{\pi A_H^2 + (1 - \pi)A_L^2} = \frac{A_H A_L}{\mathbb{E}[A^2]}.
\]

Note that the RHS is always less than 1 since \(\pi > \frac{1}{2}\).

Proof of Lemma 3

A type \((q, k)\) will prefer equity if and only if its unit cost of financing is no greater:

\[
\frac{C_q + A_q + F}{\mathbb{E}[E|X = E]} \leq \frac{A_q(1 + k)}{\mathbb{E}[A|X = A]}.
\] (22)

The cutoff \(k^*_q\) is that which allows (22) to hold with equality. Thus, it is defined by:

\[
1 + k^*_q = \frac{C_q + A_q + F}{A_q} \frac{\mathbb{E}[A|X = A]}{\mathbb{E}[E|X = E]}.
\] (23)

Although \(k^*_q\) is not attainable in closed form, we can study whether \(k^*_H \leq k^*_L\). Since only the \(\frac{C_q + A_q + F}{A_q}\) term on the RHS depends on \(q\), the higher cutoff \(k^*_q\) belongs to the quality \(q\) for which this term is higher. Thus, \(k^*_H > k^*_L\) if and only if

\[
\frac{C_H + A_H + F}{C_L + A_L + F} > \frac{A_H}{A_L}
\] (24)
\[ F < F^* \equiv \frac{C_H A_L - C_L A_H}{A_H - A_L}. \] (25)

From the cutoff equation (23), we also have

\[ A_L (1 + k^*_L) \] \[ \frac{E_L}{E_A} = A_H (1 + k^*_H) \] \[ \frac{E_H}{E_A} = \mathbb{E}[A|X = A] \] \[ \mathbb{E}[E|X = E] \].

These equations mean that, in any \( SE \), \( k^*_L \) and \( k^*_H \) obey the following relationship:

\[ 1 + k^*_H = \lambda(F) (1 + k^*_L), \] (26)

where \( \lambda(F) \equiv \frac{A_H E_H}{A_L E_L} \), which is decreasing in \( F \). If \( F < (>) F^* \), then \( \lambda > (<) 1 \) so \( k^*_H > (<) k^*_L \) from (26).

These general results hold regardless of whether the cutoffs \( k^*_q \) are interior or are at the boundaries \( \bar{k} \) or \( \underline{k} \). However, to formally prove existence of any of these equilibria, we must deal separately with the cases where cutoffs are interior or are at the boundaries. Results are summarized in the following Lemma.

**Lemma 9.** A full semi-separating equilibrium where both qualities \( q \) strictly separate \((k < k^*_q < \bar{k})\) is sustainable under the following conditions:

- (ia) If \( F < F^* \), a necessary condition is \( 1 + \bar{k} > \frac{E_H}{A_H} \frac{\mathbb{E}[A]}{\mathbb{E}[E]} \) and a sufficient condition is \( 1 + \bar{k} \geq \frac{E_H}{A_H} \frac{\mathbb{E}[A]}{\mathbb{E}[E]} \).

- (ib) If \( F > F^* \), a necessary condition is \( 1 + \underline{k} < \frac{E_H}{A_H} \frac{\mathbb{E}[A]}{\mathbb{E}[E]} \) and a sufficient condition is \( 1 + \underline{k} \leq \frac{E_H}{A_H} \frac{\mathbb{E}[A]}{\mathbb{E}[E]} \).

- (ic) If \( F = F^* \), this is sufficient for existence.

A partial semi-separating equilibrium where H’s cutoff is at a boundary is sustainable in the following cases:

- (iia) If \( F < F^* \), we can sustain a SSE where all H-firms sell assets \((k^*_H = \bar{k})\) and L-firms strictly separate \((k < k^*_L < \bar{k})\), where \( k^*_L > 0 \). A necessary condition is \( \frac{\mathbb{E}[A]}{A_L} < 1 + \bar{k} < \frac{E_H}{A_H} \frac{\mathbb{E}[A]}{\mathbb{E}[E]} \) and a sufficient condition is \( \frac{A_L}{A_H} \leq 1 + \bar{k} \leq \frac{\mathbb{E}[A]}{A_H} \frac{E_H}{E_L} \).

- (iib) If \( F > F^* \), we can sustain a SSE where all H-firms sell equity \((k^*_H = k)\) and L-firms strictly separate \((k < k^*_L < \bar{k})\), where \( k^*_L < 0 \). A necessary condition is \( \frac{A_L}{A_H} < 1 + \underline{k} < \frac{E_L}{E_H} \frac{\mathbb{E}[E]}{\mathbb{E}[E]} \) and a sufficient condition is \( \frac{A_L}{A_H} \leq 1 + \underline{k} \leq \frac{E_L}{E_H} \).

A partial semi-separating equilibrium where L’s cutoff is at a boundary is sustainable in the following cases:

- (iia) If \( F < F^* \), we can sustain a SSE where all L-firms sell equity \((k^*_L = \underline{k})\) and H-firms strictly separate \((k < k^*_H < \bar{k})\). A set of sufficient conditions is \( \underline{k} = 0 \),
1 + $k > \frac{E_H}{E_L}$, and $\pi$ sufficiently close to 1.

(iiib) If $F < F^*$, we can sustain a SSE where all $L$-firms sell assets ($k^*_L = \bar{k}$) and $H$-firms strictly separate ($\underline{k} < k^*_H < \bar{k}$). A set of sufficient conditions is $\bar{k} = 0$, $1 + k < \frac{A_H}{A_L}$, and $\pi$ sufficiently close to 1.

If $F$ is close to $F^*$ and $k$ or $k^*$ is extreme, synergy motives are strong, and so firms of the same quality issue different claims depending on $k$. We thus have a full SSE, where firms of both quality separate. If synergies are moderate relative to information asymmetry, we have a partial SSE where all firms of one quality issue the same claim, regardless of $k$, and firms of the other quality strictly separate.

We first derive sufficient conditions under which a full SSE exists (cases (ia), (ib), and (ic) of Lemma 9). Our general proof strategy is to show existence of a pair of interior cutoffs ($k^*_H, k^*_L$) such that neither $H$ nor $L$ has an incentive to deviate. We start by observing that, given any $k^*_L$, the corresponding $k^*_H$ in any equilibrium must be given by (26) above. The problem therefore reduces to proving the existence of a $k^*_L \in (\underline{k}, \bar{k})$ such that $L$ has no incentive to deviate, and such that the corresponding $k^*_H$ is also in $(\underline{k}, \bar{k})$.

In each case, our proof technique will apply the Intermediate Value Theorem (“IVT”). This will prove the existence of a $k^*_L$ such that $L$ has no incentive to deviate, but will not deliver the actual value of that $k^*_L$, so the condition $k^*_H(k^*_L) \in (\underline{k}, \bar{k})$ cannot be checked explicitly. Instead, we will provide necessary and sufficient conditions for $k^*_H$ to be interior regardless of the value of $k^*_L$. These are the conditions we state in the Lemma. For each case, we provide the necessary and sufficient conditions first, then prove the existence of $k^*_L$.

We start with part (ia), where $F < F^*$. The ND condition for $(H, k^*_H)$ is $1 + k^*_H = \frac{E_H}{A_L} \frac{E[A|X = A]}{E[E|X = E]}$. Given a pair of cutoff rules $k^*_H$ and $k^*_L$, and associated valuations $E[A|X = A]$ and $E[E|X = E]$, for some $H$-firms to be willing to issue equity (so that $k^*_H$ is interior), we must have

$$1 + \bar{k} > \frac{E_H}{A_H} \frac{E[A|X = A]}{E[E|X = E]}.$$  \hfill (27)

The RHS is bounded below by $\frac{E_H}{A_H} \frac{E[A]}{E[E]}$ and above by $\frac{E_H}{E_L}$. Thus, a sufficient condition for some $H$-firms to issue equity is $1 + \bar{k} \geq \frac{E_H}{E_L}$ and a necessary condition is $1 + \bar{k} > \frac{E_H}{A_H} \frac{E[A]}{E[E]}$. These quantities no longer depend on $k^*_L$ since they contain no conditional expectations. Now, given that $k^*_H(k^*_L) \in (\underline{k}, \bar{k})$ for any $k^*_L$, we demonstrate the existence of an equilibrium cutoff $k^*_L$. For a candidate cutoff $k^*_L$, the indifference condition for
Using this, we can rewrite the incentive of \((L, k'_L)\) to sell assets rather than issue equity as a function continuous in \(k'_L\):

\[
f(k'_L) = \frac{E_L}{\mathbb{E}[E|X = E]} - \frac{A_L(1 + k'_L)}{\mathbb{E}[A|X = A]}.
\]  

If \(f(k'_L) > (\leq) 0\), \((L, k'_L)\) will sell assets (equity). Thus, \(k'_L\) is an equilibrium cutoff if and only if \(f(k'_L) = 0\). We show that \((L, k'_L)\) sells assets if \(1 + k'_L = \frac{E_L \mathbb{E}[A]}{A_L \mathbb{E}[E]}\), and equity if \(1 + k'_L = 1 + \frac{\lambda}{\mathbb{E}[F]}\) (The latter yields the highest possible \(k'_L\), since \(k'_L\) and \(k'_H\) are related by (26), and \(k'_H\) is capped at \(\overline{F}_L\).) Then, by the IVT, there exists a \(k'_L\) between these two values of \(k'_L\) for which \(f(k'_L) = 0\) and so the firm is indifferent. (Note that \(f\) is everywhere defined and continuous on the interval \([\overline{F}_L, \overline{F}_H]\).

To show that \((L, k'_L)\) sells assets if \(1 + k'_L = \frac{E_L \mathbb{E}[A]}{A_L \mathbb{E}[E]}\), we use the fact that \(F < F^*\) implies \(\lambda(F) > 1\) and so \(k'_H > k'_L\). We thus have \(\mathbb{E}[A|X = A] > \mathbb{E}[A]\) and \(\mathbb{E}[E|X = E] < \mathbb{E}[E]\), which yields \(f(k'_L) > 0\). Similarly, \(1 + k'_L = \frac{1 + \overline{F}_L}{\lambda(F)}\) yields

\[
f (k'_L) = \frac{E_L}{\mathbb{E}[E|X = E]} - \frac{A_H(1 + \overline{F}_L)}{\mathbb{E}[A|X = A]} \frac{E_L}{\mathbb{E}[E]},
\]

and so \(f (k'_L) < 0\) holds if and only if \(1 + \overline{F}_L > \frac{E_L \mathbb{E}[A|X = A]}{A_H \mathbb{E}[E]}\), which is the same condition as (27). Thus, the sufficient condition for \(H\) to follow an interior cutoff, \(1 + \overline{F}_L \geq \frac{E_L \mathbb{E}[A]}{A_H \mathbb{E}[E]}\) is also sufficient for the IVT to imply an equilibrium \(k'_L^*\), and so is sufficient for the \(SSE\) to exist.

The analysis for part (ib) \((F > F^*)\) is analogous. The ND condition is now

\[
1 + k < \frac{E_H \mathbb{E}[A|X = A]}{A_H \mathbb{E}[E|X = E]}.
\]  

With \(F > F^*\) we now have \(\mathbb{E}[A] > \mathbb{E}[A|X = A]\) and \(\mathbb{E}[E] < \mathbb{E}[E|X = E]\), so the RHS of (29) is bounded above by \(\frac{E_H \mathbb{E}[A]}{A_H \mathbb{E}[E]}\). Thus, a sufficient condition for some \(H\)-firms to sell assets is \(1 + k \leq \frac{A_H}{A_H} \frac{E_H \mathbb{E}[A]}{\mathbb{E}[E]}\) and a necessary condition is \(1 + k \leq \frac{E_H \mathbb{E}[A]}{A_H \mathbb{E}[E]}\).

We now turn to the ND condition for \((L, k'_L)\), which remains (28), and again use the IVT. We can easily show that \((L, k'_L)\) will deviate to equity at \(1 + k'_L = \frac{E_L \mathbb{E}[A]}{A_L \mathbb{E}[E]}\). A sufficient condition for \((L, k'_L)\) to deviate to assets sales at \(1 + k'_L = \frac{1 + \overline{F}_L}{\lambda(F)}\) is \(1 + k \leq \frac{A_H}{A_H} \frac{E_H \mathbb{E}[A]}{\mathbb{E}[E]}\), which is the same as the sufficient condition for some \(H\)-firms to sell assets, and so is sufficient for the \(SSE\) to exist.
We next to the partial SSEs in parts (ii) and (iii), where one cutoff is at a boundary. In case (iia), all $H$-firms sell assets and $L$-firms choose an interior cutoff. Assets are priced at $\mathbb{E}[A|X = A] > \mathbb{E}[A]$ and equity is priced at $E_L$. The ND condition for $H$-firms is:

$$1 + \overline{k} \leq \frac{\mathbb{E}[A|X = A]}{A_H} E_H = \frac{\mathbb{E}[A]}{A_L} = \lambda(F) \frac{\mathbb{E}[A|X = A]}{A_L}.$$  \hfill (30)

A sufficient condition for (30) is $1 + \overline{k} \leq \frac{E_H}{E_L} \frac{\mathbb{E}[A]}{A_H}$ and a necessary condition is $1 + \overline{k} < \frac{E_H}{E_L}$.

The indifference condition for $(L, k_{L}^*)$ yields

$$1 + k_{L}^* = \frac{\mathbb{E}[A|X = A]}{A_L},$$  \hfill (31)

and so $k_{L}^* > 0$: since assets are priced above their unconditional mean, $L$ is willing to sell them even if they are synergistic. For (31) to hold, we must have $1 + \overline{k} > \frac{\mathbb{E}[A|X = A]}{A_L}$, for which $1 + \overline{k} > \frac{\mathbb{E}[A]}{A_H}$ is a sufficient condition and $1 + \overline{k} > \frac{\mathbb{E}[A]}{A_L}$ is a necessary condition. Combining (30) with (31), we have $\frac{\mathbb{E}[A|X = A]}{A_L} < 1 + \overline{k} \leq \lambda(F) \frac{\mathbb{E}[A|X = A]}{A_L}$. Since $\lambda(F^*) = 1$ and $\lambda(F) < 0$, both conditions can be simultaneously satisfied only if $F < F^*$.

Finally, we need to show that a cutoff $k_{L}^*$ actually exists at which the cutoff type $(L, k_{L}^*)$ is indifferent between asset sales and equity (at which the equilibrium condition (31) holds). We again employ the IVT. If we specify a cutoff $1 + k_{L}'$ equal to the necessary lower bound $\frac{\mathbb{E}[A]}{A_L}$ on $1 + \overline{k}$, $(L, k_{L}')$ deviates to asset sales. Meanwhile, if we specify $1 + k_{L} = \frac{\mathbb{E}[A]}{A_L}$, $(L, k_{L}')$ deviates to equity. Thus, a pair of sufficient conditions for existence of the equilibrium is $1 + \overline{k} \geq \frac{\mathbb{E}[A]}{A_L}$ and $1 + \overline{k} \leq \frac{E_H}{E_L} \frac{\mathbb{E}[A]}{A_H}$.

In case (iib), all $H$-firms issue equity and $L$-firms choose an interior cutoff. Assets are priced at $A_L$ and equity is priced at $\mathbb{E}[E|X = E] > \mathbb{E}[E]$. The ND condition for $H$-firms is

$$1 + k \geq \frac{A_L}{A_H} \frac{E_H}{\mathbb{E}[E|X = E]} = \lambda(F) \frac{E_L}{\mathbb{E}[E|X = E]}.$$  \hfill (32)

A sufficient condition for (32) is $1 + k \geq \frac{A_L}{A_H} \frac{E_H}{\mathbb{E}[E|X = E]}$ and a necessary condition is $1 + k \geq \frac{A_L}{A_H}$.

The indifference condition for $(L, k_{L}^*)$ yields

$$1 + k_{L}^* = \frac{E_L}{\mathbb{E}[E|X = E]},$$  \hfill (33)

and so $k_{L}^* < 0$. For (33) to hold, we must have $1 + k < \frac{E_L}{\mathbb{E}[E|X = E]}$, for which $1 + k \leq \frac{E_L}{E_H}$ is a sufficient condition and $1 + k < \frac{E_L}{\mathbb{E}[E|X = E]}$ is a necessary condition. Combining (32) with (33), we have $\lambda(F) \frac{E_L}{\mathbb{E}[E|X = E]} \leq 1 + k < \frac{E_L}{\mathbb{E}[E|X = E]}$. Since $\lambda(F^*) = 1$ and $\lambda(F) < 0$, both conditions can be simultaneously satisfied only if $F > F^*$.
Finally, we need to show that a cutoff \( k_L^* \) actually exists at which the cutoff type \((L, k_L^*)\) is indifferent given the resulting equilibrium valuations. We again employ the IVT. If we specify a cutoff \( 1 + k_L^* \) equal to the necessary upper bound \( \frac{E_L}{E_H} \) on \( 1 + \bar{k} \), \((L, k_L^*)\) deviates to equity. Meanwhile, if we specify \( 1 + k_L^* = \frac{E_L}{E_H} \), \((L, k_L^*)\) deviates to asset sales. Thus, a pair of sufficient conditions for existence of the equilibrium is \( 1 + k < \frac{E_L}{E_H} \) and \( 1 + \bar{k} > \frac{A_H}{A_L} \frac{E_H}{E_L} \).

In case (iiiia), assets are priced at \( A_H \) and equity is priced at \( E[H \mid X = E] < E[A] \). The ND condition for \( L \) is \( \frac{A_L(1+k\bar{\pi})}{A_H} \geq \frac{E_L}{E[H \mid X = E]} \), or equivalently

\[
(1 + Pr(q = H \mid X = E) \frac{E_H - E_L}{E_L}) (1 + \bar{k}) \geq 1 + \frac{A_H - A_L}{A_L}.
\]

Note that \( \frac{E_H - E_L}{E_L} > \frac{A_H - A_L}{A_L} \) if and only if \( F < F^* \). Then the inequality is satisfied if \( F \leq F^* \), \( \bar{k} = 0 \) and \( Pr(q = H \mid X = E) \) is sufficiently high. \( Pr(q = H \mid X = E) \) approaches 1 from below as \( \pi \to 1 \) (in the limit, there are only \( H \) firms remaining), so for \( \pi \) sufficiently close to 1 we can satisfy the inequality and all \( L \) firms will cooperate with the equilibrium. It remains to show that there is an equilibrium \( k_H^* \) at which type \((H, k_H^*)\) is indifferent between selling assets and issuing equity. We again apply the IVT. First, we show that there is a candidate value \( k_H' \) at which \((H, k_H')\) deviates to selling assets. This occurs if \( 1 + k_H' < \frac{E_H}{E[H \mid X = E]} \), which will be satisfied if, for example, \( k_H' = 0 \). Next, we find a candidate \( k_H' \) at which \((H, k_H')\) deviates to issuing equity: this happens if \( 1 + k_H' > \frac{E_H}{E[H \mid X = E]} \). A sufficient condition for such a \( k_H' \) to exist is that potential synergies be very high: if \( 1 + \bar{k} > \frac{E_H}{E_L} \), then we can specify a \( k_H' \) that will deviate to equity issuance regardless of the price reaction. Then an equilibrium \( k_H^* \) exists between 0 and \( \frac{E_H}{E_L} \), allowing the equilibrium to exist.

The proof for case (iiiib) is analogous. Assets are priced at \( E[A \mid X = A] < E[A] \) and equity is priced at \( E_H \). The ND condition for \( L \) is \( \frac{A_L(1+\bar{\pi})}{E[H \mid X = A]} \leq \frac{E_L}{E[H \mid X = A]} \), or equivalently

\[
\left(1 + \frac{E_H - E_L}{E_L}\right) (1 + \bar{k}) \leq 1 + Pr(q = H \mid X = A) \left( \frac{A_H - A_L}{A_L} \right).
\]

This will be satisfied if \( F \geq F^* \), \( \bar{k} = 0 \), and \( \pi \) is sufficiently close to 1 so that \( Pr(q = H \mid X = A) \) is also close to 1. It remains to show that an equilibrium \( k_H^* \) exists. Type \((H, k_H')\) will deviate to asset sales if \( 1 + k_H' < \frac{E[H \mid X = A]}{A_H} \), A sufficient condition for such a \( k_H' \) to exist is \( 1 + k_H' < \frac{A_L}{A_H} \). Type \((H, k_H')\) will deviate to equity issuance if \( 1 + k_H' > \frac{E[H \mid X = A]}{A_H} \), which is satisfied for \( k_H' = 0 \). Thus all the conditions stated in the Lemma are sufficient for the equilibrium to exist.
Proof of Proposition 1

Parts (ia), (ib), and (ii) follow from the discussion of the various equilibria in Lemmas 1-3.

For (ic), we first prove $F^{EPE,IC} < F^* < F^{APE,IC}$. Suppose $F \leq F^{EPE,IC}$. This means that the IC is violated for $EPE$, so that $\frac{A_L(1+k)}{A_H} \geq \frac{E_L}{E_H}$. This implies $\frac{A_L}{A_H} > \frac{E_L}{E_H}$ and so $F < F^*$. Thus $F^{EPE,IC} < F^*$. Similarly, suppose $F \geq F^{APE,IC}$. This means that the IC is violated for $APE$, so that $\frac{E_L}{E_H} \geq \frac{A_L(1+k)}{E[A]}$. This implies $\frac{E_L}{E_H} > \frac{A_L}{A_H}$, and so $F > F^*$. Thus $F^{APE,IC} > F^*$.

Next, we prove that $F^* \leq F^{APE,ND,H}$. $F^* \leq F^{APE,ND,H}$ if $F \geq F^{APE,ND,H}$ implies $F \geq F^*$; and the inequality is strict if $F \geq F^{APE,ND,H}$ implies $F > F^*$. Suppose that $F \geq F^{APE,ND,H}$, so that some $H$-firm would deviate under $APE$, i.e. $\frac{A_H(1+k)}{E[A]} \geq \frac{E_H}{E_L}$. If $1 + k < \frac{E[A]}{A_L}$, then $\frac{A_H(1+k)}{E[A]} < \frac{A_L}{A_L}$ and thus $F > F^*$. If we only have $1 + k \leq \frac{E[A]}{A_L}$, then $\frac{A_H(1+k)}{E[A]} \leq \frac{A_L}{A_L}$ and thus $F \geq F^*$. Recall that $1 + k \leq \frac{E[A]}{A_L}$ was a necessary condition for $APE$ to be sustainable, from part (i). Thus, $F^* \leq F^{APE,ND,H}$ whenever $APE$ is sustainable, and the inequality is strict except when $1 + k$ exactly equals $\frac{E[A]}{A_L}$.

Finally, we prove $F^{EPE,ND,H} \leq F^*$. $F^{EPE,ND,H} \leq F^*$ if $F \leq F^{EPE,ND,H}$ implies $F < F^*$ Suppose $F \leq F^{EPE,ND,H}$, so that some $H$-firm weakly prefers to deviate under $EPE$, i.e. $\frac{E_H}{E[A]} \geq \frac{A_H(1+k)}{A_L}$. If $1 + k > \frac{E_H}{E[A]}$, then $\frac{E_H}{E_L} > \frac{A_H}{A_L}$ and thus $F < F^*$. If we only have $1 + k \geq \frac{E_H}{E[A]}$, then $\frac{E_H}{E_L} \geq \frac{A_H}{A_L}$ and thus $F \leq F^*$. Recall that $1 + k \geq \frac{E_H}{E[A]}$ was a necessary condition for $EPE$ to be sustainable, from part (i). Thus, whenever $EPE$ is sustainable, we have $F^{EPE,ND,H} \leq F^*$, and the inequality is strict except when $1 + k$ exactly equals $\frac{E_H}{E[A]}$.

Taking these three points together, whenever both $PE$s are sustainable, $F^{EPE} \leq F^{APE}$. The inequality is strict unless $1 + k = \frac{E[A]}{A_L}$ and $1 + k = \frac{E_H}{E[A]}$.

Proof of Lemma 4

This Lemma differs from Lemma 1 in two ways: it contains $r_q$ terms and inaction has been added to the action space for each firm. The $r_q$ terms modify the bounds stated in (iii) and (iv), but their derivation is otherwise exactly analogous to that in Lemma 1. It only remains to examine any new conditions that arise due to the firm’s option to do nothing.

The equilibrium requires three new conditions due to the expanded action space: one each to guarantee that no $H$- or $L$-firms deviate to inaction, and one to guarantee that the IC continues to hold (that, if equity issuance is inferred as stemming from $H$, there is some type $(L,k)$ that will deviate to equity issuance rather than continuing
to sell assets or deviating to inaction). Of these, the only nontrivial condition is the first, that no \(H\)-firm deviates to inaction, which gives rise to the new condition (ii). Intuitively, \(H\) suffers a fundamental loss from asset sales, so if the investment opportunity is sufficiently small, he will deviate to inaction. The condition to prevent \(L\) from deviating to inaction is trivial, since he benefits from both the growth opportunity and the fundamental gain. The same logic implies that any \(L\) with non-positive synergies will prefer equity issuance to inaction if inferred as \(H\), satisfying the IC.

**Proof of Lemma 5**

The derivation of the conditions is exactly analogous to that in Lemma 2, reworked to include the \(r_q\) terms. The only new condition is part (ii), which prevents \(H\) from deviating to inaction.

**Proof of Proposition 2**

Parts (ia) and (ib) repeat the results of the previous two Lemmas. In part (ic), we start with the \(SSE\), which is similar to Lemma 3. \(L\)-firms will not deviate to inaction, as they are enjoying a fundamental gain and exploiting a desirable investment opportunity. A high-quality equity issuer will not deviate to inaction if

\[
1 + r_H \geq \frac{E_H}{\mathbb{E}[E|X = E]},
\]

i.e., the capital loss from selling undervalued equity is less than the value of the growth opportunity. Similarly, a high-quality asset seller will not deviate if

\[
1 + r_H \geq \frac{A_H (1 + k_H)}{\mathbb{E}[A|X = A]}.
\]

Since \(k_H^*\) is defined by \(\frac{E_H}{\mathbb{E}[E|X = E]} = \frac{A_H (1 + k_H^*)}{\mathbb{E}[A|X = A]}\), we have \(\frac{A_H (1 + k_H)}{\mathbb{E}[A|X = A]} \leq \frac{E_H}{\mathbb{E}[E|X = E]}\) for all asset sellers (because \(k_H \leq k_H^*\)). Thus, (34) is the applicable lower bound on \(r_H\) for no firm to deviate. Since \(\mathbb{E}[E|X = E]\) is an equilibrium value, the sufficient condition in terms of model primitives is \(1 + r_H \geq \frac{E_H}{E_L}\).

Turning to part (ii), we start by considering the case of interior cutoffs. The definitions of \(k_H^*\) and \(k_L^*\) in the Proposition are given by the indifference conditions. \(L\)-firms will not deviate to inaction, as they are enjoying a (weakly positive) fundamental gain and exploiting a desirable investment opportunity. An inactive \(H\)-firm will not deviate to equity issuance if

\[
1 + r_H \leq \frac{E_H}{E_L},
\]
i.e., the capital loss from selling undervalued equity exceeds the value of the growth opportunity. If the above is satisfied, it is easy to show that a high-quality asset seller will not deviate either to inaction or equity issuance.

Combining \(1 + r_H = \frac{A_H(1+k^*_H)}{E[H|X=A]}\) and \(1 = \frac{A_L(1+k^*_L)}{E[A|X=A]}\) (the definition of the cutoffs if they are interior) yields

\[
(1 + r_H) \frac{A_L}{A_H} = \frac{1 + k^*_H}{1 + k^*_L}.
\]

When \(r_H\) is high (specifically, \(1 + r_H > \frac{A_H}{A_L}\)), we have \(k^*_H > k^*_L\): \(H\) is more willing to sell assets than \(L\) because, if it switches to doing nothing, it loses the growth opportunity (whereas \(L\) continues to exploit the growth opportunity if it does not sell assets, since it issues equity instead). When \(1 + r_H \leq \frac{A_H}{A_L}\), we have \(k^*_H \leq k^*_L\): \(H\) is less willing to sell assets than \(L\), because they are undervalued. Note that \(r_H\) is bounded above, since \(1 + r_H < \frac{E_H}{E_L}\) for this equilibrium to hold. Thus, we have

\[
1 + r_H = \frac{1 + k^*_H}{1 + k^*_L} \frac{A_H}{A_L} \frac{E_H}{E_L} > \frac{1 + k^*_H}{1 + k^*_L} \frac{A_H}{A_L}.
\]

If \(\frac{E_H}{E_L} < \frac{A_H}{A_L}\) in Lemma 3, we had \(k^*_H < k^*_L\); we similarly have \(k^*_H < k^*_L\) here. If \(\frac{E_H}{E_L} > \frac{A_H}{A_L}\) in Lemma 3, we had \(k^*_H > k^*_L\). However, here we need not have \(k^*_H > k^*_L\). \(H\) is relatively less willing to sell assets, as he has the outside option of doing nothing.

Finally, if \(1 + r_H < \frac{A_H}{A_L} (1 + k)\), then all \(H\)-firms do nothing: we have a boundary cutoff. The investment opportunity is sufficiently unattractive, and dissynergies are sufficiently weak, that no \(H\)-firm wishes to sell its high-quality assets for a low price.

**Proof of Lemma 6**

As discussed in the text, it is trivial that \(H\) will cooperate. The condition stated in the Lemma is \(L\)’s ND condition. If \(L\) issues equity, it is correctly valued. Both fundamental value and the stock price, and thus the manager’s objective function, equal \(C_L + A_L\). If \(L\) deviates to selling assets, its stock price will be \(C_H + A_H\), and it will receive a price of \(\frac{A_L}{A_H}\) for each dollar of assets sold. \(L\) will thus cooperate with equity issuance if

\[
C_L + A_L \geq \omega(C_H + A_H) + (1 - \omega) \left(C_L + A_L + F - F \frac{A_L}{A_H}\right),
\]

which simplifies to the condition stated in the text.
Proof of Lemma 7

As discussed in the text, it is trivial that $H$ will cooperate. The condition stated in the Lemma is $L$’s ND condition. If $L$ sells assets, these are valued at the pooled price of $\pi A_H + (1 - \pi) A_L$. Similarly, its stock price is $\pi (C_H + A_H) + (1 - \pi) (C_L + A_L)$. If $L$ deviates to issuing equity, this will be valued correctly at $C_L + A_L + F$ and its stock price will be correct at $C_L + A_L$, so its objective function is simply $C_L + A_L$. $L$ will thus cooperate with asset sales if

$$\omega (\pi (C_H + A_H) + (1 - \pi) (C_L + A_L)) + (1 - \omega) \left( C_L + A_L + F - F \left( \frac{A_L}{\pi A_H + (1 - \pi) A_L} \right) \right) \geq C_L + A_L,$$

which simplifies to the condition stated in the text.

Proof of Lemma 8

As discussed in the text, it is trivial that $L$ will cooperate. The condition stated in the Lemma is $H$’s ND condition. If $H$ issues equity, it is valued at $\pi (C_H + A_H + F) + (1 - \pi) (C_L + A_L + F)$ and its stock price is $\pi (C_H + A_H) + (1 - \pi) (C_L + A_L)$, since $H$ pools with all other firms. If $H$ deviates to selling assets, the assets sold will be valued at $A_L$, and its stock price will be $C_L + A_L$. $H$ will cooperate with equity issuance if

$$\omega \left( E[C + A] \right) + (1 - \omega) \left( C_H + A_H + F - F \left( \frac{E[C + A]}{C_H + A_H + F} \right) \right) \geq \omega (C_L + A_L) + (1 - \omega) \left( C_H + A_H + F - F \left( \frac{A_H}{A_L} \right) \right).$$

To derive the IC condition, $L$ will sell assets if inferred as $H$ if

$$\omega (C_H + A_H) + (1 - \omega) \left( C_L + A_L + F - F \left( \frac{A_L}{A_H} \right) \right) > \omega E[C + A] + (1 - \omega) \left( C_L + A_L + F - F \left( \frac{E[C + A]}{E[C + A] + F} \right) \right).$$

Both inequalities simplify to the conditions stated in the text.

To show that the IC condition is stronger, we compare the conditions as stated in the text. Since $\pi > 1/2$ and so $1 - \pi < \pi$, it is sufficient to show that

$$\frac{A_L}{A_H} - \frac{C_L + A_L + F}{E[C + A] + F} > \frac{C_H + A_H + F}{E[C + A] + F} - \frac{A_H}{A_L}.$$

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This inequality can be rearranged to
\[
\frac{A_L}{A_H} + \frac{A_H}{A_L} > \frac{(C_H + A_H + F) + (C_L + A_L + F)}{\mathbb{E}[C + A] + F}.
\]

The LHS takes the form \(a + \frac{1}{a}\) with \(a > 0\), and therefore exceeds 2. The RHS is less than 2, because \(\pi > \frac{1}{2}\) means that the uninformed valuation of equity (the denominator) is greater than the equal-weighted average of the high and low values (half of the numerator). Thus, the inequality holds, and so the IC condition is stronger.

**Proof of Proposition 3**

We first show that \(\omega^{APE} < \omega^{SE}\). To facilitate the comparison, we multiply by \(\pi\) the top and bottom of the bound \(\omega^{SE}\) stated in Lemma 6:
\[
\omega^{SE} = \frac{F^{\frac{\pi(A_L-A_H)}{A_H}}}{F^{\frac{\pi(A_L-A_H)}{A_H}} + \pi(C_H - C_L) - (A_L - A_H)}.
\]

Now both \(\omega^{SE}\) and \(\omega^{APE}\) are of the form \(\frac{\alpha}{\alpha + \pi}\), with a common value of \(\alpha \equiv (C_H - C_L) - (A_L - A_H)\). They are increasing in \(\alpha\) since \(\pi > 0\) (by assumption (1), \(C_H - C_L > A_L - A_H\)), so it only remains to show that the numerator of \(\omega^{SE}\) is greater than that of \(\omega^{APE}\). Note that in the numerator of \(\omega^{SE}\), \(\pi(A_L - A_H) = A_L - \mathbb{E}[A]\), so we wish to show \(\frac{A_L - \mathbb{E}[A]}{\mathbb{E}[A]} < \frac{A_L - \mathbb{E}[A]}{A_H}\), which follows from \(A_H < \mathbb{E}[A]\).

We next show that \(\omega^{SE} < \omega^{EPE}\). First, since \(\pi > \frac{1}{2} > 1 - \pi\), we have
\[
\omega^{EPE} > \frac{F\left(\frac{A_L}{A_H} - \frac{E_L}{\mathbb{E}[E]}\right)}{\pi((C_H - C_L) - (A_L - A_H)) + F\left(\frac{A_L}{A_H} - \frac{E_L}{\mathbb{E}[E]}\right)}.
\]

As before, the form of the expressions involved mean that it is sufficient to show
\[
\frac{A_L}{A_H} - \frac{E_L}{\mathbb{E}[E]} > \frac{\pi(A_L - A_H)}{A_H} = \frac{A_L}{A_H} - \frac{\mathbb{E}[A]}{A_H},
\]
i.e., \(\frac{\mathbb{E}[A]}{A_H} > \frac{E_L}{\mathbb{E}[E]}\). This holds because \(A_H < \mathbb{E}[A]\) and \(\mathbb{E} > E_L\).
B Selling the Core Asset

B.1 Positive Correlation

This subsection extends the core positive correlation model of Section 2.1 to allow the firm to sell the core asset (in addition to the non-core asset and equity). Proposition 4 below characterizes which equilibria are sustainable and when. For simplicity of exposition, we shut down synergies ($\bar{k} = \underline{k} = 0$), but the results extend to the case of general $\bar{k}$ and $\underline{k}$.

**Proposition 4.** (Positive correlation, selling the core asset.) Consider a pooling equilibrium where all firms sell non-core assets ($X = A$) and a firm that sells equity or the core asset is inferred as $L$. The prices of core assets, non-core assets, and equity are $C_L$, $\pi A_H + (1 - \pi) A_L$, and $C_L + A_L + F$, respectively. This equilibrium is sustainable if the following conditions hold:

$$F \leq F^{APE,IC} \equiv \frac{A_L(C_H + A_H) - \mathbb{E}[A](C_L + A_L)}{\mathbb{E}[A] - A_L}$$

(35)

$$\frac{\mathbb{E}[A]}{A_L} \leq \frac{C_H}{C_L}.$$  

(36)

Consider a pooling equilibrium where all firms sell core assets ($X = C$) and a firm that sells equity or the non-core asset is inferred as $L$. The prices of core assets, non-core assets, and equity are $\pi C_H + (1 - \pi) C_L$, $A_L$, and $C_L + A_L + F$, respectively. This equilibrium is sustainable if the following conditions hold:

$$F \leq \frac{(C_H + A_H)C_L - (C_L + A_L)\mathbb{E}[C]}{\mathbb{E}[C] - C_L}$$

(37)

$$\frac{A_L}{A_H} \leq \frac{C_L}{\mathbb{E}[C]}.$$  

(38)

Consider a pooling equilibrium where all firms sell equity ($X = E$) and a firm that sells either asset is inferred as $L$. The prices of core assets, non-core assets, and equity are $C_L$, $A_L$, and $\pi(C_H + A_H) + (1 - \pi)(C_L + A_L) + F$, respectively. This equilibrium is sustainable if the following conditions hold:

$$F \geq F^{EPE,IC} \equiv \frac{A_L\mathbb{E}[C + A] - A_H(C_L + A_L)}{A_H - A_L}$$

(39)

$$F \geq \frac{C_L\mathbb{E}[C + A] - C_H(C_L + A_L)}{C_H - C_L}.$$  

(40)
For the APE, equation (35) is the same as (9) in the core model: it means that the OEPB that an equity issuer is of quality $L$ satisfies the IC. Equation (36) is new and guarantees that the belief that a core asset seller is of quality $L$ satisfies the IC. This condition is stronger than the condition that prevents $H$ deviating to sell the core asset. For the core-asset-pooling equilibrium (CPE), equations (37) and (38) guarantee that the OEPB, that a seller of the non-core asset or equity is of quality $L$, satisfies the IC. Again, these conditions are stronger than the conditions preventing $H$ from deviating to either of these actions.

The main result of Proposition 4 is to show that an EPE is still sustainable. Equations (39) is the same as (12) in the core model: it means that the OEPB that a seller of the non-core asset is of quality $L$ satisfies the IC. Equation (40) is new and guarantees that the belief that a core-asset seller is of quality $L$ is also consistent with the IC. Again, it is stronger than the condition preventing $H$ from deviating to this action. It is possible for both inequalities to be satisfied: thus, equity issuance may be sustainable even though it does not exhibit the least information asymmetry (absent the certainty effect). One of the assets (core or non-core) will exhibit more information asymmetry than the other; since equity is a mix of both assets, its information asymmetry will lie in between. Even though equity is never the safest claim, it may still be issued, if $F$ is sufficiently large, due to the certainty effect.

Comparing the conditions from CPE and APE that prevent $H$ from deviating to non-core and core assets, respectively, the former is harder to satisfy if

$$\frac{A_H}{A_L} < \frac{C_H}{C_L}. $$

Thus, as is intuitive, if the core asset exhibits greater information asymmetry, it is more difficult to sustain its sale. This result is a natural extension of MM.

### B.2 Negative Correlation

We now move to the negative correlation case. Proposition 5 characterizes the equilibria.

**Proposition 5.** (Negative correlation, selling the core asset.) Consider a pooling equilibrium where all firms sell non-core assets ($X = A$) and a firm that sells equity or the core asset is inferred as $L$. The prices of core assets, non-core assets, and equity are $C_L$, $\pi A_H + (1 - \pi) A_L$, and $C_L + A_L + F$, respectively. This equilibrium is sustainable.
if the following conditions hold:

\[
\omega \geq \frac{F \left( \frac{A_L}{E[A]} - 1 \right)}{\pi \left( (C_H - C_L) - (A_L - A_H) \right) + F \left( \frac{A_L}{E[A]} - 1 \right)}.
\] (41)

Consider a pooling equilibrium where all firms sell core assets \((X = C)\) and a firm that sells equity or the non-core asset is inferred as \(L\). The prices of core assets, non-core assets, and equity are \(\pi C_H + (1 - \pi)C_L\), \(A_L\), and \(C_L + A_L + F\), respectively. This equilibrium is sustainable if the following conditions hold:

\[
\omega \geq \frac{F \left( \frac{C_H}{E[C]} - \frac{A_H}{A_L} \right)}{\pi \left( (C_H - C_L) - (A_L - A_H) \right) + F \left( \frac{C_H}{E[C]} - \frac{A_H}{A_L} \right)}.
\] (42)

\[
\omega \geq \frac{F \left( \frac{A_L}{A_H} - \frac{C_L}{E[C]} \right)}{(1 - \pi)\left( (C_H - C_L) - (A_L - A_H) \right) + F \left( \frac{A_L}{A_H} - \frac{C_L}{E[C]} \right)}.
\] (43)

Consider a pooling equilibrium where all firms sell equity \((X = E)\) and a firm that sells either asset is inferred as \(L\). The prices of core assets, non-core assets, and equity are \(C_L\), \(A_L\), and \(\pi (C_H + A_H) + (1 - \pi) (C_L + A_L) + F\), respectively. This equilibrium is sustainable if the following conditions hold:

\[
\omega \geq \frac{F \left( \frac{C_H + A_H + F}{E[C] + F} - \frac{A_H}{A_L} \right)}{\pi \left( (C_H - C_L) - (A_L - A_H) \right) + F \left( \frac{C_H + A_H + F}{E[C] + F} - \frac{A_H}{A_L} \right)}.
\] (44)

\[
\omega \geq \frac{F \left( \frac{A_L}{A_H} - \frac{E_L}{E[F]} \right)}{(1 - \pi)\left( (C_H - C_L) - (A_L - A_H) \right) + F \left( \frac{A_L}{A_H} - \frac{E_L}{E[F]} \right)}.
\] (45)

Starting with the APE, equation (41) is the ND condition for \(L\) not to deviate to equity, and is the same as equation (19) in the core model. If \(L\) deviates to selling the core asset, his objective function is also \(C_L + A_L\) and so we have the same condition. This is intuitive: regardless of whether he deviates to the core asset or equity, the claim he issues is fairly priced as he is revealed as \(L\). The IC condition that a seller of the core asset or equity is of quality \(L\) is trivially satisfied.

Moving to a CPE, \(L\) will automatically not deviate. If \(H\) deviates to sell the non-core asset, his unit cost of financing is \(\frac{A_H}{A_L} < 1\), but if he deviates to sell equity, his unit cost of financing is \(\frac{C_H + A_H + F}{C_L + A_L + F} > 1\). Thus, he will prefer to deviate to non-core assets,
and we have the ND condition stated. The IC condition that a seller of the core asset is of quality $L$ is again trivially satisfied; the IC condition that a seller of the non-core asset is of quality $L$ is satisfied if (43) holds.

Finally, in the EPE, $L$ will automatically not deviate. $H$ will deviate to non-core assets rather than the core asset, since $A_H < 1 < C_H$, and so we have the same ND condition as before. The IC condition that a seller of the core asset is of quality $L$ is again trivially satisfied; the IC condition that a seller of the non-core asset is of quality $L$ is satisfied if (45) holds. Equation (45) is stronger than (41), the APE lower bound, if and only if:

\[
\pi \left( \frac{A_L}{A_H} - \frac{C_L}{\mathbb{E}[C]} \right) > (1 - \pi) \left( \frac{A_L - \mathbb{E}[A]}{\mathbb{E}[A]} \right) \\
\pi \left( \frac{C_L}{\mathbb{E}[C]} \right) < \frac{\pi A_L \mathbb{E}[A] - (1 - \pi) A_H (A_L - \mathbb{E}[A])}{A_H \mathbb{E}[A]}.
\]

Since $C_L < \mathbb{E}[C]$, it is sufficient that

\[
\pi A_H \mathbb{E}[A] < \pi A_L \mathbb{E}[A] - (1 - \pi) A_H (A_L - \mathbb{E}[A]) \\
0 < (A_L - A_H) \pi \mathbb{E}[A] - (1 - \pi) A_H (A_L - \mathbb{E}[A]),
\]

which is true since $\pi > 1 - \pi$, $(A_L - A_H) > (A_L - \mathbb{E}[A])$, and $\mathbb{E}[A] > A_H$.

Thus, the APE is easier to sustain than the CPE. This is a simple extension of the camouflage effect of the core model. A deviation from the APE to either the core asset or equity is relatively unattractive, since the firm suffers a “lemons” discount on both the security being issued and the rest of the firm as a whole. This is because both the core asset and equity are positively correlated with the value of the firm. In contrast, a deviation from either the CPE or the EPE to selling the non-core asset is harder to rule out: even if a high price is received for the non-core asset, this does not imply a high valuation for the firm as a whole, and so it is difficult to satisfy the IC.

The SEs are very similar to the core model. As in the core model, there is a SE where $H$ sells non-core assets and $L$ issues equity. There is also a SE where $H$ sells non-core assets and $L$ sells core assets. The conditions for this equilibrium to hold are exactly the same as in the core model. In both equilibria, by deviating, $L$’s stock price increases but his fundamental value falls by $\frac{F'(A_L - A_H)}{A_H}$. Regardless of whether $L$ sells equity or core assets in the SE, deviation involves him selling his highly-valued non-core assets and thus suffering a loss. There is no SE where $H$ sells core assets and $L$ sells equity, or when $H$ sells equity or $L$ sells the core asset, since $L$ will mimic $H$ in
both cases. The only possible $SE$ is where $H$ sells non-core assets, as $L$ will not wish to mimic him as this will involve selling assets at a fundamental loss.

**B.3 A Three-Asset Model**

The previous sub-section showed that, in the case of negative correlation, it is easier to sustain an equilibrium in which all firms sell the non-core asset than one in which all firms sell the core asset. While this result is suggestive of the correlation effect, it may also arise from the fact that the non-core asset exhibits less information asymmetry, because $A_L - A_H < C_H - C_L$. If we reversed this assumption, then firm value would be higher for $L$ than $H$, and so we would have the same model but with reversed notation. Since firm value is higher for $L$, then $L$ is effectively $H$. Since $A$ is positively correlated with firm value, $A$ is effectively $C$ and $C$ is effectively $A$. We will obtain the result that it is easier to sustain a $CPE$ than an $APE$, but this would be because $C$ exhibits less information asymmetry rather than $C$ being negatively correlated.

Thus, to allow for both positively and negatively correlated assets, and also for either asset to exhibit higher information asymmetry, we need to move to a 3-asset model. Let the three assets be $C$, $P$, and $N$. Asset $C$ cannot be sold as it is the core asset, but assets $P$ and $N$ can be. Asset $P$ is the positively correlated asset ($P_H \geq P_L$) and asset $N$ is the negatively correlated asset ($N_H \leq N_L$). We allow for both $P_H - P_L > N_L - N_H$ and $P_H - P_L < N_L - N_H$: either asset may exhibit more information asymmetry. We only assume $C_H + P_H + N_H > C_L + P_L + N_L$: the existence of the third asset $C$ means that $H$ has a higher firm value than $L$, even if $N$ exhibits more information asymmetry than $P$. Let $A = P + N$ be the total value of the two non-core assets.

Proposition 6 characterizes the equilibria.

**Proposition 6.** (Three-asset model.) Consider a pooling equilibrium where all firms sell the negatively-correlated asset ($X = N$) and a firm that sells equity or the positively-correlated asset is inferred as $L$. The prices of the positively-correlated asset, negatively-correlated asset, and equity are $P_L$, $\pi N_H + (1 - \pi) N_L$, and $C_L + P_L + N_L + F$, respectively. This equilibrium is sustainable if the following conditions hold:

$$\omega \geq \frac{F \left( \frac{N_L}{E[N]} - 1 \right)}{\pi (E_H - E_L) + F \left( \frac{N_L}{E[N]} - 1 \right)}. \quad (46)$$

Consider a pooling equilibrium where all firms sell the positively-correlated asset ($X = P$).
P) and a firm that sells equity or the negatively-correlated asset is inferred as L. The prices of the positively-correlated asset, negatively-correlated asset, and equity are $\pi P_H + (1 - \pi) P_L$, $N_L$, and $C_L + P_L + N_L + F$, respectively. This equilibrium is sustainable if the following conditions hold:

$$\omega \geq \frac{F \left( \frac{P_H}{\mathbb{E}[P]} - \frac{N_H}{N_L} \right)}{\pi (E_H - E_L) + F \left( \frac{P_H}{\mathbb{E}[P]} - \frac{N_H}{N_L} \right)}$$  \hspace{1cm} (47)

$$\omega \geq \frac{F \left( \frac{E_L}{E_H} - \frac{P_L}{\mathbb{E}[P]} \right)}{(1 - \pi) (C_H - C_L + A_H - A_L) + F \left( \frac{E_L}{E_H} - \frac{P_L}{\mathbb{E}[P]} \right)}$$  \hspace{1cm} (48)

Consider a pooling equilibrium where all firms sell equity ($X = E$) and a firm that sells either asset is inferred as L. The prices of the positively-correlated asset, negatively-correlated asset, and equity are $P_L$, $N_L$, and $\pi (C_H + P_H + N_H) + (1 - \pi) (C_L + P_L + N_L) + F$, respectively. This equilibrium is sustainable if the following conditions hold:

$$\omega \geq \frac{F \left( \frac{N_L}{N_H} - \frac{E_L}{\mathbb{E}[E]} \right)}{(1 - \pi) (C_H - C_L + A_H - A_L) + F \left( \frac{N_L}{N_H} - \frac{E_L}{\mathbb{E}[E]} \right)}$$  \hspace{1cm} (49)

$$\omega \geq \frac{F \left( \frac{E_H}{\mathbb{E}[E]} - \frac{N_L}{N_E} \right)}{\pi (C_H - C_L + A_H - A_L) + F \left( \frac{E_H}{\mathbb{E}[E]} - \frac{N_L}{N_E} \right)}$$  \hspace{1cm} (50)

Starting with the $N$-pooling equilibrium, $H$ will not deviate; equation (46) gives the condition for $L$ not to deviate to either equity or $P$. The IC conditions that $L$ will deviate to $P$ or equity if it were revealed good are trivially satisfied. $L$ would make a capital gain on selling low-quality $P$ or low-quality equity, compared to its capital loss on selling high-quality $N$, and enjoy a higher stock price.

Moving to the $P$-pooling equilibrium, $L$ will not deviate. $H$ will always deviate to sell $N$ rather than equity, and equation (47) is the ND condition for him not to do so. Equation (48) is the IC condition for $L$ to be willing to deviate to equity if he were revealed good, which is stronger than the IC condition for deviation to $N$.

The IC condition for the $P$-pooling equilibrium (equation (48)) is stronger than the ND condition for the $N$-pooling equilibrium ((46)) if and only if

$$\pi \left( \frac{N_L}{N_H} - \frac{P_L}{\mathbb{E}[P]} \right) > (1 - \pi) \left( \frac{N_L}{\mathbb{E}[N]} - 1 \right).$$
This always holds, since $\pi > 1 - \pi$, and $\frac{N_L}{N_H} > \frac{N_H}{E[N]}$, and $\frac{P_L}{E[P]} < 1$. Thus, it is easier to sustain an equilibrium in which all firms sell negatively-correlated assets than one in which all firms sell positively-correlated assets, due to the correlation effect.

Finally, for the $EPE$, $L$ will not deviate. There are two IC conditions, one to ensure deviation to $P$ and one to $N$, but the latter condition is stronger and is the first of the two conditions listed. There are similarly two ND conditions for $H$, one to prevent deviation to $P$ and the other to $N$, but again the latter is stronger and is the second of the two conditions listed. The ND condition for $L$ is trivial. Since every type has the potential to deviate to an asset that will be valued highly, we require high stock price concerns to deter such a deviation.

C Financing from Multiple Sources

The core model assumes that firms can only raise financing from a single source. One potential justification is that the transactions costs from using multiple sources of financing are prohibitive. Alternatively, the assumption can be endogenized with the OEPB that any firm that issues multiple financing sources is of quality $L$. This section studies conditions under which this belief satisfies the IC.

For three of the four pooling equilibria studied in the paper, our existing IC condition (that $L$ would deviate to a claim consisting entirely of the off-equilibrium security choice, if valued as $H$ by doing so) is already sufficient to achieve the new desired result (that $L$ would deviate to any mixture of asset sales and equity issuance, if valued as $H$ by doing so). For the equilibria in the positive correlation model, this happens because $L$ receives a high price for both components of the mixture, instead of receiving a pooled price from cooperating with the pooling equilibrium. For the $EPE$ in the negative correlation model, $L$ receives a low price if he deviates to sell assets and is inferred as $H$, but this loss will be lower if he mixes the asset sale with an equity issue, since the latter will fetch a high price. Thus, his fundamental value is higher when selling the mixture than when selling assets only. As a result, the existing IC condition, which guarantees that he will deviate to assets if inferred as $H$, ensures that he will deviate to any mixture if inferred as $H$.

For the $APE$ in the negative correlation model, we require an additional condition (a lower bound on $\omega$, given in (51) below) to ensure that the IC condition is satisfied. This additional condition is only necessary because, unlike the other three pooling equilibria, this pooling equilibrium required no IC condition in the core model. It was automatic that $L$ would deviate to pure equity if he was inferred as $H$, since he avoids
the capital loss from selling high-quality assets and also enjoys a high stock price. When financing mixtures are possible, there may be mixtures that comprise such a high proportion of asset sales that \( L \) would suffer a large fundamental loss by selling this mixture and so will not deviate despite enjoying a high stock price. This is the case we rule out with (51) below; the results and economic intuition of the model do not change in response to this new condition.

We now proceed with formal proofs of the above statements. Consider a deviation by \( L \) to raise \( \alpha F \) from asset sales and \( (1 - \alpha) F \) from equity issuance. We wish to study whether, if he is inferred as \( H \) from such a deviation, his payoff is higher than in the pooling equilibrium, for any \( \alpha \). We consider the four pooling equilibria in turn.

**Positive correlation, APE.** The existing IC condition (9) implies that the capital gain to \((L, \bar{k})\) from selling equity at a high price (if he deviates and is inferred as \( H \)) exceeds his gain from selling assets at a pooled price in the pooling equilibrium:

\[
\frac{E_L}{E_H} \leq \frac{A_L(1 + \bar{k})}{\pi A_H + (1 - \pi)A_L}
\]

We wish to show that his gain from selling any mix of assets and equity at a high price exceeds his gain from selling assets at a pooled price:

\[
\alpha \frac{A_L(1 + \bar{k})}{A_H} + (1 - \alpha) \frac{E_L}{E_H} \leq \frac{A_L(1 + \bar{k})}{\pi A_H + (1 - \pi)A_L}
\]

The existing IC condition (9) establishes the inequality for \( \alpha = 0 \). The LHS is linear in \( \alpha \), and for \( \alpha = 1 \) it simplifies to \( \alpha \frac{A_L(1 + \bar{k})}{A_H} \leq \frac{A_L(1 + \bar{k})}{E[A]} \), which holds because positive correlation implies \( A_H > E[A] \). Thus, the inequality is satisfied for all \( \alpha \in [0, 1] \).

**Positive correlation, EPE.** We wish to show that, for all \( \alpha \):

\[
\alpha \frac{A_L(1 + k)}{A_H} + (1 - \alpha) \frac{E_L}{E_H} \leq \frac{E_L}{E[E]}
\]

The LHS is again linear in \( \alpha \). The IC condition (12) in the core model establishes the inequality for \( \alpha = 1 \), and for \( \alpha = 0 \) the LHS simplifies to

\[
\frac{E_L}{E_H} \leq \frac{E_L}{E[E]},
\]

which always holds. Thus, the inequality is satisfied for all \( \alpha \in [0, 1] \).
Negative correlation, APE. We wish to show that, for all \( \alpha \):

\[
\omega \mathbb{E}[C + A] + (1 - \omega) \left( C_L + A_L + F - F \left( \frac{A_L(1 + \bar{k})}{\mathbb{E}[A]} \right) \right) \leq \omega(C_H + A_H) + (1 - \omega) \left( C_L + A_L + F - F \left( \frac{A_L(1 + \bar{k})}{A_H} + (1 - \alpha) \frac{E_L}{E_H} \right) \right)
\]

We can rearrange this condition to \( \omega \geq \frac{MF_\kappa}{\kappa + MF_\kappa} \), where \( \kappa \equiv (C_H - C_L) - (A_L - A_H) \) and \( M \) is defined appropriately. For \( \alpha = 0 \), \( M < 0 \) and the lower bound on \( \omega \) is negative, which is why the IC condition was trivial in the core model. However, the derivative of the bound with respect to \( \alpha \) is positive: it equals the sign of \( \frac{\partial M}{\partial \alpha} \), which is positive since \( A_L > A_H \) under negative correlation. Thus, as \( \alpha \) increases, the lower bound on \( \omega \) rises and can eventually become positive and constitute a nontrivial IC condition. Intuitively, if \( L \) is inferred as \( H \), his capital loss to selling assets is higher than under the pooling equilibrium, since he receives a low price \( A_H \) rather than a pooled price. Thus, financing mixes that are primarily comprised of assets (high \( \alpha \)) are particularly costly to him and he may be unwilling to deviate even if he is inferred as \( H \). To ensure that \( L \) is willing to deviate for all \( \alpha \), we require the condition to be satisfied for \( \alpha = 1 \). This in turn requires:

\[
\omega \geq \frac{F \left( \frac{A_L(1 + \bar{k})}{A_H} - \frac{A_L(1 + \bar{k})}{\mathbb{E}[A]} \right)}{(C_H - C_L) - (A_L - A_H) + F \left( \frac{A_L(1 + \bar{k})}{A_H} - \frac{A_L(1 + \bar{k})}{\mathbb{E}[A]} \right)}.
\]

(51)

To encourage deviation, \( L \) must have a high weight on the stock price to offset his capital loss from asset sales. Condition (51) is stronger than (19) (the ND condition for APE) if and only if \( (1 - \pi)A_L > A_H \), which is not imposed or ruled out by any of our assumptions thus far. Thus, if \( (1 - \pi)A_L > A_H \), the additional condition (51) is needed for the OEPB, that an issuer of multiple financing sources is of quality \( L \), to satisfy the IC.

Negative correlation, EPE. We wish to show that, for all \( \alpha \):

\[
\omega \mathbb{E}[C + A] + (1 - \omega) \left( C_L + A_L + F - F \left( \frac{E_L}{\mathbb{E}[E]} \right) \right) \leq \omega(C_H + A_H) + (1 - \omega) \left( C_L + A_L + F - F \left( \alpha \frac{A_L(1 + \bar{k})}{A_H} + (1 - \alpha) \frac{E_L}{E_H} \right) \right).
\]

The existing IC condition establishes the inequality for \( \alpha = 1 \). If \( \alpha = 0 \), the inequality also holds since \( E_H > E_L \). Since the RHS is linear in \( \alpha \), the inequality also holds at
any value of $\alpha$ between these extremes.

## D Voluntary Capital Raising: Additional Material

### D.1 Positive Correlation, Positive-NPV Investment, Relaxing Assumptions (15) and (16)

Assumption (15) was sufficient for the RHS of the conditions in parts (iii) and (iv) of Lemma 4 to be positive. If (15) does not hold, i.e., assets are so volatile that $APE$ is never sustainable in the core model, then the RHS of one of these conditions is negative. For example, if $\frac{C_H+A_H}{C_L+A_L} > \frac{A_H(1+\tilde{E})}{E[A]}$, the RHS of the ND condition is negative.

Then, if $\frac{A_H(1+\tilde{E})}{E[A]} > \frac{1+r_L}{1+r_H}$ (the information asymmetry of investment is lower than that of assets), the LHS is positive and so $APE$ is never sustainable for any $F$, just as in the core model. Intuitively, if assets exhibit higher information asymmetry than both equity and the new investment, then no portfolio of equity and the new investment will have greater information asymmetry than assets, and so $APE$ cannot be sustained.

If, on the other hand, the extreme case in which (15) is violated is combined with $\frac{A_H(1+\tilde{E})}{E[A]} \leq \frac{1+r_L}{1+r_H}$, the LHS is also negative and so we now have a lower bound: the ND condition becomes $F > \frac{E[A](C_H+A_H)-A_H(C_L+A_L)(1+\tilde{E})}{A_H(1+\tilde{E})(1+r_L)-E[A](1+r_H)}$. Intuitively, if the new investment has high information asymmetry, then the portfolio of equity plus the new investment will also have high information asymmetry (allowing the $APE$ to hold) if the weight placed on the new investment is sufficiently high, reversing the usual upper bound for $APE$. Similar intuition applies to the IC condition.

Assumption (16) was sufficient for the RHS of the conditions in parts (iii) and (iv) of Lemma 5 to be positive. If (16) does not hold, i.e., assets are so volatile that $EPE$ is always sustainable in the core model, then the RHS of one of these conditions is negative. For example, if $\frac{C_H+A_H}{C_L+A_L} > \frac{A_H(1+\tilde{E})}{E[A]}$, the RHS of the ND condition is negative.

Then, if $\frac{A_H(1+\tilde{E})}{E[A]} \leq \frac{1+r_L}{1+r_H}$, the LHS is positive and so $EPE$ is sustainable for all $F$, just as in the core model. Intuitively, if assets exhibit higher information asymmetry than both equity and the new investment, then no portfolio of equity and the new investment will have greater information asymmetry than assets, and so $EPE$ can always be sustained. If, on the other hand, the extreme case in which (16) is violated is combined with $\frac{A_H(1+\tilde{E})}{E[A]} \leq \frac{1+r_L}{1+r_H}$, the LHS is also negative and so we now have an upper bound: the ND condition becomes $F < \frac{A_L(C_H+A_H)-A_HE[C+A](1+\tilde{E})}{A_H(1+\tilde{E})E[A](1+r_H)-A_L(1+r_H)}$. Intuitively, if the new investment has high information asymmetry, the portfolio of equity plus the
new investment will also have high information asymmetry (allowing the EPE to hold) unless the weight on the new investment is sufficiently low. Similar intuition applies to the IC condition.

E Negative Correlation With Synergies

This section repeats the analysis of Section 3 allowing for synergies. The primary difference is that we can now have semi-separating equilibria in which \( H \) and \( L \) separate between equity issuance and asset sales based on their level of synergies. The conditions for the other equilibria are more complex but intuitively analogous to those in the main text of the paper. Proofs are presented in Section E.3.

E.1 Separating and Semi-Separating Equilibria

As in Section 2.1.3, we have a SSE characterized by a cutoff \( k_q^* \). The prices paid for assets and equity are again given by (13) and (14). Since the manager now places weight on the firm’s stock price, we need to calculate the stock prices of asset sellers and equity issuers. These are, respectively:

\[
\mathbb{E}[V|X = A] = \pi \left( \frac{k_H^* - k}{\mathbb{E}[k_q^*] - k} \right) (C_H + A_H) + (1 - \pi) \left( \frac{k_L^* - k}{\mathbb{E}[k_q^*] - k} \right) (C_L + A_L) \\
- \frac{1}{2} F \left( \frac{\mathbb{E}(k_q^*)^2 - k^2}{\mathbb{E}[k_q^*] - k} \right),
\]

(52)

\[
\mathbb{E}[V|X = E] = \pi \left( \frac{k - k_H^*}{k - \mathbb{E}[k_q^*]} \right) (C_H + A_H) + (1 - \pi) \left( \frac{k - k_L^*}{k - \mathbb{E}[k_q^*]} \right) (C_L + A_L).
\]

(53)

The stock price of an asset seller includes an additional term, \(-F \mathbb{E}[k|X = A] = -\frac{1}{2} F \left( \frac{\mathbb{E}(k_q^*)^2 - k^2}{\mathbb{E}[k_q^*] - k} \right)\), which reflects the expected synergy loss (which may be negative). Note that \( \mathbb{E}[k|X = A] < \mathbb{E}[k] \), since the decision to sell assets suggests that synergies are low. The stock price is higher for an asset seller than an equity issuer (\( \mathbb{E}[V|X = A] > \mathbb{E}[V|X = E] \)) if and only if

\[
[\Pr(q = H|X = A) - \Pr(q = H|X = E)] \times [(C_H - C_L) - (A_L - A_H)] > F \mathbb{E}[k|X = A].
\]

(54)
The cutoff $k^*_q$ for a particular quality $q$ is defined by:

$$
\omega (\mathbb{E}[V|X = A] - \mathbb{E}[V|X = E]) = (1 - \omega) F \left( \frac{A_q(1 + k^*_q)}{\mathbb{E}[A|X = A]} - \frac{C_q + A_q + F}{\mathbb{E}[E|X = E]} \right).
$$

(55)

Only the parenthetical term on the RHS differs by quality $q$. Ignoring $k$, this term will be higher for $L$, and so $k^*_H > k^*_L$. This is intuitive: since $H$ has low-quality assets but high-quality equity, he is more willing to sell assets. Under positive correlation, $k^*_H > k^*_L$ only if assets exhibit less (certainty effect-adjusted) information asymmetry than equity, as then the capital loss from asset sales is lower. With negative correlation, the capital loss from asset sales is always lower since it is negative (i.e., a capital gain), and so we always have $k^*_H > k^*_L$. From (52) and (53), $k^*_H > k^*_L$ implies that asset (equity) sales lead to a positive (negative) inference about firm quality, i.e. $\Pr(q = H|X = A) > \Pr(q = H|X = E)$, and so the LHS of (54) positive. Thus, in the absence of the additional term $F \mathbb{E}[k|X = A]$ on the RHS, (54) will hold: the stock price is higher for an asset seller, since $H$ is more likely to sell assets than $L$. However, if synergies become extremely strong so that $F \mathbb{E}[k|X = A]$ is very large, this could theoretically lead to a violation of (54): an asset seller is expected to lose very large synergies, swamping the positive quality inference. Since this paper considers the trade-off between information asymmetry and synergies, to ensure that synergies are not so strong that they dominate the trade-off, we assume that (54) holds. One sufficient condition for this is symmetric synergies ($k = -k$). (In this case, we have $\mathbb{E}[k] = 0$ and so $\mathbb{E}[k|X = A] < \mathbb{E}[k] = 0$; thus, the RHS of (54) is negative and (54) holds.) In turn, (54) implies that the LHS of (55) is positive. Setting $q = H$ on the RHS yields $k^*_H > 0$ for the equality to hold. Intuitively, $H$ will sell assets even if they are moderately synergistic, as he benefits from both the capital gain and the higher stock price.

The amount of financing $F$ has three effects on the cutoffs in (55). To illustrate, consider $L$’s decision. First, an increase in $F$ augments the certainty effect and makes equity less attractive, because $L$ enjoys a smaller capital gain. This tends to increase $k^*_L$. Second, an increase in $F$ augments fundamental value considerations due to the base effect, which tends to decrease $k^*_L$. Third, $F$ multiplies the expected synergy loss of an asset seller. If the expected synergy loss $\mathbb{E}[k|X = A]$ is negative (on average, sold assets are dissynergistic), a higher $F$ magnifies this expected gain, increasing the stock price reaction to selling assets and raising $k^*_L$.

It is possible to have a separating equilibrium by quality only (a “SEq”), i.e. where all high (low)-quality firms sell assets (equity) as in Lemma 6. This equilibrium corre-
sponds to $k_H^* = \bar{k}$ and $k_L^* = \bar{k}$. The required conditions are as follows:

$$\omega \geq \omega^{SE^q,H} = \frac{F \left( (1 + \bar{k}) - \frac{E_H}{E_L} \right)}{((C_H - C_L) - (A_L - A_H)) - \frac{1}{2} F(\bar{k} + k) + F \left( (1 + \bar{k}) - \frac{E_H}{E_L} \right)}$$

(56)

$$\omega \leq \omega^{SE^q,L} = \frac{F \left( \frac{A_L(1 + k)}{A_H} - 1 \right)}{((C_H - C_L) - (A_L - A_H)) - \frac{1}{2} F(\bar{k} + k) + F \left( \frac{A_L(1 + k)}{A_H} - 1 \right)}$$

(57)

The lower bound on $\omega$ ensures that $H$ will not deviate. Type $(H, \bar{k})$ may wish to deviate to retain its synergistic assets; a high $\omega$ is needed for stock price concerns to deter deviation.\(^{19}\) There are three effects of changing $F$ on the lower bound, analogous to the three effects on the cutoffs in (55). First, a rise in $F$ increases $\omega^{SE^q,H}$ due to the certainty effect (reducing $\frac{E_H}{E_L}$). Second, it reduces it due to the base effect. Third, $F$ multiplies the expected synergy loss of an asset seller. If the expected synergy loss $\frac{E + k}{2}$ is negative, a higher $F$ magnifies this expected gain, reducing $\omega^{SE^q,H}$. The upper bound ensures that $L$ will not deviate. If $1 + k \leq \frac{A_H}{A_L}$, i.e., the benefits of getting rid of a disynergistic asset exceed the capital loss from selling high-quality assets, deviation to asset sales yields $(L, \bar{k})$ a fundamental gain and so $SE^q$ can never hold. However, if $1 + k > \frac{A_H}{A_L}$, deviation yields $(L, \bar{k})$ a fundamental loss. Since it also leads to a stock price increase, $\omega$ must be low to deter deviation. Unlike the lower bound, there are only two effects of changing $F$ on the upper bound as there is no certainty effect. The range of $\omega$’s that satisfy (56) and (57) is increasing in $k$ and decreasing in $\bar{k}$: the weaker the synergy motive, the easier it is to sustain $SE^q$.

Finally, we may have partial SSEs where one quality pools and the other separates. As in the positive correlation case, if $\bar{k}$ is sufficiently low, we have a partial SSE where all $H$-firms sell assets and $L$-firms strictly separate. Unlike the positive correlation case, we cannot have a partial SSE where $H$-firms issue equity and $L$-firms strictly separate. Such an equilibrium would require some $L$-firms to be willing to sell assets but all $H$-firms not to be. However, since $H$’s assets are lower-quality under negative correlation, $H$ is more willing to sell assets than $L$. Similarly, if $k$ and $\bar{k}$ are high and $\omega$ is low, we have a partial SSE where all $L$-firms issue equity and $H$-firms strictly separate. We cannot have a partial SSE where all $L$-firms sell assets and $H$-firms strictly separate: since some $H$-firms are issuing equity, $L$-firms will enjoy both a capital gain and a stock

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\(^{19}\)If $1 + k < \frac{E_H}{E_L}$, then the loss of synergies is less than the capital loss that $(H, \bar{k})$ would suffer by issuing equity. Thus, $H$’s fundamental value and stock price are both higher under asset sales, and the lower bound on $\omega$ is trivially satisfied.
price increase by deviating to equity. Thus, the only feasible partial SSEs involve all 
H-firms selling assets, or all L-firms issuing equity, which is intuitive since H’s assets 
and L’s equity are both low-quality.

The results of this section are summarized in Lemma 10 below.

**Lemma 10.** *(Negative correlation, semi-separating equilibrium.)* Assume that (54) holds.

(i) A full semi-separating equilibrium is sustainable where quality \( q \) sells assets if 
\( k \leq k^*_q \) and equity if \( k > k^*_q \), where \( k^*_q \) is defined by (55), if \( k \) is sufficiently low and \( \overline{k} \) is 
sufficiently high. We have \( k^*_H > k^*_L \) and \( k^*_H > 0 \); the sign of \( k^*_L \) depends on parameter 
values. The stock prices of asset sellers and equity issuers are given by (52) and (53) 
respectively.

(ii) A partial semi-separating equilibrium in which all firms of quality \( H \) (L) sell assets (equity) is sustainable if the following two conditions hold:

\[
\omega \geq \omega^{SE_{q,H}} = \frac{F \left( (1 + \overline{k}) - \frac{E_H}{E_L} \right)}{((C_H - C_L) - (A_L - A_H)) - \frac{1}{2}F(\overline{k} + k) + F \left( (1 + \overline{k}) - \frac{E_H}{E_L} \right)}
\]

\[
\omega \leq \omega^{SE_{q,L}} = \frac{F \left( \frac{A_L(1+k)}{A_H} - 1 \right)}{((C_H - C_L) - (A_L - A_H)) - \frac{1}{2}F(\overline{k} + k) + F \left( \frac{A_L(1+k)}{A_H} - 1 \right)}
\]

(iii) A partial semi-separating equilibrium where all H-firms sell assets (\( k^*_H = \overline{k} \)) 
and L-firms strictly separate (\( k < k^*_L < \overline{k} \)) is sustainable if \( k \) is sufficiently low, \( \overline{k} \) is 
sufficiently high, and \( \omega > \omega^{SE_{q,H}} \).

(iv) A partial semi-separating equilibrium where all L-firms issue equity (\( k^*_L = k \)) 
and H-firms strictly separate (\( k < k^*_H < \overline{k} \)) is sustainable if \( k \) is sufficiently high, \( \overline{k} \) is 
sufficiently high, and \( \omega < \omega^{SE_{q,L}} \).

**E.2 Pooling Equilibria**

The APE and EPE are analogous to those in the main text and are summarized by 
the following two Lemmas:

**Lemma 11.** *(Negative correlation, pooling equilibrium, all firms sell assets.)* Consider 
a pooling equilibrium where all firms sell assets \( (X_H = X_L = A) \) and a firm that sells 
equity is inferred as type \( (L, \overline{k}) \). The prices of assets and equity are \( \pi A_H + (1 - \pi)A_L \) 
and \( E_L \) respectively. The stock prices of asset sellers and equity issuers are \( E \left[ C + A \right] - \)
\( F[k] \) and \( C_L + A_L \), respectively. This equilibrium is sustainable if

\[
\omega \geq \omega^{APE,ND,L} = \frac{F \left( \frac{A_L}{E[A]} (1 + k) - 1 \right)}{\pi((C_H - C_L) - (A_L - A_H)) - \frac{1}{2} F(k + k) + F \left( \frac{A_L}{E[A]} (1 + k) - 1 \right)}.
\]

For the EPE, the IC condition is stronger than the ND condition if and only if:

\[
F(-k)(N_1 + N_2) < [(C_H - C_L) - (A_L - A_H)](\pi N_2 - (1 - \pi)N_1), \tag{58}
\]

where \( N_1 \) and \( N_2 \) are the parenthetical terms in the numerators of the IC and ND bounds, respectively (these bounds are presented in the Lemma below):

\[
N_1 \equiv A_L (1 + k) - \frac{E_L}{E[E]} > 0
\]

\[
N_2 \equiv \frac{E_H}{E[E]} - A_H (1 + k) - \frac{A_L}{A_L} > 0.
\]

The EPE is summarized in the following Lemma:

**Lemma 12.** (Negative correlation, pooling equilibrium, all firms sell equity.) Consider a pooling equilibrium where all firms sell assets (\( X_H = X_L = A \)) and a firm that sells assets is inferred as type \((L,k)\). The prices of assets and equity are given by \( A_L \) and \( \pi(C_H + A_H) + (1 - \pi)(C_L + A_L) + F \) respectively. The stock prices of asset sellers and equity issuers are \( C_L + A_L - Fk \) and \( E[C + A] \), respectively. This equilibrium is sustainable if \( \omega \geq \omega^{EPE} \), where

\[
\omega^{EPE} = \begin{cases} 
\omega^{EPE,IC} & \text{if (58) holds;} \\
\omega^{EPE,ND,H} & \text{if (58) does not hold.}
\end{cases}
\]

\[
\omega^{EPE,IC} = \frac{F \left( \frac{A_L}{E[A]} (1 + k) - \frac{E_L}{E[E]} \right)}{(1-\pi)(C_H - C_L - (A_L - A_H)) + F \left( \frac{E_H}{E[E]} - \frac{A_H}{A_L} \right)}\tag{59}
\]

\[
\omega^{EPE,ND,H} = \frac{\frac{E_H}{E[E]} - \frac{A_H}{A_L}}{\pi(C_H - C_L - (A_L - A_H)) + F \left( \frac{E_H}{E[E]} - \frac{A_H}{A_L} \right)}
\]

**E.3 Proofs for Appendix E**

**Proof of Lemma 10**

For part (i), the logic is as follows. We seek a pair of cutoffs \((k_H^*, k_L^*)\) for which both types \((q, k_q^*)\) are indifferent between the two financing sources. As before, we use \( k_q^* \) to denote candidate cutoffs that may not be equilibria, in response to which we will derive the optimal action of the types.
First we show (under certain assumptions) that, given any candidate cutoff $k'_H$, there will be a $k'_L$ at which type $(L, k'_L)$ is indifferent, with this value of $k'_L$ implicitly determined as a continuous function of $k'_H$. Then we consider candidate equilibria such that $k'_L$ is chosen conditional on $k'_H$ in this manner, and we show that there exists a $k'_H$ where $(H, k'_H)$ is indifferent as well. This method will show that an equilibrium exists.

To prove the first statement, we take as given a cutoff $k'_H > 0$, and we employ the IVT as before, showing that for a sufficiently low (high) $k'_L$, type $(L, k'_L)$ will deviate to assets (equity). Quality $L$ deviates to asset sales if the price difference between an asset seller and an equity issuer exceeds:

\[
(1 - \omega)F \left( \frac{A_L(1 + k'_L)}{E[A|X = A]} - \frac{E_L}{E[E|X = E]} \right).
\]

(60)

Recall that the difference in stock price is positive by assumption (54). If $1 + k'_L < \frac{E_L A_H}{E_H A_L}$, then expression (60) is negative, and $(L, k'_L)$ will then deviate to asset sales. On the other hand, as we increase $k'_L \to k'_H > 0$, the stock price reaction to an asset seller relative to an equity issuer falls to a negative value (the difference in posterior probabilities $Pr(q = H|X = A) - Pr(q = H|X = E)$ falls to zero, and the expected synergy loss grows), while expression (60) is positive and increasing.

Thus, there will be values of $k'_L$ high enough that type $(L, k'_L)$ issues equity rather than sell assets. Note that both of these conclusions hold regardless of the value of $k'_H$. Thus, applying the IVT, and allowing sufficiently strong dissynergies that $1 + k'_L < \frac{E_L A_H}{E_H A_L}$, we conclude that for any candidate value of $k'_H$, there is a value of $k'_L$ at which type $(L, k'_L)$ is indifferent between asset sales and equity. Moreover, since there are no discontinuities in the model, the function implicitly determining this value is continuous.

Turning to the second statement, let us consider different candidate values $k'_H$, and choose $k'_L$ such that $(L, k'_L)$ is indifferent as described above. Type $(H, k'_H)$ will deviate to asset sales if the (positive) stock price reaction to asset sales relative to equity is greater than

\[
(1 - \omega)F \left( \frac{A_H(1 + k'_H)}{E[A|X = A]} - \frac{E_H}{E[E|X = E]} \right).
\]

This expression is negative if $1 + k'_H < \frac{E_H E[A|X = A]}{E_H E[E|X = E]}$. Since the RHS of this inequality is greater than 1, there will be values $k'_H > 0$ such that type $(H, k'_H)$ deviates to asset sales. On the other hand, the above expression grows without bound in $k'_H$, while the difference in the stock price reactions to asset sales and equity is bounded above by $(C_H - C_L) - (A_L - A_H) - Fk'$. Thus, after $k$ crosses some threshold $k'H$, there
will be values of \( k_H' \) high enough that type \((H, k_H')\) issues equity rather than sell its highly-synergistic assets. (As described above, \( k_L' \) adjusts in both cases such that type \((L, k_L')\) remains indifferent.) We conclude that with synergies strong enough such that
\[ k > k_H' \quad \text{and} \quad 1 + k < \frac{E_H}{E_H A_H} \]
are both feasible, then there will be at least one pair of cutoff values \( k_q^* \) at which types \((H, k_H')\) and \((L, k_L^*)\) are both indifferent between equity and asset sales, giving rise to the existence of a full SSE.

To prove (ii), it suffices to write out the ND conditions for both qualities, solve for \( \omega \), and state the bounds in terms of the type with the synergy value that is most likely to issue a different claim.

To prove (iii), first we examine \( H \)'s ND condition, which is:
\[
\omega \left( \Pr(q = H | X = A) \left( (C_H - C_L) - (A_L - A_H) \right) - F \times \mathbb{E}[k | k < k_q^*] \right)
> (1 - \omega) F \left( \frac{A_H (1 + \bar{k})}{\mathbb{E}[A | X = A]} - \frac{E_H}{E_L} \right).
\]

In general, the condition is that \( \omega \) be sufficiently high that even managers with the highest level of synergies cooperate with asset sales. To obtain a condition that is sufficient regardless of the equilibrium value of \( k^*_L \), we consider the limiting case \( k^*_L \to \bar{k} \) (the strictest possible condition on \( \omega \), where all \( L \)-firms are issuing equity). Then the bound on \( \omega \) is
\[
\omega \geq \frac{F \left( 1 + \bar{k} - \frac{E_H}{E_L} \right)}{((C_H - C_L) - (A_L - A_H)) - \frac{1}{2} F(k + \bar{k}) + F \left( (1 + \bar{k} - \frac{E_H}{E_L}) \right)}
\]

Note that this bound is identical to \( \omega^{SEq,H} \). In this limiting case, we require the same behavior of \( H \) as in the \( SEq \): all \( H \)-firms must cooperate with asset sales, which perfectly reveal their quality, while equity would perfectly "reveal" them to be \( L \).

Next, we again apply the IVT to prove existence of an equilibrium. We first seek a candidate cutoff value \( k_L' \) at which \((L, k_L')\) will deviate to asset sales, given the price reactions that result from this cutoff. This happens if the (positive) difference in stock price reactions between asset sales and equity is greater than
\[
(1 - \omega) F \left( \frac{A_L (1 + k_L')}{\mathbb{E}[A | X = A]} - 1 \right).
\]

When \( 1 + k_L' = \frac{A_H}{A_L} \), the above expression is negative. Thus if \( 1 + \bar{k} \geq \frac{A_H}{A_L} \), there will be an \( L \)-firm that deviates to asset sales.
Finally, we must find a candidate cutoff value $k'_L$ at which $(L, k'_L)$ will deviate to equity. Clearly, $L$ will do this if $k'_L$ is sufficiently high, and as we have imposed no upper bound on $\overline{k}$, we conclude that for sufficiently high $\overline{k}$ (along with the previously-imposed bounds on $\omega$ and $\overline{k}$), there will be values of $k'_L$ such that $L$ deviates to equity, allowing the equilibrium to exist. (Note that the lower bound on $\omega$ increases as we raise $\overline{k}$. This does not invalidate the equilibrium, as that lower bound is still strictly less than 1.)

To prove part (iv), we first examine the ND condition for $L$:

$$\omega \left( 1 - \Pr(q = H|X = E) \right) \left( (C_H - C_L) - (A_L - A_H) - \frac{1}{2} F(k + k'_H) \right)$$

$$\leq (1 - \omega) F \left( \frac{A_L(1 + k)}{A_H} - \frac{E_L}{E|E|X = E} \right)$$

To satisfy this, we require $\omega$ to be sufficiently low. Consider the limiting case $k'_H \to \overline{k}$. If

$$\omega \leq \frac{F \left( \frac{A_L(1 + k)}{A_H} - 1 \right)}{\left( (C_H - C_L) - (A_L - A_H) \right) - \frac{1}{2} F(\overline{k} + k) + F \left( \frac{A_L(1 + k)}{A_H} - 1 \right)}$$

then all $L$-firms will cooperate with equity issuance. The bound on $\omega$ is identical to $\omega^{SEq,L}$. In this limiting case, we require the same behavior of $L$ as in $SEq$: all $L$-firms must cooperate with equity issuance even though it perfectly reveals their quality, while asset sales would perfectly “reveal” them to be $H$.

Note also that we must also have $1 + k \geq \frac{A_H}{A_L}$ for this to be possible, the reverse of the condition that was imposed in (ii) to ensure that some $L$-firms sell assets.

Given these conditions, we proceed as before. We find candidate cutoffs $k'_H$ at which $(H, k'_H)$ deviates to asset sales and to equity, and then apply the IVT to conclude that an equilibrium cutoff $k''_H$ exists between them. $H$ will deviate to asset sales if the positive stock price incentive to sell assets is greater than

$$(1 - \omega) F \left( 1 + k'_H \right) - \frac{E_H}{E[E|X = E]}$$

Since $E_H > E[E|X = E]$, the above expression is negative, and the inequality holds for any $k'_H \leq 0$. 

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Finally, $H$ will deviate to equity if the opposite is true:

$$\omega \left( 1 - Pr(q = H|X = E)\left( (C_H - C_L) - (A_L - A_H) - \frac{1}{2} F(k + k^*_H) \right) \right) \leq (1 - \omega) F \left( (1 + k'_H) - \frac{E_L}{E[E|X = E]} \right)$$

With no upper bound imposed on synergies, we can choose $\bar{k}$ sufficiently high that there will be values of $k'_H$ satisfying this inequality.

**Proofs of Lemmas 11 and 12**

These Lemmas can be derived analogously to Lemmas 7 and 8 in the main text, simply adding the synergy term $k$ to all asset sales, and expressing the final condition in terms of the type most likely to deviate (either $\bar{k}$ or $\underline{k}$).
<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\theta$</td>
<td>Firm type</td>
</tr>
<tr>
<td>$q$</td>
<td>Firm quality</td>
</tr>
<tr>
<td>$k$</td>
<td>Firm synergy</td>
</tr>
<tr>
<td>$F$</td>
<td>Level of financing required</td>
</tr>
<tr>
<td>$C_q$</td>
<td>Value of core asset in firm of quality $q$</td>
</tr>
<tr>
<td>$X$</td>
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<td>$A_q$</td>
<td>Value of non-core asset in firm of quality $q$</td>
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<tr>
<td>$APE$</td>
<td>Asset-pooling equilibrium</td>
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<tr>
<td>the $EPE$</td>
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<tr>
<td>$SE$</td>
<td>Semi-separating equilibrium</td>
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<tr>
<td>$k^*_q$</td>
<td>“Threshold” synergy level. Quality $q$ with $k \leq (&gt;) k^*_q$ sell assets (equity)</td>
</tr>
</tbody>
</table>

**Positive Correlation Model**

- $F^{APE,IC}$: Upper bound on $F$ in an $APE$ to satisfy the intuitive criterion condition
- $F^{APE,ND,q}$: Upper bound on $F$ in an $APE$ to satisfy the no-deviation condition for all firms of quality $q$
- $F^{APE}$: The applicable upper bound on $F$, $F^{APE} = \min\{F^{APE,IC}, F^{APE,ND,H}\}$
- $F^{EPE,IC}$: Lower bound on $F$ in an $EPE$ to satisfy the intuitive criterion condition
- $F^{EPE,ND,q}$: Lower bound on $F$ in an $EPE$ to satisfy the no-deviation condition for all firms of quality $q$
- $F^{EPE}$: The applicable lower bound on $F$, $F^{EPE} = \max\{F^{EPE,IC}, F^{EPE,ND,H}\}$
- $F^{APE,IC,I}$: Upper bound on $F$ in an $APE$ to satisfy the intuitive criterion condition in investment model. Other variables with superscript $I$ defined analogously

**Negative Correlation Model**

- $\omega$: Manager’s weight on the stock price
- $\omega^{APE,IC}$: Upper bound on $\omega$ in an $APE$ to satisfy the intuitive criterion condition.

Other $\omega$ variables defined analogously