Financing Through Asset Sales*

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Abstract

Most research on firm financing studies debt versus equity issuance. We model an alternative source – non-core asset sales – and identify three new factors that contrast it with equity. First, unlike asset purchasers, equity investors own a claim to the firm’s balance sheet (the “balance sheet effect”). This includes the new financing raised, mitigating information asymmetry. Contrary to the intuition of Myers and Majluf (1984), even if non-core assets exhibit less information asymmetry, the firm issues equity if the financing need is high. Second, firms can disguise the sale of low-quality assets – but not equity – as motivated by dissynergies (the “camouflage effect”). Third, selling equity implies a “lemons” discount for not only the equity issued but also the rest of the firm, since both are perfectly correlated (the “correlation effect”). A discount on assets need not reduce the stock price, since assets are not a carbon copy of the firm.

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

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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, such as 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 from SDC.) Eckbo and Kisser (2014) argue that “the prominence of illiquid asset sales challenges the traditional financing pecking order”.

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 many banks after the financial crisis), and to address one-time cash needs (BP targeted $45bn in asset sales).

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.
sales to cover the costs of the Deepwater Horizon disaster).\(^1\) In each of these cases, the firm could presumably have met its 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 in which the decision to sell assets depends not only on the need to raise capital, but also on operational considerations (positive or negative synergies). 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 that 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 either 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. The model is tractable and allows for two dimensions of private information (quality and synergy), which typically make a signaling model difficult to solve.

It may seem that asset sales can already be analyzed by applying the intuition 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 is the **balance sheet effect**, which represents an advantage to selling equity. 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 funds raised. Since the amount of funds raised is known, this mitigates the information asymmetry of assets in place. Unlike the MM intuition, even if the firm’s total assets exhibit more information asymmetry than the non-core asset alone, the manager may sell equity if enough funds are raised that the balance sheet effect dominates. Formally, a pooling equilibrium is sustainable

\(^1\)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.
where all firms sell assets (equity) if the financing need is sufficiently low (high) relative to the firm’s existing balance sheet. 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. Thus, the source of financing depends on the amount required. 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 balance sheet effect continues to operate in separating equilibria, where firms of the same quality sell assets if their synergies are below a threshold, and equity otherwise. Higher financing needs reduce the information asymmetry of equity, making it more (less) attractive to high (low)-quality firms, and thus the threshold synergy level that induces equity issuance is lower (higher).

The initial analysis considers any use of funds whose expected value is uncorrelated with firm quality: replenishing the balance sheet, repaying debt, paying suppliers, or financing a risky investment with known expected return. We also extend the analysis to the case in which investment return is correlated with firm quality, and thus exhibits information asymmetry. One might expect that an uncertain return makes the balance sheet riskier and thus weakens the balance sheet effect, but this intuition is incomplete due to a second consideration: Since investment is positive-NPV, it increases the value of the funds that investors are injecting, and so these funds comprise more of the balance sheet relative to the uncertain assets in place. If the minimum investment return (earned by the low-quality firm) is sufficiently large compared to the information asymmetry about returns, this second consideration dominates, and high financing needs thus become even more likely to spur equity issuance than in the previous analysis. 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 improves investment opportunities for all firms in the industry. In contrast, if the additional return generated by the high-quality firm over the low-quality firm is large, the balance sheet effect weakens: increasing financing needs has a weaker effect on inducing equity issuance. In almost all cases, the balance sheet effect remains positive: it remains robust that asset (equity) sales are used for low (high) financing needs.

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, it is outweighed by the adverse selection discount that high-quality firms suffer from issuing equity, and so they will not do so. However, they will sell assets if they are sufficiently dissynergistic, not to finance growth
but to get rid of dissynergies. Asset sales by high-quality firms allow low-quality firms to pool: they can camouflage an asset sale driven by overvaluation (the asset is 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.

Note that any non-informational motive allows a seller to “camouflage” the disposal of an overvalued claim. For example, in MM and Cooney and Kalay (1993), firms can issue overvalued equity and claim that the sale is instead driven by the need to finance investment. However, the motive of financing investment can be used to disguise both asset sales and equity issuance alike. We use the term “camouflage effect” quite precisely, to refer not to general non-informational motives (which arise in many other models and apply to both asset and equity sales), but the camouflage provided specifically by dissynergy motives, which apply only to asset sales but not equity, and is unique to this paper. We show that, when growth opportunities are strong, high-quality firms sell both assets and equity to finance growth; since both financing channels offer camouflage, low-quality firms have no clear preference for either. When growth opportunities are low, the only non-informational motive to issue claims is dissynergies. This motive exists only for assets and not equity, and so low-quality firms exhibit a clear preference for asset sales.

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. Thus, it is not only an asset’s information asymmetry that matters (as in MM) but also its correlation with the rest of the firm. An asset could exhibit high information asymmetry, but its sale could still be attractive if this does not imply that the rest of the firm is low quality. Formally, a pooling equilibrium where all firms sell equity can never be sustained, while one in which all firms sell assets can be. 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.²

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²See the articles “With Sale of Assets, BP Bets on More Deep Wells” (July 20, 2010) and “BP to Sell
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, since they are more likely to have negatively-correlated assets. 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 balance sheet 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 balance sheet effect as investors only own a claim to the asset, not the parent company’s balance sheet (where the new funds reside).


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. In those papers (as in DeMarzo and Duffie (1999)), the firm consists of only the assets being sold and so there is no distinction between a pro rata asset sale and an equity

Oil Assets in Gulf of Mexico for $5.6 billion” (September 10, 2012).
issue; here, the firm has other (core) assets in addition to the ones under consideration for sale. Thus, we show that such correlation effects are stronger for 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 core assets and thus the firm. Nanda and Narayanan (1999) also consider both asset sales and equity issuance under information asymmetry, but do not feature the balance sheet, camouflage, or correlation effects. In their model, information asymmetry only exists under negative correlation, and there is no correlation effect because the manager is unconcerned about how the capital raising choice affects the market’s perception of firm value.\footnote{Leland (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 microfound the determinants of the cost of equity finance versus asset sales.}

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.\footnote{Empirically, 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.}

Finally, while we show that the MM pecking order intuition 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 dimensions. The first is firm 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 $k \sim U[k, \overline{k}]$, where $-1 < k \leq 0$, $\overline{k} > 0$, 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 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:

$$C_H + A_H > C_L + A_L,$$

i.e., $H$ has a higher total value even if $A_H < A_L$. The distinction between the two cases of $A_H > A_L$ and $A_H < A_L$ reflects that it is not only the information asymmetry of the non-core asset that matters ($|A_H - A_L|$), as in MM, but also its correlation with the core asset ($\text{sign}(A_H - A_L)$).\(^6\)

We consider an individual firm, which must raise financing of $F$.\(^7\) In the initial analysis, the funds raised increase expected firm value by $F$, which incorporates many possible uses for capital raising. Examples include retaining cash on the balance sheet to replenish capital; repaying creditors, debtholders or suppliers; meeting one-time cash needs such as litigation expenses; or financing an uncertain investment whose expected value is uncorrelated with

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\(^5\)The values $C_q$ and $A_q$ represent asset values net of liabilities, and so our model also incorporates information asymmetry about a firm’s liabilities. For example, if a firm has unknown litigation liabilities at the parent company level, a purchaser of one of its factories is not exposed to them.

\(^6\)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.
q. Consistent with the second and third motives, DeAngelo, DeAngelo, and Stulz (2010) find that a near-term cash need is the primary motive for seasoned equity issues, and that the majority of issuers would have run out of cash without the issue; the introduction cites several papers showing that cash needs motivate asset sales. The initial analysis also treats the financing decision as exogenous. 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.

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 balance sheet, 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 the main paper, we only allow firms to use a single source of financing. Appendix C shows that the pooling equilibria continue to hold when firms are allowed to use a combination of both sources; the restriction could also be justified by the transactions costs of using multiple sources. 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. We abstract from differences between asset sales and equity issuance due to 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 the weakest frictions.

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.\(^9\) 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

\(^8\)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 \( F \leq \min (A_L, A_H) \).

\(^9\)Synergies \( k \) thus do not appear under the current balance sheet, but instead affect the fundamental value lost if assets are sold. We have also worked out the model where synergies explicitly appear on the firm’s balance sheet before financing is raised, i.e. the firm’s current equity value is \( C_q + A_q (1 + k) \). The economic forces remain robust but the exposition is more cumbersome because the privately-known synergies \( k \) now appear in the equity claim and thus requires additional inference by investors.
by operational reasons (dissynergies) rather than only financing reasons.\textsuperscript{10} 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 $X$. That the value of the claim to investors depends only on quality $q$ and not synergy $k$ allows for two dimensions of private information while retaining tractability. 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)).

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 (for asset sales) any loss of (dis)synergies.

We solve for pure strategy equilibria.\textsuperscript{11} 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; (v) Beliefs on off-equilibrium actions are consistent with the D1 refinement of Banks and Sobel (1983) and Cho and Kreps (1987). For an off-equilibrium action, D1 precludes putting any weight on a type for which the set of beliefs that would induce deviation to that action are a strict subset of the set for a different type. Specifically, if the set of prices for claim $X$ that would induce $L$ to deviate to claim $X$ are a strict subset of that which

\textsuperscript{10}One may wonder why the firm will have dissynergetic assets to begin with. Firms may acquire assets when they are synergistic, but they may become dissynergetic over time. One may still wonder why the firm has not yet disposed of the dissynergetic 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 disynergies.

\textsuperscript{11}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.
would induce $H$ to deviate – loosely speaking, if $L$ is “less willing” to deviate than $H$ – then the off-equilibrium path belief (“OEPB”) that a deviator to claim $X$ is of quality $L$ is ruled out. We use the D1 refinement as it is typically used in other security issuance models, such as Boot and Thakor (1993), Nachman and Noe (1994), and DeMarzo and Duffie (1999), and thus maximizes comparability with prior literature. An earlier version of the paper used the weaker equilibrium refinement of the Cho and Kreps (1987) Intuitive Criterion; all results continue to hold although the expressions are somewhat more complex.

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

2 Positive Correlation

For ease of exposition, we set $\omega = 0$ in the positive correlation model, 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 positive correlation, there is no such trade-off: being inferred as $L$ worsens both market and fundamental values. Allowing for $\omega > 0$ only adds additional terms to the equilibrium conditions, without affecting the set of sustainable equilibria or their general properties.

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

2.1 Mandatory Capital Raising

We first consider pooling equilibria, which are of two types: asset-pooling equilibria ($APE$) and equity-pooling equilibria ($EPE$). These equilibria will demonstrate the balance sheet effect – how the amount of capital required $F$ affects the financing choice – in the clearest manner. The core of this section is the semi-separating equilibria ($SSE$), where both claims are issued and the choice of claim depends on not only the amount of capital required but also both dimensions of the firm’s type (quality and synergy).

2.1.1 Pooling Equilibria

We first state the equilibria and then describe the economic forces driving them. They are given in Proposition 1 below, where we define $E_q \equiv C_q + A_q + F$ as the equity value of a
firm of quality $q$, and $F^* = \frac{C_H A_L - C_L A_H}{A_H - A_L}$.

**Proposition 1.** (Positive correlation, pooling equilibria):

(i) An asset-pooling equilibrium is sustainable if and only if (ia) $1 + k \leq \frac{E[A]}{A_L}$ and (ib) $F \leq F^*$. In this equilibrium, all firms sell assets for $E[A] = \pi A_H + (1 - \pi) A_L$. If equity is sold (off the equilibrium path), it is inferred as quality $L$ and valued at $E_L$.

(ii) An equity-pooling equilibrium is sustainable if and only if (iia) $1 + k \geq \frac{E[L]}{E[E]}$ and (iib) $F \geq F^*$. In this equilibrium, all firms sell equity for $E[E] = \pi E_H + (1 - \pi) E_L$. If assets are sold (off the equilibrium path), they are inferred as quality $L$ and valued at $A_L$.

We first discuss the APE. This equilibrium entails three requirements: first, no $L$-firms wish to deviate; second, no $H$-firms wish to deviate; and third, the OEPB that a deviator is of quality $L$ satisfies the D1 refinement.\(^{12}\)

We start by analyzing the first requirement. In the APE, $L$ enjoys a capital gain of $F \pi (A_H - A_L)$ by selling low-quality assets (worth $A_L$) at a pooled price (of $E[A]$), but loses the synergies from the asset. His overall fundamental gain is

$$F \pi (A_H - A_L) - k A_L$$

If $L$ deviates to equity, its fundamental gain is zero since low-quality equity (worth $E_L$) is sold for $E_L$. If condition (ia) is satisfied, then for all synergy levels $k$, (2) $> 0$: the fundamental gain is higher from selling assets than equity. Synergies are sufficiently weak that, even for the $L$-firm with greatest synergies (type $(L, k)$), the capital gain exceeds the synergy loss. Thus, no $L$-firm wishes to deviate to equity.

Condition (ib), $F \leq F^*$, is key to understanding the balance sheet effect and is the main force in the APE. This condition can be rewritten

$$\frac{A_H}{A_L} \leq \frac{C_H + A_H + F}{C_L + A_L + F}$$

The left-hand-side ("LHS") is the ratio of high- to low-quality asset values, and the right-hand-side ("RHS") is the ratio of high- to low-quality equity values. Thus, condition (ib) implies that the information asymmetry of assets is less than that of equity. Crucially, $F$ appears only in the equity term, but not the assets term. An equity investor has a claim to the firm’s entire balance sheet, which contains the funds raised $F$. Since $F$ is known, this

\(^{12}\)More precisely, the OEPB is that a deviator is of type $(L, \bar{k})$ in APE and type $(L, k)$ in APE. Since only the quality, and not the synergy, of the type that deviates affects the price of the claim upon deviation, we focus the discussion on the former. Similarly, future Propositions only state the quality the market infers from deviation, but the proofs specify both quality and synergy.
balance sheet effect mitigates the information asymmetry of equity. In contrast, an asset purchaser owns a claim to the asset alone, and so bears the full information asymmetry associated with its value. As \( F \) rises, the RHS of (3) 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). Thus, the RHS falls towards 1, and the inequality is harder to satisfy. Note that, even if non-core assets exhibit less information asymmetry than total assets in place \( AH < CH + AL + AH \), they may still exhibit more information asymmetry than equity if \( F \) is large enough. Contrary to the MM intuition, equity is not always the riskiest claim. The balance sheet effect applies equally to risky debt, since debt – like equity but unlike assets – is also a claim on the firm’s balance sheet and thus shares in the new funds raised. Thus, risky debt will also exhibit less information asymmetry if \( F \) is large.

Condition \( F \leq F^* \), i.e. that assets exhibit less information asymmetry than equity, plays two roles. First, combined with (ia), it ensures that no \( H \)-firm wishes to deviate (the second requirement of the APE). The intuition is as follows. In equilibrium, \( H \) suffers a capital loss as it sells high-quality assets (worth \( AH \)) at a pooled price (of \( E[A] \)). By deviating to equity, it also suffers a capital loss as it sells high-quality equity (worth \( EH \)) at a low price (of \( E_L \)). The relative magnitudes of the capital losses depend on the relative information asymmetries. Condition (ib) ensures that the balance sheet is sufficiently weak that the information asymmetry of equity remains greater than that of assets. Thus, \( H \) would suffer an even greater capital loss by issuing equity. In addition, (ia) ensures that this additional capital loss outweighs the synergies saved by retaining assets, so that even \((H, \bar{k})\), the \( H \)-firm with the greatest synergies, is willing to sell assets.

The second role of \( F \leq F^* \) is to ensure that the OEPB, that a deviator to equity is of quality \( L \), satisfies D1 (the third requirement of the APE). Loosely speaking, D1 requires \( L \) to be “more willing” to deviate to equity than \( H \). \( H \) prefers claims with low information asymmetry as it suffers a smaller capital loss, and \( L \) prefers high information asymmetry. If \( F \leq F^* \), the balance sheet effect is sufficiently small that equity exhibits higher information asymmetry than assets, and so \( L \) is indeed “more willing” to sell it than \( H \).

In sum, the balance sheet effect is the economic force for why the APE requires the amount of capital required to be low. When this is the case, assets exhibit lower information asymmetry than equity. As a result, \( H \) is unwilling to deviate to equity, satisfying the second requirement, and \( L \) is more willing to deviate to equity, satisfying the third requirement.

The intuition for the EPE is the same. Condition (iia) ensures that dissynergies are not strong enough to persuade \( L \) to deviate to assets. Condition (iib) implies that \( F \) is sufficiently high that the balance sheet effect reduces the information asymmetry of equity
below that of assets. Alone, this condition ensures that the OEPB, that a deviator to asset sales is of quality $L$, satisfies D1 – assets exhibit higher information asymmetry and so $L$ is “more willing” to sell them. Combined with (iia), $F \geq F^*$ ensures that all $H$-firms, including those with the greatest dissynergies, are unwilling to deviate to assets, as their high information asymmetry leads to a larger capital loss.

Overall, Proposition 1 states that, if (dis)synergies are sufficiently weak (both (ia) and (iia) are satisfied), a pooling equilibrium exists. Intuitively, deviation from a pooling equilibrium leads to being inferred as $L$; if (dis)synergies are not strong enough to outweigh the resulting capital loss, deviation is ruled out and so the equilibrium holds. The claim sold in the pooling equilibrium depends on the amount of financing required. When it increases, the balance sheet effect strengthens, and firms switch from selling assets ($APE$) to equity ($EPE$). Thus, the type of claim issued depends not only on its inherent characteristics (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 restrictions on financing such as limited debt capacity. Here, $F$ can be fully raised from either source. 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 threshold $F^* = \frac{C_H A_L - C_L A_H}{A_H - A_L}$ would also double.

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. If all assets are synergistic ($k = 0$), then asset sales reduce total surplus. Surprisingly, greater financial constraints may improve real efficiency as firms retain their synergistic assets and issue equity instead.

One interesting case is a single-segment firm, which corresponds to $C_q = A_q$: core and non-core assets are one and the same. Then, $F^* = 0$ and so the $APE$ is never sustainable for any $F$. Intuitively, since the information asymmetry of the firm equals that of the non-core asset, the balance sheet effect will push the information asymmetry of equity lower. If non-core assets have greater information asymmetry, $F^* < 0$ and again $APE$ is unsustainable.

Appendix B shows that the balance sheet 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 greater information asymmetry; 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 balance sheet effect: an $EPE$ can
be sustained.

2.1.2 Semi-Separating Equilibria

The pooling equilibria require (dis)synergies to be sufficiently weak that all firms are willing to sell the same claim. If synergies are sufficiently strong, we have a semi-separating equilibrium where firms choose to sell either assets or equity depending on their level of synergy. This equilibrium is characterized in Proposition 2 below.

Proposition 2. (Positive correlation, synergies, semi-separating equilibrium): Consider a semi-separating equilibrium in which type \((q,k)\) sells assets (equity) if \(k < (>) k^*_q\). This equilibrium is sustainable if neither pair of conditions (a) \(1 + k \leq \frac{E[A]}{A_L} \) and \(F \leq F^*\) nor (b) \(1 + k \geq \frac{E[L]}{E[E]} \) and \(F \geq F^*\) is satisfied.

(i) If \(F < F^*\), then \(k^*_H > 0\) and \(k^*_L > k^*_H\). Assets are sold at a premium to their unconditional expected value \(E[A]\), while equity is issued at a discount.

(ii) If \(F > F^*\), then \(k^*_H < 0\) and \(k^*_L < k^*_H\). Equity is issued at a premium to its unconditional expected value \(E[E]\), while assets are sold at a discount.

(iii) If \(F = F^*\), then \(k^*_L = k^*_H = 0\).

The choice of financing depends on both components of the firm’s type. First, it depends on the synergy parameter \(k\): there is an equilibrium threshold \(k^*_q\), and any firm below (above) the threshold sells assets (equity). Second, it depends on quality \(q\), because it affects the threshold \(k^*_q\): \(H\) and \(L\) use different thresholds. The main result of Proposition 2 is how the level of \(F\) affects whether \(k^*_H > (>) k^*_L\), and thus whether \(H\) is more (less) willing to sell assets than \(L\).

The role of \(F\) again arises through the balance sheet effect. When \(F < F^*\), the balance sheet effect is weak and so equity exhibits more information asymmetry than assets. As a result, \(H\) is more willing to sell assets than \(L\), and so uses a higher cutoff \((k^*_H > k^*_L)\). In particular, if \(k^*_L < k < k^*_H\), the firm will sell assets if it is high-quality and equity otherwise. We also have \(k^*_L > 0\): even \(H\)-firms with strictly positive synergies are willing to sell assets, due to their lower information asymmetry. The different cutoffs in turn affect the valuations. Since \(H\) is more willing to sell assets, the asset (equity) price is higher (lower) than its unconditional expectation.

In contrast, if \(F > F^*\), the balance sheet effect is sufficiently strong that equity is more attractive to \(H\) \((k^*_H < k^*_L)\). Similar to the pooling equilibria, if \(\frac{A_H}{A_L} < \frac{C_H + A_H}{C_L + A_L}\), then non-core assets exhibit less information asymmetry than the firm’s existing balance sheet, and so the MM intuition would suggest that \(H\) would prefer asset sales. However, if the balance sheet effect is sufficiently strong \((F > F^*)\), \(H\) prefers equity. The asset (equity) price is
now lower (higher) than its unconditional expectation. We also have $k_H^* < 0$: $H$ retains assets even if they are mildly dissynergistic, due to their higher information asymmetry. Finally, when $F = F^*$, the information asymmetry of assets and equity are the same, and so $H$ and $L$ use the same cutoff.

Unlike in the pooling equilibria, here the impact of a stronger balance sheet effect is nuanced – it does not make one claim universally more popular, but instead increases the attractiveness of equity to high-quality firms and reduces its attractiveness to low-quality firms. This differential effect contrasts with standard frictions, such as taxes, transactions costs, liquidity, and bargaining power, which have the same directional effect on both high- and low-quality firms. Due to this differential effect, changes in $F$ affect the price and quality of assets sold in the real asset market, as well as the quality and price in equity. The effect of $F$ in turn affects the sign of the market reaction to the sale of assets and equity. Market reactions to financing-motivated asset (equity) sales are likely to be less positive (negative) for a large sale, as large sales are more likely to stem from low- (high-) quality firms.

Combining the results of Propositions 1 and 2 illustrates that an equilibrium always exists, and the class of equilibrium is unique. When synergy motives are strong (either $1 + \bar{k} \geq \frac{E[A]}{A_L}$ or $1 + \bar{k} \leq \frac{E[L]}{E[E]}$), then they lead firms of the same quality to choose different securities depending on their level of synergy. Specifically, consider the case $F < F^*$. An APE is sustainable if and only if $\bar{k} \leq \frac{E[A]}{A_L} - 1$. When $\bar{k}$ crosses the threshold $\frac{E[A]}{A_L} - 1$, we move to a semi-separating equilibrium. Moreover, as Lemma 1 in the Proof of 2 shows, we first move to a partial SSE where only $L$ separates: $H$ continues to pool, as the capital loss from issuing equity and being inferred as low-quality still outweighs synergy motives. Only when $\bar{k}$ crosses a second, higher, threshold do we have a full SSE where both $H$ and $L$ separate. The intuition is similar for $F > F^*$: for low dissynergies, we have an EPE, and as dissynergies strengthen, we move to a partial SSE and finally to a full SSE.

### 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, $H$ would never issue equity unless the capital raised could be used productively. The analysis will generate two results. First, it shows that the balance sheet effect of Section 2.1 continues to hold, and can even strengthen, when

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13At the knife-edge cases of $\bar{k} = \frac{E[A]}{A_L} - 1$ and $\bar{k} = \frac{E[L]}{E[E]} - 1$, the equilibrium is still unique, but can be labeled either a pooling equilibrium (since all types are selling the same claim) or a semi-separating equilibrium since there is a (boundary) type that is exactly indifferent between the two claims.
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 $F$ finances an investment for which the expected payoff is independent of $q$ (and so does not exhibit information asymmetry).} Second, it demonstrates the camouflage effect: low-quality firms prefer to raise capital via asset sales than equity issuance, as they can disguise the capital raising as being motivated by operational reasons (dissynergies) 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 balance sheet effect and making equity less desirable. However, we will show that this need not be the case. We continue to assume $E_H > E_L$: i.e. even if $H$ has weaker growth opportunities, its total value remains higher (else we would relabel $H$ and $L$).

Proposition 3 gives conditions under which pooling equilibria are sustainable:

Proposition 3. (Positive correlation, pooling equilibria.)

(i) An asset-pooling equilibrium is sustainable if and only if the following hold:

(ia) $\frac{E_H}{E_L} \geq \frac{A_H}{A_L}$ and $1 + k \leq \frac{E[A]}{E[L]}$ (analogous conditions to Proposition 1); and

(ib) $1 + r_H \geq \frac{A_H(1+k)}{E[A]}$ (a new condition not in Proposition 1).

The prices of assets and equity are $\pi A_H + (1-\pi)A_L$ and $C_L + A_L + F(1+r_L)$ respectively.

(ii) An equity-pooling equilibrium is sustainable if and only if the following hold:

(iia) $\frac{E_H}{E_L} \leq \frac{A_H}{A_L}$ and $1 + k \geq \frac{E[A]}{E[E]}$ (analogous conditions to Proposition 1); and

(iib) $1 + r_H \geq \frac{E[H]}{E[E]}$ (a new condition not in Proposition 1).

The prices of assets and equity are $A_L$ and $E[C + A] + F(E[1+r])$, respectively.

Part (ia) are the conditions to deter both $H$ and $L$ from deviating to equity issuance. These conditions also guarantee that $L$ does not deviate to inaction – if $L$ does not deviate to fairly-priced equity, he will not deviate to inaction and lose the investment opportunity. Part (ib) is a new condition that ensures that $H$’s investment return is sufficiently high to deter him from deviating to inaction and saving the capital loss from raising financing. Parts (iia) and (iib) are analogous.

As in Section 2.1, $\frac{E_H}{E_L} \geq \frac{A_H}{A_L}$ is a necessary condition for an APE and the reverse inequality is necessary for EPE. When investment opportunities are zero ($r_H = r_L = 0$)
then this translates to the condition $F \leq F^*$ from Section 2.1. With positive investment opportunities, it now becomes

$$F [A_H(1 + r_L) - A_L(1 + r_H)] \leq C_H A_L - C_L A_H. \tag{4}$$

We first consider the case in which $\frac{C_H}{C_L} > \frac{A_H}{A_L}$, so that the RHS is positive. This is the more realistic case for a number of reasons. First, if $\frac{C_H}{C_L} < \frac{A_H}{A_L}$, assets have so high information asymmetry that an APE can never be sustained in the mandatory capital raising model, regardless of $F$: we have $F^* < 0$ in Proposition 1. Second, as Appendix B shows, if firms have the option to sell both the core and non-core asset, in a pooling equilibrium firms can only sell the asset with lower information asymmetry, and so we can label this asset as the “non-core” one. Third, the core business bears the risk of the firm’s future prospects, such as its ability to launch new products and retain key employees, whereas a separable non-core asset (such as a factory or oilfield) does not.

If the LHS is also positive, (4) yields

$$F \leq F^{*l} \equiv \frac{C_H A_L - C_L A_H}{A_H(1 + r_L) - A_L(1 + r_H)}. \tag{5}$$

In the Section 2.1, the denominator was $A_H - A_L$. If $r_L > r_H$, the denominator of (5) is greater than that of $F^* \equiv \frac{C_H A_L - C_L A_H}{A_H - A_L}$ in the no-investment 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 $\frac{r_H}{r_L} < \frac{A_H}{A_L}$, the denominator of (5) is still higher than that of $F^*$. 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. Due to this second effect, $r_H \geq r_L$ is not sufficient for the upper bound to relax. Only if $\frac{r_H}{r_L} > \frac{A_H}{A_L}$ does the first effect dominate, loosening the upper bound.

If the LHS of (4) is negative ($\frac{A_H}{A_L} < \frac{1+r_H}{1+r_L}$), (4) is satisfied for any $F$. Intuitively, 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, $\frac{A_H}{A_L}$, 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., $\frac{A_H}{A_L} \leq \frac{C_H}{C_L}$ and $\frac{A_H}{A_L} \leq \frac{1+r_H}{1+r_L}$, 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 he investment is safer than non-core assets, i.e., $\frac{A_H}{A_L} > \frac{1+r_H}{1+r_L}$. 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 both cases it remains true that the APE requires $F$ to be below an upper bound, as in Section 2.1.

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.

The case of $\frac{C_H}{C_L} < \frac{A_H}{A_L}$ arises in the rare case where non-core assets exhibit greater information asymmetry than core assets. Then, the RHS of (4) is negative and so (if the LHS is positive, i.e. $\frac{1+r_H}{1+r_L} < \frac{A_H}{A_L}$), the inequality is violated for any $F$ – APE is unsustainable. Intuitively, when non-core assets exhibit more information asymmetry than both core assets and the new investment, then they automatically exhibit more information asymmetry than equity, regardless of the weighting $F$ placed on the new investment. The final case is where

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.”

For $\frac{A_H}{A_L} \leq \frac{1+r_H}{1+r_L}$, the upper bound is infinite, so the inequality is satisfied for any $F$. 

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non-core assets exhibit more information asymmetry than core assets and the information asymmetry of the investment opportunity is even higher still \((1 + \frac{r_H}{1 + r_L}) > \frac{A_H}{A_L}\). Then, both sides of (4) are negative, and so the inequality in (5) is reversed, i.e. \(F > F^{*I}\). Now, APE holds only when the amount of financing required is high. Intuitively, if investment exhibits more information asymmetry than non-core assets, but core assets exhibit less, then we need a sufficiently high weight \(F\) on the investment for the overall balance sheet to exhibit more information asymmetry than non-core assets, and for asset sales to be sustainable. Note that this reversal only arises in the extreme case in which assets exhibit so high information asymmetry that asset sales can never be sustained in the core model for any \(F\) (formally, \(F^{*} < 0\)).

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 4 below compares all the equilibria.

**Proposition 4.** *(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 Proposition 3.

(ib) An equity-pooling equilibrium is sustainable under the conditions in Proposition 3.

(ic) A semi-separating equilibrium, where quality \(q\) sells assets if \(k \leq k^*_q\) and equity if \(k > k^*_q\), is sustainable under the conditions stated in Proposition 2, 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 \(\frac{E_H}{E_L} \geq 1 + r_H > \frac{A_H}{A_L}(1 + K)\), then \(k^*_H > K\) and \(k^*_L > 0\). The price of assets exceeds \(A_L\) and the price of equity is \(C_L + A_L + F(1 + r_L)\). If \(1 + r_H > (\frac{A_H}{A_L}(1 + K)\), then \(k^*_H > (\frac{K}{K})\) and assets are sold at a premium (discount) to their expected value \(E[A]\).

(iib) If \(1 + r_H \leq \frac{E_H}{E_L} \min\left(\frac{A_H}{A_L}(1 + K)\right)\), 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 4 shows that the pooling and semi-separating 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 funds can be invested productively.
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, 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. The key result of this equilibrium is \( k^*_L > 0 \): \( L \) 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 only moderate, 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 \( L \). In contrast, asset sales may be undertaken because the asset is either low-quality (low common value, sold by \( L \)) or dissynergistic (low private value, sold by \( H \)), and so the asset price exceeds \( A_L \). This high price induces \( L \) to sell assets \( (k^*_L > 0) \). 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 \( SSE \), there may be said to be “camouflage” in that multiple types pool into the same action. Prior papers have featured non-informational motives, such as the desire to finance investment (MM and Cooney and Kalay (1993)), which allow sellers to camouflage the disposal of an overvalued claim. However, those motives can be used to disguise both asset and equity sales, and so do not affect a firm’s choice between them. We use the term “camouflage effect” to refer specifically to the ability to disguise a sale as motivated by dissynergies, which applies only to assets. Here, it manifests in \( k^*_L > 0 \): since \( H \) sells only assets, only assets offer camouflage and so \( L \) will sell assets even if they are synergistic.\(^{17}\) In particular, if investment opportunities are weak \( (1 + r_H < \frac{E_H}{E_L}) \), then firms cannot disguise sales as being motivated by the desire to finance investment – the only non-overvaluation motive for sales is getting rid of synergies, which only applies to assets. In contrast, when \( 1 + r_H > \frac{E_H}{E_L} \) (part (i)), we cannot sign \( k^*_L \): both assets and equity offer camouflage, since both are sold by \( H \), and so \( L \) exhibits no clear preference between them.

Just like the balance sheet effect, the camouflage effect in our paper also applies to the choice between asset sales and risky debt. Absent a profitable growth opportunity, the issue of risky debt signals that the debt is overvalued, since it cannot be camouflaged as

\(^{17}\)In contrast, we do not claim that the semi-separating equilibria of Lemma 2 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 dissynergies. Capital raising is mandatory, and so even when \( H \) prefers to sell assets \( (k^*_H > 0) \), it is because assets exhibit less informational asymmetry than equity rather than assets being dissynergistic.
stemming from an operational reason, unlike an asset sale.

The SSE in part (i), where all firms sell either assets or equity, exhibits greater real efficiency than the ones in part (ii) since all firms are undertaking profitable investment. It is easier to satisfy the condition for part (i) \(1 + r_H \geq \frac{E_H}{E_L}\) 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 balance sheet 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 encouraging investment.

Part (iib) shows that if \(r_H\) is low and dissynergies are not severe \((1 + r_H \leq \frac{A_H}{A_L} (1 + k))\), 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 cannot invest the cash raised profitably. Thus, low-quality firms with sufficiently synergistic assets \((k > k^*_L)\) are indifferent between selling equity and inaction. 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 4, when the investment opportunity is zero (part (iii)), the equity market can shut down, as in MM. When \(r_H\) is moderate (part (ii)), equity is issued only by low-quality firms, and only those with very high synergies \((k > k^*_L > 0)\). Only when \(r_H\) is high (parts (ib) and (ic)) do firms of both quality issue equity. A high \(r_H\) gives \(H\) a reason to issue equity, to finance growth, which in turn encourages a greater measure of \(L\) to issue equity also. Without growth opportunities, only asset sales can be justified by operational reasons and thus offer camouflage.

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 (also as suggested by our Figure 1). 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), \(1 + r_H > \frac{A_H}{A_L} (1 + k)\), easier to satisfy than for (iib) – 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*, which increases the attractiveness of selling assets relative to equity. This is because, even if the market infers that an asset being sold is low-quality, this need not imply that the firm as a whole is 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.

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. Since investment opportunities \(r_q\) do not affect the sustainability of any equilibria in this section, but only add additional terms to the expressions, for simplicity we return to the core model where capital raising is mandatory and the funds raised remain on the balance sheet. We also make the following technical assumption:

\[
F \times \mathbb{E}[k] < (C_H - C_L) - (A_L - A_H).
\] (6)

Condition (6) is sufficient to ensure that being revealed as low-quality can never increase a firm’s stock price compared to being revealed as high-quality. While it seems intuitive that this should always be the case, it is theoretically possible that a firm’s stock price can be *lower* from being revealed as high-quality, if doing so involves selling assets and the expected synergy loss \(\mathbb{E}[k] = \frac{\bar{\kappa} + k}{2}\) from asset sales is so high that it swamps the inference over quality. Since our paper is about the trade-off between information asymmetry and synergy motives for financing, we assume that inequality (6) holds so that synergies are not
so strong as to swamp the other forces in the model. A sufficient (although unnecessary) condition is that synergies are symmetric, i.e. $\bar{k} = k$. Thus, even if synergy motives are strong, i.e. $\bar{k}$ and $k$ are both large in absolute terms, (6) will still be satisfied; we only require that synergies are not substantially larger than dissynergies.\footnote{Note that (6) does not rule out a particular firm (e.g. one with the highest synergy level $\bar{k}$) preferring to sell equity despite the negative inference, only that the average synergy level $\mathbb{E}[k]$ is not so high that the market (which does not observe the synergy level) attaches a higher price to an equity issuer that it infers as low-quality than to an asset seller of unknown quality.}

### 3.1 Pooling Equilibria

Proposition 5 below states that an $EPE$ is never sustainable under negative correlation, but an $APE$ is sustainable if the manager’s stock price concerns $\omega$ are sufficiently high.

**Proposition 5.** (Negative correlation, pooling equilibria.) An equity-pooling equilibrium is never sustainable. An asset-pooling equilibrium is sustainable if and only if

$$\omega \geq \omega^{APE} \equiv \frac{F \left( \frac{A_L}{\mathbb{E}[A]} (1 + \bar{k}) - 1 \right)}{\pi((C_H - C_L) - (A_L - A_H)) - FE[k] + F \left( \frac{A_L}{\mathbb{E}[A]} (1 + \bar{k}) - 1 \right)}.$$  \hspace{1cm} (7)

In this equilibrium, all firms sell assets for $\mathbb{E}[A] = \pi A_H + (1 - \pi) A_L$. If equity is sold (off the equilibrium path), it is inferred as quality $L$ and valued at $E_L$. The stock prices of asset sellers and equity issuers are $\mathbb{E}[C + A] - FE[k]$ and $C_L + A_L$, respectively.

We start by discussing the $APE$. Unlike in the positive correlation section, it is now $L$ ($H$) that makes a capital loss (gain). Combined with the fact that $L$ has lower-quality equity than $H$, $L$ is “more willing” to deviate to equity than $H$, and so the only OEPB that satisfies D1 is that a deviator to equity is of quality $L$. Under this OEPB, it is automatic that $H$ will not deviate. We now consider $L$’s incentive to deviate. Under the $APE$, $L$ is suffering a capital loss, but enjoying a pooled stock price. If it deviates to equity, $L$ breaks even as its low-quality equity (worth $E_L$) is sold for a low price (of $E_L$). However, the low price applies not only to the equity sold, but also the rest of the firm, as it is a carbon copy. The manager would thus suffer a low stock price, and so will not deviate if stock price concerns are sufficiently high ($\omega \geq \omega^{APE}$) to outweigh the avoidance of a capital loss.

We now turn to the $EPE$. As in the positive correlation section, $H$ ($L$) is making a capital loss (gain). Combined with the fact that $H$ has lower-quality assets than $L$, $H$ is “more willing” to deviate to assets, and so the only OEPB that satisfies D1 is that a deviator to asset sales is of quality $H$. We now consider $H$’s incentive to deviate under
this OEPB. If $H$ deviates to assets, it would receive a (fair) low price of $A_H$ and break even compared to its current capital loss. Moreover, this low price applies only to the asset being sold and not the rest of the firm, as it is not a carbon copy. Instead, deviation leads to a high stock price which, coupled with the avoidance of a capital loss, induces $H$ to deviate and so the $EPE$ is unsustainable for any $\omega$. Under deviation, $H$’s assets are correctly assessed as “lemons,” and so the market-timing motive for financing (e.g., Baker and Wurgler (2002)) does not exist – yet deviation is still profitable as it leads to a high stock price.

In sum, a pooling equilibrium where all firms sell assets is sustainable, but one where all firms issue equity is not. This preference for asset sales stems from the correlation effect, which arises from two sources. First, equity is necessarily perfectly correlated with the rest of the firm, but the asset need not be. Thus, if a low price is attached to the equity being sold, it is also attached to the rest of the firm; in contrast, even if an asset is assessed as a “lemon”, this need not imply a low valuation for the firm. Note that this force also applies to risky debt since, like equity, it is positively correlated with firm value. The issuance of debt may imply that debt is low-quality, and so the firm is also low-quality. Second, the manager places sufficient weight on the current stock price ($\omega \geq \omega^{APE}$), so that he is concerned with how the security issued affects the market’s inference over firm value.

Both sources are key to the correlation effect – not only do assets and equity have different effects on the market’s inference over firm value, but the manager must care about this inference. If the manager had no stock price concerns, then no pooling equilibrium would be sustainable under negative correlation. The $q$ that is selling the high-quality claim under the pooling equilibrium will avoid its capital loss by deviating to the other claim, as this other claim will be low-quality due to negative correlation. In the absence of stock price concerns, the deviation decision is driven only by capital loss considerations, and so cannot be ruled out. However, if stock price concerns are sufficiently high ($\omega \geq \omega^{APE}$), then even though a $L$-manager would avoid its capital loss in an $APE$ by deviating to equity, this would be outweighed by the fact that the rest of the firm would be inferred as being low-quality. Thus, the correlation effect allows the $APE$, but not the $EPE$, to be sustainable under negative correlation, and so represents an advantage to asset sales.

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.

The lower bound in expression (7), for the $APE$ to be satisfied, is increasing in $F$. Thus, again the amount of financing required affects the choice of financing, but the role of $F$ is different from in Section 2. The balance sheet effect is not relevant when considering $L$’s incentive to deviate to equity, as it would receive a fair (low) price and break even regardless of $F$. Instead, a greater $F$ means that, under the $APE$, $L$’s capital loss from selling assets is sustained over a larger base, encouraging deviation. Thus, higher stock price concerns $\omega$ are needed to deter deviation and sustain the $APE$.

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 can be sustained, but neither one in which all firms sell equity, nor one in which all firms sell the core asset, is feasible. 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.

### 3.2 Separating Equilibrium

In the positive correlation model of Section 2, all separating equilibria were semi-separating, where firms of one quality sell either assets or equity depending on their synergy. In particular, it was not possible to have a fully-separating equilibrium ($FSE$) where all $H$-firms sell one security and all $L$-firms sell the other. $L$ would be fully revealed and break even, but would make a capital gain by deviating to the security sold by $H$. Thus, an $L$-firm with no synergies would strictly gain from deviation. However, with negative correlation, a $FSE$ in which $H$ sells assets and $L$ issues equity\(^{19}\) may be possible due to the correlation effect. Proposition 6 gives the conditions for this equilibrium to hold:

\(^{19}\)There is no “reverse” $FSE$ 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 a higher stock price.
Proposition 6. (Negative correlation, fully-separating equilibrium.) A fully-separating equilibrium is sustainable if and only if $\omega \in [\omega^{FSE,H}, \omega^{FSE,L}]$, where

$$\omega^{FSE,H} \equiv \frac{F \left( (1 + \bar{k}) - \frac{E_H}{E_L} \right)}{\left( (C_H - C_L) - (A_L - A_H) \right) - F E \left[ k \right] + F \left( (1 + \bar{k}) - \frac{E_H}{E_L} \right)} \quad (8)$$

$$\omega^{FSE,L} \equiv \frac{F \left( \frac{A_L(1+k)}{A_H} - 1 \right)}{\left( (C_H - C_L) - (A_L - A_H) \right) - F E \left[ k \right] + F \left( \frac{A_L(1+k)}{A_H} - 1 \right)}. \quad (9)$$

In this equilibrium, all $H$-firms sell assets for $A_H$ and all $L$-firms sell equity for $C_L + A_L + F$. The stock prices of asset sellers and equity issuers are $C_H + A_H - FE \left[ k \right]$ and $C_L + A_L$, respectively.

Since both assets and equity are sold at fair value, there are no capital gains or losses. If $L$ deviates to asset sales, his fundamental value falls by $F \left( A_L(1+k) - A_H \right) / A_H$. $L$ will suffer a capital loss, but also get rid of a dissynergistic asset (if $k < 0$), and so fundamental value may rise or fall. In addition, deviating leads to the firm being inferred as $H$ which, by assumption (6), increases the stock price. Thus, he will cooperate with the $FSE$ only if stock price concerns are sufficiently low ($\omega \leq \omega^{FSE,L}$).

If $H$ deviates to equity, his fundamental value increases by $F \left( (1 + k) - \frac{E_H}{E_L} \right)$: he suffers a capital loss from selling underpriced equity, but avoids losing the synergy $k$. If $k$ is sufficiently positive, it outweighs the capital loss and so fundamental value rises from deviation. However, deviation also leads to a low stock price: $H$ would receive a low price for not only the equity sold, but also the rest of the firm. Thus, if stock price concerns are sufficiently strong, ($\omega \geq \omega^{FSE,H}$), then even the $H$-firm with the greatest synergy motives to deviate to equity, $(H, \bar{k})$, will not do so. Again, both sources of the correlation effect are critical deviating to equity leads to the firm being inferred as low-quality, and the manager cares about this inference due to his stock price concerns.

There are three effects of changing $F$ on the lower bound $\omega^{FSE,H}$. First, a rise in $F$ increases $\omega^{FSE,H}$ due to the balance sheet effect (reducing $\frac{E_H}{E_L}$). Second, it reduces it by magnifying $(H, \bar{k})$’s fundamental gain from deviating to equity (the $F \left( (1 + \bar{k}) - \frac{E_H}{E_L} \right)$ term). Third, $F$ multiplies the expected synergy loss $E \left[ k \right]$ of an asset seller, and the

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20 If $1 + \bar{k} < \frac{A_H}{A_L}$, i.e. the benefits of getting rid of a dissynergistic asset exceed the capital loss from selling high-quality assets, deviation to asset sales yields $(L, \bar{k})$ a fundamental gain and so a $FSE$ can never hold. Technically, $\omega^{FSE,L}$ becomes negative and so the upper bound cannot be satisfied.

21 If $1 + \bar{k} < \frac{E_H}{E_L}$, 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 so he does not deviate. Technically, $\omega^{FSE,H}$ becomes negative and so the lower bound cannot be satisfied.
direction of this effect depends on the sign of the average synergy $E[k]$. In contrast, there are only two effects of changing $F$ on the upper bound $\omega^{FSE,L}$ as there is no balance sheet effect: $L$ issues equity for a fair price, regardless of $F$. The range of $\omega$’s that satisfy (8) and (9) is increasing in $k$ and decreasing in $\bar{k}$: the weaker the synergy motive, the easier it is to sustain $FSE$.\textsuperscript{22}

In addition to the $FSE$ in Proposition 6, there also exist semi-separating equilibria as in Proposition 2. Since the economics are similar to the $FSE$, we defer the analysis of these equilibria to Appendix D.

4 Implications

This section 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 a 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.

The first set of empirical implications concerns the determinants of financing choice. One is the amount of financing required: Proposition 2 shows that equity is preferred for high financing needs, due to the balance sheet 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 asset sales.

A second determinant is the use of funds. Both the balance sheet and camouflage effects predict that the probability of equity issuance is increasing in growth opportunities. Starting with the former, Proposition 4 shows that the balance sheet effect is stronger when financing an investment opportunity that is attractive regardless of firm quality ($r_L$ is high). Moving to the latter, Proposition 4 also shows that, if growth opportunities are low,

\textsuperscript{22}This separating equilibrium is also featured in Nanda and Narayanan (1999), where assets are always negatively correlated and $\omega = 0$. (If assets are positively correlated, there is no information asymmetry in their model.) Since $\omega = 0$, there is no correlation effect (the manager is unconcerned with how the financing choice affects the market’s perception of firm value) and no pooling equilibria are sustainable without 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.
high-quality firms do not issue equity, and low-quality firms prefer asset sales as only they can provide camouflage. When $r_H$ increases above a threshold, not only do high-quality firms start to issue equity to take advantage of the growth opportunity, but also low-quality firms issue equity to a greater extent, as they can camouflage themselves with high-quality equity issuers.

Both the balance sheet 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 balance sheet 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 are 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.\(^{23}\) Holderness (2013) finds a

\(^{23}\) Cooney and Kalay (1993) and Wu and Wang (2005) show that an extension of MM can also generate
positive reaction in some countries, although does not relate it to 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 are 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 (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. A rise in operational motives for asset sales also encourages overvaluation-motivated asset sales, as the seller can camouflage the disposal as resulting from dissynergies. 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.

Second, the aforementioned link between the source of financing and the amount required is stronger with fewer 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.

positive returns to equity issuance. In their papers, the sign of the return depends on the uncertainty about the growth opportunity; here it depends on the size of the equity issue and the correlation structure of the issuer.
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, equity investors – but not asset purchasers – have a claim to the firm’s entire balance sheet, which includes the amount of funds raised. Since this amount is known, it mitigates the information asymmetry of equity: the balance sheet 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 balance sheet 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 if 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


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Online Appendix for “Financing Through Asset Sales”
Alex Edmans and William Mann

A Proofs

Proof of Proposition 1

We start with some notation. For a given pooling equilibrium, designate by $X$ the claim issued in equilibrium and $\tilde{X}$ the claim issued off-equilibrium. Further, designate by $c(X, q, k)$ the true value, to its current owner, of claim $X$ issued by type $(q, k)$. Thus, $c(E, q, k) = C_q + A_q + F$ and $c(A, q, k) = A_q(1 + k)$. Finally, designate by $\tilde{\pi}$ the posterior probability that $q = H$ for a firm deviating from the equilibrium, and by $\tilde{k}$ the posterior expected value of that firm’s synergies. Jointly, $(\tilde{\pi}, \tilde{k})$ define the OEPB. \(^\text{24}\)

In the equilibria of Proposition 1, the OEPB is that a deviator to claim $\tilde{X}$ is of quality $L$, so that $\tilde{\pi} = 0$. In APE, $\tilde{k} = \bar{k}$, while in EPE, $\tilde{k} = \underline{k}$. We first derive conditions under which no firms deviate under these OEPBs, and then derive conditions under which these OEPBs satisfy the D1 refinement.

Starting with the former, no firms will deviate if

$$\frac{c(X, q, k)}{E[X]} \leq \frac{c(\tilde{X}, q, k)}{\tilde{X}_L + \tilde{\pi}(\tilde{X}_H - \tilde{X}_L)} \quad \forall (q, k)$$ \quad (10)

i.e. the “unit cost of financing” (true value of the claim divided by the price received for the claim) is weakly lower for the equilibrium claim than the off-equilibrium claim. Since $\tilde{\pi} = 0$, (10) yields $\tilde{X}_L \leq \frac{c(\tilde{X}, q, k)}{c(X, q, k)} E[X] \quad \forall (q, k)$. For $X = E$ (and given $F > F^*$) this leads to the condition $1 + \tilde{k} \geq \frac{F}{\tilde{E}[F]}$ stated in Proposition 1, and for $X = A$ (and given $F < F^*$) it leads to $1 + \bar{k} \leq \frac{\tilde{E}[A]}{\tilde{A}_L}$.

Second, we observe that D1 rules out any OEPB other than $(L, \bar{k})$ in the APE and $(L, \underline{k})$ in the EPE. To do so, we follow a proof strategy that we will apply repeatedly throughout this Appendix.

Consider first the APE. Given an OEPB $(\tilde{\pi}, \tilde{k})$, $(q, k)$ deviates to equity issuance if and only if $\frac{E_q}{E_L + \tilde{\pi}(E_H - E_L)} < \frac{A_q(1 + k)}{\tilde{E}[A]}$. This inequality is easier to satisfy for higher values of $k$. Moreover, since the assumption $F < F^*$ implies $\frac{E_q}{\bar{E}_L} > \frac{A_q}{\bar{A}_L}$, it is easier to satisfy for $q = L$ than for $q = H$. Thus the beliefs under which any $(q, k)$ deviates are a subset of those

\(^{24}\)Strictly speaking, beliefs about $k$ should encompass an entire distribution, not just an expectation. However, in our equilibria, only the expected value of synergies matters.
under which \((L, k)\) deviates. Loosely speaking, \((L, k)\) is “more willing to deviate” than any other type.

To show that the beliefs are a strict subset, we must also that there is a OEPB for which \((L, k)\) will deviate and the other types will not (since the argument in the above paragraph could be consistent with no type deviating for any OEPB). First note that \((L, k)\) deviates if \(\pi = 1\) (again, this is implied by \(F < F^*\)). Without loss of generality we can assume that there is a \(\pi\) at which \((L, k)\) cooperates (else APE clearly is not sustainable). Then, because all the expressions defining the incentive of this type to deviate are continuous in \(\pi\), there must be a \(\pi\) at which \((L, k)\) is exactly indifferent between asset sales and equity issuance, while any other firm strictly prefers asset sales. Again by continuity, given any other type \((q', k')\), we can slightly decrease \(\pi\) to find an OEPB at which \((L, k)\) strictly prefers to deviate to equity issuance, while \((q', k')\) still strictly prefers asset sales, demonstrating that the beliefs under which the other type deviates are a strict subset of the beliefs under which \((L, k)\) does. D1 then requires investors’ beliefs after equity issuance to put zero weight on the deviator being any type other than \((L, k)\) (formally, D1 requires \(\pi = 0, k = k\)).

This logic demonstrates that the APE described in the Proposition exists for \(F < F^*\). On the other hand, if \(F > F^*\), then the APE cannot exist, because now the inequality above is more easily satisfied for \(q = H\) than \(q = L\). Loosely speaking, \((H, k)\) is now “more willing” to deviate than \((L, k)\). In this case, D1 would only allow OEPBs with \(\pi = 1\), and any type with \(q = H\) and \(k \geq 0\) would deviate to equity issuance, selling fairly-valued equity instead of making a capital loss by pooling on asset sales.

An analogous argument works for the EPE. Type \((q, k)\) deviates to asset sales if and only if \(\frac{A_q(1+k)}{A_L + \pi(A_H - A_L)} < \frac{E_q}{E[L]}\). This inequality is most easily satisfied for lower values of \(k\). Moreover, since the assumption \(F > F^*\) implies \(\frac{E_q}{E[L]} < \frac{A_H}{A_L}\), it is easier to satisfy for \(q = L\) than \(q = H\). Thus, the beliefs under which any \((q, k)\) deviates are a subset of the beliefs under which \((L, k)\) does. We can show they are a strict subset using an analogous argument to earlier, and so D1 requires \(\pi = 0, k = k\). If \(F < F^*\), then the EPE cannot exist, because now the inequality above is more easily satisfied for \((H, k)\) than for \((L, k)\). D1 would then require \(\pi = 1\), and any type with \(q = H\), \(k \leq 0\) would deviate to asset sales, selling fairly-valued assets instead of making a capital loss by pooling on equity issuance.

**Proof of Proposition 2**

We start with some useful observations about any sustainable SSE, in which both \(H\) and \(L\) follow interior cutoff rules \(k^*_q\). A type \((q, k)\) will prefer equity if and only if its unit
cost of financing is no greater:

\[
\frac{E_q}{\mathbb{E}[E|X = E]} \leq \frac{A_q(1 + k)}{\mathbb{E}[A|X = A]}. \tag{11}
\]

The prices paid for assets and equity are given by:

\[
\mathbb{E}[A|X = A] = \pi \left( \frac{k_H^* - \frac{k}{k_H^*}}{\mathbb{E}[k_H^*] - \frac{k}{k_H^*}} \right) A_H + \left( 1 - \pi \right) \left( \frac{k_L^* - \frac{k}{k_L^*}}{\mathbb{E}[k_L^*] - \frac{k}{k_L^*}} \right) A_L, \tag{12}
\]

\[
\mathbb{E}[E|X = E] = \pi \left( \frac{k - k_H^*}{k - \mathbb{E}[k_H^*]} \right) (C_H + A_H) + \left( 1 - \pi \right) \left( \frac{k - k_L^*}{k - \mathbb{E}[k_L^*]} \right) (C_L + A_L) + F. \tag{13}
\]

The cutoff \( k_q^* \) is that which allows (11) to hold with equality. Thus, it is defined by:

\[
1 + k_q^* = \frac{E_q}{\mathbb{E}[E|X = E]} \frac{\mathbb{E}[A|X = A]}{A_q} \tag{14}
\]

Although \( k_q^* \) is not attainable in closed form, we can study whether \( k_H^* \leq k_L^* \). Since only the \( \frac{E_q}{\mathbb{E}[E]} \) 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 \( \frac{C_H + A_H + F}{C_L + A_L + F} > \frac{A_H}{A_L} \), i.e. \( F < F^* \).

From the cutoff equation (14), we also have

\[
\frac{A_L(1 + k_L^*)}{E_L} = \frac{A_H(1 + k_H^*)}{E_H} = \frac{\mathbb{E}[A|X = A]}{\mathbb{E}[E|X = E]}. \]

Thus, in any SSE, \( k_L^* \) and \( k_H^* \) obey the following relationship:

\[
1 + k_H^* = \lambda(F) (1 + k_L^*), \tag{15}
\]

where \( \lambda(F) \equiv \frac{A_L}{A_H} \frac{E_H}{E_L} \), which is decreasing in \( F \). If \( F < (>) F^* \), then \( \lambda > (<) 1 \) so \( k_H^* > (<) k_L^* \) from (15). (For brevity, we will suppress \( \lambda \)’s dependence on \( F \) hereafter.)

We now fully characterize the set of sustainable equilibria, both pooling and semi-separating. To do so, we must consider separately the cases \( F < F^* \) and \( F > F^* \). The equilibrium that is sustainable depends on the value of \( \bar{k} \) if \( F < F^* \), and on the value of \( \underline{k} \) if \( F > F^* \). The results are given in the following Lemma.

**Lemma 1.** The sustainable equilibria are as follows:

(i) First, consider the case \( F < F^* \):

(ia) If \( F < F^* \) and \( \bar{k} \leq \bar{k}_P^* \equiv \frac{\mathbb{E}[A]}{A} - 1 \), then the unique equilibrium is an asset-pooling equilibrium, as in Proposition 1, part (i).
(ib) If $F < F^*$ and $\bar{k}^\text{PSE} \leq \bar{k} \leq \bar{k}^\text{SSE}$, where $\bar{k}^\text{SSE}$ is a constant defined below, then the unique equilibrium is a partial semi-separating equilibrium (PSE) in which all $H$-firms sell assets while $L$-firms separate between equity issuance and asset sales based on their synergy level ($k_H^* = \bar{k}$ and $\bar{k} < k_L^* < \bar{k}$). Assets are sold at a premium to their unconditional expected value and equity is sold at $E_L$.

(ic) If $F < F^*$ and $\bar{k} \geq \bar{k}^\text{SSE}$, then the unique class of equilibria is a full semi-separating equilibrium (SSE) in which both $H$ and $L$ separate between equity issuance and asset sales based on their synergy levels, and $k_H^* < k_L^* < \bar{k}$. Assets are sold at a premium to its unconditional expected value and equity is sold at a discount.

(ii) Second, consider the case $F > F^*$:

(iia) If $F > F^*$ and $k \geq \bar{k}^\text{PSE} \equiv \frac{E_L}{E_H} - 1$, then the unique equilibrium is an equity-pooling equilibrium, as in Proposition 1, part (ii).

(iib) If $F > F^*$ and $\bar{k}^\text{PSE} \geq k \geq \bar{k}^\text{SSE}$, where $\bar{k}^\text{SSE}$ is a constant defined below, then the unique equilibrium is a partial semi-separating equilibrium (PSE) in which all $H$-firms issue equity while $L$-firms separate between equity issuance and asset sales based on their synergy level ($k_H^* = \bar{k}$ and $\bar{k} < k_L^* < \bar{k}$). Equity is sold at a premium to its unconditional expected value and assets are sold at $A_L$.

(iic) If $F > F^*$ and $k \leq \bar{k}^\text{SSE}$, then the unique class of equilibria is a full semi-separating equilibrium (SSE) in which both $H$ and $L$ separate between equity issuance and asset sales based on their synergy levels, and $k < k_H^* < k_L^* < \bar{k}$. Equity is sold at a premium to its unconditional expected value and assets are sold at a discount.

Parts (ia) and (iia) repeat the results from the pooling equilibria analysis in Proposition 1. For $F < F^*$, the value $1 + \bar{k}^\text{PSE}$ represents the “threshold” between $\text{APE}$ and $\text{PSE}$; for $F > F^*$, the value $1 + \bar{k}^\text{PSE}$ represents this threshold.

To show (ib) and (ic), we first show that there is a similar “threshold” value $\bar{k}^\text{SSE}$ between $\text{PSE}$ and $\text{SSE}$. Formally, that means showing there exists a unique $\bar{k}^\text{SSE} > \bar{k}^\text{PSE}$ such that an $\text{SSE}$ with $k_H^* = \bar{k}^\text{SSE}$ (and $k_L^* = \frac{1 + \bar{k}^\text{SSE}}{\lambda} - 1$) constitutes both a valid $\text{PSE}$ and a valid $\text{SSE}$. Then $\text{PSE}$ is ruled out for any $\bar{k}$ greater than this value, and $\text{SSE}$ is ruled out for any $\bar{k}$ below this value. We will then demonstrate existence of the equilibria to complete the proof.

To find the threshold $\bar{k}^\text{SSE}$, we need to find the value of $\bar{k}^\text{SSE}$ such that an $\text{SSE}$ with $k_H^* = \bar{k}$ is an equilibrium, i.e. such that $\frac{A_H(1 + \bar{k}^\text{SSE})}{E[H|X = A]} = \frac{E_H}{E_L}$ when $L$ follows the cutoff rule defined by $1 + k_L^* = \frac{1 + \bar{k}}{\lambda} < 1 + k_H^*$ (which was derived above). We can rearrange this equilibrium condition to

$$1 + \bar{k}^\text{SSE} = \lambda \frac{E[H|X = A]}{A_L}. \quad (16)$$
We have $E[A|X = A] = A_L + (A_H - A_L) \times Pr(q = H|X = A)$. Using Bayes’ rule yields

$$Pr(q = H|X = A) = \frac{\pi(k^*_H - k)}{\pi(k^*_H - k) + (1 - \pi)(k^*_L - k)} = \frac{1}{1 + \frac{1 - \pi}{\pi} \left(\frac{1 + \bar{k}^{SSE}}{\lambda - (1 + \bar{k})} - 1\right)}.$$ 

Substituting $Pr(q = H|X = A)$ into (16), and defining $p \equiv \frac{1 - \pi}{\pi}$, $K \equiv \frac{1 + \bar{k}^{SSE}}{\lambda}$, and $a \equiv \frac{A_H}{A_L} - 1$, yields:

$$K - 1 = a \times \frac{1}{1 + p \left(\frac{K - (1 + k)}{\lambda K - (1 + k)}\right)}.$$ (17)

The only endogenous variable is $K$. Equation (17) can be rewritten as a quadratic form in $K$: it becomes $\tilde{q}(K) = 0$, where

$$\tilde{q}(K) \equiv \left(\lambda + p\right) K^2 - \left[(a + 1)\lambda + p + (p + 1)(1 + k)\right] K + (1 + k)(p + a + 1).$$

If $\tilde{q}(K) < (>)0$, type $(H, \bar{k}^{SSE})$ strictly prefers to sell assets (equity), rather than being indifferent as desired.

If $\bar{k}^{SSE} = \bar{k}^{PSE}$, then $\tilde{q}(K) < 0$. This is true because, at the threshold between $APE$ and $PSE$, type $(H, \bar{k}^{PSE})$ was indifferent even though all $L$-firms sold assets. $\tilde{q}(K)$ implies some $L$-firms are not selling assets $(1 + k^*_L = \frac{1 + \bar{k}}{\lambda} < 1 + \bar{k})$, raising the equilibrium price of assets sold. Thus, type $(H, \bar{k}^{PSE})$ now strictly prefers to sell assets and so $\tilde{q}(K) < 0$ when $\bar{k}^{SSE} = \bar{k}^{PSE}$.

We can also show that $\tilde{q}(a + 1) > 0$:

$$\tilde{q}(a + 1) = \left(\lambda + p\right) (a + 1)^2 - \left[(a + 1)\lambda + p + (p + 1)(1 + k)\right] (a + 1) + (1 + k)(p + a + 1)$$

$$= \lambda(a + 1)^2 + p(a + 1)^2 - \lambda(a + 1)^2 - p(a + 1) - (1 + k) \left[p + a + 1 - (p + 1)(a + 1)\right]$$

$$= p(a + 1)(a - (1 + k)[ap] = p(a + 1)(a) + (1 + k)ap > 0$$

$K = a + 1$ corresponds to $1 + \bar{k}^{SSE} = \lambda(a + 1) = \frac{E_H}{A_H/A_L} \times \frac{A_H}{A_L} = \frac{E_H}{B_H}$. If we set $1 + \bar{k}^{SSE} = \frac{E_H}{B_L}$, the equilibrium with $k^*_H = \bar{k}^{SSE}$ will fail because type $(H, \bar{k}^{SSE})$ will strictly prefer equity.
issuance rather than being indifferent. Since $\tilde{q}$ is continuous in $K$ (and therefore in $\bar{k}_{SSE}$), and since $\tilde{q} < 0$ when $1 + \bar{k}_{SSE} = \frac{E[A]}{A}$ and $\tilde{q} > 0$ when $1 + \bar{k} = \frac{E[A]}{A}$, by the Intermediate Value Theorem ("IVT") there must be a value of $\bar{k}_{SSE}$ in between that constitutes both a valid $SSE$ (because the cutoffs are defined by $1 + k^*_H = \lambda(F)(1 + k^*_L)$) and a valid $PSE$ (because all $H$-firms are selling assets). Moreover, since $\tilde{q}$ is quadratic in $\bar{k}_{SSE}$, this equilibrium is unique. (The other root of $\tilde{q}$ must involve $k < k_{PSE}$, where $PSE$ is not admissible because the only sustainable equilibrium is an $APE$.) Then, for $k < k_{SSE}$, $SSE$ is not sustainable as even type $(H, k)$ strictly prefers asset sales. For $k > k_{SSE}$, $PSE$ is not sustainable as type $(H, \bar{k})$ strictly prefers equity issuance.

It only remains to show that $PSE$ and $SSE$ actually exist within their respective ranges. For $PSE$, we can demonstrate both existence and uniqueness of a single $PSE$ for every value of $\bar{k}$ within the “admissible” range from $\bar{k}_{PSE}$ to $\bar{k}_{SSE}$. Our strategy can be sketched as follows: Given a value of $\bar{k}$, and a candidate value $k'_L$ for the equilibrium cutoff $k^*_L$ (and thus the resulting valuations applied by investors), we show that the resulting incentive for type $(L, k'_L)$ to choose either claim is captured by a continuous quadratic form in $k'_L$. An equilibrium is a value of $k'_L$ such that this quadratic form equals zero. We then show that type $(L, k'_L)$ would strictly prefer equity issuance if $k'_L = \bar{k}$ and asset sales if $k'_L = k$, thus yielding a unique equilibrium value of $k^*_L$ given any value of $\bar{k}$.

First, we derive the quadratic form. Type $(L, k'_L)$ strictly prefers asset sales if and only if the unit cost of financing is lower:

$$A_L(1 + k'_L) < \frac{E[A|X = A, k^*_L = k'_L]}{A} < 1,$$

where the RHS captures the fact that all $H$-firms sell assets, so any equity issuer is correctly valued at $L$. This condition can be rearranged to

$$1 + k'_L < \frac{E[A|X = A, k^*_L = k'_L]}{A_L} = 1 + a \times Pr(q = H|X = A),$$

where

$$Pr(q = H|X = A) = \frac{\pi(k - \bar{k})}{\pi(k - \bar{k}) + (1 - \pi)(k'_L - \bar{k})} = \frac{1}{1 + p \frac{k'_L - \bar{k}}{\bar{k}} - \bar{k}}.$$

Multiplying out, we obtain a quadratic form $q(\cdot)$ in $k'_L$ that is negative if type $(L, k'_L)$ would strictly prefer asset sales; positive if $(L, k'_L)$ would strictly prefer equity issuance; and zero if $(L, k'_L)$ would be indifferent (in which case $k^*_L = k'_L$ is an equilibrium):

\[\text{A closed-form expression for } \bar{k}_{SSE} \text{ can be obtained using the quadratic formula, but we skip this step for brevity as the resulting expression yields no additional intuition.}\]
\[q(k'_L) = p \times k'_L^2 + \left(1 - p \frac{k}{k - k'}\right) \times k'_L - a.\] 

Next, we show that \((L, k'_L)\) strictly prefers equity issuance if \(k'_L = \overline{k}\). This arises if the unit cost of financing is strictly lower for equity, \(\frac{A_L(1+\overline{E})}{A_L} > 1\). This yields \(1 + \overline{k} > \frac{E[A|X=A, k'_H=\overline{k}]}{A_L} = 1 + \overline{k}^{PSE}\), which is true by assumption.

Finally, we show that \((L, k'_L)\) strictly prefers asset sales if \(k'_L = \underline{k}\). This arises if \(\frac{A_L(1+\underline{E})}{A_L} < 1\). If investors believe that all \(H\)-firms sell assets and all \(L\)-firms sell equity \((k'_L = \underline{k})\), \(E[A|X = A, k'_L = \underline{k}] = A_H\) and so the inequality holds. Since the preference for assets versus equity is given by a quadratic expression (18) that changes sign once in the range \([\underline{k}, \overline{k}]\), there is a unique equilibrium value of \(k'_L\) in this range.

We now show that an \(SSE\) actually exists in this region. The strategy is similar to before. Under \(SSE\), the expression capturing \((L, k'_L)\)'s choice between asset sales and equity issuance is now a polynomial in \(k'_L\) of higher order than 2, so this strategy can no longer deliver uniqueness of the equilibrium cutoffs as it did with \(PSE\). However, we can still demonstrate existence simply by showing that this preference changes over the potential range of cutoffs \(k'_L\).

If we set \(k'_H = \overline{k}\), so that \(1 + k'_L = \frac{1+\overline{E}}{\lambda}\) (the maximum possible value for \(k'_L\) in \(SSE\)), then as before we can show that type \((L, k'_L)\) strictly prefers equity issuance, i.e.

\[
\frac{A_L \left(1+\overline{E}\right)}{E[A|X = A, k'_H = \overline{k}]} > \frac{E_L}{E[E|X = E, k'_L = \overline{k}]}.
\]

Since equity is valued at \(E_L\) (all \(H\)-firms sell assets), this is equivalent to showing

\[
1 + \overline{k} > \lambda \frac{E[A|X = A, k'_H = \overline{k}]}{A_L}.
\]

Compared to (16), the condition defining \(\overline{k}^{SSE}\) which holds with equality, the LHS is higher since \(\overline{k} > \overline{k}^{SSE}\). This inequality also implies that the numerator on the RHS is lower, since the valuations of assets (equity) fall (rise) towards their unconditional expectations as synergies strengthen. Thus, the inequality is satisfied: \((L, k')\) would strictly prefer equity issuance given \(k'_L = \overline{k}\).

Finally, if \(1 + k'_L = \frac{E_L E[A]}{A_L E[E]}\), we can show that \((L, k'_L)\) strictly prefers asset sales. This is true if

\[
\frac{A_L \left(E_L E[A]\right)}{E[A|X = A, k'_L = \overline{k}]} < \frac{E_L}{E[E|X = E, k'_L = \overline{k}]}.
\]
which is equivalent to
\[ \frac{\mathbb{E}[A]}{\mathbb{E}[A|X = A]} < \frac{\mathbb{E}[E]}{\mathbb{E}[E|X = E]}. \]

As shown above, in any SSE with \( F < F^* \), we must have \( \lambda > 1 \), which implies \( k_H^* > k_L^* \) and therefore \( \mathbb{E}[A] < \mathbb{E}[A|X = A], \mathbb{E}[E] > \mathbb{E}[E|X = E] \). Since the (continuous) incentive to choose asset sales over equity issuance changes between \( 1 + k_L' = 1 + \kappa \) and \( 1 + k_L' = \frac{E_L}{A_L} \mathbb{E}[A] \mathbb{E}[E] \), there must be an equilibrium value of \( k_H^* \) between these two for any value of \( \kappa > \kappa^{SSE} \). Then the equilibrium value of \( k_H^* \) is defined as usual by \( 1 + k_H^* = \lambda (1 + k_L^*) \).

Turning to \( F > F^* \), the reasoning is analogous to the case of \( F < F^* \), so the discussion is briefer. First, we show that there is a unique threshold between \( PSE \) and \( SSE \) for \( F > F^* \); that is, there exists a unique \( k_{SSE}^* < k_{PSE}^* \) such that an \( SSE \) with \( k_H^* = k_{SSE}^* \) (and \( k_L^* = \frac{1 + k_{SSE}^*}{\lambda} - 1 \)) constitutes both a valid \( PSE \) and a valid \( SSE \). This \( k_{SSE}^* \) is defined by
\[ 1 + k_{SSE}^* = \frac{E_L}{\mathbb{E}[E|X = E]} \frac{A_H}{A_L}. \]

Defining \( P \equiv \frac{1 - \pi}{\pi}, e \equiv \frac{E_H}{E_L}, \) and \( K = 1 + \kappa \) yields the quadratic form \( \tilde{q}(K) = 0 \), where
\[ \tilde{q}(K) \equiv \left( e + \frac{p}{\lambda} \right) K^2 - \left[ (e + p)(1 + \kappa) + \lambda + p \right] K + \lambda(1 + \kappa)(1 + p). \]

If \( \tilde{q}(K) < (>)0 \), type \((H, k_{SSE}^*)\) strictly prefers to sell assets (equity), rather than being indifferent as desired.

We know that \( \tilde{q} \) is negative if \( k_{SSE}^* = k_{PSE}^* \), for the same reason as in the \( F < F^* \) section. We can also easily show that \( \tilde{q} \left( \frac{\lambda}{E + 1} \right) > 0 \), and \( K = \frac{\lambda}{E + 1} \) corresponds to \( 1 + \kappa = \frac{A_L}{A_H} \). This change of sign implies a unique value of \( k_{SSE}^* \) between \( k_{PSE}^* \) and \( \frac{A_L}{A_H} - 1 \) that serves as the threshold between \( PSE \) and \( SSE \).

Next we show that, for any \( k \) strictly between \( k_{PSE}^* \) and \( k_{SSE}^* \), there exists a unique \( k_L^* \) such that the associated \( PSE \) is an equilibrium. As with \( F < F^* \), we can show that the preference for assets versus equity is captured by a quadratic expression in the candidate cutoff \( k_L' \). Type \((L, k_L')\) strictly prefers asset sales when \( k_L' = \bar{k} \), because the corresponding condition is \( 1 + k < \frac{E_L}{\mathbb{E}[E]} = 1 + k_{PSE}^* \) which is true by assumption. Type \((L, k_L')\) prefers equity issuance when \( k_L = \bar{k} \), because the corresponding condition \( 1 + k > \frac{E_L}{\mathbb{E}[E]} \) is also automatically satisfied.

Finally, we show that, for any \( k < k_{SSE}^* \), there exist \( k_H^* \) and \( k_L^* \) such that the associated \( SSE \) is an equilibrium. Again, the preference for assets versus equity is captured by an expression that is continuous, though not quadratic. We first show that type \((L, k_L')\) strictly
prefers asset sales if \( k'_L = k \). The condition for this is
\[
\frac{A_L(1+k)}{A_H} < \frac{E_L}{E[X = E]} A_H.
\]
Compared to (19), the condition defining \( k^{SSE} \) which holds with equality, the LHS is smaller since \( k < k^{SSE} \). The RHS is larger because the greater range of potential synergies reduces \( E[X = E] \) towards its unconditional value, and so the inequality is satisfied.

Finally, if \( 1 + k'_L = \frac{E_L}{A_L} \frac{E[A]}{E[X = A]} \), we can show that \( (L, k'_L) \) strictly prefers equity issuance. This is true if \( A_L(1+k) \geq A_L(1+k'_L) \), which simplifies to \( E[X = E] \geq E[A] \). Since \( F > F^* \) implies \( \lambda < 1 \), the relationship \( 1 + k'_H = \lambda(1 + k'_L) \) implies that \( 1 + k'_H < 1 + k'_L \). Thus, equity is valued above (below) its unconditional expectation, satisfying the inequality.

**Proof of Proposition 3**

The conditions to ensure that both \( H \) and \( L \) do not deviate to equity are the same as in Proposition 1, except that the definition of equity value \( E_q \) now includes the investment return \( r_q \). We also have a new set of conditions to prevent all firms from deviating to inaction:

\[
1 + r_q \geq \frac{c(X, q, k)}{E[X]}.
\]

Intuitively, the return on investment must exceed the unit cost of financing. This yields, for \( APE \), the conditions \( 1 + r_L \geq \frac{A_L(1+E)}{E[A]} \) and \( 1 + r_H > \frac{A_H(1+E)}{E[A]} \) and for \( EPE \), the conditions \( 1 + r_L \geq \frac{E_H}{E[X]} \) and \( 1 + r_H \geq \frac{E_H}{E[X]} \). The first \( APE \) condition is implied by condition \( 1 + k \leq \frac{E[A]}{A_L} \) that deters deviation to equity since \( r_L \geq 0 \), and the first \( EPE \) condition is implied by \( E_L < E_H \). This leaves the new conditions stated in the Proposition, \( 1 + r_H \geq \frac{A_H(1+E)}{E[A]} \) for \( APE \) and \( 1 + r_H \geq \frac{E_H}{E[X]} \).

Finally, we confirm that the OEP valuation of \( \tilde{X} \) at \( X_L \) is consistent with D1. This only requires a slight addition to the argument in Proposition 1. As before, we wish to show that there is no \( k \) for which the beliefs under which \( (L, k) \) deviates to \( \tilde{X} \) are a strict subset of the beliefs under which some other \( (H, k') \) deviates to \( \tilde{X} \). In Proposition 1, this merely required knowing when each type prefers \( \tilde{X} \) to \( X \). Here, we must also check that, when the firm prefers \( \tilde{X} \), it prefers inaction even more. This is automatic, since inequality (20) already implies that the firm prefers \( X \) to inaction. Thus, if it prefers \( \tilde{X} \) to \( X \), it also prefers \( \tilde{X} \) to inaction.

**Proof of Proposition 4**

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 2. \( L \)-firms will not deviate to inaction, as they
are enjoying a fundamental gain plus the investment return. A high-quality equity issuer will not deviate to inaction if

$$1 + r_H \geq \frac{E_H}{E[X = E]}$$

(21)
i.e., the capital loss from selling undervalued equity is less than the investment return. Similarly, a high-quality asset seller will not deviate if

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

Since $k^*_H$ is defined by

$$E_H = A_H (1 + k_H) \frac{E[A|X = A]}{E[X = E]}$$

and $k^*_L = \min \left( R, \frac{E[A|X = A]}{A_L} - 1 \right) > 0$; for part (b), $k^*_H$ and $k^*_L$ are stated in the Proposition. All are given by the indifference conditions. L-firms will not deviate to inaction, as they are enjoying a (weakly positive) fundamental gain plus the investment return. 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 investment return. 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 $1 + r_H = \frac{A_H (1 + k^*_H)}{E[A|X = A]}$ 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 $1 + r_H > \frac{A_H}{A_L}$, we have $k^*_H > k^*_L$: H is more willing to sell assets than L because, if it switches to inaction, 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

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hold. Thus, we have

\[ 1 + r_H = \frac{1 + k_H^* \cdot A_H}{1 + k_L^* \cdot A_L} \]

\[ \frac{E_H}{E_L} > \frac{1 + k_H^* \cdot A_H}{1 + k_L^* \cdot A_L}. \]

If \( \frac{E_H}{E_L} < \frac{A_H}{A_L} \) in Lemma 2, 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 2, 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 inaction.

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 disynergies are sufficiently weak, that no \( H \)-firm wishes to sell its high-quality assets for a low price.

**Proof of Proposition 5**

We first show that an \( EPE \) is unsustainable, by demonstrating that the only OEPB that satisfies D1 is that an asset seller is type \((H, k)\), and that some \( H \)-firms will automatically deviate under such an OEPB.

Given an OEPB \((\tilde{\pi}, \tilde{k})\), type \((q, k)\) deviates to asset sales if and only if

\[ \omega \left[ (\tilde{\pi} - \pi)((C_H - C_L) - (A_L - A_H)) - F \tilde{k} \right] > (1 - \omega)\tilde{F} \left( A_q(1 + k) \right) \left( \frac{A_q(1 + k)}{A_L - \tilde{\pi}(A_L - A_H)} \right) \left( \frac{E_q}{E[L]} \right). \]

The LHS is independent of firm type. The RHS is lower for \( q = H \) than for \( q = L \), and is also increasing in \( k \), so the OEPBs under which any firm deviates to asset sales are a subset of those under which \((H, k)\) deviates. We can show that they are a strict subset using an analogous argument to the proof of Proposition 1.

Under this OEPB, the stock price \( C_H + A_H - F_k \) upon selling assets and being inferred as \( H \) is higher than that upon pooling on equity issuance \( \mathbb{E}[C + A] \). A \( H \)-firm deviating to asset sales receives this higher stock price and sells assets at a fair value compared to suffering a fundamental loss on equity issuance. Thus, any firm with \( q = H \) and \( k \leq 0 \) will deviate to asset sales, and so \( EPE \) is unsustainable.

We now discuss the conditions under which an \( APE \) is sustainable. We first show that no firm wishes to deviate under condition (7) and the OEPB that a deviator is of type \((L, \overline{k})\), and then show that this is the only OEPB that satisfies D1. Under the equilibrium, \( L \) sells assets worth \( A_L (1 + k) \) at the pooled price of \( \pi A_H + (1 - \pi) A_L \), and its stock price is \( \pi (C_H + A_H) + (1 - \pi) (C_L + A_L) - F \times \mathbb{E}[k] \). If \( L \) deviates to equity, it will be valued correctly at \( E_L \) and its stock price will be \( C_L + A_L \), so its objective function is simply \( C_L + A_L \). \( L \)
will thus cooperate with asset sales if

\[
\omega(\pi(CH + AH) + (1 - \pi)(CL + AL) - F \times \mathbb{E}[k])
+ (1 - \omega) \left( CL + AL + F - F \left( \frac{AL}{\pi AH + (1 - \pi)AL} \right) \right) \geq CL + AL,
\]

which simplifies to condition (7).

We now show that, in APE, the only OEPB that satisfies D1 is that a deviator to equity is of type \((L, k)\). The proof is similar to the EPE analysis. Type \((q, k)\) deviates to equity issuance if and only if

\[
\omega \left[ (\tilde{\pi} - \pi)((C_H - C_L) - (A_L - A_H)) + F \times \mathbb{E}[k] \right] > (1 - \omega) F \left( \frac{E_q}{E_L + \tilde{\pi}(E_H - E_L)} - \frac{A_q(1 + k)}{\mathbb{E}[A]} \right)
\]

Inequality (23) is easier to satisfy as \(k\) increases. It is also easier to satisfy for \(q = L\) than for \(q = H\), since \(E_L < E_H\) and \(A_L > A_H\). Therefore, the beliefs under which any type deviates (in this case, captured by \(\tilde{\pi}\) alone) are a subset of those under which \((L, k)\) deviates. We can show that they are a strict subset using an analogous argument to the proof of Proposition 1. Thus, the only OEPB that satisfies D1 is that an equity issuer is type \((L, k)\).

**Proof of Proposition 6**

The equilibrium requires two incentive constraints (“ICs”), one for each quality \(q\). Condition (8) is the IC for \((H, k)\), the \(H\)-firm most likely to deviate. In equilibrium, investors know that any asset seller is high-quality, but they also price in the average synergy loss across all \(H\)-firms, \(\mathbb{E}[k]\). Thus, the stock price of an asset seller \(C_H + A_H - F \mathbb{E}[k]\). Comparing \((H, k)\)’s payoffs under the equilibrium action of selling assets and deviating to equity issuance leads to his IC being inequality (8).

Condition (9) is the incentive compatibility condition for \((L, k)\), the \(L\)-firm most likely to deviate to asset sales. An equity issuer is correctly revealed as low-quality. Thus, both fundamental value and the stock price, and therefore the manager’s objective function, equal \(CL + AL\). Comparing \((L, k)\)’s payoffs under the equilibrium action of issuing equity and deviating to asset sales leads to his IC being inequality (8).

Note that it may be the case that \(\omega^{FSE,H} > \omega^{FSE,L}\), and so \(\omega \in [\omega^{FSE,H}, \omega^{FSE,L}]\) does not hold for any \(\omega\). Intuitively, this will arise if \(k\) is very high and \(k\) is very low, i.e. (dis)synergies are extreme. Then, synergy motives outweigh capital gain and stock price concerns, and so a \(H\)-firm with high synergies will issue equity and an \(L\)-firm with high dissynergies will sell assets. Thus, we will have a \(SSE\).
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 7 below characterizes which equilibria are sustainable and when. For simplicity of exposition, we shut down synergies ($k_1 = k_2 = 0$), but the results extend to the case of general $k_1$ and $k_2$.

Proposition 7. (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:

$$F \leq F^* \equiv \frac{C_H A_L - C_L A_H}{A_H - A_L}$$ (24)

$$\frac{A_H}{A_L} \leq \frac{C_H}{C_L}.$$ (25)

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:

$$F \leq F^{*C} \equiv \frac{C_L A_H - C_H A_L}{C_H - C_L}$$ (26)

$$\frac{A_H}{A_L} \geq \frac{C_H}{C_L}.$$ (27)

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:

$$F \geq F^* \equiv \frac{C_H A_L - C_L A_H}{A_H - A_L}$$ (28)

$$F \geq F^{*C} \equiv \frac{C_L A_H - C_H A_L}{C_H - C_L}.$$ (29)

For the APE, condition (24) is the same as condition (ib) in Proposition 1 of the core
model: it ensures that the OEPB that an equity issuer is of quality $L$ is the only admissible OEPB under D1. Equation (25) is new and similarly ensures that the belief that a core asset seller is of quality $L$ satisfies D1. Thus, the APE can only be sustained if non-core assets have less information asymmetry than core assets, as is intuitive. For the core-asset-pooling equilibrium ($CPE$), equations (26) and (27) similarly guarantee that the OEPB that a seller of the non-core asset or equity is of quality $L$ satisfies the IC. To understand the intuition, note that $F \leq F^*$ can be rewritten as $\frac{A_L}{E} \leq \frac{E_H}{E_L}$, while $F \leq F^{*C}$ can similarly be rewritten $\frac{A_L}{E} \leq \frac{E_H}{E_L}$.

The main result of Proposition 7 is to show that an EPE is still sustainable. Equations (28) is the same as condition (iib) of Proposition 1 in the core model: it means that the OEPB that a seller of the non-core asset is of quality $L$ satisfies D1. Equation (29) is new and guarantees that the belief that a core-asset seller is of quality $L$ also satisfies D1. 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 balance sheet 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 balance sheet effect.

### B.2 Negative Correlation

We now move to the negative correlation case. Proposition 8 characterizes the pooling equilibria.

**Proposition 8.** (Negative correlation, selling the core asset.) The only sustainable pooling equilibrium is one in which 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:

$$\omega \geq \frac{F \left( \frac{A_L}{E[A]} - 1 \right)}{\pi ((C_H - C_L) - (A_L - A_H)) + F \left( \frac{A_L}{E[A]} - 1 \right)}.$$  \hspace{1cm} (30)

An EPE is not sustainable by the same logic as in the main text, and the same intuition rules out a CPE since, like equity, the core asset is positively correlated with firm quality. In either equilibrium, the only OEPB consistent with D1 is that a deviator to non-core asset sales is of type $(H, k)$. Under this belief, $(H, k)$ will indeed deviate to non-core asset sales, destroying the equilibrium. Thus, even if the core asset exhibits less information
asymmetry than the non-core asset, and so MM would suggest that it is more likely to be sold, a CPE cannot exist due to the correlation effect.

Equation (30) is the IC for \( L \) not to deviate to equity, and is the same as equation (7) 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 OEPB that a seller of the core asset or equity is of quality \( L \) is trivially consistent with D1: For either claim, type \( L \) has a stronger incentive than type \( H \) to issue it regardless of the OEPB, because that type will retain valuable assets while selling less-valuable non-core assets or equity.

The SEs are very similar to the main model. As in the main 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, under exactly the same conditions as in the main model. In both equilibria, by deviating, \( L \)'s stock price increases but his fundamental value falls by \( F(A_L - A_H) / A_H \). 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. In both cases, the OEPB that a deviator to the off-equilibrium claim is of quality \( L \) is consistent with D1, because \( L \) has a strictly stronger incentive than \( H \) to do so. 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.

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. This section allows firms to choose a combination of financing sources and shows that the pooling equilibria of the core model continue to hold.

We start with the case of positive correlation. The action space now consists of a fraction \( \alpha \in [0, 1] \) of financing that is raised from the pooling claim, which is no longer restricted to be 0 or 1. The OEPB still consists of a pair \( \left( \tilde{\pi}, \tilde{k} \right) \), but there may be a different OEPB for each \( \alpha \). The equilibrium choice is \( \alpha = 0 \) for asset-pooling and \( \alpha = 1 \) for equity-pooling. We will show that the OEPB, that firm choosing \( \alpha \in (0, 1) \) (i.e. using both sources) is of quality \( L \), satisfies D1 and that the pooling equilibria of the core model continue to hold under this OEPB.

To show this, we consider the incentive of a type \( (q, k) \) to deviate to an action \( \alpha \in (0, 1) \).
Given the resulting OEPB, the type deviates if the unit cost of financing is lower,

$$\alpha \left( \frac{c(X, q, k)}{X_L + \tilde{\pi}(X_H - X_L)} \right) + (1 - \alpha) \left( \frac{c(\bar{X}, q, k)}{\bar{X}_L + \tilde{\pi}(\bar{X}_H - \bar{X}_L)} \right) < \frac{c(X, q, k)}{E[X]}$$

Dividing both sides by $c(X, q, k)$, and invoking from Proposition 1 the condition $F < F^*$ for $APE$ and $F > F^*$ for $EPE$, we see that, for any given $k$, this deviation is most likely for firms of quality $L$, and so D1 requires $\tilde{\pi} = 0$ for any $\alpha \neq 1$. This is sufficient to check the sustainability of the equilibrium: $\frac{c(X, q, k)}{E[X]} < \frac{c(\bar{X}, q, k)}{X_L}$, and the IC conditions from the Proposition guarantee that $\frac{c(X, q, k)}{E[X]} < \frac{c(\bar{X}, q, k)}{X_L}$, so the linear combination of these inequalities under weight $\alpha$ continues to hold. It is not possible to pin down a unique belief about $k$ for a deviator, but this is not necessary since $\tilde{k}$ does not appear in the inequality above.

Moving to the negative correlation case, the $EPE$ continues to be unsustainable by the same logic as in Proposition 5, since we have only expanded the action space compared to the core model. Turning to the asset-pooling equilibrium, a type $(q, k)$ deviates from asset-pooling to a given $\alpha$ if

$$\omega \left[ (\tilde{\pi} - \pi)((C_H - C_L) - (A_L - A_H)) + F E[k] \right] > (1 - \omega) F \left( \alpha \frac{A_q(1 + k)}{E_L + \tilde{\pi}(E_H - E_L)} + (1 - \alpha) \frac{E_q}{A_L + \tilde{\pi}(A_H - A_L)} - \frac{A_q(1 + k)}{E[L]} \right)$$

We will first show that $\tilde{\pi} = 0$ is consistent with D1 for any $\alpha$, although it is no longer possible to prove that this is the only belief consistent with D1. We seek a belief $(\tilde{\pi}, \tilde{k})$ under which a firm of quality $L$ has the strongest incentive to deviate. If $\tilde{\pi} = 0$, then the inequality simplifies to $E_q E[L] < \frac{A_q(1 + k)}{E[L]}$, which does not depend on $\alpha$. Under this belief, type $(L, \tilde{k})$ has at least as strong an incentive to deviate as any other type, so this belief cannot be ruled out under D1. (As above, the belief $\tilde{k}$ about the synergy of a deviator is a free parameter.)

### D Negative Correlation With Synergies

This characterizes the SSEs in the negative correlation model of Section 3.2. As in Section 2, these equilibria are characterized by cutoffs $k^*_q$. The prices paid for assets and equity are again given by (12) and (13). The stock prices of asset sellers and equity issuers are,
respectively:

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

(31)

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

(32)

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

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

(33)

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

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

(34)

Only the parenthetical term on the RHS differs by quality \(q\). Ignoring the \(k^*_q\) element, this term will be higher for \(L\), and so \(k_H^* > k_L^*\). Under positive correlation, \(k_H^* > k_L^*\) only if assets exhibit less information asymmetry than equity (after adjusting for the balance sheet effect), 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 \(k_H^* > k_L^*\). The FSE of Proposition 6 corresponds to \(k_H^* = k\) and \(k_L^* = k\).

From (31) and (32), \(k_H^* > k_L^*\) 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 (33) positive. The RHS is the expected loss of synergies from asset sales. This loss will be smaller, and so (33) will hold, except for the extreme case in which expected synergies are so high that a firm’s stock price falls from selling assets even though doing so is a positive signal on firm quality. A sufficient condition for (33) is symmetric synergies \((\bar{k} = -k)\).\(^{26}\)

In turn, (33) implies that the LHS of (34) is positive. Setting \(q = H\) on the RHS yields \(k_H^* > 0\) for the equality to hold. \(H\) will sell assets even if they are moderately synergistic.

\(^{26}\)In this case, we have \(\mathbb{E}[k] = 0\) and so \(\mathbb{E}[k|X = A] < \mathbb{E}[k] = 0\); thus, the RHS of (33) is negative and (33) holds.
and even if the synergy loss outweighs the capital gain relative to equity issuance, since he
benefits from the stock price increase — the correlation effect.

Finally, we may have partial SSEs where one quality pools and the other separates.
As in the positive correlation case, if \( \overline{k} \) 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 \( \overline{k} \) 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 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 2 below.

**Lemma 2.** (Negative correlation, semi-separating equilibrium.) Assume that (33) 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 (34), 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 (31) and (32) 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:

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

\[
\omega \leq \omega^{SSE,L} = \frac{F \left( \frac{A_L(1+k)}{A_H} - 1 \right)}{((C_H - C_L) - (A_L - A_H)) - F\mathbb{E}[k] + F \left( \frac{A_L(1+k)}{A_H} - 1 \right)}
\]

(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 \( \omega > \omega^{SSE,H} \).

(iv) A partial semi-separating equilibrium where all \( L \)-firms issue equity (\( k^*_L = k \)) and
\( H \)-firms strictly separate (\( \overline{k} < k^*_H < k \)) is sustainable if \( k \) is sufficiently high, \( \overline{k} \) is sufficiently
high, and \( \omega < \omega^{SSE,L} \).
Proof of Lemma 2

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:

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

(35)

Recall that the difference in stock price is positive by assumption (33). If \(1 + k_L'^* < \frac{E_L}{E[H \mid X = A]}\), expression (35) 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 (35) 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 disynergies that \(1 + k_L'^* < \frac{E_L}{E[H \mid X = A]}\) is feasible, 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 \(1 + k_H'^* < \frac{E_H}{E[H \mid X = A]}\). 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 $(C_H - C_L) - (A_L - A_H) - F_{E_L}$. Thus, after $k$ crosses some threshold $\bar{k}^H$, 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 $k > \bar{k}^H$ and $1 + k < \frac{E_L A_H}{E_L A_L}$ 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:

$$\omega \left( Pr(q = H | X = A) \left( (C_H - C_L) - (A_L - A_H) \right) - F \times \mathbb{E}[k | k < k^*_q] \right)$$

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

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 $k^*_q$, we consider the limiting case $k^*_q \rightarrow \bar{k}$ (the strictest possible condition on $\omega$, where all $L$-firms are issuing equity). Then the bound on $\omega$ is

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

Note that this bound is identical to $\omega^{SE^q, H}$. In this limiting case, we require the same behavior of $H$ as in the $SE^q$: 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

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

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When \(1 + k_L' = \frac{A_H}{A_L}\), the above expression is negative. Thus if \(1 + k \geq \frac{A_H}{A_L}\), 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 \(\bar{k}\), we conclude that for sufficiently high \(\bar{k}\) (along with the previously-imposed bounds on \(\omega\) and \(k\)), 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 \(\bar{k}\). 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 \(L\):

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

To satisfy this, we require \(\omega\) to be sufficiently low. Consider the limiting case \(k_H^* \rightarrow \bar{k}\). If

\[
\omega \leq \frac{F \left(\frac{A_L(1 + k)}{A_H} - 1\right)}{((C_H - C_L) - (A_L - A_H)) - F[E[k] + F \left(\frac{A_L(1 + k)}{A_H} - 1\right]}\]

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 \(1 + k > \frac{A_H}{A_L}\) 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

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

Since \(E_H > E[E|X = E]\), the above expression is negative, and the inequality holds for any \(k_H' \leq 0\).
Finally, $H$ will deviate to equity if the opposite is true:

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

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