Firm Value and Market Liquidity around the Adoption of Common Accounting Standards

Pingyang Gao
Booth School of Business
The University of Chicago
pingyang.gao@chicagobooth.edu

Xu Jiang
Fuqua School of Business
Duke University
xu.jiang@duke.edu

Gaoqing Zhang
Carlson School of Management
University of Minnesota
zhangg@umn.edu

*We are grateful for comments from Michael Brennan, Tim Baldenius, Qi Chen, Hans Christensen, Phil Dybvig, Christian Leuz, Pierre Liang, Katherine Schipper, Luo Zuo and workshop participants at Columbia, Duke, the University of Chicago, University of Minnesota, and SWUFE. All errors are our own. Pingyang Gao gratefully acknowledges financial support from the University of Chicago Booth School of Business, the Centel Foundation/Robert P. Reuss Faculty Research Fellowship, and the PCL Faculty Scholarship. Xu Jiang gratefully acknowledges financial support from the Duke University Fuqua School of Business and the Center for Financial Excellence.
Abstract

We study firm value and market liquidity when firms adopt common accounting standards. The adoption has two features. On the one hand, it has a precision effect of directly changing the quality of financial reports. On the other hand, it generates a network effect: when firms use the same standards, information processors can leverage their knowledge about the standards to process more financial reports. Embedding these two features into the economic framework of Baiman and Verrecchia (1995, 1996), we identify the mechanisms through which the adoption affects the firm value and market liquidity of both the switcher and the early adopter. By explicating both the precision and network effects in one model, we provide empirical implications that reconcile existing results and help address the identification challenge in the empirical literature on IFRS adoption.

JEL classification: M41, G15

Key words: Reporting Quality, Network Effect, Information Processing, Firm Value, Liquidity, International Financial Reporting Standards (IFRS)
1 Introduction

In 2002 the European Union (EU) mandated International Financial Reporting Standards (IFRS) for all companies listed on the main European stock exchanges in 2005. Since then hundreds of thousands of firms in over 100 countries have switched to IFRS, and yet many are still contemplating (De George, Li, and Shivakumar (2016)). This common switch to IFRS is possibly the largest regime change in accounting history to date. A vast empirical literature has followed to examine how IFRS adoption is associated with various capital market outcomes.\(^1\)

The empirical literature has informally relied on two mechanisms to predict the economic consequences of IFRS adoption. First, IFRS adoption can either increase or decrease the precision of a firm’s financial reports. Second, the adoption generates a network effect. It is costly to process financial reports (e.g., Kim and Verrecchia (1994, 1997), hereafter KV) and one part of the cost is to learn about accounting standards. The adoption of IFRS means that more firms from different countries prepare their financial reports under the same standards. This increases their comparability and lowers the cost for investors to process the financial reports.

How do we link the precision and network effects to the various capital market outcomes documented in the empirical literature? The theoretical endeavor on the economic consequences of IFRS adoption has been sparse, which is perhaps surprising especially in light of the vast empirical literature and the obvious importance of the topic. This paper intends to fill in this void by incorporating both the precision effect and the network effect into a model that links financial reporting to its economic consequences.

KV is a seminal contribution in understanding how a firm’s financial reporting affects both the public and private information of investors due to their differential abilities to process financial reports. While all investors receive financial reports, it could be costly to better

\(^{1}\)See De George, Li, and Shivakumar (2016) for an extensive review of the empirical literature on IFRS adoption. In addition, Hail, Leuz, and Wysocki (2010) review IFRS studies to determine the implications of US firms potentially switching to IFRS and the focus is on the effects of potential IFRS adoption on reporting quality, costs and the capital market. Leuz and Wysocki (2016) focus more broadly on the economic effects of disclosure regulation and reporting standards that has implications for IFRS adoption. Relatedly, there is also a literature on how IFRS adoption affects performance evaluation, credit ratings and executive turnover (e.g., Wu and Zhang (2009, 2014, 2016).)
analyze financial reports. We extend KV to a multi-standard setting in which the adoption of common standards generates both the precision effect and the network effect.

Specifically, in the model, there are two economies represented by two firms, labeled as the early adopter and the switcher, respectively. The early adopter has already been using the common accounting standards, while the switcher is switching from its local standards to the common standards. Adapting KV to the common financial reporting setting, an information processor can incur a cost to develop standard-specific information processing ability that enables her to glean superior information from financial reports prepared under the corresponding standards.

To link accounting information to firm value and liquidity, we introduce market liquidity and the monitoring role of stock prices by adapting to the economic framework of Baiman and Verrecchia (1995, 1996) (hereafter BV). In each economy, an entrepreneur makes an unobservable investment, issues an accounting report, and then for life-cycle reasons sells his equity stake in an imperfectly competitive market a la Kyle (1985). The market maker, who receives the public information and observes the aggregate order flow from both information processors and liquidity investors but cannot distinguish between the two, sets the stock price equal to the expected firm value. A fraction of information processors’ superior information is impounded into the stock price through the trading process. By affecting the stock price informativeness, the accounting standards choice is linked to the firm value and the liquidity.

We obtain two main results. First, the effect of adopting common accounting standards on firm value and liquidity is ambiguous. The adoption can lead to a higher firm value and liquidity even if it reduces the switcher’s reporting quality. Second, the switcher’s adoption of the common standards generates an unambiguously positive externality for the early adopter that increases both of its firm value and liquidity.

The key economic intuition behind our results lies in the two effects of the common standards adoption: the precision effect and the network effect. First, the switcher’s adoption of the common standards directly affects the information quality of its report. Second, the adoption also generates the network effect. After the adoption, the switcher uses the same common standards as the early adopter. Information processors versed in the early adopter’s
standards can leverage their information processing ability to trade in the switcher’s stock. The increased profitability from understanding the common standards attracts more investors to analyze the switcher’s reports and the increased competition among them impounds more information into the stock price. Moreover, the network effect becomes even stronger for the switcher as the early adopter’s relative size increases.

The interaction between the precision effect and the network effect ultimately determines the overall economic consequences of adopting the common accounting standards. When only the precision effect is present, a necessary condition for the adoption to improve firm value and liquidity is that the common standards are more precise than the local standards. Adopting more precise common accounting standards improves the stock price informativeness and mitigates the information asymmetry between the market maker and the information processors. These two informational effects lead to higher firm value and liquidity, respectively. However, in the presence of both the precision effect and the network effect, the adoption can still lead to a higher firm value and liquidity even if the accounting standards precision decreases after the adoption. As the adoption’s network effect expands the base of information processors, the resulting higher stock price informativeness always improves the switcher’s firm value and liquidity. This benefit from the network effect partly compensates for the cost from adopting less precise common standards, making the measurement error in the common standards more tolerable. This explains our first result on the adoption’s ambiguous effect on the switcher.

As for the early adopter, the adoption does not directly affect the reporting precision but instead, through its network effect, expands the base of information processors in the common standards. Therefore, while the information processors’ information precision is the same, a larger fraction of that information is impounded in the stock price. The improvement in the stock price informativeness in turn increases both firm value and liquidity of the early adopter. This explains our second result.

Our analyses provide some implications for the empirical literature on IFRS adoption. A chief implication is that, in the presence of both the precision effect and the network effect, the economic consequence of adopting common accounting standards on switching firms is
ambiguous. Therefore, our analysis cautions against making unequivocal claims in empirical studies regarding the association between common accounting standards adoption and various capital market outcomes of switching firms. Specifically, our result predicts that the common accounting standards adoption could lead to positive capital market outcomes even if it reduces the financial reporting quality. This result may help reconcile the empirical findings of both lower financial reporting quality and improved capital market outcomes associated with IFRS adoption (e.g., Ahmed, Neel, and Wang (2013), Barth, Landsman, Lang, and Williams (2012), De George, Li, and Shivakumar (2016)). Another empirical implication is that the common accounting standards adoption generates a positive externality for the early adopter and improves its firm value and liquidity unambiguously. Furthermore, the magnitude of this externality is strictly decreasing in the relative size of the early adopter to the switcher. Finally, our results also have implications for the identification challenge in the IFRS literature, which we will elaborate in Section 5. A key identification difficulty is that IFRS adoption often occurs at the same time as other regulatory changes that also affect the quality of financial reporting. To the extent that the network effect is a more salient feature of IFRS adoption than of other confounding changes, the difference between the precision effect and the network effect that our model explicates may present researchers an opportunity to better identify the economic consequences of IFRS adoption.

While we use the adoption of IFRS as our motivating setting, the insights of our model can be applied to a variety of settings with a staggered adoption of accounting rules/standards. For example, it can be applied to a setting where accounting standards offer firms a choice between Accounting Treatment A and Accounting Treatment B, with some firms choosing to adopt Treatment A early and some waiting to consider adopting it later (examples include fair value option for financial instruments and SFAS 106 accounting for postretirement benefits other than pensions). It can also be applied to a setting where the SEC requires firms to adopt Disclosure Format A or Disclosure Format B for certain types of information (e.g., the Financial Reporting Release No. 48 on disclosure about market risk in firms' financial

\footnote{From a practical perspective, it should be the relative size of the adopting group of firms as compared to the existing adopters. While, for simplicity we only model a single adopting firm in our setting, our analyses also extend qualitatively when there are many adopting firms.}
instrument portfolios provides considerable latitude in disclosure presentation for firms). Our model predicts that some firms would adopt the disclosure choice or accounting treatment that may not be the most precise for their purposes, but offers the greatest network benefits (e.g., because lots of other firms have already adopted that treatment/format).

We contribute to the literature on global financial reporting. While this literature is vast, theoretical analysis has been sparse. Ours is closely related to Barth, Clinch, and Shibano (1999) who extend KV to study the economic consequences of harmonizing domestic GAAP with foreign GAAP. Using a variant of the model in Grossman and Stiglitz (1980), Barth, Clinch, and Shibano (1999) study investors’ information acquisition and trading decisions and the effects of accounting standards harmonization on various price efficiency measures. Like Barth, Clinch, and Shibano (1999), we also exploit the observation that harmonization (adoption) reduces investors’ cost of processing financial reports. Our paper complements Barth, Clinch, and Shibano (1999) in three ways. The first two follow the suggestions in Verrecchia (1999) who discusses Barth, Clinch, and Shibano (1999). First, we use a model with imperfect competition to study the effects of the adoption on liquidity. Second, we adapt to the economic framework in BV to link accounting information to both firm value and liquidity, two major variables of empirical interest. Finally, even though there are two countries in their model, Barth, Clinch, and Shibano (1999) only analyze investors’ trading decisions on domestic firms, making it effectively a single-country setting. In contrast, we explicitly study investors’ trading in both countries.

Another paper on IFRS adoption is Ray (2012) who builds a model of neoclassical production to draw implications for IFRS adoption. Common standards lower investors’ cost of accessing the capital market, increase the total capital supply, and lower the cost of capital. The downside of common standards is that it increases firms’ compliance costs. The trade-off leads to ambiguous net welfare. Ray (2012) incorporates neither information-based capital market trading nor the explicit use of information in monitoring managerial actions.

The paper proceeds as follows. Section 2 articulates the model setup. Section 3 solves the equilibrium. Section 4 explicates the network effect and the precision effect and examines the economic consequences of the switcher’s adoption of the common accounting standards.
We focus on firm value and liquidity for both the switcher and the early adopter. In Section 5 we elaborate our model’s empirical implications. Section 6 concludes.

2 The model

We compare-and-contrast two otherwise identical economies with two firms that are also identical except for their relative size. In both economies there is an early adopter of common accounting standards. However, in the first economy the second firm (denoted as the switcher) has already switched to common standards, whereas in the second economy the switcher has not-as-yet switched and thus uses local standards. We then compare-and-contrast two endogenous features of both firms in the two economies, firm value and liquidity.

We start by adapting to the framework in KV and BV to link firm value and liquidity to accounting standards. We then augment the model with the network effect to study the economic consequences of adopting common accounting standards. In our analysis, there are two endogenous features of the economies that interest us:

- the value of the firm, where we represent the firm value by the firm’s terminal cash flow net of investment cost;
- the liquidity of the firm, where we represent the liquidity by the inverse of the effect of order flow on the price for shares in the firm.

All other calculations in the analysis are intermediate results that will ultimately allow us to characterize the value of the firm and liquidity in a firm’s shares in equilibrium.

Specifically, consider first the switcher, indexed as $S$. The firm’s entrepreneur chooses unobservable investment $K_S$ at $t = 0$ and for life cycle reason needs to sell the firm at $t = 1$ at price $p_S$ that will be endogenously determined. The firm’s terminal cash flow at $t = 2$ is

$$ v_S = K_S + \theta_S. \tag{1} $$

$K_S$ is the entrepreneur’s investment choice. The investment costs the entrepreneur privately $\frac{\gamma^2}{2} K_S^2$. $\theta_S \sim N(0, \sigma_\theta^2)$ is the portion of firm $S$’s cash flow that is orthogonal to the
entrepreneur’s investment. We call $\theta_S$ firm $S$’s fundamental for ease of reference. $\sigma_S^2$ is the uncertainty about the firm’s fundamental. In sum, the entrepreneur’s expected payoff, which is also the ex-ante firm value, is given by

$$V_S = E_0[p_S] - \frac{\kappa}{2}K_S^2.$$  

(2)

Next, we follow KV to introduce investors’ processing of financial reports. Specifically, at $t = 1$, the firm issues its report under the governing accounting standards:

$$r_S = v_S + \varepsilon_S.$$  

(3)

$v_S$ is the terminal cash flow. $\varepsilon_S \sim N(0, \sigma_S^2)$ represents the measurement error of the accounting standards. $\sigma_S^2$ depends on whether the firm switches to common standards or uses local standards. By varying $\sigma_S^2$ when the firm switches to the common standards, we accommodate the possibility that adopting the common standards can either increase or decrease the measurement error.³

Anticipating the release of the financial report at $t = 1$, investors decide at $t = 0$ whether to acquire, at a cost $c$, the ability to process financial reports. We call an investor who has the ability to process financial reports as an information processor. Denote the number of information processors in firm $S$ as $N_S$. In addition to the report $r_S$, an information processor observes a signal $O_S$ about the measurement error of the firm’s accounting report:

$$O_S = \varepsilon_S + \eta_S,$$  

(4)

where $\eta_S \sim N(0, \sigma^2)$. The market maker and other investors who have not acquired the

³It has been documented empirically that accounting standards are different in their precision. Barth and Clinch (1996) show that the reconciliation to US GAAP provides additional information about UK and Canadian firms. Barth, Landsman, and Lang (2008) find that reporting quality (proxied by earnings management, timely loss recognition and value relevance) becomes higher after firms voluntarily adopt IAS relative to firms using non-U.S. local GAAPs (see also Chalmers, Clinch, and Godfrey (2011)). In contrast, Capkun, Collins, and Jeanjean (2016) show that IFRS adoption increases earnings management and they attribute this adverse effect to IFRS’ flexibility, which is necessary for accommodating a wide array of heterogeneous countries (see also Leuz (2003) and Christensen, Lee, Walker, and Zeng (2015)). After reviewing the literature, De George, Li, and Shivakumar (2016) conclude that studies on mandatory IFRS adoption provide “at best, mixed evidence that adoption improves the quality of accounting reports.”
ability to process financial reports receive no additional information from accounting reports. In sum, the information processors’ information set is \( \{ r_S, O_S \} \), while the market maker and other investors’ information set is \( \{ r_S \} \).

At \( t = 2 \), the stock market opens and investors trade. There are three types of investors participating in trades. First, each information processor submits a demand order \( d_S \) as a function of her information \( r_S \) and \( O_S \). We omit the index for individual information processors since they trade in a symmetric way. As is standard in the literature, non-information-processors without liquidity needs do not trade. Second, the liquidity traders trade for reasons orthogonal to the firm’s fundamentals. The aggregate order from liquidity traders is \( \xi_S \sim N(0, \sigma^2_{\xi_S}) \). \( \sigma^2_{\xi_S} \) measures a capital market’s size and depth, following Holmstrom and Tirole (1993). Finally, the market maker observes the total order flow \( q_S = N_S d_S + \xi_S \) and sets stock price \( p_S \) to break even:

\[
p_S = E[v_S | r_S, q_S].
\]

So far our model is a fairly standard one that combines KV and BV. We now augment it to incorporate the network effect. Towards this goal, we expand the single-firm model and introduce the early adopter, indexed as \( E \), that always uses the common accounting standards:

\[
r_E = v_E + \varepsilon_E,
\]

where \( \varepsilon_E \sim N(0, \sigma^2_{\varepsilon_E}) \) represents the measurement error of the early adopter’s report.

The introduction of the early adopter allows investors to trade in both firms. If the switcher adopts the common accounting standards, then both the switcher and the early adopter use the same accounting standards. In this case, an investor can process both firms’ financial reports after incurring cost \( c \) to learn about the common accounting standards. In contrast, if the switcher uses the local standards, then an investor incurs cost \( c \) to learn one accounting standard and an incremental cost of \( \gamma c \) to learn the second standard, with \( \gamma \in [0, 1] \). If \( \gamma = 0 \), then the incremental cost to learning a second standard is zero irrespective of other considerations. Therefore the network effect is absent. We thus focus on the case of \( \gamma > 0 \) to incorporate the network effect. For ease of exposition, we focus on \( \gamma = 1 \) and show in a separate appendix that the main results hold qualitatively for any interior \( \gamma \in (0, 1) \) as
well. Finally, the early adopter’s market size is $\sigma_{E} = \chi \sigma_{S}$ and $\chi \equiv \frac{\sigma_{E}}{\sigma_{S}} \geq 0$ measures the relative size of the early adopter.

In sum, the timeline of the events is as follows.

1. At $t = 0$, each entrepreneur chooses unobservable investment $K_j$ where $j \in \{S, E\}$. Each investor decides whether to incur a cost to become an information processor.

2. At $t = 1$, firm $j$ issues report $r_j$ under its governing accounting standards. An information processor also observes $O_j$.

3. At $t = 2$, the stock market opens and stock price $p_j$ is determined.

4. At $t = 3$, firms pay out.

Our equilibrium consists of each entrepreneur’s investment $K_j$, the number of information processors $N_j$, information processors’ trading decisions $d_j$, and stock price $p_j$, such that

1. Each entrepreneur chooses unobservable $K_j^*$ to maximize $V_j$;

2. Each investor is indifferent between becoming an information processor or not;

3. Given the firms’ reports, each information processor chooses $d_j^*$ to maximize gross trading profit and the market maker sets stock price $p_j^*$ to break even.

The following table provides a list of notations that will be used in the paper.
### Table 1: Notations.

<table>
<thead>
<tr>
<th>$S$</th>
<th>switcher</th>
<th>$E$</th>
<th>early adopter</th>
</tr>
</thead>
<tbody>
<tr>
<td>$K_{ij}$</td>
<td>firm $j$’s investment</td>
<td>$\kappa$</td>
<td>cost of investment</td>
</tr>
<tr>
<td>$\theta_j$</td>
<td>firm $j$’s fundamentals</td>
<td>$v_j$</td>
<td>firm $j$’s terminal cash flow</td>
</tr>
<tr>
<td>$\sigma^2_{\theta}$</td>
<td>variance of $\theta_j$</td>
<td>$V_j$</td>
<td>ex-ante value of firm $j$</td>
</tr>
<tr>
<td>$r_j$</td>
<td>firm $j$’s report</td>
<td>$\varepsilon_j$</td>
<td>measurement error in $r_j$</td>
</tr>
<tr>
<td>$\sigma^2_{\varepsilon_j}$</td>
<td>variance of $\varepsilon_j$</td>
<td>$O_j$</td>
<td>information processor’s signal about firm $j$</td>
</tr>
<tr>
<td>$\eta_j$</td>
<td>measurement error in $O_j$</td>
<td>$\sigma^2_\eta$</td>
<td>variance of $\eta_j$</td>
</tr>
<tr>
<td>$\xi_j$</td>
<td>orders from firm $j$’s liquidity traders</td>
<td>$\sigma^2_{\xi_j}$</td>
<td>size of firm $j$’s capital market</td>
</tr>
<tr>
<td>$\chi$</td>
<td>relative size of early adopter</td>
<td>$p_j$</td>
<td>firm $j$’s price</td>
</tr>
<tr>
<td>$q_j$</td>
<td>total order flow of firm $j$</td>
<td>$d_j$</td>
<td>information processor’s order of firm $j$’s shares</td>
</tr>
<tr>
<td>$\lambda_j$</td>
<td>effect of order flow on firm $j$’s price</td>
<td>$\beta_j$</td>
<td>information processor’s response to information</td>
</tr>
</tbody>
</table>

### 3 The equilibrium

We solve the model by backward induction. To better illustrate the intuition, we first analyze a benchmark case where 1) both firms use common accounting standards and 2) both firms are identical, including identical in size. That is, we assume that $\sigma_{\varepsilon_S} = \sigma_{\varepsilon_E} = \sigma_{\varepsilon}$ and $\sigma_{\xi_S} = \sigma_{\xi_E} = \sigma_{\xi}$ (i.e., $\chi = 1$). Since both firms are symmetric, it is sufficient to analyze one firm. To economize on notations, we suppress the subscript $j$.

We summarize the equilibrium in the following proposition.

**Proposition 1** In the benchmark case, the equilibrium is as follows:

1. an information processor’s demand function $d^* = \beta^*(E[v|r,O] - E[v|r])$ and the market maker’s pricing $p^* = E[v|r] + \lambda^*q$ with the following coefficients:

   \[
   \beta^* = \sqrt{\frac{1}{N^* \tau \sigma^2_{\theta}}} \tag{6}
   \]

   \[
   \lambda^* = \sqrt{\frac{N^* \tau \sigma^2_{\theta}}{(N^* + 1)^2 \sigma^2_{\xi}}} \tag{7}
   \]
2. The equilibrium number of information processors \( N^* \) is determined by

\[
\frac{2\sigma_\xi \sigma_\eta \sqrt{\tau}}{\sqrt{N^*(N^* + 1)}} = c; \tag{8}
\]

3. The equilibrium amount of investment \( K^* \), which is the same for both firms, is

\[
K^* = \frac{\delta + \lambda^* N^* \beta^* \tau}{\kappa}. \tag{9}
\]

\( \{\delta, \tau\} \) are constants defined in the appendix.

The solution techniques used in the benchmark case are fairly standard as in KV and BV. The coefficient \( \beta^* > 0 \) in the information processor’s demand function reflects how aggressively the information processor responds to her private information advantage. A larger \( \beta^* \) indicates more aggressive trading by the information processor. On the other hand, as is standard in the imperfect competition literature of Kyle (1985), the market maker suffers from the adverse selection problem and price-protects herself by taking into account the order flow in setting the price. The equilibrium (il)liquidity thus arises from the information asymmetry between the market maker and the information processors. \( \lambda^* \) measures the extent to which the total net demand order for shares in firm \( j \) (\( q_j \)) affects the price of those shares; this implies that \( \frac{1}{\tau} \) measures the extent to which trade in firm \( j \)’s shares is illiquid.

Next, the equilibrium number of information processors is derived from an indifference condition for investors. The benefit from acquiring information is that the information processor earns positive trading profits in expectation. On the other hand, acquiring information processing ability costs \( c \). Since both firms use the common accounting standards, an investor can incur a single cost \( c \) to be able to process both firms’ accounting reports and thus earn profits from trading in both firms. In equilibrium, the expected trading profit from mastering accounting standards must be equal to the learning cost, which determines the equilibrium number of information processors.

Finally, the entrepreneurs’ optimal investment decisions are chosen to maximize firm value
and determined by the standard first-order condition. As in BV, the entrepreneur’s investment is increasing in the stock price’s responsiveness to his actual investment choice, or stock price informativeness. The reason is as follows. The entrepreneur’s equilibrium investment is lower than the first-best level due to its un-observability. However, this underinvestment problem is mitigated by the stock price informativeness. An improvement in the stock price informativeness leads to more efficient investment and higher firm value. In this sense, the stock price plays a monitoring role.

4 Equilibrium analysis

Now we examine our main research question on the economic consequences of adopting common accounting standards for both the switcher and the early adopter. We proceed in two steps. First, we extend the benchmark case to a more general setting (general setting I) in which both firms use common standards but differ in their sizes. Analyzing such a setting allows us to highlight the network effect of adopting common accounting standards. Second, we extend the benchmark case to another general setting (general setting II) in which the two firms use different standards and differ in their sizes. Comparing this setting with the general setting I characterizes the economic consequences of common accounting standards adoption.

4.1 General setting I: the network effect

In this section, we generalize our benchmark model by allowing the two firms to differ in their sizes, i.e., $\chi \equiv \frac{\sigma E}{\sigma s} \geq 0$. It is straightforward to show that repeating the exercise that involves the benchmark economy results in the following change in characterizing this economy. With the size of the switcher fixed, increasing the relative size of the early adopter (a higher $\chi$) produces a network benefit to the switcher. A larger early adopter allows an information processor to earn more profits from trading in the early adopter’s shares, which encourages more investors to acquire the information processing abilities. As the base of information processors expands, the stock price of the switcher becomes more informative.
The greater stock price informativeness in turn leads to both higher firm value and liquidity for the switcher. We summarize these results in the proposition below.

**Proposition 2 (The network effect)** In the general setting I, the switcher’s firm value and liquidity are both strictly increasing in the early adopter’s size, i.e., \( \frac{\partial V}{\partial x} > 0 \) and \( \frac{\partial}{\partial x} \left( \frac{1}{S_x} \right) > 0 \).

### 4.2 General setting II: the economic consequences of adoption

#### 4.2.1 The switcher’s firm value and liquidity

In this section, we consider another general setting in which the two firms use different standards and differ in their sizes. In particular, we assume that 1) \( \chi \geq 0 \) and 2) under the common standard, the early adopter’s measurement error is \( \sigma_{\hat{\varepsilon}_E} = \sigma_{\hat{\varepsilon}} \) and under the local standard, the switcher’s measurement error is \( \sigma_{\hat{\varepsilon}_S} = (1 + m) \sigma_{\hat{\varepsilon}} \). \( m \) thus captures the relative precision of common accounting standards to that of the local standards. An \( m \geq (<)0 \) indicates that the common accounting standards are more (less) precise than the local accounting standards in reflecting the firm’s fundamentals.

Comparing the general setting II with the general setting I allows us to examine how the switcher’s adoption of the common accounting standards affects its firm value and liquidity. It is straightforward to show that repeating the exercise that involves the benchmark economy results in the following two changes in characterizing the general setting II. First, the switcher’s switch between the local and the common standards directly affects the information quality of its report. We call this a precision effect, which is captured by parameter \( m \). Second, compared to the general setting I, the switcher’s use of the local standards results in a loss of the network benefit. The set of information processors who are vested in the common standards can no longer process the switcher’s financial report. This leads to a smaller base of information processors for the switcher and makes the stock price of the switcher less informative.

The overall effect of the adoption ultimately depends on the interaction between the precision effect and the network effect. We summarize the economic consequences of common accounting standards adoption in the following proposition.
Proposition 3 The impact of common accounting standards on the switcher’s value and liquidity is ambiguous.

The ambiguity of the adoption’s effect stems from the trade-off between the network effect and the precision effect. With only the precision effect, more precise common standards are both sufficient and necessary for their adoption to improve firm value and liquidity. Adopting more precise common accounting standards improves the stock price informativeness and mitigates the information asymmetry between the market maker and the information processors. These two informational effects lead to higher firm value and liquidity, respectively. However, in the presence of both the precision effect and the network effect, the adoption can still lead to a higher firm value and liquidity even if the precision of the accounting standards decreases after the adoption. The underlying intuition is that, as the adoption’s network effect expands the base of information processors, it always improves the switcher’s firm value and liquidity. This benefit from the network effect partly compensates for the cost from adopting less precise common standards, making the measurement error in the common standards more tolerable. In other words, the combination of the network effect and the precision effect makes the overall effect of the common standards adoption ambiguous.

In the following table, we provide a summary of the key determinants of the switcher’s firm value and liquidity under the general setting I where both firms use common standards and the general setting II where the firms use different standards.

<table>
<thead>
<tr>
<th></th>
<th>Firm value/Liquidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different standards</td>
<td>Switcher’s size and local standards’ precision</td>
</tr>
<tr>
<td>Common standards</td>
<td>Total size and common standards’ precision</td>
</tr>
</tbody>
</table>

Table 2: Determinants of the switcher’s firm value and liquidity.

4.2.2 The externality for the early adopter

Another benefit often argued in support of the common accounting standards adoption is that it can create an externality to other firms/countries that have already adopted the common accounting standards. To gauge the externality, we examine the effects of the switcher’s adoption of the common accounting standards on the value and liquidity of the
early adopter. Notice that such an externality would be moot in the presence of only the precision effect. This is because, to the early adopter, the new adoption of the common standards by other firms does not directly affect its reporting precision (i.e., the precision effect for the early adopter is absent). However, the adoption generates the network effect. The network effect expands the base of information processors who trade in the early adopter, which leads to both a higher firm value and better liquidity. We state these results in the following proposition.

**Proposition 4** The common accounting standards adoption increases both the firm value and the liquidity of the early adopter unambiguously.

An implication of Propositions 4 is that mandating the adoption of the common accounting standards may be desirable to the extent that each firm/country cannot internalize the benefit of its adoption of the common accounting standards for others.\(^4\)

We also examine how the switcher’s adoption of the common accounting standards affects the joint value of the switcher and the early adopter. Propositions 3 and 4 have established that common accounting standards adoption always improves the value of the early adopter but the effect on the value of the switcher is ambiguous. A direct implication is that the effect of common accounting standards adoption on the joint firm value is also ambiguous, as stated in the following corollary.

**Corollary 1** The impact of common accounting standards on the joint firm value is ambiguous.

5 The empirical implications

In our main analysis, we have formalized both the precision effect and the network effect of common accounting standards adoption in one coherent model. One chief empirical implication from our analysis is that, in the presence of both the precision effect and the network

\(^4\)It is noteworthy that this result is consistent with the conjecture in section 4.4 of Barth, Clinch, and Shibano (1999). However, they do not provide a formal proof whereas we directly show that this is due to the network effect which is absent in Barth, Clinch, and Shibano (1999).
effect, the economic consequence of adopting common accounting standards on switching firms is ambiguous. Therefore, our analysis cautions against making unequivocal claims in empirical studies regarding the association between common accounting standards adoption and various capital market outcomes of switching firms. For concreteness, we state this implication as follows.

**Result 1** *If the adoption of common accounting standards improves the switcher’s financial reporting quality, it always improves both the firm value and liquidity of the switcher; if the adoption of common accounting standards reduces the switcher’s financial reporting quality, it can still improve both the firm value and liquidity of the switcher as long as the switcher is small relative to the adopter.*

Another implication from our analysis is an unambiguous prediction on the economic consequences of common accounting standards adoption on early adopters, as summarized in Result 2.

**Result 2** *The adoption of common accounting standards generates a positive externality for both the firm value and liquidity of the early adopter. Moreover, the magnitude of the externality is decreasing in the relative size of the early adopter to the switcher.*

As we have discussed in the introduction, both Result 1 and Result 2 can be applied to a variety of settings, including staggered adoptations of accounting methods and disclosure formats. To be more specific, we elaborate the implications of our model for IFRS adoption as an example.

First, Result 1 can help reconcile two seemingly puzzling findings in the IFRS literature. On the one hand, many empirical studies report that IFRS adoption can either increase or decrease the quality of financial reporting, as discussed in Footnote 3. On the other hand, there has also been strong evidence that capital market outcomes improve after IFRS adoption, as concluded in the reviews by De George, Li, and Shivakumar (2016) and Leuz and Wysocki (2016). Thus, in the absence of the network effect, it may seem puzzling to observe both lower financial reporting quality and improved capital market outcomes.
after the adoption. Result 1 shows that the joint consideration of both the precision effect and the network effect can reconcile the above findings. That is, with the network effect, IFRS adoption could lead to positive capital market outcomes even if it reduces the financial reporting quality.

Second, Result 2 characterizes the unambiguously positive externality for the early adopter due to the network effect. In the IFRS literature, a few studies have begun to explore the network effect and the empirical evidence so far is generally consistent with Result 2. For example, Ramanna and Sletten (2014) find that the perceived benefits for IFRS adoption increases as more jurisdictions with economic ties to that country adopt IFRS. Amiram (2012) finds that investors from countries that use IFRS increase investments in other IFRS-adopting countries compared with countries that do not use IFRS. Daske, Hail, Leuz, and Verdi (2008) and Christensen, Hail, and Leuz (2013) have also run auxiliary tests related to these predictions about the liquidity.

Third, the combination of Result 1 and Result 2 contrasts the network effect with the precision effect, which may provide a way to partially address an identification challenge in the empirical IFRS literature. More specifically, while the empirical evidence about the association between IFRS adoption and significant capital market consequences has accumulated, it is still hotly debated whether these consequences are attributable to IFRS adoptions.\(^5\) One source of this identification difficulty is that IFRS adoption often occurs at the same time as other institutional and market changes that may also affect the quality of financial reporting.\(^6\) To the extent that the network effect is arguably a more salient feature of IFRS adoption than of other confounding changes, the difference between the precision effect and the network effect may present researchers an opportunity to better address this identification difficulty. In particular, Result 1 and Result 2 indicate that the following empirical phenomena are more

---

\(^5\) For example, Leuz and Wysocki (2016) claim that “(t)he capital-market effects are best described as effects that occur around the time of or after IFRS adoption, but they are not necessarily effects of IFRS adoption.” For another example, De George, Li, and Shivakumar (2016) state that “(m)ore recent studies attempt to narrow down the sources of the observed benefits of IFRS adoption and conclude that at least some of the earlier documented benefits are not driven by the adoption of new accounting standards per se.”

\(^6\) The range of institutional variables that affect financial reporting quality is large, including the legal system, property protection, tax codes, other aspects of securities regulations such as corporate governance, enforcement, culture and social norms. Isidro, Nanda, and Wysocki (2016) show that at least 70 country-level institutional variables have explanatory power for reporting and disclosure outcomes around the world.
suggestive about the effects of IFRS adoption (than about other concurrent changes):

1. the improvement for the switcher is decreasing in its relative size to the early adopters cross-sectionally;

2. the adoption leads to a positive externality for the early adopters;

3. for the switcher, the adoption improves the firm value and liquidity, but at the same time reduces the financial reporting quality.

6 The conclusion

We study the economic consequences of adopting common accounting standards. Adopting common accounting standards has two features. First, the common standards may be more or less precise than the local accounting standards in faithfully representing firms’ financial conditions and performance. Second, the adoption generates a network effect because investors who are able to process the common accounting standards can leverage this expertise to process all financial reports prepared under the same standards. Incorporating these two features in the economic framework of BV, we show that the adoption of the common standards may increase the switcher’s firm value and liquidity even when the common standards are less precise than the local standards. In addition, we also show that the switcher’s adoption unambiguously benefits the early adopters in terms of higher firm value and better liquidity.

Appendix: Proofs

Proof. of Proposition 1: Since two firms are symmetric, we suppress the subscript $j$. We first conjecture the following symmetric linear demand function for the information processor $k \in SI$, where $SI$ represents the set of information processors:

$$d_k = \beta(E[v|r, O] - E[v|r]),$$

(10)
and the following linear pricing rule,

\[ p = E[v|r] + \lambda q \]
\[ = E[v|r] + \lambda (d_k + \sum_{k'=SI, k' \neq k} d_{k'}) + \xi. \]  

(11)

Given the price \( p \), an information processor \( k \)'s profit from trading can be written as

\[ E[d_k(v - p)|r, O] = E[d_k(v - E[v|r] - \lambda q)|r, O] \]
\[ = d_k \left\{ E[v|r, O] - E[v|r] - \lambda \left[ d_k + E[\sum_{k'=SI, k' \neq k} d_{k'}]|r, O]\right]\right\}. \]  

(12)

Taking the first-order condition results in

\[ 2d_k \lambda = E[v|r, O] - E[v|r] - \lambda E[\sum_{k'=SI, k' \neq k} d_{k'}]|r, O]. \]  

(13)

Given the symmetry, i.e., \( d_{k'} = d_k \ \forall k' \in SI \),

\[ 2d_k \lambda = E[v|r, O] - E[v|r] - \lambda (N-1)d. \]  

(14)

Solving the equation gives

\[ d_k = \frac{E[v|r, O] - E[v|r]}{(N+1)\lambda}. \]  

(15)

That is, we have verified our linear conjecture of \( d_k = \beta (E[v|r, O] - E[v|r]) \) and matching coefficient gives:

\[ \beta = \frac{1}{(N+1)\lambda}. \]  

(16)

We now derive the optimal pricing rule. Writing out the conjectured pricing rule in equation (11) results in

\[ p = E[v|r] + \lambda q \]
\[ = E[v|r] + \lambda (Nd_k + \xi) \]
\[ = E[v|r] + N \lambda d_k + \lambda \xi \]
\[ = E[v|r] + \frac{N}{N+1}(E[v|r, O] - E[v|r]) + \lambda \xi. \]  

(17)

The fourth step follows by substituting in equation (10) and equation (16).

Standard Bayesian updating gives the expressions for \( E[v|r] \) and \( E[v|r, O] \):

\[ E[v|r] = \delta r + (1-\delta) K^*, \]  

(18)

\[ E[v|r, O] = \phi r + (1-\phi) K^* - \mu O, \]  

(19)

where \( \delta = \frac{\sigma_\theta^2}{\sigma_\theta^2 + \sigma_\eta^2} \), \( \phi = \frac{1}{\sigma_\theta^2 + \frac{1}{\sigma_\eta^2} + \frac{1}{\sigma_y^2}} \) and \( \mu_j = \frac{1}{\sigma_\theta^2 + \sigma_\eta^2 + \sigma_j^2} \). Plugging in the expressions of \( E[v|r] \)
and $E[v|r,O]$, we can simplify $p$ in equation (17) and $q = N\beta(E[v|r,O] - E[v|r]) + \xi$ into:

$$p = \frac{N}{N+1} [\phi r + (1 - \phi)K^* - \mu O] + \frac{1}{N+1} [\delta r + (1 - \delta) K^*] + \lambda \xi, \quad (20)$$

$$q = N\beta(E[v|r,O] - E[v|r]) + \xi = N\beta \tau (r - K^*) - N\beta \mu O + \xi, \quad (21)$$

where

$$\tau \equiv \phi - \delta = \frac{\sigma^2}{\sigma^2 + 2 \sigma^2 \frac{1}{\sigma^2} + \frac{1}{\sigma^2} + \frac{1}{\sigma^2}} = \frac{\sigma^4}{\sigma^4 + \sigma^4 \sigma^2 + \sigma^2 \sigma^4 + \sigma^2 \sigma^2} = (1 - \delta) \mu. \quad (22)$$

The equilibrium condition requires that the market maker sets the price equal to the expected firm value:

$$p = E[v|r,q]. \quad (23)$$

Standard Bayesian updating gives

$$p = E[v|r,q] = E[v|r] + \frac{cov(v,q|r)}{var(q|r)} (q - E[q|r]) = E[v|r] + \frac{var(v|r) - var(v|r,q)}{cov(v,q|r)} q. \quad (24)$$

The second step follows because $E[q|r] = N\beta(E[v|r,O]|r] - E[v|r]) + E[\xi|r] = 0$. The last step is due to the equality that

$$var(v|r,q) = var(v|r) - \frac{cov(v,q|r)^2}{var(q|r)}. \quad (25)$$

Matching coefficients with $p = E[v|r] + \lambda q$ gives:

$$\lambda = \frac{var(v|r) - var(v|r,q)}{cov(v,q|r)} = \frac{var(v|r) - var(v|r,q)}{N\beta \tau \sigma^2} = \frac{\rho}{N\beta}. \quad (26)$$
The second step uses

\[
\text{cov}(v, q|r) = \text{cov}(v, q) - \text{cov}(E[v|r], E[q|r])
\]

\[
= \text{cov}(v, q) - \frac{\text{cov}(v, r) \text{cov}(r, q)}{\text{var}(r)}
\]

\[
= N\beta\tau\sigma_\theta^2 - \sigma_\theta^2 \text{cov}(N\beta\tau(r - K^*) - N\beta\mu O + \xi, r)
\]

\[
= N\beta\tau\sigma_\theta^2 - \sigma_\theta^2 \frac{N\beta\tau \text{var}(r) - N\beta\mu \text{var}(\varepsilon)}{\text{var}(r)}
\]

\[
= N\beta\tau\sigma_\theta^2 - \sigma_\theta^2 \frac{N\beta\tau \text{var}(r) - N\beta\mu \text{var}(\varepsilon)}{\text{var}(r)}
\]

\[
= N\beta\tau\sigma_\theta^2.
\]

The last step defines the fraction of the information processors' information that is impounded in the equilibrium stock price as

\[
\rho \equiv \frac{\text{var}(v|r) - \text{var}(v|r, q)}{\text{var}(v|r) - \text{var}(v|r, O)} = \frac{\text{var}(v|r) - \text{var}(v|r, q)}{\tau \sigma_\theta^2},
\]

(28)

and uses

\[
\text{var}(v|r, O) = (1 - \phi) \sigma_\theta^2,
\]

(29)

\[
\text{var}(v|r) = (1 - \delta) \sigma_\theta^2.
\]

(30)

Plugging equation (16) into (26), we obtain

\[
\rho = \frac{N}{N + 1}.
\]

(31)

We now derive \( \beta \) and \( \lambda \) from the definition of \( \rho \):

\[
\rho = \frac{\text{var}(v|r) - \text{var}(v|r, q_j)}{\tau \sigma_\theta^2}
\]

\[
= \frac{N^2\beta^2 \tau \sigma_\theta^2}{N^2\beta^2 \tau \sigma_\theta^2 + \sigma_\xi^2}.
\]

(32)

The second step uses equations (25) and (29). Therefore, solving \( \beta \) gives

\[
\beta = \frac{1}{N} \sqrt{\frac{\sigma_\xi^2 \rho}{(1 - \rho) \tau \sigma_\theta^2}}.
\]

(33)
Plugging in $\rho = \frac{N}{N+1}$, we obtain that

$$\beta^* = \sqrt{\frac{1 \sigma^2}{N \tau \sigma^2_\theta}},$$

$$\lambda^* = \sqrt{\frac{N \tau \sigma^2_\theta}{(1 + N)^2 \sigma^2_\xi}}.\quad (34)$$

Conditional on the information set \{r, O\}, the expected profit to an information processor from trading in each firm is

$$E[d^*(v - p^*)|r, O] = E[d^*(v - E[v|r] - \lambda^* q)|r, O]$$

$$= E[d^*(v - E[v|r] - N \lambda^* d^*)|r, O]$$

$$= d^*(E[v|r, O] - E[v|r]) - N \lambda^*(d^*)^2$$

$$= d^* \frac{d^*}{\beta^*} - N \lambda^*(d^*)^2$$

$$= (N + 1) \lambda^*(d^*)^2 - N \lambda^*(d^*)^2$$

$$= \lambda^*(d^*)^2.\quad (36)$$

In the second-to-last step, we use equation (16). The ex-ante expected profit from trading in each firm is

$$\pi^* = \lambda^* E[(d^*)^2]$$

$$= \lambda^* (\beta^*)^2 E[E[v|r, O] - E[v|r]]^2$$

$$= \lambda^* (\beta^*)^2 \text{var} (E[v|r, O] - E[v|r])$$

$$= \lambda^* (\beta^*)^2 \tau \sigma^2_\theta$$

$$= \frac{\sigma_\xi \sigma_\theta \sqrt{\tau}}{\sqrt{N(N + 1)}}.\quad (37)$$

In the last step, we use equations (6) and (7). Setting $2\pi^* = c$ results in

$$\frac{2 \sigma_\xi \sigma_\theta \sqrt{\tau}}{\sqrt{N^2(N^2 + 1)}} = c.\quad (38)$$

Finally, an entrepreneur choose $K$ to maximize

$$V = E_0[p^*] - \frac{K}{2} K^2.\quad (39)$$

Recall that the price $p^* = E[v|r] + \lambda^* q$ is a linear combination of a base belief of the terminal cash flow by non-information-processors, $E[v|r]$, and an adjustment for the total order flow, $q = N^* \beta^*(E[v|r, O] - E[v|r]) + \xi$. Plugging the total order flow into $p^*$ and writing out the
expectations give that

\[
p^* = \delta r + (1 - \delta) K^* + \lambda^* N^* \beta^* \phi r + (1 - \phi) K^* - \mu O - \delta r - (1 - \delta) K^* + \lambda^* \xi
\]

adjustment for order flow

\[
= \delta r + (1 - \delta) K^* + N^* \beta^* \tau (r - K^*) - N^* \lambda^* \beta^* \mu O + \lambda^* \xi. \tag{40}
\]

Given the report \( r = v + \varepsilon \), rearranging terms gives \( p^* \) as a signal of \( v \):

\[
p^* = (N^* \lambda^* \beta^* \tau + \delta) v + (1 - \delta - (N^* \lambda^* \beta^* \tau)) K^* - N^* \lambda^* \beta^* \mu O + \lambda^* \xi + (N^* \lambda^* \beta^* \tau + \delta) \varepsilon. \tag{41}
\]

Plugging in the expressions for \( \lambda^* \) and \( \beta^* \), we simplify \( p^* \) into

\[
p^* = \left( \frac{\nu^*}{N^* + 1} + \delta \right) v + \left( 1 - \nu^* \frac{N^*}{N^* + 1} \right) K^* - \frac{N^*}{N^* + 1} \mu O + \lambda^* \xi + \left( \frac{\nu^*}{N^* + 1} + \delta \right) \varepsilon. \tag{42}
\]

Plugging the expression of \( p^* \) into the entrepreneur’s objective function gives that

\[
E_0[p^* | K] - \frac{1}{2} \kappa K^2
\]

\[
= \left( \frac{\nu^*}{N^* + 1} + \delta \right) K^* + \left( 1 - \nu^* \frac{N^*}{N^* + 1} \right) K^* - \frac{1}{2} \kappa K^2. \tag{43}
\]

Taking the first-order condition results in

\[
K^* = \frac{1}{\kappa} \left( \frac{\nu^*}{N^* + 1} + \delta \right) < \frac{1}{\kappa}. \tag{44}
\]

The last inequality is due to \( \tau \frac{N^*}{N^* + 1} + \delta = \frac{N^*$}{N^*+1} \phi + \frac{1}{N^*+1} \delta < 1 \).

The equilibrium ex-ante firm value

\[
V^* = E_0[p^* | K^*] - \frac{1}{2} \kappa (K^*)^2 = K^* - \frac{1}{2} \kappa (K^*)^2. \tag{45}
\]

\[\blacksquare\]

**Proof.** of Proposition 2: We first prove that \( \frac{\partial V^*_S}{\partial \chi} > 0 \). This is because, from Proposition 1, \( V^*_S \) is strictly increasing in \( K^*_S = \frac{\nu^*}{N^*+1} \tau S + \delta S \). In addition, since \( N^*_S \) is defined by

\[
\frac{(\chi + 1)\varphi_\xi \sigma_\theta \sqrt{\tau}}{\sqrt{N^*_S(N^*_S + 1)}} = c. \tag{46}
\]

\( N^*_S \) is increasing in \( \chi \). Therefore, \( V^*_S \) is increasing in \( \chi \).
Next, we prove that rove that \( \frac{\partial}{\partial \chi} \left( \frac{1}{\lambda_S^*} \right) > 0 \). All else equal, \( \frac{1}{\lambda_S^*} = \frac{N_S^* + 1}{\sqrt{N_S^*}} \frac{\sigma_{\xi_S}^2}{\tau_S \sigma_{\theta}^2} \) is strictly increasing in \( \chi \) because it is increasing in \( N_S^* \), which is, in turn, strictly increasing in \( \chi \).

**Proof.** of Proposition 3: From Proposition 1, the equilibrium investment of the switcher is given by

\[
K_S^* = \frac{1}{\kappa} \left( \tau_S \frac{N_S^*}{N_S^* + 1} + \delta_S \right). \tag{47}
\]

We claim that there exist some thresholds \( \{m^*, \chi^*\} \) such that for \( m \geq m^* \), \( K_{S,A}^* \geq K_{S,NA}^* \) and for \( m < m^* \), \( K_{S,A}^* < K_{S,NA}^* \) if \( \chi < \chi^* \). The subscript \( A \) and \( NA \) refers to adoption and no adoption, respectively. Similarly, recall that the liquidity of the switcher is given by

\[
1 \lambda_S^* = \frac{N_S^* + 1}{\sqrt{N_S^*}} \frac{\sigma_{\xi_S}^2}{\tau_S \sigma_{\theta}^2}. \tag{48}
\]

We claim that there exist some thresholds \( \{\hat{m}, \hat{\chi}\} \) such that for \( m \geq \hat{m} \), \( \frac{1}{\lambda_{S,A}^*} \geq \frac{1}{\lambda_{S,NA}^*} \) and for \( m < \hat{m} \), \( \frac{1}{\lambda_{S,A}^*} < \frac{1}{\lambda_{S,NA}^*} \) if \( \chi < \hat{\chi} \).

We prove our claims in two steps. In step 1, we first prove that both \( K_{S,A}^* - K_{S,NA}^* \) and \( \frac{1}{\lambda_{S,A}^*} - \frac{1}{\lambda_{S,NA}^*} \) are strictly increasing in \( m \). In step 2, we evaluate \( K_{S,A}^* - K_{S,NA}^* \) and \( \frac{1}{\lambda_{S,A}^*} - \frac{1}{\lambda_{S,NA}^*} \) at some extreme values of \( m \) and apply the intermediate value theorem to prove our claims.

**Step 1:** Notice that since \( m \) only affects the precision of the local standards, both \( K_{S,A}^* \) and \( \frac{1}{\lambda_{S,A}^*} \) (when both firms use the common standards) are independent of \( m \). Thus to show that both \( K_{S,A}^* - K_{S,NA}^* \) and \( \frac{1}{\lambda_{S,A}^*} - \frac{1}{\lambda_{S,NA}^*} \) are strictly increasing in \( m \), it suffices to prove that both \( K_{S,NA}^* \) and \( \frac{1}{\lambda_{S,NA}^*} \) are strictly decreasing in \( m \).

We first prove that \( \frac{\partial K_{S,NA}^*}{\partial m} < 0 \). This is because,

\[
K_{S,NA}^* = \frac{1}{\kappa} \left[ \frac{N_{S,NA}^*}{N_{S,NA}^* + 1} \tau_{S,NA} + \delta_{S,NA} \right]
\]

\[
= \frac{1}{\kappa} \left[ \frac{\phi_{S,NA} - \tau_{S,NA} N_{S,NA}^*}{N_{S,NA}^* + 1} \right]
\]

\[
= \frac{1}{\kappa} \left\{ \phi_{S,NA} - N_{S,NA}^* \left( \frac{c}{\sigma_{\xi_S} \sigma_{\theta}} \right)^2 \right\}. \tag{49}
\]

The third step uses

\[
\frac{\sigma_{\xi_S} \sigma_{\theta} \sqrt{\tau_{S,NA}}}{\sqrt{N_{S,NA}^* (N_{S,NA}^* + 1)}} = c. \tag{50}
\]

Notice that in equation (49), the first term \( \phi_{S,NA} \) decreases in \( m \). The second term decreases in \( N_{S,NA}^* \), which in turn increases in \( m \). \( N_{S,NA}^* \) increases in \( m \) because \( \tau_{S,NA} \) increases in \( m \). Overall, \( \frac{\partial K_{S,NA}^*}{\partial m} < 0 \).
We now prove that \( \frac{\partial}{\partial m} \left( \frac{1}{\lambda_{S,NA}} \right) < 0 \). We can rewrite \( \frac{1}{\lambda_{S,NA}} \) as

\[
\frac{1}{\lambda^*_{S,NA}} = \frac{N^{*}_{S,NA} + 1}{\sqrt{N^{*}_{S,NA}}} \sqrt[\tau_{S,NA}] {\frac{\sigma^2_{\xi_S}}{\tau_{S,NA} \sigma^2_\theta}} \\
= \frac{\sigma_{\xi_S} \tau_{S,NA}}{cN^{*}_{S,NA}} \sqrt[\tau_{S,NA}] {\frac{\sigma^2_{\xi_S}}{\tau_{S,NA} \sigma^2_\theta}} \\
= \frac{\sigma^2_{\xi_S}}{cN^*_S}. \tag{51}
\]

In the second step, we use the definition of \( N^*_S \) (1) given by

\[
\frac{\sigma_{\xi_S} \sigma_\theta \sqrt{\tau_{S,NA}}}{\sqrt{N^*_S} (N^*_S + 1)} = c, \tag{52}
\]

which gives that

\[
\frac{N^{*}_{S,NA} + 1}{\sqrt{N^{*}_{S,NA}}} = \frac{\sigma_{\xi_S} \sigma_\theta \sqrt{\tau_{S,NA}}}{cN^*_S}. \tag{53}
\]

From equation (51), \( \frac{1}{\lambda_{S,NA}} \) is strictly decreasing in \( N^{*}_{S,NA} \) and thus strictly decreasing in \( m \) because \( N^*_S \) is strictly increasing in \( m \).

**Step 2:** We now evaluate \( K^{*}_{S,A} - K^{*}_{S,NA} \) and \( \frac{1}{\lambda_{S,A}} - \frac{1}{\lambda_{S,NA}} \) at some extreme values of \( m \). Consider first \( K^{*}_{S,A} - K^{*}_{S,NA} \) evaluated at two extremes. At one extreme of \( m = 0 \),

\[
\lim_{m \to 0} K^{*}_{S,A} = \frac{1}{\kappa} \lim_{m \to 0} \left( \frac{N^{*}_{S,A}}{N^{*}_{S,NA} + 1} \right) \left( \tau_{S,A} + \delta_{S,A} \right) \\
> \frac{1}{\kappa} \lim_{m \to 0} \left( \frac{N^{*}_{S,NA}}{N^{*}_{S,NA} + 1} \right) \tau_{S,NA} + \delta_{S,NA} \\
= \lim_{m \to 0} K^{*}_{S,NA}. \tag{54}
\]

The second step follows from 1) \( \lim_{m \to 0} \tau_{S,A} = \lim_{m \to 0} \tau_{S,NA} = \frac{\sigma^2_{\xi_E} \tau_{S,A}}{\sigma^2_\varphi + \sigma^2_{\xi_S}} + \frac{1}{\sigma^2_\varphi} \) and \( \lim_{m \to 0} \delta_{S,A} = \lim_{m \to 0} \delta_{S,NA} = \frac{\sigma^2_{\xi_E} \tau_{S,A}}{\sigma^2_\varphi + \sigma^2_{\xi_S}} \); and 2) \( \lim_{m \to 0} N^{*}_{S,A} > \lim_{m \to 0} N^{*}_{S,NA} \) because \( \lim_{m \to 0} N^{*}_{S,A} \) is given by

\[
\frac{\sigma_\theta \sigma_{\xi_S} \tau_{S,A} + \lim_{m \to 0} \sigma_\theta \sigma_{\xi_S} \sqrt{\tau_{S,A}}}{\sqrt{N^{*}_{S,A} (N^{*}_{S,A} + 1)}} = c, \tag{55}
\]

and \( \lim_{m \to 0} N^{*}_{S,NA} \) is given by

\[
\frac{\sigma_{\xi_S} \sigma_\theta \lim_{m \to 0} \sqrt{\tau_{S,NA}}}{\sqrt{N^{*}_{S,NA} (N^{*}_{S,NA} + 1)}} = c. \tag{56}
\]
Since \( \lim_{m \to 0} \tau_{S,A} = \lim_{m \to 0} \tau_{S,NA} \), \( \lim_{m \to 0} N^*_{S,A} > \lim_{m \to 0} N^*_{S,NA} \). Overall, \( \lim_{m \to 0} K^*_{S,A} > \lim_{m \to 0} K^*_{S,NA} \) in turn leads to \( \lim_{m \to 0} V^*_{S,A} > \lim_{m \to 0} V^*_{S,NA} \).

Now consider the other extreme of \( m = -1 \). Notice that \( N^*_{S,NA} \) is determined by the equation

\[
\frac{\sigma_{\xi_S} \sigma_{\theta} \sqrt{\tau_{S,NA}}}{\sqrt{N^*_{S,NA} (N^*_{S,NA} + 1)}} = c. \tag{57}
\]

Therefore, \( N^*_{S,NA} \) is independent of \( \chi \). On the other hand, \( N^*_{S,A} \) is strictly increasing in \( \chi \). As a result, \( \lim_{m \to -1} K^*_{S,A} - \lim_{m \to -1} K^*_{S,NA} \) is strictly increasing in \( \chi \). Furthermore, at the extreme of \( \chi = 0 \), our model effectively reduces into a one-firm model. In this case, \( K^*_{S,A} \) and \( K^*_{S,NA} \) differs only to the extent that when adopting local accounting standards, the precision of the accounting standards is \( \lim_{m \to 0} \frac{1}{(1-m)\sigma^2} = +\infty \) whereas when adopting common accounting standards, the precision of the accounting standards is \( \frac{1}{\sigma^2} \). Since \( K^*_{S,A} \) increases in the precision of the adopted accounting standards, \( \lim_{m \to -1} K^*_{S,A} - \lim_{m \to -1} K^*_{S,NA} \) is strictly increasing in \( \chi \). Consequently, we obtain that at \( m = -1 \), there exists some \( \chi^* \) such that \( \lim_{m \to -1} K^*_{S,A} = \lim_{m \to -1} K^*_{S,NA} \) if \( \chi < \chi^* \). For \( \chi \geq \chi^* \), \( \lim_{m \to -1} K^*_{S,A} \geq \lim_{m \to -1} K^*_{S,NA} \).

Finally, since \( K^*_{S,A} - K^*_{S,NA} \) is strictly increasing in \( m \) as we have shown in step 1, an application of the intermediate value theorem gives that:

1. If \( \chi < \chi^* \), then \( \lim_{m \to -1} K^*_{S,A} < \lim_{m \to -1} K^*_{S,NA} \). Combined with \( \lim_{m \to -1} K^*_{S,A} > \lim_{m \to -1} K^*_{S,NA} \), there exists some \(-1 < m^* < 0\) such that \( K^*_{S,A} < K^*_{S,NA} \) if \( m < m^* \) and \( K^*_{S,A} \geq K^*_{S,NA} \) if \( m \geq m^* \).

2. If \( \chi \geq \chi^* \), then \( \lim_{m \to -1} K^*_{S,A} \geq \lim_{m \to -1} K^*_{S,NA} \) which implies that for all \( m \), \( K^*_{S,A} \geq K^*_{S,NA} \). In this case, without loss of generality, we define \( m^* \equiv -1 \).

The proof also shows that when \( \chi = 0 \), i.e. when the network effect is absent, \( K^*_{S,A} \geq K^*_{S,NA} \) if and only if the precision of common accounting standards is not lower than that of the local accounting standards, i.e. \( m \geq 0 \).

We now turn to examine the switcher’s liquidity and evaluate \( \frac{1}{\lambda^{*}_{S,A}} - \frac{1}{\lambda^{*}_{S,NA}} \) at two extremes.

First, we prove that for \( m > 0 \), \( \frac{1}{\lambda^{*}_{S,A}} > \frac{1}{\lambda^{*}_{S,NA}} \). If \( N^*_{S,A} \geq N^*_{S,NA} \), \( \frac{N^*_{S,A} + 1}{\sqrt{N^*_{S,A}}} \geq \frac{N^*_{S,NA} + 1}{\sqrt{N^*_{S,NA}}} \). In addition, \( \tau_{S,A} < \tau_{S,NA} \) given that \( m > 0 \). As a result, \( \frac{1}{\lambda^{*}_{S,A}} > \frac{1}{\lambda^{*}_{S,NA}} \). On the other hand, if \( N^*_{S,A} < N^*_{S,NA} \), we can rewrite the expression of \( \frac{1}{\lambda^{*}_{S,A}} \) as:

\[
\frac{1}{\lambda^{*}_{S,A}} = \frac{\sigma_{\xi_E} \sigma_{\xi_S} \sqrt{\tau_{E,A}} + \sigma^2_{\xi_S}}{c N^*_{S,A}}, \tag{58}
\]

and rewrite \( \frac{1}{\lambda^{*}_{S,NA}} \) as:

\[
\frac{1}{\lambda^{*}_{S,NA}} = \frac{N^*_{S,NA} + 1}{\sqrt{N^*_{S,NA}}} \frac{\sigma^2_{\xi_S}}{\sigma^2_{\xi_S} \tau_{S,NA} \sigma^2_{\theta}} + \frac{\sigma_{\xi_S} \sigma_{\theta} \sqrt{\tau_{S,NA}}}{c N^*_{S,NA}} = \frac{\sigma^2_{\xi_S}}{c N^*_{S,NA}}. \tag{59}
\]
In the second step, we use

\[
\frac{\sigma_\xi \sigma_{\theta} \sqrt{T_{S,NA}}}{\sqrt{N_{S,NA}(N_{S,NA}^* + 1)}} = c, \tag{60}
\]

which gives that

\[
\frac{N_{S,NA}^* + 1}{\sqrt{N_{S,NA}^*}} = \frac{\sigma_\xi \sigma_{\theta} \sqrt{T_{S,NA}}}{cN_{S,NA}^*} \tag{61}
\]

Since \(\sigma_\xi \sigma_{\theta} \sqrt{T_{S,NA}} + \sigma_\xi^2 > \sigma_\xi^2\) and \(N_{S,NA}^* < N_{S,NA}^*\),

\[
\frac{1}{\lambda_{S,A}^*} = \frac{\sigma_\xi \sigma_{\theta} \sqrt{T_{S,NA}} + \sigma_\xi^2}{cN_{S,NA}^*} > \frac{\sigma_\xi^2}{cN_{S,NA}^*} = \frac{1}{\lambda_{S,NA}^*}. \tag{62}
\]

We now consider the other extreme of \(m = -1\). To determine the sign of \(\lim_{m \to -1} \frac{1}{\lambda_{S,A}} - \lim_{m \to -1} \frac{1}{\lambda_{S,NA}}\), recall that \(N_{S,NA}^*\) is determined by the equation

\[
\frac{\sigma_\xi \sigma_{\theta} \sqrt{T_{S,NA}}}{\sqrt{N_{S,NA}^*(N_{S,NA}^* + 1)}} = c. \tag{63}
\]

Therefore, \(N_{S,NA}^*\) is independent of \(\chi\). On the other hand, \(N_{S,NA}^*\) is strictly increasing in \(\chi\). As a result, \(\lim_{m \to -1} \frac{1}{\lambda_{S,A}} - \lim_{m \to -1} \frac{1}{\lambda_{S,NA}}\) is strictly increasing in \(\chi\). Furthermore, at an extreme of \(\chi = 0\), our model effectively reduces into a one-firm model. In this case, \(\frac{1}{\lambda_{S,A}^*}\) and \(\frac{1}{\lambda_{S,NA}^*}\) differ only to the extent that when adopting local accounting standards, the precision of the local accounting standards is \(\lim_{m \to -1} \frac{1}{(1+m)^2 \sigma_\xi^2} = \infty\) whereas when adopting common accounting standards, the precision of the common standards is \(\frac{1}{\sigma_\xi^2}\). Since \(\frac{1}{\lambda_{S,A}^*}\) increases in the precision of the accounting standards, \(\lim_{m \to -1} \frac{1}{\lambda_{S,A}^*} < \lim_{m \to -1} \frac{1}{\lambda_{S,NA}^*}\).

Combined with the result that \(\lim_{m \to -1} \frac{1}{\lambda_{S,A}^*} - \lim_{m \to -1} \frac{1}{\lambda_{S,NA}^*}\) is strictly increasing in \(\chi\), we thus obtain that at \(m = -1\), there exists some \(\hat{\chi}\) such that \(\lim_{m \to -1} \frac{1}{\lambda_{S,A}^*} < \lim_{m \to -1} \frac{1}{\lambda_{S,NA}^*}\) if \(\chi < \hat{\chi}\). For \(\chi \geq \hat{\chi}\), \(\lim_{m \to -1} \frac{1}{\lambda_{S,A}^*} \geq \lim_{m \to -1} \frac{1}{\lambda_{S,NA}^*}\).

Finally, since \(\frac{1}{\lambda_{S,A}^*} - \frac{1}{\lambda_{S,NA}^*}\) is strictly increasing in \(m\), an application of the intermediate value theorem gives that:

1. If \(\chi < \hat{\chi}\), then \(\lim_{m \to -1} \frac{1}{\lambda_{S,A}^*} < \lim_{m \to -1} \frac{1}{\lambda_{S,NA}^*}\). Combined with \(\frac{1}{\lambda_{S,A}^*} > \frac{1}{\lambda_{S,NA}^*}\) for \(m = 0\), there exists some \(-1 < \hat{m} < 0\) such that \(\frac{1}{\lambda_{S,A}^*} < \frac{1}{\lambda_{S,NA}^*}\) if \(m < \hat{m}\) and \(\frac{1}{\lambda_{S,NA}^*} > \frac{1}{\lambda_{S,NA}^*}\) if \(m \geq \hat{m}\).

2. If \(\chi \geq \hat{\chi}\), then \(\lim_{m \to -1} \frac{1}{\lambda_{S,A}^*} \geq \lim_{m \to -1} \frac{1}{\lambda_{S,NA}^*}\), which implies that for all \(m\), \(\frac{1}{\lambda_{S,A}^*} \geq \frac{1}{\lambda_{S,NA}^*}\). In this case, without loss of generality, we define \(\hat{m} \equiv -1\).

The proof also shows that when \(\chi = 0\), i.e. when the network effect is absent, \(\frac{1}{\lambda_{S,A}} \geq \frac{1}{\lambda_{S,NA}}\), if and only if the precision of common accounting standards is not lower than that of the local accounting standards, i.e. \(m \geq 0\).
Proof. of Proposition 4: From Proposition 1, the equilibrium investment of the early adopter is given by

$$K_E^* = \frac{1}{\kappa} \left[ \frac{N_E^*}{N_E^* + 1} \tau_E + \delta_E \right],$$  

(64)

and the liquidity of the early adopter is given by

$$\frac{1}{\lambda_E^*} = \frac{N_E^* + 1}{\sqrt{N_E^*}} \sqrt{\frac{\sigma^2_{\xi_E}}{\tau_E \sigma^2_\theta}}.$$  

(65)

Adoption increases $N_E^*$ while keeps $\tau_E$ and $\delta_E$ unchanged, resulting in an increase in $K_E^*$ and $\frac{1}{\lambda_E^*}$. ■

Proof. of Corollary 1: For $\chi \geq \chi^*$, from Proposition 3, $V_{S,A}^* > V_{S,NA}^*$ for any finite $m$. In addition, from Proposition 4, $V_{E,A}^* > V_{E,NA}^*$ for any finite $m$. We thus obtain that $V_{S,A}^* + V_{E,A}^* > V_{S,NA}^* + V_{E,NA}^*$. Again we use subscript $A$ to refer to after common accounting standards adoption and $NA$ to refer to before common accounting standards adoption.

Next, consider the case that $\chi < \chi^*$. At $m = m^* \in (-1, 0)$, from Proposition 3, $\lim_{m \to m^*} V_{S,A}^* = \lim_{m \to m^*} V_{S,NA}^*$. Since from Proposition 4, $V_{E,A}^* > V_{E,NA}^*$ for any finite $m$, we obtain that $\lim_{m \to m^*} \left[V_{S,A}^* + V_{E,A}^*\right] > \lim_{m \to m^*} \left[V_{S,NA}^* + V_{E,NA}^*\right]$. Furthermore, $V_{E,A}^*$, $V_{E,NA}^*$ and $V_{S,NA}^*$ are all independent of $m$ whereas $V_{S,NA}^*$ is decreasing in $m$. As a result, $V_{S,A}^* + V_{E,A}^* - V_{S,NA}^* - V_{E,NA}^*$ is strictly increasing in $m$. Thus, an application of the intermediate value theorem gives that:

1. If $\lim_{m \to -1} \left[V_{S,A}^* + V_{E,A}^*\right] < \lim_{m \to -1} \left[V_{S,NA}^* + V_{E,NA}^*\right]$. Combined with $\lim_{m \to m^*} \left[V_{S,A}^* + V_{E,A}^*\right] > \lim_{m \to m^*} \left[V_{S,NA}^* + V_{E,NA}^*\right]$, there exists some $m^{**} < m^*$ such that $V_S^* (1) + V_E^* (1) < V_S^* (0) + V_E^* (0)$ if and only if $m < m^{**}$.

2. If $\lim_{m \to -1} \left[V_{S,A}^* + V_{E,A}^*\right] \geq \lim_{m \to -1} \left[V_{S,NA}^* + V_{E,NA}^*\right]$, then $V_{S,A}^* + V_{E,A}^* \geq V_{S,NA}^* + V_{E,NA}^*$ for all $m$. In this case, without loss of generality, we define $m^{**} \equiv -1 < m^*$.

■

References


