JOBS and SOX: 'Evolving with New Paths to Capital Formation'[1]

A. Carvajal, M. Rostek and G. Sublet[2]

The Universities of Western Ontario, Wisconsin-Madison and Minnesota

November 6, 2014

Following the economic slowdown of 2009-11, U.S. Congress approved legislation that weakens information disclosure requirements for small companies seeking financing. This policy has been criticized by analysts who warn against a reduction in investors' willingness to invest and, hence, in capital raised by firms. We argue that risk sharing motive for trading implies that the new legislation is indeed consistent with its intended goal, and that a full disclosure requirement, in fact, minimizes the capital that a firm can raise, given its business scale. Differential disclosure requirements for small and large firms in the new legislation may improve economic efficiency. (*JEL* G18, G32, G38, D80)

Keywords: Innovation; Startups; Crowdfunding; Initial Public Offerings; Information disclosure; Value of information; Financial regulation

The *Sarbanes-Oxley (SOX) Act of 2002* is the general regulatory framework governing the informational, financial, accounting and remuneration practices of firms whose shares are traded on the U.S. securities exchanges. It was introduced in response to the scandals that affected flagship corporations as large as Enron and WorldCom in 2000 and 2001.[3] Among other restrictions, the SOX Act imposes rules requiring disclosure of all internal information that may be of relevance to potential investors in *any* publicly traded firm.[4] Strict disclosure rules apply, in particular, during the period in which a company prepares to float its stock on the market for the first time, in an *Initial Public Offering* (IPO). The Act requires that the intention to issue an IPO be made

[1] From the keynote address of the SEC Chair, Mary Jo White, on the ongoing and upcoming changes in the securities regulation embraced by the SEC. See "The SEC in 2014," January 27, 2014, available at `http://www.sec.gov/News/Speech/Detail/Speech/1370540677500`.

[2] The authors thank numerous colleagues as well as seminar and conference audience members for comments. A. Carvajal acknowledges, in particular, a stimulating conversation with Gonçalo Farias at the very earliest stages of this research.

[3] Analogous legislation was enacted in Australia, Canada, France, Germany, Holland, India, Italy, Japan, South Africa, and Turkey.

[4] The original scope intended for this regulation was limited to large companies only, but this qualification was removed in the final version approved by Congress, and the scope was extended to include all publicly traded stocks.

public immediately after the company communicates it to the Securities Exchange Commission (SEC), and that all communications between the SEC and the company in regards to the IPO be made available to the public; it also establishes minimum time periods between different phases of the IPO, which are meant to give potential buyers ample opportunity to scrutinize the information made available by the company.

In the context of the economic slowdown of 2009-2011, with a decline in IPOs and mergers and acquisitions, concerns arose about the inability of small companies to raise the equity needed to fund the start of their economic activities.[5] In response to this concern, the U.S. Congress approved the *Jumpstart Our Business Startups Act*, or JOBS Act, which was signed into law in April 2012. This act eases the securities regulations for small companies going public in a significant way: it reduces the time to be maintained between the planning and the actual occurrence of the IPO, and lightens the reporting requirements; moreover, it permits confidentiality of a company's declaration to the SEC that it plans to issue an IPO, and allows the company to withhold from the public information about its finances until just before shares are sold;[6] it allows confidentiality of the communications between the company and the SEC; and it permits withdrawal from the IPO process without informing the public.[7] We provide a brief review of these regulations below.

Perceived by some as a "historic turning point,"[8] the intent of this change in the regulatory

[5] Since the peak in 1997 with 8,823 exchange-listed companies, public company listings in the United States declined for 15 consecutive years to only 4,916 companies at the end of 2012 (Weild, Kim and Newport, 2013).

[6] In its famously "secret" IPO, Twitter filed documents two months prior to announcing, in a tweet, its intention to go public. About 70-80% of all IPOs in the United States that took place in 2013 began as confidential filings. An estimated 75% of companies, typically small, that file for an IPO do not go public. `http://dealbook.nytimes.com/2014/02/09`.

[7] The Act was signed on April 5, 2012. Title I (IPO On-Ramp) entitles firms with annual gross revenues of up to $1 billion to reduced regulatory and reporting requirements. Title II lifts the ban on general solicitation and general advertising. Under review by the SEC are Title III, or the *Capital Raising Online While Deferring Fraud and Unethical Non-Disclosure* Act (CROWDFUND Act), allowing small firms to raise capital from unaccredited investors through crowdfunding and Title IV (Regulation A+, an exemption from the registration, auditing and reporting requirements mandated by the Securities Act, applicable to *small public* offerings). An overview of the status of the provisions of the JOBS Act, as of May 2014, is available at `http://crowdfunding.mit.edu`; the SEC Staff Report issued in December 2013 (SEC, 2013) provides a summary of the studies and solicited comments on disclosure requirements, as mandated by the JOBS Act.

[8] Harvard Law School Forum on Corporate Governance and Financial Regulation, `http://blogs.law.harvard.edu /corpgov/2014/01/15`. The JOBS Act has been called "a potential game-changer" for startups by President Obama, when signing the bill into law; "the start of what promises to be a period of transformative change in capital formation" by SEC Chairwoman White; and "the most significant change to United States federal securities laws for developing companies in modern history" in a report for OECD prepared by David Weild IV (former Vice-chairman of NASDAQ, also known as the "father" of the JOBS Act), Edward Kim and Lisa Newport.

framework is not only to make it easier for companies to go public in an IPO process, but also to enhance the ability of smaller business, subject to lighter regulation, to raise capital in *private* markets through the figure of *crowdfunding*.[9] The rationale has been that forcing small firms to engage in extensive information disclosure was detrimental to their funding, particularly for young, high-growth companies seeking capital from the public market, and for small startups looking for financing in the private market in a rapid manner.[10] Apart from receiving bipartisan support in Congress, the bill was widely supported by the National Venture Capital Association, many startup founders, investors and entrepreneurs.

At the same time, the Act has been criticized by state regulators and investor advocate groups (including the American Association of Retired Persons, or AARP, the Consumer Federation of America, the Council of Institutional Investors, the North American Securities Administrators Association, and Americans for Financial Reform), who argue that the practice of less forthcoming information disclosure will not only decrease investors' welfare, but thereby also reduce their willingness to invest and, hence, the value of equity ultimately raised by the issuing firms.

To a large extent, these criticisms are consistent with the existing literature. The arguments based on the classic "information unraveling mechanism" suggest that the easier provisions of the JOBS Act would not be of benefit to the issuer of an IPO: when an informed party tries to withhold his private knowledge from another agent, in equilibrium he is unable to do so, as the uninformed party is able to deduce what information the informed agent has, from how much he chooses to disclose. In the language of equity investment, a potential buyer would interpret the limited disclosure of information as an indication that the firm is of low value, which in turn would lower his willingness to pay.

Main results: The message of this paper is that, to a large extent, these criticisms are excessively pessimistic and, in fact, the provisions of the new legislation are in line with their intentions. To begin, the unraveling mechanism is not of first order: the very nature of the innovations and startups explicitly targeted by the JOBS Act is that the seeking of financing occurs at an early, often experimental stage of project development, when uncertainty about the return is faced by both investors and entrepreneurs. Information gathering by entrepreneurs themselves requires

[9] The U.S. private markets are already larger than the public ones in terms of providing access to capital. In 2013, capital raised in public offerings totaled \$1.3 trillion, in comparison to \$1.6 trillion raised in offerings not registered with the SEC.

[10] A majority of small companies view accessing new investors and raising capital as their biggest challenge (`http://money.cnn.com/2014/01/07/smallbusiness/crowdfunding-investments`). For the past 80 years, any public announcement by a startup that they were seeking investment — be it at speaking engagements, through videos, or via a post on their website or social networks — was deemed illegal by Rule 506 of Regulation D and Rule 144A of the Securities Act of 1933. (As of the writing of this article, the solicitation ban was removed with respect to unaccredited investors; the lift is expected to be extended to unaccredited investors.)

a certain advancement in project development. Thus, the canonical information asymmetry in which the 'quality' of innovation (or the state of the world) is known to one of the parties is largely absent at the funding seeking phase.[11]

Our first main result is that, as long as the investors differ in their risk sharing needs but have the same utility over consumption, with decreasing absolute risk aversion, the SOX Act, in fact, *minimizes* the amount of capital that the issuer can raise in the IPO, given the business scale. The key mechanism is that full disclosure lowers the *average* marginal utility of income across investors, state by state.[12] With less forthcoming information, instead, investors typically cannot share their risks perfectly, which opens a wedge between their wealth levels. The resulting increase in the average marginal utility across investors takes place in all states of the world, at least weakly, so the pricing kernel of the firm's market price increases. We show that *any* partial disclosure is, hence, preferred over full disclosure by a firm seeking financing, for a large class of firm objectives encompassing all non-risk-loving behavior.

Apart from the effectiveness in raising capital, a major concern of the JOBS Act's critics has been investor protection — a concern due to the limited transparency permitted by the Act and the high riskiness of the businesses it intends to promote.[13] The second main finding of the paper suggests that the Act's less stringent requirements on information gathering and disclosure are not only consistent with the goal of regulatory change to facilitate raising capital, but may also benefit the investors. While any limitation on information to investors distorts *ex-post* efficiency of the wealth allocation, by affecting the investors' *ex-ante* risk sharing needs and, hence, willingness to pay, it also *alters the marginal expected revenue function of the entrepreneurs*. This marginal revenue effect differs for small- and large-scale businesses. Consequently, with non-decreasing marginal cost of innovation, limited disclosure not only raises more capital for small-scale (high-marginal-cost) firms, but it also encourages greater innovations than stricter

[11] The *ex-ante* risk involved in the innovator's ability to generate equity value by building a company is seen as the main characteristic of equity-based crowdfunding (Agrawal, Catalini and Goldfarb, 2014).

[12] Carvajal, Rostek and Weretka (2012) showed that a similar mechanism, though operating through the span of assets and not information disclosure, gives rise to endogenous market incompleteness.

[13] Investor protection was a key notion for many state regulators in opposing the new Regulation A+ and blocking the usage of preexisting Regulation A, argued to be promoting investment too risky for retail investors (Guzik, 2014). In fact, major grounds for the SEC's non-participation (under its prior Chair) in creating the federal legislation of the JOBS Act and in its lack of support of crowdfunding for profit was the perceived inconsistency with the Commission's obligation to protect investors. SEC commissioner Luis A. Aguilar expressed concern that "the bill would seriously hurt investors by reducing transparency and investor protection" and that "access to ... information [is] needed to make good investment decisions" (March 16, 2012; `http://www.sec.gov/News/PublicStmt/Detail/PublicStmt/1365171490120`). Our findings suggest that the JOB Act's provisions are in accordance with the three statutory missions of the SEC — "to protect investors, maintain fair, orderly, and efficient markets, and facilitate capital formation."

disclosure requirements would;[14] and large-scale (low-marginal-cost) innovations are greater under *strict* disclosure requirements. That is, disclosure requirements that scale with the size of the firm induce larger projects for both small and large businesses, which in turn benefits the investors. Thus, a regulation of information disclosure that exploits the differential effect of information disclosure on the scale has the potential to improve welfare not only for small businesses, but also for investors.[15] Thus, differential regulation may be Pareto-improving. This qualifies the negative conclusions about strict disclosure, which continues to apply to large firms in the new financing framework, that one might draw from the analysis for a fixed business size.

Several properties of the optimal disclosure strategy we establish shed light on other debated aspects of the JOBS Act. For the objective of raising capital, requiring *more* disclosure may be the preferred choice by *large* firms: the firm would choose to disclose information fully, in order to commit itself to issuing a large IPO — although it gets less funding per unit of scale, the choice of scale is sufficiently large for the total capital raised to be larger. Importantly, in this sense the regulation is self-enforcing, which indicates a low regulatory monitoring burden. We show that, even without accounting for the additional effect of disclosure on the business scale, lifting the mandate of full disclosure does *not* imply that the firms will necessarily choose maximal withdrawal. In general, firms will benefit from providing investors with some information — the value of information is not monotone in disclosure. Thus, insofar as the arguments concerning investor protection intrinsically value that a certain degree of transparency be preserved, a regulation that requires the firm to disclose or report some information, if or when they have it, can be in line with the incentives of capital-seeking firms. Furthermore, so can a regulation mandating that investors be informed about any losses, as is often deemed appropriate for investor protection: as we show, a policy that requires firms to disclose detailed information about losses and only the fact that it is not losing money in states with positive returns would, in fact, be preferred by these firms to revealing all information in states where the firm makes positive profits and revealing only that profits will not be positive when the firm loses money. Along with

[14] Equating investor protection with maximal transparency used to be the traditional view at the SEC. Our analysis offers support to an apparent shift away from that view. While the SEC Chair at the time of the bill's signing, Mary Schapiro, expressed her opposition to the Act, new Chairwoman White proclaimed that important priorities for 2014 were: providing new and more flexible ways for companies of all sizes, but particularly smaller companies, to raise capital; the final implementation of crowdfunding; and an updated Regulation A (`https://www.sec.gov/News/Speech/Detail/Speech/1370540677500`).

[15] Our finding that the introduction of mild disclosure requirements for small businesses and, contingent on size exemptions, for high-growth businesses increases the scale of these businesses is, then, consistent with the major objective of the JOBS legislation in the post-crisis economy to stimulate employment creation. Following the passage of the JOBS Act, the Kauffman Foundation released a report stating that 92% of a company's job growth occurs after its IPO; and that nearly 1.9 million new jobs were forfeited during the previous decade due to a 70% decline in IPOs.

no reliance on unravelling, this contrasts sharply with the classic "good news/bad news" result in asymmetric information environments.

The key economic mechanism that this paper highlights as relevant in the design of the financing framework is that disclosure policy can be an effective instrument in impacting firm financing, incentives and welfare *even absent inference effects*. The mechanism involves a link between disclosure and risk sharing, rather than value or 'quality.' The results hold for any distributions of firm returns and distributions of investors' wealth, and, thus, demand little knowledge from regulatory bodies.

Related Literature: Important lessons concerning the impact of information disclosure have come from the theory on asymmetric information. In particular, the influential strand of literature on *persuasion games* examines how, in an attempt to benefit from privately known information, the informed party manages the disclosure of these facts (Milgrom and Roberts, 1986; Shin, 2003; Kamenica and Gentzkow, 2011; Che, Dessein and Kartik, 2013; and Gentzkow and Kamenica, 2014).[16] As mentioned above, though, the adverse selection effects between the investors and the firm do not bind for early-stage financing, given that the information about return is limited on the part of entrepreneurs seeking funding and investors alike.[17] Likewise, the moral hazard effects of improved incentives through disclosure that ties stock prices to managerial actions and, thus, enhances investment efficiency at the firm level (e.g., Fishman and Hagerty, 1989) are less likely to play a role at the stage where the information about return needed for structuring incentives is unavailable.

The idea that less information can make agents better off has been recognized at least since Hirshleifer (1971). The argument we present differs from the Hirshleifer effect — i.e., that uncertainty helps risk sharing. In our setting, investors would benefit *unambiguously* if information were to be disclosed fully. The mechanism through which limited disclosure can make raising capital more effective operates by introducing less than full risk sharing among investors. While this conflicts with efficiency for a fixed size of innovation, efficiency may improve once the effect of information disclosure on the size of innovations is accounted for.

In the past decade, some authors have discussed the potential welfare-reducing effects of disclosing public information about fundamentals, when agents learn from public (price) and private signals (e.g., Morris and Shin, 2002; Angeletos and Pavan, 2007; and Amador and Weill, 2010). These arguments, too, explore inference and coordination externalities among investors

[16] Milgom (2008) offers an early review of this literature.

[17] Or, these effects are only part of the challenge in designing a regulatory framework for capital access, for which, familiar institutional solutions are available. In fact, as we report below, the screening measures stipulated in the JOBS Act apply to investors, in terms of their capacity to bear risk, rather than to firms (other than large businesses).

when information is asymmetric among the investors.[18]

In the context of the economic crisis, several authors have also put forward new arguments according to which less transparency ensures more *market liquidity*. Pagano and Volpin (2008) and Dang, Gorton and Holmstrom (2009) suggest that security design itself may give rise to adverse selection and shut down trade. Morris and Shin (2012) argue how market confidence, defined as approximate common knowledge, can shut down trade in the presence of adverse selection. The closely related discussion of regulatory reforms regarding transparency has pointed to trade-offs between providing accuracy and commonality of beliefs (Morris and Shin, 2007; Holmstrom, 2009). Again, all these effects of asymmetric information, either direct or through higher-order beliefs, are absent in our analysis and, to the extent that they are more relevant for the risky, small firm innovations covered by the JOBS Act, would strengthen our conclusions.[19]

Broadly speaking, the problem we study is one of information design: the information to be made available in the economy is chosen *ex ante* (i.e., when information is symmetric across agents). Information disclosure then affects both beliefs and allocations. While the recent and growing literature on information design (referenced in Gentzkow and Kamenica, 2014) focuses on the strategic effects of information through beliefs, this paper studies market-based effects of information through allocations. In particular, the main results in Kamenica and Gentzkow (2011) suggest that if the value function of the sender is convex in the belief of the receiver, then information disclosure creates a dispersion in posterior beliefs, which benefits the sender (since the concavification lies strictly above a convex value function). This paper argues that, with decreasing absolute risk aversion, the value function of the sender is convex in the allocation; full information disclosure minimizes the dispersion in the allocation, which minimizes the benefit of the sender. Also, since, in a market economy, the information designer's value function is parametrized by the endowment allocation, the insight of Kamenica and Gentzkow (2011) about a simplification of the optimal information design problem is not readily applicable here.

Finally, to the best of our knowledge, the strong predictive link between the behavior of risk aversion (the shape of marginal utility) and the effects of information disclosure is new.

[18] A major advantage of crowdfunding is seen in 'leveraging the wisdom of the crowd.' Low communication costs via online platforms facilitate information gathering and progress monitoring for distant funders, also enabling funders to participate in the very development of the idea. In any case, the mechanisms deriving from the information dispersed among investors, as proposed by these authors, would reinforce our conclusions.

[19] At the same time, the asymmetric information considerations – adverse selection, moral hazard and, in a game-theoretic jargon, persuasion and pandering – continue to shape the new regulatory framework through the strict disclosure, audit and reporting requirements for financing of large businesses going public, or medium size firms beyond their exemption period. One insight from our results is that the financing benefits from more complete disclosure for large businesses suggest that at the stage of company development when entrepreneurs will have gained knowledge about returns, taking measures against adverse selection or moral hazard can be self-enforcing.

I. Some Details of the JOBS Act and Our Results

By recognizing that the disclosure policy transforms the firms' marginal revenues and indirectly impacts the choice of business scale, our analysis suggests that the financing options introduced by the JOBS Act appear to jointly create a regulatory framework that exploits the *differential* impact of disclosure on capital raised, efficiency and investor protection between small and large firms. The new options, either enacted or at an advanced review stage, are:

- *Crowdfunding*: This option enables financing through a large number of small investors in the private market, with light disclosure requirements for small businesses — up to $1 million in equity.[20]

- *Regulation A+*: This option offers disclosure exemptions for financing through the public market that are *contingent* on the scale of business for a certain time period;[21] to increase the equity dollar ceiling from $5 million to $50 million, and to lower the regulatory cost burden, at the cost of additional reporting and audit.

- *IPO On-Ramp*: This option makes it easier for young, high-growth firms to raise capital in the public market at an early stage by extending the period that temporarily lowers the cost of accessing the capital markets from 2 to up to 5 years.[22]

Essentially, along with the SOX Act, these financing options design a regulatory model allowing for *limited disclosure that scales with business size.* Also scaled across the new financing options are investor restrictions (i.e., individual investment limits based on income, aggregate

[20] This rule refers to equity-based crowdfounding with capital raised by selling stock, as opposed to donation-based crowdfunding.

[21] It aims to improve upon Regulation A, which intended to ease the process of going public for small firms (up to $5 million in equity). Available for over 20 years, Regulation A was rarely used — a fact attributed to the small scale threshold and high regulatory costs. Offerings are subject to compliance with separate registration, review and qualification requirements in every state where the offering is conducted. In addition, many states *de facto* prohibited utilizing Regulation A on the grounds of investor protection — practice that excluded entire industries from taking advantage of Regulation A, such as biotech, which generates little if any revenue in the early years and expects to be profitable only after 3 to 5 years, and high-tech development-stage companies, excluded under some state (*blue sky*) laws on the grounds of oversized valuations relative to book value or earnings per share. Numerous businesses, including Apple Computer, were denied financing this way.

[22] To "enter the ramp," a company must qualify as an *emerging growth company* — a newly defined class with annual gross revenue of less than $1 billion in the prior fiscal year. A company "exits the ramp" when it has more than $1 billion in gross revenue, completes the five-year transitionary period, issues more than $1 billion in non-convertible debt within a three-year period, or becomes classified as a large accelerated filer (e.g., due to market capitalization starting at $700 million).

offering limits, and investor accreditation requirements).[23] In addition to the improvement in the allocative efficiency for small and large innovations, the transformation of the firm's marginal revenue through disclosure that we show indicates an aggregate efficiency effect: the capital formation framework in which disclosure and investor protection scale with business size changes the market structure for financing by leveraging capital potential that may otherwise not be available, or utilized. Namely, crowdfunding, along with the currently reviewed proposal to further extend business financing to unaccredited investors, gives rise to a *private* market with a new asset class and a new investor class for early stage investment.[24] In turn, Regulation A+ and IPO On Ramp incentivize companies with high growth potential to aim for large, efficient scale, while enabling initial financing under limited disclosure at an early stage of small-scale development and attracting large investments at a large-scale stage under more complete disclosure that induces greater risk sharing by investors.[25]

[23] A condition for the exemption from the requirement to register public offerings with the SEC is a limit on the amount a person may invest per year: the maximum of \$2,000 or 5% for investors earning, or worth, up to \$100,000; and the minimum of \$100,000 or 10% for investors earning, or worth, at least \$100,000. In addition, offerings in the range \$100,000-\$500,000 require a review of financial statements, and offerings above \$500,000 (the maximum capped at \$1,000,000) require an audit.

Part of the rationale behind legalizing Internet solicitation is the expectation that online technology can help protect investors, by screening purchasers of securities to ensure that risky securities are purchased by investors who can afford the risk. The usage of online platforms also seeks to reduce risk exposure by making funding in small increments economically feasible.

[24] A study by CrowdFund IQ (2013) reports that 58% of all adults in the United States are interested in participating in crowdfunding with the average investment estimated at \$1,300, and the size of the market of unaccredited investors estimated as a multiple of that of accredited investors and venture capital combined.

It is understood that many small businesses could not be expected to meet the heightened audit and ongoing disclosure requirements of the new Regulation A+. The JOBS Act left unchanged the pre-Title IV Regulation A for small businesses seeking to raise up to \$5 million in the public market. At the same time, the SEC has solicited another round of comments on increasing the aggregate investment limit above \$1 million for crowdfunding investments.

[25] Timing is considered to be a critical element in the process of financing. The lighter reporting restrictions allowed by the JOBS Act for firms seeking funding privately facilitate quick access to capital. For the companies going public that are innovative and *ex-ante* risky, the disclosure exemptions provide the time necessary to develop the knowledge and capacity to comply with the stricter reporting and disclosure demanded from larger companies, unless and until a company meets the threshold subject to strict reporting requirements. Confidential filing of IPO-related documents when going public enables a company to control the timing of its announcement, the binding deadline for public disclosure of the offering documents being about 21 days before the "road show" for prospective investors, which is a couple months less than under JOBS. The main benefit of secret filings is seen in allowing companies to *test the waters* for an offering without disclosing their financial data if they decide not to go public. During the process, the information in the draft registration statement will continue to change and the antifraud provisions of the federal securities laws continue to apply to the content of testing-the-waters communications.

II. The Setting

Let us consider an information disclosure problem in which a firm, a set of competitive investors and an investment bank interact over three periods, $t = 0, 1, 2$.

In period 0, the firm looks to raise capital to fund the research and development (R&D) phase of an investment project. The outcome of this project — namely, the firm's return in period 2 — is *ex-ante* uncertain. Let $\mathcal{S}$ denote the set of states, which we assume to be finite, and for each $s \in \mathcal{S}$, let r_s be the return in that state. There is a commonly held prior belief, $\Pr(s) > 0$, that state s will occur.

There are $I \geq 2$ classes of investors, indexed by $i = 1, \ldots, I$. We assume that each of these classes is of equal, unit mass.[26] They differ in their future wealth: investors of type i have an income w_s^i in period 2, when the state is s. This means that, after trading in all other existing assets, we allow for correlation between the investors' wealth and the investment project's risk.[27]

All investors are risk averse and have expected-utility preferences with respect to a common cardinal utility function, $u : \mathbb{R} \to \mathbb{R}$, over period-2 wealth. With respect to period-1 wealth, their preferences are quasi-linear. That is, given wealth x in period 1, and uncertain wealth $(x_s)_{s \in \mathcal{S}}$ in period 2, their *ex-ante* utility is

$$x + \sum_{s \in \mathcal{S}} \Pr(s) \cdot u(x_s).$$

We assume that function u is twice continuously differentiable, strictly increasing and strictly concave, and satisfies the standard Inada conditions. Importantly, we also assume that the investors are *prudent*: their marginal utility is strictly convex, so that they exhibit decreasing absolute risk aversion.[28]

The assumption that all investors have common preferences means that their motive for trading is risk sharing, and not any kind of betting.[29]

[26] This assumption can easily be modified, at the cost of extra notation only.

[27] Our approach is one of partial equilibrium in that we leave the trade in other assets unmodelled, and in our assumption that such trade will be unaffected by the IPO of the firm. We believe that this approach is acceptable, since the policy we study, the JOBS Act, covers only small firms.

[28] The functional forms that are most common in economic models — e.g., CARA, CRRA, logarithmic — have globally convex marginal functions. If the marginal utility function is concave over the relevant domain, the effects of information disclosure on prices will be reversed. It is important to note that the implications of the general link between the convexity of marginal utility and valuation (through information disclosure) that this paper develops concern heterogeneity in marginal utilities *across* investors and apply in *every* state. Thus, they differ from the *individual* optimization effects of marginal utility differences *across* states in the precautionary saving motive.

[29] Betting based on beliefs is less likely to be relevant at the funding-seeking stage, see Ft. 18 Also, in view of Ft. 27, the reader may want to impose further structure on the distribution of investors' incomes. Of particular interest is the assumption that investors may have traded a riskless asset, in which case one would like to impose

In period 0, the firm receives liquidity from a risk-neutral investment bank. These funds represent the amount that the bank and the firm agree upon in the underwriting contract, discounted at a risk-free interest rate, $\bar{r}$.[30] Once the R&D stage is completed, at date 1, the firm privately learns the realized state of nature, after which the underwriting investment bank sells the firm's stock to public investors in the IPO.

III. Information Disclosure and Liquidity

As allowed by the JOBS Act, the firm *chooses* how much of its private information to disclose before the IPO takes place. While the firm need not disclose all its information, its statements are assumed to be verifiable and cannot mislead the market about the return of its investment project. For this, we assume that, after realizing state s, the firm announces and event $E \subset \mathcal{S}$ such that $s \in E$.[31] With this information, the stock of the firm is traded in a competitive IPO.

Importantly, under the provisions of the JOBS Act the firm can use the investment bank as a commitment device. In view of this, we assume that when the bank and the firm sign the underwriting contract, the firm commits to disclosing (future) information according to a partition, $\mathcal{P}$, of the state space.[32] Then, in period 1, if the firm realizes state s, it will make public the event E of the partition that contains s.[33] This *ex-ante* commitment of the firm to a partition implies that the investors cannot discern any of the firm's private information beyond

---

that for all investors i and i',

$$\sum_{s \in \mathcal{S}} \Pr(s) \cdot u'(w_s^i) = \sum_{s \in \mathcal{S}} \Pr(s) \cdot u'(w_s^{i'}). \tag{$*$}$$

Our results remain unaffected by this assumption.

[30] E.g., in the most commonly used types of contracts, *firm commitment contract* or the *best effort contract*, the bank guarantees to sell the entire or possible amount at this agreed upon price.

Implicitly, we assume that there is a set of competitive risk-neutral investment banks, with free entry to the market, who share the common prior beliefs of the firm and the investors. This is why we assume that the underwriting bank does not extract any surplus, and discount the price at rate $\bar{r}$.

[31] For all agents in the economy, the prior belief over event E is $\Pr(E) = \sum_{s \in E} \Pr(s)$.

[32] All our conclusions carry over even if not all partitions are feasible or if the choice is dictated by a policy requirement rather than optimization.

Also, an alternative way of understanding the choice of a partition does not require this *ex-ante* commitment. That is, suppose that at date 0, the firm chooses how much information it will *gather* to be published in the future prospecti of the IPO. Then, the R&D phase will consist on finding out the realized *cell* of the partition, but no more. This interpretation may be favoured if information gathering is considered to be costly.

[33] At the risk of being repetitive, note that under the SOX Act, the firm would have no legal choice but to reveal all its private information. Under JOBS, however, this is no longer the case. For instance, the firm can sign a contract with the investment bank, under which the bank will impose a penalty if the information disclosure does not agree with the partition. If the stipulated fine is high enough, the bank will have an incentive to enforce this contract, and the courts would uphold the penalty.

the event that is revealed: the "unraveling" argument of Milgrom and Roberts (1986) does not operate, and the posterior belief of investors for state s is, simply, $\Pr(s \mid E)$.[34]

We shall refer to the case when the firm chooses the finest partition, $\mathcal{P}^* = \{\{s\} \mid s \in \mathcal{S}\}$, as *full information disclosure.* This would be the only option under the SOX regulations. The opposite case, when the firm chooses $\mathcal{P}_* = \{\mathcal{S}\}$, amounts to *no information disclosure.* Any other partition will be referred to as a case of *partial information disclosure.*

The partition chosen by the firm at date 0 will determine the information with which investors trade in period 1. We denote by $p(E)$ the price resulting in the IPO, when the investors are informed of event E. (This price, of course, is to be determined endogenously.) Foreseeing these event-contingent prices, the liquidity provided by the investment bank to the firm at date 0 is

$$L(\mathcal{P}) = \frac{1}{1+\bar{r}} \cdot \sum_{E \in \mathcal{P}} \Pr(E) \cdot p(E). \tag{1}$$

At a technical level, it may be worthwhile to emphasize that once the firm chooses a partition $\mathcal{P}$, the price of its stock is induced as a random variable p over the state space $\mathcal{S}$: this is the mapping $s \mapsto p(E_s)$, where E_s denotes the partition cell that contains state s.

IV. The Price of the IPO

After event E has been announced, if the price of the stock is $\bar{p}$, investor i trades an amount $y^i_E(\bar{p})$ of the stock, so as to solve the program

$$\max_{y \in \mathbb{R}} \left\{ -\bar{p} \cdot y + \sum_{s \in E} \Pr(s \mid E) \cdot u(w^i_s + y \cdot r_s) \right\}.$$

The stock price after the announcement of event E, $p(E)$, is such that the total equity of the firm is absorbed by the public: $\sum_i y^i_E[p(E)] = 1$.

It is important to note here that the only trade taking place in the investors' optimization problems is the issuer's IPO. We are *not* modelling any other financial operations, nor are we allowing for secondary trade of the firm's equity — which is in accordance with the provisions of the JOBS Act.

[34] In line with Ft. 32, note that we may simply assume that the firm only observes an event that contains the actual state of nature, and then announces an event in the partition that contains its private observation, which is consistent with verifiability.

Relatedly, it has become common for the underwriters in IPOs under the emerging growth status to voluntarily impose a contractual research-quiet period. For IPOs that will be listed on a national securities exchange registered with the SEC, this period typically lasts for 25 calendar days following the IPO effective date. This practice comes from the view, shared by many industry participants, that investors ought to be looking at the information provided in the prospectus (Latham & Watkins LLP, 2013).

For an objective function for the firm to be well-defined, we want the price of its stock to be uniquely determined for each event in the partition. To see that this is the case, define $X(E)$ as the set of all period-2 investor wealth levels that may result from the trade of the stock after event E has been announced. That is, $X(E)$ contains all profiles

$$[(x_s^i)_{s \in E}]_{i=1}^I \in \mathbb{R}^{\|E\| \times I} \tag{2}$$

that satisfy the following conditions: (1) for each $s \in E$, $\sum_i (x_s^i - w_s^i) = r_s$; and, (2) for each i, there exists some y^i such that $x_s^i = w_s^i + y^i \cdot r_s$ for all $s \in E$. Now, let $x(E)$ be the unique maximizer of program

$$\max \left\{ \sum_i \sum_{s \in E} \Pr(s \mid E) \cdot u(x_s^i) \mid [(x_s^i)_{s \in E}]_{i=1}^I \in X(E) \right\}, \tag{3}$$

and define, for each $s \in E$,

$$\kappa(E, s) = \frac{1}{I} \cdot \sum_i u' \left(x_s^i(E) \right). \tag{4}$$

Eq. (4) defines for us a second random variable, $s \mapsto \kappa(E_s, s)$, where, as before, E_s denotes the cell in $\mathcal{P}$ that contains s. We denote this variable as κ and shall refer to it as the *pricing kernel*. This is so, because, by Lemmas 1 and 2 in Carvajal, Rostek and Weretka (2012), the equilibrium price of the stock satisfies that

$$p(E) = \sum_{s \in E} \Pr(s \mid E) \cdot \kappa(E, s) \cdot r_s. \tag{5}$$

V. The Firm's Objective

The preferences of the firm are a binary relation, $\succsim$, over the set of all partitions of the state space. We assume that the firm ranks partitions as a function of *only* how they affect the price as a random variable. [35]

In what follows, we shall say that the firm's preferences *are monotonic* if, whenever a partition $\mathcal{P}$ induces a first-order stochastic improvement in the pricing kernel, κ, relative to that of partition $\mathcal{P}'$, the firm strictly prefers the former partition, so $\mathcal{P} \succ \mathcal{P}'$. If, under the same premise, we only have that $\mathcal{P} \succsim \mathcal{P}'$, we say that the preferences are *weakly monotonic*. Similarly, we shall say that preferences are *monotonic over information coarsening* if, whenever $\mathcal{P}$ is a coarsening of $\mathcal{P}'$ that induces a first-order stochastic improvement in the pricing kernel, we have that $\mathcal{P} \succ \mathcal{P}'$, with the weak version defined as above.

[35] That is, there is no intrinsic motive why the firm prefers one partition over another, other than the probability distribution they induce on the IPO price. For instance, it seems natural to assume that a partition that generates a first-order stochastic improvement in the stock price is preferred by the firm.

Now, the stated goal of the regulatory change that motivates this paper was to improve the ability of small firms to fund their business startups. For that reason, we will assume, for the moment, that the firm ranks partitions according to the liquidity they generate. We refer to this ranking as *expected liquidity preferences*: the firm prefers $\mathcal{P}$ over $\mathcal{P}'$ if, and only if, the liquidity extended upon commitment to partition $\mathcal{P}$ is higher than that upon commitment to $\mathcal{P}'$, namely[36]

$$\mathcal{P} \succsim \mathcal{P}' \Leftrightarrow \sum_{E \in \mathcal{P}} \Pr(E) \cdot p(E) \geq \sum_{E \in \mathcal{P}'} \Pr(E) \cdot p(E).$$

Our first result is that, under this criterion, the firm prefers a partition that induces a higher pricing kernel, in the sense of first-order stochastic dominance:

LEMMA **1** (**Preference Monotonicity**). *If the return of the firm is positive in all states of the world, then the expected liquidity preferences are strictly monotonic.*

VI. Suboptimality of Full Disclosure

Our first main claim is that if the firm is risk averse, at least weakly, then its least preferred information disclosure strategy is the one imposed by the SOX regulation: *any* partial disclosure partition will be preferred to full disclosure. The key mechanism is the relation between information disclosure and the pricing kernel, which the following proposition establishes to hold in the strong sense of the first-order stochastic dominance. Our next proposition states that this is indeed the case when the firm has expected liquidity preference (and is, hence, risk neutral).

PROPOSITION **1** (**Disclosure and Pricing Kernel**). *Suppose that the return of the firm is positive in all states of the world. If the firm has expected liquidity preferences, then any partition that discloses no or only partial information is strictly preferred to the full disclosure partition, generically in the investors' wealth profiles. For all wealth profiles, all partitions are at least as good as the full disclosure partition.*

The intuition behind this result is not obscure. In the full information partition, the firm eliminates all risk at the moment of the IPO, so the investors trade the stock only because it provides riskless savings rather than risk sharing. When this is the case, all investors *ex post* have the same wealth.[37] Instead, if a partition discloses less information, some risk remains at the IPO. Generically, the investors will be unable to use the firm's equity to trade away all the remaining risk, and, consequently, they will not all have the same *ex-post* wealth in at least one

[36] Under the assumption that the investment banks are risk-neutral, it is immaterial whether the firm gets the loan at date 0, or if it wants to maximize its expected value in the IPO at time 1. This is why we can refer to this relation as *expected* liquidity preferences.

[37] That is, for all s, $x_s^i = x_s^j$, for all i and all j.

state. Since the utility function of the investors displays prudence, so that the marginal utility of wealth is convex, this dispersion in wealth will increase the average marginal utility of investors in that state.

It follows, immediately, that the result of Proposition 1 holds true for any monotonic preference relation, and not just for the expected liquidity preferences. The next result strengthens this insight and shows that the disclosure partition induced by the SOX Act is the least preferred one according to any preferences that are monotonic over information coarsening.

PROPOSITION **2** (**Optimality of Partial Disclosure**). *Suppose that the return of the firm is positive in all states of the world. If the firm's preferences are monotonic in information coarsening, then any partition that discloses no or only partial information is strictly preferred to the full disclosure partition, generically in the investors' wealth profiles. For all wealth profiles, if the firm's preferences are weakly monotonic in information coarsening, all partitions are at least as good as the full disclosure partition.*

Proposition 2 shows that the firm prefers any disclosure that allows only partial information over full disclosure, and that this holds for all distributions of investor wealth and not just in expected terms. This is important, as it implies that the issuer does not need to know the wealth profiles of the investors in order to determine that full disclosure is suboptimal.

We will show below that the result of this proposition applies to a general class of firm preferences that includes essentially any form of non-risk loving behavior. For the moment, let us highlight several additional properties of the optimal disclosure: It is important to note that Proposition 2 asserts that the full disclosure partition is the least preferred one, but does not imply that disclosing no information is the optimal decision of the firm, if they have information, or that acquiring none is. The first-order stochastic kernel dominance of Proposition 1 does not necessarily hold for finer partitions. It is easy to show that with more than two states, the partition that discloses no information need not be optimal; e.g., if $S = \{1, 2, 3\}$, it can happen that $L(\{\{1, 2\}, \{3\}\}) > L(\{\{1\}, \{2\}, \{3\}\})$. Furthermore, note that it follows from our results that in its optimal partition, the firm will fully disclose *at most one* contingency (state).[38]

[38] Intuitively, whether a contingency will be disclosed depends on the heterogeneity in the distribution of investors' wealth, i.e., how they correlate with the returns of the firm. Precisely, suppose that the optimal choice of the entrepreneur is $\mathcal{P} = \{E_1, \dots, E_N, \{S\}\}$, so that state S is the contingency that is fully disclosed, when realized. A necessary condition for optimality is that for all $n \leq N$:

$$\sum_{s \in E_n} \Pr(s) \cdot [\kappa(E_n, s) - \kappa(E_n \cup \{S\}, s)] \cdot r_s \geq \Pr(S) \cdot [\kappa(E_k \cup \{S\}, S) - \kappa(\{S\}, S)] \cdot r_S,$$

which can be expressed as

$$\sum_{s \in E_n} \frac{\Pr(s)}{\Pr(S)} \cdot \left[\sum_i u'\left(x_s^i(E_n)\right) - \sum_i u'\left(x_s^i(E_n \cup \{S\})\right) \right] \cdot \frac{r_s}{r_S} \geq \sum_i u'\left(x_S^i(E_n \cup \{S\})\right) - \sum_i u'\left(x_S^i(\{S\})\right).$$

Otherwise, when combining any two singleton states in the same event, the pricing kernel would increase in the first-order stochastic dominance sense.

With two states, it follows, no contingency will be disclosed. Formally:

COROLLARY 1 (**Optimality of no disclosure when there are only two states**). *Suppose that there are only two states of nature, and that the return of the firm is positive in both of them. If the firm's preferences are weakly monotonic in information coarsening, the optimal disclosure strategy for the firm is the partition that reveals no information. Generically in the investors' wealth profiles, this strategy is strictly preferred to the one that reveals the states of the world.*

VII. Firm Scale and Liability

So far, we have treated the size of the firm as fixed. However, since the more lenient information disclosure requirements of the JOBS Act apply only to small businesses, the disclosure exemptions introduced in the new regulatory framework may impact the choice of business scale. We examine this impact from the perspective of capital raised and investor protection. We show that the limited disclosure and reporting permitted by the JOBS Act may induce *larger* investments by small businesses and benefit both the firm and prospective investors.[39] We then study how the possibility of negative return interacts with the firm's preferred disclosure strategy.

A. Disclosure and the Scale of the Firm

Consider a market with two equally likely states of the world and two (classes of) investors, who have cardinal utility $u(x) = \ln(x)$ and incomes $w^1 = (2, 1)$ and $w^2 = (1, 2)$, respectively. Suppose that the firm's project is riskless, but can be undertaken at different scales: if the business scale chosen is K, the return is $r = (1, 1) \cdot K$.[40] The cost of undertaking a project of scale K is $c(K)$, which is increasing and convex on the scale.

At date 0, the firm chooses both the scale of the project and the information partition it will follow. While the investment cost is independent of the partition chosen by the firm, the revenue from the IPO depends on both of those decisions. Intuitively, we can see the price p as corresponding to each "unit of scale" of the project, so that we can write the revenue as $R = p \cdot K$. Importantly, the scale will affect the firm's revenue via p, and not just directly.

The right-hand side of this inequality is strictly positive, generically in investors' wealth.

[39] Gale and Stiglitz (1989) emphasize how potential investors may change their perception of the conditions of the firm as a result of the size of the intended IPO. This change in perception does not take place in our framework.

[40] This particular specification is borrowed from Example 4 in Carvajal, Rostek and Weretka (2011).

To keep with our previous notation, for an event E and a scale K, (re-)define the set $X(E;K)$ as the set of arrays $(x_s^1, x_s^2)_{s\in E}$ such that: (i) for each state $s \in E$, $(x_s^1 - w_s^1) + (x_s^2 - w_s^2) = K$; and (ii) for both investor classes i, there exists y^i such that $x_s^i = w_s^i + y^i$ at all $s \in E$. Here, y^i is the number of units of investment purchased by i, each paying 1 unit of revenue in each state of the world. The first condition simply says, then, that the whole project is sold: $y^1 + y^2 = K$. The investors' allocation, given an event and a scale, continues to be characterized by optimization problem (3), and the pricing kernel of Eq. (4) holds, with the pricing equation written as

$$p(E;K) = \sum_{s\in E} \Pr(s \mid E) \cdot \kappa(E, s; K). \tag{6}$$

Under full disclosure, the state of the world is reported to investors before trade. In equilibrium, investors will have the same income *ex post*: the investor who receives bad news will invest one more unit. This implies that

$$x_s^1(\{s\};K) = x_s^2(\{s\};K) = \frac{3+K}{2}$$

and

$$\kappa(\{s\}, s; K) = \frac{2}{3+K}$$

and the firm's expected revenue from the IPO, conditional on the scale, is given by

$$R^*(K) = \frac{4K}{3+K}.$$

Suppose, instead, that trade occurs under no information disclosure. (An analogous argument can be provided for partial disclosure. For simplicity, we develop the argument with two states, to compare the provisions of JOBS and SOX.) By symmetry, each investor will buy one half of the IPO, and the *ex-post* incomes will differ, with one of the investors having $2 + K/2$, and the other having $1 + K/2$. The pricing kernel will, thus, be

$$\kappa(\{1,2\}, s; K) = \frac{1}{2}\left(\frac{2}{4+K} + \frac{2}{2+K}\right)$$

and the revenue brought by the IPO is, then,

$$R_*(K) = \frac{4K(3+K)}{(4+K)(2+K)}.$$

Turning to the optimal business scale, it is immediate that, for any given scale of the project, the revenue under no disclosure is higher. It turns out, however, that how the *marginal* revenue changes is *not* independent from the scale. As we show, the regulatory frameworks under full and no disclosure differ in their impact on the entrepreneurs' incentives at the margin and, consequently, give rise to different choices of the optimal firm scale.

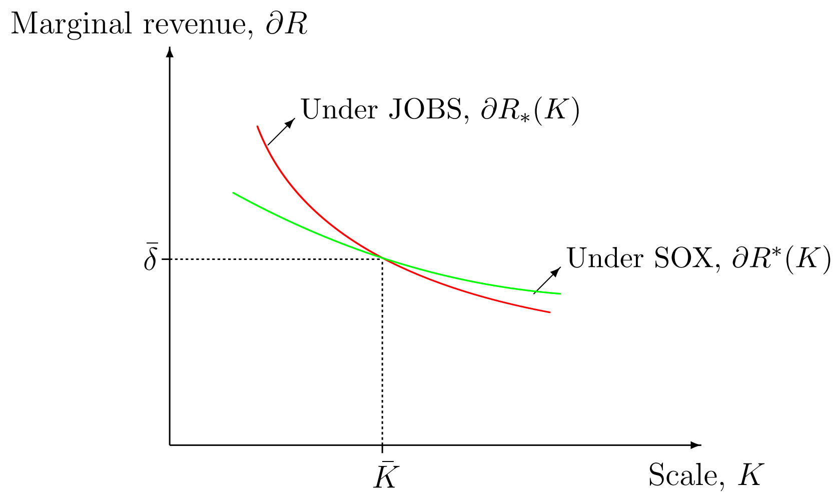

Figure 1: Marginal expected revenue as a function of the scale of the project, under full disclosure and under no disclosure.

Figure 1 depicts the entrepreneur's marginal revenue functions under both regulations. Marginal revenue under no disclosure dominates that under full disclosure, for all project scales below a certain threshold, $\bar{K}$. For either regulation, the optimal scale is determined by equalization of the induced marginal revenue with the entrepreneur's primitive marginal cost, which is nondecreasing. To illustrate, when the cost function is linear with marginal cost $c > 0$, if $c > \bar{\delta}$, the optimal scale will be larger under no information disclosure than under full disclosure. *While investors face greater uncertainty, the larger scale of the firm is, in fact, beneficial for them.*[41] The larger investment scale, induced by the more profitable IPO under no disclosure, can offset the detrimental welfare effect of the distortion in efficient risk sharing due to uncertainty. In turn, a firm with sufficiently small marginal costs, $c < \bar{\delta}$, would choose a smaller business scale when issuing under no disclosure, compared to full disclosure. *Stricter* disclosure requirements, therefore, enhance efficiency for large businesses.

These conclusions are not specific to the example above. Lemma 2 gives sufficient conditions for the scale effect. To elaborate further on the economics behind the scale effect on the marginal

[41] This effect differs from the one underlying the result of Kurlat and Veldkamp (2013), who also examine the requirements to disclose payoff-relevant information as a measure of investor protection. There, the investors may benefit from higher uncertainty when this results in a higher risk premium and, hence, a less profitable IPO for the firm. Here, increasing the uncertainty of the investors by issuing the IPO under the JOBS Act is beneficial for the firm and detrimental for the investor, but the larger scale induced by the more profitable IPO can offset this detrimental effect. Moreover, Kurlat and Veldkamp find that whether the welfare impact of mandatory disclosure is detrimental for investors depends on the extent of informational asymmetry and the costs of information, which our result is independent of.

revenue, let us write the revenue function as

$$R(K;\mathcal{P}) = \sum_{s\in S} \Pr(s)\cdot \kappa(\mathcal{P},s,K)\cdot r_s \cdot K;$$

the marginal revenue, $\partial R(K;\mathcal{P})$ is, then,

$$\sum_{s\in S} \Pr(s)\cdot \left[\frac{\partial\kappa(\mathcal{P},s,K)}{\partial K}\cdot r_s\cdot K + \kappa(\mathcal{P},s,K)\cdot r_s\right].$$

Increasing the scale has two effects on the marginal revenue: a direct *scale effect* and an indirect *price effect*; respectively,

$$\sum_{s\in S} \Pr(s)\cdot \kappa(\mathcal{P},s,K)\cdot r_s$$

and

$$\sum_{s\in S} \Pr(s)\cdot \frac{\partial\kappa(\mathcal{P},s,K)}{\partial K}\cdot r_s\cdot K.$$

The direct effect is positive, decreases with K since $u'' < 0$, and is larger under no disclosure than under full disclosure (cf. Proposition 1). The indirect effect, however, is negative, grows (i.e., becomes less negative) with K and, as shown below, if $u^4 < 0$, it is larger (less negative) under full disclosure than under no disclosure. Note that the direct effect depends on K only through κ while the indirect effect depends on K through $\partial\kappa(\mathcal{P},s,K)/\partial K$ scaled by K.

To characterize the indirect (pecuniary) effect of an increase in scale, recall that

$$\frac{\partial\kappa(\mathcal{P},s,K)}{\partial K} = \frac{1}{I}\cdot\sum_i u''\left(x_s^i(\mathcal{P},K)\right)\cdot\frac{\partial x_s^i(\mathcal{P},K)}{\partial K}.$$

This motivates restricting attention to a symmetric economy for which $\partial x_s^i(\mathcal{P},K)/\partial K = 1/I$ for all i, all s, and all $\mathcal{P}$: we maintain the assumptions of the example that there is a market with two equally likely states of the world and two classes of investors of equal mass, with incomes $w^1 = (2,1)$ and $w^2 = (1,2)$. In this economy, if u^4 is strictly negative, Jensen's inequality implies that, for a generic set of investors' endowments, defined in (the proof of) Proposition 1,

$$\begin{aligned}\frac{1}{I}\sum_i u''\left(x_s^i(\mathcal{P}_*,K)\right) &< u''\left(\frac{1}{I}\sum_i x_s^i(\mathcal{P}_*,K)\right)\\ &= \frac{1}{I}\sum_i u''\left(x_s^i(\mathcal{P}^*,K)\right).\end{aligned}$$

That is, the indirect pecuniary effect is strictly smaller under $\mathcal{P}_*$ (JOBS) than under $\mathcal{P}^*$ (SOX), generically in endowments.

Parts (i) and (iii) of Lemma 2 provide sufficient conditions under which the differential regulation for small and large firms improves efficiency in the following sense: for small companies (i.e., those with high marginal cost), the weaker information disclosure regulation induces a larger scale; however, for large companies (i.e., those with low marginal cost), it is full disclosure that induces a larger scale.

Lemma **2** (**Marginal Revenue and Scale**). *In the above symmetric economy:*

(i) *There exists a threshold for the scale of the firm below which the marginal revenue is higher under full disclosure of information than under no disclosure, strictly so for a generic set of investors' endowments.*

(ii) *If u^4 is strictly positive, the marginal revenue is higher under no disclosure than under full disclosure, strictly so for a generic set of investors' endowments.*

(iii) *Suppose that u^4 is strictly negative, and sufficiently so in the sense that there exists a strictly convex, twice continuously differentiable function f, with $f' > 1$ and such that $-u'' = f \circ u'$. Then, there exists a threshold for the scale of the firm above which the marginal revenue is higher under full disclosure than under no disclosure, strictly so for a generic set of investors' endowments.*

Loosely speaking, for statement (iii) to hold, u^4 has to be sufficiently negative for the effect of Jensen's inequality on u'' to dominate its effect on u', and, hence, for the indirect effect to outweigh the direct effect. This is intuitive: just as a condition on the convexity of marginal utility (u''') determines the optimality of full (as opposed to partial) information disclosure given the scale (cf. Proposition 1), a condition on the marginal utility's convexity (u^4) matters for the marginal revenue effects.

B. Unlimited Liability

If the investors are protected by limited liability regulations, the assumption that returns are positive is not very restrictive. We now allow the returns to be positive in some states and negative in others. Suppose, for definiteness, that

$$r_1 \geq r_2 \geq \ldots \geq r_{\bar{s}} > 0 > r_{\bar{s}+1} \geq \ldots \geq r_S, \tag{7}$$

and consider the following two partitions

$$\mathcal{P}^{\bullet} = \{\{1, 2, \ldots, \bar{s}\}, \{\bar{s}+1\}, \{\bar{s}+2\}, \ldots, \{S\}\}$$

and

$$\mathcal{P}_{\bullet} = \{\{1\}, \{2\}, \ldots, \{\bar{s}\}, \{\bar{s}+1, \bar{s}+2, \ldots, S\}\}.$$

Partition $\mathcal{P}^{\bullet}$ discloses detailed information in states where the firm loses money and only the fact it is not losing money in states where it makes positive returns. We call this the *candid* partition. Partition $\mathcal{P}_{\bullet}$ does the opposite: in states where the firm makes positive profits, it reveals all information; but if the firm is to lose money, this partition only reveals that profits will not be positive. We refer to $\mathcal{P}_{\bullet}$ as the *braggart* partition.

PROPOSITION **3** (**Optimality of the Candid vs. the Braggart Partitions**). *Suppose that the firm generates positive and negative returns, as in Eq.* (7)*. Generically in investors' endowments, the candid partition is strictly preferred by the firm to the braggart partition. For all endowments, the former is at least as good as the latter.*

In fact, for any return distribution, for negative returns, informing investors in detail is preferred by the issuer to informing them coarsely. For positive returns, informing investors in detail is suboptimal relative to informing them coarsely:

$$\kappa(\{1,\ldots,\bar{s}\},s) \geq \kappa(\{s\},s) \text{ for all } s \leq \bar{s}, \tag{8}$$

while

$$\kappa(\{s\},s) \geq \kappa(\{\bar{s}+1,\ldots,S\},s) \text{ for all } s > \bar{s}. \tag{9}$$

The result that the firm would choose to commit to disclosing detailed information about negative returns and only coarse information about positive returns contrasts with the classic "good news/bad news" prediction (cf. Milgrom, 1981); namely, that it is optimal for the seller of a product to test it and reveal "good news," and to withhold "bad news" by not testing the product. In that literature, when missing detailed information, the uninformed buyers reduce their purchases, though to a lesser extent than if they learned actual bad news about the good: the seller can thus benefit from not conducting and reporting verifiable tests.[42]

As in the "good news/bad news" problem, here the "high return/low return" news does translate into more or less trade. However, here return distributions matter through how they impact risk sharing, and not through the returns' intrinsic value or 'quality.' Unlike the case of value that derives from information, the returns' effect on the average valuation is *ex ante* favorable for the issuer if the negative returns are to be announced in detail. Thus, the auditing, verification and reporting conditions associated with some financing options introduced by the JOBS Act can be aligned with the firms' incentives.[43]

[42] Similarly, the issuers would not choose to pander — strategically bias disclosed information as conditionally *better*-looking (Che, Desssein and Kartik, 2013) — Proposition 3 holds for any distribution of firm returns and any distribution of the investors' endowments and, if the firms were to exploit the correlation between the returns and wealth distributions to tailor the particulars of disclosure, they would aim for a presentation that *enhances* the riskiness from the investors' perspective.

[43] Reviewing the disclosure practices, the report on the JOBS Act by Latham & Watkins LLP (2013) shows

VIII. The Firm's Preferences

The riskiness of the funding raised is, in practice, a common consideration in the financing process. It is of concern not only to business innovators; often, investment banks are reluctant to take all the risk of an offering and, instead, a syndicate of underwriters is formed. This is relevant even for the smaller firms that qualify for the JOBS Act exemptions (Latham & Watkins LLP, 2013). Let us consider firm objectives that are not invariant to riskiness.

A. Worst-case Scenario Liquidity Preferences

Expected liquidity preferences capture risk neutrality in the firm. A firm seeking financing exhibits extreme risk aversion if it is concerned *only* about the lowest possible price it could attain in the IPO. That is, denoting these preferences by $\succsim_1$,

$$\mathcal{P} \succsim_1 \mathcal{P}' \Leftrightarrow \min_{E \in \mathcal{P}} p(E) \geq \min_{E \in \mathcal{P}'} p(E).$$

B. A Family of Risk Averse Preferences

The difficulty with directly applying the usual definition of risk aversion is that there need not be a partition that delivers as value of the firm the expectation of the random value induced by another partition. However, using the extremes of risk-neutrality and worst-case risk aversion, we can parameterize a family of preferences over partitions that captures the preferences between those two extremes. For each $\lambda \in [0, 1]$, define the relation $\succsim_\lambda$ by saying that $\mathcal{P} \succsim_\lambda \mathcal{P}'$ if, and only if,

$$\lambda \min_{E \in \mathcal{P}} p(E) + (1 - \lambda) \sum_{E \in \mathcal{P}} \Pr(E) \cdot p(E)$$

is at least as large as

$$\lambda \min_{E \in \mathcal{P}'} p(E) + (1 - \lambda) \sum_{E \in \mathcal{P}'} \Pr(E) \cdot p(E).$$

Evidently, $\lambda = 0$ corresponds to the case of expected liquidity preferences, while $\lambda = 1$ amounts to worst-case scenario preferences.[44] The higher the value of λ, the more weight is given to the

that many firms selecting to use the exemptions under the *emerging growth company* (EGC) status also choose to disclose in the registration statement additional information beyond what is required, even when *not* requested by the SEC Staff reviewing the statement. As the most frequent additions, the report singles out (i) additional risk factors related to the EGC status, such as a warning that the reduced requirements for EGCs could make the issued securities less attractive to investors; (ii) that the issuer's costs from operating as a public company may have increased and these costs will increase further when the issuer loses EGC status; and (iii) that the issuer's exemption from Sarbanes-Oxley's auditor attestation requirements may result in unsuccessful internal controls.

[44] For the remainder of this section, we denote by $\succsim_0$ the expected-liquidity preference relation, and use $\succsim$ to denote arbitrary preference relations.

worst-case price in the IPO, so we interpret λ as a measure of risk aversion. Denote by Λ the class of all preferences $\succsim_\lambda$, for $\lambda \in [0,1)$, and let $\bar{\Lambda} = \Lambda \cup \{\succsim_1\}$.

C. Expected Utility Preferences

Of the preferences considered so far, only the expected liquidity relation satisfies the Independence Axiom and can be given a von Neumann-Morgenstern representation. We now consider the class of all relations that have such representation, restricting attention to risk averse preferences (using the usual definition of risk aversion). As usual, we say that $\succsim$ has an expected utility representation if there exists a function $v : \mathbb{R} \to \mathbb{R}$ such that $\mathcal{P} \succsim \mathcal{P}'$ when, and only when,

$$\sum_{E\in\mathcal{P}} \Pr(E) \cdot v\left(p(E)\right) \geq \sum_{E\in\mathcal{P}'} \Pr(E) \cdot v\left(p(E)\right).$$

We denote by $\mathcal{V}$ the class of all relations (over partitions) that are representable with a concave and strictly increasing cardinal utility index. Note that $\bar{\Lambda} \cap \mathcal{V} = \{\succsim_0\}$.

D. Suboptimality of Full Disclosure

Lemma 3 (**General Preference Monotonicity**). *Suppose that the return of the firm is positive in all states of the world. Then:*

(i) *The worst-case scenario preferences are weakly monotonic over information coarsening;*

(ii) *All risk averse preferences in class Λ are monotonic over information coarsening; and*

(iii) *All preferences that admit an expected utility representation with concave and strictly increasing utility index are monotonic over information coarsening.*

The prediction about suboptimality of full disclosure from Proposition 2 holds under weak assumptions on the firm objective.

Corollary 2 (**General Optimality of Partial Disclosure**). *Suppose that the return of the firm is strictly positive in all states of the world. For any preferences in classes Λ and $\mathcal{V}$, any partition that discloses no or only partial information is strictly preferred to the full disclosure partition, generically in investors' wealth profiles.*

For all the preference relations in classes $\bar{\Lambda}$ and $\mathcal{V}$, and for all investors' wealth profiles, any partition that discloses no or only partial information is at least as good as the full disclosure partition.

With two states, disclosing no information is optimal for the firm, strongly so in a generic set of investors' wealth profiles.

More generally, the predictions — for both fixed and endogenous business size — hold for the firm objectives that are affected by ambiguity of returns. Thus, small firm financing can benefit from limited disclosure even if the firm does not know the distribution of returns and not just the realization of the state. The availability of greater financing for large firms under more complete disclosure provides incentives to acquire the knowledge necessary for reporting. Furthermore, it assures that the greater investment encouraged from the investors results in risk sharing that is appropriate given fundamental information.

IX. Discussion

Since its inception, the JOBS Act has been expected to transform the possibilities for financing. In fact, it already has — through the considerable volume of public and private financing that opted for exemptions provided by the Act.[45] While the new legislation was prompted by the objective to stimulate job creation in a post-crisis economy, the JOBS Act — the first major change in securities regulation in eight decades — is seen as modernizing the financing of innovation by taking advantage of the possibilities previously unavailable for raising capital. The Act legislates and leverages the usage of communication technology for capital markets, somewhat analogously to how goods markets transformed a decade earlier, allowing investment firms to go digital and use the Internet to crowdfund new companies[46] and take advantage of the speed and lower search costs online to match and communicate with potential investors.

This paper shows that the investors' risk sharing motive itself offers support to weakening disclosure requirements of small companies and to differential regulation of disclosure for small and large companies. Disclosure and business scale jointly determine the firms' price-setting ability, which the JOBS Act makes more flexible, relative to SOX. Our analysis suggests that the contingent-on-size disclosure framework of the JOBS Act encourages firms to use this form of market power in a way that is consistent with improving efficiency, relative to the pre-JOBS regulation. The ultimate impact of the innovations in the securities legislation is tied to the ongoing efforts to regulate the functioning and transparency of financial market structure and microstructure.[47]

[45] Looking just at Title I provisions, over 90% of companies that publicly filed their first registration statement during the first year after April 5, 2012 under the EGC status chose at least one accommodation offered by the JOBS Act. Especially popular is confidential submission — approximately 65% of those confidentially submitted at least one draft of a registration statement prior to public filing (Latham & Watkins LLP, 2013).

[46] Internet platforms connect accredited investors to startups who need their capital, and verify their accreditation status. Some of the leading platforms for investment crowdfunding (i.e., with a potential for financial return) include AngelList, CircleUp, Crowdfunder, FundAmerica, FundersClub, and MicroVentures, RockThePost, SeedInvest, Somolend, WeFunder — many of which participated in the JOBS legislation process.

[47] These efforts are in large part a response to the changes in markets that occurred with technological advances.

It follows from our results that, while full disclosure under the SOX regulation *minimizes* the firm's funding for a fixed business size, accounting for the joint optimization with respect to scale and disclosure, it *maximizes* the firm's funding for large firms; and the reverse holds for small firms. Specifically, per unit of scale, a low-marginal-cost firm prefers partial disclosure (by Proposition 1). However, if a firm that has a sufficiently low marginal cost aims to maximize the total amount of capital raised, it may choose to disclose fully. The firm's decision to disclose more is a commitment device to select a larger scale at the time of its IPO. When applied to the specific provisions of the JOBS Act, with their different disclosure requirements, the argument above suggests that the logic of lighter disclosure for small or high-growth, high-risk businesses, and stricter disclosure for large projects appears consistent with the goals of the regulatory change, with respect to (1) efficiency, (2) effectiveness in raising capital, and (3) investor protection.

The observation that a regulatory disclosure framework alters the marginal revenue structure of a firm illuminates this logic. Respectively:

1. The *contingency on the scale* of exemptions from strict disclosure (Regulation A+ and IPO On-Ramp) incentivizes innovative companies with high growth potential (or creates an option which can be foregone during a certain period) to aim to develop a larger, efficient business scale.[48] Disclosure contingent on business scale (efficiently) increases the scale of both small and large firms (cf. Figure 1 and Lemma 2).

2. The exemptions increase the capital raised for small and high-growth companies. (cf. Proposition 1.)

3. At the same time, to ensure investor protection, the financing options maintain restrictions on individual investment caps to limit individual risk exposure. In light of our model, implicitly, the investors' risk capacity and the size of businesses are endogenously aligned through investment limits. The framework allows investors with large incomes and less convex u' (greater capacity to bear risk) to make large investments in larger firms, while

Some commentators attribute the global decline in small IPOs to electronic- and computer-based stock market structures removing capital commitment and intermediaries' incentives to support small public companies; high-frequency trading causing a shift of trading away from long-term investing, displacing the marketing of individual stocks by derivatives and hindering capital formation; and a dramatic shrinkage in trading spreads and tick sizes in all stocks followed by the introduction of new Order Handling Rules in 1997 and Regulation Alternative Trading Systems (ATS) in 1998 (e.g., Weild, Kim and Newport, 2013). In 2010, the Joint CFTC-SEC Advisory Committee on Emerging Regulatory Issues was established to develop recommendations on emerging and ongoing issues relating to both agencies.

[48] Using Figure 1, with a non-contingent maximum scale imposed above $\bar{K}$, a firm with $c < \bar{\delta}$, whose optimal scale would put it above that maximum, would choose to issue at that maximum scale, in order to be able to use the more profitable JOBS Act. This would be detrimental to all agents.

imposing disclosure to incentivize large investments for financing these large firms. Small firms are financed with investments from lower-income investors and more convex u' (lower capacity to bear risk) who are restricted to small-amount investments. Additionally, Regulation A+ introduces new audited financial statements and periodic reporting; and issuers choosing crowdfunding will be required to use intermediaries on Internet portals registered with the SEC funding and brokers, who will screen for the investors' capacity to bear risk. Finally, as we argued above, the greater uncertainty under limited information disclosure may improve the investors' welfare.

Appendix

Proof of Lemma 1: Using Eq. (5),

$$\sum_{E\in\mathcal{P}}\left[\Pr(E)\cdot\sum_{s\in E}\kappa(E,s)\cdot r_s\right]=\sum_{s\in\mathcal{S}}\Pr(s)\cdot\kappa(E_s^{\mathcal{P}},s)\cdot r_s,$$

where $E_s^{\mathcal{P}}$ denotes the event of $\mathcal{P}$ that contains s.

It is immediate that, if $r_s > 0$ for all s, then an increase in κ for some s, without a decrease in it for any other s', increases this value. *Q.E.D.*

Proof of Proposition 1: For each state s, let

$$\bar{x}_s=\frac{1}{I}\cdot\left(r_s+\sum_i w_s^i\right).$$

denote the average income realized in period 2 in state s. As defined by Eq. (2), the set of period-2 incomes that can result from trade, $X(\{s\})$, is

$$\left\{x\in\mathbb{R}^I \mid \sum_i(x_s^i-w_s^i)=r_s \text{ and } \exists y\in\mathbb{R}^i : x^i=w_s^i+y^i\cdot r_s \text{ and } \sum_i y^i=1\right\},$$

and we have that $(\bar{x}_s,\dots,\bar{x}_s)\in X(\{s\})$.[49]

Consider $s,s'\in E$, $s\neq s'$. Suppose that $(\bar{x}_s,\dots,\bar{x}_s)\in X(E)$. This means that, $w_s^1-w_s^2=r_s\cdot(y^2-y^1)$, for some pair of scalars (y^1,y^2). If, in addition, $(\bar{x}_{s'},\dots,\bar{x}_{s'})\in X(E)$, we further have that $w_{s'}^1-w_{s'}^2=r_{s'}\cdot(y^2-y^1)$, and, hence, that

$$\frac{w_s^1-w_s^2}{r_s}=\frac{w_{s'}^1-w_{s'}^2}{r_{s'}}.$$

This condition fails in an open subset of $\mathbb{R}^{S\times I}$ with full Lebesgue measure.[50]

[49] Since $r_s\neq 0$, simply let $y^i=(\bar{x}_s-w_s^i)/r_s$.

[50] Following the remarks in Ft. 27 and Ft. 29, notice that Eq. $(*)$ in Ft. 29 does not disrupt this argument, so long as u' remains monotonically decreasing.

Since $\mathcal{S}$ is finite, it follows that in a generic set of profiles of investors' wealth, for any event $E \subseteq \mathcal{S}$ that contains more than one state, there exists at least one $s \in E$ such that $(\bar{x}_s, \ldots, \bar{x}_s) \notin X(E)$. Let us denote by W such a generic set.

It is immediate from the quasi-linearity and strict concavity of u that the unique solution to maximization problem (3) for $E = \{s\}$ is $x(\{s\}) = (\bar{x}_s, \ldots, \bar{x}_s)$. By convexity of u', we further have that $\bar{x}_s$ also solves problem

$$\min_{x_s \in X(\{s\})} \left\{ \frac{1}{I} \cdot \sum_i u'(x_s^i) \right\}.$$

It follows that in W, for any non-singleton event E, $\kappa(E, s) \geq \kappa(\{s\}, s)$ for all $s \in E$, with a strict inequality for some. *Q.E.D.*

Proof of Proposition 2: This assertion follows from Proposition 1 and Lemma 1. *Q.E.D.*

Proof of Lemma 2: Let W be the generic set constructed in the proof of Proposition2.

(i) For $K = 0$, the direct effect is strictly larger under $\mathcal{P}_*$ (JOBS) than under $\mathcal{P}^*$ (SOX), in set W. Therefore, by continuity of u' and since for any i and s, $u''\left(x_s^i(\mathcal{P}^*, K)\right)$ is bounded below for any $K \geq 0$, there exists a sufficiently small $\underline{K} > 0$ such that the difference in direct effects outweighs the difference in indirect effects for any $K \leq \underline{K}$.

(ii) Jensen's inequality, with u^4 strictly positive, implies that, generically in W,

$$\frac{1}{I} \cdot \sum_i u''\left(x_s^i(\mathcal{P}_*, K)\right) > u''\left(\frac{1}{I} \sum_i x_s^i(\mathcal{P}_*, K)\right) = \frac{1}{I} \sum_i u''\left(x_s^i(\mathcal{P}^*, K)\right).$$

It follows that both the direct and the indirect effects are larger under $\mathcal{P}_*$ than under $\mathcal{P}^*$.

(iii) Let f be the convex increasing function such that $-u'' = f \circ u'$. Since both u' and f are convex and f is increasing:

$$f\left(u'\left(x_s^1(\mathcal{P}^*), K\right)\right) < f\left(\frac{1}{I} \cdot \sum_i u'\left(x_s^i(\mathcal{P}_*, K)\right)\right) < \frac{1}{I} \cdot \sum_i f\left(u'\left(x_s^i(\mathcal{P}_*, K)\right)\right).$$

It follows that

$$f\left(\frac{1}{I} \cdot \sum_i u'\left(x_s^i(\mathcal{P}_*, K)\right)\right) - f\left(u'\left(x_s^1(\mathcal{P}^*, K)\right)\right) < \frac{1}{I} \cdot \sum_i f\left(u'\left(\left(x_s^i(\mathcal{P}_*, K)\right)\right) - f\left(u'\left(x_s^1(\mathcal{P}^*, K)\right)\right)\right),$$

and therefore,

$$f\left(\frac{1}{I} \cdot \sum_i u'\left(x_s^i(\mathcal{P}_*, K)\right)\right) - f\left(u'\left(x_s^1(\mathcal{P}^*, K)\right)\right) < \left|\frac{1}{I} \cdot \sum_i u''\left(x_s^i(\mathcal{P}_*, K)\right) - u''\left(x_s^1(\mathcal{P}^*, K)\right)\right|.$$

Since f has slope larger than 1, we have

$$\frac{1}{I}\cdot\sum_i u'\left(x_s^i(\mathcal{P}_*,K)\right)-u'\left(x_s^1(\mathcal{P}^*,K)\right)<f\left(\frac{1}{I}\cdot\sum_i u'\left(x_s^i(\mathcal{P}_*,K)\right)\right)-f\left(u'\left(x_s^1(\mathcal{P}^*,K)\right)\right).$$

Combining the two inequalities above, it follows that, for any $K>I$,

$$\frac{1}{I}\cdot\sum_i u'\left(x_s^i(\mathcal{P}_*,K)\right)-u'\left(x_s^1(\mathcal{P}^*,K)\right)<\left|\frac{1}{I}\cdot\sum_i u''\left(x_s^i(\mathcal{P}_*,K)\right)-u''\left(x_s^1(\mathcal{P}^*,K)\right)\right|\cdot\frac{K}{I};$$

that is, for any $K\geq\bar{K}=I$, the difference in indirect effects outweighs the difference in direct effects.

Q.E.D.

Proof of Proposition 3: Recall Eqs. (8) and (9), noting that, generically in endowments, each of them is strict for at least one state of nature. Using Eq. (5), generically,

$$\begin{aligned}\sum_{E\in\mathcal{P}^\bullet}\left[\Pr(E)\cdot\sum_{s\in E}\kappa(E,s)\cdot r_s\right]&=\sum_{s\in\mathcal{S}}\Pr(s)\cdot\kappa(E_s^{\mathcal{P}^\bullet},s)\cdot r_s\\&=\sum_{s\leq\bar{s}}\Pr(s)\cdot\kappa(\{1,\ldots,\bar{s}\},s)\cdot r_s+\sum_{s>\bar{s}}\Pr(s)\cdot\kappa(\{s\},s)\cdot r_s\\&>\sum_{s\leq\bar{s}}\Pr(s)\cdot\kappa(\{s\},s)\cdot r_s+\sum_{s>\bar{s}}\Pr(s)\cdot\kappa(\{\bar{s}+1,\ldots,S\},s)\cdot r_s\\&=\sum_{s\in\mathcal{S}}\Pr(s)\cdot\kappa(E_s^{\mathcal{P}_\bullet},s)\cdot r_s\\&=\sum_{E\in\mathcal{P}_\bullet}\left[\Pr(E)\cdot\sum_{s\in E}\kappa(E,s)\cdot r_s\right],\end{aligned}$$

where the first equality is as in the proof of Lemma, and the inequality comes from Eqs. (7), (8) and (9). Then, by definition, $\mathcal{P}^\bullet\succ_0\mathcal{P}_\bullet$.

On the complement of the generic set of endowments, the inequality above is weak, and, therefore, $\mathcal{P}^\bullet\succsim\mathcal{P}_\bullet$. *Q.E.D.*

Proof of Lemma 3:

(i) Let $\mathcal{P}$ be a coarsening of $\mathcal{P}'$ that induces a first-order stochastic dominance increase in the pricing kernel, and fix $E'=\operatorname{argmin}_{\tilde{E}\in\mathcal{P}'}p(\tilde{E})$.

Fix any $E \in \mathcal{P}$, and let $\mathcal{E} \subseteq \mathcal{P}'$ be such that $\cup_{\tilde{E}\in\mathcal{E}} \tilde{E} = E$. Using again Eq. (5),

$$\begin{aligned}
p(E) &= \sum_{s\in E} \Pr(s \mid E) \cdot \kappa(E, s) \cdot r_s \\
&= \sum_{\tilde{E}\in\mathcal{E}} \sum_{s\in\tilde{E}} \Pr(s \mid E) \cdot \kappa(E, s) \cdot r_s \\
&\geq \sum_{\tilde{E}\in\mathcal{E}} \sum_{s\in\tilde{E}} \Pr(s \mid \tilde{E}) \cdot \Pr(\tilde{E} \mid E) \cdot \kappa(\tilde{E}, s) \cdot r_s \\
&= \sum_{\tilde{E}\in\mathcal{E}} \Pr(\tilde{E} \mid E) \cdot p(\tilde{E}) \\
&\geq \sum_{\tilde{E}\in\mathcal{E}} \Pr(\tilde{E} \mid E) \cdot p(E') \\
&= p(E'),
\end{aligned}$$

where the first inequality comes from the improvement in the pricing kernel, and the second from the definition of event E'. Since the latter holds for any $E \in \mathcal{P}$, it follows that

$$\min_{E\in\mathcal{P}} p(E) \geq p(E') = \min_{E\in\mathcal{P}'} p(E).$$

(ii) Fix $\succsim_\lambda$, $\lambda \in (0, 1)$, and, as above, let $\mathcal{P}$ coarsen $\mathcal{P}'$ and induce a first-order stochastic dominance increase in the pricing kernel. By the previous argument,

$$\min_{E\in\mathcal{P}} p(E) \geq \min_{E\in\mathcal{P}'} p(E),$$

while

$$\sum_{E\in\mathcal{P}} \Pr(E) \cdot p(E) > \sum_{E\in\mathcal{P}'} \Pr(E) \cdot p(E)$$

by Lemma 1. Since $\lambda < 1$,

$$\lambda \min_{E\in\mathcal{P}} p(E) + (1 - \lambda) \sum_{E\in\mathcal{P}} \Pr(E) \cdot p(E) > \lambda \min_{E\in\mathcal{P}'} p(E) + (1 - \lambda) \sum_{E\in\mathcal{P}'} \Pr(E) \cdot p(E).$$

(iii) Let $\succsim$ be an expected utility preference relation with concave and strictly increasing utility index v. Once again, let $\mathcal{P}$ coarsen $\mathcal{P}'$ and induce a first-order stochastic dominance increase in κ. Let p and p' be, respectively, the (random) prices induced by the two partitions, using Eq. (5), and let π be an auxiliary random variable constructed as follows: for each $E \in \mathcal{P}$, let $\{E_1', \ldots, E_N'\} \subseteq \mathcal{P}'$ be such that $\cup_{n=1}^N E_n = E$, and let

$$\pi(E) = \sum_{n=1}^{N} \left[\Pr(E_n' \mid E) \cdot \sum_{s\in E_n'} \Pr(s \mid E_n') \cdot \kappa(E_n', s) \cdot r_s \right].$$

This variable gives us the counterfactual prices that would arise under the coarser partition $\mathcal{P}$, under the assumption that the pricing kernel is the one induced by the finer partition $\mathcal{P}'$.

Note that p' is a mean-preserving spread of π, so it follows that π is at least as large as p' in the sense of second-order stochastic dominance. Since $r_s > 0$ at all s, and the pricing kernel under $\mathcal{P}$ first-order stochastically dominates that under $\mathcal{P}'$, it follows that p first-order stochastically dominates the auxiliary variable π. By transitivity, then, p second-order stochastically dominates p', which suffices since v is concave and increasing.

Q.E.D.

References

Agrawal, A., C. Catalini, and A. Goldfarb (2014): "Some simple economics of crowdfunding," Innovation Policy and the Economy 14, 1, 63-97.

Amador, M. and P.-O. Weill (2010): "Learning from prices: public communication and welfare," Journal of Political Economy 118, 866-907.

Angeletos, G.M. and A. Pavan (2007): "Efficient use of information and the social value of information," Econometrica 75, 4, 1103-1142.

Carvajal, A., M. Rostek, and M. Weretka (2011): "Bundling without price discrimination," Warwick Economics Research Paper Series 936.

Carvajal, A., M. Rostek, and M. Weretka (2012): "Competition in financial innovation," Econometrica 80, 5, 1895-1936.

Che, Y.-K., W. Dessein, and N. Kartik (2013): "Pandering to persuade," American Economic Review 103, 1, 47-79.

CrowdFund IQ (2013): U.S. Equity Crowdfunding Investor Report, March.

Dang, T.-V., G. Gorton, and B. Holmstrom (2009) "Opacity and the optimality of debt for liquidity provision," unpublished manuscript, School of Management, Yale University; available electronically at:
`http://www.econ.yale.edu/~dirkb/teach/pdf/d/dang/Paper_Liquidity.pdf`

Fishman, M.J. and K. Hagerty (1989): "Disclosure decisions by firms and the competition for price efficiency," Journal of Finance 44, 3, 633-646.

Gale, I. and J. Stiglitz (1989): “The informational content of initial public offerings,” Journal of Finance 44, 2, 469-477.

Gentzkow, M. and E. Kamenica (2014): “Costly persuasion,” American Economic Review 104, 5, 457-62.

Guzik, S.S. (2014): “Regulation A+ offerings: A new era at the SEC,” available electronically at:
`http://blogs.law.harvard.edu/corpgov/2014/01/15`

Hirshleifer, J. (1971): “The private and social value of information and the reward to inventive activity,” American Economic Review 61, 4, 561-574.

Holmstrom, B. (2009): “Comment on “The credit rating crisis”,” in D. Acemoglu, K. Rogoff, and M. Woodford (eds.), NBER Macroeconomics Annual 24, 215-222.

Kamenica, E. and M. Gentzkow (2011): “Bayesian persuasion,” American Economic Review 101, 6, 2590-2615.

Kurlat, P. and L. Veldkamp (2013): “Should we regulate financial information?” Stern School of Business Working Paper EC-12-15.

Latham & Watkins LLP (2013): The JOBS Act After One Year: A Review of the New IPO Playbook, available electronically at:
`http://www.sec.gov/info/smallbus/acsec/acsec-091713-lathamreport-slides.pdf`

Milgrom, P. (1981): “Good news and bad news: Representation theorems and applications,” Bell Journal of Economics 12, 2, 380-91.

Milgrom, P. and J. Roberts (1986): “Relying on the information of interested parties,” RAND Journal of Economics 17, 1, 18-32.

Morris, S. and H.S. Shin (2002): “The social value of public information,” American Economic Review 92, 5, 1521-1534.

Morris, S. and H.S. Shin (2007): “Optimal communication,” Journal of the European Economic Association (Papers and Proceedings) 5, 2-3, 594-602.

Morris, S. and H.S. Shin (2012): “Contagious adverse selection,” American Economic Journal: Macroeconomics 4, 1, 1-21.

Pagano, M. and P. Volpin (2012): “Securitization, transparency and liquidity,” Review of Financial Studies 25, 8, 2417-2453.

Security and Exchange Commission (2013): "Report on review of disclosure requirements in regulation S-K. As required by Section 108 of the Jumpstart Our Business Startups Act," SEC Staff Report, December 20, 2013, available electronically at: http://www.sec.gov/news/studies/2013/reg-sk-disclosure-requirement-review.pdf

Shin, H.S. (2003): "Disclosures and asset returns," Econometrica 71, 1, 105-133.

Weild, D., E. Kim, and L. Newport (2013): "Making stock markets work to support economic growth: Implications for governments, regulators, stock exchanges, corporate issuers and their investors," Capital Markets Series, OECD Corporate Governance Working Paper 10.