Self-Regulation Versus Government Regulation: An Externality View*

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Abstract

Who should be responsible for industry regulation, a private self-regulatory agency or a public agency? This paper provides a simple framework to analyze the optimal scope of a private self-regulatory organization (SRO) versus government regulation. The trade-off depends on three key elements: externalities, monopoly distortions, and the degree of asymmetric information. Self-regulation is more desirable than government regulation if the degree of asymmetric information between the public regulator and private industry is larger than the size of the monopoly distortion and externalities from the industry to society. An optimal mechanism consists of both self-regulation and government regulation where an SRO internalizes externalities within the industry and the government corrects any distortions generated by the SRO. These insights can be applied to many practical settings and policy discussions—for example, in the context of the financial sector, as with the Financial Industry Regulatory Authority (FINRA).

Keywords: Self-Regulation; Government Regulation; Externalities
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"As I have stated before, it is the private sector, not the public sector, that is in the best position to provide effective supervision."[1]

— Larry Summers in 2000

"No substantially interconnected institution or market on which the system depends should be free from rigorous public scrutiny."[2]

— Larry Summers in 2009

1 Introduction

Self-regulation has been a feature for many industries and professions throughout the world. In the U.S. financial markets, all firms dealing with securities are required to be members in one of two self-regulatory organizations (SROs): Financial Industry Regulatory Authority (FINRA) or the Municipal Securities Rulemaking Board. These SROs license their members, write and examine rules for market players, and are themselves also subject to government regulation.[3] Self-regulation is not a unique feature for security markets but also exists in other industries such as the nuclear and chemical industry. Interestingly, a similar arrangement is prevalent in many professions such as accounting, law and medicine. Moreover, self-regulation is a worldwide phenomenon. For example, the Swiss Banker Association plays an important role in implementing banking regulation in Switzerland, and the Advertising Standards Authority conducts regulation in the UK advertising industry.

The existence of self-regulation has confused many people for a long time due to the conventional belief that a private organization can never achieve efficient and effective market discipline given its internal conflict of interest. From the quotes

[1]See "Remarks of Treasury Secretary Lawrence H. Summers to the Securities Industry Association" on Nov. 9, 2000 at http://www.treasury.gov/press-center/press-releases/Pages/ls1005.aspx.

[2]See "Remarks of Lawrence H. Summers Director of the National Economic Council Responding to an Historic Economic Crisis: The Obama Program" on March 13, 2009 at https://www.brookings.edu/wp-content/uploads/2012/04/0313_summers_remarks.pdf.

[3]For a detailed description for FINRA, see http://en.wikipedia.org/wiki/Financial_Industry_Regulatory_Authority.

at the beginning of the introduction, it is not hard to see the stark difference between Larry Summers before and after the Great Recession, where he discusses how to allocate the regulatory power between the private and public sector. Indeed, the allocation of regulatory power between an SRO and government has significant welfare implications. Given its widespread popularity in different industries, one might expect a comprehensive understanding of self-regulation versus government regulation in the literature. However, some fundamental questions are still unclear. For example, what is the trade-off between industrial self-regulation and government regulation? What is the optimal regulatory mechanism when regulating an industry? In this paper, I provide a simple theoretical framework to understand these questions.

Broadly speaking, self-regulation refers to the phenomenon in which an industry establishes a private organization to exercise regulatory authority over the industry members. Obviously, the effectiveness of self-regulation depends on whether the government grants an SRO regulatory power. In some industries, the government delegates regulatory power to private sectors, such as FINRA in the securities market. In other industries, however, the government still controls regulatory power, but the SRO significantly affects industry regulation, such as the Institute of Nuclear Power Operation in the nuclear industry and the American Medical Association in the medical profession. These are typical examples of regulatory capture. In either case, self-regulation can be conducted in an effective way and can shape the industry's regulatory policy. In this paper, I refer to self-regulation as cases where an SRO has de facto regulation over the industry.

There are many explanations for the emergence of self-regulation, such as asymmetric information, externalities, forestalling public intervention, moral concerns, etc. In this paper, I take an externality view and analyze the scope of self-regulation in addressing market inefficiencies in the economy. By introducing a simple general theoretical framework, I investigate the trade-off between self-regulation and government regulation. In the end, I also analyze the optimal regulatory mechanism and apply theoretical insights to real-world observations and ongoing policy debates.

In the model, there are three elements affecting the trade-off between self-regulation and government regulation. The first element is about the externalities in the economy. Depending on who is affected, the different types of externalities make a large difference. An SRO has an incentive to internalize any externalities within the industry but has no incentive to internalize externalities to the rest of society. Even worse, the SRO's behavior might exacerbate such externalities to society. The government, on the other hand, has an incentive to correct any types of externalities. The second element is about monopoly distortions. Self-regulation is usually associated with monopoly power since an SRO can coordinate industry behavior through regulation. The last element is about asymmetric information. Government regulation can correct any externalities if the government has perfect information about the economy. The existence of asymmetric information between the public and private sector renders the effectiveness of government regulation and thus creates a role for self-regulation.

To fully understand this trade-off, I impose more informational structure and apply a second-order approximation following Weitzman (1974) and Laffont (1977). I find that self-regulation is more desirable than government regulation if the degree of asymmetric information is larger than the size of monopoly distortion and the externalities to society. Moreover, not all information asymmetries matter for this trade-off. In particular, the asymmetric information about the externalities to the rest of society does not matter as long as it is uncorrelated with the asymmetric information about other externalities. The intuition is as follows. An SRO has no incentive to utilize information on the externalities to the rest of society for the regulation on its own industry. Even if the government has an incentive to correct such externalities, the regulation is not effective due to the asymmetric information issue. As a result, asymmetric information does not affect the trade-off between self-regulation and government regulation.

I also derive an optimal regulatory mechanism in this economy. The general message is to combine both self-regulation and government regulation where self-regulation aims at correcting externalities within the sector, and government regulation aims at correcting any distortions from self-regulation. Depending on the information structure of the government, the first best allocation might not be implementable. In particular, if the government does not have information about the externalities to society, the first best can never be achieved since an SRO has no incentive to utilize such information. But a second best allocation can be achieved as long as the government has enough information to correct the monopolistic distortions generated by the SRO.

The insights of the general framework can be applied to many empirical observations and theoretical works. I provide several arguments to apply this insight in order to understand regulatory arrangements in many different industries. I argue that the degree of the three elements identified in this paper plays an important role. Furthermore, their relative importance can change with the development of industries. Moreover, the insights can be applied to many policy discussions. I argue that there should be a room for self-regulation other than government regulation.

Literature Review This paper is related to several strands of literature. In particular, it is related to the literature on industrial self-regulation.[4] Existing work has focused on the reasons that firms want to join the SROs for self-regulation in different industries. For example, King et al. (2011) provides an excellent survey of the adoption of industry self-regulation. Maxwell et al. (2000) provides both a theoretical and empirical work to argue that firms form self-regulation to preempt government regulations. Lyon and Maxwell (2003) and Lyon and Maxwell (2012) analyze the welfare implication of self-regulation with the interaction of government. Departing from this literature, this paper takes an externality view and focuses on the scope of self-regulation.

This paper is also related to the literature investigating the benefits and costs of self-regulation. There is evidence that self-regulation tends to generate monopolistic distorations. For example, Shaked and Sutton (1981) argue that a professional group tends to restrict the number of members to gain monopoly power. Moreover, Pirrong (1995) argues that self-regulation is a weak tool to prevent monopoly power by analyzing the self-regulation of commodity exchanges. There is some evidence that an SRO tends to behave in favor of the industry rather than consumers (see DeMarzo et al. (2005)). Even so, there are still benefits for the existence of

[4]For example, there are many theoretical work on self-regulation in financial markets including Núñez (2001), Stefanadis (2003), DeMarzo et al. (2005), Núñez (2007) and Aboura and Lepinette (2014), etc.

self-regulation. For example, Carson (2011) argues that self-regulation is important for emerging markets to develop financial markets. Leland (1979), Gehrig and Jost (1995) and Shapiro (1986) model the economic benefit of self-regulation as reducing asymmetric information and argue that its existence might improve the welfare of society. This paper provides a general framework to analyze the trade-off between self-regulation and government regulation.[5] Consistent with the literature, I argue that government regulation improves the effectiveness of self-regulation. For example, Kondo (2007) provides evidence that more control of an SRO over customer–firm dispute resolution increases the level of enforcement against a firm's misbehavior. Moreover, DeMarzo et al. (2005) show that government oversight is desirable to reduce the misbehavior of the SRO.

The organization of the paper is as follows: Section 2 presents the general model; Section 3 derives an optimal regulatory mechanism; Section 4 provides several applications; and Section 5 concludes.

2 The Model

In this section, I provide a simple general framework to analyze the scope of self-regulation and government regulation.

2.1 Environment

The economy consists of two sectors: producers and consumers, where each sector has a continuum of individual agents. There is only one good in the economy, which is traded at a market price p. There is a case for regulation in this economy due to the existence of externalities.[6] It is assumed that there are two types of externalities, which are generated by producers and negatively affect both producers and consumers. Hence, there is a case for industrial self-regulation to internalize externalities within the producer sector. There is also room for government regu-

[5] Grajzl and Murrell (2007) also pursue the question of self-regulation versus government as an allocation of lawmaking power and identify conditions for improving social welfare.

[6] To simplify analysis, I do not provide a micro-foundation for such externalities. In the applications, I provide examples to illustrate how such externalities might evolve.

lation because producers have no incentive to internalize the externalities affecting consumers.

Producers There is a continuum of producers indexed by $i \in [0,1]$. Producer i produces good x_i at a cost of $c(x_i;\theta)$, where x_i denotes the quantity of the good and θ summarizes all the parameters in the cost function. Moreover, there is a general equilibrium effect on individual profit captured by the term $C(X;\Theta)$, where $X = \int x_i di$ is the overall production of the good and Θ is the parameter. This general equilibrium effet is a negative externality from production, which hurts the producer sector. One rationale is the existence of a production externality: excessive production leads to a reduction of profit for individual production. Presumably, $c' > 0, C' > 0$ and $c'' > 0, C'' > 0$ are imposed. The profit Π^i for individual producer i is given by

$$\Pi^i = px_i - c(x_i;\theta) - C(X;\Theta)$$

Consumers There is a continuum of consumers indexed by $j \in [0,1]$. Consumer j buys consumption good y_j from producers at price p. Moreover, the consumer's utility function takes the form of $u(y_j;\phi)$, where y_j is the individual demand of consumer j and ϕ is the parameter. Similarly, there is an additional term $U(X;\Phi)$ rationalized as consumption externalities where Φ summarizes the parameters. It is assumed that $u' > 0, U' > 0$ and $u'' < 0, U'' > 0$. The utility U^j for consumer j is given by

$$U^j = u(y_j;\phi) - py_j - U(X;\Phi)$$

Competitive Equilibrium consists of an allocation (x_i^{CE}, y_j^{CE}) and price p such that under price p, x_i^{CE} maximizes Π^i and y_j^{CE} maximizes U^j for $\forall i, j \in [0,1]$. Moreover, the market clears, i.e., $X^{CE} = \int_0^1 x_i^{CE} di = Y^{CE} = \int_0^1 y_j^{CE} dj$.

Given the definition of competitive equilibrium, one can solve the optimality condition for X^{CE}, which satisfies

$$u'(X^{CE};\phi) = c'(X^{CE};\theta) \tag{1}$$

First Best Allocation Unsurprisingly, the allocation under competitive equilibrium is not socially optimal given the existence of externalities in the economy. To formalize the idea, we define the first best allocation as the one chosen by a utilitarian social planner who cares equally about consumers and producers. As is noted later, such an allocation should be considered as the first best allocation since there is no asymmetric information between the social planner and private agents. The social planner can improve the collective welfare of consumers and producers by internalizing both the technology externality and consumption externality. The planner's optimization problem is given as follows:

$$\max_X u(X;\phi) - U(X;\Phi) - c(X;\theta) - C(X;\Theta)$$

The optimality condition for the social optimal allocation X^{FB} satisfies

$$u'\left(X^{FB};\phi\right) = U'(X^{FB};\Phi) + c'(X^{FB};\theta) + C'(X^{FB};\theta) \tag{2}$$

Inefficiency of Competitive Equilibrium By comparing the optimality conditions (1) and (2), it is not hard to see that $X^{CE} > X^{FB}$ since $U', C' > 0$. In other words, there is an over-production in competitive equilibrium. This result is straightforward since both producers and consumers fail to internalize the externality terms.[7]

Implementation of First Best Allocation Intuitively, implementation of the first best allocation requires a knowledge of all the parameters such as $\{\theta, \Theta, \phi, \Phi\}$. As we will show later, all the government needs to know is the information about the consumer side, $\{\phi, \Phi\}$. By joining with an industrial self-regulatory organization, the first best allocation can be implemented.

2.2 Government Regulation and Industrial Self-Regulation

Regulation is justified since there is a discrepancy between competitive equilibrium and the first best allocation. The interesting question is who should conduct regula-

[7] It is the producers who should bear the blame for over-production because the externality term depends on total production by assumption. However, total production equals total consumption in equilibrium. Furthermore, it is possible that consumers are also responsible for the inefficiency if the externality term depends on total consumption.

tion: an SRO representing producers or a government representing both consumers and producers. As discussed before, the SRO has an incentive to internalize the externalities within the producer sector but not the externalities to the consumers. Moreover, it generates monopolistic distortions.[8] Hence, government regulation is needed to address such concerns. However, there might be an asymmetric information issue for the government. It is reasonable to assume that producers have a better information structure than the government. Specifically, we assume that producers can perfectly observe the information structure $\mathcal{F} = \{\theta, \Theta, \phi, \Phi\}$, while the government cannot observe all of them. Instead, the government has a prior distribution over $\mathcal{F}$. Hence, there is a trade-off between government regulation and self-regulation.

Lemma 1. ***Government Regulation***
A benevolent government chooses allocation $X^G < X^{CE}$ to maximize expected social welfare. To implement X^G, it can put restrictions on individual production x_i.

Proof. See Appendix A.1. □

A brief comparison between the first best allocation X^{FB} and the allocation under government regulation X^G reveals the inferior information structure of government. Ex ante, X^G implements X^{FB} based on the government's information structure. Ex post, there is some discrepancy since X^{FB} is a function of parameters in $\mathcal{F}$ while X^G is constant. This difference captures two types of cost for government regulation in reality. First, government regulation suffers from asymmetric information. The inability of precisely targeting the source of externalities becomes a distortion for government regulation. Second, even if the government has the same information structure as the private sector, government regulation is inflexible to changing parameters due to many other restrictions, such as budget constraints, political processes, etc.

An SRO plays a role in regulation since it has a superior information structure. But it also has two types of costs due to the incentive problem. Since an SRO has

[8] Indeed, correcting externalities to consumers requires a reduction in production, the same result when the SRO exerts monopolistic distortion. However, the magnitude of reduction in production might differ. Furthermore, depending on assumptions, correcting externalities to consumers might call for an increase in production.

the power to set rules in coordinating industry-level production, it can effectively introduce monopoly power in many respects, such as choosing an industry standard to restrict supply as in Leland (1979) and Shaked and Sutton (1981). Here, I simply model the monopoly distortion by assuming that an SRO can perfectly observe a downward-sloping demand curve defined by $p(X;\phi) = u'(X;\phi)$. Furthermore, the SRO has no incentive to internalize externalities to consumers $U(X;\Phi)$ even if they can observe the externality parameter Φ perfectly.

Lemma 2. ***Self-Regulation***
An SRO chooses industry production level $X^S < X^{CE}$ to maximize the collective profit of producers. It can implement X^S by putting production restrictions on the industry.[9]

Proof. See Appendix A.2 □

There is no conflict of interest between an SRO and an individual producer since the SRO and the individual producer share the same profit function. By internalizing the production externality and pursuing monopoly rent, the profit of the industry has been increased. However, this might hurt the welfare of consumers. Specifically, there are two distortions with self-regulation: the monopoly distortion captured by the term $u''(X^S;\phi)X^S$ and the externalities to consumers captured by $U(X^S;\Theta)$.

2.3 Trade-off of Self-Regulation Versus Government Regulation

From the analysis in Lemma 1 and 2, neither government regulation nor self-regulation can implement the first best allocation X^{FB}. A natural question to consider is the trade-off between self-regulation and government regulation. Specifically, if one has to choose between industrial self-regulation and government regulation, what factors should be considered? To answer this question, I define the following welfare function $\Delta^{S/G}$, which measures the welfare benefit of self-regulation

[9]It might seem strange to claim that an SRO could choose production level since it violates anti-trust law. But effectively, an SRO can affect individual choice of production by choosing regulation rules and achieve its ideal production level.

over government regulation under the information structure of government. Presumably, one prefers self-regulation if $\Delta^{S/G} > 0$, and government regulation otherwise.

$$
\begin{aligned}
\Delta^{S/G} &\equiv E[W(X^S;\mathcal{F}) - W(X^G;\mathcal{F})] \\
&\equiv E[u(X^S;\phi) - U(X^S;\Phi) - c(X^S;\theta) - C(X^S;\Theta)] \\
&- E[u(X^G;\phi) - U(X^G;\Phi) - c(X^G;\theta) - C(X^G;\Theta)]
\end{aligned}
$$

where the expectation is taken over the prior distribution of information structure $\mathcal{F}$.

To get an analytical solution for $\Delta^{S/G}$, I follow Weitzman (1974) and Laffont (1977) to impose information structure in the model and apply a second-order approximation. Specifically, functions u, U, c, C can be approximated around $x = X^G$ or $X = X^G$ as follows.

$$
\begin{aligned}
u(x;\phi) &\approx u\left(X^G;\phi\right) + [\bar{u'} + \phi](x - X^G) + \frac{1}{2}\bar{u''}(x - X^G)^2 \\
U(X;\Phi) &\approx U\left(X^G;\Phi\right) + [\bar{U'} + \Phi](X - X^G) + \frac{1}{2}\bar{U''}(X - X^G)^2 \\
c(x;\theta) &\approx c\left(X^G;\theta\right) + [\bar{c'} + \theta](x - X^G) + \frac{1}{2}\bar{c''}(x - X^G)^2 \\
C(X;\Theta) &\approx C\left(X^G;\Theta\right) + [\bar{C'} + \Theta](X - X^G) + \frac{1}{2}\bar{C''}(X - X^G)^2
\end{aligned}
$$

The restrictions on information structure imply that information asymmetries $\mathcal{F}$ only appear up to the first-order derivatives. To normalize, I assume the parameters have zero mean and denote their variance by $\sigma^2_{\mathcal{F}}$. Moreover, the parameters in $\mathcal{F}$ are uncorrelated.

The relative welfare benefit of self-regulation over government regulation can be approximated as

$$
\begin{aligned}
\Delta^{S/G} &\approx E\left[(\bar{u'} - \bar{U'} - \bar{c'} - \bar{C'} + \phi - \Phi - \theta - \Theta)(X^S - X^G)\right] \\
&+ \frac{1}{2}(\bar{u''} - \bar{U''} - \bar{c''} - \bar{C''})E\left[(X^S - X^G)^2\right]
\end{aligned}
$$

Applying the optimality condition for X^S and X^G, $\Delta^{S/G}$ can be approximated by the following relationship.[10]

$$\begin{aligned}
\Delta^{S/G} &\approx E\left[(\bar{u'} - \bar{U'} - \bar{c'} - \bar{C'} + \phi - \Phi - \theta - \Theta)(X^S - X^G)\right] \\
&+ \frac{1}{2}(\bar{u''} - \bar{U''} - \bar{c''} - \bar{C''})E\left[(X^S - X^G)^2\right] \\
&= -\frac{\sigma_\phi^2 + \sigma_\theta^2 + \sigma_\Theta^2}{\bar{u''} - \bar{c''} - \bar{C''} + \bar{u''}} + \frac{\sigma_\phi^2 + \sigma_\theta^2 + \sigma_\Theta^2}{2} \frac{\bar{u''} - \bar{U''} - \bar{c''} - \bar{C''}}{(\bar{u''} - \bar{c''} - \bar{C''} + \bar{u''})^2} \\
&+ \frac{1}{2}\frac{\bar{u''} - \bar{U''} - \bar{c''} - \bar{C''}}{(\bar{u''} - \bar{c''} - \bar{C''} + \bar{u''})^2}\left(\bar{u''}X^G + \bar{U'}\right)^2 \\
&= \underbrace{\Psi(\sigma_\phi^2 + \sigma_\theta^2 + \sigma_\Theta^2)\left(\frac{1}{2} + \frac{\bar{U''} + \bar{u''}}{\bar{u''} - \bar{U''} - \bar{c''} - \bar{C''}}\right)}_{\text{Benefit of Self-Regulation}} - \underbrace{\frac{1}{2}\Psi\left(\bar{u''}X^G + \bar{U'}\right)^2}_{\text{Cost of Self-Regulation}}
\end{aligned}$$

where

$$\Psi \equiv -\frac{\bar{u''} - \bar{U''} - \bar{c''} - \bar{C''}}{(\bar{u''} - \bar{c''} - \bar{C''} + \bar{u''})^2} > 0$$

The advantage of self-regulation comes from the SRO's superior information structure. Information about ϕ, θ and Φ improves the efficiency of self-regulation over government regulation. Since X^S is a function of ϕ, θ and Θ, it represents an inherent regulatory advantage of self-regulation. But superior information can also create distortions. The second component in the bracket of benefit of self-

[10] Apply the approximation for optimality conditions (4) and (5).

$$\begin{aligned}
0 &= E[u'(X^G;\phi) - U'(X^G;\Phi) - c'(X^G;\theta) - C'(X^G;\Theta)] \\
&\approx E[\bar{u'} + \phi - \bar{U'} - \Phi - \bar{c'} - \theta - \bar{C'} - \Theta] \\
&= \bar{u'} - \bar{U'} - \bar{c'} - \bar{C'}
\end{aligned}$$

$$\begin{aligned}
0 &= u'(X^S;\phi) + u''(X^S;\phi)X^S - c'(X^S;\theta) - C'(X^S;\Theta) \\
&\approx \bar{u'} + \phi + \bar{u''}X^S - \bar{c'} - \theta - \bar{C'} - \Theta + (\bar{u''} - \bar{c''} - \bar{C''})(X^S - X^G) \\
&= \bar{U'} + \phi - \theta - \Theta + \bar{u''}X^S + (\bar{u''} - \bar{c''} - \bar{C''})(X^S - X^G)
\end{aligned}$$

The difference between X^G and X^S can thus be written as

$$X^S - X^G = -\frac{\bar{u''}X^G + \bar{U'} + \phi - \theta - \Theta}{\bar{u''} - \bar{c''} - \bar{C''} + \bar{u''}}$$

regulation, $\frac{\bar{U''}+\bar{u''}}{\bar{u''}-\bar{U''}-\bar{c''}-\bar{C''}}$ captures the distortions associated with its superior information. $\bar{U''}$ captures the externalities to consumers while $\bar{u''}$ captures the monopolistic distortion. If there is large asymmetric information about the externalities to consumers, the effectiveness of government regulation is reduced. If the monopolistic distortion is very large, captured by a large curvature of individual utility function $u(\cdot)$, it is better to use government regulation since an SRO simply uses its superior information to generate monopolistic distortion.

As noted before, there are two types of distortions with an SRO. First, the SRO has an incentive to create monopoly distortions. This is captured by two pieces: one is associated with its superior information captured by the term $\bar{u''}$ in the bracket of benefit of self-regulation, and the other is not related to information captured by the term $\bar{u''}X^G$ in the bracket of cost of self-regulation. Second, the SRO has no incentive to internalize its effect on consumers even if it has superior information about $\mathcal{F}$. The distortions are captured by $\bar{U''}$ and $\bar{U'}$ respectively in the second term of bracket in the benefit and cost of self-regulation.

There is one further interesting result from this approximation: information about Φ is irrelevant if it is not correlated with other parameters. The reason is that only the government cares about the externalities to consumers. But an SRO has no use for such information since Φ does not affect its profit function. Only if Φ could provide information about other unknown parameters will it affect the trade-off between self-regulation and government regulation.

Claim 1. ***Trade-off of Self-Regulation Versus Government Regulation***
The trade-off of self-regulation versus government regulation depends on three elements: the degree of asymmetric information, the size of monopoly distortions and the externalities to consumers. Self-regulation is more desirable if

- $\hookrightarrow$ *degree of asymmetric information is large;*
- $\hookrightarrow$ *size of monopoly distortions is small;*
- $\hookrightarrow$ *size of externalities to consumers is small.*

Moreover, the asymmetric information about externalities to consumers is irrelevant for the trade-off unless it provides information about other sources of asymmetric *information in the economy.*

3 Optimal Regulatory Mechanism

I have established the trade-off between self-regulation and government regulation in the economy. One interesting question is how to utilize the benefits of both the SRO and the government and thus provide an optimal regulatory mechanism. To understand this question, we start from a case in which the government has perfect information such that the first best allocation X^{FB} can be implemented. Then we introduce the asymmetric information problem as before and analyze the optimal regulatory mechanism in this setting.

Proposition 1. ***Optimal Regulation Under Perfect Information***
If government can observe $\mathcal{F}$, it can implement the first best allocation X^{FB} using the following three mechanisms:

1. *Regulating individual consumers by a Pigovian tax $\tau = U'(X^{FB};\Phi) + C'(X^{FB};\Theta)$ that is rebated by $T = \tau X^{FB}$ or a quantity restriction $y_j \leq X^{FB}$.*

2. *Regulating individual producers by a Pigovian tax $\tau_0^* = -U'(X^{FB};\Phi) - C'(X^{FB};\Theta)$ that is rebated by $T_0^* = -\tau_0^* X^{FB}$ or a quantity restriction $x_i \leq X^{FB}$.*

3. *Regulating an SRO by a Pigovian tax $\tau_1^* = -U'(X^{FB};\Phi) - u''(X^{FB};\phi)X^{FB}$ on production that is rebated by $T_0^* = -\tau_1^* X^{FB}$.*

Moreover, if $\tau_1^* > 0$, the government can implement the first best allocation X^{FB} by delegating regulatory power to a specific number of multiple SROs.

Proof. See Appendix A.3 □

Proposition 1 provides a benchmark to implement the first best allocation. Clearly, there is not much room for self-regulation if the government has the same information structure as the production sector. In terms of implementation, it is equivalent to purely regulating the consumers or the producers since the demand and supply coincide in equilibrium.[11] Furthermore, there is an equivalent result between price- and quantity-based regulation, a well-known result in the literature, as in Weitzman (1974).

As for the role of self-regulation, government regulation is needed to correct any distortions generated by an SRO. Only if the monopolistic distortions generated by the SRO is larger than the externalities to consumers does there exist a specific market stucture such that the first best allocation can be implemented by the self-regulation. The intuition is straightforward. When the monopolistic distortion is large enough, one SRO tends to reduce production too excessively. The resulting equilibrium with self-regulation is under-production with respect to the first best allocation. Introducing competition between SROs increases production, which moves the equilibrium toward the first best allocation.

The question becomes more interesting once the government has limited information about $\mathcal{F}$. Intuitively, the industry knows $\mathcal{F}$ and utilizes it in its decision-making process. However, the information about Φ plays no role in an SRO's choice X^S due to a lack of incentive. Therefore, unless government has information about Φ, the first best allocation cannot be achieved. In such a scenario, one can expect that the maximum social welfare in an environment where government and an SRO cooperates is $\bar{W}$, which is a second best benchmark.

$$\bar{W} = \max_X u(X;\phi) - E[U(X;\Phi)] - c(X;\theta) - C(X;\Theta) \tag{3}$$

It is reasonable to argue that an SRO has the same incentive as the government to reduce externalities in the industry. From that perspective, information about θ and Θ can be utilized properly even if the government does not know directly. The difficulty comes from information about ϕ. An SRO has a distorted incentive to extract monopoly rent. Therefore, knowledge about ϕ determines the implementation of the second best social welfare $\bar{W}$.

Proposition 2. ***Optimal Regulation If Government Knows Demand Information***
If the government knows demand information ϕ, the second best allocation $\bar{W}$ can

[11] One direct implication is that government can regulate both the consumers and producers to implement the first best allocation. For simplicity, Proposition 1 only considers regulations either on consumers or producers. For the analysis below, I focus on the regulations on the producer side.

be implemented. Specifically, the government announces a Pigovian tax formula $\tau(X;\phi) = -u'(X;\phi) + \frac{u(X;\phi)-E[U(X;\Phi)]}{X}$ *to an SRO to replace its demand function. Meanwhile, an SRO is subsidized by a lump-sum transfer* $T = -\tau(X;\phi)X$.

Proof. See Appendix A.4. □

The intuition behind Proposition 2 is as follows. The SRO has an incentive to internalize the externalities within the production sector. Hence, the government does not need to know the parameters about such externalities. Instead, the SRO has no incentive to internalize the externalities to consumers, whose information asymmetry matters for the government regulation. If the government only knows the demand information ϕ, it can announce a tax schedule to correct the monopolistic distortions from the SRO and implement the second best allocation. Furthermore, if the government also knows the externality parameter Φ, the first best allocation X^{FB} can be implemented (see Corollary 1).

Corollary 1. *If the government knows demand information* ϕ *and externalities parameter* Φ*, the first best allocation* X^{FB} *can be implemented. Specifically, the government announces a Pigovian tax formula* $\tau(X;\phi,\Phi) = -u'(X;\phi) + \frac{u(X;\phi)-U(X;\Phi)}{X}$ *to an SRO to replace its demand function. Meanwhile, an SRO is subsidized by a lump-sum transfer* $T = -\tau(X;\phi,\Phi)X$.

The second best allocation cannot be implemented if the government has no information about ϕ, which delivers a similar message as in Armstrong and Sappington (2007).[12] In such scenarios, the relative social welfare function should be revised, and I define the following social welfare function $\bar{\bar{W}}$.

$$\bar{\bar{W}} = \max_X E[u(X;\phi) - U(X;\Phi)] - c(X;\theta) - C(X;\Theta)$$

Proposition 3. ***Optimal Regulation for Unknown Demand Information***

If the government does not know demand information ϕ*, the second best allocation*

[12] In Armstrong and Sappington (2007), they summarize the insights about regulating a monopoly and claim that the first best can be implemented if the regulator knows consumer demand. Here in my settings, if the government knows the demand parameter ϕ, it can only implement the second best since the government also needs to know the externality parameter Φ.

$\bar{W}$ cannot be implemented. Only $\bar{\bar{W}}$ can be implemented through price regulation. Specifically, the government buys goods according to a price menu where $P(X) = E[u'(X;\phi) - U'(X;\Phi)]$.

Proof. See Appendix A.5. □

The general message from Proposition 1, 2 and 3 can be summarized as follows. First, that optimal mechanisms consist of government regulation, which corrects monopoly distortions and externalities to consumers; and self-regulation, which corrects externalities to producers. Second, the first best allocation can be implemented if the government knows at least the information about the demand parameter ϕ and externality parameter Φ.

4 Applications

In this section, I provide several empirical and theoretical applications for my general framework. The goal is twofold. First, I apply the insights from the previous analysis to understand many empirical observations in the real world, especially why self-regulation is more desirable than government regulation in some industries. Second, I argue that the idea of self-regulation should be added into some ongoing policy discussions, such as banking regulation.

4.1 Mapping to the Real World

In the real world, many industries have self-regulations. One important question is why self-regulation emerges in some markets and whether such arrangements are socially desirable. The key insight from Claim 1 is essentially a benefit/cost analysis based on three elements: the degree of asymmetric information, the size of monopoly distortions, and the size of externalities to consumers. Whenever the degree of asymmetric information about the externalities in the industry is larger than the size of monopoly distortion and the externalities to consumers, self-regulation is superior to government regulation. To understand different regulatory mechanisms in different markets, one need to quantify these three elements. Although it is difficult to quantify all three components in the data, one can still make inferences based on subjective judgments.

For example, in the nuclear industry, the role of INPO is to set rules and standards for its members since writing such criteria requires specific knowledge and working experience. It is more efficient for the industry expert to do so, which justifies the scope for self-regulation. The monopoly distortion from the nuclear industry tends to be small since products from the nuclear industry can be perfectly substituted by products from the traditional power industry. Even if the externalities from the nuclear industry to the general public are catastrophic, the probability of such events is small and tends to be declining as technology improves. Overall analysis suggests that the benefit of self-regulation overrides the cost. Therefore, it is reasonable to have self-regulation in the nuclear industry.

Similar arguments can be applied to the securities market. The asymmetric information about the externalities between different securities firms is very large since consumers cannot perfectly observe service quality provided by each firm. Without regulations in this market, one firm's misbehavior will tend to negatively affect other firms through the industry's reputation. Self-regulation can improve the efficiency by regulating the provision of high-quality service and reducing the negative externalities among different firms. Meanwhile, monopoly distortions in the security market are low since consumers can always deposit their money into a traditional banking account. Also, externalities from the securities market to society are small and even close to zero. Therefore, the economic benefit of self-regulation is larger than its cost.

It is also interesting to apply the general insight to self-regulation in the banking industry. Before the establishment of the Federal Reserve System, the banking industry was de facto self-regulated by the New York Clearing House. Afterwards, the self-regulation was replaced by government regulation. My model can help understand such a change. The asymmetric information about the negative externalities between banks used to be large since it was hard for outsiders to understand their internal operation. Today, the government has a better understanding of the banking business, which significantly reduces the information asymmetries. The monopoly distortion also becomes large since the banking industry provides a comprehensive financial service to the general public. Moreover, the externalities from the banking sector to society are very large, as documented by Bernanke (1983).[13] Given the dynamic changes in the banking industry, it was reasonable to have self-regulation in the early days and government regulation today. Nonetheless, it is still worth considering self-regulation as complementary given its flexibility to a changing environment. In the next subsection, I argue that due to the increasing complexity of externalities in the banking sector, the idea of self-regulation is worth considering.

4.2 Theoretical Applications

The general insights in our theoretical framework could be applied to many ongoing policy discussions such as macroprudential and banking regulation. In this section, I provide one simple example in the literature that can be mapped into a general theoretical framework.

In the macro/finance literature, two types of distortions are widely analyzed to justify financial regulation—bailout externality and pecuniary externality (see Farhi and Tirole (2012), Keister (2015), Bianchi (2016), Jeanne and Korinek (2010a), Ma (2017), etc.). Bailout funds are essentially externalities from the banking sector (producers in our model) to the general public (consumers) and fire-sale externalities are negative effects between banks. These two types of externalities correspond to consumption externalities $U(X;\Phi)$ and production externality $C(X;\Theta)$ in my general framework. Therefore, policy discussions based on these types of models should have room for self-regulation. Surprisingly, current policy discussion does not have it. In this section, I provide a simple model with the flavor of both fire-sale externalities and bailout in the spirit of Bianchi (2011), Jeanne and Korinek (2010a) and Jeanne and Korinek (2010b) to analyze the potential role for self-regulation. In the end, I argue that self-regulation should be considered as an alternative to current policy discussions.

The model consists of three time periods $t = 0, 1, 2$ and is inhabited by two types of atomistic agents of mass 1, bankers and investors. Bankers are assumed

[13] The externalities are even larger given the existence of deposit insurance and bailout funds.

to be natural borrowers and need to borrow at period 0 and 1 in order to smooth consumption. Investors are assumed to be natural lenders and have affluent endowments available in three periods. The critical feature of this model is a collateral borrowing constraint, as in Jeanne and Korinek (2010a).

Specifically, Bankers have equity e in period 0 and issue debt d_1 to satisfy their consumption c_0. In period 1, after repaying debt d_1,[14] bankers receive an income shock $\tilde{e}$ and 1 unit of asset, which yields a fixed payment y at period 2. Meanwhile, bankers decide the share of asset κ to hold in period 2 and issue another debt d_2 to satisfy consumption c_1. In period 2, bankers receive the payoff from the asset, repay the debt d_2, and consume the remaining amount. However, the bankers' ability to roll over the debt is affected by an imperfect collateral constraint where its value depends on the collateral value. Intuitively, this financial constraint can be rationalized as a limited enforcement or commitment problem in the financial market and thus creates pecuniary externalities. The financial constraint can be expressed as follows.

$$d_2 \leq \phi p$$

where $\phi < 1$ captures the financial friction.

The utility function of the bankers is assumed to be $U^B = c_0 + u(c_1) + c_2$, where in the last period the utility function is assumed to be risk neutral for convenience. Investors are assumed to have an abundant endowment, and their utility functions are $U^I = c_0^I + c_1^I + c_2^I$.

The problem can be solved using backward induction. In period 1, depending on the realization of net worth $m = \tilde{e} - d_1$ there are two states: the unconstrained state where no fire sale happens and the constrained state where the individual banker fire sells his asset. The fire sale creates inefficiencies because the individual does not realize that the asset price is a downward-sloping function and depends on the aggregate net worth of the banking sector, M. In order to map the problem into my general setup, I leave the derivation of value function in Appendix B and write the

[14] Here, the interest rate R can be normalized to 1 due to the specific setting of an investor's utility function.

banker's optimality problem in the fashion of value function in period 0, i.e.

$$\begin{aligned}
\max_{d_0} \quad & c_0 + E[V(m;M)] \\
\text{s.t.} \quad & c_0 = d_0 \\
& m = \tilde{e} - d \\
\equiv \max_{d_0} \quad & \underbrace{d_0}_{px_i} + \underbrace{E[V(\tilde{e} - d_0, \tilde{E} - D_0)]}_{-c(x;\theta) - C(X;\Theta)}
\end{aligned}$$

To see how this can be mapped into the general framework in Section 2, notice that the price of d_0 is 1 and the $E[V(m;M)]$ is the utility function $-c(x;\theta) - C(X;\Theta)$ for producers, where $\{\theta, \Theta\} = \{\tilde{e}, \phi\}$. The appearance of negative externalities in the banking sector provides room for self-regulation and could yield some economic benefit especially when $\{\theta, \Theta\}$ is unobservable to government.

As to the economic cost of self-regulation, one needs to look at the consumers' utility. In the simple case where it is linear and without bailout, there is no cost of self-regulation. But one can imagine that consumers have the utility form of $U^I = u(c_0^I) + c_1^I + c_2^I$ with $u' > 0, u'' < 0$. Then the monopoly distortions need to be taken into account. As for the externalities from the banking sector to society, one needs to think of the existence of bailouts. Imagine that in period 1, whenever there is a binding constraint, the government will bail out the banks. Suppose that the government can only mitigate part of the constraint due to the cost of taxation. Then there is a tax function T in period 1 deducted from consumer's utility and this T depends on the aggregate level of M. This T function corresponds to the $U(X;\Phi)$ function in my general framework and should be taken into account for the discussion of self-regulation in the banking sector.

Notice that correcting fire-sale externalities requires superior information about $\{\theta, \Theta\}$. Without such information, the policy recommendation, such as the Pigovian tax in Bianchi (2011) and Jeanne and Korinek (2010a) is ineffective. Self-regulation, however, could reduce such information asymmetries. An optimal regulatory mechanism in the banking sector should include both government regulation and self-regulation where both focus on different sources of externalities in the economy.

5 Conclusion

In this paper, I provide a simple framework for the analysis of self-regulation versus government regulation. I argue that three elements are crucial for the trade-off: externalities, monopoly distortions, and the degree of asymmetric information. Whenever the degree of asymmetric information is larger than the size of monopoly distortions and externalities to society, it is worthwhile to have self-regulation. Moreover, an optimal mechanism consists of both self-regulation and government regulation where self-regulation focuses on externalities in the industry, and government regulation focuses on monopoly distortion and externalities to society.

Based on these insights, I provide some examples to understand real-world observations. Moreover, my work can shed light on current ongoing policy discussions. As long as an economy has the three elements identified in this paper, there is room for analysis of self-regulation versus government regulation. One general takeaway is that optimal regulatory mechanisms should take self-regulation into account.

Future work needs to be done on this paper. For example, the SRO in my model has the same incentive as the government to internalize the negative externalities and does not have a conflict of interest for misusing the superior information from a social perspective. It can enrich the model predictions if the conflict of interest is introduced in the model. Moreover, there is no asymmetric information between producers and consumers in my model. It is interesting to analyze these cases because it might increase the case for self-regulation. After all, SROs can help allieviate the asymmetric information and thus faciliate the transactions between producers and consumers. Last, my model can also be generalized into a dynamic setting in order to analyze the dynamic trade-off between self-regulation and government regulation.

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A Proofs

A.1 Proof of Lemma 1

Proof. The objective function for a benevolent government is

$$\max_{X^G} E\left[u(X;\phi) - U(X;\Phi) - c(X;\theta) - C(X;\Theta)\right]$$

The optimality condition is

$$E[u'(X^G;\phi)] = E[U'(X^G;\Phi) + c'(X^G;\theta) + C'(X^G;\Theta)] \tag{4}$$

To implement X^G, government could impose restrictions on individual production $x_i \leq X^G$. To see how it works, realize that $X^G < X^{CE}$. Otherwise, $X^G \geq X^{CE}$. The following relation implies a contradiction.

$$\begin{aligned}
0 &= E[u'(X^G;\phi) - U'(X^G;\Phi) - c'(X^G;\theta) - C'(X^G;\Theta)] \\
&\leq E[u'(X^{CE};\phi) - U'(X^G;\Phi) - c'(X^{CE};\theta) - C'(X^G;\Theta)] \\
&\leq -E[U'(X^G;\Phi) + C'(X^G;\Theta)] \\
&< 0
\end{aligned}$$

Therefore, government can impose a restriction $x_i \leq X^G$ to individual producer and it binds always. $\square$

A.2 Proof of Lemman 2

Proof. The objective function for an SRO is

$$\begin{aligned}
\max_{X^S} \quad & p(X^S;\phi)X^S - c(X^S;\theta) - C(X^S;\Theta) \\
\text{s.t.} \quad & p(X^S;\phi) = u'(X^S;\phi)
\end{aligned}$$

The optimality condition is

$$u'(X^S;\phi) + u''(X^S;\phi)X^S = c'(X^S;\theta) + C'(X^S;\Theta) \tag{5}$$

Equivalently, it can be written as

$$u'(X^S;\phi)\left(1-\frac{1}{E_d(X^S;\phi)}\right)=c'(X^S;\theta)+C'(X^S;\Theta)$$

where $E_d(X^S;\phi)$ is the price elasticity of demand at the point $X=X^S$.

To implement X^S, SRO could impose restrictions on individual production $x_i \leq X^S$. To see how it works, realize that $X^S < X^{CE}$ due to the following relationship.

$$\begin{aligned} & u'(X^{CE};\phi)-c'(X^{CE};\theta)=0 \\ < \quad & -u''(X^S;\phi)X^S+C'(X^S;\Theta) \\ = \quad & u'(X^S;\phi)-c'(X^S;\theta) \end{aligned}$$

Then an SRO can impose a restriction $x_i \leq X^S$ to individual producer and it binds always. □

A.3 Proof of Proposition 1

Proof. If government has perfect information about $\mathcal{F}$, it can choose X^{FB} defined by the optimality condition (2). Furthermore, $X^{FB} < X^{CE}$.

To implement X^{FB}, government can regulate either consumers or producers. To regulate the consumers, government can use a Pigovian tax τ on individual consumers and rebate them by a lump-sum transfer T. For the individual consumer j, his objective function is thus

$$\max_{y_j} u(y_j;\phi)-(p+\tau)y_j-U(X;\Psi)+T$$

The optimality condition is

$$p+\tau=u'(y_j;\phi)$$

The optimality condition for producers is unaffected by the policy. Therefore, in equilibrium, the following relationship holds.

$$\tau = u'(X;\phi) - c'(X;\theta)$$

To implement the first best allocation, one can choose $\tau = U'(X^{FB};\Phi) + C'(X^{FB};\Theta)$ and $T = \tau X^{FB}$. Furthermore, one can simply put a quantity restriction $y^j \leq X^{FB}$ on the individual consumer and implement the first best allocation. The reason is that $X^{FB} < X^{CE}$ in equilibrium.

By a similar argument, one can easily show that the first best allocation X^{FB} can be implemented by a tax τ_0^* and a lump-sum transfer T_0^* on an individual producer. For individual producer i, his objective function is thus

$$\max_{x_i} (p + \tau_0^*)x_i - c(x_i;\theta) - C(X;\Theta) + T_0^*$$

The optimality condition is thus

$$p + \tau_0^* = c'(x_i;\theta)$$

The optimality condition for consumers is unaffected by the policy. Therefore, in equilibrium, the following relation holds.

$$\tau_0^* = c'(X;\theta) - u'(X;\phi)$$

By monotonicity of $c' - u'$, choosing $\tau_0^* = -U'(X^{FB};\Phi) - C'(X^{FB};\Theta)$ can implement X^{FB} in the decentralized economy. Also $T_0^* = -\tau_0^* X^{FB}$ is implied by government's budget constraint. Similarly, one can also put a production restriction $x^i \leq X^{FB}$ to implement X^{FB} because $X^{CE} > X^{FB}$ in equilibrium.

Now, we consider a case where the government allows the producers to form a industrial SRO and regulates the SRO instead. The SRO thus faces the following maximization problem.

$$\max_{X} (u'(X;\phi) + \tau_1^*)X - c(X;\theta) - C(X;\Theta) + T_1^*$$

The optimality condition is thus

$$u'(X;\phi)+\tau_1^*+u''(X;\phi)X=c'(X;\theta)+C'(X;\Theta)$$

Hence, one can choose $\tau_1^*=-u''(X^{FB};\phi)X^{FB}-U'(X^{FB};\Phi)$ and $T_1^*=-\tau_1^*X^{FB}$ to implement X^{FB}.

Interestingly, if $\tau_1^*=-u''(X^{FB};\phi)X^{FB}-U'(X^{FB};\Phi)>0$, it implies that $X^S<X^{FB}<X^{CE}$. In other words, government needs to subsidize an SRO to implement the first best allocation. It turns out that there exists a specific number of monopolistic competitive SROs such that the first best allocation X^{FB} can be implemented. To see this point, first assume that there exists N SROs in the market for self-regulation and each has a market share of $\frac{1}{N}$. For each of them, the maximization problem is as follows.

$$\begin{array}{ll}\max\limits_{X_i} & P\left(\frac{X_i}{N}+\sum_{j\neq i}\frac{X_j}{N};\phi\right)X_i-c(X_i;\theta)-C\left(\frac{X_i}{N}+\sum_{j\neq i}\frac{X_j}{N};\Theta\right)\\ \text{s.t.} & P\left(\frac{X_i}{N}+\sum_{j\neq i}\frac{X_j}{N};\phi\right)=u'\left(\frac{X_i}{N}+\sum_{j\neq i}\frac{X_j}{N};\phi\right)\end{array}$$

The optimality condition is

$$\frac{1}{N}u''\left(\frac{X_i}{N}+\sum_{j\neq i}\frac{X_j}{N};\phi\right)X_i+u'\left(\frac{X_i}{N}+\sum_{j\neq i}\frac{X_j}{N};\phi\right)=c'(X_i;\theta)+\frac{1}{N}C'\left(\frac{X_i}{N}+\sum_{j\neq i}\frac{X_j}{N};\Theta\right)$$

By symmetry, it implies

$$\frac{1}{N}u''(X^N;\phi)X^N+u'(X^N;\phi)=c'(X^N;\theta)+\frac{C'(X^N;\Theta)}{N}$$

Realize that if $N=1$, there is only one SRO in the market and $X^1=X^S$; if $N=\infty$, there is a continuum of agents in the market and $X^\infty=X^{CE}$. Moreover, X^N is an increasing function of N. Therefore, if $X^S<X^{FB}<X^{CE}$, by continuity there exists N^* such that $X^{N^{FB}}=X^{FB}$. □

A.4 Proof of Proposition 2

Proof. Suppose government announces $\tau(X;\phi)$ to an SRO and rebates it by $T = -\tau(X;\phi)X$. The objective function for the SRO is

$$\begin{array}{ll} \max_X & [P(X;\phi)+\tau(X;\phi)]X - c(X;\theta) - C(X;\theta) + T \\ \text{s.t.} & P(X;\phi) = u'(X;\phi) \end{array}$$

Notice that by choosing $\tau(X;\phi) = -u'(X;\phi) + \frac{u(X;\phi)-E[U(X;\Phi)]}{X}$, the SRO chooses the second best allocation as in (3) □

A.5 Proof of Proposition 3

Proof. By choosing the price menu as $P(X) = E[u'(X;\phi) - U'(X;\Phi)]$, the government can implement $\bar{\bar{W}}$. To implement, government buys goods from an SRO according to such price menu and sells to the consumer. The difference between selling and buying is transferred to the SRO. □

B Derivation of Value Function

In period 1, define the state variable as $m = \tilde{e} - d_1$ and $M = m$ in equilibrium. The value function can be written as

$$\begin{aligned} V(m;M) = \quad & \max_{d_2,\theta} \; u(c_1) + c_2 \\ \text{s.t.} \quad & c_1 = m + d_2 + (1-\kappa)p, \\ & c_2 = \kappa y - d_2 \\ & d_2 \leq \phi p \cdots (\lambda) \end{aligned}$$

The FOCs are

$$\begin{aligned} u'(c_1) &= 1+\lambda \\ u'(c_1)p &= y \end{aligned}$$

In equilibrium, since the asset is held only by bankers, $\kappa = 1$ and $C_1 = M + D_2$, where the capital letters denote the aggregate level of variables. There are two states in period 1. Define c^* such that $u'(c^*) = 1$ and $\hat{M}$ such that $\hat{M} = c^* - \phi$. Then if $M \geq \hat{M}$, the economy is in the unconstrained state and $c^1 = c^*, d_2 = c^* - m, p = 1$; if $M < \hat{M}$, the economy is in the constrained state and $c_1 = m + \phi \frac{y}{u'(c_1)}$, $p = \frac{y}{u'(c_1)} \equiv p(M)$. Therefore,

$$V(m;M) = \begin{cases} u(c^*) + y + m - c^* & \text{if } M \geq \hat{M} \\ u(m + \phi p(M)) + y - \phi p(M) & \text{if } M < \hat{M} \end{cases}$$