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Financial-Intermediation Regime and Efficiency in a Boyd-Prescott Economy

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Abstract

We examine the relationship among a liberal financial-market regime, asset-by-asset supervisory assessment of intermediaries' portfolios, and economic efficiency. We show that, in Boyd and Prescott's (*JET* 1986) model of financial intermediary coalitions, asset-by-asset supervisory assessment in a liberal regime is inefficient for some, but not all, parameters of the economy.

1 Introduction

The 1998 financial crisis in several Asian countries is the most recent, major example of a situation in which the asset portfolio of a national or regional banking and financial system has been perceived to have been mismanaged. On account of perceived mismanagement, the countries involved have been given strong incentives to foster Walrasian competition in financial markets. In this article, we suggest that neither the diagnosis of mismanagement nor the recommended response to it can successfully be justified by appealing,

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as is typically done, to the simplest economic theory of market competition. The problem with appealing to that theory is that it envisions an environment in which, even without any intermediaries, arms-length transactions in markets for financial assets would support an economically efficient allocation, including efficient investment decisions. Such a supposition contradicts policy makerrs' belief that intermediaries play an essential role in structuring efficiency-enhancing financial contracts and relationships for which arms-length transactions cannot substitute. Indeed, if intermediaries' role were not essential, then the logical policy response to a tendency of the financial-intermediation sector to generate crises would be to ban intermediation and to rely wholly on asset markets (with requirements for auditing to prevent fraud) to allocate capital and share risk.

Our perspective is that, given the unanimously held view that financial intermediation makes an essential contribution to economic efficiency, policy toward financial intermediation ought to be based on an equilibrium model that succeeds in explaining why intermediaries are needed in addition to markets. Moreover, given that intermediation does not merely replicate what asset markets would otherwise accomplish, systematic differences between intermediated portfolios and asset-market portfolios should be expected. In the following analysis we focus on Boyd and Prescott's (1986) model of intermediation in a private-information environment because it possesses these features. While our formal analysis solely concerns this model, however, we believe that conclusions in the same spirit would follow from any other model that takes the essential role of intermediation seriously.

In the context of Boyd and Prescott's model environment, we examine the relationship among a liberal financial-market regime, asset-by-asset supervisory assessment of intermediaries' portfolios, and economic efficiency. An economy is said to have a *liberal* financial regime if financial intermediation is not restricted in scope or heavily taxed and if there is free entry of intermediaries. Under these conditions, the before-tax profits of intermediaries are close to zero in a steady-state equilibrium. *Asset-by-asset supervisory assessment* requires that each investment undertaken by the intermediary should have nonnegative present expected discounted value from an ex ante perspective. Equivalently, each project funded by a contract with the intermediary must receive no higher an ex ante level of expected contractual claims than its expected marginal product to the economy.

We show that, in Boyd and Prescott's model of financial intermediary coalitions, asset-by-asset supervisory assessment of intermediaries' management of their portfolios in a liberal regime can potentially be inefficient.[1] We provide a simple condition, expressed as a relationship among values of various parameters, that is sufficient for the combination of the two policies to be inefficient. The question of efficiency must be settled by looking at the facts, since the theoretical answer is contingent on values of model parameters. A factual study of whether or not actual economies satisfy the condition is beyond the scope of our work. Rather, our limited goal is is to develop a coherent framework, within which a factual discussion of this important policy issue might be conducted.

2 Model environment

The set of agents is represented by a continuum A, on which there is a measure P normalized so that $\mathrm{P}(A) = 1$. Agents belong to various subsets of A, or *types*.Implicitly there is a probability space isomorphic to the measure space A, such that each agent believes that his probability of being in a given type is the P-measure of that type.

Each agent is endowed with ω units of a production good, or *input* and with a project that can perhaps transform the production good into a consumption good, or *output.* Input and output are homogeneous goods. Some projects belong to a type G that can transform a nonnegative amount k of input into $\min(k, \kappa)$ units of output, where the constant κ is a parameter of the economy. The remaining projects, of type G', simply exhaust input without producing any output.[2]

Each agent maximizes his expected consumption of output, which must always be nonnegative. The agent is indifferent to whether, or how, his project is used for production.

[1]Much of what we show here is implicit, at least, in a numerical example that Boyd and Prescott have presented. Our formal results clarify why the example works as it does. These results draw on previous research by Chiang (1993), who also provides a detailed characterization of the efficient contracts that result from intermediation.

[2]Our notational convention is that a primed symbol naming a type is the name of the set-theoretic complement of the type that the symbol would denote by itself.

Each agent possesses dichotomous information regarding his own project. Let I denote the type of agent whose information is favorable. We will distinguish between two environments on the basis of whether or not an agent's informational type is public. In the *public-information environment,* contracting with each agent can be made explicitly contingent on whether or not the agent is in I, and there is no cost to invoking this contingency. In the *private-information environment,* a contract with an agent cannot be made directly contingent on whether or not the agent is in I. A contract can be made contingent on whether or not the agent *reports* that he is in I, but such a report cannot be verified or refuted.

By using ϵ units of input, a project can be evaluated to generate a dichotomous public signal. Let E be type of agent whose project would, if evaluated, generate a favorable signal.

The spirit of this model is that investment in a project at the maximum productive level is infeasible in autarky. This viewpoint is formalized by assuming that

$$\omega < \kappa \, . \tag{1}$$

Note that an autarkic agent would never evaluate his project, since knowing the outcome would be of no use to him individually and the opportunity cost of making the evaluation would be reduced investment of productive input.

Both favorable agent's information and a favorable evaluation are informative, albeit imperfect, indications of a good project. Specifically,

$$0 < \mathrm{P}[T] \text{ for type } T = I \cap E, I \cap E', I' \cap E, I' \cap E' \tag{2}$$

$$0 < \mathrm{P}[G|I \cap E'] < \mathrm{P}[G|I'] < \mathrm{P}[G|I] < \mathrm{P}[G|I \cap E] < 1 \tag{3}$$

$$0 < \mathrm{P}[G|I'] < \mathrm{P}[G|I' \cap E] < 1 \, . \tag{4}$$

Favorable agent's information increases the usefulness of evaluation. To formalize this idea, consider the public-information environment. Compare two ways of using $\epsilon + \kappa$ units of input. Allocating ϵ units of input, the project of a type-T agent ($T \in \{I, I'\}$) can be evaluated. If the evaluation is favorable (that is, if the agent is of type $T \cap E$), then the agent's project would receive the remaining κ units of input. If the evaluation is unfavorable, then the project of another type-T agent would receive the remaining input

without being evaluated. Alternatively the entire $\epsilon + \kappa$ units of input can be allocated to type-T agents for production, without performing any evaluation and without exceeding investment level κ in any individual project.

The relationship between agents' information and the public information generated by project evaluation is expressed by assuming that the former allocation has higher expected output than the latter if, and only if, the agent is of type I. That is,

$$(\epsilon + \kappa)\mathrm{P}[G|I] < \mathrm{P}[E|I]\,(\kappa\mathrm{P}[G|I \cap E]) + \mathrm{P}[E'|I]\,(\kappa\mathrm{P}[G|I]) \tag{5}$$

$$\mathrm{P}[E|I']\,(\kappa\mathrm{P}[G|I' \cap E]) + \mathrm{P}[E'|I']\,(\kappa\mathrm{P}[G|I']) < (\epsilon + \kappa)\mathrm{P}[G|I'] \tag{6}$$

By the rules of conditional probability, these inequalities can be simplified to

$$(\epsilon + \kappa)\mathrm{P}[G|I] < \kappa\,(\mathrm{P}[G \cap E|I] + \mathrm{P}[E'|I] \cdot \mathrm{P}[G|I]) \tag{7}$$

$$\kappa\,(\mathrm{P}[G \cap E|I'] + \mathrm{P}[E'|I'] \cdot \mathrm{P}[G|I']) < (\epsilon + \kappa)\mathrm{P}[G|I'] \tag{8}$$

Assumptions (3), (7) and (8) clearly establish the following priorities for using input in the public-information environment. First, while input is available, type-I projects should be evaluated and investment at level κ should be provided whenever the project is in E. If input remains after all type-I projects have been taken care of in this way, then type-I' projects should receive up to κ units of investment. If input still remains, then projects in $I \cap E'$ should receive input.

Assume that input is sufficiently scarce so that, if this priority rule is followed, then type-I' projects cannot receive the maximum amount of input. Formally, assume that

$$\epsilon\mathrm{P}[I] + \kappa\mathrm{P}[E \cap I] < \omega < \epsilon\mathrm{P}[I] + \kappa\,(\mathrm{P}[E \cap I] + \mathrm{P}[I'])\ . \tag{9}$$

3 Contractual intermediation

Intermediation is represented in terms of a binding contract among a coalition of agents. By joining the coalition, these agents delegate the allocation

of their input endowments to the coalition. In the private-information environment, the contract requires each agent to report whether his type is I or I'. Contingent on the agent's observable type or on this statement (in the public- and private-information environments, respectively), a decision—possibly randomized—is made whether or not to evaluate the project. Next, contingent on the agent's actual or reported type, on whether or not evaluation has been performed, and on the outcome of evaluation if it has been performed, a quantity of input is assigned to the agent. Finally, contingent on these matters and also on the quantity of output produced by the agent's project, a quantity of output is provided to the agent for consumption.

Formally, a contract is represented by an evaluation rule r, a vector k of input allocations, and a vector x of consumption promises. The evaluation rule is a pair $(r^I, r^{I'}) \in [0,1] \times [0,1]$, where r^T specifies the probability that the project of an agent of type T will be evaluated. (In the private-information environment, intermediary's decisions regarding I versus I' are determined by the agent's report, not by the agent's actual informational type.) The allocation vector is $(k^{I\cap E}, k^{I\cap E'}, k^{I,(E)}, k^{I'\cap E}, k^{I'\cap E'}, k^{I',(E)})$. Interpret k^T to be the amount of input that is allocated to an agent who is *known* (by observation or report of his informational type, and by actually having evaluated his project) to be of boolean-combination type T, and interpret $k^{T,(E)}$ to be the amount that is allocated to an agent of informational type T whose project has not been evaluated.

Similarly the variable x, superscripted by a boolean combination of types, refers to the expected consumption level provided by the contract to agents in that boolean-combination type. As in the case of the investment vector k, we assume that the intermediary cannot distinguish between agents based on their evaluation outcomes unless they have actually been evaluated. Likewise the intermediary cannot distinguish between agents based on their success in production if they have received no investment of input. To simplify the analysis, we assume that type-I' agents are not evaluated, and that no investment is made in type-I projects with unfavorable evaluations. By conditions (3), (7) and (8), an intermediary must observe these rules in order to implement an efficient allocation. Thus, for our purposes, the vector of of consumption promises can be represented as $(x^{I\cap E\cap G}, x^{I\cap E\cap G'}, x^{I\cap E'}, x^{I'\cap G}, x^{I'\cap G'})$.

Technical feasibility requires that all quantities of input and output are nonnegative, that the aggregate amount of input provided is at most ω (that

is, the per-capita endowment times the measure of agents), and that the aggregate amount of output provided is at most the total amount that is produced.

Voluntary participation in the contract (sometimes called *individual rationality*) implies that each informational type of agent must receive at least as high a level of expected consumption from participating in the contract as from consuming his autarkic output. The voluntary-participation constraints are that

$$\mathrm{P}[E \cap G|I]x^{I\cap E\cap G} + \mathrm{P}[E \cap G'|I]x^{I\cap E\cap G'} + \mathrm{P}[E'|I]x^{I\cap E'} \quad \geq \quad \omega\mathrm{P}[G|I] \tag{10}$$

$$\mathrm{P}[G|I']x^{I'\cap G} + \mathrm{P}[G'|I']x^{I'\cap G'} \geq \omega\mathrm{P}[G|I'] \; . \tag{11}$$

In the private-information environment, there are also incentive-compatability constraints requiring that the contract must provide agents of each informational type with higher expected consumption from truthful reporting than from lying. These constraints are, for types I and I' respectively,

$$\begin{array}{rl} & \mathrm{P}[E \cap G|I]x^{I\cap E\cap G} + \mathrm{P}[E \cap G'|I]x^{I\cap E\cap G'} + \mathrm{P}[E'|I]x^{I\cap E'} \\ \geq & \mathrm{P}[G|I]x^{I'\cap G} + \mathrm{P}[G'|I]x^{I'\cap G'} \end{array} \tag{12}$$

$$\begin{array}{rl} & \mathrm{P}[G|I']x^{I'\cap G} + \mathrm{P}[G'|I']x^{I'\cap G'} \\ \geq & \mathrm{P}[E \cap G|I']x^{I\cap E\cap G} + \mathrm{P}[E \cap G'|I']x^{I\cap E\cap G'} + \mathrm{P}[E'|I']x^{I\cap E'} \; . \end{array} \tag{13}$$

4 Notational streamlining

The foregoing equations can be presented in more streamlined notation by introducing variables for conditional probabilities and for intended expected-consumption promises.

For a boolean-combination type T, define

$$\begin{aligned} \eta^T &= \mathrm{P}[T|I] \\ \lambda^T &= \mathrm{P}[T|I'] \end{aligned} \tag{14}$$

Define expected-consumption promises, to type-I and type-I' agents respectively, by

$$c^I = \eta^{E\cap G} x^{I\cap E\cap G} + \eta^{E\cap G'} x^{I\cap E\cap G'} + \eta^{E'} x^{I\cap E'} \tag{15}$$

$$c^{I'} = \lambda^{G} x^{I'\cap G} + \lambda^{G'} x^{I'\cap G'} \tag{16}$$

In this notation, constraints (10) – (13) can be reformulated as follows.

Voluntary participation:

$$\omega \mathrm{P}[G|I] \leq c^I \tag{17}$$

$$\omega \mathrm{P}[G|I'] \leq c^{I'} \tag{18}$$

Incentive compatibility:

$$\eta^{G} x^{I'\cap G} + \eta^{G'} x^{I'\cap G'} \leq c^I \tag{19}$$

$$\lambda^{E\cap G} x^{I\cap E\cap G} + \lambda^{E\cap G'} x^{I\cap E\cap G'} + \lambda^{E'} x^{I\cap E'} \leq c^{I'} \tag{20}$$

5 Liberalism, supervisory assessment, and efficiency

We represent a liberal regime of financial intermediation as one where, implicitly on account of free entry and absence of taxation, intermediation absorbs none of the surplus generated by economic activity. In the model economy, this means that the full product of the economy is distributed to the agents through satisfaction of their contractual claims on the intermediary. That is, $\mathrm{P}[I]c^I + \mathrm{P}[I']c^{I'}$ must be both the aggregate amount of output produced and the aggregate amount distributed.

In the model economy where all agents maximize expected consumption, economic efficiency (i.e., Pareto efficiency) is simply a matter of maximizing output and distributing it all, in an arbitrary pattern, to agents. Recall

that, by assumptions (3), (7) and (8), output is maximized in the public-information environment by evaluating all type-I projects, investing the full κ units of input in each of these that receives a favorable evaluation, and investing whatever input remains in type-I' projects without evaluation. That is, in the efficient contract, $r = (1, 0)$ and $k = (\kappa, 0, 0, 0, 0, (\omega - (\mathrm{P}[I]\epsilon + \mathrm{P}[I \cap E]\kappa))/\mathrm{P}[I'])$. Aggregate output is therefore $\kappa\mathrm{P}[I \cap E \cap G] + ((\omega - (\mathrm{P}[I]\epsilon + \mathrm{P}[I \cap E]\kappa))/\mathrm{P}[I'])\mathrm{P}[I' \cap G]$.

Public-information efficiency in this economic environment requires, then, that

$$\begin{aligned} & \mathrm{P}[I]c^{I} + \mathrm{P}[I']c^{I'} \\ = \; & \kappa\mathrm{P}[I \cap E \cap G] + ((\omega - (\mathrm{P}[I]\epsilon + \mathrm{P}[I \cap E]\kappa))/\mathrm{P}[I'])\mathrm{P}[I' \cap G] \; . \end{aligned} \tag{21}$$

Asset-by-asset supervisory assessment requires that each project receive no higher a level of expected contractual claims than its expected marginal product to the economy. Since there is more than enough input for full investment in type-I projects, and since it is optimal not to evaluate type-I' projects, the expected marginal product of a type-I' project is identical to its expected product in autarky–that is, $\omega\mathrm{P}[G|I']$. By the voluntary-participation constraint (18), this is the minimum, as well as the maximum, that the contract can provide to a type-I' agent. Therefore,

$$c^{I'} = \omega\mathrm{P}[G|I'] \; . \tag{22}$$

Boyd and Prescott proved the following result.

Proposition 1 *Even in a private-information environment, there is a contractual arrangement for intermediation that attains the public-information-efficient level of production and welfare. Such an arrangement involves all output being distributed to the agents in the economy as contractually specified consumption, so it is consistent with a liberal financial regime. However, such an arrangement may not satisfy (22), and therefore it may not be consistent with asset-by-asset supervisory assessment of the arrangement.*

Multiplying (22) by $\mathrm{P}[I']$ and subtracting the resulting equation from (21)

yields[3]

$$c^I = (\kappa \mathrm{P}[I \cap E \cap G] - ((\epsilon - \omega)\mathrm{P}[I] + \kappa \mathrm{P}[I \cap E])\mathrm{P}[G|I'])/\mathrm{P}[I] \; . \tag{23}$$

Conditions (22) and (23) immediately imply the following proposition.

Proposition 2 *An efficient allocation in a liberal financial regime subject to asset-by-asset supervisory assessment must have a determinate ratio between the expected consumption levels of type-I' and type-I agents, which is*

$$\begin{aligned} \frac{c^{I'}}{c^I} &= \frac{\omega \mathrm{P}[G|I']\mathrm{P}[I]}{\kappa \mathrm{P}[I \cap E \cap G] - ((\epsilon - \omega)\mathrm{P}[I] + \kappa \mathrm{P}[I \cap E])\mathrm{P}[G|I']} \\ &= \frac{\omega \lambda^G}{\kappa \eta^{E \cap G} - ((\epsilon - \omega) + \kappa \eta^E)\lambda^G} \; . \end{aligned} \tag{24}$$

6 A lower bound for the ratio $c^{I'}/c^I$

Consider equation (15) defining c^I, the incentive-compatibility constraint (20) for type-I' agents, and the nonnegativity constraints for the consumption-promise variables x^T. These can be expressed geometrically as follows. Define

$$X = \{c^I\} \times (-\infty, c^{I'}] \times [0, \infty) \times [0, \infty) \times [0, \infty) \tag{25}$$

Then, the conditions are equivalent to the geometric condition that

$$x^{I \cap E \cap G} \begin{bmatrix} \eta^{E \cap G} \\ \lambda^{E \cap G} \\ 1 \\ 0 \\ 0 \end{bmatrix} + x^{I \cap E \cap G'} \begin{bmatrix} \eta^{E \cap G'} \\ \lambda^{E \cap G'} \\ 0 \\ 1 \\ 0 \end{bmatrix} + x^{I \cap E'} \begin{bmatrix} \eta^{E'} \\ \lambda^{E'} \\ 0 \\ 0 \\ 1 \end{bmatrix} \in X \tag{26}$$

That is, the linear space spanned by the three vectors on the left side of (26) has nonempty intersection with the convex set X. Therefore, by a

[3]Note that $\mathrm{P}[I']\mathrm{P}[G|I'] = \mathrm{P}[I' \cap G]$ and that $1 - \mathrm{P}[I'] = \mathrm{P}[I]$.

separating-hyperplane theorem (Rockafellar, 1970, Theorem 22.6), there are variables x^T satisfying (26) if and only if there is no vector $z \in \mathbb{R}^5$ that satisfies the following two conditions.

$$z \cdot \begin{bmatrix} \eta^{E\cap G} \\ \lambda^{E\cap G} \\ 1 \\ 0 \\ 0 \end{bmatrix} = z \cdot \begin{bmatrix} \eta^{E\cap G'} \\ \lambda^{E\cap G'} \\ 0 \\ 1 \\ 0 \end{bmatrix} = z \cdot \begin{bmatrix} \eta^{E'} \\ \lambda^{E'} \\ 0 \\ 0 \\ 1 \end{bmatrix} = 0 \tag{27}$$

$$\{z \cdot x | x \in X\} \subseteq (0, \infty) \tag{28}$$

Define $m = \min\{\lambda^{E\cap G}/\eta^{E\cap G}, \lambda^{E\cap G'}/\eta^{E\cap G'}, \lambda^{E'}/\eta^{E'}\}$, and suppose that $c^{I'}/c^I < m$. Then (27) and (28) can be satisfied by defining $z_1 = m$, $z_2 = -1$, $z_3 = \lambda^{E\cap G} - m\eta^{E\cap G}$, $z_4 = \lambda^{E\cap G'} - m\eta^{E\cap G'}$, $z_5 = \lambda^{E'} - m\eta^{E'}$. This proves that

Lemma 1 *If a feasible contract x satisfies the incentive-compatibility constraint (20) for type-I' agents, and if c^I and $c^{I'}$ are defined by (15) and (16), then*

$$\min\{\lambda^{E\cap G}/\eta^{E\cap G}, \lambda^{E\cap G'}/\eta^{E\cap G'}, \lambda^{E'}/\eta^{E'}\} \leq c^{I'}/c^I \ . \tag{29}$$

7 Discussion

Proposition 2 and lemma 1 together imply that

Proposition 3 *The following inequality is a necessary condition for intermediation in a liberal financial regime, subject to asset-by-asset supervisory assessment, to implement an efficient allocation in the private-information environment.*

$$\begin{aligned} & \min\{\lambda^{E\cap G}/\eta^{E\cap G}, \lambda^{E\cap G'}/\eta^{E\cap G'}, \lambda^{E'}/\eta^{E'}\} \\ \leq & \quad \frac{\omega\lambda^G}{\kappa\eta^{E\cap G} - ((\epsilon-\omega)+\kappa\eta^E)\lambda^G} \end{aligned} \tag{30}$$

As we have mentioned earlier, Boyd-Prescott and Chiang have provided numerical examples of parameterized model economies in which the combination of a liberal financial regime and asset-by-asset supervisory assessment of the intermediary contract is inconsistent with economic efficiency. They emphasize that, in such examples, the voluntary participation condition (18) for type-I' agents is not binding, violating condition (22).

Proposition 3 provides the basis for understanding those examples, and for understanding the incompatibility assertion in proposition 1. Since the proof of proposition 3 depends straightforwardly on (29), we suggest that condition (29), better than condition (22), captures the essence of the problem. Incentive compatibility for type-I' agents, together with the impossibility of imposing a negative utility level on a type-E' agent who reports being of type I, implies a lower bound on the ratio of expected consumption between type-I' and type-I agents. This lower bound can be larger than the ratio between the expected marginal contributions of the two types of agents. In order to achieve incentive-compatibility, then, either the expected consumption of a type-I' agent must be higher than his expected marginal contribution—the alternative emphasized by Boyd and Prescott—or else the expected consumption of a type-I agent must be lower than his expected marginal contribution, or both.

A financial-intermediation regime can fail to be liberal because intermediation is taxed or because the intermediary has monopoly power. In either case, the expected consumption level of type-I agents can be reduced. (This can be true even if the type-I agents are among the owners of the intermediary to whom its rents are distributed, or if they are among the recipients of a public subsidy financed by the tax on intermediation.) However, the expected consumption level of type-I' cannot be reduced below their expected marginal contribution by the voluntary participation constraint, since the expected marginal contribution is the expected level of production in autarky. The upshot is that, in an illiberal financial regime, the ratio of expected

consumption between the two types of agent will tend to be closer to parity than in a liberal regime. With a sufficiently high tax rate on, or degree of monopoly power in, intermediation, the ratio will satisfy the constraint (29).

Supervisors of intermediaries might suggest that, at present, asset-by-asset assessment is the only practicable way to mitigate inefficiency due to public subsidy (either explicit or implicit) of risky intermediary investment. In that case, three prospective welfare costs have to be compared. One is the cost of declining to mitigate the effect of the risk-taking subsidy. Another is the dead-weight cost of taxation of, or monopoly in, intermediation. Finally, there is the prospective welfare cost of having a pooling contract—one in which treatment of agents would be independent of their informational types per se (although, unless agent's information and evaluation were independent, there would be an indirect dependence)—rather than the efficient contract that elicits and uses truthful revelation. That cost would include over-use of costly evaluation. If sufficiently many type-I' projects were evaluated favorably, then there might be an additional cost of not having sufficient input to invest fully in all type-E projects (particularly, in all type-$I \cap E$ projects).

While a very considerable distributional effect of public subsidy to risky investment has been evident around the world, the magnitude of the efficiency effect is not obvious. Certainly the risky investments were bad ones from an *ex post* perspective, but the proper perspective from which to judge investment efficiency is *ex ante*. We are not aware of any study having been done to quantify that *ex ante* cost.

Similarly, the welfare cost of an illiberal regime of financial intermediation is uncertain. Certainly there have been countries with illiberal regimes that have enjoyed high rates of economic growth over prolonged periods, for instance. If the derived demand for input is inelastic, or if intermediaries are able to use nonlinear pricing to extract monopoly rents without imposing severe distortions, then such impressionistic evidence of high growth might truly be indicative of near-optimal economic performance. Again, however, we would emphasize that we are unaware of convincing studies that explicitly quantify this welfare cost, large or small.

If some actual economies are suspected to exemplify the inconsistency assertion of proposition 1, then carrying out the sort of welfare-economic

studies that we have just described ought to have high priority.

Moreover, whether or not an actual economy does exemplify the inconsistency assertion ought to be settled by factual investigation. Conditions (29) and (30), while highly schematic, suggest the type investigation that might be informative. Moreover, we believe that the convex-analysis approach that we have taken to deriving (29) can be extended to derive analogous conditions in richer models.

8 Conclusion

Analysis of the Boyd-Prescott model shows that it is invalid to draw a conclusion of portfolio mismanagement by financial intermediaries from the premise that some sectors of the portfolio (such as loans to finance commercial real estate, for example) have been unprofitable, or even that they must have seemed unprofitable from an ex ante perspective.[4] It also shows that some reforms that are deemed to be market oriented can possibly be counterproductive if they are implemented in an economy where financial intermediaries actually have not mismanaged their portfolios. This conclusion calls into question the logic by which some reforms that have been urged on counties in Asia and elsewhere have been justified.

Analysis of the Boyd-Prescott model supports the conclusion that, in an economy where financial intermediaries provide an essential service for which arms-length transactions in a financial market could not substitute, attaining economic efficiency requires at least one of three conditions to obtain that current policy thinking seems to hold in disfavor. Either some assets in intermediaries' portfolios must be unprofitable from an ex ante perspective, or else intermediation must be taxed, or else the benefit of intermediation must be transferred by monopoly power from intermediaries' customers to the owners of intermediary firms.

These analytic conclusions regarding the Boyd-Prescott environment have three main implications for policy. First, policy should recognize that, due to

[4]Again we emphasize that a conclusion may happen to be true in a particular case, even though it has been reached by invalid logic. A factual examination of financial crises is beyond the scope of this article.

private information, some combination of the following alternatives must be chosen: (1) public subsidy or private cross-subsidy of some risky investments that have relatively low ex ante return, (2) taxation of, or monopoly in, financial intermediation, and (3) production inefficiency due to failure to elicit and utilize private information. Second, a potential role for nonlinear pricing should be contemplated when evaluating policies that would involve cross-subsidy, taxation of intermediaries, or monopoly. Nonlinear pricing mitigates deadweight losses caused by these various policies. Third, private-information considerations complement the conventional case for a model-based (i.e., consolidated-portfolio) approach to supervision and regulation of banks and other financial intermediaries.

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