Institut für Wirtschaftsforschung Halle

Halle Institute for Economic Research

Does too much Transparency of Central Banks Prevent Agents from Using their Private Information Efficiently?

Axel Lindner

Dezember 2007 No. 16

IWH-Diskussionspapiere

IWH-Discussion Papers

Does too much Transparency of Central Banks Prevent Agents from Using their Private Information Efficiently?

Axel Lindner

December 2007 No. 16

Author: Axel Lindner
Halle Institute for Economic Research
Macroeconomics Department
Email: axel.lindner@iwh-halle.de

Herausgeber:

INSTITUT FÜR WIRTSCHAFTSFORSCHUNG HALLE (IWH)
Prof. Dr. Ulrich Blum (Präsident), Dr. Hubert Gabrisch (Forschungsdirektor)
Das IWH ist Mitglied der Leibniz-Gemeinschaft

Hausanschrift: Kleine Märkerstraße 8, 06108 Halle (Saale)

Postanschrift: Postfach 11 03 61, 06017 Halle (Saale)
Hausanschrift: Kleine Märkerstraße 8, 06108 Halle (Saale)
Telefon: +49 345 7753 60
Telefax: +49 345 7753 20

Internet: http://www.iwh-halle.de

Does too much Transparency of Central Banks Prevent Agents from Using their Private Information Efficiently? *

Abstract

This paper analyses in a simple global games framework welfare effects of different communication strategies of a central bank: it can either publish no more than its overall assessment of the economy or be more transparent, giving detailed reasons for this assessment. The latter strategy is shown to be superior because it enables agents to use private information and to be less dependent on common knowledge. This result holds true even if the strategies of agents are strategic complements, for which case it has been argued that too much transparency might induce agents to neglect their private knowledge.

Keywords: transparency; private information; common knowledge.
JEL-Codes: D83, E58

Zusammenfassung

Der Beitrag analysiert im Rahmen eines einfachen Global Games-Ansatzes die Wohlfahrtseffekte verschiedener Kommunikationsstrategien von Zentralbanken: Die Bank kann entweder nur ihre Einschätzung des Gesamtzustandes einer Ökonomie geben, oder sie kann tranparenter sein, indem sie detailliert Gründe für ihre Einschätzung veröffentlicht. Es wird gezeigt, dass letztere Strategie überlegen ist, weil sie es erst den Wirtschaftssubjekten ermöglicht, ihre private Information voll zu nutzen. Das Ergebnis bleibt auch dann bestehen, wenn die Strategien der Wirtschaftssubjekte komplementär zueinander sind, obwohl für diesen Fall häufig argumentiert wird, dass zu viel Zentralbanktransparenz zu einer Vernachlässigung privater Information führen könnte.

Schlagwörter: Transparenz; Private Information; Common Knowledge.
JEL-Codes: D83, E58

* I would like to thank Alexander Ludwig and participants of the session "'monetary policy transparency and heterogeneity"' of the 2007 meeting of the European Economic Association for helpful comments. Any erros are my own.

Contents

Does too much Transparency of Central Banks Prevent Agents from Using their Private Information Efficiently?

1 Introduction

"Striking the balance between the need for clear and simple messages and the need to adequately convey complexity is a constant challenge for central bank communication." This statement of a central banker, the long standing chief economist of the European Central Bank Otmar Issing (2005), has recently been put into the language of economic theory: Stephen Morris and Hyun Song Shin (2007) argue that "there may be welfare losses resulting from the fact that the opportunity to utilize the greater sophistication is foregone in favor of simplicity. However, simplicity is a great virtue in its ability to generate common understanding. There is a trade-off here." [1] Morris and Shin show this trade-off under the assumption that the central bank can either publish a set of highly precise pieces of information, that are however 'fragmented' in the sense that each piece is only understood by a specific subgroup of the general public, or publish a single piece of information that is less precise, but becomes common knowledge to the whole public. In this setting, it might be better to be less precise and less fragmented if coordination between agents is an important objective. If, however, it is more important that agents are well informed about the state of the economy, then it might be better to publish the more precise and more fragmented information. In a closely related paper, Morris and Shin (2002) show that if the central bank can only publish information as common knowledge, and coordination of agents is irrelevant for common welfare, then it might be better not

[1] They see this trade-off not only in the communication strategy of central banks, but also in the regulation of accounting systems for firms.

to publish information that helps agents coordinating but might have the effect that private information about the state of the economy is neglected.

This paper argues that the trade-off between publishing information as common knowledge and the use of more precise, but ”fragmented” information by private agents can be considered as an artefact of the simplicity of the information structure used by Morris and Shin (2002, 2007). Instead, we will stress the point that good public information is an important precondition for an efficient use of private or ”fragmented” information. This is shown in a simple global games framework that is in many aspects close to that of Morris and Shin (2007). In particular, we assume that the central bank has reasons for its assessment of the state of the economy, and it has the option either to communicate these reasons to the public or just to publish the overall assessment. The former strategy of communication is called transparent, the latter intransparent. The transparent strategy does not yield better common knowledge about the state of the economy than in the case of the intransparent strategy. However, the detailed account on the information which has led to the assessment makes the agents' private information on the economy more precise. This is so because each agent is expert for a specific sector of the economy, and a detailed account from the central bank gives her valuable information about those sectors she is not expert of. It will be shown that in such a setting, a transparent communication strategy is always welfare-enhancing, even if positive or negative externalities of coordination between the actions of economic agents exist.

In the following this argument will be stated formally: section 2 sets the framework. Section 3 analyses the welfare effects of a transparent communication strategy as opposed to an intransparent one. Section 4 sums up and gives an outlook on possible future research.

2 A formal framework

The basic model of the central bank's communication strategies centres around a parameter Θ that represents the fundamental state of the economy.

We might think of Θ as standing for the activity level of the economy. There is a continuum of agents of unit mass indexed by the unit interval [0; 1]. For them, information about Θ is important, because it is beneficial for them to align their actions, e.g. their investment into shares, to the overall activity level. In addition, the single representative agent k benefits from aligning her action to those of the other agents (or from "coordination" of actions). Thus, the incentives for actions are partly those of the famous "beauty contest" that served Keynes (1936, chapter 12) as a metaphor for modern stock market activities. For example, if the prices of shares go up because the demand from other agents is high, it is beneficial to participate in the stock investment boom.

For a start, we assume that the agents weigh the two aspects according to the same loss function according to Radner (1961):

$$L = (1-r)\int (a_k - \Theta)^2 dk + \frac{r}{2}\int\int (a_k - a_m)^2 dm\, dk \qquad (1)$$

(with $0 \leq r \leq 1$). Thus, the interests of all agents are identical; this case of common interest can be used as a simple benchmark in analysing the welfare effects of different information structures (see Morris and Shin 2007).

Parameter Θ is a catch-all variable for the fundamental state of the economy; it equals the sum of the activity levels θ_i of the n sectors ($n \geq 2$) the economy consists of:

$$\Theta = \sum_{i=1}^{n} \theta_i \qquad (2)$$

Every agent is expert in one sector i (a type i-expert). This means that she knows the realisation of the activity level of one sector i, θ_i. Experts are equally distributed over the sectors: $1/n$th of all agents are experts for a sector i. For the sake of simplicity, it is assumed that prior to the information from the central bank, any activity level of a sector agents are not experts of is equally likely for them: for an agent of type i, the parameter $\theta_{j\neq i}$ has an improper uniform distribution over the real line.

The central bank observes noisy signals $x_i = \theta_i + \eta_i$ over the activity levels of the single sectors, with η_i as independent and identically distributed random variables with mean zero and variance $1/\gamma$ (precision γ). The central bank can choose between two communication strategies: the first is called intransparent. Here, the bank publishes only the overall assessment $X = \sum_{i=1}^{n} x_i$ and in this way makes it common knowledge among all agents. The second strategy is publishing the detailed reasons for the overall assessment, i.e. making all x_i and with them X common knowledge. This strategy is called transparent.

Next we look at the equilibrium strategies of agents under the two different regimes of central bank communication.

2.1 Equilibrium strategies of agents

Agent k minimizes her loss according to (1) by choosing the following action a_k:

$$a_k = (1 - r)E_k(\Theta) + rE_k(\overline{a}) \tag{3}$$

with $\overline{a}$ as the average action $\int a_m dm$ of agents. The expected activity level of the economy $E_k(\Theta)$ and the average action of other agents $E_k(\overline{a})$ expected by agent k depend on the information published by the central bank.

2.1.1 The case of transparent communication

Agents know that there are n different types of agents that each have a particular information set. The equilibrium can be found by the "Guess and solve"-method. First we take the hypothesis that in equilibrium, the action of a type-i agent is a linear combination of the overall activity level expected by an agent of type i, $E_i(\Theta) = \theta_i + \sum_{j \neq i}^{n} x_j$, and of the overall activity level expected by the central bank X:

$$a_i = (1-\lambda)\left(\theta_i + \sum_{j \neq i}^{n} x_j\right) + \lambda X \tag{4}$$

Using this assumption for determining $E_k(\overline{a})$ gives the following representation of the optimal strategy a_i (see appendix):

$$a_i = \left(1 - \frac{r(n-1+\lambda)}{n}\right)\left(\theta_i + \sum_{j \neq i}^{n} x_j\right) + \frac{r(n-1+\lambda)}{n} X \tag{5}$$

Thus, if other agents behave according to (4), it is optimal for an agent of type i to do so too, with $\lambda = r(n-1+\lambda)/n$ or

$$\lambda = \frac{r(n-1)}{n-r} \tag{6}$$

Clearly, the more important acting in close alignment with other agents is, the more closely to her estimation of $\overline{a}$ the agent acts ($\partial\lambda/\partial r > 0$). Moreover, if there are only a few sectors in the economy, the private information of an agent will help her to estimate the true activity level very well and this information will strongly influence her action ($\partial\lambda/\partial n > 0$).

With equilibrium strategies derived, the expected loss under transparency, L_t, of an agent can be calculated. It is dependent on $E_i(a_i - \Theta)^2 = n(n-1)/(\gamma n) + \lambda^2/\gamma$ and

$E_i(a_i - a_{j\neq i})^2 = 2(1-\lambda)^2/\gamma$ (see appendix) and is given by:

$$L_t = (1-r)\int (a_k - \Theta)^2 dk + \frac{r}{2}\int\int (a_k - a_m)^2 dm\, dk = \frac{n(r+n-nr-1)}{\gamma(n-r)} \quad (7)$$

Clearly, the loss decreases with increasing precision of the public information ($\partial L_t/\partial\gamma < 0$); it is increasing in the number of sectors ($\partial L_t/\partial n > 0$) because a small n means that every agent has a precise knowledge about a larger part of the overall economy. In the special case that agents are only interested in coordination of actions ($r = 1$), there is no loss because they simply coordinate on the public signal $X = \sum x_i$, independently of their private information on specific sectors.

2.1.2 The case of intransparent communication

In the case of intransparent communication, the central bank publishes only its overall assessment of the economy X. Because it is assumed that prior to the information from the central bank, any value of the fundamental of a sector agents are not experts of is equally likely for them, the private information about the sector they know has no value for estimating the overall activity level. Thus, the best strategy for all agents is to adapt their action to the overall assessment of the central bank. The loss of an agent is given by:

$$L_{nt} = \frac{(1-r)n}{\gamma} \quad (8)$$

Because all agents choose the same action, the loss depends only on the precision of the overall assessment of the central bank n/γ, and on how important the objective of coordination is.

3 Welfare effects of transparency

3.1 The case without externalities

As mentioned at the beginning of section 2, for the loss function (1), losses of all agents are identical and are a measure of the overall welfare loss. The difference between the welfare loss under an intransparent communication policy and a transparent one is:

$$L_{nt} - L_t = \frac{n(r-1)^2}{\gamma(n-r)} \tag{9}$$

We find that $L_{nt} - L_t > 0$ for $r < 1$. Thus, in general, the transparent policy is better than the intransparent one. The positive effect of transparency is the smaller the more important the objective of coordination is:[2]

$$\frac{\partial(L_{nt} - L_t)}{\partial r} = \frac{1}{\gamma}\frac{n(2n-r-1)(r-1)}{(n-r)^2} < 0 \tag{10}$$

Even in the extreme case of $r = 1$, however, intransparent communication is not strictly preferable ($L_{nt} - L_t = 0$): if agents care only about coordination, they pay attention only to the overall assessment of the central bank X as a coordination device. The result that publishing information useful only to specific parts of the public cannot do harm whatever the importance of coordination is contrary to the results in Morris and Shin (2007); those were derived under the assumption that publishing both specific information and an overall assessment is not an option.

3.2 The case with negative externalities

[2] Note that $n \geq 2$.For $n = 1$ there is perfect information of all agents without any need for communication.

Up to now, we worked with preference structures that implied no externalities between actions of different agents. This simplification will be removed now, because, as Morris and Shin (2002) have argued, too much transparency might be detrimental to welfare if the objective of coordination is very important for the single agents, but not for overall welfare. Such a case can be modelled by measuring the reward of being close to the average action of other agents relatively to the average dispersion of actions. Thus, in order to check whether the result of Morris and Shin (2002) is possible in our setting, we define the individual loss function with negative externalities L_k^{ne} for agent k as:

$$L_k^{ne} = (1-r)(a_k - \Theta)^2 + r\left(V_k - \overline{V}\right) \tag{11}$$

with

$$V_k = \int (a_k - a_m)^2 dm \tag{12}$$

and the average dispersion $\overline{V}$:

$$\overline{V} = \int V_m dm \tag{13}$$

The optimal action is still given by (3). Because the complementary part of the utility function $r\left(V_k - \overline{V}\right)$ leads to a zero-sum game of agents with respect to coordination, it cancels out for welfare L^{ne}:

$$L^{ne} = (1-r)\int (a_k - \Theta)^2 dk \tag{14}$$

The welfare analysis is (except for the constant $(1-r)$) identical to the case without externalities and $r = 0$. Clearly, a transparent policy is welfare-enhancing. This result is in contrast to the main point of Morris/Shin (2002), because in our setting it is just the transparent policy itself that enables agents to exploit their private information.

3.3 The case with positive externalities

What if choosing complementary strategies generates positive instead of negative externalities? Quite opposite to what was discussed above, it might be argued that in this case a transparent communication strategy could be detrimental in our setting, because it enables agents to exploit their private knowledge and come closer to the real state Θ instead of coming closer to each other. Positive externalities arise if agents benefit from being close to one another independently of the average dispersion.[3] The individual loss function with positive externalities L_k^{pe} for agent k is:

$$L_k^{pe} = (1-r)(a_k - \Theta)^2 + r\int (a_k - a_m)^2 dm \tag{15}$$

The optimal action is again given by (3). The social loss function L^{pe} is simply the average of the individual losses:

$$L^{pe} = (1-r)\int (a_k - \Theta)^2 dk + r\int\int (a_k - a_m)^2 dm\, dk \tag{16}$$

If an agent k maximized this social loss function, she would take the positive externalities of being close to other agents into account and choose the action:

$$a_k = \frac{1-r}{1+r} E_k(\Theta) + \frac{2r}{1+r} E_k(\overline{a}) \tag{17}$$

3 In coming closer to somebody else an agent is better off, but the other agent benefits too; this is an externality.

Note that the expected average strategy $E_k(\overline{a})$ would have more weight in determining a_k than in the case without positive externalities.

Comparing the losses of a transparent and an intransparent communication strategy gives:

$$L_{nt}^{pe} - L_t^{pe} = -\frac{n^2(r-1)^3}{\gamma(n-r)^2} \tag{18}$$

We have $L_{nt}^{pe} - L_t^{pe} > 0$ for $r < 1$. Thus, in general, welfare is still higher with a transparent policy than with an intransparent one. The advantage is, however, smaller than in the case without positive externalities from coordination.[4]

[4] Note that $L_{nt}^{pe} - L_t^{pe}$ can be written as $\frac{n(r-1)^2}{\gamma(n-r)}\frac{n(1-r)}{(n-r)}$.

4 Conclusions

This paper has shown for a specific informational structure that the communication strategy of a central bank does not face a the trade-off between enhancing the common knowledge about the state of the economy and the use of more precise, but "fragmented" information by private agents. Instead, a transparent communication strategy is an important precondition for an efficient use of private or "fragmented" information. This means in our framework that the central bank should publish reasons for its assessment that are detailed enough to meet the differing needs of differently informed agents. This point was also stressed by Issing (2005) in his statement about the challenges a central banker faces in communicating with the public; he added to the words cited at the beginning of this paper: "An additional difficulty stems from the need to address various target groups, including academics, the markets, politicians, and the general public. Such a broad spectrum may require a variety of communication channels geared to different levels of complexity." The framework presented here might be interpreted as the model of a communication that is able to completely solve the tasks described by Issing. But trade-offs might again be found in a more complex informational setting. One step in this direction would, for example, be introducing some prior information of a representative agent of type i about the state of the sectors $\theta_{i \neq k}$ she is not expert of. The basic argument of this paper, however, should still hold in a more complex setting: a more transparent information policy makes private information of traders more valuable.[5]

[5] This is also the central point of Lindner (2006) that deals with conditions for multiplicity of equilibria in a global games context.

A Derivation of equation 5

Using the guessed equation

$$a_k = (1-\lambda)\left(\theta_k + \sum_{i\neq k} x_i\right) + \lambda X \tag{19}$$

for determination of the average strategy $\overline{a}$ yields the following representation of the agent's action:

$$a_k = (1-r)\left(\theta_k + \sum x_{m\neq k}\right) + r\left(\frac{1}{n}\left((1-\lambda)(\theta_k + \sum x_{m\neq k}) + \lambda X\right) + \frac{n-1}{n}X\right) \tag{20}$$

Rearranging terms yields equation (5).

B Derivation of the loss function 7

The loss consists of two weighed parts. The first part is

$$\int (a_k - \Theta)^2 dk = E\left((1-\lambda)\left(\theta_k + \sum_{m\neq k}\theta_m + \sum_{m\neq k}\eta_m\right) + \lambda\left(\sum_m \theta_m + \sum_m \eta_m\right) - \sum \theta_m\right)^2 \tag{21}$$

Further rearrangement yields:

$$\int (a_k - \Theta)^2 dk = \frac{(n-1)}{\gamma} + \frac{\lambda^2}{\gamma} \tag{22}$$

The second part is

$$\int\int (a_m - a_k)^2 dm dk = (1-\frac{1}{n})E(a_{m\neq k} - a_k)^2 = \frac{n-1}{n}(1-\lambda)^2 E(\theta_k - \theta_{m\neq k} + x_{m\neq k} - x_k)^2 \tag{23}$$

After rearrangement we have:

$$\int\int(a_m - a_k)^2 dm\, dk = 2\frac{(n-1)}{n}\frac{(1-\lambda)^2}{\gamma}$$

Summing these two weighted terms and simplifying gives equation (7).

References

Issing, O., Communication, Transparency, Accountability: Monetary Policy in the Twenty-First Century, *Federal Reserve Bank of St. Louis Review* 87, 65-83.

Keynes, J.M. (1936), *The General Theory of Employment, Interest, and Money*, London: Macmillan.

Lindner, A. (2006), Can Transparency of Central Banks produce Multiple Equilibria on Currency Markets?, *Scandinavian Journal of Economics 108*, 1-14.

Morris, S., Shin, H. (2002), Social Value of Public Information, *The American Economic Review 92,* 1521-1534.

Morris, S., Shin, H. (forthcoming), Optimal Communication, *Journal of the European Economic Association, Papers and Proceedings 5* (2007).

Radner, R. (1961), Team Decision Problems, *Annals of Mathematical Statistics 33,* 857-881.