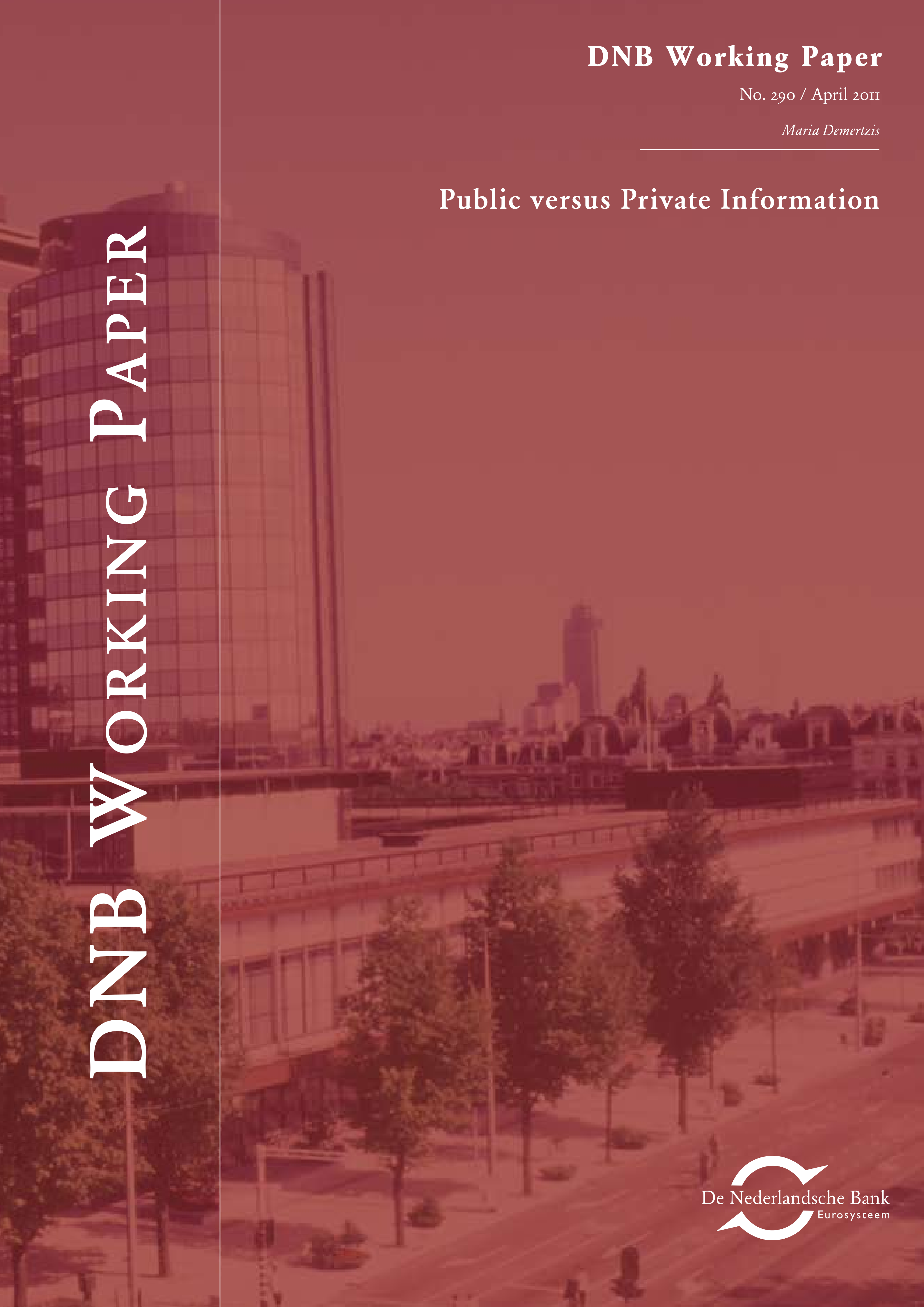

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Maria Demertzis

Public versus Private Information

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De Nederlandsche Bank
Eurosysteem

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* Views expressed are those of the author and do not necessarily reflect official positions of De Nederlandsche Bank.

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Public versus Private Information*

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Abstract

Using the model by Morris and Shin (2002), we distinguish between how people *perceive* a state and how they *act* upon it. We show than even for perceptions, where the coordination motive plays no role, improving the quality of public information does not always reduce the forecasting error. The reason why this happens is because *better* information is always *more relevant* information. But if improvements in information attract more attention than they deserve, the overall effect may be detrimental to the accuracy of perceptions. Increases in private information quality, on the other hand, are always beneficial to the decisions. Moreover, the assumption of no private information error on average implies that agents would do better collectively if there was no public information signal.

Keywords: Signal extraction, Public and Private information, Actions vs Perceptions
JEL codes: D82, E52,E58

1 Introduction

In their seminal paper, Morris and Shin (2002) (MS hereafter) extend the standard signal extraction set-up of forecasting a given state, to include agents' will to coordinate with each other. MS show the role that information plays in helping agents reduce their forecasting error, (see Vives, 1993). They show that in the presence of a coordination motive, private

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agents pay disproportionately more attention to public information than is justified by its quality.[1] This leads to the effect that increases in the quality of public information are not always beneficial in terms of welfare.[2]

In this note, we would like to add two points to this discussion: first, the existence of the coordination motive implies that people would not necessarily act in accordance with their own perceptions. We thus distinguish between the way agents *perceive* reality and the way they *act* upon it. Perceptions are independent of this motive, whereas actions are not. Increases in public information precision will align actions to the state easier than they will align the corresponding perceptions. In other words, in the presence of a coordination motive, agents are quick to change their actions so as to achieve coordination, even if their perceptions are slower to adapt.[3] We show that irrespective of this coordination motive, the observation that better public information is not always beneficial still holds. The reason why this happens is because *better* information is always *more relevant* information (i.e. the extent to which people rely on it), whether it be public or private. In other words, better information will always attract more attention. But if the improvements in information attract more attention that they deserve, then the overall effect may be detrimental to prediction made. We show this to hold for the way perceptions are formed.

The second point that we would like to make is that the MS set-up introduces an asymmetry in the way that public and private information feed into the outcome. It is thus assumed that while each agent makes a private error, when aggregating across all individuals this error is eliminated. By contrast, public information will always appear in the final solutions with a non-zero error term, which is weighted by its relative precision. This implies that while

[1] See Amato et al (2003), Hellwig (2004), Angeletos and Pavan (2007), Amador and Weil, (2008), Demertzis and Viegi (2008) for applications to monetary policy.

[2] Svensson (2006) argued that the parameterization that is required for this to hold is very specific and actually improbable. If one was to assume plausible values for the underlying parameters, the benefits of increasing public information precision are rescued and actually dominate the range of outcomes. In response to this, Morris et al (2006) have argued that when the coordination motive is high, the hurdle rate for this to be true can actually be quite high.

[3] It is often observed that in matching games players coordinate much more frequently than by randomizing (Casajus, 2000, Bacharach, Gold and Sugden, 2006). Indeed, according to Wilson and Rhodes (1997), it is to the benefit of all actors to avoid the conflict that escalates as solutions are delayed.

individuals will alone always make a mistake based on the quality of their own information, collectively they will do better when they have no public information but rely instead on their own devices. We argue that this is more of a model peculiarity, than a realistic outcome.

The paper is organized as follows. Section 2 summarizes the MS model and defines perceptions versus actions. In section 3 we then examine the relevance of information and describe the asymmetric role of public and private information. Section 4 concludes.

2 The Model

We summarize briefly the information model described by MS. For a continuum of agents indexed by the unit interval $[0,1]$, each agent has the following utility function:

$$u_i(\mathbf{a},\theta) \equiv -(1-r)(a_i-\theta)^2 - r\left(L_i - \bar{L}\right), \tag{1}$$

where a_i is individual i's action and θ is the *ex post* state. We use $\mathbf{a}$ to refer to the action profile over all agents. L_i and $\bar{L}$ are defined as follows:

$$L_i \equiv \int_0^1 (a_j - a_i)^2 \, dj,$$
$$\bar{L} \equiv \int_0^1 L_j dj.$$

The first term in (1) shows that the individual chooses her action to close the distance to the state. The second term however represents Keynes' 'beauty term' element in which the agent cares how far away her action is vis-à-vis all other agents.[4] With reference to the actual state, this constitutes an externality and MS show how this affects the individual's behavior.

[4]There are numerous examples that justify the existence of this term in the objective function. MS refer to the parallelisms of the beauty term with the Lucas-Phelps island economy. Also, based on Canzoneri (1985), Demertzis and Viegi (2008) similarly explain the importance of agents having similar inflation expectations. When forecasting inflation agents needs to second guess what others think about future inflation, as it is the collective forecast that will affect the final outcome.

Parameter r represents how strong this externality weighs on the utility function ($0 \leq r \leq 1$) and is assumed to be constant. Optimizing (1) produces individual agents' action, given by

$$a_i \equiv \arg\min_{a_i} u_i(\mathbf{a}, \theta) = (1-r)E_i(\theta) + rE_i(\bar{a}). \tag{2}$$

It follows from (2) that individual i's action is a function of how she perceives the state $E_i(\theta)$ as well as how she perceives everybody else's action on average, $E_i(\bar{a})$ where $\bar{a} = \int_0^1 a_i di$. The interesting feature in (2) is that it allows for the underlying state θ to be interpreted by individual agents, given their information. And in doing so, they form their own views about what the state is but also about what everybody else thinks the state is (higher order expectations). In that respect, the game can arguably be considered of a 'matching' nature, in the sense that identical actions are preferable. Naturally, if θ were common knowledge, then (2) would collapse to $a_i = \theta$. However θ is not common knowledge but information about it is available in the form of a public signal common to all agents, and a private signal which is specific to each agent in the economy. Information is then summarized as follows:

$$\text{Public signal:} \quad y = \theta + \eta, \tag{3}$$

$$\text{Private signal:} \quad x_i = \theta + \varepsilon_i. \tag{4}$$

Both η and ε_i have a zero mean and variance σ_η^2 and σ_ε^2 respectively. Furthermore, the two error terms are independent of θ and of each other, such that $E(\varepsilon_i \varepsilon_j) = 0$ for $i \neq j$. Based on these two types of signals, MS show that the agent will weigh the two sources of information by their relative precision to form a view about the state, i.e.:

$$E_i(\theta) = \frac{\alpha y}{\alpha + \beta} + \frac{\beta x_i}{\alpha + \beta}, \tag{5}$$

where $\alpha = \frac{1}{\sigma_\eta^2}$ and $\beta = \frac{1}{\sigma_\varepsilon^2}$, the precision of public and private information respectively. The average perception of the state across all agents is then:

$$
\begin{aligned}
\bar{E}(\theta) &= \int_0^1 E_j(\theta)\,dj \\
&= \theta + \frac{\alpha\eta}{\alpha+\beta}.
\end{aligned} \tag{6}
$$

Moving then from perceptions to actions, the individual needs to allow for how others view the state. This gives rise to higher order expectations and implies that perceptions and actions are not necessarily the same. In solving this, the authors assume that the action of each individual is a linear function of the signals they have. When agent i factors this in, her action is equal to:

$$
a_i = \theta + \frac{\alpha\eta + \beta(1-r)\varepsilon_i}{\alpha+\beta(1-r)}. \tag{7}
$$

Similarly, the average action is now,

$$
\bar{a} = \int_0^1 a_j dj = \theta + \frac{\alpha\eta}{\alpha+\beta(1-r)}. \tag{8}
$$

Equation (6) and (8) show that the average expectation of θ and the average action across all agents are not equal to the state of θ but are distorted by the precision of the two signals as well as the preference for coordination, 'beauty term', r. It is the case therefore that public (private) information receives more (less) weight by comparison to its relative precision $\frac{\alpha}{\alpha+\beta(1-r)} > \frac{\alpha}{\alpha+\beta}$, $\left(\frac{\beta(1-r)}{\alpha+\beta(1-r)} < \frac{\beta}{\alpha+\beta}\right)$in (7), as a result of the coordination motive. As a consequence, Morris and Shin argue that it is not unequivocal that greater public information precision is beneficial to general welfare. In what follows we will look more carefully at what affects people's perceptions and actions and therefore examine how improvements in the quality of information may affect outcomes.

A Two 'errors' and their causes

Based on this model, we re-write these arguments in terms of how people's perceptions ($\bar{E}(\theta)$) and actions ($\bar{a}$) differ from reality. We define formally these two '*errors*' in terms of information precision α and β, and look at them more carefully.

We first look at how perceptions formed differ from reality. This points to the way information imperfections distort the way agents form opinions.

Definition 1 ***Perception Error:***

$$\mathbb{P}_e \equiv \bar{E}(\theta) - \theta = \frac{\alpha\eta}{\alpha+\beta}. \tag{9}$$

Formulation (9) shows that the error agents make is directly proportional to the relative precision of the public signal. Note that the private signal error ε_i disappears as we aggregate across all agents, by assumption.

Next we look at the way actions (and not just perceptions) individuals take differ from the state.

Definition 2 ***Actual Error:***

$$\mathbb{A}_e \equiv \bar{a} - \theta = \frac{\alpha\eta}{\alpha+\beta(1-r)}. \tag{10}$$

Again we observe that the error is proportional to the relative precision of the public signal, except this time the weight on the public signal error is increased due to the existence of the coordination motive r.

3 The role of information

We examine next how improving the quality of information that agents have affects actions and perceptions. Table 1 summarizes the results.

Table 1

$\lim(.)$		$\alpha \to 0$	$\alpha \to \infty$	$\beta \to 0$	$\beta \to \infty$
$\mathbb{P}_e$	$\left(= \frac{\alpha\eta}{\alpha+\beta}\right)$	0	0	η	0
$\mathbb{A}_e$	$\left(= \frac{\alpha\eta}{\alpha+\beta(1-r)}\right)$	0	0	η	0

Note: $\alpha \to \infty$, $\frac{\alpha}{\alpha+\beta} \to 1$ and $\frac{\alpha\eta}{\alpha+\beta} \to \eta$. However, $\alpha \to \infty$ is true only when $\sigma_\eta^2 \to 0$ and $\eta \to 0$. In turn this implies that $\frac{\alpha\eta}{\alpha+\beta} \to 0$.

A The Relevance of Information

Notation 1. *Let $T \in [0,1]$ be the relative precision (relevance) of the public information signal. More precisely, $T^{\mathbb{P}} \equiv \frac{\alpha}{\alpha+\beta}$ and $T^{\mathbb{A}} \equiv \frac{\alpha}{\alpha+\beta(1-r)}$ are the weights given to public information noise in $\mathbb{P}_e$ and $\mathbb{A}_e$ respectively.*

Remark: *An increase in the quality of public information is not only associated with a reduction in public information noise, σ_η^2; it is also associated with an increase in the relevance of public information, T.*

As quality increases, public information is both subject to less noise as well as more heavily weighted. It is in this sense that *better* information is also more *relevant* information. The opposite implies that public information is not only subject to higher noise but is also discounted by the smaller weight that is attached to it. It is not unequivocal therefore that the perception error decreases as a result; it depends on how the gain in relative signal precision, associated with the likelihood of sufficiently small actual errors being drawn, compares to the increase in emphasis it attracts. In either of the two extreme cases ($T = 0$ or 1), the perception error made is zero.[5]

Lemma 1. *Better public information ($\alpha_2 > \alpha_1$) is likely to reduce the propability with which perception errors take a certain value,* $\Pr(|\mathbb{P}_{e,1}| \leq k) < \Pr(|\mathbb{P}_{e,2}| \leq k)$, *only when the extra emphasis put on the public signal is smaller than the gain in public information noise, i.e.: $\frac{T_2^{\mathbb{P}}}{T_1^{\mathbb{P}}} < \frac{\sigma_{\eta 1}}{\sigma_{\eta 2}}$.*

[5] When public information precision is infinite, there is no scope for errors in perceptions. However, when there is only bad quality public information people discount it and rely entirely on their own private information. Again, as average private information error across all agents is zero, the average perception will be equal to the state and the perception error equals zero at both extreme cases.

Proof 1: See Appendix.

Lemma 2. *The same improvement in public information precision ($\alpha_2 > \alpha_1$) is likely tor educe the propability with which action errors take a certain value,* $\Pr(|\mathbb{A}_{e,1}| \leq k) < \Pr(|\mathbb{A}_{e,2}| \leq k)$, *only when* $\frac{T_2^{\mathbb{A}}}{T_1^{\mathbb{A}}} < \frac{\sigma_{\eta 1}}{\sigma_{\eta 2}}$, *(or* $\sigma_\varepsilon^2 > \sigma_{\eta_1}\sigma_{\eta_2}(1-r)$*).*

Proof 2: See Appendix.

Lemmas 1 and 2 are in line with the observation that MS had made that "...Increased precision of public information is beneficial only when the private information of the agents is not very precise." We see this when expressing the conditions in terms of the actual signal variances. However, when comparing the two propositions we can also make an additional observation:

Corollary: *Better public information is more likely to reduce the actual error,* $\mathbb{A}_e$*, than the perception error,* $\mathbb{P}_e$*.*

Proof: As the coordination motive implies that public information receives more weight, it is also the case that changes in the quality of public information affect it by more than they affect perceptions. This can be seen from the fact that $\frac{T_2^{\mathbb{A}}}{T_1^{\mathbb{A}}} < \frac{T_2^{\mathbb{P}}}{T_1^{\mathbb{P}}} < \frac{\sigma_{\eta 2}}{\sigma_{\eta 1}}$, or alternatively since $\sigma_\varepsilon^2 > \sigma_{\eta_1}\sigma_{\eta_2}(1-r)$ is easier[6] to satisfy than $\sigma_\varepsilon^2 > \sigma_{\eta_1}\sigma_{\eta_2}$ for a given private information error, σ_ε^2 (see Appendix for details). The intuition behind this is that if agents have an incentive to coordinate they will always seek to act in ways that will help them do so, even if their perceptions are slower to adapt. This is a rather common result in coordination games where it is shown that agents are quick to exploit ways that will achieve (tacit) coordination (Casajus 2000).

B Public vs Private Information

The relevance of information argument is naturally also true for private information. From (5) we see that as the noise in private information decreases the relative weight given to private

[6]Note, how for non zero standard errors this inequality will always be true as the coordination motive tends to one.

signal increases. However as, by assumption, the average private information error across all agents is zero, the term disappears from the average perception. An increase in β will therefore unequivocally reduce the error in perceptions that agents make. That of course is an important difference to the way public information affects the system and allows us to make an additional point. Our discussion so far is done for a given finite and non-zero value of public information precision, α. MS have referred to the possibility of a "bang-bang" solution to a social planner's attempt to choose *ex ante* the optimal precision of public information. We see the same here as $\mathbb{P}_e$ and $\mathbb{A}_e$ errors are eliminated when either $\alpha = 0$, or $\alpha = \infty$ (from Table 1). In other words agents come closer to the state when they have either perfect public information or no public information at all. Infinitely precise public information ($\alpha = \infty$) may not be easy, especially if there are costs to doing so.[7] However, these errors would also be eliminated if public information was either not provided or simply ignored ($\alpha = 0$). It does not matter how well informed private agents are (i.e. this is true for any β): given the fact that *average* private information is free of errors, society as a whole would be better-off left to its own devices. It would therefore appear that a social planner who optimizes for the whole society based on this model, may achieve the first best result effortlessly, by simply making sure not to provide any information. We argue that this is the result of the fact that private agents make no mistakes on average. If private errors were to exhibit some persistence, then public information would regain a constructive role. Moreover, as Morris and Shin (2002) and Morris et al (2006) have pointed out there is clearly scope for correlations across the errors, which the main model ignores. In the presence of such correlations, these corner solutions would again become unattractive. Finally, we argue that it is unlikely that a social planner is the sole provider of public information. It is not therefore possible to fully control what information is available at the public domain. Once some public information is available, then it becomes important again for the social planner to identify the optimal level of public information precision and help steer it that way.

[7] See Svensson (2006) and Demertzis and Hoeberichts (2007) for examples of introducing costs associated with improvements in the public signal.

4 Conclusions

Our first point is that since good information is more relevant than bad information (be it private or public), there will always be a range of values for which increasing public information precision is not beneficial to the way people perceive the state. And that is independent of the coordination motive that agents may or may not have, as it affects both perceptions as well as actions. What the coordination motive does allow for however, is for more precise public information to be quicker beneficial to the quality of the decisions (actions) taken. Our second point is that the asymmetric way in which private and public information affect average magnitudes implies that it is better (in the sense of eliminating errors) for private agents and society at large, not to receive any public information but are left to decide based on their own information.

APPENDICES

A Proof of Proposition 1

For simplification we assume that $\eta_1 \to \mathbb{N}\left(0, \sigma^2_{\eta_1}\right)$ and $\eta_2 \to \mathbb{N}\left(0, \sigma^2_{\eta_2}\right)$. Increasing public information precision implies that $\sigma_{\eta_2} < \sigma_{\eta_1}$, $\alpha_2 > \alpha_1$ and, for a given β, $\frac{\alpha_2}{\alpha_2+\beta} > \frac{\alpha_1}{\alpha_1+\beta}$. For a given perception error value, say k, increased precision will be beneficial to perceptions if the following is true:

$$\Pr\left(|\mathbb{P}_{e,1}| \leq k\right) < \Pr\left(|\mathbb{P}_{e,2}| \leq k\right). \tag{11}$$

In other words if (11) holds, it follows that an increase in precision increases the probability of the perception error being between two given numbers. Otherwise put, for a given likelihood, the increase in precision reduces the range of values that the perception error can take. Following the assumptions for η, the moments of the distribution of perception errors are known:

$$\mathbb{P}_{e,i} \to \mathbb{N}\left(0, \frac{\alpha_i^2}{\left(\alpha_i + \beta\right)^2}\sigma^2_{\eta_i}\right) \text{ where } i = 1, 2.$$

Through the process of normalization we can then re-write (11) as follows:

$$\Pr\left(|z_1| \leq \frac{k\left(\alpha_1 + \beta\right)}{\alpha_1 \sigma_{\eta_1}}\right) < \Pr\left(|z_2| \leq \frac{k\left(\alpha_2 + \beta\right)}{\alpha_2 \sigma_{\eta_2}}\right)$$

where z_i is the standardized normal transform of $\mathbb{P}_{e,i}$. For greater precision to be beneficial to perception errors, it suffices to show under which conditions the following is true:

$$\frac{-k\left(\alpha_2 + \beta\right)}{\alpha_2 \sigma_{\eta_2}} < \frac{-k\left(\alpha_1 + \beta\right)}{\alpha_1 \sigma_{\eta_1}}. \tag{12}$$

It is straight forward to show that (12) is true when the following holds[8]:

$$\frac{-k(\alpha_2+\beta)}{\alpha_2\sigma_{\eta_2}} < \frac{-k(\alpha_1+\beta)}{\alpha_1\sigma_{\eta_1}} \Rightarrow$$
$$\frac{\alpha_2\sigma_{\eta_2}}{\alpha_2+\beta} < \frac{\alpha_1\sigma_{\eta_1}}{\alpha_1+\beta} \Leftrightarrow$$
$$\frac{T_2^{\mathbb{P}}}{T_1^{\mathbb{P}}} < \frac{\sigma_{\eta_1}}{\sigma_{\eta 2}}.$$

Re-write:

$$\frac{\alpha_i}{\alpha_i+\beta} = \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2+\sigma_{\eta_i}^2}$$

for $i = 1, 2$ and therefore

$$\frac{\frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2+\sigma_{\eta_2}^2}}{\frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2+\sigma_{\eta_1}^2}} < \frac{\sigma_{\eta_1}}{\sigma_{\eta_2}} \Rightarrow$$
$$\sigma_\varepsilon^2 > \sigma_{\eta_2}\sigma_{\eta_1}. \tag{13}$$

For better public information to be beneficial, it is important that the increase in the weight that public information gets is smaller than the gain (decrease) in its variance. An alternative way of interpreting this is that better public information is beneficial if private information noise is larger than the product of the standard deviations of the two public information regimes[9].

Q.E.D.

[8]Under symmetry, when (12) is true, the following is also true

$$\frac{k(\alpha_2+\beta)}{\alpha_2\sigma_{\eta_2}} > \frac{k(\alpha_1+\beta)}{\alpha_1\sigma_{\eta_1}}$$

and the proof is complete.

[9]This is similar to the point made by Morris et al (2006), "Thus, for the benchmark case where the precision of public information is no lower than the precision of private information (i.e. where $\alpha \geq \beta$), welfare is higher with the public signal than without."

B Proof of Proposition 2

Similarly to above, for a given action error value, say k, greater public information precision will be beneficial to actions when the following is true:

$$\Pr\left(\left|\mathbb{A}_{e,1}\right| \leq k\right) < \Pr\left(\left|\mathbb{A}_{e,2}\right| \leq k\right). \tag{14}$$

Following the assumption for η, the moments of the distribution of action errors are known:

$$\mathbb{A}_{e,i} \rightarrow \mathbb{N}\left(0, \frac{\alpha_i^2}{\left[\alpha_i + \beta\left(1-r\right)\right]^2}\sigma_{\eta_i}^2\right) \text{ where } i = 1, 2$$

and the standardized equivalent of (14) is as follows:

$$\Pr\left(\left|z_1\right| \leq \frac{k\left[\alpha_1 + \beta\left(1-r\right)\right]}{\alpha_1\sigma_{\eta_1}}\right) < \Pr\left(\left|z_2\right| \leq \frac{k\left[\alpha_2 + \beta\left(1-r\right)\right]}{\alpha_2\sigma_{\eta_2}}\right)$$

where z_i is the standardized normal transform of $\mathbb{A}_{e,i}$. For better public information to be beneficial to action errors, it suffices to show under which conditions the following is true[10]:

$$\begin{gathered}\frac{-k\left[\alpha_2 + \beta\left(1-r\right)\right]}{\alpha_2\sigma_{\eta_2}} < \frac{-k\left[\alpha_1 + \beta\left(1-r\right)\right]}{\alpha_1\sigma_{\eta_1}} \Leftrightarrow \\ \frac{T_2^{\mathbb{A}}}{T_1^{\mathbb{A}}} < \frac{\sigma_{\eta_1}}{\sigma_{\eta_2}}.\end{gathered} \tag{15}$$

Alternatively, we can show this in terms of the actual variances:

$$\frac{\alpha_i}{\alpha_i + \beta\left(1-r\right)} = \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \sigma_{\eta_i}^2\left(1-r\right)}$$

and therefore:

[10] Again, under symmetry, the following is also true

$$\frac{k\left[\alpha_2 + \beta\left(1-r\right)\right]}{\alpha_2\sigma_{\eta_2}} > \frac{k\left[\alpha_1 + \beta\left(1-r\right)\right]}{\alpha_1\sigma_{\eta_1}}$$

and the proof is complete.

$$\frac{\frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2+\sigma_{\eta_2}^2(1-r)}}{\frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2+\sigma_{\eta_1}^2(1-r)}} < \frac{\sigma_{\eta_1}}{\sigma_{\eta_2}} \Rightarrow$$

$$\sigma_\varepsilon^2 > \sigma_{\eta_2}\sigma_{\eta_1}(1-r)\,. \tag{16}$$

Q.E.D

A Proof of Corollary

We show that$\frac{T_2^A}{T_1^A} < \frac{T_2^P}{T_1^P}$ and therefore (15) is easier to satisfy than (13):

$$\frac{T_2^{\mathbb{A}}}{T_1^{\mathbb{A}}} < \frac{T_2^{\mathbb{P}}}{T_1^{\mathbb{P}}} \Leftrightarrow$$

$$\frac{\frac{\alpha_2}{\alpha_2+\beta(1-r)}}{\frac{\alpha_1}{\alpha_1+\beta(1-r)}} < \frac{\frac{\alpha_2}{\alpha_2+\beta}}{\frac{\alpha_1}{\alpha_1+\beta}} \Rightarrow$$

$$\alpha_1-\alpha_2 < (\alpha_1-\alpha_2)(1-r)$$

since $\alpha_1-\alpha_2<0$. Alternatively, we can show this in terms of variances. Since,

$$\sigma_{\eta_2}\sigma_{\eta_1} \geq \sigma_{\eta_2}\sigma_{\eta_1}(1-r) \tag{17}$$

condition (16) is easier to satisfy than (13) for a given value of private information error[11] σ_ε^2.

[11] Condition (16) is always true for $r=1$.

References

[1] Amador, M. and P-O. Weil, 2008. Learning from Prices: Public Communication and Welfare, manuscript, Stanford University.

[2] Amato, J.D. S. Morris and H.S. Shin, 2003. Communication and Monetary Policy, Oxford Review of Economic Policy, 18(4), 495-503.

[3] Angeletos, G-M and A. Pavan, 2007. Efficient Use of Information and Social Value of Information, Econometrica, 75:4, July.

[4] Bacharach, M., Gold, N. and R. Sugden, 2006. Beyond Individual Choice: Teams and Frames in Game Theory, Princeton University Press.

[5] Canzoneri, M. 1985. Monetary Policy Games and the Role of Private Information, American Economic Review 75 (5): 1056-70.

[6] Casajus, A., 2000. Focal Points in Framed Strategic Forms, Games and Economic Behavior, 32, 263-291.

[7] Demertzis, M. and M. Hoeberichts, 2007. The Costs of Increasing Transparency, Open Economies Review, 18, 263-80.

[8] Demertzis, M. and N. Viegi, 2008. Inflation Targets as Focal Points, International Journal of Central Banking, Vol. 4, No. 1, March.

[9] Hellwig, C., 2004. The Social Cost of Heterogeneous Information, UCLA, Mimeo, June.

[10] Morris, S. and H. S. Shin, 2002. Social Value of Public Information, The American Economic Review, Vol. 92, No. 5, December, 1521-1534.

[11] Morris, S., H.S. Shin and H. Tong, 2006. Reply to "Social Value of Public Information: Morris and Shin (2002) is Actually Pro Transparency Not Con" American Economic Review, 96(1), 453-455.

[12] Svensson, L., 2006. Social Value of Public Information: Morris and Shin (2002) Is Actually Pro Transparency, Not Con, American Economic Review 96, 448-451.

[13] Vives, X., 1993. How Fast do Rational Agents Learn?, Review of Economic Studies, 60, 329-347.

[14] Wilson, R.K. and C.M. Rhodes, 1997. Leadership and Credibility in N-Person Coordination Games, Journal of Conflict Resolution, Vol. 41, 6, December, 767-791.

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