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Macroeconomic Stabilization and Asymmetrical Information in a Heterogeneous Monetary Union

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Abstract

The subsidiarity principle governing the collection of statistical data in the EMU may cause asymmetrical information. The national governments may be tempted to distort their economic and financial data communicated to ECB in order to influence its monetary policy decisions. We base our analysis on a static Keynesian model in a closed monetary Union and we prove that the governments' incentives to modify their private information depend mainly on the nature of the asymmetrical information between the Union's policy-makers, on the degree of monetary activism and on the extent of structural heterogeneity between the Union's members.

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1. Introduction

Since the creation of the Euro zone, the question of the policy-mix has been discussed according to two main issues. The first one is an issue of credibility concerning the combination of the economic policies and involves possible discrepancies relative to macroeconomic objectives between the national governments and the single Central Bank[1]. The second issue is concerned with the macroeconomic stabilization against the different types of shocks that can affect the economies of the member countries in a specific institutional context, which is that of the independence of the ECB and of the fiscal constraints imposed on the governments by the Stability and Growth Pact[2].

These two major issues trigger another problematic aspect specific to the EMU, which is the asymmetrical information that may appear between the policy-makers and thus influence the organization of the policy-mix. A type of asymmetrical information specific to the EMU relies on the fact that the governments can have private information about their economic shocks which they may choose either to hide or to transmit in a deformed manner to the other governments and to the Central Bank in order to enhance their individual welfare. This asymmetrical information can be accounted for by two major aspects of the current organization of the EMU. Firstly, the governments have a certain influence on the national statistical information. Indeed, despite the measures of control and harmonisation, the statistical data are essentially collected by the national institutes[3]. Secondly, when deciding on the single monetary policy, the ECB takes into account the aggregate values of macroeconomic variables at the level of the entire Euro zone, which can even more encourage the countries to distort their information to the ECB so that its policy could be oriented according to their specific objectives. For instance, by overestimating the extent of its demand shock, a country can allow to avoid the compensation of shocks' effects at the aggregate level of the Union. This is indeed the only means for a country to generate a stabilization effort from the Central Bank in order to stabilize its national variables[4].

So far, very few studies have discussed the European policy-mix in a case of asymmetrical information. Their main conclusion points out the lack of effectiveness of a decentralized system collecting economic and financial information on account of the Union countries being inclined to modify their information in order to influence the ECB's decisions. This lack of effectiveness is however linked with heterogeneities existing within the EMU either at the level of the policy-makers objectives (Crettez (1998)) or at the level of economic shocks (Bottazzi and Manasse (2005), Duchassaing and Koessler (2004)). Inexact information provided by the governments may generate an inflation and public deficit bias as well as an excessively restrictive monetary policy and recession bias (Bottazzi and Manasse (1998, 2005)).

Based on the literature on the subject, this paper aims at further exploring the issue by analysing the impact of asymmetrical information on the effectiveness of the economic policies within a heterogeneous monetary Union. As the country members have private information on their specific shocks, we want to point out the governments' interest in

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[1] See Dixit and Lambertini (2001), Beetsma and Bovenberg (1998, 1999), Beetsma and Uhlig (1999), Chari and Kehoe (1998), Dornbusch (1997), Villieu (2003).

[2] See Uhlig (2002), Mundschenk and Von Hagen (2003), Beetsma et al. (2001), Engwerda et al. (2002).

[3] This issue is currently put forward by the accusations against Greece which has been suspected of having falsified its statistics relative to its public deficit and its public debt for 2009. In fact, in the last few years, in addition to the Greek case, the European Commission has also questioned the quality of Italy's and Portugal's economic and financial statistics. Because of such irregularities, in February 2010 the Commission proposed a reform of the system controlling the reliability of the economic statistics provided by the European countries.

[4] In a monetary Union, the single monetary policy doesn't take into account the national asymmetric shocks since their effects are compensated at the aggregate level.

changing this private information that will then be provided to the Central Bank. Several questions will thus be addressed: which are the mechanisms accounting for the governments changing their statistical data? Is this behaviour systematic? Does the Central Bank have the means to discipline the governments and prevent them from providing modified data[5]? In other words, we analyse the reliability of the subsidiarity principle, currently used in the EMU, in collecting statistical data.

The second section of the paper presents the model and the third section analyses the incentives of the governments to distort the information transmitted to the Central Bank. A distinction will be made between the existence or not of a type of informational cooperation game between the countries of the Union.

2. The model

We use a static Keynesian model within a closed monetary Union with two countries (i, j). The macroeconomic equilibria are described by demand and supply functions and we consider that the heterogeneity of the Union concerns both the mechanisms of monetary policy transmission and the economic shocks affecting the Union members (Oros (2008)). All the variables (except the interest rate) are expressed in logarithms. Thus the demand function is represented by a standard IS function, often used in the literature:

$$y_i = ag_i + bg_j - \delta_i r + \varepsilon_i \qquad \text{where} \quad 0 < a < 1 \;\; ; \;\; |b| < 1 \; ; \;\; \delta > 0 \tag{1}$$

y_i and g_i stand for the output (as deviation from the natural output) and the budget deficit respectively of the country i; g_j represents the budget deficit of the country j; r represents the short-term interest rate; ε_i the demand shock specific to the country i with zero mean and finite variance $\sigma^2_{\varepsilon_i^d}$. The demand shocks ($\varepsilon_i$, ε_j) are independent random variables whose density functions are expressed by normal distributions with zero mean.

The national demand of the country i depends positively on its national budget deficit according to a sensitivity bellow the unit ($a < 1$) because of the crowding out effect, and depends negatively on the interest rate according to sensitivity δ. At the same time, the national output of the country i is influenced by the budget deficit of the other Union member in a proportion b. The sign of the parameter b can be positive or negative according to whether it is the output channel or the common interest rate channel respectively that play the major part in the transmission of the fiscal spillovers. Finally, the national output is influenced by a specific demand shock.

Since the heterogeneity of the Union concerns the mechanisms of monetary policy transmission, the parameter δ is specific to each country. If we represent the degree of heterogeneity between countries by a coefficient h ($0 < h < 1$), then $\delta_i = (1+h)\delta$ and $\delta_j = (1-h)\delta$, where δ stands for the average impact of the monetary policy on the economic activity of the countries i and j. Therefore, if $h = 0$, the countries will be perfectly homogeneous in terms of monetary policy transmission mechanisms ($\delta_i = \delta_j$), whereas, if $h = 1$, the heterogeneity between the two countries attains its maximum degree,

[5] The simplest way for the Central Bank to be sure of the reliability of the statistical data would be to directly take part in their collection. Nevertheless, the current institutional framework of the Euro zone doesn't allow for this possibility. As a matter of fact, it is very unlikely that the situation changes in the immediate future. Indeed, a centralized collection of the statistical data could be seen by the countries as a loss of their independence and as a sign of lack of confidence in their capacity of collecting and communicating reliable data. These effects can affect the EMU's cohesion.

as the monetary policy influences exclusively and with a maximum impact the national demand of the country i ($\delta_i = 2\delta$ et $\delta_j = 0$).

Regarding the supply equation, we use a Lucas function. We consider that the expected inflation is zero as we are only investigating the issue of the macroeconomic stabilization and therefore leave aside any questions of credibility.

$$\pi_i = \mu\, y_i \qquad \text{where} \quad \mu > 0 \tag{2}$$

π_i represents the inflation of the country i. For any variable x, we define the aggregate component, $x = (x_i + x_j)/2$ and the difference component, $\bar{x} = (x_i - x_j)/2$. Regarding shocks, we consider ε and $\bar{\varepsilon}$ which stand for symmetric and asymmetric shocks respectively.

Having described the macroeconomic equilibria, we will now analyse the behaviour of the policy-makers. The Central bank decides on the single monetary policy independently, using its interest rate as a policy instrument in order to minimize its loss function (L^M). The Central Bank is mainly interested in price stabilization at the aggregate level of the Union (with a weight β_0), but also in the interest rate smoothing (with a weight β_2).[6]

$$L^M = \frac{1}{2}\left[\beta_0 \pi^2 + \beta_2 r^2\right] \qquad \text{where} \qquad \beta_0\ , \beta_2 > 0 \tag{3}$$

The governments are in charge of the implementation of the fiscal policies using the budget deficit as a policy instrument. Their aim is to minimize a loss function (L_i^G) which depends on the evolution of national output and budget deficit (the relative weight of these objectives is α_1 et de α_2 respectively).

$$L_i^G = \frac{1}{2}\left[\alpha_1 y_i^2 + \alpha_2 g_i^2\right] \qquad \text{where} \qquad \alpha_1\ ,\ \alpha_2 > 0 \tag{4}$$

We will first present the values of the policy instruments in a complete information game; we will then use these values to identify the macroeconomic equilibrium in a case of asymmetrical information. The players observe the shocks affecting the member countries before the beginning of the simultaneous and non cooperative game (Nash equilibrium). The equilibrium values of the public deficit and the interest rate become[7] :

$$\begin{aligned} g &= -\frac{a\alpha_1(1-z)}{D}\varepsilon \\ \bar{g} &= \frac{a\alpha_1\alpha_2 zh}{DC}\varepsilon - \frac{a\alpha_1}{C}\bar{\varepsilon} \\ r &= \frac{z\alpha_2}{\delta D}\varepsilon \quad \text{where} \quad z = \frac{\beta_0\mu^2}{\beta_0\mu^2 + \frac{\beta_2}{\delta^2}}\ ,\ D = \alpha_2 + a\alpha_1(a+b)(1-z)\ ,\ C = \alpha_2 + a\alpha_1(a-b) \end{aligned} \tag{5}$$

The equations (5) show that for a specific demand shock, the stabilization efforts made by the governments affected by this shock and by the Central bank converge. For instance, in the case of a negative demand shock affecting the country i, its government and the Central Bank will adopt an expansionary policy; the public deficit will rise while the interest rate will go down in order to encourage the demand and to boost the activity.[8]

[6] The target values of the macroeconomic variables in the policy-makers' loss functions are normalized to zero.

[7] The complete equations are available upon request.

[8] In the case of symmetric shocks, the convergence of stabilization efforts concerns all the public authorities (the governments and the Central Bank). Moreover, when $z = 1$, the Central Bank is not constrained in using its policy instrument and it manages to perfectly absorb the impact of the symmetric shocks.

Moreover, it can be noticed that the Central Bank's reaction is determined by the average demand shock of the Union. Consequently, if the demand shocks are asymmetric, each government may be inclined to overestimate their shocks so that the Central Bank should adapt its monetary policy in favour of each government's specific objective.

3. Governments' strategic communication of private information

We examine the case of an incomplete information game which means that there is an information gap between the players. The asymmetrical information hypothesis corresponds to the current institutional context of the EMU where the governments are in possession of private information about their own economic shocks. The game configuration will therefore be a Bayesian game in which each player knows the density function of the shocks. The governments' and the Central Bank's decisions are taken simultaneously and non-cooperatively.

In order to better take into consideration the institutional framework of the Euro zone, we consider that each government accepts ex-ante to inform the Central Bank about the exact nature and extent of their national shocks. Formally, this commitment of the government i writes : $\theta_i = \varepsilon_i$ where θ_i represents the message transmitted by the government i to ECB when the shock ε_i occurs. After this stage, the simultaneous game will be put into place and each player's optimal decisions will be identified.

We will point out the governments' incentive to fail to their commitments and to transmit a distorted message ($\underline{\theta}_i$ where $\underline{\theta}_i \neq \varepsilon_i$) to the Central Bank. We will distinguish between two cases: on the one hand the countries have access to their partners' private information, on the other hand the countries are aware merely of their own shocks.

3.1. Informational cooperation between governments

We consider that contrary to the Central Bank, the governments have exact information about the specific shocks affecting the Union's country members. This configuration can be associated to a form of informational cooperation between governments which authorize each other access to their private information. A new game equilibrium is achieved if we consider the hypothesis put forward so far and the fact that the country i tries to deviate unilaterally from its commitment. Therefore, the Central Bank determines its interest rate according to the information about the economic shocks provided by the two governments ($\underline{\theta}_i$ and ε_j).

The equilibrium values of macroeconomic variables (see equations A1 in Appendix) will be introduced in the government i' s loss function (L_i^G). If we minimize this loss function relative to $\underline{\theta}_i$, we obtain the optimum message provided by the country i:

$$\underline{\theta}_i = \varepsilon_i + \frac{1-z}{z}(\varepsilon_i + \varepsilon_j) + \frac{h\left[a\alpha_1(a+b)z - (\alpha_2 + a\alpha_1(a+b))\right]}{z\left[C + h(\alpha_2 + a\alpha_1(a+b))\right]}\left[\varepsilon_i + \varepsilon_j\right] + \frac{D}{z\left[C + h(\alpha_2 + a\alpha_1(a+b))\right]}\left[\varepsilon_i - \varepsilon_j\right] \quad (6)$$

According to the same principle, we obtain the optimum message provided to the Central Bank by the country j:

$$\underline{\theta}_j = \varepsilon_j + \frac{1-z}{z}(\varepsilon_j + \varepsilon_i) - \frac{h\left[a\alpha_1(a+b)z - (\alpha_2 + a\alpha_1(a+b))\right]}{z\left[C - h(\alpha_2 + a\alpha_1(a+b))\right]}\left[\varepsilon_j + \varepsilon_i\right] + \frac{D}{z\left[C - h(\alpha_2 + a\alpha_1(a+b))\right]}\left[\varepsilon_j - \varepsilon_i\right] \quad (7)$$

Given the governments' optimum messages we may conclude that they will be systematically tempted to bias these messages whatever the parameters of the model and whatever the nature (symmetrical or asymmetrical) or the extent of the shocks affecting the Union's countries.

At the same time, we can notice that the governments' temptation to bias their messages to the Central Bank consists of three elements that we will analyse in order to further detail the description of the fiscal authorities' behaviour.

The first element accounting for a country's modifying its message ($\frac{1-z}{z}=\frac{\beta_2/\delta^2}{\beta_0\mu^2}$) concerns the symmetric shocks and is identical for the two countries. We can notice that the governments will be all the more tempted to lie as the Central Bank will be more interested in the interest rate smoothing (β_2 rises) to the detriment of stabilizing inflation (β_0 goes down). In other words, given that the governments and the Central Bank's stabilization efforts converge in stabilizing the symmetric shocks, if the Central Bank's activism diminishes, the governments will be tempted to compensate for the Central Bank's loss of interest in stabilization and will therefore overestimate the extent of their shocks.

The second element accounting for the governments' information manipulation is still concerned with symmetric shocks but it functions differently for the two countries ($\pm\frac{h[a\alpha_1(a+b)z-(\alpha_2+a\alpha_1(a+b))]}{z[C\pm h\,(\alpha_2+a\alpha_1(a+b))]}$) as it is based on the Union's structural heterogeneity (h). If the degree of heterogeneity (h) between the countries rises, the country i (j)[9] will be less (more) inclined to deform its message provided to the Central Bank. This attitude can be accounted for by the same situation as in the first case: as the stabilization efforts made by the Central Bank and the countries directly affected by the demand shocks converge, the governments will bias their information to make up for a potential loss of effectiveness in the monetary policy stabilization' s effects. Indeed, if the heterogeneity of the Union increases (h rises) then the single monetary policy will have a high (low) influence on the country i (j) and the Central bank's stabilization efforts will be more efficiently transmitted to the country i to the detriment of the country j. Therefore, the two countries communication strategies will be oriented differently as long as h is rising: the country i will be less and less interested in manipulating its message to the Central Bank since the latter takes in charge a growing part of its stabilization needs. On the contrary, the country j will try to make up for the lower stabilization effects of the single monetary policy by gradually overestimating its shock.

The third element playing a part in the governments' distorting their messages to the Central Bank ($\frac{D}{z[C\pm h(\alpha_2+a\alpha_1(a+b))]}$) is explained by the existence of asymmetric shocks in the Union. With the shocks asymmetries between the two countries growing bigger, each government will be more tempted to overestimate their specific shocks so that the ECB be more sensitive to their macroeconomic environment over their neighbours'. There is however an exception from this general rule in the case of country j when a high degree of structural heterogeneity (high h) is associated with positive fiscal spillovers ($b>0$)[10]. Indeed, when the shocks are asymmetric, the ECB may well favour the country j's objective to the detriment of the country i, if the country j distorts its information. In order to make up for

[9] A sufficient condition to guarantee these mechanisms is $a>|b|$. It is a rather restrictive condition, implying that the fiscal spillovers can't be superior, in absolute value, to the sensitivity of the demand to the national public deficit.

[10] Formally, this exception occurs when $C-h(\alpha_2+a\alpha_1(a+b))<0$ which is satisfied if h is high and $b>0$.

the counter-productive effects of the single monetary policy, the country i has to have a fiscal policy all the more reactive since h is high (the monetary policy affects more effectively the country i). Therefore, when b is positive, the country j suffers from the destabilization effects of the reactive fiscal policy conducted by its neighbour. These effects may cancel the monetary policy's stabilizing effects (whose transmission effectiveness is slowed down if h is high), which explains why the country j is less inclined to modifying its message to the Central Bank. This mechanism doesn't occur if the fiscal spillovers are negative ($b < 0$) no matter how high the Union's structural heterogeneities are. In this case, the neighbour's fiscal policy has a stabilizing effect on the country j, which will be thus more inclined to bias its message.

3. 2. Asymmetrical information between governments

We consider that the governments are aware only of their shocks and do not have any information about their partners' shock. In this game configuration, the equilibrium occurs under the same principles as previously, knowing that to fix their optimum fiscal policies the governments minimize their expected loss functions ($\left[\partial E(L_i^G)/\partial g_i\right] = 0$ and $\left[\partial E(L_j^G)/\partial g_j\right] = 0$).

If we introduce the equilibrium values of the output and the public deficit (see equations A2 in the Appendix) in the governments' loss functions (L_i^G and L_j^G), the optimum messages for the countries i and j respectively write:

$$\underline{\theta}_i = \frac{1}{z(1+h)}\varepsilon_i \text{ and } \underline{\theta}_j = \frac{1}{z(1-h)}\varepsilon_j \qquad (8)$$

These optimum government messages reveal the same mechanisms of strategic communication as in the previous case: the country i (j) is more (less) inclined to inform the Central Bank about the real nature of its own shock as the structural heterogeneity inside the Union is reinforced (h goes up).

The most important element put forward by the analysis of the expression (8) is that, contrary to the previous case, the two governments are no longer systematically tempted to distort their private information. We can notice that the revealing equilibrium (when the two governments announce their true shocks to the Central Bank) occurs if the Central Bank is not constrained in using its interest rate ($z = 1$) and if the Union is structurally homogeneous ($h = 0$). Indeed, for a maximum level of monetary activism, the governments no longer have a reason to overestimate their specific shocks if they do not know their neighbours' situation and have all the same benefits from the Central Bank's stabilization efforts. This stabilization mechanism didn't appear in the previous case (the governments were aware of their neighbours' shocks) since, even if $z = 1$ and $h = 0$, the governments were equally tempted to lie if the shocks affecting the Union members were asymmetric. In this case, the governments know that the Central Bank has to divide its stabilization efforts between the two asymmetric shocks and, as a result, they overestimate their own shocks in order to be able to benefit best from the Central Bank's stabilization action.

This result has a main drawback which is the relatively restrictive hypothesis on which it is based: $z = 1$ and $h = 0$. Nevertheless, even if the two hypothesis are less strict, there is still a revealing equilibrium within the Union, which underlines the specificity of this informational game configuration compared with the previous one. Thus, when the Central Bank is constrained in the use of its interest rate ($z < 1$), it is possible to identify a revealing equilibrium for the country i if there are structural heterogeneities within the Union

($h \neq 0$)[11]. Indeed, the country i can be disciplined by the existence of structural heterogeneities because it benefits from a more efficient transmission of the monetary policy effects allowing it to compensate from the Central Bank's lower reactivity in stabilizing the macroeconomic variables ($z < 1$). On the contrary, for the country j, the revealing equilibrium cannot be reached if $z \neq 1$ or $h \neq 0$. Indeed, even if the Central Bank is ready to maximize its efforts to stabilize the macroeconomic variables ($z = 1$), the country j will still be tempted to overestimate its shock since it can't take a maximum advantage from the Central Bank's stabilization efforts ($h \neq 0$).

On the whole, we can conclude that the lack of information about the partner's economic environment can discipline the governments and dissuades them to provide distorted messages to the Central Bank. In other words, a centralized system of statistical information with the Central Bank taking an active part in collecting the statistical data is not the only solution to prevent the governments' incentives to manipulate the information.

4. Conclusion

In this paper, we have analysed the impact in terms of macroeconomic stabilization of a form of asymmetrical information between the countries of a heterogeneous monetary Union. Considering the heterogeneity of the Union both with respect to the mechanisms of monetary policy transmission and to the nature of the shocks affecting the Union members, we have assumed that the countries have private information about their specific shocks. We have thus examined if the governments are inclined to take advantage of this information gap in order to influence indirectly the Central Bank in its choice of monetary policy.

We have proved that the governments are always inclined to distort their messages to the Central Bank if they develop a form of cooperation by sharing their information on their specific shocks. This configuration can be seen as a coalition between the governments that are interested in lying to the Central Bank in order to improve their national welfare whatever the nature and the extent of the economic shocks and whatever the degree of the Union's structural heterogeneity. Therefore, as long as the Union members have this informational advantage over the Central Bank, the latter has no means to persuade the governments to provide it with the real information about their specific shocks.

On the contrary, the Central Bank will be able to discipline the governments which won't be interested in giving distorted information if there is a perfect informational asymmetry within the Union, that is the countries have no longer access to their partners' private information. With the Central Bank's commitment to perfectly stabilize the Union's symmetric shocks and with the mechanisms of monetary policy transmission being homogeneous between the countries, the governments will lose the incentive to distort the national statistical data. Moreover, according to our results, even if the countries are structurally heterogeneous and the Central Bank is constrained in the use of its monetary policy instrument, the asymmetrical information between governments represents a second best solution as it disciplines the behaviour of one country member which is the country most affected by the single monetary policy effects.

Concerning the institutional framework of the EMU, this mechanism, which allows to achieve a revealing equilibrium, is compatible with the current principle of subsidiarity in collecting statistical data, a principle which is unlikely to be banned at least not in the near future.

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[11] The revealing equilibrium occurs if $h = \frac{1-z}{z}$.

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Appendix

In the case of informational cooperation between governments, the aggregate and difference component of public deficit and output write:

$$\text{(A1)}\quad \begin{cases} g = -\dfrac{a\alpha_1}{D}\left[\varepsilon_i - z\underline{\theta}_i + (1-z)\varepsilon_j\right] \\ \bar{g} = \dfrac{a\alpha_1}{DC}\left[-\left(D + a\alpha_1(a+b)zh\right)\varepsilon_i + zh\left(\alpha_2 + a\alpha_1(a+b)\right)\underline{\theta}_i + \left(D + \alpha_2 zh\right)\varepsilon_j\right] \\ y = \dfrac{\alpha_2}{D}\left[\varepsilon_i - z\underline{\theta}_i + (1-z)\varepsilon_j\right] \\ \bar{y} = \dfrac{\alpha_2}{DC}\left[\left(D + a\alpha_1(a+b)zh\right)\varepsilon_i - zh\left(\alpha_2 + a\alpha_1(a+b)\right)\underline{\theta}_i - \left(D + \alpha_2 zh\right)\varepsilon_j\right] \end{cases}$$

In the case of asymmetrical information between governments, the equilibrium values of national output and public deficit write:

$$\text{(A2)}\quad \begin{cases} y_i = \dfrac{-\alpha_2 \mathrm{A}\left[z(1+h)\underline{\theta}_i - \varepsilon_i\right]}{\mathrm{AB} - \left(a\alpha_1\right)^2\left(b - z(a+b)(1-h)\right)\left(b - z(a+b)(1+h)\right)} \\ g_i = \dfrac{aA\alpha_1\left[z(1+h)\underline{\theta}_i - \varepsilon_i\right]}{\mathrm{AB} - \left(a\alpha_1\right)^2\left(b - z(a+b)(1-h)\right)\left(b - z(a+b)(1+h)\right)} \\ y_j = \dfrac{-\alpha_2 B\left[z(1-h)\underline{\theta}_j - \varepsilon_j\right]}{\mathrm{AB} - \left(a\alpha_1\right)^2\left(b - z(a+b)(1-h)\right)\left(b - z(a+b)(1+h)\right)} \\ g_j = \dfrac{aB\alpha_1\left[z(1+h)\underline{\theta}_j - \varepsilon_j\right]}{\mathrm{AB} - \left(a\alpha_1\right)^2\left(b - z(a+b)(1-h)\right)\left(b - z(a+b)(1+h)\right)} \end{cases}$$

where $\mathrm{A} = \alpha_2 + a\alpha_1\left[a - z(a+b)(1-h)\right]$, $\mathrm{B} = \alpha_2 + a\alpha_1\left[a - z(a+b)(1+h)\right]$