Advances in Business-Related Scientific Research Journal (ABSRJ)
Volume 6 (2015), Number 2

ISSN 1855-931X

BURDEN SHARING AND OPTIMAL STATE AID SCHEMES

Marc Jegers*

Vrije Universiteit Brussel, Department of Applied Economics, Pleinlaan 2, BE-1050 Brussel

Belgium

marc.jegers@vub.ac.be

Caroline Buts

Vrije Universiteit Brussel, Department of Applied Economics, Pleinlaan 2, BE-1050 Brussel

Belgium

caroline.buts@vub.ac.be

Abstract

The European Commission attaches great importance to a shared investment burden when it comes to projects supported by state aid. The presence of own funds, whether they are coming from the beneficiary company itself or from other investors, signals that the beneficiary believes that the project is sound and can also contribute to limiting the possible distortion of competition. More specifically, substantial levels of equity ensure that the aid is kept to a minimum, a key principle when evaluating aid measures. This paper builds a model of optimal state aid schemes, taking into account this very important principle of burden sharing. Our model distinguishes between three sorts of state aid, two kinds of politicians and three types of entrepreneurs. The presence of equity increases the attractiveness of government guarantees in cases of failing entrepreneurs for both kinds of politicians: the ones aiming to maximize the externalities of the projects subsidized, as well as the ones acting with overall welfare in mind.

Keywords: State aid, burden sharing, competition policy

Topic Groups: Industrial Organization, microeconomics

JEL Classification: L50, L00, H70

1. INTRODUCTION

Over the past decade, the topic of state aid has gained considerable importance in the literature as well as on the policy agenda. Especially during the recent financial crisis, state

aid policy has played a vital role in saving banks and guiding them through the restructuring process. Even when excluding crisis measures, large amounts of resources are still spent when granting aid to firms. In 2011, about 0.5%[1] of aggregated GDP was spent on state aid by EU Member States (excluding crisis measures.). In addition, both theoretical and empirical economic literature on state aid covering such diverse topics as welfare effects, efficiency studies, electoral motives and consequences on competition, has increased substantially.

In the case of an integrated market, prohibiting state aid can increase welfare as is derived by Collie (2002), studying differentiated products in oligopoly. Martin and Valbonesi (2008) study state aid in an integrating market such as the EU. When achieving efficiency benefits from integration and market expansion, typically, some firms in an industry will go out of business. Consequently, it can be beneficial for a government to aid local firms. Martin and Valbonesi conclude that although it is welfare reducing (as it takes away part of the benefits of the integration process,) providing state aid is an equilibrium outcome. Despite a common understanding and an agreement to forbid state aid, except in particular circumstances within the EU, many governments still grant aid for diverse reasons. Friederiszick et al. (2006) put forward an economic framework to assess these state aid measures. This framework should contribute to reduced and better targeted state aid, less politics and more predictability. More and more, the Commission uses economic analysis to evaluate the impact of state aid measures. A very important part of such an analysis is the balancing test, weighing the benefits of an aid against possible costs, such as the distortion of competition. However, there is a difference between what the Commission considers minimally distortive for competition and what economists model as welfare maximizing. On the one hand, the Commission has a strong preference for fixed cost aid or start-up aid as opposed to aid affecting a firm's variable costs, because fixed cost aid is less distortive for competition. For example, the regional aid guidelines[2] explicitly require that aid is awarded for initial investment projects. On the other hand, variable cost aid should be preferred when maximizing welfare as discussed by Chor (2009) and Mariniello (2012). As the Commission focuses on the distortion of competition, Garcia and Neven (2005) establish a benchmark model of the effect of three types of state aid. They distinguish between aid affecting marginal cost, entry, and quality and study their effects on competition in markets with different characteristics.

Hainz and Hakenes (2012; HH hereafter) build a model on how to best grant state aid, taking into account three groups of actors, i.e. three types of entrepreneurs, credit specialists and two kinds of politicians. They study direct subsidies as well as indirect subsidies and find that subsidies through banks often bring higher social welfare than direct subsidies.

To the best of our knowledge, there does not exist a theoretical study modeling optimal state aid schemes that explicitly incorporates the principle of burden sharing. However, when assessing state aid, burden sharing is a frequently used concept, to which the European Commission attaches great importance. Basically, the Commission expects the beneficiary to make a considerable contribution of its own funds to a project. For example, the aid beneficiary in a restructuring case should contribute substantially to the restructuring and this input should be "real and free of aid" (European Commission, 2004, p. 1). This should prove that one still believes in the possibility of restructuring. In addition, it will ensure that the aid is kept to a minimum. Also, in light of assistance to the Spanish banking sector, the

[1] European Commission, 2012 (b).
[2] European Commission, 2006 (b).

importance of minimizing the cost for taxpayers was emphasized[3]. Bomhoff et al. (2009) explain that burden sharing when restructuring banks can be achieved, for example, by putting temporary restrictions on coupon and dividend disbursement.

Several other Commission documents such as the Community Framework for State Aid for Research and Development and Innovation[4], the Guidelines on National Regional Aid for 2007-2013[5], and the General Block Exemption Regulation[6] all fix maximum aid intensities. These represent the maximum percentage of eligible costs of a project to be covered by the aid and thus also imply the need of a contribution (be it in own resources or by market creditors).

This paper aims to contribute to the theoretical literature and builds on the model of how to efficiently grant state aid which was developed by HH, by explicitly taking burden sharing into account. We thus study the influence of the presence of equity on the optimal state aid scheme. The structure of the paper is as follows: The next and main part starts with our base model. We distinguish between three types of entrepreneurs, two types of politicians, and three methods of granting state aid. It continues by describing the effect of an aid on this base model, resulting in three propositions related to the three state aid methods. The paper carries on by investigating optimal aid schemes which leads to two additional propositions. Next, we assess whether overall predictions on optimal aid schemes, valid for both categories of politicians, can be made, as in HH (p. 223) in the case of an absence of equity. The last part concludes and looks at some possibilities for future research.

2. THE MODEL

2.1. The model: assumptions and definitions

Our model takes the one proposed by HH as a starting point and adds realism to it by explicitly considering the availability of own funds (equity) to entrepreneurs applying for (subsidized) loans. Hence, we focus on the impact of (the amount of) burden sharing by the entrepreneurs on the choice of an optimal state aid scheme. Whenever we depart from the HH model, this will be stated explicitly.

The economy consists of risk neutral non-discounting entrepreneurs (the number of which is normalized to one) perfectly competitive banks which are also credit specialists, and a politician. A typical project requires an investment of I and results, if successful, in a private outcome Y>0 for the entrepreneur, and a positive social externality X>0. If not successful, both outcomes are zero. Entrepreneurs differ in their abilities to be successful. There are three groups (called 1, 2, and 3) with respective probabilities $p_1>p_2>p_3$ for success and shares m_1, m_2, and m_3 in the total population of entrepreneurs. The first group of entrepreneurs are able to make the investment privately profitable, the second group not, but their abilities would be sufficient to make their investments socially profitable (adding Y and X,) whereas investments made by the third group would not be successful in any sense. The entrepreneur invests an amount E (< I) of its own funds, hence applying for a loan of (I-E), which obviously is smaller than I. The banks are assumed to have the necessary credit expertise to screen the entrepreneurs. This costs c per application. Entrepreneurs do not

[3] European Commission, 2012 (a).
[4] European Commission, 2006 (a).
[5] European Commission, 2006 (b).
[6] European Commission, 2008.

know themselves to which group they belong as they all believe in their competences to develop profitable businesses. The banks correctly assign loan applicants to the correct group, which also follows from the assumption made by HH (p. 220, 224) that they manage to make the noise 'arbitrarily small', mathematically falling to zero.

If the bank accepts the loan applicant, an entrepreneur of group i has to refund R_i if available. As the values of R_i differ across state aid methods, Y can only be interpreted on a 'before financial cost' basis. Profitability however has to be assessed 'after financial costs' ($Y-R_i$). Therefore, avoiding endogeneity issues[7], we assume that the values of p_i, R_i, Y, I, E, and X allow us to characterize the three groups of entrepreneurs as follows:

group 1: $p_1(Y-R_1) \geq E$

group 2: $p_2(Y-R_2) < E \leq p_2(Y-R_2+X)$

group 3: $p_3(Y-R_3+X) < E$

If, e.g., the condition for group 1 would not be met, the group 1 projects would not be privately profitable. Note that if $Y < I$, no 'group 1' investments will be made (as, inevitably, $R_1 \geq (I-E)$). Therefore, Y should exceed I. As for group 2, we will also confine ourselves to situations in which group 2 entrepreneurs do not have enough of their own funds to be able to borrow the remainder needed without any subsidy, even at a zero interest rate: $p_2Y<(I-E)$.

Two types of politicians are considered: politicians of the first type want to maximize overall social welfare (the sum of private benefits and externalities) and politicians of the second type only maximizing externalities, their utility functions being W and U respectively. HH (p. 222) label the latter type as 'selfish', as they assume that confining oneself only to externalities increases the probability of being re-elected. The first group of politicians is called 'benevolent'. This choice of terminology of the two groups might be unfortunate, as it is not fully justified by the difference in objective functions. However, we will use the same descriptors for consistency.

Three methods of subsidizing are considered and compared as to their welfare effects: a guarantee paid to the bank in case of default ('uninformed subsidy', S^{US}), a subsidy paid to the bank for each application of an entrepreneur of the second group of entrepreneurs after having been rejected by a non-subsidized bank ('subsidized bank', S^{SB})[8], and a direct subsidy to entrepreneurs of the second group ('informed subsidy', S^{IS}). The concomitant fiscal distortions are characterized by the factor d describing the welfare distortion per unit of subsidy granted. Under the assumption of an efficient government, this implies that d exceeds 1 by a very small amount (Neary, 1994; Collie, 2000). Note that in cases in which governments are inefficiently spending tax money, d could be smaller than 1.

[7]We in fact only assume Y to be large enough to allow the condition for group 1 to be met, p_2 to be low enough and X large enough to allow the conditions for group 2 to be met, and p_3 small enough for group 3 projects to exist. If, e.g., $p_1Y \geq E$ but $p_1(Y-R_1) < E$ then the bank's calculus becomes much more elaborate.

[8] The aid provided by the European Bank for Reconstruction and Development or the European Investment Bank, in the aftermath of the fall of the Berlin Wall in 1989 are prominent examples of such a type of aid.

2.2. The effects of aid measures

The following propositions describe the outcomes under the three state aid methods described in the previous section.

Proposition 1. Under an **uninformed subsidy** scheme, repayments to the bank by group 1 and group 2 entrepreneurs, the guarantee paid by the politician if a borrowing firm is unsuccessful, aggregate welfare, and the level of externalities are respectively:

$$R_1^{US} = \frac{(I-E)-(1-p_1)S^{US}}{p_1} + \frac{c}{m_1 p_1}$$

$$R_2^{US} = Y$$

$$S^{US} = \frac{(I-E)-p_2 Y}{1-p_2} \left(< \frac{(I-E)-p_2(I-E)}{1-p_2} = I\text{-}E \right)$$

$$W^{US} = (m_1p_1 + m_2p_2)X + m_1p_1Y - m_1p_1 R_1^{US} - (m_1+m_2)E - d(m_1(1-p_1)+m_2(1-p_2))S^{US}$$

$$U^{US} = (m_1p_1 + m_2p_2)X - d(m_1(1-p_1)+m_2(1-p_2))S^{US}$$

For the proofs of Propositions 1-3, see Appendix A. There it is established that group 3 projects will never be funded by the bank. Therefore we confine ourselves to the implications for projects from groups 1 and 2 for all aid schemes. The expressions for W and U will be used to select optimal subsidy schemes, if any.

Under the uninformed subsidy scheme all entrepreneurs apply for a loan. The bank screens all of them, and grants a loan to all applicants of group 1 and group 2. In the case of default, the subsidy is paid directly to the bank. The uninformed subsidy is set at such a level that funding group 2 projects (socially profitable) is feasible for the bank, because in this group, the expected revenues will be $p_2Y + (1\text{-}p_2)S^{US}$, which equals (I-E). If successful, group 2 entrepreneurs repay their income earned (Y, remember we normalized the interest rate to zero). All screening costs are borne by the group 1 entrepreneurs, through the term c/m_1p_1.

Proposition 2. Under a **subsidized bank** scheme, repayments to the bank by group 1 and group 2 entrepreneurs, the subsidy paid to the bank for each application of a group 2 entrepreneur, aggregate welfare, and the level of externalities are respectively:

$$R_1^{SB} = \frac{(I-E)}{p_1} + \frac{c}{m_1 p_1}$$

$$R_2^{SB} = Y$$

$$S^{SB} = (I - E) - p_2Y + \left(1 + \frac{m_3}{m_2}\right)c$$

$$W^{SB} = (m_1p_1 + m_2p_2)X + m_1p_1Y - m_1p_1 R_1^{SB} - (m_1+m_2)E - dm_2S^{SB}$$

$$U^{SB} = (m_1p_1 + m_2p_2)X - dm_2S^{SB}$$

The sequence of the game proposed by HH (p. 221), and therefore applied by us, starts with all the entrepreneurs applying for a loan with a non-subsidized bank, which selects the group 1 applicants. The other ones then turn to the subsidized bank, which must distinguish group 2 and group 3 entrepreneurs. It receives a subsidy for the loans granted to group 2 applicants. Their repayment when successful is the same as under the uninformed subsidy scheme. Group 1 entrepreneurs again carry the burden of screening, and do not enjoy guarantees, making their repayment higher than in the uninformed subsidy system. The screening cost also affects the subsidy amount, as it has to be set in such a way that the bank does not incur a loss by granting a loan to a group 2. As it receives the subsidy for each loan granted to a group 2 project and also has to screen group 3 applicants, its expected revenues amount to $m_2S^{SB} + m_2p_2Y - (m_2+m_3)c$ which equals $m_2(I-E)$, the amount lent.

Proposition 3. Under an informed subsidy scheme, repayments to the bank by group 1 and group 2 entrepreneurs, the subsidy paid to each entrepreneur of group 2, aggregate welfare, and the level of externalities are respectively:

$$R_1^{IS} = \frac{(I-E)}{p_1} + \frac{m_1+m_3}{m_1}\frac{c}{p_1}$$

$$R_2^{IS} = (I - E) + (1 - p_2)Y$$

$$S^{IS} = (I - E) - p_2Y$$

$$W^{IS} = (m_1p_1 + m_2p_2)X + m_1p_1Y - m_1p_1 R_1^{IS} - (m_1+m_2)E - dm_2S^{IS} - dc$$

$$U^{IS} = (m_1p_1 + m_2p_2)X - d(m_2S^{IS} + c)$$

The sequence of events proposed by HH (p. 222) is as follows: the politician contracts out the assessment of loan applicants, which directly grants a subsidy to group 2 projects. The fact of having obtained the subsidy reveals that they belong to group 2, which implies the bank cannot distinguish group 1 applicants from group 3 applicants without screening. Also here, the subsidy is designed in such a way that the bank does not object to financing group 2 projects. As the subsidy is granted to all group 2 entrepreneurs, they are able with a probability p_2 to pay R_2^{IS}. In the case of failure, they will have to transfer the subsidy they received to the bank (probability $(1-p_2)$). The expected revenues for the bank therefore are

$$p_2(I-E) + p_2(1-p_2)Y + (1-p_2)(I-E) - (1-p_2)p_2Y = I-E$$

The bank also has to distinguish group 1 applicants from group 3 applicants, hence the (m_1+m_3) in R_1^{IS}.

2.3. Optimal state aid methods

In Appendix B, the optimal state aid methods for the benevolent politician and the selfish politician are derived.

For the benevolent politician, the following proposition applies:

Proposition 4. The **benevolent politician** will never apply the subsidized bank method to grant state aid when he has the possibility to apply either the uninformed or informed subsidy method. The optimal choice between the two possibilities can be described as follows:

i. for increasing E, the probability that the uninformed subsidy scheme is optimal increases.
ii. for decreasing m_1 and m_2, and increasing c and p_1, the probability that the uninformed subsidy scheme is optimal increases.
iii. the effects of d and p_2 are indeterminate.

These results differ from the ones obtained by HH as they, in their Proposition 5 (p. 232) find conditions under which the subsidized bank method might be optimal. The basic mechanism underlying the proof in Appendix B is the trade-off between the expected revenues of the entrepreneurs, including possible subsidies they might obtain, and the fiscal distortion entailed by the subsidies granted. When determining the optimal state aid schemes for selfish politicians, the only relevant differences between the aid mechanisms are the fiscal distortions, the expected externalities generated by the projects (through X) being identical for the three mechanisms.

Proposition 5. The **selfish politician** will never apply the informed subsidy method. The choice between the subsidized bank method and the uninformed subsidy method depends on the configuration of the parameters involved:

i. for increasing E, the probability that the uninformed subsidy scheme is optimal increases.
ii. the level of fiscal distortion (d) does not affect the choice between the subsidized bank method and the uninformed subsidy method.
iii. for decreasing m_1, and increasing m_2, m_3, p_1 and c, the probability that the uninformed subsidy scheme is optimal increases.
iv. the effect of p_2 is indeterminate.

In the following section we discuss some empirical implications of Propositions 4 and 5.

2.4. Empirical predictions

The three state aid methods discussed cover in a way three generic types: guarantees (US), subsidies to financial institutions to stimulate them to provide loans to a specific group of firms (SB), and direct subsidies to a specific group of firms (IS) [9]. HH (p. 223) derive from their analysis, in which the entrepreneur's financial input is disregarded, three empirical

[9] For an overview of currently used aid instruments, see the overview in the European Commission's search engine available at: http://ec.europa.eu/competition/elojade/isef/index.cfm?clear=1&policy_area_id=3 (last assessed 21.05.2013).

predictions unaffected by the politicians' characteristics. Taking into consideration the entrepreneur's input, however, makes two of these predictions conditional upon the politicians' characteristics, as can be seen from our Propositions 4 and 5. Further, our analysis reveals a new prediction, irrespective of the politicians' characteristics: higher shares of the entrepreneurs' own funds in investments make guarantees more attractive.

HH's Prediction 1 implies that high values of m_2 tend to make guarantees optimal for both groups of politicians. This is not the case anymore when equity is accounted for in the analysis (our Propositions 4(ii) and 5(iii)): guarantees would only be optimal for selfish politicians.

HH's second prediction states that subsidized loans will be preferred for higher values of m_1 and lower values of m_2. We prove in Proposition 4 that, once the role of equity is acknowledged, subsidized loans are never optimal for benevolent politicians. However, they remain optimal for the selfish politicians (Proposition 5(iii)).

The last prediction formulated by HH is hardly affected by considering the presence of equity: increasing screening costs favors the application of guarantees (Proposition 4(ii) and Proposition 5(iii)).

The upshot is the conclusion that one has to be very cautious when proposing general predictions as to optimal aid schemes: the introduction of one (in our case very realistic) aspect in the analysis drastically reduces the overall validity of a number of predictions derived in earlier work.

3. CONCLUSION

Building on the existing literature on optimal state aid schemes, we model the effect of burden sharing where the beneficiary of an aid contributes its own substantial funds to the project on the optimal state aid scheme. We take the entrepreneur's financial burden into account when assessing the beneficiary's profitability, and we analyze the impact of the level of the beneficiary's own funds on the optimality conditions. One of our inferences is that, from the viewpoint of a politician striving for maximum overall welfare (the 'benevolent' politician,) a system in which banks are directly subsidized for each loan application by financially unprofitable but socially profitable firms is never optimal and therefore not applied. Furthermore, a politician preferring as much externalities as possible (the 'selfish' politician) will not utilize the informed subsidy method. Increasing the equity level makes guarantee mechanisms ('uninformed subsidies') preferable to both kinds of politicians.

Looking at the limited number of studies and the constantly dynamic framework that surrounds state aid policy, many routes are still open to further analyze the best way in which to grant state aid. Further research could look, for example, at the possibility of imperfect screening and / or at the option to endogenize X, dependent on the method of state aid implemented. The former increases complexity by adding realism to the model. The latter builds on the idea that X may vary under different state aid mechanisms, depending on the specific objective of the aid[10]. Contributing to further knowledge on this theme is highly relevant for state aid policy; a policy that is still controlling the efficient spending of a substantial amount of resources and has proven its importance recently in guiding governments on how to deal best with the rescue and restructuring of the financial sector.

[10] e.g. Chang-Yang, 2011, Chor, 2009, Petkov, 2007 and Tassey, 1996.

State aid policy has in this way played a vital role in restoring trust and saneness in the financial sector, an essential part of our economic system.

REFERENCES

Bomhoff, A., Jarosz-Friis, A., & Pesaresi, N. (2009). Restructuring banks in crisis-overview of applicable State aid rules, (European Commission) *Competition Policy Newsletter, 3*, 3-9.

Chang-Yang, L. (2011). The differential effects of public R&D support on firm R&D: Theory and evidence from multi-country data, *Technovation, 31*, 256-269.

Chor, D. (2009). Subsidies for FDI: Implications from a model with heterogeneous firms, *Journal of International Economics, 78*, 113-125.

Collie, D. R. (2000). State aid in the European Union: the prohibition of subsidies in an integrated market, *International Journal of Industrial Organization, 18*, 867-884.

Collie, D. R. (2002). Prohibiting state aid in an integrated market: Cournot and Bertrand oligopolies with differentiated products, *Journal of Industry, Competition and Trade, 2*, 215-231.

European Commission (a), (2006). Community Framework for State Aid for Research and Development and Innovation, *Official Journal of the European Union, C323* of 30.12.2006.

European Commission (a), (2012). State aid: Commission's contribution to Spanish financial assistance programme focusing on banking sector, available online at: http://europa.eu/rapid/press-release_MEMO-12-1013_en.htm (last assessed 26.02.2013).

European Commission (b), (2012). Total state aid by Member State as a percentage of GDP, available online at: http://ec.europa.eu/competition/state_aid/studies_reports /expenditure.html (last assessed 26.02.2013).

European Commission (b), 2006, Guidelines on National Regional Aid for 2007-2013, *Official Journal of the European Union, C54* of 4.3.2006.

European Commission, (2004). Communication from the Commission- Community guidelines on State aid for rescuing and restructuring firms in difficulty, *Official Journal of the European Union, 244* of 1.10.2004.

European Commission, (2008). Commission Regulation (EC) No. 800/2008 declaring certain categories of aid compatible with the common market in application of Articles 87 and 88 of the Treaty (General Block Exemption Regulation), *Official Journal of the European Union, L214* of 9.8.2008.

Friederiszick, H. W., Röller, L. H., & Verouden, V. (2006). European State aid control: an economic framework, in Buccirossi P. (ed.), 2008, *Handbook of antitrust economics,* Cambridge, MIT Press.

Garcia, J. A., & Neven, D. (2005). State aid and the distortion of competition, a benchmark model, HEI Working Paper, No. 06/2005, available online at: http://graduateinstitute.ch/webdav/site/international_economics/shared/international_economics/publications/working%20papers/2005/HEIWP06-2005.pdf (last assessed 27.02.2013).

Hainz, C., & Hakenes, H. (2012). The politician and his banker – how to efficiently grant state aid. *Journal of Public Economics, 96*, 218-225.

Mariniello, M. (2012). Should variable cost aid to attract foreign direct investment be banned? A European perspective, *Journal of Industry, Competition and Trade,* forthcoming.

Martin, S., & Valbonesi, P. (2008). Equilibrium state aid in integrating markets, *The BE Journal of Economic Analysis & Policy,* vol. 8.1.

Neary, J. P. (1994). Cost asymmetries in international subsidy games: should governments help winners or losers?, *Journal of International Economics*, *37*, 197-218.

Petkov, P. (2007). Infant firm subsidization in industries with dynamic structure, *Journal of Industry, Competition and trade, 7*, 73-93.

Tassey, G. (1996). Choosing government R&D policies: tax incentives vs. direct funding, *Review of Industrial Organization, 11*, 579-600.

APPENDIX A

Substituting I by (I-E), the proofs to obtain R_1^*, R_2^* and S^* are identical to the one provided by Hainz and Hakenes (2012, p. 221), including the implication that S* will not be sufficient to make group 3 projects acceptable for the bank.

Only the projects contribute to aggregate welfare, as the banking market is perfectly competitive. Entrepreneurs receive a credit of (I-E) and invest it together with their own funds E, making then a net investment of +(I-E)-(I-E)-E = -E

Fiscal distortions have a negative effect on welfare. The welfare expressions for the three aid methods in the propositions are obtained after algebraic simplification of the following initial expressions:

$$W^{US} = m_1(p_1(Y+X-R_1^{US}) - E) - dm_1(1-p_1)S^{US} + m_2(p_2X - E) - dm_2(1-p_2)S^{US}$$

Note that, for entrepreneurs of group 2, revenues Y are fully used to pay the bank, as R_2^{US} = Y.

$$W^{SB} = m_1(p_1(Y+X-R_1^{SB}) - E) - dm_2S^{SB} + m_2(p_2X - E)$$

and

$$W^{IS} = m_1(p_1(Y+X-R_1^{IS}) - E) + m_2(p_2X - E) - dm_2S^{IS} - dc$$

APPENDIX B

To compare the welfare effects of the three state aid methods, it suffices to look at the terms in the welfare expressions that are not common to the three expressions. These are:

for W^{US}: $- m_1p_1R_1^{US} - d(m_1(1-p_1)+m_2(1-p_2))S^{US}$

for W^{SB}: $- m_1p_1R_1^{SB} - dm_2S^{SB}$

for W^{IS}: $- m_1p_1R_1^{IS} - d(m_2S^{IS} + c)$

for U^{US}: $- d(m_1(1-p_1)+m_2(1-p_2))S^{US}$

for U^{SB}: $- dm_2S^{SB}$

for U^{IS}: $-d(m_2S^{IS} + c)$

The comparison of welfare effects under the three state aid methods is further simplified by expressing repayments and subsidies in function of the values obtained for the 'informed subsidy' case:

$$R_1^{US} = R_1^{IS} - \frac{m_1 + m_3}{m_1}\frac{c}{p_1} - \frac{(1-p_1)S^{US}}{p_1} + \frac{c}{m_1 p_1} = R_1^{IS} - \frac{(1-p_1)S^{US}}{p_1} + \frac{m_2 c}{m_1 p_1}$$

$$R_1^{SB} = R_1^{IS} + \frac{m_2 c}{m_1 p_1}$$

$$S^{US} = S^{IS}/(1-p_2)$$

$$S^{SB} = S^{IS} + (1 + \frac{m_3}{m_2})c$$

Inserting these in the six utility expressions above, and deleting the common terms ($-m_1 p_1 R_1^{IS}$ and $-dm_2S^{IS}$) in the first three we obtain the following expressions to be compared:

for W^{US}: $W^{US} = \frac{m_1(1-p_1)}{(1-p_2)}(1 - d)S^{IS} - m_2c = \frac{m_1(1-p_1)}{(1-p_2)}(1 - d)((I-E)-p_2Y) - m_2c$

for W^{SB}: $W^{SB} = - m_2c -d(m_2+m_3)c$

for W^{IS}: $W^{IS} = -dc$

for U^{US}: $U^{US} = - \frac{d(m_1(1-p_1) + m_2(1-p_2))S^{IS}}{1-p_2}$

for U^{SB}: $U^{SB} = -d(m_2S^{IS} + (m_2+m_3)c)$

for U^{IS}: $U^{IS} = -d(m_2S^{IS} + c)$

We first look at the optimum for the benevolent politician. As the factors $\frac{m_1(1-p_1)}{(1-p_2)}$ and ((I-E)-p_2Y) are positive, as well as $d(m_2+m_3)c$, and the absolute value of (1-d) is very small (its real value even being positive in the case of inefficient governments), W^{US} always exceeds W^{SB}. We therefore have to compare W^{US} and W^{IS}. $W^{US} > W^{IS}$ if and only if

$$\frac{m_1(1-p_1)}{(1-p_2)}(1 - d)((I-E)-p_2Y) - m_2c > -dc$$

The statements in Proposition 4 immediately follow from this inequality, considering (1-d)<0. Note that the predictions would be different when d<1.

Next, we look at the optimum for the selfish politician. The subsidized bank method dominates the informed subsidy method, as (m_2+m_3)<1. U^{IS} exceeds U^{SB} if and only if

$$- \frac{d(m_1(1-p_1)+m_2(1-p_2))S^{IS}}{1-p_2} > -d(m_2S^{IS} + (m_2+m_3)c)$$

or

$$- \frac{d(m_1(1-p_1))}{1-p_2}((I-E)-p_2Y) > -d(m_2+m_3)c$$

The statements in Proposition 5 immediately follow from this inequality.