

Which countries receive aid as insurance and why? A theory of optimal aid policy *

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Abstract

Empirical evidence shows that developing countries with opaque institutions receive procyclical Official Development Aid (ODA) while developing countries with transparent institutions receive acyclical or countercyclical ODA. This paper provides a dynamic equilibrium model of optimal aid policy that quantitatively accounts for this fact. In the model, the donor wants to (a) encourage actions by the aid receiving government that increase output and (b) smooth out economic fluctuations. The transparency of institutions in the country affects the donor's ability to distinguish downturns caused by exogenous shocks, from those caused by government actions. The solution to the donor's mechanism design problem is dependent on the transparency of government actions. If the donor has good information about government actions, aid policy is countercyclical and aid acts as insurance. However, if the donor is unable to infer perfectly the cause of the downturn, aid policy is procyclical to encourage unobservable good actions. The model predicts a similar pattern for ODA commitments for the following year which is supported by the data. For countries with opaque institutions procyclical aid is the result of optimal policies given the information constraints of donors.

Keywords: ODA, Business cycles, HIPCs, Principal-Agent, Moral Hazard, Dynamic contracts, Institutions.

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1 Introduction

Official Development Assistance (ODA) is one of the most important instruments with which developing countries finance their current account deficits. This observation has prompted a number of papers to suggest that welfare in developing countries could be improved if aid flows were countercyclical or less volatile, in order to smooth the consumption of households in developing countries (Bulir and Hamann, 2003; Pallage, Robe and Berube, 2006, Arellano, Bulir, Lane and Lipschitz, 2009). This reasoning stands in sharp contrast to the empirical findings of Pallage and Robe (2001) who show that ODA is predominantly procyclical. This raises a critical question: Why are aid flows not given countercyclically?

In Banerjee (2009), I provide an empirical insight into this question. I show that developing countries with weak institutions (in particular, institutional measures related to government transparency) receive strongly procyclical ODA while developing countries with good institutions receive acyclical or countercyclical ODA. For ODA disbursements (actual aid given) the inverse relationship between institutional quality and the procyclicality of aid is strongest for *bilateral* ODA and weaker for *multilateral* ODA. However, for ODA commitments (aid promises for the next year) the inverse relationship between institutional quality and aid procyclicality is strongest for *multilateral* donors but insignificant for *bilateral* donors.

Section 3 examines the impact of institutions on donor behaviour in a case study to understand why some countries receive aid as insurance while others do not. It contrasts the nature of aid flows to Malawi and Zaire. Although both Malawi and Zaire went through structural adjustment in the early 1980s, Malawi, which has relatively good institutions, received strongly countercyclical aid, whilst Zaire with weak institutions received strongly procyclical aid. The case study finds that for Malawi, donors worked closely with the government and trusted that the government had implemented reforms effectively. Donors therefore attributed downturns to exogenous events. This prompted donors to give aid as insurance to Malawi. However, in Zaire donors inferred that government actions were at least partially responsible for the downturns, while the government claimed the downturns were caused by donor policy. The case study concludes that the transparency of actual government policies and the credibility of announced policies being implemented influences donor decisions to provide aid as insurance or not. The paper also shows that the measures of institutions that are most negatively related to the correlation between aid and GDP are those which contain information about the transparency of government actions, such as the level of corruption, transparency of public institutions and rule of law.

The main part of the paper provides a calibrated dynamic moral hazard model that accounts for these facts. The model considers an altruistic donor that cares about the utility of the poor in a developing country. The donor wants to (a) increase the level of consumption and (b) smooth out economic fluctuations of the poor. There is a recipient government that can divert some of the aid to a favoured subgroup. The recipient government can undertake costly actions that increase expected output, which benefits society at large. However, the donor's ability to monitor government actions depends on government transparency.

In countries with transparent institutions, recipient government actions are observable, therefore, donors can distinguish downturns caused by exogenous shocks from those caused by recipient government actions. Therefore, with full information, the donor's optimal policy is to condition aid on observable actions and give aid countercyclically as insurance against economic fluctuations.

In contrast, in countries with less transparent institutions, it is harder for the donor to monitor recipient government actions. Because the donor is unable to distinguish perfectly downturns caused by exogenous shocks from those caused by government actions, the recipient government faces a moral hazard problem. With moral hazard, the donor solves the mechanism design problem by conditioning disbursed aid (and aid commitments for the next period) on observable output, to encourage actions that increase expected output. The mechanism rewards high output states with more aid and low output states with less. If the donor were to give aid as insurance in downturns, there would be no incentive for the government to incur the cost of higher effort because actions that increase GDP are not rewarded by more aid, while actions that decrease GDP are rewarded with more aid. Therefore, with moral hazard, the donor is unable to encourage government effort to increase GDP while simultaneously smoothing out economic fluctuations. Thus the optimal aid policy for the donor is procyclical if the donor cannot perfectly observe the source of the shocks and the benefits from higher government effort outweigh the costs of not smoothing consumption.

The dynamic dimension of the model provides an explanation for the different behaviour of aid flows from *multilateral* and *bilateral* donors. In the model, this difference in the behaviour can be explained if we assume that *multilateral* donors are forward looking and use not only aid disbursements but also aid commitments to encourage good actions while *bilateral* donors are myopic and rely entirely on aid disbursement alone. Indeed there is evidence to support this assumption. In the data, *bilateral* ODA commitments are used for political motives rather than encouraging good policy (Banerjee, 2009). Therefore, it appears that *bilateral* ODA disbursements alone are used to encourage good actions. This can also explain the stronger relation

between institutional transparency and the procyclicality of aid *disbursements* in the data.

Alesina and Dollar (2000) and Alesina and Weder (2002) empirically examine the impact of institutions on the level of aid a country receives. Both studies do not find a significant relationship between institutions and the level of aid. Any model which attempts to match the cyclical properties of aid in Banerjee (2009) must also simultaneously match this fact about the level of aid. The model in this paper uses a realistic mechanism to allow the level of aid to be independent of institutional quality, while at the same time maintaining the inverse relationship between institutional quality and the correlation between aid and GDP. The model assumes there is a separate branch of the donor government/organisation which exogenously promises a level of utility to the recipient government perhaps for political reasons. This promise determines the expected level of aid in equilibrium. Actual aid disbursements are administered by a separate aid agency which is altruistic in the sense of the donor described above. This paper shows that it is still optimal for the altruistic aid agency to give countercyclical aid to countries with good institutions and procyclical aid to countries with weak institutions, irrespective of the exogenous promised utility and hence also irrespective of the level of aid.

The results from this paper directly address the policy debate about whether aid flows are welfare inefficient and destabilising in developing countries (Bulir and Hamann, 2003; Pallage, Robe and Berube, 2006; Chauvet and Guillaumont, 2008; Arellano, Bulir, Lane and Lipschitz, 2009). This paper shows that conditional on having good institutions, aid does act as insurance for developing countries during downturns. In the model, as the quality of institutions deteriorates, aid becomes more procyclical under the optimal policy. Therefore, the fact that some developing countries receive procyclical aid could be a conscious decision on the part of donors. The paper shows that if aid were given countercyclically to countries with weak institutions, welfare would be reduced. With moral hazard, countercyclical aid removes the incentive for recipient governments to incur effort. This reduces the level of GDP in the developing country, reducing welfare. Some of this GDP reduction is mitigated by the countercyclical aid which smooths consumption, but this positive welfare effect is dominated by the negative welfare cost from lower GDP. To achieve the same welfare of the donor's target group with countercyclical aid, the aid to GDP ratio would need to be increased from 10% to 20% of GDP.

The model is closest to Svensson (2000) and follows the literature on optimal aid contracts with an altruistic donor and a recipient government that favours the welfare of a subset of agents in the economy (Adam and O'Connell, 1999, Svensson, 2000, Azam and Laffont, 2003). This paper extends the analysis by solving a calibrated intertemporal moral hazard problem using the techniques of Spear and Srivastava (1988) and Phelan and Townsend (1991). It then goes

onto show how this model can quantitatively explain the dynamics of aid flows to developing countries.

Section 2 examines the empirical relationship between aid, GDP and institutions. Section 3 examines a two country case study to illustrate how donors treat different types of governments. Section 4 presents the theoretical model and describes the solution method, section 5 discusses the calibration and section 6 compares the model to the data. Finally section 7 concludes.

2 Stylised facts on the cyclical relationship between aid and GDP

Banerjee (2009) presents five stylised facts that any model of the cyclical behaviour of ODA must explain:

1. The correlation between institutional quality and the correlation between aid *disbursements* and GDP is negative. Countries with weak institutions receive strongly procyclical aid while countries with good institutions receive countercyclical aid.
2. The correlation between institutional quality and the correlation between *multilateral* and *total aid commitments* in period $t + 1$ and GDP in period t is negative. For *multilateral* and *total* ODA, countries with weak institutions receive procyclical aid *commitments* while countries with good institutions receive countercyclical aid *commitments*.
3. The volatility of GDP is independent of institutional quality.
4. The volatility of aid is independent of institutional quality.
5. The level of aid per capita is uncorrelated with institutional quality.

The model should be able to generate both procyclical and countercyclical aid for the same level of aid per capita. Furthermore the model must provide a plausible explanation for the different properties of multilateral and bilateral aid flows.

Banerjee (2009), generates these results using a dataset composed of annual data from 1974 to 2007. The sample consists of 56 countries from Africa, Asia and Latin America. Due to data availability of institutional measures some countries are dropped in some samples. The sample for the main regression results reported here consists of 49 developing countries.

The data on aid flows come from the Official Development Assistance (ODA) figures published by the OECD's DAC database. The OECD collects information on aid disbursements (actual aid given in a year) and aid commitments (promises of aid for the year)¹. ODA disbursements are measured as the net value of grants and concessional loans². ODA commitments are measured on a gross basis because net figures are not published.

GDP per capita is taken from the World Bank's World Development Indicators (WDI). All series are deflated by the purchasing power parity (PPP) GDP deflators from the Penn World Tables prior to 2000 and thereafter using the WDI PPP deflators.

To compute the cyclical properties of ODA and GDP per capita, I detrend the data using the Hodrick-Prescott filter and drop the endpoints. For my main results I use a weighting parameter of 10, as suggested by Baxter and King (1995) for annual data. My results are also robust to using the Baxter-King (1999) band pass filter as an alternative filtering mechanism.

The International Country Risk Guide (ICRG) ratings are used as the main source for institutional quality data. The ICRG provides the longest time series with broad country coverage starting in 1982 with further improvements in the coverage of developing countries in 1985. The ICRG offers quantitative assessments of institutions provided by a group of unidentified private experts not necessarily resident in the country. Institutional quality is measured as the mean of the ICRG measures for corruption, rule of law/law and order tradition and private expropriation risk.

2.1 ODA disbursements

Figure 1 plots institutional quality against the correlation between detrended total ODA disbursements and detrended GDP. The inverse relationship between the quality of institutions and the correlation between ODA disbursements and GDP is clear. The correlation between ODA disbursements and GDP ranges from 0.9 to -0.55. Figures 2 and 3 plot the same graph for multilateral and bilateral ODA disbursements respectively.³ The inverse relationship between institutions and the aid-GDP correlation is still evident.

¹Celasun and Walliser (2008) provide a detailed statistical analysis of the relationship between ODA commitments and disbursements. They find that commitments are predictors of disbursements, but a large unexplained component remains.

²Loans must have a concessional nature to qualify as ODA. For example IMF, standby agreement credits are not considered ODA because they are given at interest rates sufficiently close to market rates.

³Bilateral aid constitutes around two thirds of ODA and multilateral around one third.

Table 1: Determinants of the correlation between ODA disbursements and GDP

Corr (aid, GDP)	Total	Multilateral	Bilateral
Institutions	-0.167*** (0.036)	-0.092** (0.038)	-0.145*** (0.038)

Note: White standard errors in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% levels.

Table 1 summarises Banerjee’s (2009) results from regressing the correlation between ODA and GDP on institutional quality. The coefficient on institutions is significant at the 1% level for total and bilateral ODA disbursements and significant at the 5% level for multilateral disbursements. Banerjee (2009) also shows that these results are robust to including both country and time fixed effects. The relationship between institutions and the cyclicity of ODA disbursements holds both within and between countries.

Countries that had relatively poor institutions in the 1970s, but improved them by the 1990s (e.g. Ghana and Uganda) had a high correlation between aid and GDP in the 1970s and early 1980s, but a relatively low correlation in the 1990s and beyond. On the other side, countries which had relatively good institutions in the 1970s and early 1980s but declining institutional quality thereafter (e.g. Cote d’Ivoire and Sierra Leone) show the opposite trend. Countries which had poor institutions throughout had a high correlation between aid and GDP in all decades (e.g. Democratic Republic of Congo), while countries with relatively good institutions throughout had a low correlation between aid and GDP in all decades (e.g. Malawi).

For total and bilateral ODA, the negative relationship between institutions and the aid-GDP correlation is robust to controlling for a multitude of other possible explanatory variables (Table 2), although, this is not true for multilateral aid. Table 2 shows that neither the volatility of GDP, the volatility of aid nor the aid to GDP ratio are significant in explaining the correlation between aid and GDP. This result is in line with Pallage and Robe (2001) and Bulir and Hamann (2003), who do not find significant relationships between these variables and the correlation of aid with the business cycle. Any model which attempts to explain differences across countries in the correlation between aid and GDP must be capable of doing so independent of these variables. The negative relationship between institutions and the correlation between aid and GDP is also robust to controlling for other plausible explanatory variables such as the prevalence of coups in a country, armed conflicts, the political structure, civil liberties and economic crises (table 2).

These results indicate that countries with weaker institutions receive more procyclical aid on average. As institutions improve, aid becomes acyclical or countercyclical on average. For

Table 2: Determinants of the correlation between ODA disbursements and GDP, with controls

Corr(aid, GDP)	Total	Multilateral	Bilateral
Institutions	-0.115** (0.055)	-0.005 (0.552)	-0.132* (0.068)
SD(aid)	-3.56e-6 (0.002)	-0.011 (0.027)	0.001 (0.001)
Average(aid/GDP)	0.816 (0.705)	1.412 (1.502)	1.29 (1.302)
Average(GDP)	0.031 (0.092)	-0.067 (0.085)	0.046 (0.107)
SD(GDP)	0.762 (2.282)	1.333 (1.788)	0.428 (2.593)
SD(Terms of Trade)	-0.025 (0.445)	0.096 (0.417)	-0.093 (0.518)
Coups	0.041 (0.087)	-0.032 (0.076)	0.063 (0.102)
Conflicts	-0.078 (0.087)	-0.046 (0.101)	-0.108 (0.102)
Polity IV	-0.010 (0.02)	-0.015 (0.030)	0.006 (0.030)
Civil liberties	0.010 (0.031)	-0.011 (0.028)	-0.0004 (0.038)
Crisis	0.651 (1.147)	0.026 (1.602)	0.089 (2.506)
Time dummy	-0.030 (0.095)	-0.027 (0.096)	0.018 (0.105)

Note: White standard errors in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% levels.

Table 3: Which institutions are negatively related to the correlation between aid and GDP?

Significant	Insignificant
ICRG	
Corruption	Ethnic Tension
Rule of law	Quality of bureaucracy
Expropriation risk	Repudiation of government contracts
Kaufmann Kraay	
Government Effectiveness	Voice and accountability
Control of Corruption	Political Stability, No Violence
Rule of Law	Regulatory Quality
CPIA	
Public sector management and institutions	Equity of public resource use
Structural policies cluster	Financial sector rating
Transparency, accountability and corruption	Fiscal policy rating
Property rights and rule base governance	Budgetary and financial management
Efficiency of revenue mobilisation	Quality of public administration
Economic management cluster	Trade rating

All regressions run with controls

those countries aid acts as insurance during downturns. This is a striking finding given that the previous literature failed to find any relationship between the level of aid and the quality of policy (World Bank, 1998, Dollar and Svensson, 2000, Alesina and Dollar, 2000 and Alesina and Weder, 2002).

In Banerjee (2009), I also use the 1996 Kaufmann and Kraay (2008) governance indicators and the 2006 World Bank CPIA institutional quality measures as alternatives to the measure constructed from the ICRG. Table 3 lists the institutional quality measures which are significantly related to the correlation between aid and GDP. For the Kaufmann and Kraay indicators, control of corruption, rule of law and government effectiveness are significant. The CPIA measures for the quality of structural policy, public sector management and transparency and accountability in the public sector appear most strongly correlated with the correlation between aid and GDP. Overall, these alternative measures of institutions suggest that transparency and trust in the quality of decision-making of the government and its ability to carry out announced plans influence whether a country receives procyclical or countercyclical aid. Note that measures of institutions unrelated to transparency and credibility such as ethnic tension and political stability, are not related to the correlation between aid and GDP.

Turning to the relationship between the *level* of ODA and institutions, Table 4 confirms the

Table 4: Determinants of the level of aid

Aid per capita	(1)	(2)
Institutions	-0.259*	-0.140
	(0.155)	(0.148)
GDP per capita		-0.252*
		(0.162)

Note: White standard errors in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% levels.

Table 5: Determinants of the correlation between ODA commitments and GDP

Corr(aid com., GDP)	Total	Multilateral	Bilateral
Institutions	-0.052*	-0.105***	0.005
	(0.029)	(0.039)	(0.033)

Note: White standard errors in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% levels.

results of Alesina and Weder (2002) that the level of ODA a country receives is not influenced by institutional quality. The results show that once GDP per capita is controlled for, the institutional quality variable is not a significant explanatory variable for the level of aid. Thus institutions matter for the cyclical characteristics of aid but not the level of aid. This is an important fact that any theory of aid cyclicalities must replicate.

2.2 ODA Commitments

Motivated by the model in this paper, Banerjee (2009) also examines the cyclical relationship between GDP and ODA commitments for the following year. Table 5 shows the results from regressing the correlation between aid commitments and GDP on institutional quality. The correlation between institutional quality and the correlation between ODA commitments for period $t+1$ and GDP in period t is negative and significant at the 1% level for multilateral ODA commitments and negative and significant at the 10% level for total ODA commitments. For bilateral ODA commitments, however, the coefficient is not significant. Figure 4 also shows that the correlation between multilateral ODA commitments and GDP is negatively correlated with my measure of institutional quality. These results are also robust to including both country and time fixed effects and holds both within and between countries.

In Banerjee (2009), I also show that the results in Table 5 are robust to including additional control variables. Interestingly coups are a significant explanatory variable for the cyclicalities

Table 6: Determinants of the correlation between ODA commitments and GDP, with controls

ODA Commitments	Total	Multilateral	Bilateral
Institutions	-0.058 (0.041)	-0.130** (0.060)	-0.0004 (0.045)
Coups	-0.159** (0.064)	-0.046 (0.075)	-0.182*** (0.060)
plus control variables			

Note: White standard errors in parentheses. ***, **, * indicates significance at the 1%, 5% and 10% levels.

Table 7: Business cycle moments

	Total		Multilateral		Bilateral	
	Good	Weak	Good	Weak	Good	Weak
SD(GDP)	0.043	0.064	0.043	0.064	0.043	0.064
SD(ODA dis.)	0.235	0.261	0.358	0.305	0.306	0.248
SD(ODA com.)	0.282	0.299	0.432	0.429	0.315	0.304
corr(GDP, ODA dis.)	-0.209	0.418	-0.082	0.245	-0.158	0.378
corr(GDP, ODA com.)	-0.158	0.020	-0.235	0.122	0.007	-0.069
(ODA dis.)/GDP %	1.3	6.1	0.5	2.0	2.4	4.6
min(ODA dis./GDP) %	0.03	0.07	0.00	0.01	0.01	0.06
max(ODA dis./GDP) %	18.1	44.8	7.26	17.2	12.9	25.5

Note:(1) Sample split into good and weak institutions by the median value in the sample.

Note:(2) ODA dis. are ODA disbursements, ODA com. are ODA commitments.

Note: (3) Correlations are taken from the trend line in tables 1 and 5

of total and bilateral ODA *commitments* (Table 6). The sign is negative, which suggests that countries that experience a coup have less procyclical ODA commitments than countries that do not. It would appear that bilateral donors use ODA commitments for other purposes (e.g. stabilising a country) rather than to encourage better government policies.

2.3 Business cycle statistics

Table 7 shows cross country averages of key business cycle moments from my dataset which I will use to calibrate the model. The countries are divided into those with good and weak institutions, defined as those with above and below median institutional quality. As expected from the results above, the correlation between aid and GDP is lower in the group with better institutions. The median volatility of aid is approximately similar across groups, which which is not surprising given the results from table 2. GDP is slightly more volatile in countries

with weaker institutions. The median aid to GDP ratio is higher for countries with weaker institutions. However, the maximum and minimum aid to GDP ratios for countries with good and weak institutional quality show there is very little correlation between institutional quality and the amount of aid a country receives. Furthermore table 4 that the correlation between quality and the level of aid is not significant once one controls for the level of GDP.

3 A case study: Aid flows to Malawi and The Democratic Republic of the Congo

Given the empirical relationship between institutional quality and the correlation between aid and GDP, I compare the contrasting aid experiences of Malawi and Zaire⁴ to better understand which aspects of institutional quality influence donor behaviour. Malawi traditionally had better institutions than Zaire. During the early 1980s, when both countries faced difficult economic adjustments, they both cooperated with donor conditions and met donor targets. However, during the 1980s Malawi received strongly countercyclical aid flows (Figure 5) while Zaire received strongly procyclical aid flows (Figure 6). Why were the aid experiences so different?

By 1979 both countries had adopted stabilisation plans and standby agreements with the IMF due to balance of payments difficulties. By 1982 Malawi had made more progress meeting the objectives of the plan than Zaire (Gulharti, 1989 and Kiakwama and Chevallier, 2001) but Zaire *“adopted a comprehensive and far reaching reform program in 1983 ... [t]he adjustment during 1983-85 was substantial ... [d]ebt service payments were made on schedule and external arrears were substantially reduced, but [this] failed to generate additional donor support”* (p.632 para 5 Kiakwama and Chevalier, 2001). This account of events is reflected in Figure 6, where GDP per capita is decreasing after 1980, while aid flows remain below 1980 levels. Despite following donor plans closely, Zaire did not receive aid as insurance against the downturn.

Malawi suffered a financial crisis in 1985 (Harrigan, 1991). The government resorted to domestic borrowing and the pace of inflation accelerated (Gulharti, 1991). The drop in GDP can be seen in Figure 5, but in contrast to the experience of Zaire, aid to Malawi clearly increased during the downturn.

In Zaire, with opaque institutions, donors had very little information about government

⁴I refer to the Democratic Republic of the Congo by its former name since I am focussing on that period of its history.

actions. To encourage beneficial government actions, donors increased aid only after observable variables improved because they could not monitor the actions themselves.

Wrong (2001) indicates that the donors clearly had very little information about actual government actions: “*‘We never had solid data, because they [the Zairian authorities] weren’t willing to provide it,’ admitted a senior World Bank economist. ‘We could never get a good grasp of what was happening.’*” (p.209 para. 1, Wrong, 2001).

Young and Turner (1985) argue that donors had not only very little information about government actions, but also that official flows were dependent on information about government actions: “*... the IMF had rescinded Zaire’s eligibility for higher tranche credit, noting that the country was not meeting arrears, and that indeed it had no notion of what Zaire was doing.*” (p.383 para. 4, Young and Turner, 1985).

Given this lack of information about government actions, Young and Turner (1985) show that the donor community instead conditioned aid on observable outcomes: “*In mid-1981 this temporary improvement [in macro variables] led to another - and larger - IMF advance of approximately \$950 million. Soon thereafter Zaire was again out of compliance with the agreement, and by 1982 further advances had again been cut off.*” (p. 384, para. 3, Young and Turner, 1985).

Furthermore, Wrong (2001) argues that donors understood the incentive effect of withholding aid in downturns on government actions: “*... the first structural adjustment programme went into action, at the end of 1982. [...] there was also a feeling in Washington that with national bankruptcy now a concrete threat and this regime unchallenged on the political front, Mobutu might see the need to knuckle down. For three years the calculation seemed the right one as, under the tutelage of Prime Minister Kengo Wa Dondo, Zaire set in place a reform program regarded as a model of its kind.*” (p.210 para. 1, Wrong, 2001).

In contrast, in Malawi, there were few areas of asymmetric information between the donors and the government about the implemented policy because “*[s]taff of these international organizations undertook the bulk of the analysis (or helped the government to define, supervise and finance expatriate consultants who did the policy analysis) that underpinned the reforms.*” (p.39 para. 3, Gulharti, 1991). Gulharti (1991) concludes that Malawi’s poor economic performance in the 1980s was a case of ‘promising reforms, bad luck’. It appears that because of the close working relationship with the government, the donors could monitor reform implementation more clearly in Malawi than in Zaire. This is arguably why donors were willing to give more aid to Malawi during downturns, because donors could more clearly evaluate that the downturn due to exogenous shocks and not due to the government not fulfilling promised actions. Meanwhile, in Zaire, donors had very little information about the government’s actual actions, they could not

observe the cause of the downturn, but realised the incentive effect on reforms from withholding aid in downturns.

4 Model

4.1 Environment

I consider a developing economy inhabited by two groups, called rich and poor. The economy is closed except for foreign aid flows, to capture the fact that the majority of developing countries in my sample have very limited access (if any) to international capital markets. There is a government of the developing country and a foreign donor. To capture the fact that aid is given for both political and economic purposes, I assume that independent of the donor administering the aid disbursements (e.g. USAID), there is another branch of the donor organisation/government (e.g. The State Department) which exogenously promises a level of utility w_0 to the developing country at $t = 0$. This separates the level of aid from the cyclical behaviour.⁵ The promise w_0 will determine the expected level of aid a country receives in equilibrium. The donor administering the aid disbursement would like to ensure the recipient government exerts effort to improve the welfare of the poor, subject to the political constraint of delivering welfare w_0 to the recipient government. The donor administering the aid cares about the welfare of the poor and pays a constant marginal cost for each unit of aid disbursed⁶. The donor's expected utility function is

$$U = E_0 \sum_{t=0}^{\infty} \beta^t [u(c_t^p) - \phi a_t] \quad (1)$$

where β is the discount rate of the donor, $u(\cdot)$ is the period utility function of the poor in the country, with $u'(\cdot) > 0$ and $u''(\cdot) < 0$, c_t^p is the consumption of the poor, a_t is the amount of aid disbursed in period t and ϕ is the marginal cost of aid.

The government of the country cares about the welfare of both the rich and the poor. Actions (policy) by the government can increase the expected output of the economy. However, these actions are costly to the government. The recipient government's expected utility function is

$$V = E_0 \sum_{t=0}^{\infty} \gamma^t [\theta v(c_t^r) + (1 - \theta)u(c_t^p) - g(e_t)] \quad (2)$$

⁵Alesina and Dollar (2000) showed that the level of aid is determined independent of institutions, while political alliances were found to be an important determinant of the level of aid.

⁶This can be thought of as a constant marginal cost for the use of funds for other purposes/countries.

where γ is the discount factor of the government, θ measures the degree of favouritism of the government towards the rich, $v(\cdot)$ is the period utility function of the rich and is concave with $v'(\cdot) > 0$ and $v''(\cdot) < 0$ and c_t^r is the consumption of the rich in period t . The function $g(\cdot)$ is convex with $g'(\cdot) > 0$ and $g''(\cdot) > 0$ and measures the cost of effort e_t by the government.

Effort by the government increases output y_t in the developing country. Output is determined by a set of conditional probability distribution functions of y conditional on e and is denoted by $f(y|e)$. It is assumed that it is impossible to perfectly infer the government's effort perfectly from output outcomes:

$$f(y|e) > 0 \quad \forall e \quad (3)$$

Also for any $e^{high} > e^{low}$, $f(y|e^{high})$ first order stochastically dominates $f(y|e^{low})$.

The government runs a balanced budget and chooses the distribution of output between the rich and poor. The donor can give aid directly to the poor in order to increase the welfare of the poor, but the aid is subject to diminishing returns. Thus the economy faces the following resource constraints,

$$c_t^r = y_t - d_t \quad (4)$$

and

$$c_t^p = d_t + h(a_t) \quad (5)$$

where d_t is the amount of output given to the poor by the government. Following the empirical results from Clemens, Radelet and Bhavani (2004) about the short-run impact of aid, there are decreasing returns to aid, $h'(\cdot) > 0$, $h''(\cdot) \leq 0$ and $h(0) = 0$.

4.2 Recipient government's problem in Autarky

In autarky, the government receives no aid. The solution to this problem provides a lower bound on the donor's aid problem. The government's problem in autarky is to choose both effort and the optimal division of output between the rich and poor conditional on the level of aid a . For tractability, I assume no storage. Under this condition the government's dynamic problem reduces to a sequence of static problems

$$V = \max_{\{e_t, d_t\}} \int [\theta v(y_t - d_t) + (1 - \theta)u(d_t) - g(e_t)] dF(y_t|e_t) \quad (6)$$

The first order condition of the government for the optimal choice of d equates the ratio of the marginal utilities of the rich and poor to the ratio of their weights in the utility function.

While the parameter θ indexes the inequality in the country the government completely shares aggregate risk between the two groups.

$$\frac{\theta}{1 - \theta} = \frac{u'(d_t)}{v'(y_t - d_t)} \quad (7)$$

Assuming that effort e is discrete (as done in the numerical section), the optimal choice of e can be obtained by computing the level of e which generates the highest value for V given the first order condition (10) and a . For example suppose for two levels of effort e^h and e^l there are two conditional distributions functions $F(y|e^h)$ and $F(y|e^l)$. The government evaluates expected utility from each level of effort

$$V^i = \int [\theta v(y - d(y, a)) + (1 - \theta)u(d(y, a) + h(a)) - g(e^i)] dF(y|e^i) \text{ for } i = h, l \quad (8)$$

If $V^h > V^l$ then the benefit from the high level of effort outweigh the costs and the higher level of effort e^h is chosen. Else if $V^h < V^l$ the costs of the higher level of effort outweigh the benefits and the low level of effort is chosen. This method avoids the need to check the conditions in Rogerson (1985) when using the first order approach.

Let V^{aut} denote the solution to the autarky problem. This is the solution to (9) when aid equals zero.

4.3 Recipient government's problem with Aid

With positive aid flows, the government's problem is reduced to only choosing the optimal division of output between the rich and poor conditional on the level of aid a . The government's effort e is 'chosen' by the donor when the donor solves its mechanism design problem. The government's problem is given by

$$V = \max_{\{e_t, d_t\}} \int [\theta v(y_t - d_t) + (1 - \theta)u(d_t + h(a_t)) - g(e_t)] dF(y_t|e_t) \quad (9)$$

The first order condition of the government for the optimal choice of d is similar to (7) except that total resources available to the government includes aid a .

$$\frac{\theta}{1 - \theta} = \frac{u'(d_t + h(a_t))}{v'(y_t - d_t)} \quad (10)$$

The optimal choice of d is a function of y and a , denoted as $d(y, a)$. The share of output going to the poor is decreasing in aid, $\partial[d(y, a)]/\partial a < 0$. Therefore, with higher aid, the government has less incentive to transfer resources to the poor and less incentive to do higher effort to

increase total output y ⁷.

4.4 Donor

The donor's ability to monitor the recipient government's effort is dependent on the transparency of institutions. In countries where government institutions are transparent, the donor receives perfect signals about government effort. However, as the transparency of government institutions deteriorates, the donor receives increasingly noisy signals about actual government actions until the signals are so noisy that they contain no information about government effort. The quality of information affects the donor's optimal aid contract. When solving for the optimal aid contract the donor takes into account the recipient government's $d(y, a)$ function and the return to aid function $h(a)$.

4.4.1 Donor's problem with full information

With very good institutions the donor receives informative signals about the recipient government's effort. I concentrate on the full information case in which the donor perfectly observes recipient government effort. Aid can be made conditional on both output y and effort e . I assume that aid cannot be conditioned on the allocation of output given to the poor by the recipient government, d .⁸ With no storage the solution to the donor's dynamic problem with full information is equivalent to solving a sequence of static problems with full information. Therefore, the donor's problem reduces to

$$\max_{a,e} \int [u(d(y, a) + h(a)) - \phi a] dF(y|e) \quad (11)$$

s.t.

$$\int [\theta v(y - d(y, a)) + (1 - \theta)u(d(y, a) + h(a)) - g(e)] dF(y|e) \geq w_0 \geq V^{aut} \quad (12)$$

where equation (12) is the individual rationality constraint of the government, which ensures that the government receives at least the utility it would have received in autarky.

The preferences of the donor are specified such that the donor wants to (a) increase output in the developing country (through encouraging recipient government effort) and (b) smooth out

⁷For example, if $\theta = 0.5$ and $u(\cdot) = v(\cdot)$ then the optimal division of output for the government $d_t(y, a) = 0.5[y_t - h(a)]$.

⁸The problem described here where the ability to observe effort depends on institutional quality is isomorphic to a problem where the ability to observe and contract upon d depends on institutional quality.

economic fluctuations. The optimal aid policy with full information is an aid contract conditional on effort, output and w_0 . The ability to condition aid on observable effort will enable the donor to attain these dual objectives simultaneously. I describe the properties of the optimal aid policy later in section 6.

4.5 Donor's problem with hidden government effort

In countries with weak institutions the donor has noisy signals about the level of effort the government exerts. In this section I consider the other extreme in which institutions are so weak that the donor receives completely uninformative signals about government effort⁹. When the donor cannot observe government effort, the optimal contract can only be made conditional on observable output y . The donor will then use the revelation principle to ensure the government selects the level of effort prescribed by the donor.

I follow Spear and Srivastava (1987) and introduce the concept of promised utility w as a state variable to make the problem recursive. Let w_0 be the exogenous initial utility promised at $t = 0$. The donor's problem with incomplete information is similar to the full information problem, with additional incentive compatibility constraints to ensure that the government selects the level of effort prescribed by the donor.

At the beginning of each period the donor takes as given the utility w promised to the recipient government in period $t - 1$. Given w the donor selects functions for effort $e(w)$, aid $a(w, y)$ and next period promised utility $\tilde{w}(w, y)$ to maximise (1) subject to delivering the promised level of utility and ensuring the government selects the level of effort prescribed by the donor. The Bellman equation for the donors problem is

$$J(w) = \max_{e(w), a(w, y), \tilde{w}(w, y)} \int [u(d(y, a) + h(a)) - \phi a + \beta J(\tilde{w})] dF(y|e(w)) \quad (13)$$

s.t. the promise keeping constraint

$$w = \int \{[\theta v(y - d(y, a)) + (1 - \theta)u(d(y, a) + h(a(w, y)))] - g(e(w))\} + \gamma \tilde{w}(w, y) dF(y|e(w)) \quad (14)$$

⁹I have also numerically analysed cases where the donor receives a partially informative signal about recipient government effort. The results are between the full information and the hidden effort solutions. Currently solving the problem with partially informative signals increases the computation time significantly. I will update the paper with these results as they become available.

and incentive compatibility constraints

$$\begin{aligned} & \int [\theta v(y - d) + (1 - \theta)u(d + h(a(w, y))) - g(e(w)) + \tilde{w}(w, y)]dF(y|e(w)) \\ & \geq \int [\theta v(y - d) + (1 - \theta)u(d + h(a(w, y))) - g(\hat{e}) + \tilde{w}(w, y)]dF(y|\hat{e}) \forall \hat{e} \end{aligned} \quad (15)$$

Constraint (14) says that the value of the aid contract to the government must be equal to the promised utility w coming into the period. The incentive compatibility constraints (15) state that the value to the government of selecting the level of effort prescribed by the donor must be greater than the returns from any deviation in each state.

Remember that the preferences of the donor are specified such that the donor wants to both increase output in the developing country and smooth out economic fluctuations. Ideally the donor would like to give aid as insurance against downturns, but because the donor is unable to observe effort directly, it cannot distinguish whether the downturn is exogenous or due to low government effort. Because output is a noisy signal of government effort, the donor can condition aid on observable output. If effort increases output, a contract which gives more aid when output is high rewards high effort on average. On the other hand, if the donor were to give more aid in downturns, there would be no incentive for the government to incur the cost of higher effort because actions that increase GDP are not rewarded with more aid. If the benefits from government effort are small relative to the welfare benefit of smoothing consumption, it is possible that the optimal contract would give aid to smooth consumption without increasing government effort.

4.6 Solution Method

In moral hazard problems, the revelation principle requires a large number of incentive compatibility constraints to be satisfied. This can potentially make the constraint set non-convex. I follow Phelan and Townsend (1991) and use randomisation which overcomes this problem by convexifying the constraint set of the donor. Phelan and Townsend (1991) show that this enables dynamic programming theorems to be applied to moral hazard problems. Note that deterministic rules are just a subset of probabilistic rules with degenerate distributions. Furthermore, applying randomisation to the donor's problem presented in this paper is also a very realistic description of historical donor behaviour. Consider the following quote from Mosley et. al. (1991b, p.2):

“We encountered a number of cases where weak recipients gambled, sometimes correctly and sometimes not, that they could nonetheless get away with high levels of slippage.”

The randomisation works as follows. The government selects effort e from a finite set $E \subset R_+$. For a given effort $e \in E$, output y is determined by a probability density function, $P(y|e)$ which is analogous to the continuous probability distribution function $f(y|e)$ in section 4. The probability $P(y|e)$ is assumed to be strictly positive for all e so that any level of output is possible given any effort level. I denote this set of possible outputs as Y . Foreign aid gives the government some level of aid $a \in A$ where A is a finite subset of R_+ . w is the utility promised to the government and can take any value from the set $W = [V^{aut}, w_{max}]$, where V^{aut} is the utility of the government in autarky and w_{max} is the highest level of utility attainable (i.e. the lowest effort and maximum aid).

The donor's problem with randomisation is to choose a probability distribution $\Pi(e, y, a, w')$ to maximise the Bellman equation

$$J(w) = \max_{\Pi} \{u(d(y, a) + h(a)) - a + \beta J(w')\} \Pi(e, y, a, w') \quad (16)$$

subject to the the promise keeping constraint,

$$w = \sum_{E \times Y \times A \times W} \{\theta v(y - d(y, a)) + (1 - \theta)u(d(y, a) + h(a)) - g(e) + \gamma w'\} \Pi(e, y, a, w') \quad (17)$$

and for the hidden action problem, the incentive compatibility constraints for each e, \hat{e} pair:

$$\begin{aligned} & \sum_{Y \times A \times W} \{\theta v(y - d(y, a)) + (1 - \theta)u(d(y, a) + h(a)) - g(e) + \gamma w'\} \Pi(a, w', y, e) P(y|e) \\ & \geq \sum_{Y \times A \times W} \{\theta v(y - d(y, a)) + (1 - \theta)u(d(y, a) + h(a)) - g(\hat{e}) + \gamma w'\} \Pi(a, w', y, e) \frac{P(y|\hat{e})}{P(y|e)} \end{aligned} \quad (18)$$

Note that (17) is the discrete counterpart to (14) and the discrete counterpart to the set of incentive compatibility constraints is equation (18). Also the donor internalises the government's division of resources function $d(y, a)$ when solving its problem.

The final conditions with probabilistic decision rules are that the implied conditional probabilities must coincide with those imposed by nature, $P(y|e)$. For each (\bar{e}, \bar{y}) pair the following condition must hold

$$\sum_{A \times W} \Pi(\bar{e}, \bar{y}, a, w') = P(\bar{y}|\bar{e}) \sum_{Y \times A \times W} \Pi(\bar{e}, y, a, w') \quad (19)$$

Finally the probabilities from the probabilistic optimal policy must follow the laws of probability

$$\Pi(e, y, a, w') \geq 0 \quad (20)$$

and

$$\sum_{E \times Y \times A \times W} \Pi(e, y, a, w') = 1 \quad (21)$$

The model is solved using value function iteration with the Howard improvement algorithm until convergence of value functions. The steps of the algorithm are the following:

1. Guess an initial function $v^0(w)$
2. For each w solve a linear programming¹⁰ problem using equations (16) through (21) to obtain policy functions, which consist of probabilities $\Pi^1(e, y, c, w')$ that maximise the Bellman equation (16).
3. Compute $v^{i+1}(w)$ as the discounted present value of following policy Π^1 .
4. Use $v^{i+1}(w)$ as the guess in step 2 until convergence ($v^i = v^{i+1}$).

5 Calibration

I calibrate parameters so that the dynamic model with unobserved effort matches three moments estimated from countries with the least transparent institutions: the volatility of GDP, the volatility of disbursed aid and the correlation between ODA and GDP. Informative signals are then introduced to test whether the model can reproduce the differences between countries with transparent and opaque institutions in tables 1 and 5, holding all structural parameters fixed aside from the transparency of information.

¹⁰The linear programming problem is written in Python and solved using the GNU Linear Programming Kit (GLPK), both of which are free open source software (FOSS).

5.1 Functional Forms

I now describe the procedure used to select benchmark parameter values. The period utility function of the poor is $u(c) = c^\sigma/\sigma$ and $u(c) = v(c)$. The period utility function of the government is $\theta v(c_r) + (1 - \theta)u(c_p) - g(e) = \theta c_r^\sigma/\sigma + \theta c_p^\sigma/\sigma + \chi(e^{max} - e)^\delta$. Aid has decreasing returns to scale, where a units of aid produce $h(a) = a^\alpha$ units of consumption goods.

The technology specifying the conditional probability density functions $P(y|e)$ is given by

$$P(y = y^{high}|e) = 0.1 + e^\psi \tag{22}$$

$$P(y = y^{low}|e) = 1 - P(y = y^{high}|e) \tag{23}$$

where e is suitably bounded $[0,1]$ such that the probability density functions are well defined. Output takes two discrete values and the ratio of y^h/y^l equals 20% to match the standard deviation of annual GDP of 6.5%.

In my baseline model, I set the discount factors β and γ equal to 0.7 for both the donor and government in order to match the standard deviation of annual aid, 28.8%. The discount factors are on the low end of the usual estimates. Mechanically, if β were set to 0.9 in the model, the volatility of disbursed aid would become very small. This is because the donor mostly uses aid promises (commitments) to encourage government effort instead of aid disbursements (see section 6.5). The low discount factor can be justified by assuming a constant probability x of regime change or break in the relationship between government and donor with a mean $(1/x)$ of around 5 years, along with a utility discount rate of $beta = 0.9$ which implies an effective discount factor of $(1 - x)\beta = 0.7$. Given estimates for the average duration of regimes in Africa, Asia and Latin America with a mean of 8 years and median of 4.5 years, (Stier and Mundt, 1998) this is not an unrealistic calibration.

I calibrate σ , the parameter governing the curvature of utility, to 0.8 in order to match the correlation between ODA disbursements and GDP taken from the trend line in table 1 with a transparency score of 1.0 constructed from the ICRG data. I set the returns to scale in aid parameter α to 0.5. This number is derived from fitting the Cobb-Douglas returns to aid function to the estimates of the short-run impact of aid provided in Clemens, Radelet and Bhavani (2004).

The weight on effort in the utility function is mechanically set to 0.2 in order to make the autarky level of effort in the model equal zero. Finally, I parameterise the weight on the rich in the government's utility function θ to 0.5.

Table 8: Parameter Values

			<i>Target</i>
Ratio of Output	y^{high}/y^{low}	20%	SD(GDP) = 0.064
Curvature parameter	σ	0.8	Corr(Aid, GDP) = 0.436
Discount factor	$\beta = \gamma$	0.7	SD(Aid) = 0.288
Returns to aid	α	0.5	Short-run returns to aid (Clemens et. al., 2004)
Weight on effort	χ	0.2	$e^{aut} = 0$
Weight on rich	θ	0.5	
Marginal cost of aid	ϕ	1	

Table 9: Matched moments

Moment	Data	Model (hidden actions)
SD(GDP)	0.064	0.067
SD(Aid)	0.261	0.255
Corr(Aid, GDP)	0.418	0.377

Table 9 shows that the baseline model with hidden effort does a good job at matching the data moments for countries with the weakest institutions. To test the model, I keep all other parameters constant and add information about government effort to the donor’s information set to capture the increase in transparency of government actions as institutions improve. I then evaluate the ability of the model to match the observed moments for countries with the most transparent institutions.

6 Results

The results section is structured as follows. I first examine the policy functions of the calibrated model assuming full information and then examine the policy functions of the baseline calibrated model with hidden actions. I then examine the ability of the model to match the moments of both countries with transparent and opaque institutions only using differences in the informativeness of signals. Finally I examine how a change to the calibration can help the model match the different aid dynamics of bilateral and multilateral aid flows.

I show that the model can explain four of the five stylised facts presented in section 2. The model can explain the negative relationship between institutional quality and the correlation between *disbursed* ODA and GDP as well as the negative relationship between institutional quality and the correlation between ODA *commitments* and GDP. The model can match these facts for all empirically relevant levels of aid. Furthermore, the volatility of GDP is uncorrelated

with institutional quality. However, in the model the volatility of aid is not independent of institutional quality. Instead, the model predicts a counterfactual decrease in the volatility of aid as institutions improve. The model also over predicts the correlation between GDP and ODA *commitments*.¹¹

6.1 Full information - transparent institutions

Figure 7 plots the equilibrium aid policy function conditional on an initial promised government utility w_0 , output y and effort e . The solid line is expected aid in high output states and the dashed line expected aid in low output states. The key point to note is that the solid line is always below the dashed line¹². This shows that with full information, aid is given as insurance against bad states because more aid is disbursed in low output states than in high output states for any given initial promise w . Figure 7 also shows that aid is countercyclical for aid to GDP ratios between 0% to 200%.

Figure 8 plots the equilibrium effort level conditional on promised utility w . It shows that the optimal level of effort is a negative function of the initial promise. Therefore, as the exogenous promised utility w_0 increases, the effort the donor can optimally extract from the recipient government decreases. Under full information, the level of effort is a weakly monotonically decreasing function of the promised level of utility.

Figure 9 plots the equilibrium utility of the donor $J(w)$, conditional on the government's promised utility w . If w_0 were set optimally by the donor distributing the aid, it would be the maximum point on the curve. On the left hand side of the maximum, the utility function is upwards sloping because the marginal utility of the poor is greater than the cost of aid, while the promise is still sufficiently low to ensure that the government exerts the maximum effort. Therefore, in this region increasing aid is a Pareto improvement.

6.2 Hidden effort - opaque institutions

In stark contrast to the full information model, figure 10 shows that a positive relationship between aid and output is obtained when the donor cannot observe effort directly. The solid and

¹¹Unfortunately, I do not have data for *net* ODA commitments. My model does not have a measure of *gross* ODA commitments, therefore, it is difficult to attribute the inability to fit the moments to model or data issues. Comparing data from *net* ODA disbursements to *gross* ODA disbursements, there is a deterioration in the model fit with *gross* ODA disbursements which suggests that the use of *gross* ODA commitments is partially attributable to some of the poor fit.

¹²While the difference in aid disbursements between high and low output states is visually small, the simulation results below, show that this sufficiently large to match the data moments.

dashed lines plot optimal aid conditional on high and low output respectively. In contrast to the full information equilibrium, the solid line is almost always above the dashed line, except for very high exogenous promises w_0 . Aid becomes countercyclical only for values of w_0 corresponding to aid to GDP ratios greater than 200%, far in excess of maximum aid to GDP ratios observed in the data. The average aid to GDP ratios is around 6%. Therefore, in equilibrium the donor disburses less aid in low output states than in high output states for all empirically relevant regions (Table 7).

For all but the highest utility promises w , because the donor is unable to condition aid on effort directly, the donor must reward periods of high output in order to encourage the government to select the effort prescribed by the donor. However, for the highest initial promises w_0 the only way the donor can attain those promises is by allowing the government to exert the lowest level of effort and then giving aid as insurance.

Figure 11 plots government effort as a function of promised utility w . When the donor promises the lowest level of utility (the autarky level) then the government exerts the lowest effort level¹³. Therefore, unlike the full information problem, the level of effort is not monotonically decreasing with promised utility w .

Figure 12 plots the equilibrium policy functions for next period's promised utility w' . Note that these functions straddle the 45 degree line, with high output states above and low output states below. Thus promised utility is also procyclical for countries with weak institutions. Combining the aid policy functions in figure 10 with those for promised utility in figure 12, promised utility w' can be mapped into expected aid (aid commitments) for the next period. Figure 13 shows that aid commitments are also procyclical in countries with weak institutions, as found in the multilateral aid data.

6.3 Hidden effort with countercyclical aid

The optimal aid policy with hidden effort is to reward high output states with more aid in order to encourage more effort. This section analyses the impact on welfare from forcing donors to give countercyclical aid to countries with weak institutions, as suggested by Pallage, Robe and Berube (2006).

When effort is not observable and aid is not conditioned on observable output, the recipient government will exert the autarky level of effort. This is because the government is not

¹³I calibrate the model such that the autarky effort level is the lowest level of effort.

Table 10: Welfare analysis: Aid to GDP ratios required to give the same utility to the poor, with optimal and countercyclical aid

Aid to GDP ratio	
Optimal Aid	Countercyclical aid
6.1%	13.2%
10%	19.1%

rewarded for high output states, so it has no incentive to choose costly actions which increase the probability of high output states over the autarky effort level. Figure 14 plots the welfare of the donor from the optimal aid policy and the welfare from the optimal aid policy conditional on aid being non-procyclical. There is a welfare loss to the donor of around 8% from following countercyclical aid policies, for the empirically relevant region of promise utility.

I compute a compensated variation measure of welfare to give metric of the welfare costs of giving countercyclical aid to countries with opaque institutions. Table 10 shows the aid to GDP ratio required to give the poor the same level of welfare under the two policies. If a country has a 6.1% aid to GDP ratio (the average of below median transparency) the countercyclical aid policy requires the aid to GDP ratio to more than double in order to give the poor the same welfare. For an aid to GDP ratio of 10% the aid to GDP ratio required to deliver the same level of welfare is slight less than double at 19.1%.

This model suggests that giving countercyclical aid to countries with opaque institutions would actually be welfare reducing rather than welfare improving, and that it would be substantially more costly for the donor provide a given level of welfare to the poor under countercyclical policy. This is because the welfare benefits of smoothing out business cycle fluctuations is small relative to the welfare loss from the government exerting lower effort.

6.4 Business Cycle Moments

I simulate the model by averaging moments from 1000 simulations of 15 periods each, because the empirical moments are also computed over 15 year windows. The simulation moments are computed using the same method as the data moments. For the results below, the initial value of w_0 for each simulation is the value which maximises the donor's utility. Changing initial promise has very little impact on the results. This property enables the model to match the fact that the cyclical properties of aid flows are independent of the level of aid a country receives because the initial promise determines the level of aid a country receives.

Table 11: Benchmark Model Moments: Total ODA

	Data	Model	Data	Model
	Weak institutions	Hidden action	Good institutions	Full information
$\sigma(y)$	0.043	0.067	0.064	0.063
$\sigma(a)$	0.261	0.252	0.235	0.159
$\sigma(a')$	0.299	0.169	0.282	0
$\rho(a, y)$	0.418	0.377	-0.209	-0.468
$\rho(a', y)$	0.096	0.518	-0.158	0
$\rho(e, y)$		0.150		0.021

Table 11 presents the simulated moments of the benchmark model with hidden effort and compares them to the model with full information. The introduction of information causes the correlation between aid disbursements and GDP in the model to switch from procyclical (0.377) to countercyclical (-0.468). As institutions improve and the donor has better information about the actual effort of the recipient government, the correlation between aid and GDP decreases. In the data meanwhile, the correlation between aid and GDP is 0.418 for the countries opaque institutions and -0.209 for the countries with transparent institutions. The model with hidden effort predicts a positive relationship between aid commitments and GDP, as in the data. However, the predicted correlation between aid commitments and GDP is far too high, being 0.518 in the model and only 0.095 in the data. Also the model is unable to generate a negative correlation between aid commitments and GDP under full information. This is due to the tractability assumption of *i.i.d.* shocks. If shocks were persistent, then the correlation between aid commitments and GDP would also be negative for countries with transparent institutions.¹⁴

The volatility of output is approximately equal in both the full information and the hidden effort models, consistent with the empirical finding that output volatility is similar in countries with strong and weak institutions. However, aid flows are more volatile in the models with hidden effort. In the data, aid is also more volatile in countries with weak institutions, but not to the degree predicted by the model.

6.5 Sensitivity Analysis

This section conducts sensitivity analysis to study how the benchmark hidden effort model's quantitative predictions change when baseline parameters are changed. Table 12 shows the

¹⁴In numerical simulations for cases where the donor has a partially informative signal about recipient government effort, the results are between the full information and the hidden effort solutions. Currently solving the problem with partially informative signals increases the computation time significantly. I will update the paper with these results as they become available.

Table 12: Sensitivity Analysis

	$Corr(a, y)$	$Corr(w', y)$	$Corr(e, y)$	$SD(a)$	$SD(y)$	$SD(w')$
Baseline	0.377	0.518	0.150	0.252	0.065	0.011
$\phi = 0.8$	0.454	0.565	0.356	0.232	0.074	0.012
$\chi = 0.3$	0.419	0.561	0.379	0.188	0.075	0.012
$\theta = 0.52$	0.238	0.493	0.166	0.329	0.068	0.010
$\alpha = 0.6$	0.340	0.545	0.143	0.245	0.065	0.012
$\sigma = 0.85$	0.512	0.508	0.125	0.275	0.065	0.011
$\delta = 0.85$	0.374	0.506	0.160	0.227	0.067	0.011
$\beta = 0.5$	0.382	0.493	0.144	0.221	0.066	0.010
$\beta = 0.9$	0.037	0.554	0.152	0.143	0.065	0.013
$\beta = 0$	0.921	0	0.019	0.468	0.063	0

results.

Decreasing the marginal cost of aid, ϕ from 1 to 0.8 increases both the correlation of aid disbursements and commitments with GDP and the volatility of aid from the baseline. Because the marginal cost of aid is lower, more aid is given in high output states to encourage effort.

Increasing the weight on the cost of effort in the utility function χ from 0.2 to 0.3 increases the correlation between aid and GDP and the correlation between aid commitments and GDP. Because the cost of effort is higher for the recipient government, the donor must use the incentive mechanism of procyclical aid more strongly to encourage recipient government effort.

As the weight θ on the utility of the rich in the recipient government preferences increases from 0.5 to 0.52, the correlation between aid and GDP decreases relative to the benchmark. This is because the government has more incentive to choose higher effort, so that the donor does not need to use the incentive mechanism so strongly to encourage effort. This result is somewhat counterintuitive, in that one might think that a government that places a higher weight on the favoured subgroup would require a greater incentive to choose effort that benefits the poor.

Increasing the curvature parameter on consumption σ from 0.8 to 0.85 causes the correlation between aid and GDP to increase, while the correlation between aid commitments and GDP decreases. The decrease in the correlation of aid commitments and GDP is a direct result of the greater need to smooth the consumption of the poor over time given that they are more risk averse. However, in order to simultaneously maintain incentives for effort for the government, the correlation between disbursed aid and GDP increases.

Decreasing the discount rate of the donor, β from 0.7 to 0.5 has very little impact on the

correlation between aid and GDP and the correlation between aid commitments and GDP. Once the donors have a $\beta > 0$ they use aid commitments and disbursements by a roughly similar degree to encourage effort. However, moving β closer to one does have a significant impact on the model moments. Also table 12 show that for $\beta = 0.9$ the correlation between aid and GDP decreases to almost zero. All the incentive effects are being generated by changes in aid commitments. At the other extreme setting $\beta = 0$, only uses aid disbursements to encourage effort.

Finally increasing the returns to aid α from 0.5 to 0.6 causes the correlation between aid and GDP to decrease, as each unit of aid goes further in terms of creating incentives.

7 Conclusion

I have investigated why some countries receive procyclical ODA while others receive countercyclical ODA. I showed that the donor's ability to monitor the effort of the aid recipient government affects the cyclicity of aid using a case study and empirical results discussed at greater length in Banerjee (2009). In countries where government effort is transparent, aid is acyclical or countercyclical, while in countries where government effort is opaque, aid is procyclical.

I show that a dynamic model in which donor's use aid to elicit government effort can quantitatively explain many of the stylised facts of aid cyclicity. The model can explain why countries with transparent institutions receive countercyclical aid while countries with opaque institutions receive procyclical aid. The model is also consistent with the fact that the level of aid is uncorrelated with institutional quality.

The main failing of the model is that it predicts that the volatility of aid declines as institutions become more transparent. In the data, there is no relationship between aid volatility and institutional transparency. This result could be related to Celasun and Walliser (2008), who find that aid is unpredictable in countries with stable relationships with donors. The correlation between aid commitments and GDP is also too high in the model. Because aid commitments are measured in gross terms while the model measure is for net aid commitments, this shortcoming could potentially be due to the data. However, it could also be due to the assumption in the model of *i.i.d* shocks. If the conditional distributions functions for output were affected by persistent shocks, there would be a motive for donors to use aid commitments as insurance over persistent negative shocks, which would decrease the positive correlation between aid commitments and GDP for all countries, transparent and opaque.

References

- [1] Adam, C. and O'Connell, S (1999). *Aid, taxation and development in sub-saharan Africa* Economics and Politics 11(3) p.225-253.
- [2] Alesina, A. and Dollar, D. (2000). *Who gives foreign aid to whom and why?* Journal of Economic Growth 5 p.33-63.
- [3] Alesina, A. and Weder, B. (2002). *Do Corrupt Governments Receive Less Foreign Aid?* American Economic Review 92(4) p.1126-1137.
- [4] Arrellano, C., Bulir, A., Lane, T. and Lipschitz, L. (2009). *The dynamic implications of foreign aid and its variability* Journal of Development Economics 88 (2009) p. 87-102.
- [5] Azam, J. and Laffont, J. (2003). *Contracting for aid.* Journal of Development Economics 70 p.25-58.
- [6] Banerjee, R.N. (2009). *New evidence about the relationship between aid and institutions.* Mimeo.
- [7] Bulir, A and Hamann. J. (2003). *Aid volatility, an empirical assesment.* IMF Staff Papers 50(1) 64-89.
- [8] Bulir, A and Hamann. J. (2008). *Volatility of development aid: from the frying pan into the fire?.* IMF Working paper WP/06/65.
- [9] Celasun, O. and Walliser, J (2008). *Predictability of aid: do fickle donors undermine aid effectiveness?.* Economic Policy July 2008 pp. 545-594.
- [10] Chauvet, L. and Guillaumont, P. (2008). *Aid, volatility and growth again. When aid volatility matters and when it does not.* UN-WIDER Research Paper No. 2008/78.
- [11] Clemens, M., Radelet, S and Bhavani, R. (2004). *Counting Chickens when they hatch: The short term effect of aid on growth.* Center for Global Development Working paper Number 44.
- [12] Drazen, A and Easterly, W. (2001). *Do Crises Induce Reform? Simple Empirical Tests of Conventional Wisdom.* Economics and Politics 13(2) pp., 129-157.
- [13] Harrigan, J (1991). *Malawi* in Mosley, P, Harrigan, J and Toye, J. ed., Aid and Power. Routledge, London.

- [14] Kiakwama and Chevallier, (2001). *Democratic Republic of Congo*. in S. Devarajan, D. Dollar, D and Holgrem, T ed., *Aid and Reform in Africa*, (Washington: The World Bank)
- [15] Isham, J, Kaufmann, D and Prichett, L, H. (1997). *Civil Liberties, Democracy, and the Performance of Government Projects*. The World Bank Economic Review, 11(2) pp.219-242.
- [16] Kaufmann, D, Kraay, A. and Mastruzzi, M. (2008). *Governance Matters VII: Governance Indicators for 1996-2007* World Bank Policy Research June 2008.
- [17] Mosley, P, Harrigan, J and Toye, J. (1995). *Aid and Power 2nd edition Vol.1*. Routledge, London.
- [18] Mosley, P, Harrigan, J and Toye, J. (1995b). *Aid and Power 2nd edition Vol. 2*. Routledge, London.
- [19] Pallage, S and Robe, M. (2001). *Foreign aid and the business cycle*. Review of International Economics 9(4) 641-672.
- [20] Pallage, S and Robe, M. (2003). *On the Welfare Cost of Economic Fluctuations in Developing Countries*. International Economic Review 44(2) 677-698.
- [21] Pallage, S, Robe, M. and Berube, C. (2006). *The Potential of Foreign Aid as Insurance*. IMF Staff Papers 53(3).
- [22] Phelan, C and Townsend, R.M. (1991). *Computing Multi-period, Information Constrained Optima*. Review of Economic Studies 58(5), pp 853-881.
- [23] Rogerson, W. P. (1985). *Repeated Moral Hazard*. Econometrica, vol. 53(1), pages 69-76, January.
- [24] Spear, S.E. and Srivastava, S. (1987). *On repeated moral hazard with discounting*. Review of Economic Studies, 54(4), pp. 599-617.
- [25] Stier, M. and Mundt, R. J. (1998). *Is democracy stable? Compared to what?*. Mimeo, available at <http://www.stier.net/writing/demstab/stability.htm>
- [26] Svensson, J. (2000). *When is foreign aid policy credible? Aid dependence and conditionality*. Journal of Development Economics, 61, pp. 61-84.
- [27] World Bank (1998). *Assessing Aid: What Works, What Doesn't and Why* World Bank, Washington DC.

- [28] Wrong, M. (2001). *In the Footsteps of Mr. Kurtz: Living on the Brink of Disaster in the Congo*. Harper Collins, New York, USA.
- [29] Young, C. and Turner, T. (1985) *The Rise and Recline of the Zairian State*. The University of Wisconsin Press, Madison, Wisconsin, USA.

8 Figures

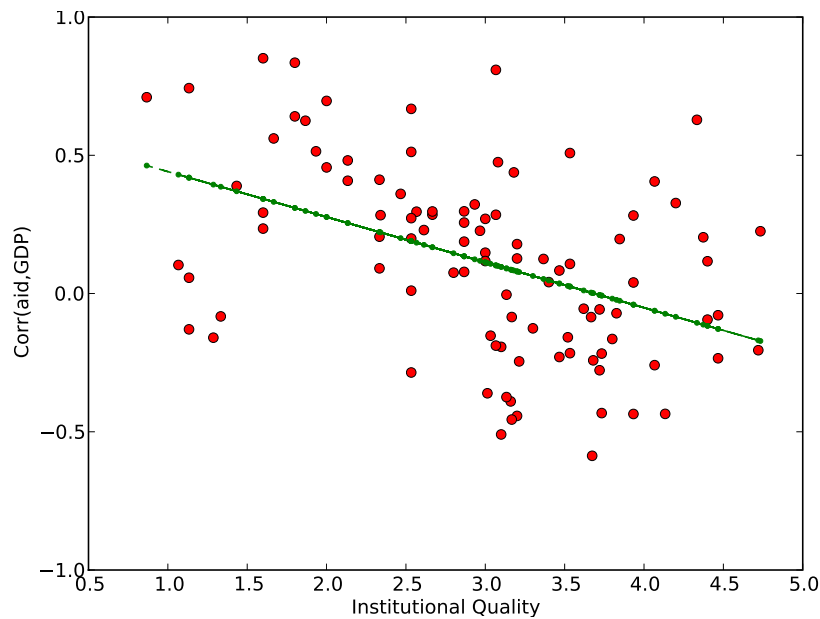


Figure 1: Total aid: Institutions plot against $\rho(aid, GDP)$

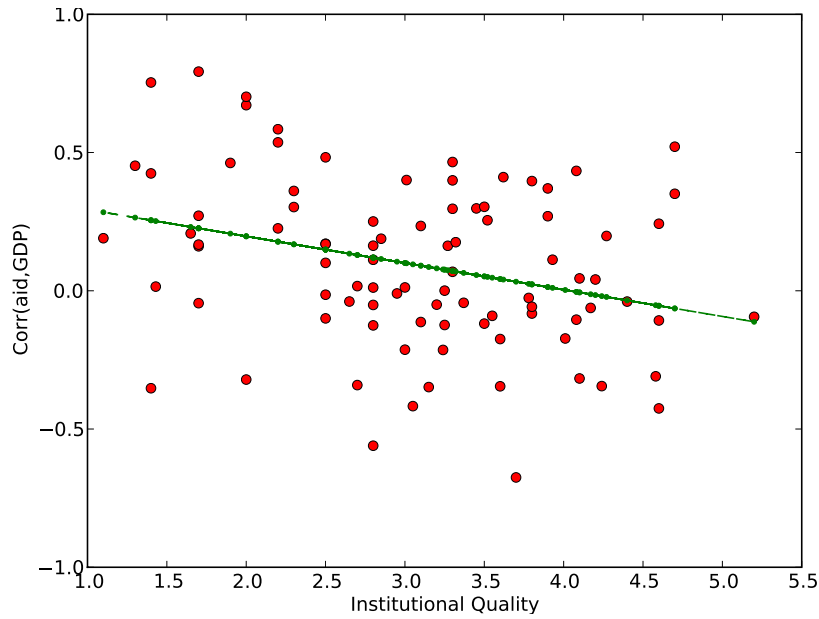


Figure 2: Multilateral aid: Institutions plot against $\rho(aid, GDP)$

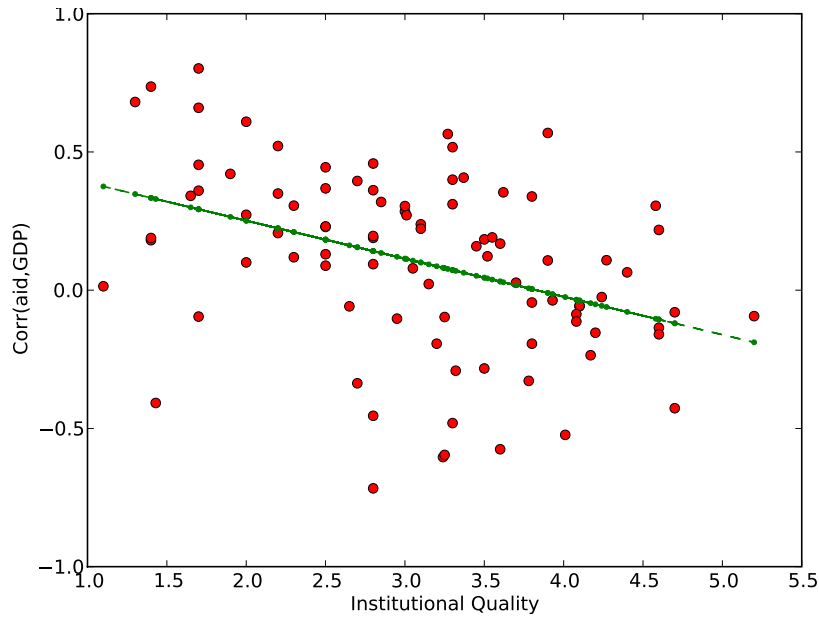


Figure 3: Bilateral aid: Institutions plot against $\rho(aid, GDP)$

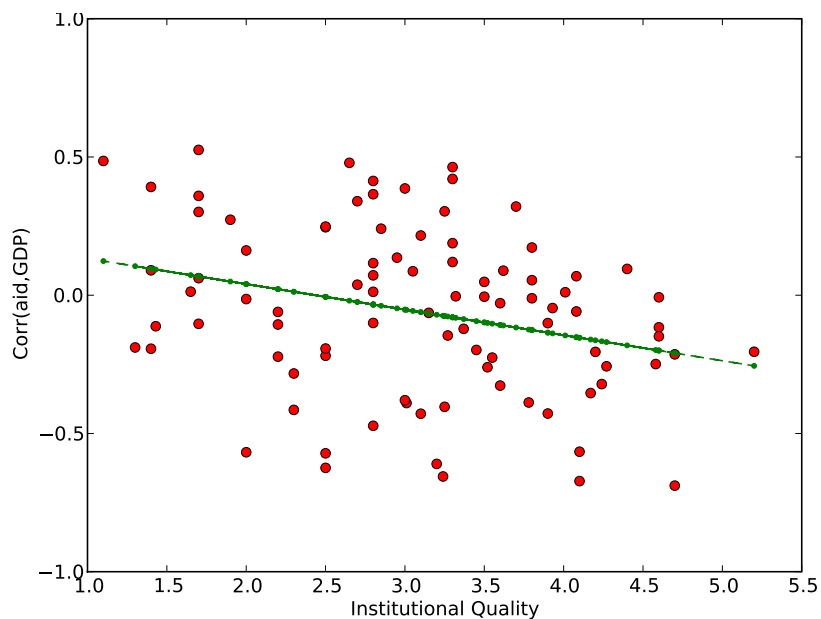


Figure 4: Multilateral commitments: Institutions plot against $\rho(aid_{t+1}, GDP_t)$

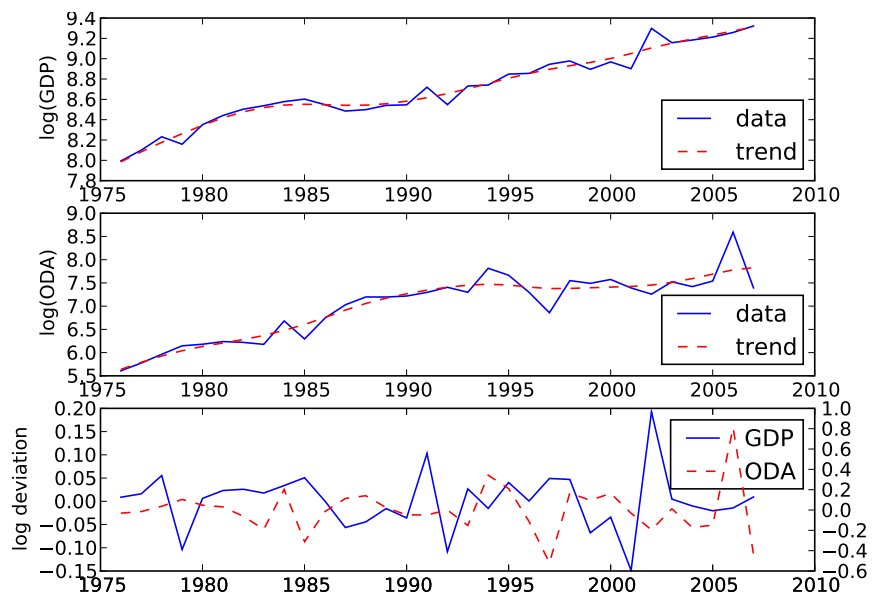


Figure 5: Malawi: GDP and ODA series with HP trend

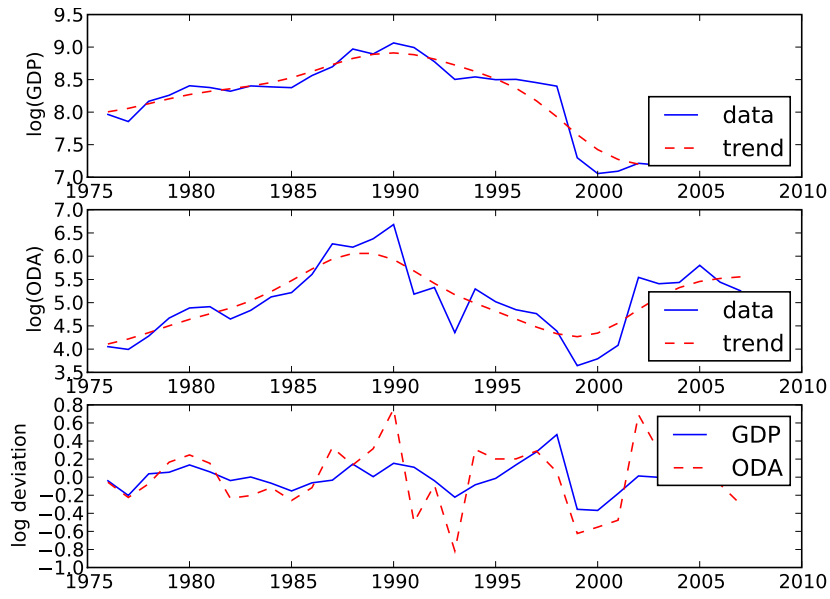


Figure 6: The Democratic Republic of the Congo: GDP and ODA series with HP trend

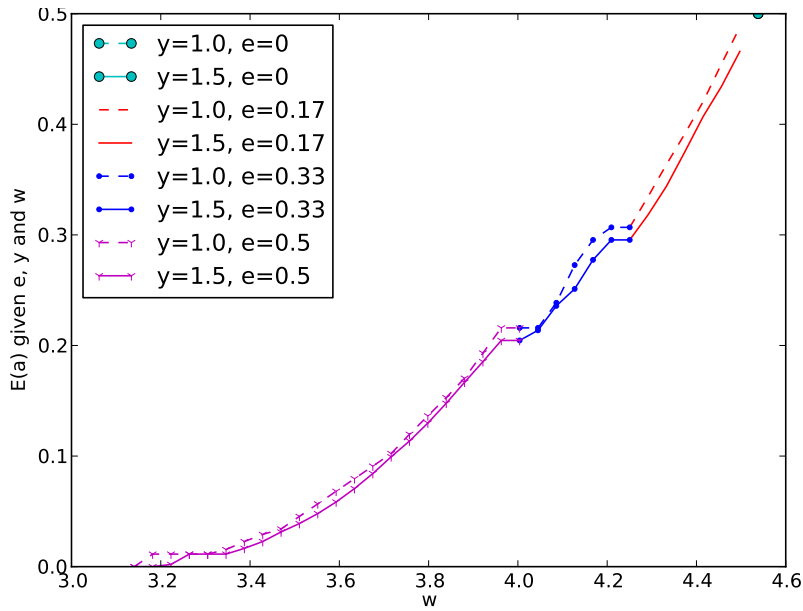


Figure 7: Optimal aid policy: Full information
Solid line: high output states, *Dashed* line: low output states

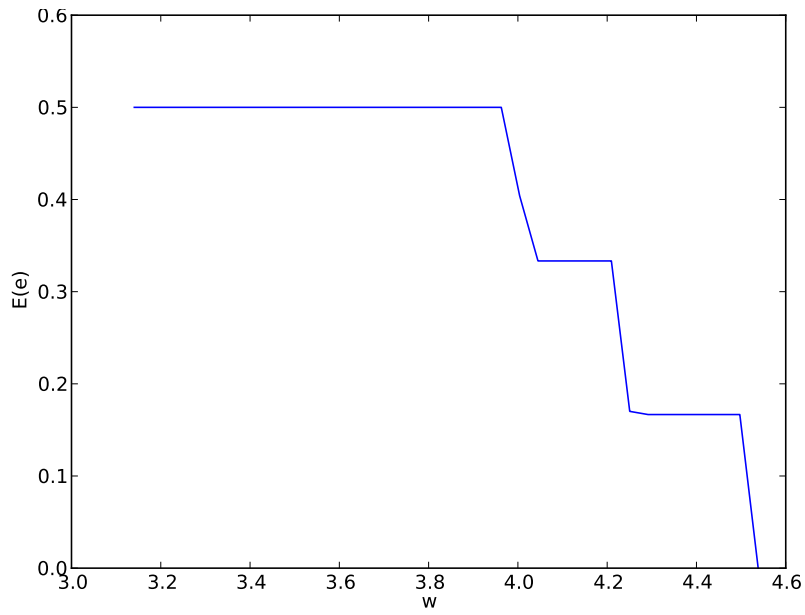


Figure 8: Effort: Full information

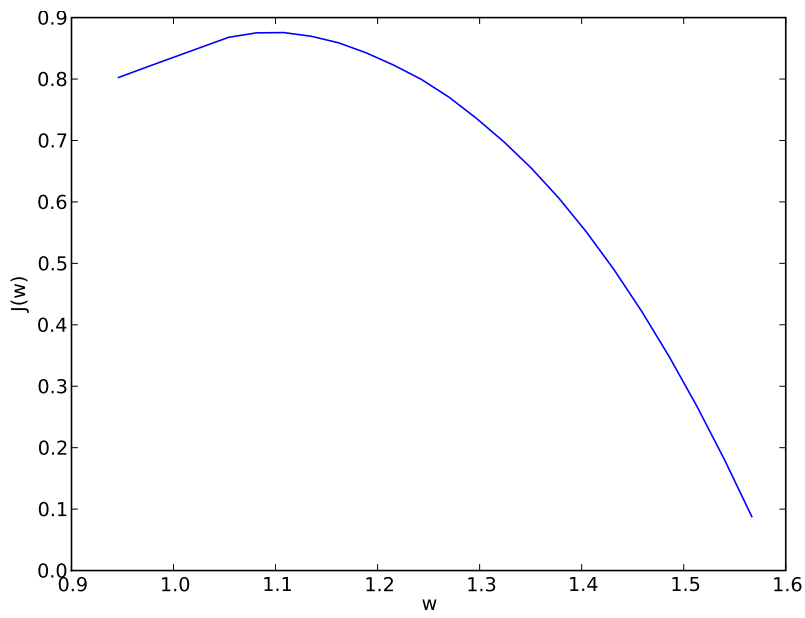


Figure 9: Donor utility: Full information

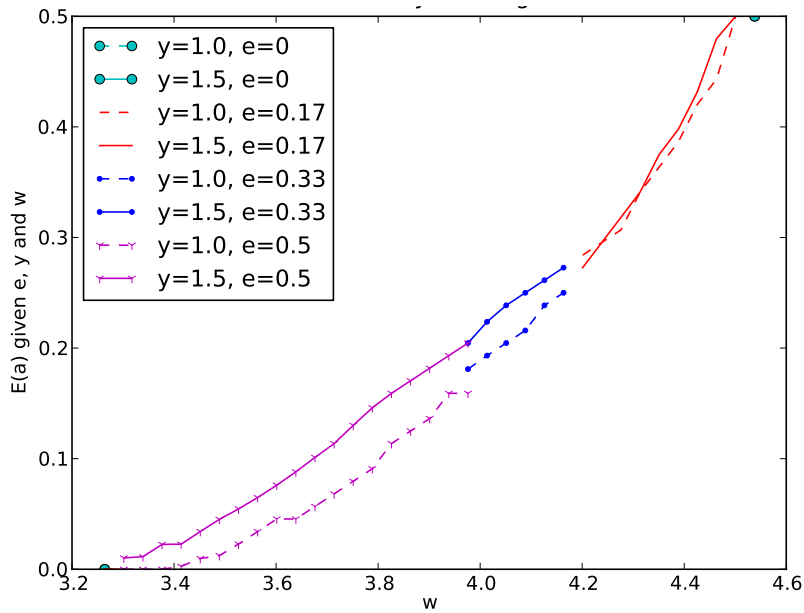


Figure 10: Optimal aid policy: Hidden action
Solid line: high output states, *Dashed* line: low output states

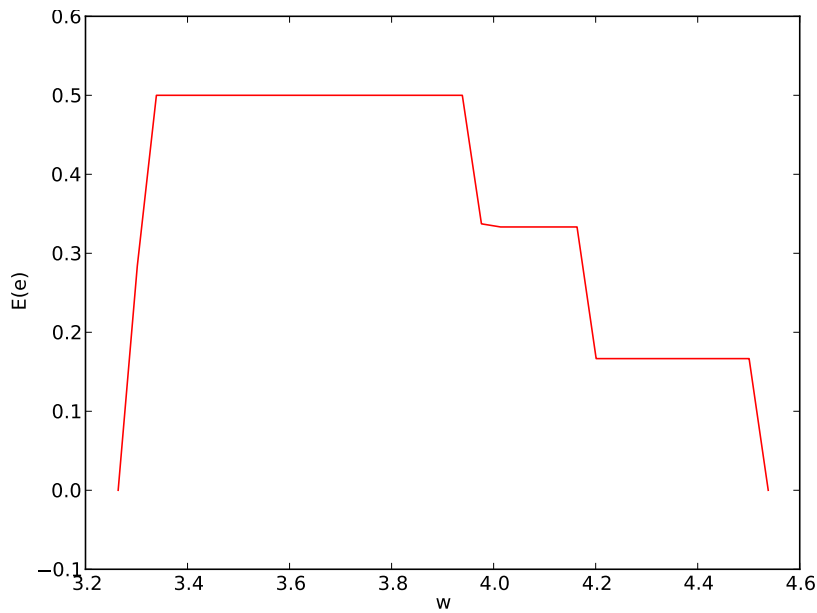


Figure 11: Effort: Hidden action

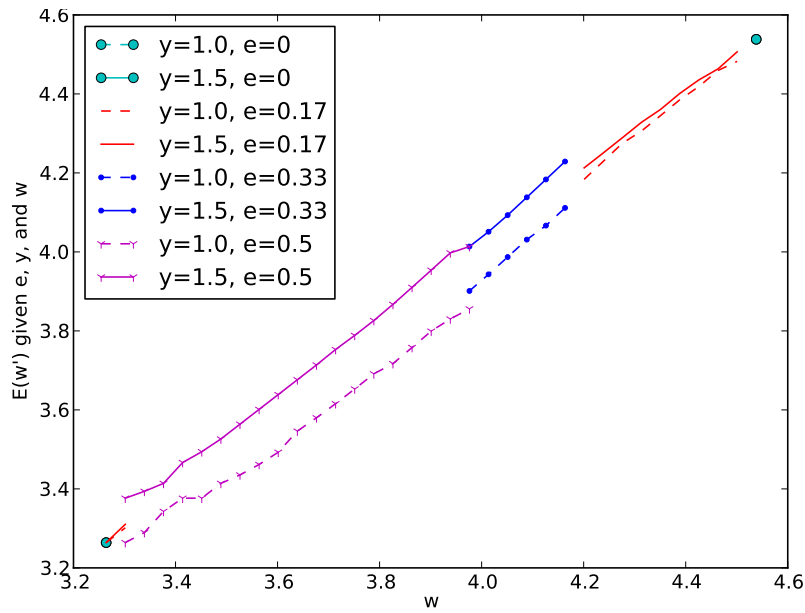


Figure 12: Promised utility: Hidden action
Solid line: high output states, *Dashed* line: low output states

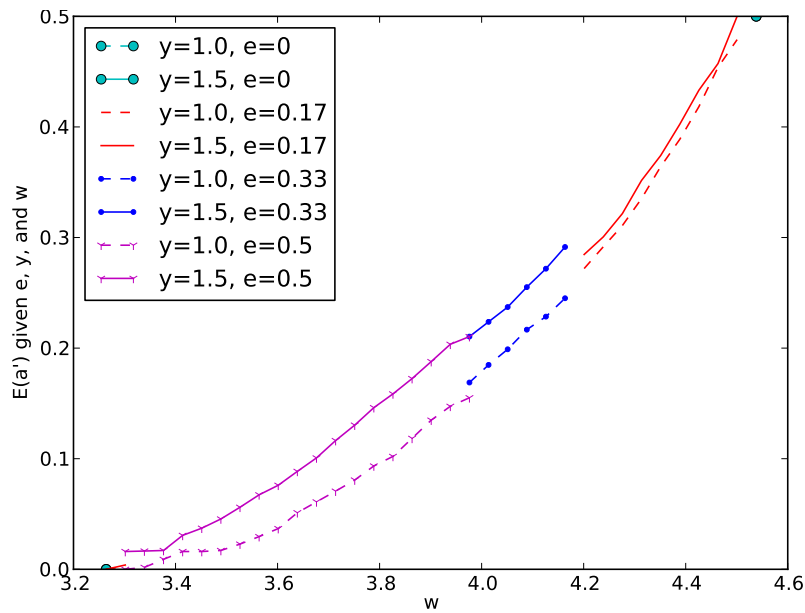


Figure 13: Promised aid: Hidden action
Solid line: high output states, *Dashed* line: low output states

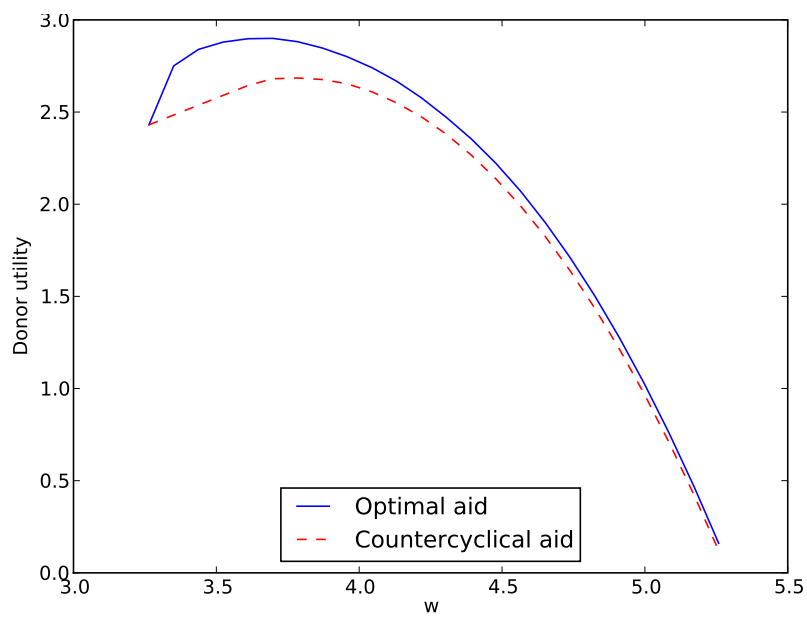


Figure 14: Donor utility, optimal vs. countercyclical aid