Can inflation targeting promote institutional quality in developing countries?

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Abstract: In a recent paper, Huang & Wei (2006, *Journal of International Economics* 70, 239-252) analyze the role of institutional quality in an Alesina-Tabellini setup with a Rogoff-style conservative banker. In particular, they "…cast doubts on the notion that a low inflationary framework can induce governments to improve public institutions" (p.239). Using a similar setup, but reversing the timing of the game, we show that inflation targeting *does* produce an incentive for governments to improve institutional quality. Some basic stylized facts support our theoretical results.

Keywords: Inflation Targeting; Institutional Quality; Financial Development; Fiscal Policy; Monetary Policy

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1. Introduction

In a recent paper, Huang & Wei (2006, *Journal of International Economics* 70, 239-252) present a very interesting model to examine the link between institutional quality and inflation in developing countries. They show notably that a Rogoff-style conservative central banker is a good prescription for such countries, and that the optimal degree of conservatism must be proportional to the quality of institutions. Furthermore, with endogenous institutional quality, they "*cast doubts on the notion that a low inflationary framework can induce governments to improve public institutions*" (p.239).

The purpose of this paper is to challenge the latter proposal, established only informally in Huang & Wei (2006) (henceforth H&W). Effectively, the proposition that a strict monetary regime does not induce governments to improve the quality of institutions is rather surprising, both empirically (see, for example, Al-Marhubi, 2000, who finds a significant positive association between inflation and alternative indicators of corruption) and theoretically, since in H&W model, the inflation-tax and the quality of institution are substitute ways of government finance (because stronger institutions increase the tax collection). Thus, low inflationary frameworks, conducting to low seigniorage revenues, should encourage government to improve the quality of institutions in order to increase tax resources.

More specifically, H&W use a two-step principal-agent setting, in which a "supra-authority" first sets the optimal degree of institutional quality, while the central bank and government determine equilibrium inflation and tax rates in the second step, taking institutional quality as given. H&W find two types of solutions for determining the level of effort in improving the quality of institutions: interior solutions and corner solutions. The authority bears the cost of the effort (θ, in H&W notations). If the cost is very high ($\theta \geq \overline{\theta}$) she has no incentive to devote any effort to strengthen institutions. On the opposite, if the cost is low ($\theta \leq \underline{\theta}$) she adopts the highest institutional quality. In both cases, only corner solutions for institutional quality can be obtained, so that, *apparently*, no relation can be found between the monetary regime and institutional quality. Nevertheless, this result may be questioned, because H&W do not wonder about the effect of the monetary regime on the thresholds $\underline{\theta}$ and $\overline{\theta}$. Furthermore, for intermediate values of the cost ($\underline{\theta} \leq \theta \leq \overline{\theta}$), an interior solution arises, but, in determining the optimal level of effort, H&W focus on the commitment case, and this procedure does not allow studying explicitly the effect of different monetary regimes (like inflation targeting or "conservative" monetary policy) on the quality of institutions.

In this paper, we explicitly address the question of how inflation targeting affects government's incentive to improve institutional quality, by modifying the principal-agent relationship in H&W setting. We consider that government can choose the degree of effort in the second step, and that the "supra-authority" (the principal) chooses the optimal inflation target in the first step, as in the standard principal-agent literature in monetary policy. By so doing, we are able to capture the effect of the monetary regime (inflation targeting or central bank conservatism) on the incentive to change institutions. In such a model, very close to H&W setting, we contradict H&W intuition and we show that a low inflation target *is* an efficient instrument to induce governments to strengthen institutions. This conclusion is supported by a short section in which we build on data on inflation targeting and show that countries having adopted inflation targeting have on average better institutions than other countries.

Moreover, our set-up exhibits two slight innovations compared to H&W. First, we introduce, together with the indicator of institutional quality, an indicator of financial development. Effectively, financial development can be a heavy drain for government finance, since a great part of the inflation tax is retrieved by the private financial sector (the tax on private deposits for example). This is the reason why seigniorage revenues are insignificant in developed countries, as illustrated by several simple correlations. Thus, we model monetary and fiscal policies symmetrically, with a "seigniorage flight" towards the private banking sector, and a "tax flight", due to weak institutions, from the public sector. Second, we introduce a social welfare function, which possibly differs from the government objective function. Indeed, we can suppose that the cost for modifying institutions is higher for a government in position, who may benefit from current institutions, than for society, who fully internalizes the benefit of enhancing institutions. In such a case, society, acting as the principal, must adopt tighter monetary regimes to encourage government to go further in reform programs, because he overvalues the cost of reform from a social welfare perspective.

Section 2 depicts several stylized facts and section 3 presents our basic setup; section 4 develops the commitment regime, while section 5 considers the discretionary solution with inflation targeting, and section 6 concludes.

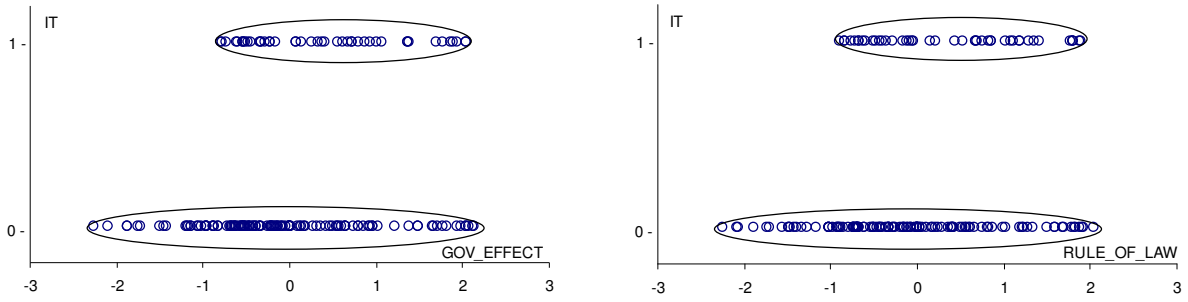
2. Inflation targeting and institutional quality: what do we learn from stylized facts?

Assessing the link between institutional quality and the monetary regime is a difficult task. In particular, this question raises several complex econometric problems (causality, data availability, the fact that central bank independence is often included in the quality of

institutions…), which are beyond the scope of this descriptive section and would deserve a separate paper.

To analyze the link between inflation targeting and institutional quality, we use data on inflation targeting from Cottarelli & Curzio (1997) and Sterne (2001), and construct the (dummy) variable IT, which equals 1 if a country is targeting inflation in 1998 (irrespective of the year when inflation targeting was introduced) and 0 if not.[1] To measure institutional quality, we use World Bank indicators for six Governance Indicators (control of corruption, government effectiveness, rule of law, political stability, regulatory quality and voice & accountability; higher values of indicators stand for better institutional quality, see *Appendix A* for descriptive statistics), developed by Kaufmann et al. (2007). *Figure 1* depicts the correlation between institutional quality (measured by "government effectiveness" or "rule of law" in 1998, horizontal axis; see *Appendix E* for the remaining governance indicators) and IT (vertical axis).

Figure 1 – Inflation targeting and institutional quality



The upper ellipses denote countries that use inflation targeting ($IT = 1$), while the lower ellipses assemble countries that lack inflation targeting ($IT = 0$). These figures suggest that countries that target inflation seem to present better institutional quality on average. *Table 1* below deepens this intuition with descriptive statistics and some simple tests. In this *Table*, for the considered institutional quality variables ("government effectiveness" and "rule of law"), we split countries in two sub-samples, with inflation targeting (GE1 or RL1, for $IT = 1$) and without (GE0 or RL0, for $IT = 0$). Remark that average values of institutional quality for inflation-targeting countries (0.411 and 0.391) overpass average values corresponding to countries that lack inflation-targeting (-0.062 and -0.123 respectively). As shown by low *p-values* into brackets for the mean equality tests, these differences are significant. Performing

[1] Our sample contains 45 countries that target inflation (see *Appendix D*) and 115 that do not. Among them, 39 adopted inflation targets before 1998, namely prior to the year when we measure institutional quality (1998).

the analysis on the median values yields the same result. Consequently, inflation targeting and institutional quality seem positively correlated.

Table 1 – Inflation targeting and institutional quality

	Tests	Gov_Effect	GE1	GE0	Rule_of_Law	RL1	RL0
Mean	*	0.072	0.411	-0.062	0.022	0.391	-0.123
Mean Equality Test	Anova F-stat	*	7.428 [0.007]		*	8.947 [0.003]	
Median	*	-0.169	0.337	-0.223	-0.148	0.434	-0.307
Median	Kruskal-Wallis	*	7.516 [0.006]		*	8.691 [0.003]	
Equality Tests	Van der Waerden	*	7.293 [0.007]		*	8.373 [0.004]	

p-values in square brackets

Alternatively, we can also evaluate the influence of IT on the quality of institution using the event analysis. Unfortunately, institutional quality indicators from Kaufmann et al. (2007) start only in 1996, while most countries in our sample adopted inflation targets before this date. To overcome this shortcoming, we use a different database for institutional quality, namely the PRS Group database, which contains 12 institutional quality indicators[2] for the period 1984-2005, in yearly frequency. Our sample is made up of 36 countries that target inflation (see *Appendix D*).

First, we normalize to zero the year in which a country decided to target inflation. Second, we compute (for each institutional quality indicator) the 10-years (or for all available years) average *before* and *after* the year when the inflation target was adopted.[3] Next, we aggregate the 12 averages (one per indicator) in a single index, using unweighted or weighted (weights are determined following a Principal Component Analysis) averages. Consequently, we obtain for each country two aggregated indexes, one for the period *before* and one for the period *after* IT adoption. Putting all countries together we get two series of 36 points, namely institutional quality before (IQB) and after (IQA) the event (the adoption of inflation target).

Table 2 presents the mean and the median of each series (IQA and IQB), with country-aggregated indicators obtained using unweighted or PCA-weighted means of the 12 indicators. On average, institutional quality indexes are higher in the period following the adoption of IT than before (IQA averages are superior to IQB averages). Simple equality tests for average (and median) show that these differences are significant. Once again, countries that target inflation seem to benefit from better institutional quality than countries that do not.

[2] The twelve indicators are: government stability, socioeconomic conditions, investment profile, internal conflict, external conflict, corruption, military in politics, religion in politics, law & order, ethnic tensions, democratic accountability and bureaucracy quality.

[3] The advantage of this method is that it focuses exclusively on the event of interest (in our case, the introduction of inflation targeting). Since countries have adopted inflation targets at different dates, this procedure lowers the importance of common factors (other than the event) that could have explained common trends.

Table 2 – Inflation targeting and institutional quality (event analysis)[4]

		IQ (unweighted)		IQ (PCA weighted)	
	Tests	IQA	IQB	IQA	IQB
Mean	*	5.517	4.786	5.689	4.979
Mean Equality Test	Anova F-stat	8.707 [0.004]		6.671 [0.012]	
Median	*	5.494	4.673	5.707	4.857
Median Equality Tests	Kruskal-Wallis	6.892 [0.009]		5.755 [0.016]	
	Van der Waerden	6.800 [0.009]		5.808 [0.016]	

p-values in square brackets

Although one should be of course cautious concerning causality,[5] simple stylized facts in this section are in line with the intuition that tighter monetary regimes, like the adoption of an inflation target, may be associated with an improvement in the quality of institutions.

3. The model

In this section we develop a model which allows studying the impact of the monetary regime (i.e. of the inflation target or of the degree of Central Bank conservatism) on the quality of institutions. All along the paper we adopt H&W notations, in order to directly compare our results to theirs. The model is based on Barro & Gordon (1983) and Alesina & Tabellini (1987). Output comes from a simple Lucas supply function, in which unexpected inflation can stimulate activity in equilibrium, but distortionary tax policies dampen aggregate supply:

$$y = \alpha\left(\pi - \pi^e\right) - \beta\tau \qquad (1)$$

π denotes the inflation rate (π^e is expected inflation), τ the tax rate and y the log of output. α and β are positive parameters.

In the government budget constraint, public expenditures (g) have to be financed by taxes on output (τ) and the inflation tax (π). As H&W, we consider that "weak" institutions may cause a leakage of tax revenues. Effectively, a low institutional quality is related to inefficient tax systems, with high collecting cost, "tax evasion" or corruption. The degree of

[4] The PCA analysis models the variance structure of a set of variables using linear combinations of variables. Among all principal components we focus on the one that explains the highest share of the total variance of the sample (usually the first component). We performed the PCA analysis on the whole sample, using the correlation matrix. The first principal component accounts for 63.93% of total variation of the 12 indicators. The (normalized) associated weights or loadings (that served to compute this principal component as a linear combination of the 12 indicators) are 1.06, 0.79, 1.03, 1.08, 0.85, 1.00, 1.06, 0.85, 1.01, 1.04, 1.04 and 0.82.

[5] The event analysis controls for global trends (since countries adopted IT at different times), but does not control for common events. For example, one could reasonably argue that the adoption of IT (in each country) was decided simultaneously with an institutional change, i.e. political changes. This issue should be tackled better if one is aiming at assessing causality.

institutional quality is $\phi \in [0,1]$, so that, as the private sector pays τ, government only collects $\phi\tau$. In addition, we also introduce a leakage in inflation-tax revenues. Indeed, in countries endowed with a large financial sector, most of seigniorage is recovered by private banks, and only the seigniorage collected on the monetary base (bank notes and bank reserves) is retrieved by monetary authorities. Thus, the degree of development of the banking sector (or, more largely, of the financial sector) may represent a "seigniorage flight" from central bank revenues. We introduce a coefficient $\eta \in [0,1]$ to capture the degree of financial development,[6] and we assume that the amount of inflation-tax collected by the central bank is $(1-\eta)\pi$. Less financially developed countries (low values of η) use extensively the inflation tax, while this way of government finance is marginal in more financially developed countries (high values of η).[7] Therefore, we can write the government budget constraint as:

$$g = \phi\tau + (1-\eta)\pi \tag{2}$$

As relation (2) clearly shows, we model monetary and fiscal policies symmetrically, with a "seigniorage flight" (η) towards the private banking sector, and a "tax flight" $(1-\phi)$ from the public sector.

The government's objective function depends on inflation, output and public goods:

$$V(\pi,\tau,f) = -\frac{1}{2}\left[\pi^2 + ky^2 + l\left(g-\bar{g}\right)^2\right] - \theta^g\left(f-1\right) \tag{3}$$

k (respectively l) is the weight placed on the stabilization of output (respectively public goods) relative to inflation.[8] In addition, we assume that government can modify the degree of institutional quality, by choosing the appropriate level of effort. As in H&W, we denote by $f \in \left[1, 1/\phi_0^2\right]$ the effort in strengthening institutional quality, and we suppose a simple relation between effort and the quality of institutions:

$$\phi = \phi_0\sqrt{f} \tag{4}$$

so that $\phi \in [\phi_0, 1]$, where ϕ_0 is the starting quality of institution. θ^g is the cost (per unit of effort) that government bears in attempting to improve the quality of institution.

[6] The coefficient η is closely related to the money multiplier (see Minea & Villieu, 2009).

[7] The negative association between the inflation tax and the level of financial development is well documented (see for example Boyd et al., 2001) and is also supported by empirical evidence in *Appendix 2*.

[8] As Alesina & Tabellini (1987) show, a positive target $\bar{g}$ on public expenditures is enough to produce an inflation bias, thus we suppose that government's (and society's) targets for inflation and output are normalized to zero.

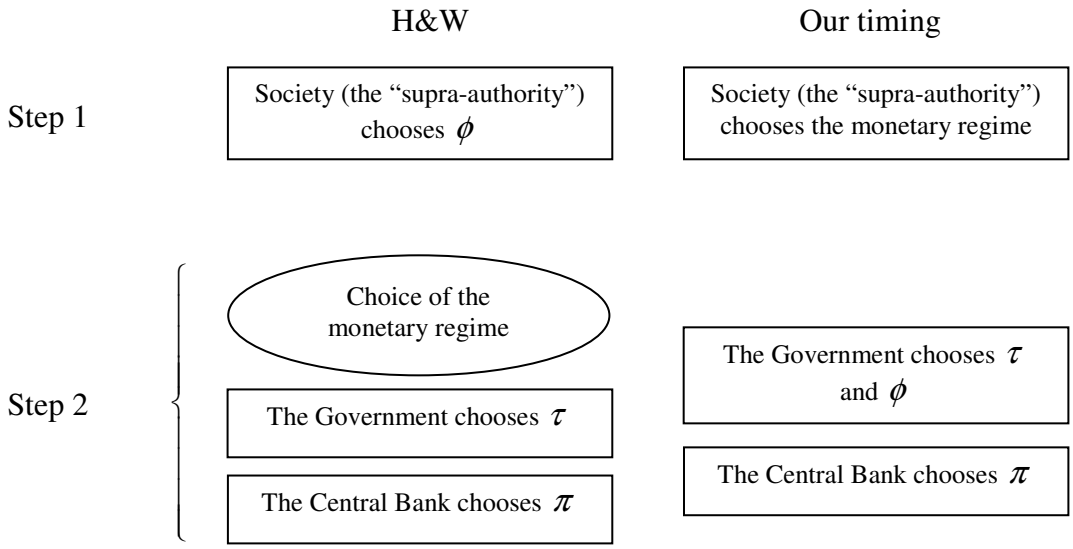
The objective function (3) differs from H&W, because the government chooses the level of effort and the tax-rate simultaneously, while institutional quality (ϕ) is given at the time government sets the tax rate in H&W setting. Effectively, H&W consider a two-step game. In the first step, a "supra-authority" (acting as the principal) chooses the appropriate level of effort that maximizes social welfare, and, in the second step, fiscal and monetary authorities choose the instruments that minimize their losses, subject to the predetermined level of effort.[9] In such a configuration, H&W cannot study the impact of alternative monetary regimes on the choice of the level of effort, because, at the time the monetary regime is chosen, the level of effort is predetermined.[10] We think this is the reason why they conclude, informally, that *"setting a low inflation level through inflation targeting or appointing a Rogoff-type conservative central banker would not by themselves induce the government to devote more effort to strengthen institutions"* (p.250). In our model we inverse H&W timing, and we suppose that the "supra-authority" chooses the monetary regime in the first step, and that government chooses the level of effort in improving the quality of institutions in the second step (see *Figure 1*). Notice that our model realistically describes the case of Supra-National Central Banks of Monetary Areas, as for example the WAEMU for African countries. In this case, we observe the presence of a "Supra-Authority" that plays first and chooses the monetary regime.

Thus, our model explicitly allows studying the effect of the monetary regime on the choice of institutions: at the time institutional quality is chosen, the monetary regime is predetermined, but the "supra-authority" acting as the Principal in the first step, can determine the optimal monetary regime in order to induce government to improve institutions in the second step.

[9] As usual in the literature, H&W use a backward-looking procedure to solve the model: tax and inflation rates are first chosen, the level of effort being given; then, the supra-authority, acting as the leader in the Stackelberg equilibrium, chooses the optimal level of effort. The analysis is based on Cukierman et al. (1992).

[10] Furthermore, H&W consider only the commitment case, and do not wonder about the degree of central bank conservatism that the principal should set, in order to induce government to choose the appropriate level of effort.

Figure 1 – The timing of the model



In addition, we introduce another innovation compared to H&W, by explicitly modeling the social welfare function, which can differ from the government objective function. Effectively, one can think that the cost for improving the quality of institutions is lower for society than for the government, who directly confronts with lobbies and with re-election difficulties. Furthermore, governments more often take advantage of established institutions and have little incentive to change the "rules of the game" (to improve institutions). Thus, let us write the social welfare function as:

$$W(\pi,\tau,f)=-\frac{1}{2}\left[\pi^2+ky^2+l\left(g-\overline{g}\right)^2\right]-\theta^*\left(f-1\right) \qquad (5)$$

where: $\theta^* \le \theta^g$. The distinction between θ^g and θ^* will play a significant role in determining the optimal inflation target in *section 5.3* below, but is unimportant as regards the main results of our paper, which trivially hold for $\theta^* = \theta^g$.

As in H&W, we consider a strategic game between the government, who chooses the tax-rate (and, in our setting, the level of effort) that maximizes V, the central bank, who chooses the inflation rate that maximizes V (or, equivalently, W) and the public, who has rational expectations. As usual, such a framework gives rise to a suboptimal equilibrium. Therefore, we introduce a "supra-authority" (the principal), who can modify the loss function of the central bank (the agent), by using inflation targeting, in order to maximize the social welfare function W. We distinguish between the commitment regime, in which the central bank is able to credibly commit to a specific inflation rate ($\pi^e = \pi$ *ex-ante*), and the discretionary regime, in which commitment is unfeasible ($\pi^e = \pi$ *ex-post* only).

4. The commitment regime

As H&W, we first describe the commitment regime. In this regime, the central bank internalizes the effect of the inflation rate on expectations, so that equilibrium output is simply $y = -\beta\tau$. The first order condition for monetary policy $\left(\frac{\partial V}{\partial \pi} = 0\right)$ is:

$$\pi + l(1-\eta)\left[\phi\tau + (1-\eta)\pi - \bar{g}\right] = 0 \tag{6}$$

Since government is not subject to time inconsistency, first order conditions for determining the tax-rate $\left(\frac{\partial V}{\partial \tau} = 0\right)$ and the level of effort $\left(\frac{\partial V}{\partial f} = 0\right)$ are the same under commitment or discretion:

$$\beta^2 k\tau + \phi l\left[\phi\tau + (1-\eta)\pi - \bar{g}\right] = 0 \tag{7}$$

$$l\phi'(f)\tau\left[\phi\tau + (1-\eta)\pi - \bar{g}\right] + \theta^g = 0 \tag{8}$$

We first describe the solution for exogenous institutional quality (i.e. without equation (8)), in the spirit of H&W, before examining the case of endogenous choice of effort.

4.1. The commitment solution with exogenous institutional quality

The commitment solution for inflation and taxes results from equations (6)-(7): $\pi^c = x^c \beta^2 kl(1-\eta)\bar{g}$ and $\tau^c = x^c l\phi\bar{g}$, where: $x^c \equiv \left[\phi^2 l + \left(1 + (1-\eta)^2 l\right)\beta^2 k\right]^{-1}$. For a given level of institutional quality (ϕ), these values are similar to H&W (for $\eta = 0$). We can see in particular that: $\pi^c\left(\underset{-}{\phi}, \underset{?}{\eta}\right)$ and $\tau^c\left(\underset{?}{\phi}, \underset{+}{\eta}\right)$. The impact of institutional quality on π^c and τ^c has been established by H&W (Proposition 1, p.243, with interpretation pp.243-245). Let us focus here on the impact of the financial development indicator (η). Since higher financial development means lower inflation-tax revenues, government must find another way of government finance, and increases the tax rate (for a given level of institutional quality), explaining why $\partial\tau^c / \partial\eta \leq 0$. At this stage, the effect of η on π^c is undetermined (but it will be negative with endogenous institutional quality, as we will see below). Indeed, a higher level of financial development reduces the inflation bias of monetary policy, but, simultaneously, weakens the efficiency of seigniorage collection (x^c increases), thus inducing

the central bank to increase the rate of inflation. If the degree of financial development is "large enough" however, the former effect overcomes the latter, and $\partial \pi^c / \partial \eta \leq 0$.

4.2. Commitment with endogenous institutional quality

The value of effort in the commitment regime can be obtained from equations (6)-(7)-(8), namely, if we abstract from corner solutions:[11]

$$f^c = \left[\beta l \phi_1 \overline{g} - \left(1 + l\left(1-\eta\right)^2\right) \beta^2 k \right] / \phi_0^2 l \tag{9}$$

where $\phi_1 \equiv \phi_0 \sqrt{k / 2\theta^g}$. This solution corresponds to the optimal level of effort chosen by the "supra-authority" in H&W (for $\eta = 0$). In the present setting, the level of effort chosen by government is not necessarily optimal for society, because government objective can differ from social welfare (if $\theta^* \neq \theta^g$), even in the commitment solution.

Furthermore, the value of effort under commitment positively depends on the level of financial development: $f^c\left(\underset{+}{\eta}\right)$. Thus, a higher level of financial development encourages government to improve the quality of institutions. Effectively, in financially developed countries, seigniorage is low and governments must increase effort to improve tax collection.

With endogenous institutional quality, first order conditions (7) and (8) of the government program can by themselves determine the value of equilibrium public spending, independently of monetary policy: $g^c = \overline{g} - \beta k / l \phi_1$. The inflation rate comes from the first order condition of the central bank (6): $\pi = -l\left(1-\eta\right)\left(g^c - \overline{g}\right)$. Thus, the commitment solution with endogenous institutions is:

$$\left.\begin{aligned} &\pi^c = \beta k \left(1-\eta\right) / \phi_1 \\ &\tau^c = \phi_0 \left(f^c\right)^{0.5} / \beta \phi_1 \Rightarrow y^c = -\left(f^c\right)^{0.5} \sqrt{2\theta^g / k} \\ &g^c = \overline{g} - \beta k / l \phi_1 \end{aligned}\right\} \tag{10}$$

Therefore, under commitment, the equilibrium inflation rate negatively depends on the degree of financial development, and positively on the cost of institutional reform: $\pi^c\left(\underset{+}{\theta^g}, \underset{-}{\eta}\right)$, with opposite results concerning the equilibrium rate of output taxation: $\tau^c\left(\underset{-}{\theta^g}, \underset{+}{\eta}\right)$. These results have a simple interpretation: higher financial development increases the efficiency of

[11] Corner solutions will be analyzed in the inflation-targeting case below.

tax collection relative to seigniorage, while higher cost of institutional reform leads the central bank to use seigniorage intensively, since weak institutions cause a leakage in tax collection.

5. Discretionary regime and inflation targeting

In the discretionary regime, government still maximizes V, without any change in first order conditions (7) and (8), since fiscal policy is not subject to time inconsistency, while the central bank maximizes V (or equivalently W), taking expectations as given. Such a regime gives rise to an inflation bias due to the time inconsistency of monetary policy $\left(\pi^d \geq \pi^c\right)$, but the tax rate is lower than in the commitment regime $\left(\tau^d \leq \tau^c\right)$. Furthermore, social welfare in the discretionary regime is lower than under commitment (see H&W Proposition 3, p.245, for a formal proof). To solve the time inconsistency problem of monetary policy, H&W suggests appointing a conservative central banker. Such a central banker maximizes:

$$V^S\left(\pi,\tau,f\right) = -\frac{1}{2}\left[S\pi^2 + ky^2 + l\left(g-\overline{g}\right)^2\right] - \theta^g\left(f-1\right) \qquad (11)$$

where the appropriate degree of conservatism S is chosen *ex-ante* by a supra-authority in a simple principal-agent setting (see Rogoff, 1985). H&W show that the optimal degree of conservatism (for $\eta = 0$ and exogenous ϕ) is: $S^* = 1 + \alpha\phi/\beta > 1$.

In this paper, we use a different solution to the problem of time inconsistency of monetary policy, based on inflation targeting. In a deterministic framework, like the present one, both inflation targeting and conservative central banker approaches can reproduce the commitment solution, as it is well known. Nevertheless, in stochastic frameworks, a conservative central banker distorts the optimal response of monetary policy to supply shocks, and gives rise to a flexibility-versus-credibility trade-off. On the contrary, an inflation targeting solution (comparable to an optimal contract *à la* Walsh, 1995, see, e.g., Svensson, 1997), provides the commitment solution, without distorting the response to shocks. In the present deterministic framework, the distinction is quite artificial, but in a more general setting with supply shocks, the optimal inflation target we find here would still be valid, while the optimal degree of conservative would not.[12] In addition, in exploring empirical evidences, some data on inflation targeting are available, while there is little evidence about the degree of central bank conservatism (see our *section 2* above).

[12] Of course, inflation targeting may raise specific issues, in link with contract implementation or renegotiation (see Maskin & Moore, 1999, for example). But such incentive problems may also emerge in the delegation game with conservative central bankers. See Cukierman (2008) for a recent survey on central bank independence.

5.1. Inflation targeting with exogenous institutional quality

Let us suppose that the supra-authority, acting as the principal, can force the central bank (the agent) to maximize the following objective:

$$\tilde{V}(\pi,\tau,f)=-\frac{1}{2}\left[(\pi-\tilde{\pi})^2+ky^2+l(g-\bar{g})^2\right]-\theta^g(f-1) \tag{12}$$

where $\tilde{\pi}$ is the inflation target determined by the principal, which the central bank and government regard as exogenous. In the discretionary regime, first order condition (6) becomes:

$$\pi-\tilde{\pi}-\alpha k\beta\tau+l(1-\eta)\left[\phi\tau+(1-\eta)\pi-\bar{g}\right]=0 \tag{13}$$

The discretionary regime generates a bias in monetary policy, because the central bank attempts to stimulate economic activity, while equilibrium output $(y=-\beta\tau)$ is independent of the inflation rate. This credibility bias is depicted by the term $\alpha k\beta\tau$.

Using equation (7), we find the values of inflation and taxes in the discretionary regime with inflation targeting, for a given level of institutional quality:

$$\pi^d=x^d\left[kl\beta\left[\alpha\phi+\beta(1-\eta)\right]\bar{g}+\left(\beta^2k+l\phi^2\right)\tilde{\pi}\right] \tag{14}$$

$$\tau^d=x^dl\phi\left[\bar{g}-(1-\eta)\tilde{\pi}\right] \tag{15}$$

where: $x^d=\left[l\phi^2+\left(1+l(1-\eta)^2\right)\beta^2k+l(1-\eta)\alpha\beta k\phi\right]^{-1}$. The optimal inflation target, which reproduces the commitment solution (with given institutional quality), is:

$$\tilde{\pi}^c=-\alpha\beta k\tau^c=-x^c\alpha\beta kl\phi\bar{g} \tag{16}$$

so that: $\tau^d=\tau^c$ and $\pi^d=\pi^c$.

A number of observations can be made. First, the inflation target $\tilde{\pi}^c$ is negative,[13] due to the positive inflation bias in discretionary monetary policy. Thus, the equilibrium inflation rate (14) is lower in the presence of inflation targeting. Second, the equilibrium tax rate (15) is higher in the presence of inflation targeting, since the discretionary tax-rate is too low, compared to the commitment one. This positive impact of inflation targeting on the tax-rate will be all the bigger as the level of financial development η is low. Third, contrary to H&W result concerning the optimal degree of central bank conservatism, the inflation target is not linearly related to the quality of institutions. Effectively, $d\tilde{\pi}^c/d\phi>0$ if

[13] This will also be the case for the optimal target with endogenous institutional quality in *section 4.3*.

$\phi > \bar{\phi} \equiv \sqrt{\left(1+l\left(1-\eta\right)^2\right)\beta^2 k / l}$ and $d\tilde{\pi}^c / d\phi < 0$ if $\phi < \bar{\phi}$. This property comes from the effect of institutional quality on τ. In (13), we can see that the incentive to generate inflation surprises depends on the equilibrium level of output $\left(-\beta\tau\right)$. A higher level of institutional quality improves the return of tax collection, allowing government using lower rates of output taxation, for a given level of public expenditures. Simultaneously, higher institutional quality induces government to increase public expenditures. If the latter effect dominates the former $\left(\phi < \bar{\phi}\right)$, taxes increase, so does the inflation target (in absolute value) in (16): monetary policy must be more restrictive to offset the higher inflation bias. In the opposite case $\left(\phi > \bar{\phi}\right)$, the inflation target must be released. Finally, we can remark that $\partial\tilde{\pi}^c / \partial\eta \leq 0$ in (16). Effectively, as we have seen, a higher degree of financial development (a lower η) induces government to increase taxes, thus reducing the equilibrium level of output $\left(-\beta\tau\right)$. Yet, as usual, the incentive to generate inflation surprises negatively depends on the equilibrium level of output (in deviation from its target, which is zero in our model), explaining why a more rigorous inflation target is necessary.

5.2. The effect of inflation targeting on institutional quality

In our setting, the inflation target $\tilde{\pi}^c$ in (16) is not optimal, since institutional quality ϕ is endogenous. Let us now compute the optimal level of effort. Using relations (7), (8) and (13) with inflation targeting, the optimal degree of institutional quality is determined in the following implicit relation:

$$\beta\phi_1 l\left[\bar{g} - \left(1-\eta\right)\tilde{\pi}\right] = l\phi^2 + \left(1+l\left(1-\eta\right)^2\right)\beta^2 k + l\left(1-\eta\right)\alpha\beta k\phi \qquad (17)$$

which is a second degree polynomial $\phi^2 + A\phi + B = 0$, with $A \equiv \left(1-\eta\right)\alpha\beta k > 0$ and $B \equiv -\beta\phi_1\left[\bar{g} - \left(1-\eta\right)\tilde{\pi}\right] + \left(1+l\left(1-\eta\right)^2\right)\beta^2 k / l \leq 0$. Let us distinguish interior solutions and corner solutions. As in H&W, we can find an interior solution if $\theta \in \left[\underline{\theta}, \bar{\theta}\right]$, with upper and lower bounds to be defined below. In this case, we can easily verify that this second degree polynomial has only one positive solution:[14]

$$\phi^d = \frac{1}{2}\left[-A + \left(A^2 - 4B\right)^{0.5}\right] \qquad (18)$$

[14] Since $A > 0$. Moreover, to obtain a positive solution $\phi > 0$, B must be negative, because $\phi^2 + A\phi = -B$.

where the degree of effort is: $f^d = \left(\phi^d\right)^2 / \phi_0^2$. From equation (18), we can immediately notice that effort in improving the quality of institution negatively depends on the inflation target:

$$\frac{d\phi^d}{d\tilde{\pi}} = -\frac{dB}{d\tilde{\pi}}\left(A^2 - 4B\right)^{-0.5} = -\frac{\beta\phi_1(1-\eta)}{A + 2\phi^d} < 0 \Rightarrow \frac{df^d}{d\tilde{\pi}} < 0 \tag{19}$$

The lower the inflation target is, the higher the effort in improving the quality of institutions will be. Therefore, by the way of inflation targeting, tight monetary policies induce the government to increase institutional quality. This result, which contradicts H&W intuition, can be easily interpreted: with a more stringent inflation target (a lower $\tilde{\pi}$), the government must find another way of government finance, and is encouraged to increase efforts in order to augment tax collection, including institutional reform. Such a result does not occur in H&W because they do not analyze the effect of the monetary regime on the choice of institutional quality, since, in their setup, the level of institutional quality is a predetermined variable at the time the optimal degree of central bank conservatism $\left(S^*\right)$ is chosen. Thus, our result does not rely on inflation targeting strictly speaking, but also works for a conservative central banker: the higher the degree of central bank conservatism, the higher the effort of government in improving the quality of institutions (see *Appendix 1*).

Let us now turn our attention to corner solutions. As H&W, we suppose that $1 \le f \le 1/\phi_0^2$, and we compute from (17) the values of thresholds $\bar{\theta}$ (such as $f = 1$) and $\underline{\theta}$ (such as $f = 1/\phi_0^2$), according to the inflation target:

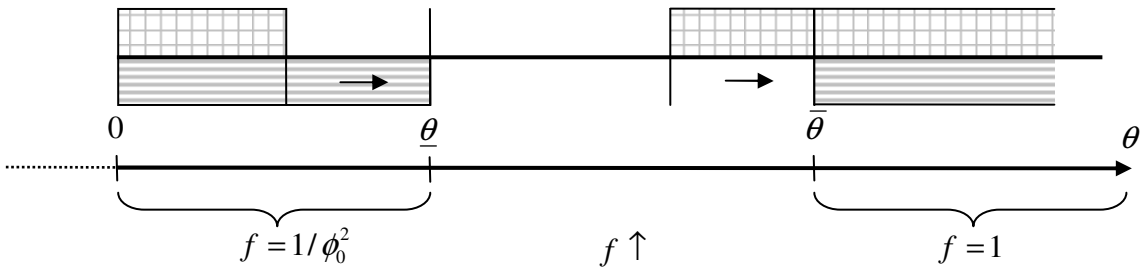
$$\left.\begin{aligned} \bar{\theta} &= \frac{k}{2}\left[\frac{\left[\bar{g} - (1-\eta)\tilde{\pi}\right]\beta l\phi_0}{\left(1 + l(1-\eta)^2\right)\beta^2 k + l\phi_0\left[\phi_0 + (1-\eta)\alpha\beta k\right]}\right]^2 = \bar{\theta}\left(\tilde{\pi}\right) \\ \underline{\theta} &= \frac{k}{2}\left[\frac{\left[\bar{g} - (1-\eta)\tilde{\pi}\right]\beta l\phi_0}{\left(1 + l(1-\eta)^2\right)\beta^2 k + l\left[1 + (1-\eta)\alpha\beta k\right]}\right]^2 = \underline{\theta}\left(\tilde{\pi}\right) \end{aligned}\right\} \tag{20}$$

If $\theta^g \ge \bar{\theta}$, government has no incentive to improve institutional quality, since the cost of reform is too high. The effort takes its minimal value $(f = 1)$, so does the quality of institutions $(\phi = \phi_0)$. If $\theta^g \le \underline{\theta}$, on the contrary, institutions become "perfect" $(\phi = 1)$, whatever the monetary regime is. Thus, as in H&W, there is a threshold level for the cost $\left(\bar{\theta}\right)$, above which the monetary regime is irrelevant for the quality of institutions. This joins related

evidence from Cukierman et al. (2002), showing that tighter monetary institutions and inflation are negatively linked only when initial institutions (political or law indicators) are above a certain level. On the other hand, if the cost is below the threshold level $\underline{\theta}$, institutions are good irrespective of the monetary regime.

However, in our setting, contrary to H&W, both thresholds depend on the monetary policy regime (i.e. on the inflation target value). Effectively, if the inflation target becomes more stringent ($\tilde{\pi}$ decreases), both thresholds increase in equation (20), thus reducing the interval in which effort is minimum $\left(f=1\right)$ and increasing the interval in which effort takes its maximal value $\left(f=1/\phi_0^2\right)$. Therefore, our model contradicts H&W intuition in three directions. A low inflation target, *i*) shortens the range of values of the cost θ^g (say, $\left[\overline{\theta},+\infty\right)$) for which government in not induced to undertake institutional reform, *ii*) extends the range of values of the cost θ^g for which the quality of institutions is maximum (say, $\left[0,\underline{\theta}\right]$), and *iii*) increases the incentive to improve institutions in the intermediate range of values $\left(\left[\underline{\theta},\overline{\theta}\right]\right)$ (since, for interior solutions, $d\phi^d/d\tilde{\pi}<0$).

Figure 2 – Impact of a tighter inflation target (decrease in $\tilde{\pi}$)



5.3 The optimal inflation target

To determine the optimal inflation target with endogenous institutional quality in our standard principal-agent framework, we first compute the equilibrium values of output, inflation and public expenditures, according to the value of the inflation target in the discretionary regime, by reintroducing (17) into (14) and (15): $y^d=-\phi^d/\phi_1$, $\pi^d=\tilde{\pi}+k\left[\alpha\phi^d+\beta\left(1-\eta\right)\right]/\phi_1$ and $g^d=\overline{g}-\beta k/l\phi_1$. The level of institutional quality $\left(\phi^d\right)$

comes from equation (18) in the discretionary regime with inflation targeting.[15] Then, we compute the value of the social welfare in this regime, by reintroducing these values in (5):

$$W(\tilde{\pi}) = -\frac{\theta^g}{k\phi_0^2}\left[\left(\phi_1\tilde{\pi} + k\left[\alpha\phi^d + \beta(1-\eta)\right]\right)^2 + \left(\frac{\theta^g + \theta^*}{\theta^g}\right)k\left(\phi^d\right)^2 + \frac{k^2\beta^2}{l}\right] + \theta^* \qquad (21)$$

so that:

$$\frac{dW}{d\tilde{\pi}} = -\frac{2\theta^g}{k\phi_0^2}\left[\left(\phi_1 + \alpha k\frac{d\phi^d}{d\tilde{\pi}}\right)\left(\phi_1\tilde{\pi} + k\left[\alpha\phi^d + \beta(1-\eta)\right]\right) + k\phi^d\left(\frac{\theta^g + \theta^*}{\theta^g}\right)\frac{d\phi^d}{d\tilde{\pi}}\right] \qquad (22)$$

Let us call $\tilde{\pi}^*$ the optimal inflation target, namely the value that maximizes $W(\tilde{\pi})$. $\tilde{\pi}^*$ is the solution of $\frac{dW}{d\tilde{\pi}}(\tilde{\pi}^*) = 0$, provided that $\frac{d^2W}{d\tilde{\pi}^2}(\tilde{\pi}^*) < 0$, namely:

$$\tilde{\pi}^* = -\left[\alpha k\phi^d + \left(\theta^g - \theta^*\right)\frac{\beta}{2\theta^g}k(1-\eta)\right]/\phi_1 \qquad (23)$$

and the associated inflation rate is:

$$\pi^d = \beta k(1-\eta)\left(\theta^g + \theta^*\right)/2\phi_1\theta^g \qquad (24)$$

If the social welfare function is identical to the government's objective function $\left(\theta^g = \theta^*\right)$, the optimal inflation target is: $\tilde{\pi}^* = \alpha k y^d$, such that the inflation rate is equal to the commitment solution $\left(\pi^d = \beta k(1-\eta)/\phi_1 = \pi^c\right)$. Consequently, from relation (17), output and taxes reach their corresponding values under commitment: $y^d = y^c$ and $\tau^d = \tau^c$. In this case, the commitment solution of *section 4* is optimal from a social welfare perspective, and the inflation target solution is similar to *section 5.2*, but with endogenous institutions.

However, if the cost of institutional reform for society is lower than what endures government $\left(\theta^* < \theta^g\right)$, the inflation target (23) have to be more stringent: $\tilde{\pi}^* < \alpha k y^d$, and the associated inflation rate is lower: $\pi^d = \beta k(1-\eta)\left(\theta^g + \theta^*\right)/2\phi_1\theta^g < \pi^c$. Effectively, the inflation target has to be defined in order to induce government to increase efforts in improving institutions, since he overvalues the cost of reform, from a social welfare perspective.

Notice that equation (23) only provides an implicit solution for $\tilde{\pi}^*$, because ϕ^d depends on $\tilde{\pi}^*$ in relation (18). Fortunately, by reintroducing (23) into (17), we are able to extract an explicit solution for institutional quality:

[15] We are only interested in interior solutions.

$$\left(\phi^*\right)^2 = \beta\phi_1\overline{g} + \left(\theta^g - \theta^*\right)\frac{\beta^2}{2\theta^g}k\left(1-\eta\right)^2 - \left(1+l\left(1-\eta\right)^2\right)\beta^2 k/l \tag{25}$$

as for the optimal effort (we focus on interior solutions):

$$f^* = \left[\beta l\phi_1\overline{g} + \left(\theta^g - \theta^*\right)\frac{\beta^2}{2\theta^g}kl\left(1-\eta\right)^2 - \left(1+l\left(1-\eta\right)^2\right)\beta^2 k\right]/\phi_0^2 l \tag{26}$$

By comparing this relation to (9), we can immediately verify that: $f^* \geq f^c$ if $\theta^g \geq \theta^*$, with the same interpretation as above: in accordance with intuition, if society bears less difficulty than government in improving institutions, she must adopt tighter monetary regimes to encourage government to go further in reform programs.

6. Conclusion

In this paper, we modify Huang & Wei (2006) model in order to capture the effect of the monetary regime on institutional quality. We show that financial development encourages government to increase effort in improving the quality of institutions. Consequently, countries with higher levels of financial development have on average higher taxes and lower inflation (or money growth) rates. In addition, our model contradicts H&W intuition, concerning the effect of the monetary regime on institutional quality. With reversed timing of the game, we show that a lower inflation target provides an incentive for government to increase his level of effort in improving the quality of institutions. Therefore, tighter inflationary frameworks *do* enhance the quality of institutions. These theoretical results are in line with several stylized facts, emphasizing that countries that target inflation present on average better institutional quality than countries that do not. Moreover, our theoretical model can reproduce the existence of a positive correlation between financial development or institutional quality indicators and taxes, and a negative association between these indicators and inflation or money growth, in accordance with evidence from data.

Future research could allow for endogenous financial development and introduce economic growth (based on productive public spending, for example), in order to study the optimal financing trade-off. Furthermore, it would be interesting to derive the welfare function from a model with optimizing agents and to extend our analysis to other monetary regimes (exchange-rate pegs or currency boards, for example).

Appendix 1: The impact of central bank conservatism on the quality of institutions

With a conservative central banker who maximizes (10), only FOC (6) is modified:

$$S\pi - \alpha\beta k\tau + l(1-\eta)\left[\phi\tau + (1-\eta)\pi - \bar{g}\right] = 0 \qquad \text{(A1)}$$

Using $\phi S\pi = \beta k\left[\alpha\phi + \beta(1-\eta)\right]\tau$, we find the discretionary solution: $\tau^d = z^d l\phi S\bar{g}$ and $\pi^d = z^d \beta k\left[\alpha\phi + \beta(1-\eta)\right]\bar{g}$, where : $1/z^d = S\left(\beta^2 k + l\phi^2\right) + (1-\eta) l\beta k\left[\alpha\phi + \beta(1-\eta)\right]$. For a given value of effort (thus exogenous institutions), we have: $\pi^d\left(\underset{-}{S}\right)$ et $\tau^d\left(\underset{?}{S}\right)$, as in H&W. To determine the optimal value of effort, we still have the relation: $\beta^2 k\tau^2 = 2\theta^g f$, so that:

$$\beta\phi_1 lS\bar{g} = S\left(\beta^2 k + l\phi^2\right) + (1-\eta) l\beta k\left[\alpha\phi + \beta(1-\eta)\right] \qquad \text{(A2)}$$

Eq. (A2) is still a second order polynomial in ϕ (namely $\phi^2 + A\phi + B = 0$), with only one positive solution, namely: $\phi^d = \frac{1}{2}\left[-A + \left(A^2 - 4B\right)^{0.5}\right]$, with $A \equiv (1-\eta)\alpha\beta k / S > 0$ and $B \equiv -\beta\phi_1\bar{g} + \beta^2 k/l + (1-\eta)^2 \beta^2 k/S \le 0$. We can verify that institutional quality (or, equivalently, effort to improve institutions) positively depends on the degree of central bank conservatism. Effectively, remark that $dA/dS < 0$ and $dB/dS < 0$, thus:

$$\frac{d\phi^d}{dS} = \frac{1}{2}\left[-\frac{dA}{dS} + \left(\frac{A\frac{dA}{dS} - 2\frac{dB}{dS}}{\left(A^2 - 4B\right)^{0.5}}\right)\right] = \frac{1}{2}\left[-\frac{dA}{dS} + \left(\frac{A\frac{dA}{dS} - 2\frac{dB}{dS}}{A + 2\phi}\right)\right] = \frac{-1}{A + 2\phi}\left[\phi\frac{dA}{dS} + \frac{dB}{dS}\right] > 0$$

The more conservative the central bank, the higher the government's incentive to undertake institutional reforms.

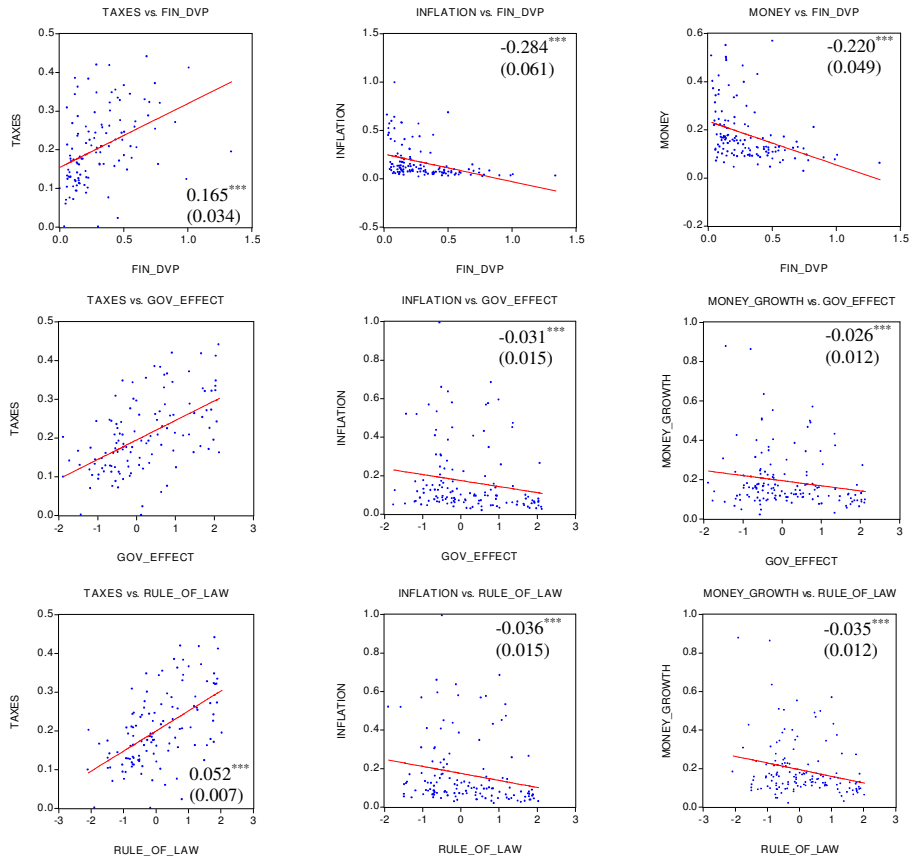
Appendix 2: Simple correlations between financial development, institutional quality, taxes and money

We illustrate two types of correlations: first, between financial development, taxes and inflation (or money growth); second, between different indicators of institutional quality, taxes and inflation (or money growth). We use annual data for 160 developing and developed countries, and we compute the 1975-1998 averages of variables "tax revenues in % of GDP" (source GFS), year-to-year change in "consumer prices" (inflation) and in "money M2" respectively (source IFS). To capture the degree of "financial development", we use the average value of "private credit by deposit money banks to GDP" from IFS. Finally, to measure institutional quality, we use World Bank indicators for six Governance Indicators

(control of corruption, government effectiveness, rule of law, political stability, regulatory quality and voice & accountability), developed by Kaufmann et al. (2007). We consider the value of these indicators in 1998, in accordance with data for the other variables (since they are rather stable in time, using another year does not qualitatively change our results). Higher values of indicators stand for better financial development and institutional quality (see *Appendix A* for descriptive statistics).

Simple correlations depicted in *Figure 3* suggest that countries with higher level of financial development or better institutional quality have on average higher taxes and lower inflation and money growth rates, in line with our model.

Figure 3 – Several simple correlations



Coefficients come from the OLS estimation (the slope of the line), with standard error in brackets and *** stands for 1% significance level. All results are established for money growth and inflation rates inferior to 100%, for illustration issues (using the whole sample makes our results even more robust). We measure institutional quality with two indicators: "government effectiveness" and "rule of law" (results for the other governance indicators lead to similar conclusions and are detailed in *Appendix C*). In accordance with our theoretical conclusions, countries with a higher level of financial development or better institutional quality use on average more taxes and less monetary financing (measured by inflation or money growth). In addition, slopes for monetary policy variables are still negative and significant when using *log* transformation of inflation and money growth (see *Appendix B*) to deal with the absence of normality of their distributions (Sarrel, 1996).

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NOT TO BE PUBLISHED (FOR REFEREES): APPENDICES A TO E

Appendix A – Descriptive statistics

	Taxes	Money	Inflation	Fin. Dvp.	Corr.	Gov.	Law	Political	Regul.	Voice
Min.	0.04%	1.90%	1.92%	0.39%	-1.909	-2.269	-2.251	-3.076	-2.992	-2.039
Max.	47.1%	1473%	1430%	134%	2.290	2.131	2.036	1.434	1.928	1.626
Mean	20.5%	44.3%	82.3%	29.2%	0.048	0.072	0.022	-0.017	0.051	0.007
Median	19.2%	15.2%	10.8%	21.0%	-0.225	-0.169	-0.148	0.071	0.156	-0.052

Appendix B – Financial development, institutional quality, taxes and monetary policy

Financial development, taxes and monetary policy

	Taxes	Inflation	Money	Log(Inflation)	Log(Money)
Constant	0.154*** (0.013)	0.255*** (0.024)	0.256*** (0.019)	-1.619*** (0.107)	-1.507*** (0.076)
Fin. Dvp.	0.165*** (0.034)	-0.284*** (0.061)	-0.220*** (0.049)	-1.858*** (0.273)	-1.175*** (0.198)
Adj. R2	0.1648	0.1418	0.1281	0.2647	0.2070
Fisher	23.5 [0.00]	21.8 [0.00]	20.2 [0.00]	46.4 [0.00]	35.2 [0.00]

Institutional quality (government effectiveness), taxes and monetary policy

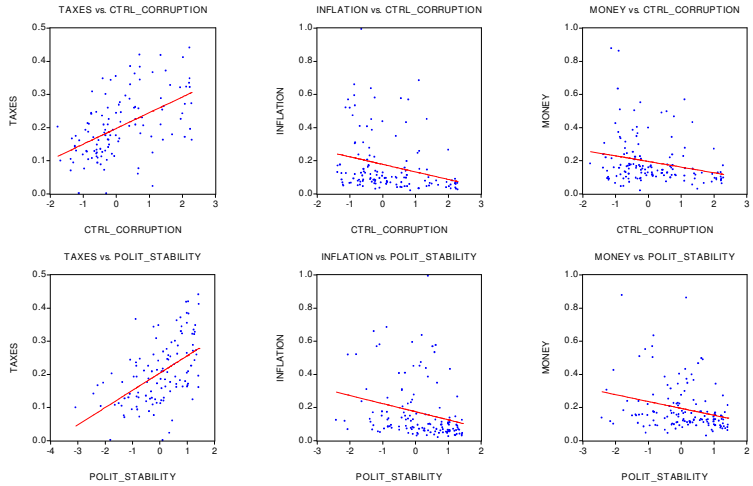
	Taxes	Inflation	Money	Log(Inflation)	Log(Money)
Constant	0.195*** (0.007)	0.175*** (0.015)	0.194*** (0.012)	-2.139*** (0.073)	-1.849*** (0.053)
Gov. Effect.	0.050*** (0.007)	-0.031** (0.015)	-0.026** (0.012)	-0.239*** (0.073)	-0.122** (0.053)
Adj. R2	0.2909	0.0232	0.0250	0.0687	0.0301
Fisher	49.4 [0.00]	4.16 [0.04]	4.62 [0.03]	10.8 [0.00]	5.38 [0.02]

Institutional quality (rule of law) taxes and monetary policy

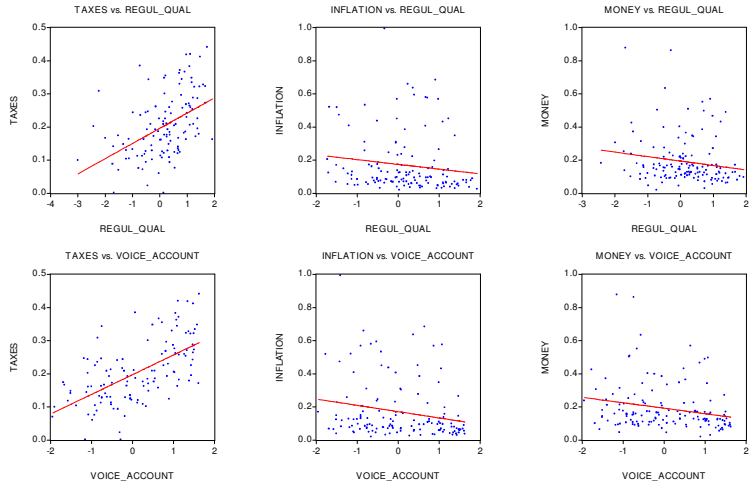
	Taxes	Inflation	Money	Log(Inflation)	Log(Money)
Constant	0.200*** (0.007)	0.175*** (0.015)	0.194*** (0.012)	-2.140*** (0.072)	-1.850*** (0.052)
Rule of Law	0.052*** (0.007)	-0.036** (0.015)	-0.035*** (0.012)	-0.272*** (0.073)	-0.158*** (0.052)
Adj. R2	0.3012	0.0332	0.0495	0.0877	0.0546
Fisher	51.9 [0.00]	5.57 [0.02]	8.34 [0.00]	13.8 [0.00]	9.14 [0.00]

*** and ** denote 1% and 5% significance respectively; standard error in round brackets, p-value in square brackets

Appendix C – Institutional quality (remaining indicators), taxes and monetary policy



	Taxes	Inflation	Money	Log(Infl.)	Log(Money)	Taxes	Inflation	Money	Log(Infl.)	Log(Money)
Constant	0.198***	0.178***	0.195***	-2.128***	-1.845***	0.1204***	0.174***	0.195***	-2.152***	-1.184***
	(0.008)	(0.015)	(0.012)	(0.071)	(0.052)	(0.007)	(0.016)	(0.012)	(0.071)	(0.049)
Ctrl. Corr.	0.047***	-0.046***	-0.034***	-0.305***	-0.164***					
	(0.007)	(0.015)	(0.012)	(0.069)	(0.051)					
Polit. Stab.						0.052***	-0.049***	-0.041***	-0.331***	-0.182***
						(0.008)	(0.017)	(0.012)	(0.078)	(0.054)
Adj. R2	0.2690	0.0611	0.0502	0.1222	0.0635	0.2786	0.0558	0.0630	0.1139	0.0692
Fisher	44.4 [0.00]	9.65 [0.00]	8.46 [0.00]	19.5 [0.00]	10.6 [0.00]	46.2 [0.00]	8.81 [0.00]	10.3 [0.00]	18.0 [0.00]	11.3 [0.00]



	Taxes	Inflation	Money	Log(Infl.)	Log(Money)	Taxes	Inflation	Money	Log(Infl.)	Log(Money)
Constant	0.196***	0.174***	0.194***	-2.142***	-1.850***	0.197***	0.171***	0.192**	-2.171***	-1.860***
	(0.008)	(0.016)	(0.012)	(0.201)	(0.053)	(0.007)	(0.015)	(0.012)	(0.073)	(0.051)
Regul. Qual.	0.046***	-0.029*	-0.027**	-0.228***	-0.129**					
	(0.008)	(0.017)	(0.013)	(0.084)	(0.059)					
Voice. Acc.						0.059***	-0.038**	-0.033***	-0.218***	-0.171***
						(0.007)	(0.016)	(0.012)	(0.075)	(0.053)
Adj. R2	0.2098	0.0128	0.0206	0.0462	0.0266	0.3584	0.0361	0.0419	0.0529	0.0630
Fisher	32.3 [0.00]	2.73 [0.10]	3.96 [0.05]	7.44 [0.01]	4.86 [0.03]	66.9 [0.00]	5.99 [0.02]	7.16 [0.01]	8.43 [0.00]	10.5 [0.00]

*** and ** denote 1% and 5% significance respectively; standard error in round brackets, p-value in square brackets

Appendix D – Countries that adopted inflation targets (up to 1998, see Sterne, 2001),

Malaysia, Tanzania, Mauritius, Slovakia, Croatia, Georgia, Kazakhstan, Kyrgyz, Slovenia;
New Zealand (1988), Greece (1990), Chile (1991), Egypt (1991), India (1991), Canada (1991), Israel (1991), Uganda (1992), Indonesia (1992), Poland (1992), United-Kingdom (1992), Guyana (1993), Nigeria (1993), Vietnam (1993), Russia (1993), Australia (1993), Finland (1993), Sweden (1993), Bangladesh (1994), Ecuador (1994), Mexico (1994), Peru (1994), France (1994), Spain (1994), Uruguay (1995), Zambia (1995), Italy (1995), Jamaica (1996), Sierra Leone (1996), Mongolia (1997), Romania (1997), China (1998), Kenya (1998), Turkey (1998), Czech Republic (1998), Korea (1998)

Appendix E – Inflation targeting and institutional quality

	Tests	Ctrl. of Corr.	CC1	CC0	Polit. Stab.	PS1	PS0
Mean	*	0.048	0.309	-0.055	-0.017	0.180	-0.097
Mean Equality Test	Anova F-stat	*	4.184 [0.042]		*	2.637 [0.106]	
Median	*	-0.225	-0.010	-0.246	0.071	0.160	-0.050
Median Equality Tests	Kruskal-Wallis	*	3.525 [0.061]		*	1.532 [0.216]	
	Van der Waerden	*	4.054 [0.044]		*	1.923 [0.166]	

Control of Corruption (CC), Political Stability (PS)
Index 1 (0) indicates the presence (absence) of inflation targeting; p-values in square brackets

	Tests	Regul. Qual.	RQ1	RQ0	Voice&Account.	VA1	VA0
Mean	*	0.051	0.396	-0.086	0.007	0.203	-0.069
Mean Equality Test	Anova F-stat	*	8.060 [0.005]		*	2.463 [0.119]	
Median	*	0.156	0.397	0.030	-0.052	0.369	-0.119
Median Equality Tests	Kruskal-Wallis	*	7.041 [0.008]		*	2.152 [0.142]	
	Van der Waerden	*	6.935 [0.009]		*	2.704 [0.100]	

Regulatory Quality (RQ), Voice & Accountability (VA)
Index 1 (0) indicates the presence (absence) of inflation targeting; p-values in square brackets