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TOWARD A POLITICAL ECONOMY OF MACROECONOMIC THINKING

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ABSTRACT

This paper investigates, in a simplified macro context, the joint determination of the (incorrect) perceived model and the equilibrium. I assume that the model is designed by a self-interested economist who knows the true structural model, but reports a distorted one so as to influence outcomes. This model influences both the people and the government; the latter tries to stabilize an unobserved demand shock and will make different inferences about that shock depending on the model it uses. The model's choice is constrained by a set of autocoherence conditions that state that, in equilibrium, if everybody uses the model then it must correctly predict the moments of the observables. I then study, in particular, how the models devised by the economists vary depending on whether they are "progressive" vs. "conservative".

The predictions depend greatly on the specifics of the economy being considered. But in many cases, they are plausible. For example, conservative economists will tend to report a lower keynesian multiplier, and a greater long-term inflationary impact of output expansions. On the other hand, the economists' margin of manoeuver is constrained by the autocoherence conditions. Here, a "progressive" economist who promotes a Keynesian multiplier larger than it really is, must, to remain consistent, also claim that demand shocks are more volatile than they really are. Otherwise, people will be disappointed by the stabilization performance of fiscal policy and reject the hypothesized value of the multiplier. In some cases, autocoherence induces the experts to make, loosely speaking, ideological concessions on some parameter values. The analysis is illustrated by empirical evidence from the Survey of Professional Forecasters.

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1 Introduction

The formation of expectations plays a key role in our understanding of the macroeconomy. Historically, economists have moved from a naive, mechanical representation of expectations to a more sophisticated one, where rational agents optimally use their information to forecast the future.

To be able to do so, agents need to use a model, which allows them to compute the expectations of the relevant variables that they need in order to make their decisions. Typically, in the rational expectations literature, it is assumed that one uses the correct model.

In practice, though, the "correct model" is unknown, and, to the extent that it is inevitably an abstraction, the concept of "correct model" is probably meaningless. Instead, we observed different models produced by different economists. Depending on the model one is using, one will act differently.

This issue has been recognized by the recent literature, which studies what happens if , instead of being in rational expectations equilibrium (REE), the economy settles at a self-confirming equilibrium (SCE), where people use an incorrect model to formulate their policies and expectations (Essential here is Sargent (2008)). In an SCE, the model is compatible with the available data; but if people were to deviate from their optimal policies and experiment with off-equilibrium paths, their beliefs would be invalidated.

In such a world, economists have substantial influence over macroeconomic outcomes: they can manipulate them by designing their theory appropriately. This influence comes from two ingredients. First, unlike the physical world, in the economy the equilibrium outcome depends on the theory, because the theory is used by the agents to decide on their actions. Second, the data do not allow to distinguish between alternative models, despite that these alternative models have important and contradictory policy implications.[1]

Of course, no economist will ever concede that he or she is motivated by a political or personal agenda. Instead, they would argue that they are pursuing truth in a disinterested fashion. Yet it is not difficult to find a correlation between an economist's personal and political background and the nature of his vision. For example, the respective visions of the working of the macroeconomy by Keynes and Hayek fit well with their political preferences.

This does not mean that the expert can say anything he wants. The models been produced must be "credible", in that their predictions fit the data. But, if the expert is influential, the data will themselves reflect the fact that people use his model to make their decisions. I define a model as "autocoherent" if, conditional on people using it to form expectations, it replicates the joint distribution of the observables. In other words, use of the model by all agents support a self-confirming equilibrium (but the same model could be defeated if, say, only a fraction of the people use it. Hence it is of some use to distinguish between autocoherence, a property of the model, and self-confirming-ness, a property of the equilibrium). A natural restriction to impose on a model is to be autocoherence. Otherwise, people will eventually abandon it.

This paper investigates, in a simplified macro context, the joint deter-

[1] King and Watson (1994) show how the same time series on inflation and unemployment can be credibly interpreted in either a "keynesian" or a "monetarist" light. Friedman (1966) points out that a model is only identified within a given specification, and therefore that no amount of data will suffice to identify the true model, as the dimension of the space of possible specifications is infinite.

mination of the prevailing model and the equilibrium. I assume that the model is designed by an economist who has his own preferences and knows the true structural model. This model influences both the people and the government; while the people need to know future prices and can just use the distribution of these prices to form expectations, the government tries to stabilize an unobserved demand shock and will make different inferences about that shock depending on the model it uses. People care about output stability but also the stability of government spending. The greater the loss from government spending volatility, the more "conservative" the individual. I then study how the models devised by the economists varies depending on whether they are "progressive" vs. "conservative".

In the present paper, there is a single expert who sets the theory (intellectual monopoly). In related work (2011b), I also study the case of intellectual competition, when several schools design different models, and each of them influences only a fraction of the population.

The predictions depend greatly on the specifics of the economy being considered. But in many cases, they are plausible. For example, conservative economists will tend to report a lower Keynesian multiplier, and a greater long-term inflationary impact of output expansions. On then other hand, the economists' margin of maneuver is constrained by the autocoherence conditions. Here, a "progressive" economist who promotes a Keynesian multiplier larger than it really is, must, to remain consistent, also claim that demand shocks are more volatile than they really are. Otherwise, people will be disappointed by the stabilization performance of fiscal policy and reject the hypothesized value of the multiplier. In some cases, autocoherence induces the experts to make, loosely speaking, ideological concessions on some parameter values. In Saint-Paul (2011c), I consider a richer example where one can show that the price to be paid for reporting a too high inflationary cost of output is that one should report a too low relative variance of aggregate supply shock.

I then illustrate the analysis using the Survey of Professional Forecasters.

The idea is that different forecasters will use different models, but that these models are constrained by autocoherence conditions. For each forecaster I estimate a pseudo-model whose coefficients capture the response of GDP forecasts on inflation forecasts and government expenditure forecasts. A tight trade-off appears among those coefficients, which captures the fact that the pseudo-models must match the average growth rates of those variables. The evidence also suggests that forecasters who believe that expansions are less inflationary, also tend to believe that public spending is more expansionary. Rather than an autocoherence condition, this seems to indicate that models more favorable to expansionary policies tend to act on both margins – they downplay the inflationary costs of output (i.e. they believe in a flat aggregate supply curve) and overemphasize the expansionary effects government spending at the same time.

The paper is related to several strands of literature.

In the Political Economy literature, an important paper by Piketty (1995) considers a redistributive problem where people may form different beliefs about the effort elasticity of income. Because of the feedback effects of these beliefs on taxation, they are self reinforcing and multiple equilibria may arise. This idea has been further pursued by Bénabou and Ok (2001) and Alesina and Angeletos (2005).

The idea of self-confirming equilibrium was proposed by Fudenberg and Levine (1993), who apply it to a discussion of the Lucas critique (2007), arguing that wrong policies may persist as long as no experimentation takes place to elicit the correct model, a point about identification I discuss below.

Sargent (2008) contains a thorough discussion of the role of incorrect perceived models and how they may have shaped policies in the past, and he provides a simple example of a policy maker who believes in a systematic trade-off between expected inflation and unemployment, while the actual observed trade-off is entirely driven by inflationary surprises. In equilibrium, the systematic component of monetary policy is held constant because that is the optimal policy, and this makes it impossible to sort out the effects of expected versus unexpected inflation. This brings about the issue of identification which is also discussed below in Sections 2.2 and 4.1. Along similar lines, Sargent et al. (2006) reverse-engineer a time series for the perceived model used by the Fed in setting its policy based on actual data and policy actions. How beliefs affect policies and how they evolve is also discussed by Buera et al (2011) and Saint-Paul (2010).

The concept of autocoherence (or self-confirming equilibrium) is also present in the literature on learning and indeterminacy. Some sunspot equilibria may be consistent with autocoherent models that may be such that the Lucas critique does not hold (Farmer, 1991). In the learning literature (Evans and Honkapohja, 2003), people postulate a law of motion and gradually learn the parameters of this law of motion over time, by running least squares regressions. Asymptotically, the equilibrium can by construction be supported by an autocoherent model as defined by the postulated law of motion.

Finally the paper is also related to the literature on cheap talk (Crawford and Sobel, 1982). Here, however, a totally different route is taken. In the cheap talk literature, the preferences of the expert are known and any signal can be reverse engineered into the true value of the parameter. However for such reverse engineering to take place, one needs to know the relevant probability distributions in addition to the expert's preferences, that is, one needs a *model.* Since this model can only be obtained by an expert, some expert must be trusted. Here, the expert is trusted, and his preferences are not known. While in the cheap talk literature the expert can only send unbiased signals, here what is constraining him instead is the set of autocoherence conditions: while the signals (i.e. the models' parameters reported by the expert) can be biased, the model's predictions are not falsified in equilibrium.

2 Autocoherence and the scope for influencing outcomes

The central idea of my approach is that, in order to make choices and form their expectations, people need a model, but that model may not be the correct model of the economy. I then want to develop a theory of how the model used by the people is determined and how it affects the equilibrium outcome. There exists a class of people whose job is to produce social representations. These people are called the intellectuals. Among intellectuals, some people produce a specific kind of representations: the macroeconomic models that agents (households, firms, and the government) use. This specific category of intellectuals are called macroeconomists.

In the model, or meta-model, developed below, it will be assumed that macroeconomists know the correct model and knowingly report another model. This is a convenient (meta) modelling choice but is to be taken as a simplifying assumption and a metaphor for the much more subtle ways in which ideological biases affect the design of theories in practice. These mechanisms are indeed an important topic for further research.

2.1 Autocoherence

Intellectuals cannot force people to believe anything they want. A model which predicts that 2+2=5 will soon be discredited and abandoned. I will impose the strongest discipline on the set of models that macroeconomists may pick, by assuming that they must be *autocoherent.* A model is autocoherent if it satisfies the following property:

Assume all agents use that model in order to compute the probability distribution of the variables of interest to them, and then implement their corresponding optimal policy. This delivers an equilibrium, which is characterized by the joint probability distribution of the endogenous variables conditional on the exogenous variables. A subset of the variables are observable. Then, the equilibrium joint distribution of the observables is equal to the one predicted by the perceived model.

This essentially means that if everybody believes in the model, then it is not defeated by the observation. This concept is akin to that of a self-confirming equilibrium in game theory (See Fudenberg and Levine (2003)), but autocoherence is a property of a model in addition to that of an equilibrium. In Saint-Paul (2011a), I provide some formal definitions and some results. It is important to remember the following aspects:

- People use the perceived model in the standard rational expectations way. That is, they assume that model is correct, that it is common knowledge, and that all agents use it to form their expectations. They do so both when using the model to form their own expectations and when deriving the predicted observable moments to confront them with the equilibrium moments.

- The use of the equilibrium probability distribution of the observables, rather than a sample distribution, means that, for simplicity, the model has to be valid against any arbitrarily large number of observations. Autocoherence restrictions would be weaker if one assumed a finite number of observations, in which case the predicted moments would have to remain within the confidence intervals implied by the observed sample moments.

- The assumption that all agents use the same model makes sense if that is indeed the case, i.e. the economist is in a situation of intellectual monopoly. If that were not the case and if different people were using different models, then the equilibrium would depend on all the models in use. A model might be autocoherent, i.e. consistent with the equilibrium data if everybody were using it, and yet in contradiction with the data in an equilibrium where only a fraction of the population is using it. In such a case, instead of autocoherence one would impose a restriction that all models in use simultaneously predict the distribution of the observables in equilibrium. In what follows, though, I only consider the case of intellectual monopoly (intellectual competition is discussed in Saint-Paul (2011a)).

A relevant question is: Why would the government believe the economists and not treat their predictions as cheap talk? The answer is that the government *has* to do something and has to use *some* model in order to design its policy. It cannot escape the necessity of trusting an expert and using his model. It is the production of such models by a trusted expert that the present paper analyses[2].

2.2 Autocoherence and Identification

The scope for exerting intellectual influence through the choice of a model and its parameters, while meeting the constraint that the model matches the observables, clearly has to do with identification. If all the parameters of the correct model are identified uniquely from the moments of the observables, then this means that matching those moments reveals the correct model, and it will then typically be the case that the autocoherence constraints will force the economist to reveal the correct model. If the perceived model has the same parameters as the correct model, and only differs from it, potentially, by the actual values of that parameters, then the number of equations involved in the identification of the structural parameters is the same as the number of autocoherence restrictions.

If some parameters are identified (in the econometric sense), then it is easy to prove that the autocoherence conditions compel the economist to reveal their true value (this is not completely straightforward because the set

[2] In Crawford and Sobel (1982), an informed party observes a signal and can send a message to an uninformed one. The uninformed one knows the true distribution of the signal as well as the preferences of the informed party. In such a setting, any attempt to manipulate the recipient can be reversed engineered and equilibria are either fully revealing or partially revealing in an unbiased way (that is, the same message is being sent for a cluster of signals, and the recipient makes an unbiased inference conditional on the signal being in that cluster). Here the government does now know the right model nor does it know the experts' preferences. It needs to rely on some expert to be able to use a model and make a decision.

of identified parameters is dependent on the equilibrium, while two different autocoherent models are typically associated with two different equilibria).

Under-identification matters to the extent that the optimal decision rule of the agents depend on the true structural parameters of the economy, not just on the reduced form parameters. In turn, the equilibrium depends on the beliefs regarding these true structural parameters. In other words, underidentification is "instrumentalized" by the intellectuals in order to manipulate outcomes.

2.3 When does the perceived model matter?

When will the expert be able to affect outcomes despite the requirement that his model is autocoherent? Here we have to distinguish between three cases.

First, it may be that all the variables whose expectations matter for private decisions are observable. This means that people do not really need a structural model. All they need to know is the joint distribution between the forecasted variables and the variables in their information set when they form their expectations. One can then solve for a rational expectations equilibrium in a standard way, replacing forecasts by expectations using the actual equilibrium distribution of the variable. If this procedure yields a unique equilibrium, then the economy must be at this equilibrium. This does not mean that one could not use several alternative models. But all those models must be autocoherent, and therefore replicate the equilibrium distribution of the observables, implying that one must be at an REE. Since that REE is unique, all autocoherent models are equivalent in that they deliver the same REE. To put it another way, in such a configuration, the conditional expectations involved in the model's equations are one of the moments of the observables. Consequently, all autocoherent models must be such that those expectations must be equal to their equivalent sample conditional average. If this restriction is enough to yield a unique outcome, then the use of any autocoherent model can only deliver that outcome. A simple example is discussed in section 4.2.

Second, it may be that the variables that need to be forecast are observable, but that the REE is not unique. This typically arises in dynamic settings such as $x_t = z_t + \beta E_t z_{t+1}$ where the relevant eigenvalues are such that ruling out explosive solutions is not enough to deliver a unique REE equilibrium. This case has been studied at length by the literature on indeterminacy and learning (see especially Evans and Honkapohja (2003) and Farmer (1991)), which studies learning by postulating a perceived law of motion and looks at the stability of the actual law of motion as a function of the perceived one. Hence in this literature autocoherence is imposed in that the perceived law of motion must match the observed one, and further restrictions on stability of this mapping often rule out the sunspots (this is because the perceived law of motion leads to a backward looking formation of expectations, so that the dynamics become truly unstable if $\beta > 1$). In Evans and Honkapohja (2003), stability rules out sunspots regardless of β and therefore there is no scope for an expert to coordinate the economy on a sunspot, as long as his model is reducible to a perceived law of motion in the class considered by Evans and Honkapohja, although the fundamental is also unstable if $\beta > 1$ so that the theory is silent about what happens in this case. If one imposes autocoherence but not stability, the scope for picking a sunspot is larger but it depends on the class of models being considered. If the model's specification rules out the specific dynamics that characterize the sunspot, an autocoherent model will only yield the fundamental solution.

Another case in which multiplicity (of a very different kind) arises is when the correct model is nonlinear. It is then easy to coordinate agents on one's preferred equilibrium by picking a model with a single equilibrium, which happens to have a unique equilibrium which is the one preferred by the expert. A natural candidate for such an equilibrium is then the linearized correct model around the preferred equilibrium. Here, and contrary to the examples worked out below, the parameters of the perceived model are "locally correct", but its functional form is misspecified. If the economy is locked at this equilibrium and has never visited a zone remote from it, there is a sense in which the perceived model is correct; in particular, any experiment designed to insulate a parameter would confirm the perceived model, as long as the experiment is small and keeps the economy in the vicinity of the relevant equilibrium.

Finally, it may be that the variables of interest are not observed. Different models will relate them differently to the observables, and thus lead to different inferences about those observables. But the models have the consistency requirements that they explain the observables. In such a case, the 'true' structural model is underidentified but which structural model is used affects expectations and thus the behavior of the economy. Economists can influence those outcomes by proposing alternative structural models; these alternative models are equally good in that they are all autocoherent, but, contrary to the first case, which model is used matters because it will change the expectations of the relevant variables. This is the case in what follows.

3 A simple example

I start by considering a simple example of stabilization policy. The economy is driven by the following process:

$$y = ag + u + v; \quad (1)$$

$$z = \omega u + \varepsilon. \quad (2)$$

Here, y is output, g is government spending, and u and v are shocks effecting output. For example, we can think of u as an aggregate demand shock. The variable z is a signal about the state of aggregate demand, which is observed prior to the government deciding on the expenditure level g. It could be some leading indicator such as a business or consumer confidence survey, order or vacancies data, and so forth. By contrast, the shock v cannot be stabilized because no signal of v is drawn by the government prior to setting policy., We will label it a 'supply' shock to distinguish it from u.

The most relevant parameter is a, which can be labelled "the Keynesian

Multiplier". As will be clear below, most ideological conflict revolves around its actual value.

The shocks u , v, and ε are uncorrelated and have zero mean and variances σ_u^2, σ_v^2, and σ_ε^2, respectively. To economize on notation, I will impose the following normalization

$$\omega^2\sigma_u^2 + \sigma_\varepsilon^2 = 1.$$

The government wants to stabilize output but suffers a cost for fiscal activism. Its preferences are

$$\min Ey^2 + \varphi Eg^2.$$

The greater φ, the more the government is "right-wing" and averse to fiscal interventions.

In order to figure out how to set g, given the value of z it observes, the government must have *model* which predicts, in particular, how g affects y. In most of the literature, all agents use the right model. Here I am assuming that the model used by the government may be wrong. Thus, while the true model is summarized by $(a, \omega, \sigma_u^2, \sigma_v^2, \sigma_\varepsilon^2)$, the government believes that these parameters are in fact given by $(\hat{a}, \hat{\omega}, \hat{\sigma}_u^2, \hat{\sigma}_v^2, \hat{\sigma}_\varepsilon^2)$. I will refer to this model as the *perceived* model, as opposed to the correct one. I will describe below how the perceived model is determined.

In general one may want to impose plausibility limits on the perceived model parameters instead of allowing any possible value. In this model and the richer model of the next section I will impose that each coefficient has the same sign as its counterpart in the actual model. This means that all these parameters must be positive (for the variances this is actually a feasibility constraint rather than a plausibility one). More generally there is a set of admissible values for the perceived model's parameters. I will refer to the inequalities that define this set as the "plausibility conditions". The correct model's parameters always match those conditions.

Under the correct model, the government sets a stabilization rule $g(z)$

which is the solution of the first order condition

$$\frac{dy}{dg}E(y \mid z) + \varphi g(z) = 0,$$

where $dy/dg = a$ is the correct effect of government spending on output.

Furthermore

$$E(y \mid z) = ag(z) + E(u \mid z),$$

and by Bayes' law

$$E(u \mid z) = \frac{1}{\omega}\frac{\omega^2\sigma_u^2 z}{\omega^2\sigma_u^2 + \sigma_\varepsilon^2}.$$

Under the perceived model, the stabilization rule satisfies

$$\frac{\hat{d}y}{\hat{d}g}\hat{E}(y \mid z) + \varphi g(z) = 0,$$

where $\hat{E}$ denotes mathematical expectation computed using the perceived model, and $\frac{\hat{d}y}{\hat{d}g} = \hat{a}$ is the perceived effect of spending on output. Here we have $\hat{E}(y \mid z) = \hat{a}g(z) + \hat{E}(u \mid z)$ and therefore the optimal stabilization policy satisfies

$$g(z) = -\frac{\hat{a}\hat{E}(u \mid z)}{\hat{a}^2 + \varphi}. \tag{3}$$

To compute $\hat{E}(u \mid z)$, the government applies Bayes' law using the perceived model. Therefore,

$$\hat{E}(u \mid z) = \frac{\hat{\omega}\hat{\sigma}_u^2}{\hat{\omega}\hat{\sigma}_u^2 + \hat{\sigma}_\varepsilon^2}z = \hat{\mu}z. \tag{4}$$

It follows that the optimal stabilization rule is

$$g(z) = -\gamma z,$$

where

$$\gamma = \frac{\hat{a}}{\hat{a}^2 + \varphi}\frac{\hat{\omega}\hat{\sigma}_u^2}{\hat{\omega}\hat{\sigma}_u^2 + \hat{\sigma}_\varepsilon^2}.$$

3.1 Equilibrium

Given the perceived model, it is straightforward to compute the equilibrium by substituting (3) into (1)and using (2):

$$y = u\left(1 - \frac{a\hat{a}\hat{\mu}\omega}{\hat{a}^2 + \varphi}\right) - \frac{a\hat{a}\hat{\mu}\varepsilon}{\hat{a}^2 + \varphi} + \hat{v}.$$

3.2 How is the perceived model determined?

I assume that the perceived model is produced by a school of professional economists. These economists are not disinterested but pursue their own agenda. That is, they want to design their model in such a way that the outcomes maximizes their utility function, which may be different from that of the government. Furthermore, I assume that they know the true model. Finally, they can only come up with an autocoherent model.

3.3 The autocoherence conditions

In the present case, people observe output y and the signal z. By definition, the autocoherence conditions mean that the joint distribution of y and z, as predicted using then perceived model, must be equal to the equilibrium one. In our Gaussian world, this reduces to matching the means and the variance-covariance matrix of y and z. It is natural to define the mean-matching conditions as the "first order autocoherence conditions", and the variance-matching conditions as the second-order ones. Here, the first-order AC conditions are matched since it is common knowledge that all means are equal to zero. Hence, the autocoherence conditions state that in equilibrium, the variance-covariance matrix of (y, z) as predicted by the perceived model must be the one observed in the data. But first-order AC conditions will play a role in the empirical illustration below.

The actual elements of the observed variance-covariance matrix are:

$$
\begin{aligned}
Ey^2 &= \left(1 - \frac{a\hat{a}\hat{\mu}\omega}{\hat{a}^2 + \varphi}\right)^2 \sigma_u^2 + \left(\frac{a\hat{a}\hat{\mu}}{\hat{a}^2 + \varphi}\right)^2 \sigma_\varepsilon^2 + \sigma_v^2; \\
Ez^2 &= \omega^2 \sigma_u^2 + \sigma_\varepsilon^2 = 1; \\
Eyz &= \left(1 - \frac{a\hat{a}\hat{\mu}\omega}{\hat{a}^2 + \varphi}\right) \omega \sigma_u^2 - \frac{a\hat{a}\hat{\mu}}{\hat{a}^2 + \varphi} \sigma_\varepsilon^2.
\end{aligned}
$$

But people believe that the data are generated by the perceived model, in which case these moments would be equal to

$$
\begin{aligned}
\hat{E}y^2 &= \left(1 - \frac{\hat{a}^2\hat{\mu}\hat{\omega}}{\hat{a}^2 + \varphi}\right)^2 \hat{\sigma}_u^2 + \left(\frac{\hat{a}^2\hat{\mu}}{\hat{a}^2 + \varphi}\right)^2 \hat{\sigma}_\varepsilon^2 + \hat{\sigma}_v^2; \\
\hat{E}z^2 &= \hat{\omega}^2 \hat{\sigma}_u^2 + \hat{\sigma}_\varepsilon^2; \\
\hat{E}yz &= \left(1 - \frac{\hat{a}^2\hat{\mu}\hat{\omega}}{\hat{a}^2 + \varphi}\right) \hat{\omega} \hat{\sigma}_u^2 - \frac{\hat{a}^2\hat{\mu}}{\hat{a}^2 + \varphi} \hat{\sigma}_\varepsilon^2 \\
&= \frac{\varphi \hat{\omega} \hat{\sigma}_u^2}{\hat{a}^2 + \varphi}.
\end{aligned}
$$

The autocoherence conditions are

$$
\begin{aligned}
Ey^2 &= \hat{E}y^2; \\
Ez^2 &= \hat{E}z^2; \\
Eyz &= \hat{E}yz.
\end{aligned}
$$

Computing, it can be seen that they are equivalent to

$$
\frac{\hat{\omega}\hat{\sigma}_u^2}{\varphi + \hat{a}^2} = \frac{\omega \sigma_u^2}{\varphi + \hat{a}a}; \tag{5}
$$

$$
\hat{\sigma}_\varepsilon^2 = 1 - \hat{\omega}^2 \hat{\sigma}_u^2; \tag{6}
$$

$$
\hat{\sigma}_v^2 = \sigma_v^2 + \frac{\hat{a}^2\hat{\omega}^2\hat{\sigma}_u^4}{(\hat{a}^2 + \varphi)} (a^2 - \hat{a}^2) + \sigma_u^2 - \hat{\sigma}_u^2 - \frac{2\hat{a}\hat{\omega}\sigma_u^2}{\hat{a}^2 + \varphi} \left(a\omega\sigma_u^2 - \hat{a}\hat{\omega}\hat{\sigma}_u^2\right) \tag{7}
$$

*

Hence, the autocoherence conditions leave the expert with two degrees of freedom. He can pick a triplet $(\hat{a}, \hat{\omega}, \hat{\sigma}_u)$ which satisfies (5) and then $\hat{\sigma}_\varepsilon$ and $\hat{\sigma}_v$ are determined residually by (6) and (7). More generally, in this class of linear models where all shocks and endogenous variables have a zero mean, and these means are common knowledge, if the dimension of the vector space spanned by the observables is n and there are p parameters, then there are $p - n(n+1)/2$ degrees of freedom in choosing the model. Here $n = 2$ and $p = 5$.

I assume that the economist's objective is similar to the policymaker's, but the weight on the stabilization of public expenditure is different. Thus the economist's objective is

$$\min Ey^2 + \bar{\varphi}Eg^2.$$

If $\bar{\varphi} > \varphi$, the economist is more "right-wing" than the government.

Given the linear quadratic structure of the problem, the optimal policy is of the form $g = -\gamma z$, and the policy problem amounts to picking γ. Given his two degrees of freedom, the economist is a quasi-dictator. That is, he can design his model so as to induce the government to select the value of γ that he would pick if he were setting γ directly. This value is clearly equal to

$$\gamma = \frac{-a\omega\sigma_u^2}{a^2 + \bar{\varphi}}. \tag{8}$$

Comparing with (3)-(4), we see that to induce this desired policy the economist must select a model which satisfies

$$\frac{-a\omega\sigma_u^2}{a^2 + \bar{\varphi}} = \frac{-\hat{a}\hat{\omega}\hat{\sigma}_u^2}{\hat{a}^2 + \varphi}. \tag{9}$$

This is an optimality condition for the model's parameters. Thus, we have a theory which predicts which models will prevail. There are the models that satisfy the autocoherence conditions (5)-(7) along with the optimality condition (9).

3.4 Properties of the equilibrium

Since we have 4 equations with 5 unknowns, there is still one degree of freedom. But ω and σ_u^2 only appear through their product. Thus this degree of freedom is irrelevant and I will now assume that $\omega = \hat{\omega} = 1$, in effect getting rid of parameter ω. The equilibrium value of $\hat{a}$ can then be obtained by substituting (5) into (9) and we get

$$\hat{a} = a\frac{\varphi}{\bar{\varphi}} \tag{10}$$

This formula implies that if the economist has the same preferences as the government, then he will reveal the true model. A similar result obtains in communication games, but we will see below that this result breaks down in richer models where the public's expectations enter the model; as in the credibility literature, one may then want to manipulate people even if everybody agrees on a common social welfare function.

We also have that the more right-wing (resp. left-wing) the economist relative to the government, the more he will understate (resp. overstate) the value of a. That is, conservative economists will produce theories where the Keynesian multiplier is low in order to deter activist policies, while left-wing ones will prefer to get a large Keynesian multiplier. The smaller the Keynesian multiplier, the more costly its is in terms of welfare to implement an activist policy (because of the aversion to public expenditure volatility in the government's preferences), and the less activist the policy. This is the reason why conservative economists have an interest in under-reporting the Keynesian multiplier, while left-wing ones want to over-report it.

However, this cannot be done independently of the rest of the theory, because the theory as a whole must match that data. The autocoherence condition (5), which can be rewritten

$$\hat{\sigma}_u^2 = \frac{\hat{a}^2 + \varphi}{a\hat{a} + \varphi}\sigma_u^2,$$

implies that $\hat{\sigma}_u^2 > \sigma_u^2$ for $\hat{a} > a$, and conversely for $\hat{a} < a$. Conservative economists downplay the contribution of demand shocks to GDP, while progressive ones overstate it. Why is that so?

Assume $\hat{a} < a$. Then the response of government spending to the demand shock u will have a stronger effect on output than what people believe. This means that government spending stabilizes output more than what people think, implying that the overall response of y to the demand shock u is weaker in reality than in the model used by the people. As such, this effect leads people to overestimate the covariance between y and z relative to the data. Similarly, output reacts more to the measurement error ε than what people believe. Since output reacts negatively to ε, this effect also induces people to overestimate the covariance between y and z. In order to compensate for those biases, the economist's model must underestimate σ_u^2 and accordingly overestimate σ_ε^2. This way, the positive contribution of the demand shock to Exy is being deflated, while the negative contribution of the measurement error is inflated. Consequently, these additional biases tend to offset the biases induced by the low value of $\hat{a}$ and restore the consistency between the predicted and actual values of Exy.

As for matching the variance of output, it can always be done by picking the appropriate variance of the 'supply' shocks σ_v^2.[3]

We thus see how because of under-identification, the same evidence can be interpreted differently depending on the theorist's political preferences.

4 Discussion and extensions

4.1 Identification and Policy

A key reason why the Keynesian multiplier a is not identified, which opens the door to manipulation by experts, is that policy is completely colinear with the realization of the signal z. This prevents people from isolating the direct effect of government spending from the effect of the demand shock u. A clear solution to that would be (as pointed out in the self-confirming equilibrium literature) to experiment by adding a random noise to the government policy, which would allow to identify the correct a by running a simple regression of output on the noise, even absent any other controls. Clearly, this experimentation is costly in terms of welfare; in fact it is *precisely* because

[3] As long as a is not too remote from $\hat{a}$, the model variance $\hat{\sigma}_v^2$ will remain positive.

the government pursues a perceived optimal policy that identification fails to hold[4]. If the government has no doubt that $\hat{a}$ is the correct value, it does not pay for it to experiment. On the other hand, even with a very small doubt, it could introduce an arbitrarily small noise and estimate the correct a at an arbitrarily low cost. But this is only true because is our setting the correct moments of the equilibrium distribution of observables can be observed. If the number of observations against which the perceived model must be validated is finite, experimentation must be large enough, and take place during enough periods, in order for something to be learned: The welfare cost of experimentation becomes commensurate with the expected value of learning and it may be that one may not want to experiment ex-ante.

4.2 Manipulating the public

In the above model the only active agent is the government. As a result, the economist acts as a quasi-dictator, and would reveal the correct model if he had the same preferences as the government. In this section, I provide some additional clarifications regarding what happens when the public uses the perceived model to form price expectations.

In the preceding example, welfare can be written as a function $G(\rho, v, \varphi)$, where ρ is the parameter characterizing the policy rule, v is the parameter vector associated with the correct model, and φ is the government's preferences. The policy parameter ρ is then set optimally by using the perceived model instead of the correct one, i.e. it satisfies the first order condition

$$\frac{\partial}{\partial \rho} G(\rho, \hat{v}, \varphi) = 0,$$

where $\hat{v}$ is the perceived parameter vector. This delivers a policy rule which is a function $\rho(\hat{v}, \varphi)$. The economist then manipulates the government by solving

$$\max_{\hat{v}} G(\rho(\hat{v}, \varphi), v, \bar{\varphi}).$$

[4] A similar issue arises in the example worked out by Sargent (2008): "For the misspecified model to reveal the lack of an exploitable trade-off, the government has to induce adequate variation in inflation, which it does not do within an SCE".

This expression reflects the fact that the economist uses the correct model, has different preferences, and internalizes the effect of the perceived model on policy. The First-order condition is

$$\frac{\partial}{\partial \rho} G(\rho(\hat{v}, \varphi), v, \bar{\varphi}). \frac{\partial \rho}{\partial \hat{v}} = 0,$$

or equivalently

$$\frac{\partial}{\partial \rho} G(\rho(\hat{v}, \varphi), v, \bar{\varphi}) = 0,$$

implying

$$\rho(\hat{v}, \varphi) = \rho(v, \bar{\varphi}). \tag{11}$$

This proves both quasi dictatorship and that the correct model is revealed if $\varphi = \bar{\varphi}$.

Now assume the model also affects how people form their expectations. It will then affect equilibrium beyond its effect on government policy. Welfare must then be rewritten as $G(\rho, v, \hat{v}, \varphi)$. Since the government uses the perceived model to set policy, its FOC is now

$$\frac{\partial}{\partial \rho} G(\rho, \hat{v}, \hat{v}, \varphi) = 0,$$

which again delivers ρ as a function $\rho(\hat{v}, \varphi)$. The economist now solves

$$\max_{\hat{v}} G(\rho(\hat{v}, \varphi), v, \hat{v}, \bar{\varphi}).$$

The FOC is

$$\frac{\partial}{\partial \rho} G(\rho(\hat{v}, \varphi), v, \hat{v}, \bar{\varphi}). \frac{\partial \rho}{\partial \hat{v}} + \frac{\partial}{\partial \hat{v}} G(\rho(\hat{v}, \varphi), v, \hat{v}, \bar{\varphi}) = 0.$$

Clearly, Equation (11) no longer holds. Even if aligned with the government, the economist does not want to reveal the true model. If he were a dictator and could set policy and beliefs simultaneously, he would set each term in the preceding equation optimally, achieving a higher welfare. Thus quasi-dictatorship no longer holds, because there is now a trade-off between targeting one's preferred policy versus influencing the expectations of agents other than the government. (This could be solved if one could somehow sell a different model to the people and the government, which raises the entire issue of paternalistic macroeconomic modelling).

Recall that, as argued in Section 2.3, it is not enough that expectations depend on the perceived model for it to affect welfare. It is also needed that autocoherence conditions leave some degrees of freedom to the expert to affect those expectations, which will not happen if the signal upon which they are based and the variables that are forecasted are observable. Key to the preceding section's results is the fact that the government needs to evaluate $E(u \mid z)$ and that u is not observed. Consider instead the following alternative model

$$\begin{aligned} y &= u + v + \gamma y^e, \\ z &= \omega u + \varepsilon. \end{aligned}$$

In principle one could affect y^e by manipulating the perceived model $(\hat{\omega}, \hat{\gamma}, \hat{\sigma}_u^2, \hat{\sigma}_v^2, \hat{\sigma}_\varepsilon^2)$. But since y is observable, and since this model has a unique rational expectations equilibrium, such manipulation is in fact impossible. Performing the same steps as previously and assuming again that $\omega^2\sigma_u^2 + \sigma_\varepsilon^2 = 1$, which implies, by autocoherence, that $\hat{\omega}^2\hat{\sigma}_u^2 + \hat{\sigma}_\varepsilon^2 = 1$, we get that

$$y^e = \hat{E}(y \mid z) = \frac{\hat{\omega}\hat{\sigma}_u^2}{1 - \hat{\gamma}} z,$$

implying

$$y = u + v + \gamma \frac{\hat{\omega}\hat{\sigma}_u^2}{1 - \hat{\gamma}} (\omega u + \varepsilon).$$

The key autocoherence condition is $\hat{E}yz = Eyz$. We have that

$$\begin{aligned} Eyz &= \omega\sigma_u^2 + \frac{\gamma\hat{\omega}\hat{\sigma}_u^2}{1 - \hat{\gamma}}, \\ \hat{E}yz &= \frac{\hat{\omega}\hat{\sigma}_u^2}{1 - \hat{\gamma}}. \end{aligned}$$

The autocoherence condition is therefore

$$\frac{\hat{\omega}\hat{\sigma}_u^2}{1 - \hat{\gamma}} = \frac{\omega\sigma_u^2}{1 - \gamma}.$$

While this does not constrain the expert to reveal the truth, it implies that all autocoherent models deliver the same rule for forming expectations, $y^e = \frac{\omega\sigma_u^2}{1-\gamma}z = E(y \mid z)$, and all deliver the same unique REE equilibrium, $y = u + v + \gamma\frac{\omega\sigma_u^2}{1-\gamma}(\omega u + \varepsilon)$.

4.3 Credibility

If the government has commitment problems in setting its policy, the economist can design the model so as to indirectly provide the government with commitment. Thus, instead of the government tying its hands by delegating policy to an agent with different preferences, here credibility is achieved by a distortion of beliefs engineered by a well-intended intellectual.

To illustrate this, consider the following simple extension of our model:

$$y = ag + u + v + bg^e.$$

We consider two alternative timings:

1. Assume expectations of public policy are set after policy is set. Then g^e is always equal to g and this variation is internalized by the government when setting policy. We are in the same situation as before except that a is replaced by $a + b$. Consequently the government will pursue

$$\begin{aligned} g &= -(\hat{a} + \hat{b})\frac{\hat{\omega}\hat{\sigma}_u^2}{(\hat{a} + \hat{b})^2 + \varphi}z \\ &= -\gamma_1 z. \end{aligned}$$

The economist, knowing the true model, would like to pursue

$$g = -(a + b)\frac{\omega\sigma_u^2}{(a + b)^2 + \bar{\varphi}}z,$$

and in what follows I will assume that the economist is benevolent, i.e. $\bar{\varphi} = \varphi$.

2. Expectations of public policy are frozen at the time policy is set, but based on the available signal z. The government then thinks that the impact effect of an increase in g is $\hat{a}$, and its FOC is

$$\hat{a}\hat{E}(y \mid z) + \varphi g(z) = 0.$$

Since people know the policy rule and must therefore correctly anticipate $g(z)$, we gain have $g^e = g$. Using this we get:

$$\begin{aligned} g &= -\hat{a}\frac{\hat{\omega}\hat{\sigma}_u^2}{\hat{a}(\hat{a}+\hat{b})+\varphi}z \\ &= -\gamma_2 z. \end{aligned}$$

Clearly, the no commitment policy will involve more activism than the commitment one if $b < 0$.

Despite being benevolent, if the government cannot commit the economist will not release the correct model but instead pick a model such that

$$\hat{a}\frac{\hat{\omega}\hat{\sigma}_u^2}{\hat{a}(\hat{a}+\hat{b})+\varphi} = (a+b)\frac{\omega\sigma_u^2}{(a+b)^2+\bar{\varphi}}. \tag{12}$$

The choice is again constrained by the autocoherence conditions. It is easy to check that the crucial autocoherence condition (5) is now replaced by[5]

$$\frac{\hat{\omega}\hat{\sigma}_u^2}{\varphi+\hat{a}(\hat{a}+b)} = \frac{\omega\sigma_u^2}{\varphi+\hat{a}(a+b)}. \tag{13}$$

Replacing into (12) we get

$$\hat{a} = (a+b)\frac{\varphi}{\bar{\varphi}}.$$

In the case where $\bar{\varphi} = \varphi$, we just have $\hat{a} = a+b$. The economist is reporting instead of the "impact Keynesian multiplier" the Keynesian multiplier that would prevail if the government could commit. In a Pigovian fashion, such beliefs make the government internalize the true social effect of government expenditure in a world where lack of commitment leads the government to take into account only part of this effect, by pretending that the parameter governing this part (the impact Keynesian multiplier a) is actually equal to the total effect. If $b < 0$, the benevolent economist offsets the activism bias

[5] To derive this, just note that $Eyz = -(a+b)\gamma_2\sigma_z^2 + \omega\sigma_u^2 = -(a+b)\gamma_2 + \omega\sigma_u^2$ and that similarly (since by autocoherence $\hat{\sigma}_z^2 = \sigma_z^2$) $\hat{E}yz = -(\hat{a}+\hat{b})\gamma_2 + \hat{\omega}\hat{\sigma}_u^2$ and equate the two.

that stems from the policymaker's lack of commitment by proposing a model with a lower impact keynesian multiplier than in reality.

In my setting throughout the paper, the economist are outright lying about the correct model, which they do know. However, this example suggest how in practice things might work in a more subtle way. The total keynesian multiplier $a + b$ is conceptually dangerously close to the impact multiplier a. The intellectual could frame his discourse so as to maintain some ambiguity about which notion of the keynesian multiplier he is talking about, so as to induce the required policy while credibly convincing himself (and his peers) that his statements are consistent with the correct model.

5 An empirical illustration

5.1 Fuchs et al. (1998)

Given its relevance, it is important to discuss the empirical findings of Fuchs et al. (1998). These authors develop a systematic investigation of labor and public economists' policy views. They document substantial disparities in those views and they want to understand whether these difference are driven by different values ("tastes") versus disagreement on the actual parameters that drive the effect of policies on outcomes ("the model").

In the above model, economists have no interest in revealing their preferences (if compelled to do so, they would report the same preferences as the government, regardless of their true preferences). Therefore we would expect all policy views to be entirely driven by beliefs about parameters, while in reality they are driven by different tastes and the economists pick the parameters that suit their tastes best.

Fuchs et al. have run a survey of attitudes among economists and ask them to position themselves on a left/right axis, as well as their opinions about the value of key economic parameters (such as, say, labor supply elasticity) and their support for a number of policy measures. They then regress the support for policy measures on both the ideological positioning of the respondent and his/her answers regarding parameter values. Overall, they claim that ideology matters much more than parameters, although this is chiefly due to the lack of statistical significance of the latter, not to the magnitude of the estimated coefficients.

Of key interest to us here, however, is the extent to which ideological positioning may affect one's perceived parameter values.The authors look at the correlations between their values variables and their parameters variables, and find that while this correlation is lower than the one between values and policy positions, it is nevertheless significant, as one would expect from the logic of the present paper.

5.2 Evidence from the Survey of Professional Forecasters

In this section, I use the Survey of Professional Forecasters (SPF) to compare the ideas developed above with the data. As the preceding analysis makes clear, the models that will arise depend on the ideological stance of the expert as well as on the autocoherence conditions and on the correct model. We have found that the outcome is highly sensitive to the parameters of the correct model and to the set of parameters that are known. This makes it hard to come up with a tight prediction about, say, the value of a parameter.

On the other hand, the analysis tells us that we expect models to be disciplined by the autocoherence conditions and that the dispersion in predictions across experts is driven by their ideological differences. The SPF is a panel of macroeconomic predictions by a large number of forecasters. It can be used in a cross section to analyze the dispersion in forecasts, and its longitudinal dimension can be used to understand how models evolve over time. In what follows I will use those data to answer the following questions:

1. What kind of autocoherence conditions are imposed on those forecasts?

2. Can we point to a correlation between the forecasts and some measure of the forecaster's ideological position or self-interest?

3. How do the models evolve over time, under the influence of new em-

pirical observations and changes in the policy regime?

5.2.1 The basic methodology

Each observation in the SPF is a year x quarter x individual forecasters. The available variables include forecasts for GDP, inflation, unemployment, GDP components, up to 6 quarters (short-run) and 4 years. The data set is broken down into four files corresponding to four different time periods: 1968:4-1979:4, 1980:1-1989:1, 1990:1-1999:4, 2000:1-2009:4....There is a lot of commonality in the individual identifiers between the first two, as well as the last two, files, but very little otherwise. Therefore, it is natural to aggregate these four files into two samples, one corresponding to 1968:4-1989:1b (Sample 1), the other to 1990:1-2009:4 (Sample 2). However, given that the public expenditure variable which plays a key role in the analysis is not available for the first period, I only report results for Sample 2.

The data set only contains forecasts, not the actual models used by the forecasters. Obviously, it is not possible to recover these models from the forecasts. Even if a forecaster uses a public macroeconometric model, such a model is not the actual one that generates its forecasts. Instead, it is just an input into the production of those forecasts and the actual model remains implicit. Despite these caveats, it is possible to estimate for each forecaster a pseudo-model which uncovers some regularities in the behavior of that agents. Specifically, for each forecaster I run the regression:

$$y_{it} = c_{0i} + c_{pi} p_{it} + c_{gi} g_{it}, \tag{14}$$

where i indexes the forecaster, t the current quarter, and y_{it} is the 4-quarter ahead forecast of GDP growth, p_{it} the 4-quarter ahead forecaster of (GDP deflator) inflation, and g_{it} the 4-quarter ahead forecast of federal government expenditure growth. To estimate such a model we need enough observations for a given forecaster. Thus, I have only kept forecasters with at least 10 observations.

Hence the pseudo-model of forecaster i is characterized by the triplet (c_{0i}, c_{pi}, c_{gi}), and this procedure applied to all forecasters generates a database of pseudo-models whose unit of observation is a forecaster. Roughly, we can interpret the variable c_{0i} as the "optimism" of forecaster i, while c_{pi} and c_{gi} capture the inverse inflationary impact of output growth and the keynesian multiplier, respectively. One has to remain cautious because these are just reduced form pseudo-model coefficients, but we may believe that a more left-wing forecaster will prefer to use larger values of c_p and c_g.

To this database are added the following control variables:

-An industry dummy (available from SPF), which denotes the industry to which the forecaster belongs. Essentially the SPF offers a breakdown into two categories, namely the financial sector vs. all other industries. The latter category is heterogeneous and includes manufacturers, universities, forecasting firms, pure research firms, investment advisors, and consulting firms. Nevertheless it may be interesting to investigate any systematic difference between the financial industry and the other forecasters, as the former may have specific preferences regarding monetary and fiscal policy (for example a preference for low interest rates).

-Three variables that capture the time span over which the forecaster is active, namely the minimum, maximum, and average years for which the forecasts are available in the sample. This allows to study any systematic drift in the forecasters' views of the world, as well as to control for some potential biases.

Table A1 in the Appendix reports the estimation results of the pseudo-models as well as the industry variables, while Table A2 report the year variables.

Table 1 reports the descriptive statistics for the three coefficients of interest: we notice they vary a lot across forecasters. This is true for their magnitude and their sign as well. In fact, in many cases the coefficients c_p and c_g do not have the predicted signs (negative and positive, respectively) associated with an aggregate demand curve interpretation of (14), although a plurality of estimates are indeed in this case (Table 2).

Variable	Mean	Std Dev	Min	Max
c_0	0.022	0.026	-0.11	0.07
c_p	0.098	0.98	-1.5	5.7
c_g	0.1	0.3	-0.37	1.87

Table 1 – Descriptive statistics for the pseudo models.

	$c_g > 0$	$c_g < 0$
$c_p > 0$	20	10
$c_p < 0$	30	18

Table 2 – Breakdown of observations by c_p and c_g.

5.2.2 Searching for autocoherence conditions

Ideally, given a specification for the correct and pseudo model, we could derive the autocoherence conditions and check whether they are satisfied in the data. Clearly, we are not even close to that. In particular, we do not know the dimension of the autocoherent space. If we were to uncover a relationship between pseudo-model coefficients of a lower dimension than that of the autocoherent space, it would be difficult to interpret because it would be driven by both the autocoherence constraints and the optimal choices of the modeller.[6] Furthermore, in the models discussed above, the variance of the unexpected disturbances enter the perceived model, and the (second order) autocoherence conditions involve those variances. But these disturbances do not appear in the forecast and in the pseudo-model coefficients. Thus the proper autocoherence conditions involve variables that are not observed.

Despite this, it is relatively easy to uncover the *first-order* autocoherence conditions. They do not involve these disturbances, and simply state that the perceived model must correctly predict the means of the observables. If this is so, and if the forecasts are unbiased predictors (conditional on the perceived

[6] For example, the autocoherence condition might be $f(c_0, c_1, c_2) = 0$ and an optimality condition, holding independently of the modeller's preferences, might be $g(c_1, c_2) = 0$. A 1-dimensional relationship between c_1 and c_2 would uncover $g(,)$, not $f(,,)$, although $g(,)$ itself depends on the shape of f. Or, if the optimality condition is $g(c_0, c_1, c_2) = 0$, such a 1-dimensional relationship would reflect both f and g.

model), it must be that for any forecaster i the following relationship holds

$$\bar{y} = c_{0i} + c_{pi}\bar{p} + c_{gi}\bar{g}, \tag{15}$$

where $\bar{y}, \bar{p}$ and $\bar{g}$ are the sample means of the forecast variables, that are supposed to be matched. Therefore, it is possible to estimate this autocoherence condition by regression c_{0i} on a constant, c_{pi} and c_{gi}, and the coefficients can be interpreted as the average growth rate of GDP, minus the average inflation rate, and minus the average growth rate of public expenditure, respectively.

Variable	Coefficient	SE	p-value
Constant	0.027	0.0007	0.000
c_p	-0.023	0.0022	0.000
c_g	-0.0216	0.0006	0.000
R^2	0.96		
N	78		

Table 3 – OLS estimation of first-order AC condition

The results are reported on Table 3. The fit is extremely tight, perhaps not so surprisingly. Most of the tightness of the fit derives from a strong negative relationship between c_p and c_g (Figure 1). The coefficients imply average annual growth rate over the period 1990-2009 of 2.7%, 2.3%, and 2.16 % for output, prices, and federal government expenditure, respectively. The corresponding numbers in the data, using OECD data, are 2.5%, 2.2%, and 3.1%. Thus the forecasters' implicit consensus value for the growth rate of public expenditure seems to understate reality, while it matches it well for the two other variables.

5.2.3 The correlation between c_p and c_g

Assume there are enough degrees of freedom to match any other autocoherence condition while freely picking c_0, c_p and c_g subject to (15), depending on ideological preferences. What kind of relationship between c_p and c_g would arise as those preferences vary? A simple approach to that question is to look at the correlation between c_p and c_g. As illustrated on Figure 2, this correlation appears as positive. This finding is confirmed by the regressions in Table 4.

Variable	(1)	(2)	(3)	(4)
Constant	0.09	0.08	0.09	0.08
c_p	0.13	0.08	0.17	0.1
$t-$stat	(4.0)	(2.2)	(4.14)	(2.25)
R^2	0.18	0.06	0.22	0.08
N	78	76	78	76

Table 4 – Dependent variable: c_g. (1): OLS, (2): OLS, dropping outliers such that $c_p > 2$. (3) Errors in variables regression, (4) Errors in variables regression, dropping observations such that $c_p > 2$. The reliability for c_p in the error of variables regression was set to 0.78, which is equal to one minus the ratio between the average variance of the estimator of c_p in the estimations of the pseudo models and the total variance of the variable c_p.

Overall, this suggests that forecasters who believe in a larger Keynesian multiplier also believe in a larger (more positive, less negative) response of output to inflation; under the AD interpretation of the pseudo-model, this could mean, for example, that they think the real exchange rate affects output less adversely. In other words, more "left-wing" people believe in a larger Keynesian multiplier and also that activity is less sensitive to "competitiveness". The price to pay for this, in terms of autocoherence, is that they must also be more pessimistic, i.e. have a lower value of the intercept c_0. Because both prices and government expenditures are growing over the sample, in order not to overpredict GDP growth on average given their beliefs about the effects of those two variables, they must also be relatively more pessimistic about the GDP growth rates that would prevail if prices and government expenditures remained constant.

Therefore, this positive correlation seems chiefly driven by the preferences of the forecaster, who act on both margins in order to promote their preferred level of government intervention, rather than being a feature imposed by the requirement of autocoherence.

5.2.4 The role of industry

I now investigate whether there might be systematic differences between forecasts depending on the industry of the forecaster. A first pass is to tabulate descriptive statistics by industry, as is done in the following Table.

Financial Industry			Other Industries	
Variable	Mean	Std Dev	Mean	Std Dev
c_0	0.018	(0.03)	0.024	(0.02)
c_p	0.19	(1.17)	0.08	(0.8)
c_g	0.17	(0.39)	0.06	(0.2)

Table 5 – Descriptive statistics for the pseudo models, by industry

The financial industry appears as more "left-wing", according to Table 5, than the other industries. In accordance with the autocoherence condition, it is also more "pessimistic". How statistically significant are those differences? Simple regressions of c_p and c_g on a dummy for the financial industry suggest that the difference is significant at the 10% level for c_g, while insignificant for c_p. Thus, the evidence of more left-wingness of the financial industry is relatively mild.

5.2.5 Trends

Do pseudo-models evolve over time or is their distribution stationary? We can answer that question by correlating the pseudo-models coefficients with the average date at which the forecaster operates. This is done by a simple regression of those coefficients on the average year variable, reported in Table 6. It should be noted from the last three columns that these results are not explained by any correlation with industry: inclusion of the industry dummy does not alter the coefficients and the industry dummy keeps its significance, as discussed in the preceding subsection.

Dep. Variable	c_0	c_p	c_g	c_0	c_p	c_g
Avg Year	-0.003	0.1	0.02	-0.003	0.1	0.02
$t-$stat	(-5.0)	(4.7)	(2.5)	(-5.0)	(4.7)	(2.5)
Industry				-0.008	0.17	0.13
$t-$stat				(-1.4)	(0.8)	(1.9)
R^2	0.25	0.2	0.08	0.27	0.23	0.12
N	78	78	78	78	78	78

Table 6–The drift over time of models.

We see that over time, as captured by their pseudo-models, forecasters have become more "left-wing". By construction, this is due to the "extensive margin"[7], i.e. forecasters who were more active recently tend to use a model more favorable to government aggregate intervention. This effect is stronger, and more significant, than the industry effects.

6 Conclusion

This paper has hopefully provided some insights about the interaction between the ideological stance of economists and the nature of the models they will design, subject to autocoherence constraints. It has two major shortcomings, that also constitute two important directions for further research.

First, as already pointed out, the assumption that experts know the true model yet report an incorrect one on purpose is too stark. What is needed instead is a theory of how intellectuals frame their discourse (and research strategy) in a self-serving fashion, in order to produce theories they prefer, in a world where there is no hidden true model but all there is instead is the perceived model. One obvious difficulty is how one could figure out the effect of the perceived model on one's welfare if one ignores the correct model, but a potential solution would involve importing ideas from the robust control literature (See Hansen et al (2006)).

Second, we need a theory of how a given model comes out to be adopted instead of an equally good model. In the work by Sargent, history depen-

[7] Regression results are virtually unchanged if the minimum year is substituted for the average year as the dependent variable.

dence plays a key role, and his view is that the currently accepted model holds until a natural experiment brings the economy into a zone which was not previously part of the equilibrium path, which in turn reduces the scope of autocoherent models and prompts the adoption of an alternative one (See the discussion of the progressive abandonment of metallic monetary standards in Sargent (2008)). One might believe that the new model has to be consistent with the pre-natural experiment data as well as with the new data. In terms of the above discussion, this means that the number of autocoherence restrictions should be equal to the number of moments to be matched multiplied by the number of "regimes" over which the moments are invariants. Over time, as new regimes appear, the correct model will be identified as the set of autocoherent ones will be reduced to the correct model. Unfortunately, in practice things do not happen that way, in particular because it is impossible to distinguish a regime change due to a change in the distribution of an exogenous variable (the most favorable case being when that distribution is known, as in the case of the "policy regimes" studied by the literature) from a shift in the underlying parameters of the structural model, in which case the old data must be discarded. This is why Marcet and Nicolini (2003), for example, assume that if the prevailing model is at odds with recent observations, agents switch to a "tracking" learning mode where more weight is given to recent observations as compared to least squares learning. If that is so, then the natural experiment need not restrict the set of autocoherent models because people eventually forget about old data. Recent observations will play a key role in the selection of the alternative model, and potentially some historical episodes (such as the Great Depression) may be more favorable to certain ideological positions (such as a taste for pervasive government involvement in the economy) than others.

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APPENDIX

Id	c0	t-statistic	cp	t-statistic	cg	t-statistic	Industry
20	0,0291665	5,75330973	0,2597794	1,44239331	-0,1577268	-2,33312437	NA
30	0,035182	2,36820535	-0,2746287	-0,5765668	-0,1174287	-0,69196967	NA
40	0,043863	9,52643484	-0,641457	-3,87753333	-0,0115602	-0,27421107	NA
60	0,0733726	3,80368088	-1,3050775	-2,76971055	0,0612603	0,71248322	NA
65	0,0317972	7,21918238	-0,5391637	-3,13755341	0,0764618	1,28522657	1
84	0,0338552	8,35994576	-0,4090922	-2,80060247	0,0660695	1,67589794	NA
94	0,0291722	5,5032092	-0,3138894	-1,38849431	-0,0775655	-1,80835333	NA
99	0,0327642	7,21881577	-0,1793925	-0,99013099	0,0976665	2,46897223	NA
404	0,0424158	9,63001132	-0,6627022	-3,67130849	-0,0124999	-0,12924532	2
405	0,053221	8,52218047	-1,2853318	-4,72414382	0,0138928	0,25220897	1
407	0,0310879	9,59393423	-0,2653334	-2,48619838	-0,0096324	-0,30194276	1
409	0,0489089	2,27298934	-0,6696379	-0,93250793	0,1656279	0,84638754	1
411	0,0394861	8,12808506	-0,6573284	-2,93386744	-0,0487492	-1,19024462	2
414	0,0431624	10,5305473	-0,8511039	-5,52728966	-0,0170939	-0,33001898	1
416	0,0621633	4,77051448	-1,5061255	-3,41198805	-0,0315969	-0,38489897	2
420	0,0412078	6,91616352	-0,671204	-2,71842561	-0,1217625	-2,72555561	1
421	0,0277533	5,37104758	-0,1782095	-0,96951118	0,1262774	2,86447168	1
422	0,0390276	2,86626922	-0,546014	-1,07488007	-0,0380561	-0,50343866	1
423	0,0288351	9,3553418	-0,071928	-0,62732069	-0,0486427	-0,86960461	2
424	0,030411	3,14839982	-0,3420663	-0,95429702	0,0879094	0,96617738	1
426	0,0157028	2,62077583	0,2329447	0,96853522	0,1002452	1,88946919	1

427	0,0469703	3,19592411	-0,6512538	- 1,43460781	0,2479889	1,68284581	1
428	0,0077211	2,01381935	0,6977693	4,59860583	0,163416	3,20750489	2
429	0,0305928	5,7006317	-0,1907546	- 0,84280776	0,0243169	0,58677619	2
431	0,0141751	2,16420046	0,4583327	1,50885833	0,101994	1,88044515	1
432	0,0068317	0,60384267	0,3431035	1,17067857	-0,2298859	-2,4103756	1
433	0,0284721	6,46425731	-0,10118	-0,5178263	0,0131549	0,32129112	2
439	0,0403918	15,8429674	-0,4638431	- 4,90991855	0,0508548	2,5764545	2
440	0,0399793	2,82343632	-0,3942468	- 0,76322981	0,0015307	0,0233835	1
442	0,027536	6,06690567	-0,0837449	- 0,50654021	0,1754977	3,79708635	1
446	0,0295458	4,51620731	-0,2028266	- 0,67404678	0,0091858	0,16269907	2
448	0,0259213	5,52643973	0,0763203	0,49304001	0,1379954	2,52800739	1
451	0,0240702	5,49324646	-0,0386597	- 0,24865734	0,0919576	2,55902219	2
452	0,0288653	8,36763244	-0,106189	- 0,70119938	0,0221157	0,27137769	3
456	0,0146151	2,85529606	0,5535762	2,73400801	0,0652784	1,19651062	1
458	0,0421897	12,2818965	-0,3122924	- 2,16470784	0,1750235	3,89846994	2
463	0,0371564	6,38166174	-0,5022085	-1,9232602	0,1709834	4,83401437	3
464	0,0185085	3,10203165	0,2127301	0,86202091	0,0772379	1,43350582	1
465	0,0240633	5,22621479	-0,0605479	- 0,27976921	0,1765792	3,2063997	1
466	0,0288523	8,5830416	-0,0791849	- 0,59180779	0,2930797	3,20682231	1
469	0,0105845	1,4777864	0,6628062	1,80042125	-0,0677059	- 0,89750327	2
471	0,0249545	5,16976631	-0,0277622	- 0,14773273	0,0549188	0,62867685	1
472	0,0219627	3,56282041	0,2025151	0,73290851	-0,0017802	- 0,03602729	2
475	0,0331005	5,1381941	-0,4863341	- 1,70392728	0,3614139	1,67557007	2
483	0,0353865	4,54570552	-0,2129009	- 0,61890293	-0,1927692	- 3,24318687	3
484	0,0258717	3,32894406	-0,0679328	- 0,18509372	-0,1251806	- 1,70223175	2
485	0,0215315	2,224357	0,2340924	0,63867601	-0,0954512	- 1,32624847	3
488	0,0272186	5,22854846	-0,1976585	- 0,83007523	0,0337739	1,41774551	1
497	0,0477334	6,51381211	-1,0308191	- 2,99083794	0,0915243	1,10606311	1
498	0,0226056	3,82651416	0,7060644	1,49471778	-0,0141165	- 0,29521705	1

499	0,0025791	0,21954757	1,1885301	1,98904316	-0,1123638	-1,90688302	1
500	0,0333052	7,76431478	-0,1976631	-1,11975419	-0,0088433	-0,24981672	2
502	0,0277348	2,64200869	-0,3078468	-0,76289359	0,2378706	1,83727963	2
504	0,0205396	4,96699733	0,3273773	1,4879987	0,1907649	1,94132207	1
506	-0,008713	-0,94617134	1,5311574	3,20797776	0,2508776	2,33874416	2
507	-0,0058264	-0,65844487	1,4501436	3,82605795	0,203616	2,65572031	3
508	0,0146863	3,36926829	0,8343401	4,06261132	0,0297634	0,2489759	2
510	0,0096814	0,72160895	0,9315052	2,03291236	0,0327105	0,15885548	2
512	0,0255425	3,53531528	-0,0372849	-0,1537406	0,0567328	0,88786008	2
516	0,0123863	2,04182109	0,5943621	1,68642443	0,2162075	0,86979012	1
518	-0,0106782	-1,09613727	1,668465	3,84506924	-0,0555432	-0,2555779	2
519	0,0333901	2,37713681	-0,4774604	-0,68107675	0,1931245	2,11058095	1
520	-0,0101986	-0,70578969	0,9998267	1,75228257	0,3950714	3,03725003	2
521	0,0334178	3,4358349	-0,6239471	-1,72653684	0,2295563	1,18443386	1
523	0,0408477	6,98480932	-0,1413184	-0,70803965	-0,1203392	-1,43994425	2
526	0,0515333	2,89485513	-1,2698777	-1,43090738	-0,365663	-1,94297752	2
527	0,0101418	0,62824326	0,4309456	0,79135742	0,1053654	0,31735962	2
528	0,0037156	0,59119453	0,6212596	2,09462156	0,34348	2,13829705	1
531	0,0378466	2,62798265	-0,4814912	-0,80473559	0,138922	0,94516791	1
535	-0,0841638	-3,04434177	2,6388265	2,36752898	1,8726818	4,29248144	1
539	0	-------	0,4945104	3,56583256	0,731403	4,66753574	1
540	0,0348535	1,96128332	-0,5791833	-1,0278126	-0,1127653	-0,59560808	2
541	-0,0212034	-0,8437598	0,6626843	1,00841866	1,2226232	1,8476206	1
542	0,0123483	0,32825671	0,6660989	0,48758691	-0,112116	-0,44339881	1
543	0,0306499	1,35507644	-0,0851956	-0,10182257	-0,3532338	-1,2414766	1
544	-0,0043406	-0,17367959	1,4953317	1,48250168	-0,1424233	-0,69621384	1
546	-0,1142303	-2,9501021	5,660021	3,65711518	0,4550205	2,36478488	1
548	-0,0217875	-2,55529	1,6002412	3,64999398	0,67243	3,8469379	2

Table A1 – Estimation results of the pseudo-model regressions and industry variables. 1=Financial services, 2=Other, 3=Don't know

id	yearmin	yearmax	avg year
20	1990	2009	1999,3538
30	1990	1993	1991,5385
40	1990	2004	1997,0513
60	1990	1993	1991,4
65	1990	1997	1993,4444
84	1990	2009	1999,2206
94	1990	2001	1994,2593
99	1990	2009	1999,25
404	1990	1999	1994,25
405	1990	2007	1997,4839
407	1990	2003	1996,4783
409	1990	1996	1993,5714
411	1990	2009	1999,9355
414	1990	2000	1994,7
416	1990	1995	1992,5556
420	1990	2009	2000,4286
421	1990	2009	1999,6286
422	1990	2009	2000,7143
423	1990	2009	1998,8378
424	1990	2009	2000,1154
426	1991	2009	1999,7826
427	1991	1993	1992
428	1991	2009	2000,3077
429	1991	2008	1999,46
431	1991	2009	2000,1786
432	1991	1994	1992,5385
433	1991	2009	1999,0952
439	1991	2007	1997
440	1991	1994	1992,5
442	1992	1998	1994,6667
446	1993	2009	2001,3065
448	1993	2008	2001,2
451	1993	1997	1994,9091
452	1994	1998	1996
456	1994	2009	2001,0444
458	1995	2000	1997,3125
463	1995	2009	2002,1455
464	1995	2000	1997,4

465	1995	2003	1998,9615
466	1995	1999	1997,2727
469	1995	2000	1997,35
471	1995	1997	1996,0909
472	1995	2009	2002,1224
475	1995	2001	1997,6364
483	1995	2009	2003,3256
484	1995	2009	2002,4706
485	1995	2004	1999,3462
488	1995	2001	1997,5556
497	1998	2008	2003,4286
498	1998	2009	2001
499	1999	2002	2000,2727
500	1999	2003	2001,0714
502	1999	2005	2001,4667
504	1999	2009	2004,2
506	1999	2009	2004,4828
507	1999	2009	2003,9474
508	1999	2009	2003,9143
510	1999	2009	2004,4872
512	1999	2009	2004,3421
516	2001	2009	2005
518	2001	2009	2005,3793
519	2001	2008	2004,8462
520	2002	2009	2005,5185
521	2002	2008	2004,9615
523	2003	2009	2006
526	2003	2009	2006,1429
527	2004	2009	2006,55
528	2005	2009	2007
531	2005	2009	2007,0909
535	2005	2009	2007
539	2005	2008	2006,1818
540	2006	2009	2007,7143
541	2005	2009	2006,9286
542	2005	2009	2006,8
543	2005	2009	2007,1176
544	2005	2009	2006,7333
546	2005	2009	2007,1176
548	2005	2009	2007,1176

Table A2 – Minimum, maximum, and average dates of the forecasters

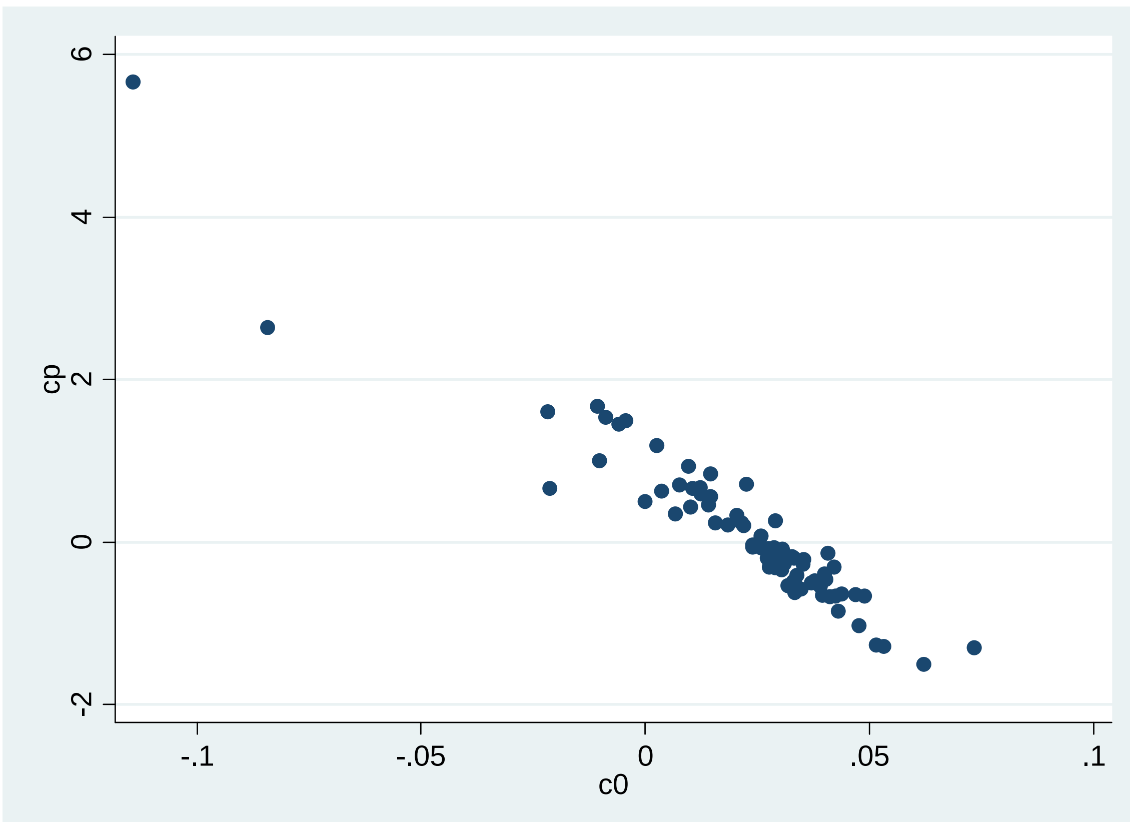

Figure 1 – The c0,cp relationship

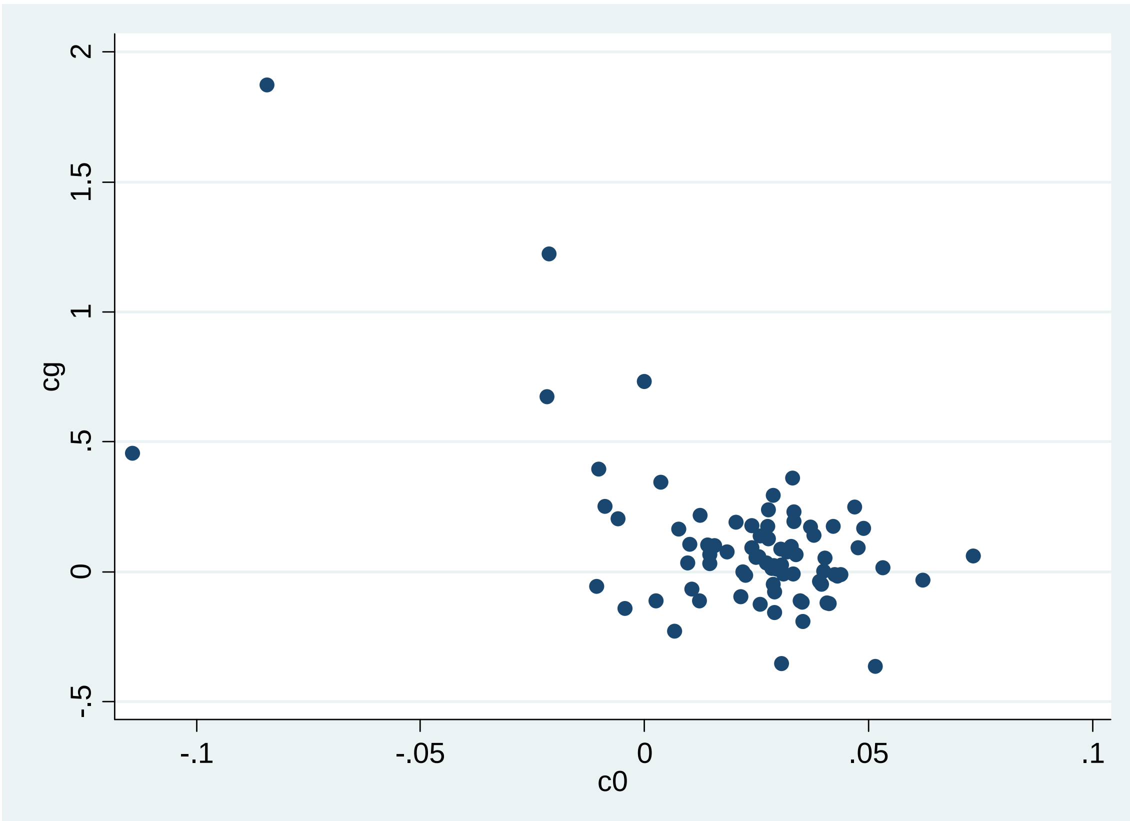

Figure 2 – the c0,cg relationship

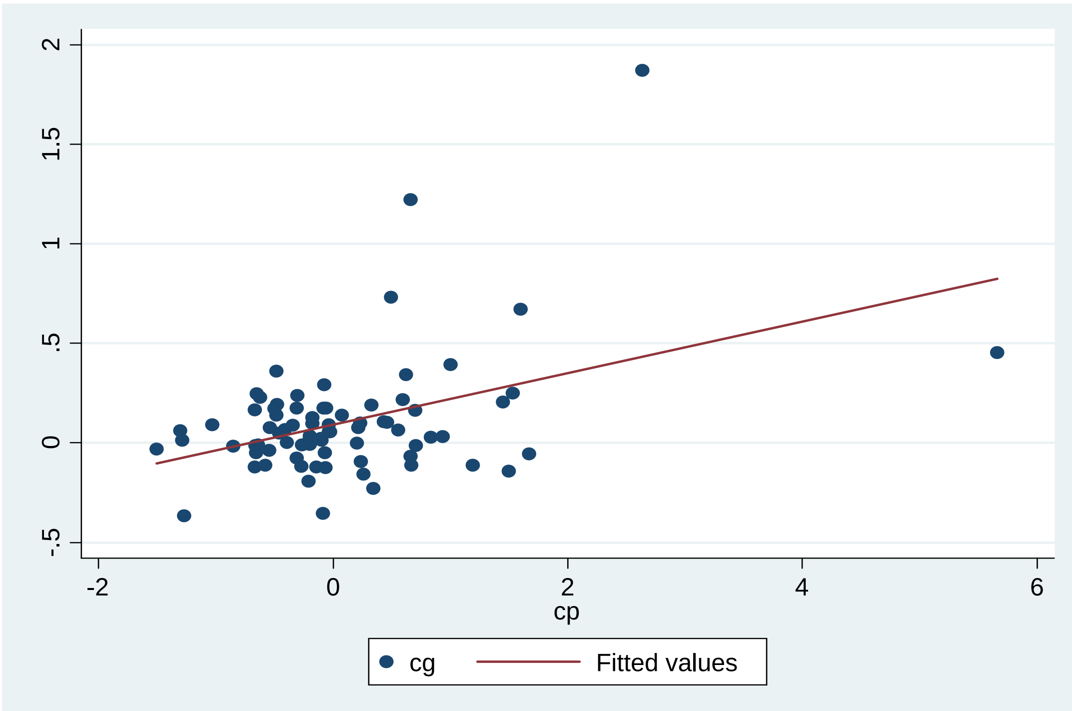

Figure 3 – The correlation between cp and cg