Partisan Theory and the New Keynesian and Sticky-Information Phillips Curves

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January 2006

Abstract

This paper attempts two things: First, to modernize partisan theory by merging the idea of partisan differences in macroeconomic preferences with recent, optimizing models of aggregate supply that account for sluggish nominal adjustment. This aids in resolving some puzzles posed by the current state of partisan theory research. Second, to exploit partisan patterns for a comparison of the empirical performance of the new Keynesian Phillips curve with that of a recent challenger, the sticky-information Phillips curve. It turns out that the sticky-information Phillips curve clearly outperforms its better established rival: in accounting for econometric estimates of partisan patterns in OECD countries, and in tracking post-war experience in the US.

Partisan theories suggest real-world experiments that probably come as close to controlled laboratory experiments as reality permits. Their focus on the element of surprise contained in national election outcomes and on the policy changes observed when new governments take office has provided a natural and welcome testing ground for macroeconomic models of the economys supply side. Two such models feature prominently in this contest. One is the original Phillips curve, which is a key building block of original Partisan Theory (PT) as proposed by Hibbs (1977). The other one is the rational-expectations augmented Phillips curve embraced by New Classical

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Macroeconomics, upon which Alesina (1987) and Alesina and Sachs (1988) based Rational Partisan Theory (RPT).

Fifteen years of comparative empirical research have left us with the puzzling result that PT often outperforms RPT in explaining the election-related patterns of income, unemployment, inflation, and other important macroeconomic variables. This is puzzling because the notion of a permanent trade-off between inflation and unemployment, as proposed by the modified Phillips curve without inflation expectations, embedded in PT, had been discarded by mainstream macroeconomics well before PT was even born. In its place, the inflation-expectations augmented Phillips curve had become the new standard and, equipped with rational expectations formation, dominated macroeconomics for much of the remainder of the 20th century, and become the distinguishing feature of RPT.

Two stylized results document the relative failure of RPT. One is that it is predominantly actual policy changes rather than election surprises that seem to trigger election-related responses in the real economy. Also, the amount of persistence observed in election-related swings in income and unemployment is much closer to what an old fashioned Phillips curve would postulate than what a rational-expectations augmented Phillips curve can account for.

Puzzling as these empirical results certainly are, it appears equally baffling that no effort has been forwarded to date to explain the stylized partisan patterns found in empirical studies by drawing on the more recent developments in the theory of aggregate supply, which include the new Keynesian Phillips curve based on sticky *prices* as proposed by Calvo (1983), and recent proposals by Mankiw and Reis (2002, 2003), who emphasize the effect of sticky *information* on flexible prices or wages. This paper makes such an attempt with the dual purpose of modernizing and improving partisan theory, while at the same time putting the new Keynesian and the sticky-information Phillips curve to a specific empirical test.

The paper is organized as follows. Section 1 provides a stylized summary of empirical and theoretical research on partisan theory, and points to open questions. In an effort to deal with these loose ends, section 2 develops two new versions of partisan theory new Keynesian partisan theory (NKPT) and sticky-information partisan theory (SIPT), which feature the new Keynesian Phillips curve and the sticky-information Phillips curve, respectively, as a macroeconomic constraint. It turns out that the two new theories imply quite different partisan patterns in macroeconomic variables. When comparing them with the empirical patterns typically encountered in pertinent

econometric studies (section 2.3), or with the patterns we deduct from US time series (section 3), new Keynesian partisan theory comes in a distant second. Section 4 sums up and concludes.

1 The puzzling state of partisan theory research

This paper merges the basic idea of partisan theory - political parties cater to different constituencies and their policies are thus guided by different preferences for macroeconomic outcomes - with recent models of the economy's supply side that derive from explicit micro foundations. One of those models is the new Keynesian Phillips curve, which motivates price stickiness in the spirit of Calvo (1983) and has become widely accepted as the proper framework for the discussion of monetary policy issues. The other one is its closest competitor, the sticky-information Phillips curve recently proposed and propagated in a series of papers by Mankiw and Reis (2002, 2003).

Success or failure of these two models of aggregate supply will ultimately be based on their ability to conform with stylized empirical facts. Partisan patterns in macroeconomic variables do provide one such testing ground. A glimpse at the current state of research on partisan theory and patterns will help to gauge the contribution of the newer partisan models proposed here and the empirical potential of the employed models of aggregate supply.

1.1 Partisan patterns in income and inflation

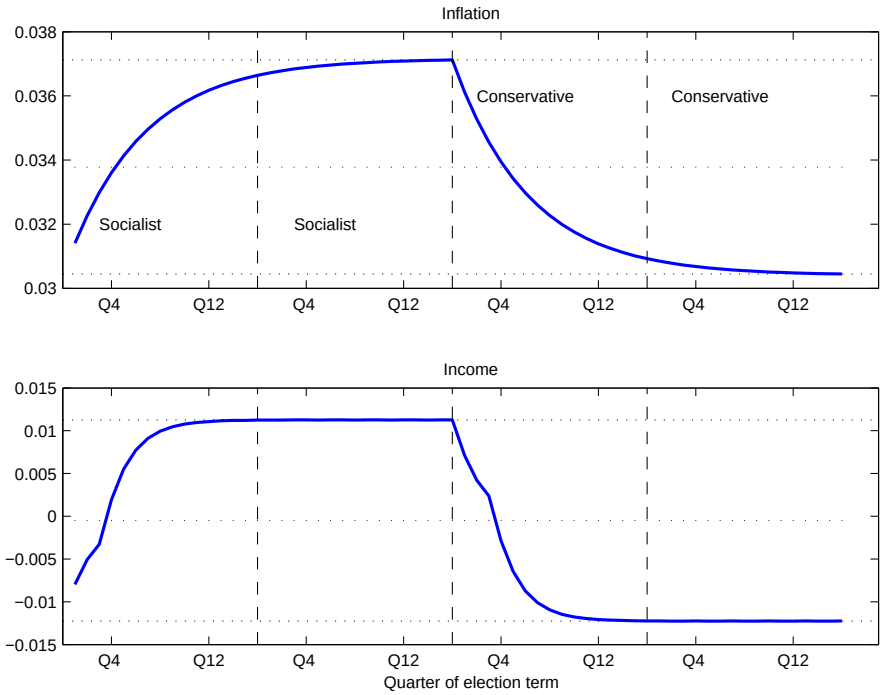
Econometric investigations into the empirical merits of partisan theory have come up with a rather bewildering spectrum of results.[1] And even papers that take stock find it hard to distill a robust set of stylized facts from the large body of empirical research.[2] It is not our intention to delve into the subtleties of this empirical discussion. Rather, our goal is to reconsider the implications of the basic idea behind partisan theory in the light of current perceptions of how the economy's supply side works. Despite this theoretical thrust of our paper, it will prove useful to keep a rough idea in the back

[1] Examples are Alesina and Roubini (1992), Carlsen and Pedersen (1999), Erlandsson (2004), or Shelton (2005).

[2] See, in particular, Hibbs (1992), Alesina et al. (1997), Drazen (2000), and Erlandsson (2004).

Figure 1: Simulations of econometric estimates from OECD panel data

The source is Alesina and Roubini (1992). The income path is derived from column 1, table 1; the inflation path from column 1, table 3.



of our head of what we are actually trying to explain. For that purpose we may turn to one of the most influential empirical studies of political cycles, conducted by Alesina and Roubini (1992). Based on 2'000 pooled quarterly observations for 18 OECD countries for the time period 1960–1987, they estimate election patterns for income, unemployment and inflation based on estimation equations that feature an autoregressive part along with dummy variables that intervene at appropriate points during the election period.

Figure 1 depicts the patterns estimated for inflation and income, as these will be the variables on which our models focus. We postulate the same sequence of events to be studied by the theoretical models below:

Initially, a socialist (or liberal, in US terminology) government holds office, which is reelected once. At the second election voters opt for a conservative government, which is also reelected once. The graphs thus show

both the inflation and income patterns that result when there is no change in government, and the patterns that accompany a change in power from left to right. A change from right to left would trigger an identical response in the opposite direction.

The upper panel graphs inflation patterns. The lower panel gives the corresponding movement in income. Obvious properties are:

(i) There are permanent differences in the rates of inflation generated under socialist and conservative governments, with socialists opting for higher inflation. Due to persistence in inflation rates, it takes more than half of an election term until the inflation rate approaches its target value.

(ii) Any election of a socialist (conservative) government boosts (represses) income. As with inflation, income differences are permanent, suggesting either a non-vertical long-run Phillips curve or hysteresis in the labor market that permits demand-side policies to change potential income permanently.

(iii) Inflation and income effects require actual policy changes. Surprise reelections that are not accompanied by a change in policy leave inflation and income levels unaffected.

1.2 The empirical performance of partisan and rational partisan theory

The income pattern shown in Figure 1 matches the result which Hibbs' (1977) seminal paper reports for Britain almost perfectly.[3] It is, therefore, also the prototype income pattern for partisan theory. Hibbs did not spell out PT in an explicit model. But his verbal account and his interpretation of empirical results reveal that his view of the economy's supply included a non-vertical long-run Phillips curve, and short-run dynamics driven by inflation expectations that only slowly adapt to current inflation and were not forward-looking. Thus, given macroeconomic preferences that feature price stability and full employment as major goals, socialists (with a knack for full-employment and much tolerance of inflation) would pick a target point

[3]Hibbs (1977) set out to explain the unemployment rate as an indicator of real activity. By means of Okun's law we find the patterns of unemployment and (the cyclical component of) income to be mirror images of each other.

high up on the negatively sloped long-run Phillips curve, while conservative parties (with the opposite ranking of priorities) would pick a point down to the right. Short-run Phillips curves that are flatter than the long-run Phillips curve, and adaptive inflation expectations determine the looping trajectory along which the economy moves from one long-run target point to the other when a new government assumes office. Time paths for inflation and income result in this theoretical framework that have all the qualitative features of the empirical patterns shown in Figure 1.

What kept PT from being a success story is that at the very time it entered the stage, macroeconomics had discarded the notion of a long-run trade-off between inflation and indicators of real activity. This paved the way for a new brand of partisan theory, developed and proposed very much simultaneously by Chappell and Keech (1986) and Alesina (1987) and Alesina and Sachs (1988). Properly coined rational partisan theory (RPT) by the latter authors, it featured a vertical long-run (or no-surprise) Phillips curve and rational inflation expectations formation. Under such a scenario any element of surprise in an election result triggers temporary effects on real activity.

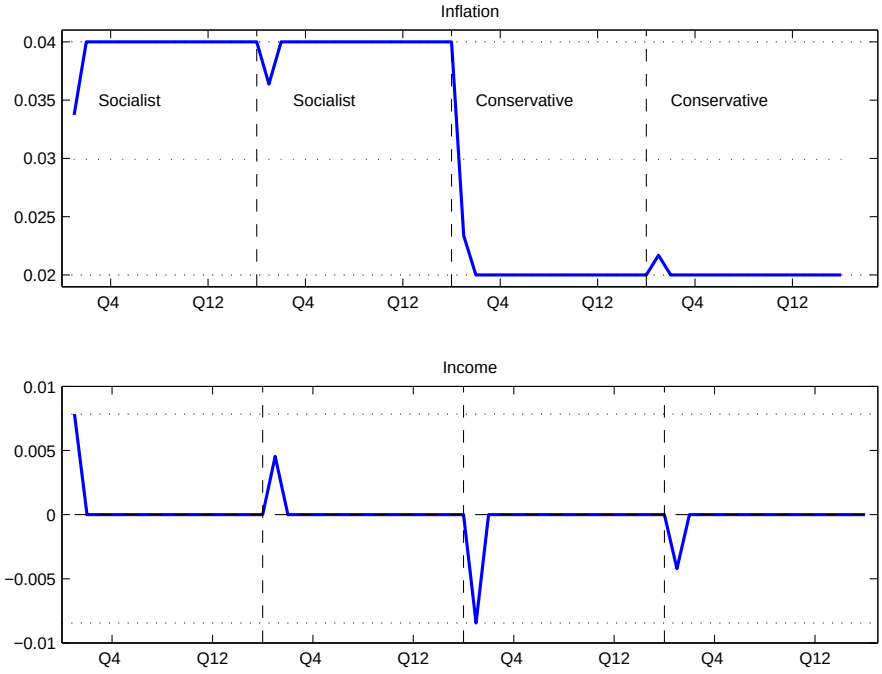
When events follow the sequence proposed in Figure 1 and aggregate supply is of the pure Lucas surprise type, inflation and income patterns as given in Figure 2 result.[4]

It is obvious that despite its logical elegance and persuasiveness RPT does not fare well in explaining the empirical patterns shown in Figure 1. In particular, the quick and brief post election blips in income do not match the absent income response when a party is reelected and the sluggish but lasting income effect observed when a new party takes office. The latter may partly be mended when staggered wage setting in the spirit of Fischer (1977) and Taylor (1980) is assumed. However, for realistic contract lengths this only extends the blips somewhat, without making real effects last. The only way to reconcile RPT with income and inflation patters as recorded in Figure 1 seems to be by postulating perfect or near-perfect hysteresis on the economy's supply side,[5] and assuming that the economy always expects

[4]The simulations assume a 65 percent reelection probability, one-period wage contracts, and party utility functions that are quadratic in both inflation and the deviation of income from desired income.

[5]Following Alesina (1987) and Alesina and Sachs (1988), this is what most RPT models actually do by recasting income in the Lucas supply function and in the Barro-Gordon (1983) utility function by income growth. Then inflation surprises have a temporary effect

Figure 2: Election patterns derived from rational partisan theory



the current party to remain in office. Then only victories of the opposition party come as a surprise and reelections of the ruling party do not trigger any macroeconomic effects. Relegating election surprises to electoral change seems implausible, however, since tossup elections are not infrequent and, by definition, lead to the incumbent party being expelled from office just as often as seeing it emerge as the winner.

As regards hysteresis, this postulate clashes with the ruling orthodoxy in other areas of macroeconomics, where the assumption of hysteresis in the face of demand-side shocks is rarely employed in theory and or found empirically.[6] We are thus left with the puzzling result that stylized partisan patterns in macroeconomic variables can only be explained by means of an obsolete model based on less than rational behavior, or by augmenting a mainstream macroeconomic model that features full rationality in expectations formation

on income growth, but a permanent effect on the level of income.

[6]See e.g. Blanchard and Quah (1989).

with a set of assumptions that are empirically questionable, to say the least.

We will now take the challenge to develop alternative versions of partisan theory that employ state-of-the art models of the economy's supply side with explicit microfoundations.

2 New Keynesian and sticky-information partisan theory

Recent advances in the theory of aggregate supply that focus on the sluggish adjustment of prices have their roots in Calvo's (1983) seminal work. Price setting is studied in an economy with an infinite number of identical, profit-maximizing firms engaged in monopolistic competition. In such a scenario, any firm's desired price $p_t^\star$ depends on the state of the business cycle, measured by the deviation of income from potential income, y_t, and on the prices set by other firms, as represented by the aggregate price level p_t (all variables in logs):

$$p_t^\star = p_t + \alpha y_t. \tag{1}$$

This equation is standard in the literature and can be derived from the firms profit maximization problem (Blanchard and Kiyotaki, 1987). The *new Keynesian Phillips curve*, surveyed by Clarida et al. (1999), incorporates Calvo's idea directly: Firms may change prices only at discrete intervals. Which firms get to change their price at a given point in time is determined by a random draw from all firms.

In an alternative model proposed by Mankiw and Reis (2002, 2003), prices are actually flexible, meaning that firms may costlessly change prices any time, and are thus planning an optimal price path rather than a fixed price level. Instead of prices, it is information about macroeconomic conditions that is sticky, which gives it the name *sticky-information Phillips curve*. Since acquiring such information or reoptimizing on acquired information is costly, a firm's current prices may often not reflect current aggregate information. Again, as in the new Keynesian Phillips curve, prices are driven by a stochastic process. This time it is those firms who are permitted to reoptimize their price path at a given point in time that are being selected by a random draw. In principle, all other firms can and may change prices as well. But since they base decisions on past information, they consider their previously computed price path still optimal.

We now merge each of these recent and influential models of aggregate supply with the postulate of partisan differences in macroeconomic preferences to obtain new Keynesian and sticky-information partisan theory.

2.1 New Keynesian partisan theory and patterns

In Calvo's model of staggered price adjustment, a firm given the opportunity to readjust choses the price that maximizes the current value of its profits, taking into account the probabilities that it may have a chance to readjust again at each future point in time. Assuming a time-discount rate of zero, Mankiw and Reis (2002) show that the optimal price for a firm resetting its price at time t, x_t, is given by

$$x_t = \lambda \sum_{j=0}^{\infty} (1-\lambda)^j E_t p^{\star}_{t+j}, \tag{2}$$

where λ denotes the probability that a firm can reset its price at a given point in time. More distant periods are given smaller weights because chances are higher that the firm will be able to reoptimize again between now and then. Mankiw and Reis (2002) show that equation (2) implies the new Keynesian Phillips curve

$$\begin{aligned} y_t &= \gamma(\pi_t - E_t \pi_{t+1}) \\ \gamma &= \frac{1-\lambda}{\alpha \lambda^2}. \end{aligned} \tag{3}$$

The economy's demand-side is perfectly controlled by a government that maximizes utility derived from price stability and full employment. Following common procedure in political macroeconomics, we model the aversion of individuals and political parties to inflation and unemployment by the double quadratic utility function

$$\begin{aligned} U_i &= \sum_{t=0}^{\infty} \beta^t V_{i,t}(y^{\star}, \pi), \\ \text{with} \\ V_{i,t} &= -\frac{\xi_i}{2}(y_t - y^{\star})^2 - \frac{1}{2}\pi_t^2, \quad i \in \{L, R\}, y^{\star} > 0 \end{aligned} \tag{4}$$

where $y^{\star}$ denotes desired income which exceeds potential income (normalized at 0). The subscripts L (left) and R (right) are used for the socialist and

conservative parties, respectively. As in Alesina (1987), we assume $\xi_L > \xi_R$, proposing that socialists suffer greater disutility from unemployment.

After substituting the new Keynesian Phillips curve into equation (4), differentiation with respect to the policy variable π yields the first order optimality condition[7]

$$\frac{dU_i}{d\pi_t} = -\left(\gamma\pi_t - \gamma E_t\pi_{t+1} - y^\star\right)\gamma\xi_i - \pi_t = 0, \tag{5}$$

This gives us party i's current optimal inflation rate as a function of expected inflation:

$$\pi_t(\xi) = \underbrace{\frac{\gamma\xi}{1+\gamma^2\xi}y^\star}_{a(\xi)} + \underbrace{\frac{\gamma^2\xi}{1+\gamma^2\xi}}_{b(\xi)} E_t\pi_{t+1}. \tag{6}$$

The line formed by the government reaction function in the $E_t\pi_{t+1} - \pi_t$ space, will in general have a positive intercept (inflation bias) and a slope which is positive but strictly less than one. In the limiting case where the party assigns zero weight for income (ξ) in its utility function, both intercept and slope will be zero. The inflation bias is linear in the difference between the full employment and the long term equilibrium output level (captured in $y^\star$). The higher ξ, the higher both the slope and the intercept.[8] Partisan patterns in inflation and, via the Phillips curve, in income result because the two parties choose different inflation rates.

To close the model, we need to make some assumption on the distribution of election results. We assume a constant reelection probability of q for the ruling party, independent of its color. Accordingly, the matrix of transition probabilities between the two types of government, which we denote by Θ, is given by

$$\Theta = \begin{bmatrix} q & (1-q) \\ (1-q) & q \end{bmatrix} \tag{7}$$

Let N denote the number of periods in an election term. Note that there are no lagged variables in the model. In fact, the state of the system is completely

[7]The assumption that inflation is the policy variable may appear to be at odds with the assumption that monopolistic competition allows firms to set prices so as to maximize profit. Note, however, that when monetary policy possesses perfect control over aggregate demand, the money supply can always be adjusted so as to make firms set current inflation to the level desired by the government.

[8] $\frac{da(\xi)}{d\xi} = \frac{\gamma}{(1+\gamma^2\xi)^2} > 0$ and $\frac{db(\xi)}{d\xi} = \frac{\gamma^2}{(1+\gamma^2\xi)^2} > 0$.

determined by which party rules the government and how far we are from the next election date. Hence, there are $2 \times N$ different equilibrium states of the economy. We collect the equilibrium inflation rates for the economy in the $2 \times N$ matrix Π. The first row of Π contains the inflation rates for conservative governments while the second row contains the inflation rates for socialist governments. Solving the model is now straightforward. From the government reaction function, it follows that

$$\Pi_{i,j} = \begin{cases} a_i + b_i \Pi_{i,j+1}, & \text{if } j \neq N \\ a_i + b_i \sum_k \Theta_{k,j} \Pi_{k,1} & \text{if } j = N, \end{cases} \tag{8}$$

where the index k gives the alignment of next period's government. This system of equations can be solved with basic matrix algebra. Given the solution for Π, we can use the Phillips curve to solve for the output gap

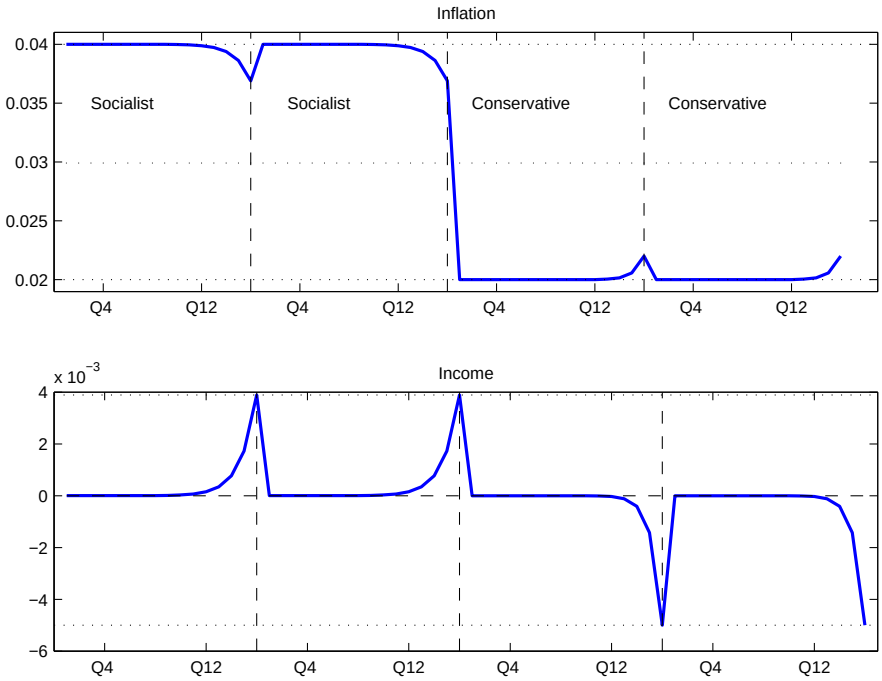
$$Y_{i,j} = \begin{cases} \gamma \left(\Pi_{i,j} - \Pi_{i,j+1} \right) & \text{if } j \neq N, \\ \gamma \left(\Pi_{i,j} - \sum_k \Theta_{k,j} \Pi_{k,1} \right) & \text{if } j = N. \end{cases} \tag{9}$$

We calibrate the model with following parameters: λ is set to 0.25, implying that one forth of the firms will be able to reset their prices every quarter—a standard value in the literature; assuming an equilibrium unemployment ratio of 0.05 and $y^\star$ is set to 0.05; and α is set such that the Phillips curve has a slope of one (i.e. $\alpha = (1-\lambda)/\lambda^2$). Equation (6) implies that in the absence of inflation changes, the inflation for each party would be given by $\pi = \gamma\xi/(1-\gamma^2\xi)y^\star$. Using this, we set ξ_i such that the long-run inflation bias of conservative and socialist governments would be 0.02 and 0.04, respectively. The probability that the incumbent party remains in power was set to 0.65. This corresponds to the fraction of incumbent US presidents who won when they ran for reelection.[9].

Figure 3 shows the inflation and output gap patterns predicted by the model. Because of the forward looking expectation in the government reaction function, most of the variation in the output gap will be at the end of the election cycle. In the period immediately preceding a new election, expected inflation for the next period will be a weighted sum of the inflation rates chosen by the two parties, with the weights being the probabilities of conservatives and socialists winning the election. If the economy is currently

[9]Assuming that the true data generating process is the one we assume, the 90 percent confidence interval for the incumbents' reelection probability is $(0.475, 0.826)$

Figure 3: Election patterns derived from new Keynesian partisan theory



governed by a socialist government, the expected inflation rate will be lower than the one the government chooses for the current period, causing the economy to boom in the last period. Under a conservative government, the opposite effect takes place.

From the government reaction function, we see that governments will accommodate parts of any change in expected inflation rates. Hence, a socialist government will choose a lower inflation rate in the last period of its term, while a conservative government will choose a higher one. (See figure). This creates repercussions from the election also in earlier periods. The change in the inflation rate in the last period of a term is perfectly predictable and will lead to a change in the inflation rate also in the *second* last period of the term, etc. However, the effect dies out rapidly as we backtrack from the election period.

To understand the economics of what is taking place, it is useful to look at the optimization of an individual representative firm. Within the framework

of the Calvo model, firms can only reset the price they charge for their output during the odd periods when chance allows them to do so. Hence a firm resetting its price will do so based on a weighed average of the expected future inflation rates for all future periods. Consider two firms which reset their price levels, one at the beginning of a socialist term; one at the end of it. The firm setting its price level at the beginning of the term knows with certainty that for the next 4 years, a high inflation government will be in power. Unless it sets a price which is very high relative to the current level, it risks getting stuck with a price which is very low compared to the desired one. In contrast, a firm resetting its price at the end of a socialist term attributes a positive probability to being in a high and low inflation environment after the election. Accordingly, it expects lower future price levels p and will choose a relatively low price. As we can see in the top panel of the figure, the government accomodates some of the reduction in expected inflation rates; still current inflation rates are above those expected for the next period, which produces a boom.

2.2 Sticky-information partisan theory and patterns

In the Mankiw-Reis model of staggered information, a firm given the opportunity to reoptimize choses the price path that maximizes the current value of its profits, taking into account the probabilities that it may have a chance to reoptimize again at each future point in time. Denoting the period t price charged by a firm that last reoptimized its price path j periods ago by $\hat{p}_{j,t}$, this implies

$$\hat{p}_{j,t} = E_{t-j} p_t^\star \tag{10}$$

where $p_t^\star$ is still the price level which maximizes current period profits, as given by equation (1). Since the aggregate price level p_t is a weighted average of the individual prices of the firms that reoptimized this period, last period, the period before, and so on, we obtain

$$p_t = \lambda \sum_{j=0}^{\infty} (1-\lambda)^j E_{t-j} p_t^\star \tag{11}$$

In contrast to the new Keynesian Phillips curve, where current prices depend on expected future prices, prices in the sticky-information scenario reflect past expectations about current prices. As Mankiw and Reis (2002) show,

this price setting generates the sticky-information Phillips curve

$$y_t = \gamma(\pi_t - A_t)$$

where

$$A_t = \lambda \sum_{j=0}^{\infty} (1-\lambda)^j E_{t-1-j}(\pi_t + \alpha \Delta y_t). \tag{12}$$

$$\gamma = \frac{1-\lambda}{\alpha\lambda}$$

Faced with this macroeconomic constraint, governments manage aggregate demand so as to maximize utility as given in equation (4). After substituting the sticky-information Phillips curve into the utility function, straightforward optimization yields

$$\pi_t = \underbrace{\frac{\gamma_{si}\xi}{1+\gamma_{si}^2\xi} y^\star + \sum_{j=1}^{\infty} \frac{\beta^j d E_t V_{i,t+j}}{d\pi_t}}_{a(t)} + \underbrace{\frac{\gamma_{si}^2\xi}{1+\gamma_{si}^2\xi}}_{b(i)} A_t. \tag{13}$$

which gives current inflation as a function of past expectations on current inflation and the change in the output gap (A_t), and the impact on future utility of an inflation increase in the current period.[10]

The state of the economy at the start of an election term will depend mainly on which party ruled the government in the previous term. A socialist government will on average finish its term with a high inflation rate and a slight, but positive output gap; a conservative one just the opposite. While historical inflation rates have no impact on economic aggregates,[11] the output gap from the last period of the previous election cycle enters the new Phillips curve, and will as such have an at least transitory impact.

[10] A change in current inflation influences future macroeconomic conditions through the output gap. An inflation hike leads to a temporary increase in current output. Those agents who update their price paths will recognize the transitory nature of the output increase and expect a negative Δy for future periods. Through the A_t term, this implies a downward shift in future Phillips curves and hence better macroeconomic conditions. This mechanism is not present in the new Keynesian Phillips curve, because it includes only forward-looking expectations.

[11] This is of course not true on the firm level, since the profit of individual firms will depend on the extent to which the current price level differs from the one expected when the firm last set its price path.

The lagged expectations in (12) complicates the solution of the model. In RPT, only expectations from last period enter the current inflation rate. With sticky information, expectations from all past periods are relevant. Hence, in principle, the current inflation rate and output gap depend on the whole history of political events. Another complicating element is that current policies reverberates on future outcomes through the output gap. The current government has to take account for this in its optimization, but in order to do so, it must also build expectations over the future. Note, however, that the influence of historic variables fades out rapidly. In the last period of an election term, only 1 percent ($(1-\lambda)^{16}$) of firms have price paths set before the current government took office, and only 0.01 percent will not reoptimize during two consecutive governments' terms. We may, hence, safely reduce the dimensionality of the problem by truncating the number of past governments we keep track of.

The complete solution algorithm we use is fairly elaborate, so its full description has been relegated to the appendix. The main idea is to iterate between the following steps until convergence.

(i) For given matrices of inflation rates, Π, and output gaps, Y, find the government reaction function for each state of the economy.

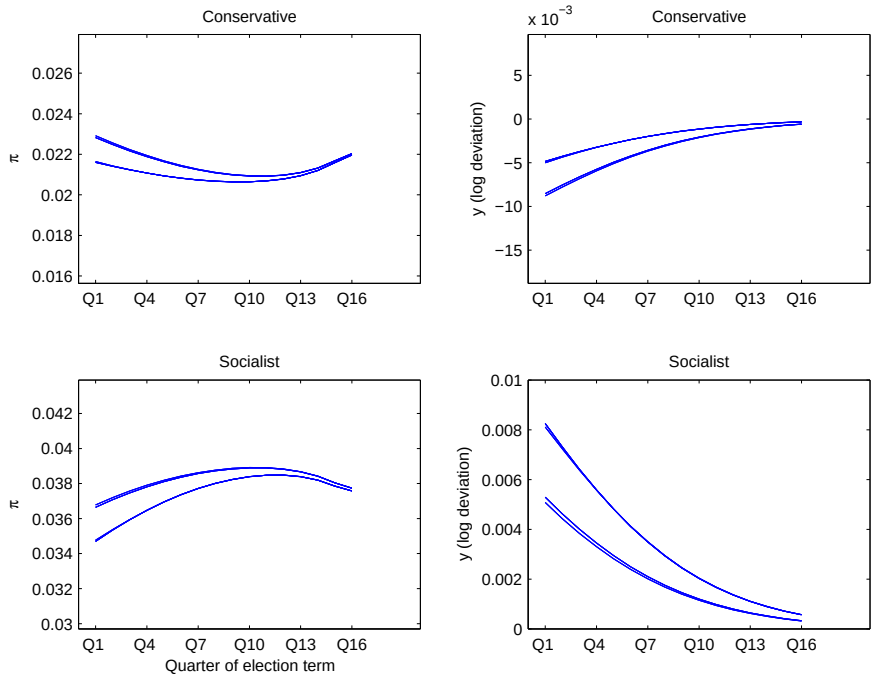
(ii) Use the reaction functions computed above to compute a new matrix of inflation rates Π' and output gaps Y'

(iii) (Stopping rule) Check whether Π and Π' are so close that we can assume that convergence is achieved; if not, reset Π and Y as Π' and Y' and return to (i).

Unsurprisingly, it turns out that only the ideological alignment of the last government leaves a strong imprint on outcomes in the current term. This is illustrated in figure 4, which draws the inflation and output gap paths for socialist and conservative governments. Every panel depicts 32 different paths—each linked to a specific history of socialist or conservative rule during the last five election periods. Such a history may read "conservative-conservative-socialist-socialist-conservative", or "conservative-socialist-socialist-conservative-socialist". Since 32 such permutations exist, we end up with 32 distinct paths under the current government. This is not really visible in the graphs, because the 32 paths are always packed into two clusters. And the position of the cluster is only determined by which party ruled during the previous election term. Who was in power further back has

Figure 4: Sensitivity of inflation and income patterns derived from sticky-information partisan theory

Each panel shows 32 paths, corresponding to all possible permutations of socialist and conservative rule during the 5 election terms preceding the current one. Paths cluster in two groups, reflecting the ideology of the last government only.

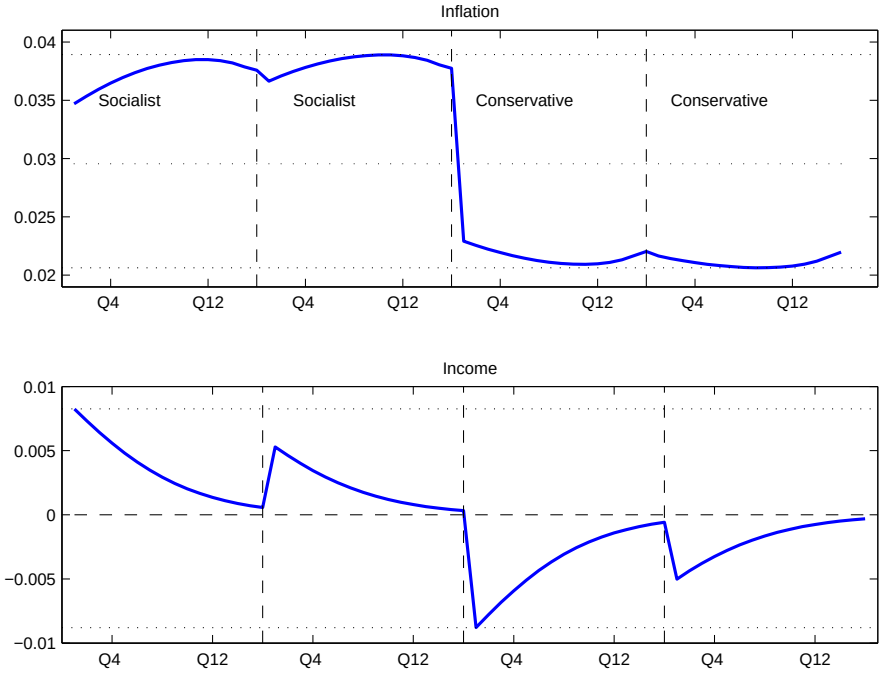


no visible effect on today's economy. Economically, the impact of the previous governing party, and hence the clustering, can be traced back to mainly two sources: Election expectations and initial output gap: If the incumbent has an election advantage, firms will assign a higher probability to a continuation of the current policy than to a change to that of the other party when setting their price path. Inflation expectations in the early periods following a socialist government will hence be higher than those in the early periods of a conservative government.

The dynamics of the model can best be discussed against the backdrop of a particular realization of the model. Figure 5 shows a simulated path which contains samples from all clusters in Figure 4. It depicts the inflation and

Figure 5: Election patterns derived from sticky-information Partisan theory

Preceding the time window shown here, the calibrated model is assumed to have a history of 5 consecutive conservative governments.



output-gap time series of an economy where—after five consecutive terms with conservative governments—the socialist party wins the election, stays in government office for two terms before loosing the election.

The election of a socialist government leads to a jump in inflation and a soaring output gap. The novel feature is that the effect is not restricted to the aftermath of the election. As we move toward the middle of the cycle there is a steady rise in the inflation rate. This comes as an ever larger fraction of firms' price paths are adjusted to take account for the inflation bias of the current government. Through the government reaction function, this change in the expected inflation rate is met with a change of the implemented inflation rate.

Inflation rates peak around the 12th quarter of the socialist government term. The slight subsequent retreat is due to changes in the government reaction function: Governments have an incentive to use current inflation to

generate benign conditions for future policy, be it their own or that of the other party. Higher inflation today will yield a higher output gap. Due to the Δy term in the Phillips curve, a high current output gap shifts future Phillips curves down. Through the government reaction function, this will reduce future inflation rates and increase output regardless of who is in power. By how much depends on which party rules. The policy of the socialist party responds stronger to changes in expectations, so the incentive to boost inflation to generate a beneficial macroeconomic environment is stronger, the more likely the socialist party is to be in power in the immediate future. In the beginning of a socialist government term, the incentive is hence stronger than at its end, explaining the falling inflation rates toward the end. The dynamics of the output gap are straightforward. The output gap is larger, the larger the gap between realized and expected inflation rates; the initial output hike slowly recedes as firms update their price paths to take account for the policy of the current government.

The inflation and output patterns during the second term of the socialist government replicate qualitatively those seen during the first term. But there are differences in their amplitude. The disparity is mainly due to the different inflation expectations at the start of the two terms. Expectations for the first term were formed given an ex-ante probability of q that the incumbent conservative party would win the election. If $q > 0.5$, i.e. if there is an incumbents advantage, as there is according to our calibration, expected inflation rates will be relatively low. As we approach the second socialist term in the plot, the socialists have the incumbent's advantage, so firms rationally expect higher inflation rates. The reelected government then accommodates the expectations by generating higher inflation rates than it did in its first term. The effect on output, however, is smaller in the second term because the surprise component of inflation is smaller.

The expected change in the output gap is also an element of the sticky-information Phillips curve, and this adds a second dimension along which the first and second socialist government terms differ. A socialist government typically ends its term with a slight positive output gap; a conservative one with a small negative one. Firms expect the gap to close during subsequent periods. This shifts the Phillips curve at the start of the second government term upward relative to where it was at the start of the first government term. Compared to the impact of inflation expectations, however, this effect is negligible.

We now move on to the third election term shown in Figure 5. This term

mirrors the first period in that it follows a loss of power for the incumbent party. Expectations formed prior to the election were based on the knowledge that a conservative victory was the least likely result. Hence, the expected inflation rate is relatively high. The conservative government accommodates some of this, but actual inflation is nonetheless below expected inflation and the economy ends up with a negative output gap. Subsequent dynamics are analogous to those for the socialist government: Firms' price paths are slowly updated to the new political realities, causing the output gap and inflation rates to recede. Again, there is a turning point in inflation rates in the second half of the term: In contrast to the situation for the socialist government, it becomes more and more attractive for the conservative party to boost the output gap as we move toward the end of its term.

As with the second socialist term, the second conservative government term is qualitatively identical to the first conservative term. Inflation rates are lower at the beginning of the term but converge to the same level as at the end of the first term; the output gap is also negative in the second conservative term, but less so than in the first.

2.3 Comparative empirical performance

A useful partisan theory needs to account for the following features in the Alesina-Roubini results shown in Figure 1:

(a) the steady rise (fall) in inflation after a socialist (conservative) party moves into power.

(b) the steady rise (fall) in income after a socialist (conservative) party moves into power.

(c) the strong comovement of inflation and income.

(d) the absence of any systematic movement in inflation or income when a ruling party gets reelected.

We already noted that RPT is unable to explain these features, and that PT, which accounts for them nicely, lacks an acceptable theoretical foundation.[12] How do new Keynesian and sticky-information partisan theory fare?

[12]Hibbs has worked on refining PT and render its theoretical underpinning more convincing by introducing incomplete information and learning processes (Hibbs, 1994). For a recent contribution along these lines see Erlandsson (2004).

2.3.1 New Keynesian Partisan theory

The empirical merits of new Keynesian partisan theory may be gauged by comparing Figures 1 and 3. The result is sobering. On the positive side, there are lasting differences in inflation rates in the proposed direction. Also, average income is indeed higher under socialist governments, though this results from relatively short blips. On the negative side, however the timing in Figure 3 and the comovement of variables is completely different from what Figure 1 depicts:

(i) Inflation rises (falls) immediately when the socialist (conservative) party assumes office, rather than gradually.

(ii) After elections, income retreats toward potential income, which is unaffected by party color, immediately.

(iii) Deviations of income from potential income occur just before elections, and they are very short lived. This leads to the disturbing result that income drops (rises) after a socialist (conservative) victory.

(iv) Finally, inflation and income do not move in the same direction. Instead, when inflation falls (rises) in the advent of an election, income rises (falls).

This last result points to a generally disturbing feature of the new Keynesian Phillips curve, as many authors have noted, namely that an anticipated disinflation generates a boom (See e.g. Mankiw and Reis, 2003).

2.3.2 Sticky-information partisan theory

The empirical merits and deficits of sticky-information partisan theory may be gauged by mapping Figure 5 against Figure 1. Here also, inflation under socialist governments is higher than under conservative governments. After a socialist (conservative) party takes over the government, inflation rises (falls), as suggested by Figure 1. However, this movement is dwarfed by the instantaneous jump that also occurs, which is not found in Figure 1. A further feature missing from Figure 1 is that inflation changes its course just before the election.

Regarding income, there are no long-run partisan differences. However, while not permanent, positive (negative) deviations from potential income under a socialist (conservative) government show persistence and last well

into the second half of an election term. Contrary to what Figure 1 shows, such deviations peak right after the election, and they are also observed, albeit in muted form, when the current government secures reelection.

None of the two new versions of partisan theory provides an entirely satisfactory account of the empirical patterns derived from the Alesina-Roubini estimates. They do fail to a quite different extent, though. NKPT is unable to even reproduce the big picture. And many details, including the crucial timing of movements around election dates and the comovement of income and inflation are simply not there. SIPT, arguably, fits the big picture, at least. A number of details are missing, though, including the sticky response of inflation and income to a change in government, suggested by Figure 1.

When theory and empirics does not match, this may be because theory does not properly capture aspects that are crucial for the issues under study. Or, we may have committed errors in stylizing the empirics. In our case, the specification of the estimation equations by Alesina and Roubini (1992) may unduly straitjacket the data. In particular, the specification as autoregressive processes with intervening dummy variables around dates of electoral change erases any effects that may actually have occurred around dates when a ruling party was reelected. Or, using an AR1-process for inflation rules out a hump-shaped path as given in Figure 5 from the beginning.

To see how NKPT and SIPT perform when empirical patterns are being obtained by more flexible methods that do not carry such a high risk of unduly constraining stylized shapes, we now look at the experience of an individual country.

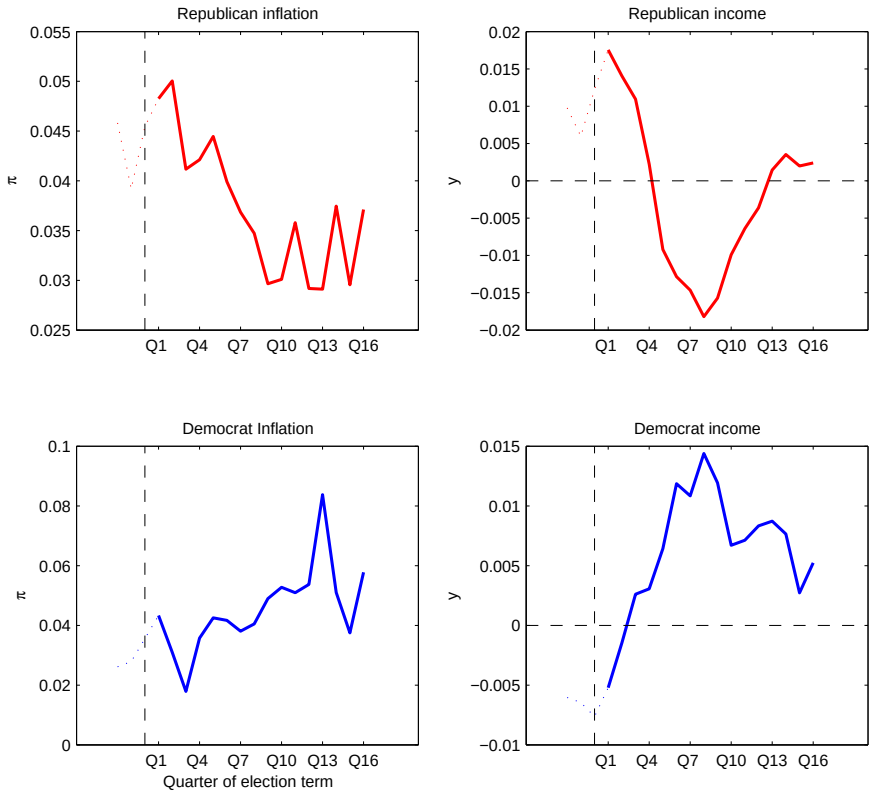
3 An empirical account of partisan patterns in the United States

In order to obtain a less prejudiced picture of partisan patterns we now focus on a single country and place no prior restrictions on pattern shapes. The country we look at is the United States, and we consider quarterly data for the 13 election periods between 1952 and 2004.[13] Inflation rates are anualized quarter on quarter changes in the CPI (seasonally adjusted with a Census X-

[13]Quarterly observations for real GDP are from the Bureau of Economic Analysis' webpage (http://www.bea.gov, line 1 of NIPA table 1.1.3), CPI data from that of the Bureau of Labor Statistics (http://www.bls.gov/data/home.htm).

Figure 6: Partisan patterns in the U.S. 1952-2004

Patterns reflect average values for each quarter of an election term. Inflation rates are seasonally adjusted. Income is measured as deviations from the H-P trend.



11 seasonal adjustment program). The output gap measures the deviation of the log of quarterly seasonally-adjusted GPD from a trend derived by means of the Hodrick-Prescott filter.

The rather small number of elections in the sample does not permit us to discriminate between cases when a party got reelected and when it got newly elected in a meaningful way. Therefore, the bold lines in Figure 3 show average inflation and income (or output gap) patterns observed under all Democrat and Republican terms in office included in the sample, respectively.

The top row depicts the experience of Democratic governments, the lower

one that of Republican governments. The left column shows inflation, the right column income patterns.

Looking at inflation rates first, these seem to gradually fall throughout a Republican term in office. Inflation bottoms out in the third year, however, and even seems to point upwards again as the next election draws closer. This is almost exactly the shape proposed by SIPT, while NKPT only accounts for the rise in inflation toward the end of the election term.

When Democrats are in power, very much the opposite pattern is being observed. Inflation accelerates throughout the first three years in office, but retreats again during the final three quarters. Again, this pattern is in accord with the implications of SIPT, but it does not really fit the pattern suggested by NKPT.

Turning to the column on the right, income deviates in a U-shaped fashion from its trend path when the Republicans rule. Soon after the election the economy is driven into a recession. But during the second year it begins to recover, and in the fourth year the economy operates very close to potential output again. This pattern is very much mirrored under Democratic rule, when the cyclical component of income moves along the shape of an inverted U. Soon after the election the economy starts to boom, but this also does not last. Starting at the beginning of the second year in office, income retreats toward potential income, which it reaches gain in the fourth year.

These partisan patterns in income have almost nothing in common with NKPT, as a comparison with the lower part of Figure 3 reveals. There income is predicted to equal potential income through most of an election period, with only brief positive (negative) blips toward the end of a term when the Democrats (Republicans) are in power. The income patterns proposed by SIPT (Figure 5) do not fit perfectly either, but the key properties are there: Democrats generate booms that do not last, and Republicans force the economy through a temporary recession. The difference between the empirical patterns and the patterns proposed by SIPT is that SIPT does not explain why the recession or boom builds up gradually. According to theory, the economy should move away from potential income quickly when a new government is installed, while in the data this takes between one and two years. But this is a minor deficiency compared to the blatant failure of NKPT.

There is another feature in the empirical patterns, however, that may appear discomforting and requires discussion: While the dynamic patterns observed under Democrat and Republican rule seem to be roughly in line

with the predictions of SIPT, the levels from which these movements start may appear confusing. Let us look at income first:

If we connect the income levels that are being reached at the end of a term of any of the two parties (which are both close to potential income) with the income levels that we observe at the beginning of a Democrat or Republican rule, we see jumps in directions that do not appear right. When Democrats move into power, income appears to drop substantially before the boom is being created that we discussed previously. And when a Republican government assumes office, the economy does boom before gradually moving into recession. These jumps would seem difficult to reconcile with SIPT, or with any of the established versions of partisan theory.

Similarly, and equally puzzling, are the inflation patterns. While the dynamics is as expected—inflation rates rise under Democratic governments, but fall under Republicans—the fact that Democrats generate lower inflation rates during the first quarters of their rule than Republicans again appears difficult to reconcile with any of the models we looked at.

The solution to these puzzles becomes obvious when we look at the inflation and income levels governments of both shades typically inherit when they move into the White House. These launch conditions, shown as thin, dotted lines, obviously have not at all been the same for Democrats and Republicans during the time window considered here. On average, Republicans moved into power when the economy was booming and inflation was high. By contrast, Democrats usually started with an economy in recession and a comparatively low inflation rate. So democrats do not employ their economic policy tools to create an instantaneous cold-turkey disinflation along and push the economy into a severe recession as soon as they move into office. They typically inherit such situations. We do not know why. It could be pure chance. Or it could be that voters trust Democrats more to make the right policy decisions in such situations than they trust Republicans. We do not know. But the data say that this is what Democratic governments typically start with. And from there they do what SIPT says they will: move toward a more expansionary monetary policy which tolerates more inflation, and stimulates income and growth. There is some persistence in the empirical patterns that SIPT does not properly account for. But, qualitatively, and as regards timing, the patterns are there.

This also applies, with reversed sign, to Republican election victories. When Republicans win an election, inflation tends to be high and the economy is usually booming. Starting from this idiosyncratic situation, Repub-

licans steer toward more price stability, while allowing the economy to slip into recession. Again, we do not know why. But the interpretation that this is not pure chance, but reflects a rational choice by forward-looking voters, is compelling. When inflation is high and the economy booms, they pick the party that rates price stability highly. When caught in a recession, and there is no visible threat to price stability, voters go with the party that is primarily concerned with fighting unemployment and raising income.

Thus, putting the US partisan patterns in inflation and income into proper historical context, they can be understood by a model that combines the policy preferences suggested by Hibbs with a sticky-information representation of the economy's supply side as suggested by Mankiw and Reis. By contrast, new Keynesian partisan theory does not succeed in explaining these empirical patterns.

4 Summary and conclusions

This paper has made an attempt to bring partisan theory into the 21st century by merging the idea of partisan differences in the preferences for macroeconomic outcomes with current views of the economy's supply side that rest on explicit microfoundations. The two such models considered are the new Keynesian Phillips curve, the model that has dominated discussions of monetary policy design for a number of years, and the sticky-information Phillips curve, a recent challenger.

The resulting two new versions of partisan theory generate quite different hypotheses as to how partisan patterns in inflation and income should look like:

According to new Keynesian partisan theory income always equals potential output after an election, no matter which party won, while inflation immediately jumps to the inflation bias associated with the preferences of the new government. During the last few quarters before the next election, inflation falls under a socialist government and the economy booms. This negative comovement of inflation and income in the run-up to an election is also observed under conservative rule, though in the opposite directions. The movement of income before an election has the characteristics of a bubble, as it constitutes an accelerating deviation from the level of potential income suggested by fundamentals. An when the news of the election result becomes available, the bubble bursts and income drops or jumps back toward

its long-run equilibrium. These immediate returns to potential income at the inauguration of a new government generates first-quarter income movements that are quite unusual: When the socialists win, income drops if this win simply extends their rule from the previous election term, but income rises if a conservative incumbent was defeated. Similarly, the election of a conservative government boosts income if this extends a conservative reign, but it drives income down if a socialist government is ousted.

Sticky-information partisan theory yields more conventional predictions. A socialist success at the polls always triggers a boom, both when this success constitutes the defeat of a conservative incumbent, and when it extends an existing socialist reign. This is interesting, because it is accompanied by a surge in inflation in the first case, but by steadily high inflation in the second. Similarly, conservative election victories always cause persistent recessions.

These implications of both NKPT and SIPT were confronted with established results from econometric partisan cycle research based on international data sets, and with our own unconstrained computations of postwar US partisan patterns. The verdict from these exercises is that SIPT is a viable successor of RPT which brings partisan theory up to the standards in current macroeconomic research. It cannot account for all empirical details. But the big picture is there. By contrast, NKPT fails in all respects: it expects inflation and income to stay put when they actually move. it expects them to move at times when they don not.

Indirectly, the relative success of SIPT is also evidence in support of the sticky-information Phillips curve, while the failure of NKPT casts doubts on the usefulness of the new Keynesian Phillips curve. This is an important result, given that the new Keynesian Phillips curve has dominated research on monetary policy design and institutions for quite a number of years now, and it adds weight to the growing list of econometric studies finding little support for the new Keynesian Phillips curve.[14]

[14]Attempts at testing the new Keynesian Phillips curve, with ambigious or negative results, include Páez-Farrell (2003), Guay and Pelgrin (2004), Nason and Smith (2005), and Tillmann (2005), and Rudd and Whelan (forthcoming). This lack of success and a number of implausible properties of the new Keynesian Phillips curve (see Mankiw and Reis, 2002), which also show in the hypotheses derived from NKPT, has motivated empirical macroeconomists to use what is being called a hybrid new Keynesian Phillips curve, which combines the forward-looking aspects of new Keynesian macroeconomics with backward-looking elements as suggested by adaptive inflation expectations.

Appendix

A Solution algorithm for sticky-information partisan theory

As outlined in the text, we solve the sticky information model by iterating between finding the optimal government policy in all states of the economy for given expectations, computing the resulting inflation and output gaps, and recomputing the expectations. The key challenge is to find a representation of the model that allows this to be done in a computationally clean and efficient manner.

The approach outlined here is based on three intuitions: 1) All expectations formed for periods within one election cycle will be perfect foresight since no there are no other external shocks except for the periodic election outcomes. 2) All expectations formed during a given election period will be identical since they are based on the same information set.[15] 3) The exponential decay in the summation ensures that the influence of current conditions on future equilibria disappear rapidly with the time horizon.

Section A.1 of this appendix demonstrates how to represent the model as Markov chain. This is the basis for the algorithm outlined in section 2.2. Section A.2 shows how to compute the government reaction function for step (i) of the algorithm; the other two steps are straightforward.

A.1 Representing the model as a markov chain

Let N denote the number of periods in an election period. We collect the sequence of governing parties P up to time t in

$$\omega_t = \{P_t, P_{t-N}, P_{t-2N}, \cdots, P_{t-\infty}\} \tag{14}$$

where P_{t-N} will be either L or R, depending on whether a socialist or conservative government was in power at time $t - N$. Since elections are the only type of shocks in the model, the expectations in A_t are completely determined by the infinite sequence of governments up till time t and where t is

[15] This is only true as long as the government behaves in a perfectly predictable manner. Since we are assuming that the government's information set is identical to that of the other agents in the model and that it is behaving optimally, it will hold.

within the current election term. Assuming that t is the nth period of a governments term and dropping the subscript, we can express the expectations in A_t by

$$\begin{aligned} A(n,\omega) =& \lambda \sum_{j=0}^{n-1} (1-\lambda)^j E_{\omega}(\pi_n + \alpha \Delta y_n) \\ &+ \lambda \sum_{j=n}^{n+N-1} (1-\lambda)^j E_{\omega_{-1}}(\pi_n + \alpha \Delta y_n) \\ &+ \lambda \sum_{j=n+N}^{n+2N-1} (1-\lambda)^j E_{\omega_{-2}}(\pi_n + \alpha \Delta + y_n) \\ &+ \cdots \end{aligned}$$

Using the feature that all expectations formed during an election cycle are identical, the expression simplifies to

$$\begin{aligned} A(n,\omega) =& (1-(1-\lambda)^{n-1})(\pi_n + \alpha(\Delta y_n)) \\ &+ (1-\lambda)^{n-1}(1-(1-\lambda)^N) E_{\omega_{-1}}(\pi_n + \alpha \Delta y_n) \\ &+ (1-\lambda)^{n+N-1}(1-(1-\lambda)^N) E_{\omega_{-2}}(\pi_n + \alpha \Delta y_n) \\ &+ \cdots \end{aligned} \tag{15}$$

The conditional expectations converge at a geometric rate to their unconditional means:

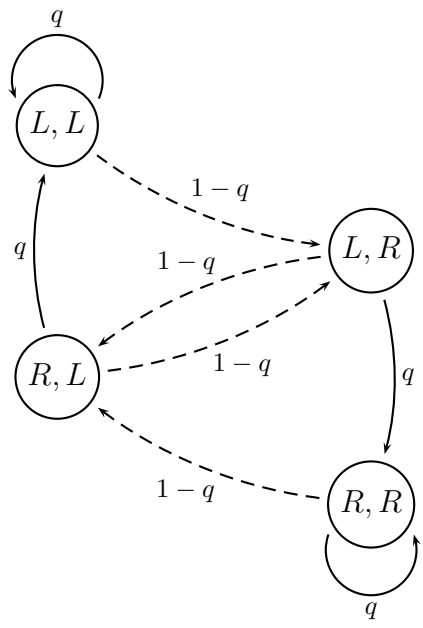
$$\lim_{i \to \infty} E_{\omega_{-i}}(\pi_n + \alpha \Delta y_n) \longrightarrow E(\pi_n + \alpha \Delta y_n),$$

so we could in fact achieve an arbitrarily close approximation by truncating equation (15) at a high enough i and set the remaining expectations equal to the unconditional mean. The method we use is a enhanced version of this idea. Let k denote the number of election periods we keep track of in the summation above. There are 2^n different permutations for the k last elements of ω. We sort them first according to the governing party in $t-k$, then in $t-k+1$, etc. up to t. For $k=2$, the following ordering obtains:

$$\begin{pmatrix} \omega_1 \\ \omega_2 \\ \omega_3 \\ \omega_4 \end{pmatrix} = \begin{pmatrix} R & R \\ R & L \\ L & R \\ L & L \end{pmatrix}$$

Figure 7: Graph of the vector of ruling parties

This figure shows the graph of the states of the vector of ruling parties when it contains only two elements. Solid arrows mark transitions where the incumbent party remains in power (i.e. where the last element of the vector is unmodified). The probability of such a transition is q. Transitions where there is a change of power are marked by dashed arrows.



As we move from period to period, the probability of switching between the paths above is constant. Path 1 and $(1 + 2^{k-1})$ share the same last $k - 1$ elements and can turn into path 1 and 2, likewise path j and $(j + 2^{k-1})$ share the last $k - 1$ elements an can turn into either path $2j - 1$ or $2j$. Since the transition probabilities between the paths are time independent, the whole system follows a Markov chain. Figure A.1 depicts its graph. The paths where the current government is conservative are represented by the nodes on the right hand side, while those with a socialist government are represented by the nodes on the left hand side. If there is an incumbent's advantage, we are more likely to remain on the same side than to switch sides. Notice that each node has two arrows leading to it and two arrows leading away from it. This is generally true, so as we increase k, the transition matrix becomes increasingly sparse.

Collecting the transition probabilities between the paths in the matrix Θ, one can verify that for $k > 2$, Θ is given by the Kronecker product

$$\Theta = \begin{bmatrix} I_{2^{k-2}} \\ I_{2^{k-2}} \end{bmatrix} \otimes \begin{bmatrix} q & 0 \\ (1-q) & 0 \\ 0 & (1-q) \\ 0 & q \end{bmatrix}$$

Where I_j denotes the $j \times j$ identity matrix. For $k = 3$ and substituting 0.65—our estimate for the incumbent's reelection probability—for q yields

$$\Theta = \begin{bmatrix} 0.65 & 0 & 0 & 0 & 0.65 & 0 & 0 & 0 \\ 0.35 & 0 & 0 & 0 & 0.35 & 0 & 0 & 0 \\ 0 & 0.35 & 0 & 0 & 0 & 0.35 & 0 & 0 \\ 0 & 0.65 & 0 & 0 & 0 & 0.65 & 0 & 0 \\ \vdots & & & & & & & \\ 0 & 0 & 0 & 0.65 & 0 & 0 & 0 & 0.65 \end{bmatrix}$$

We use the boldface $\mathbf{A}$ to signify the $2^k \times N$ matrix of equilibrium expectations for all relevant histories. Thus element $\mathbf{A}_{i,j}$ gives A_t for the case where t is the jth period of an election term where the last k governments are those given by the ith path of ω. We collect the unconditional probability distribution of the paths in the vector $q^\star$

$$q^\star = \begin{pmatrix} \text{pr}(\omega = \omega_1) \\ \vdots \\ \text{pr}(\omega = \omega_{2^k}) \end{pmatrix} \tag{16}$$

Let Π and Y denote the matrices of realized GDP gap and inflation rates over the lase election cycle in each the 2^k paths. Average GDP growth rates in the first period of an election cycle is given by the GDP in the first period less the average last period GDP in the paths leading up to the period. For all other periods, GDP growth rates are found by taking differences along the same path. Mathematically, we express this through

$$\Delta Y_{i,j} = \begin{cases} Y_{i,j} - (\sum_{k=1}^{2^n} \theta_{i,k} q_k^\star Y_{k,N}) / (\sum_{k=1}^{2^n} \theta_{i,k} q_k^\star) & \text{if } n = 1 \text{ and} \\ Y_{\cdot n} - Y_{\cdot n-1} & \text{if } n \neq 1, \end{cases} \tag{17}$$

Given that we are currently in path k, the expected inflation and output growth rate for t, which is taken to be the nth period of the jth upcoming election cycle, is given by

$$E[\pi_t + \alpha\Delta y_t] = \mathbf{e_k}'\Theta^j[\Pi_{\cdot n} + \alpha\Delta Y_{\cdot n}], \tag{18}$$

where $\mathbf{e_k}$ is the kth column of the identity matrix. We now need to map these expectations to the paths in the jth proceeding election cycle. Given that we are *currently* in path k, the probabilities that we were in each of the paths j periods ago is given by the elements of the vector $(\Theta')^{\mathrm{j}}_{k\cdot}$.

Fitting these two results together and using equation (15), the nth column of the expectations matrix $\mathbf{A}$ can be expressed as

$$\begin{aligned}
\mathbf{A}_{\cdot n} =&(1-(1-\lambda)^{n-1})(\Pi_{\cdot n} + \alpha(\Delta Y_{\cdot n})) \\
&+ \Theta(1-\lambda)^{n-1}(1-(1-\lambda)^N)\Theta'(\Pi_{\cdot n} + \alpha\Delta Y_{\cdot n}) \\
&+ \Theta^2(1-\lambda)^{n+N-1}(1-(1-\lambda)^N)(\Theta')^2(\Pi_{\cdot n} + \alpha\Delta Y_{\cdot n}) \\
&+ \cdots \\
=&(1-(1-\lambda)^{n-1})(\Pi_{\cdot n} + \alpha(\Delta Y_{\cdot n})) \\
&+ \sum_{j=1}^{\infty}(1-\lambda)^{n+(j-1)N-1}(1-(1-\lambda)^N)\Theta^j(\Theta')^j(\Pi_{\cdot n} + \alpha(\Delta Y_{\cdot n}))
\end{aligned} \tag{19}$$

The first term on the right hand side of equation (19) sums up the expectations formed within the current election cycle, while the last term sums up all other expectations. Notice that the first term disappears for $n = 1$, since none of the expectations from prior periods were formed after the last election result.

A.2 Finding the government reaction function

As we discussed in the section, the output gap in the sticky-information Phillips curve provides the government with a way to influence future outcomes through the current inflation rate. To quantify how this shifts the government reaction function, we need to find equations linking future outcomes to the current government actions.

We start out with a system of three equations: the government reaction function, the sticky-information Phillips curve, and the equation generating

expectations.

$$\begin{aligned} \pi_t &= a_t + b_t A_t \\ y_t &= \gamma_t \left(\pi_t - A_t\right) \\ A_t &= \overline{A}_{t-2,t} + \lambda E_{t-1}\left(\pi_t + \alpha \Delta y_t\right), \end{aligned} \tag{20}$$

where the $\bar{A}_{t-2,t}$ collects all expectations in A_t that date back to period $t-2$ or earlier. Shifting the system one period ahead and taking expectations with respect to the current output gap y yields

$$\begin{aligned} \frac{dy_{t+1}}{dy_t} &= -\gamma\left(1 - b_{t+1}\right)\frac{dA_{t+1}}{dy_t} \\ \frac{d\pi_{t+1}}{dy_t} &= b_{t+1}\frac{dA_{t+1}}{dy_t} \\ \frac{dA_{t+1}}{dy_t} &= \lambda\left(\frac{d\pi_{t+1}}{dy_t} + \alpha\left(\frac{dy_{t+1}}{dy_t} - 1\right)\right). \end{aligned} \tag{21}$$

Solving for the derivative of the expectations terms with respect to the output gap gives

$$\frac{dA_{t+1}}{dy_t} = -\frac{\alpha\lambda}{1 - \lambda b_{t+1} + \alpha\lambda\gamma\left(1 - b_{t+1}\right)}, \tag{22}$$

which can be substituted in the two first equations of the system to find the relation between current output gap changes and next periods output gap and inflation. Analogously, for the nth period in the future

$$\begin{aligned} \frac{dy_{t+n}}{dy_t} &= -\gamma\left(1 - b_{t+n}\right)\frac{dA_{t+n}}{dy_t} \\ \frac{d\pi_{t+n}}{dy_t} &= b_{t+n}\frac{dA_{t+n}}{dy} = -\frac{1}{\gamma}\frac{b_{t+n}}{1 - b_{t+n}}\frac{dy_{t+n}}{dy_t} \\ \frac{dA_{t+n}}{dy_t} &= \Lambda_n\left(\frac{d\pi_{t+n}}{dy_t} + \alpha\left(\frac{dy_{t+n}}{dy_t} - 1\right)\right). \end{aligned} \tag{23}$$

where $\Lambda_n = \lambda\left(1 + (1-\lambda) + ... + (1-\lambda)^{n-1}\right)$, which is the fraction of firms which will have updated their prices after the policy measure. It is now straightforward to show that the the derivative of the period $t+n$ output gap with respect to its period t counterpart can be computed recursively by

$$\frac{dy_{t+n}}{dy_t} = \frac{\alpha\Lambda_n\gamma(1 - b_{t+n})}{1 - \Lambda_n b_{t+n} + \alpha\Lambda_n\gamma(1 - b_{t+n})}\frac{dy^{(n-1)}}{dy_t}.$$

From the first two equations in (23), the derivative for the inflation rate is

$$\frac{d\pi_{t+n}}{dy_t} = \gamma \frac{1 - b_{t+n}}{b_{t+n}} \frac{dy^{(t+n)}}{dy_t}. \tag{24}$$

We now have all ingredients necessary to quantify the benefit from increasing the current output gap on future utility:

$$\begin{aligned} \frac{dV_{t+n}}{dy_t} &= \frac{\partial V_{t+n}}{\partial y_{t+n}} \frac{dy_{t+n}}{dy_t} + \frac{\partial V_{t+n}}{\partial \pi_{t+n}} \frac{d\pi_{t+n}}{dy_t} \\ &= \left(\frac{\partial V_{t+n}}{\partial y_{t+n}} - \frac{b}{\gamma (1-b)} \frac{\partial V_{t+n}}{\partial \pi_{t+n}} \right) \frac{dy_{t+n}}{dy_t} \end{aligned} \tag{25}$$

The time t government reaction function is found by using equation (25) to find expectations for the forward looking terms in the government reaction function (13).

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