Monetary Policy and Asymmetries in the Business Cycle of Argentina

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Abstract
This paper studies the asymmetries that are claimed to arise in the real economy as a response to monetary policy shocks. It follows Lo and Piger’s (2005) regime-switching specification in order to investigate time variation in the response of the transitory component of output to monetary shocks in Argentina. The results suggest time variation in the coefficients that describe the response of output, which can be well explained by a dummy variable indicating the phase of the cycle at the time the policy is applied. We also find support to Friedman’s “plucking” view of economic fluctuations, while other two features of the shocks (direction and size of the monetary policy) explain strongly the business cycle of Argentina.

Keywords: Asymmetry, Business Cycles, Monetary Policy, Regime Switching

JEL Classification: C32, E32, E52
I. Introduction

Asymmetric effects observed in the business cycle brought about by economic policies have a long history in economics, dating back indeed to the Great Depression and times of Keynes’ contributions. There is a well known stylized fact of business cycles in which expansions and contractions present quite different features from each other, with the first being typically long-lived and the second, more violent. In particular, it has been argued that the impact of monetary policy on the real economy is asymmetric depending on certain economic conditions and on the nature of the policy taken.

There is a large body of empirical literature documenting asymmetries in business cycles of developed countries (some examples are Belongia, 1996, Garcia and Schaller, 2002, Lo and Piger, 2005, Peersman and Smets, 2002, Ravn and Sola, 2004, Senda, 2001, and Weise, 1999). However, there is scant literature counting for asymmetries in the business cycle of emerging countries.1

The literature has focused on three particular features of asymmetry: (i) the asymmetry related to the direction of the monetary policy shock, i.e., the sign of the monetary action; (ii) the one related to the phase of the business cycle, i.e., depending on whether the economy is in a recession or an expansion; and (iii) the asymmetry related to the size of the policy action; that is, whether the policy implies a large or a small shock.

The asymmetries described above imply time variation in the coefficients measuring the impact of monetary policy on aggregate activity. In order to examine these effects, I apply a procedure that consists of estimating a monetary policy process that allows for changes in regime; specifically a Markov regime-switching model à la Hamilton (1989), suitably modified to the problem at hand. Indeed, this problem requires that we define indicator variables for the monetary policy for each one of the three asymmetries, in a manner that the state variables will remain either on one or the other side of the particular asymmetric effect. The distinctive feature of this model is that the transition probabilities governing the switching process are functions of these state variables; thus a time-varying transition probability (TVTP) setting in line with Lo and Piger (2005) is used to analyze the evidence of each asymmetry.

The advantage of using this framework is that it permits to evaluate the robustness of each effect without restricting the estimates to vary along time according only to a special asymmetry. Also, we observe the correlations arising as a result, and hence many expressions of asymmetric impact are allowed at the same time. Finally, the response of aggregate activity to the monetary policy is separated between the unobserved components belonging either to the trend or the cycle, i.e., the movements in real output can be identified, in the end, between their permanent and transitory components. This is an interesting feature for having in an empirical model of this kind. It allows setting up the structural representation in terms of short and long run components, which in turn gives the possibility to opt for monetary policy shocks that affect the economy only in the short run.

Theoretical models in the literature have largely rationalized the asymmetric effects of monetary policy in many ways.

Some theories assume downward sticky nominal wages (or price) together with rationing of demand. Menu-costs models à la Ball and Mankiw (1994), although in static, deterministic settings, show that “big” monetary policy shocks are neutral while “small” shocks do have real effects. The rationale for this proposition, roughly, comes from the fact that firms find it optimal to adjust nominal prices only when the menu costs associated to indexing their prices (before the monetary shock is observed) are of less magnitude relative to the additional benefits they would receive from indexation. Then, firms decide whether to index or not depending on the expected variance of the monetary policy shock. The econometric setting presented here allows to model monetary policy processes that can switch from “high” to “low” variance.

1. A few exceptions can be found in Agenor (2001), who finds asymmetries in four emerging countries, and in da Silva Correa (2003), who documents differences and similarities in business cycles of Argentina and Brazil. However, both works are quite different from the one developed here; the first with respect to the methodology employed, the second with respect to the emphasis followed.
Credit channel theories with balance-sheet effects, in line with Bernanke and Gertler (1989), generate monetary policy effects on output that are larger in unfavorable states of the cycle. Credit and liquidity may be readily available in expansions, and thus monetary shocks might result neutral. However, during recessions firms and consumer may find it harder to obtain funds and thus monetary policy might have real effects through the credit channel.

The main findings of the paper suggest strong time variation in the coefficients that describe the response of output to the monetary policy shock. This variation can be explained by a state variable that shows whether the economy is in recession or expansion at the moment of the policy. We will observe that policy shocks during expansions have greater impact on aggregate activity than those applied during recessions. There is also evidence that the other two asymmetries (direction and size of the policy) can explain the response of the output level to the monetary policy shock.

The paper is organized as follows. In Section II, I describe the model then applied for the estimation. Section III shows how the variables are built from the data. Section IV presents and discusses the estimation results. Finally, Section V concludes.

II. Model Specification

The econometric model considered here follows Lo and Piger (2005). This is a Markov regime-switching model that describes the log-level of output, \( y_t \), as explained by two unobserved-components: a permanent component, \( y_t^p \), and a transitory component, \( y_t^T \):

\[
y_t = y_t^p + y_t^T,
\]

Given the regime-switching methodology, a time series is modeled through discrete changes both in unconditional mean and unconditional variance, while the changes in regime are led by an unobservable, discrete-valued state variable, \( S_t \). I will show below how this state variable that identifies the phase of the economy is introduced into the model.

The permanent component is modeled as,

\[
y_t^p = \mu_t + y_{t-1}^p + \nu_1,
\]

where,

\[
\mu_t = \mu_{t-1} + \omega_t.
\]

The stochastic trend component is specified as a random walk with a time-varying drift, \( \mu_t \), which in turn evolves as a simple random walk without drift. The innovations \( \nu_1 \) and \( \omega_t \) are assumed to be i.i.d., normally distributed random variables. The process for the drift term enables us to study low frequency innovations to the stochastic trend, such as structural breaks.

The transitory component is modeled as

\[
\phi(L) y_t^T = \gamma_0(L) x_t + \gamma_1(L) x_t S_t + \varepsilon_t,
\]

where \( x_t \) is a scalar variable measuring the monetary policy, \( S_t \) is the regime-dummy taking on the values 0 or 1, \( \varepsilon_t \) are the i.i.d., normally distributed innovations, and

\[
\phi(L) = \sum_{k=0}^{K} \phi_k L^K; \quad \phi_0 = 1; \quad \gamma_i(L) = \sum_{j=1}^{J} \gamma_{j,i} L^j.
\]
As expressed by equations (1)-(5), the model shows that monetary policy shocks only affect the transitory component. Moreover, looking at expressions (4) and (5), this effect is introduced by, first, a collection of terms \( \gamma_s(L)\xi_t \) which are independent of the state variable \( S_t \), and, second, a collection of terms \( \gamma_s(L)\xi_t S_t \) which represent the interaction between monetary shocks and the phase of the cycle. As for the monetary policy shocks, they are constructed through a recursive VAR representation where the policy variable, \( \xi_t \), is ordered after output. Notice that, consistent with this identifying restriction, this variable does not enter expression (4) contemporaneously.

In order to introduce time variation in the response of the transitory component to shocks on the monetary policy variable, the coefficients relating \( \gamma_s^T \) and \( \xi_t \) are allowed to change over time. In this sense, the response coefficients vary between the two regimes identified by the unobservable state variable \( S_t \). This variable evolves simply as a first-order Markov process following Hamilton (1989), slightly modified to capture the TVTP setting analyzed here. Indeed, I wish to explain not only the changes in the response coefficients along time, but also their changes with respect to the three asymmetries introduced in Section I. In other words, the final goal is to determine how the response coefficients, measured by the collection of \( \gamma_s(L)^T s_t \), are affected by the size of the policy action, the direction or sign of the policy shock, and the state of the economy in the business cycle.

To pursue this objective, the model allows \( S_t \) to be also a function of state variables identifying each of the three asymmetries. Specifically, the transition probabilities of the regime-switching process are time-varying, while the time variation depends on the state variables as follows:

\[
P(S_t = 0 | S_{t-1} = 0) = \frac{\exp(c_0 + z_t^T a_0)}{1 + \exp(c_0 + z_t^T a_0)}
\]

\[
P(S_t = 1 | S_{t-1} = 0) = 1 - P(S_t = 0 | S_{t-1} = 0)
\]

\[
P(S_t = 1 | S_{t-1} = 1) = \frac{\exp(c_1 + z_t^T a_1)}{1 + \exp(c_1 + z_t^T a_1)}
\]

\[
P(S_t = 0 | S_{t-1} = 1) = 1 - P(S_t = 1 | S_{t-1} = 1)
\]

(6)

where \( z_t \) is a \( q \times 1 \) vector of state variables \( (z_{1t}, z_{2t}, \ldots, z_{qt})^T \), while \( a_0 \) and \( a_1 \) are \( q \times 1 \) vectors of coefficients \( (a_{01}, a_{02}, \ldots, a_{0q})^T \) and \( (a_{11}, a_{12}, \ldots, a_{1q})^T \).

The dummy variables included in \( z_t \) are set in accordance with the earlier discussion on asymmetries. Once again, state variables are the indicators describing sign and size of the policy shock, and phase of the cycle, all at the time the policy is being performed. Since these dummies represent the state of the economy at that period, \( J \) lags of each indicator variable are included, being the same number of lags introduced in the policy variable entering in equation (4). This is done in order to capture the same features arising from previous values of the policy. Further, as in expression (4), contemporaneous values of the policy variable are not included in \( z_t \). Finally, the vector \( z_t \) is of dimension \( q \) - and not three, as one may expect - because, as discussed below, there are some possible configurations in which we might also consider terms including multiplicative interactions between asymmetries.

In order to define the dummy variables, consider the following procedure. The direction of the policy shock is specified as

\[
\text{sign}_t = \begin{cases} 
0 & \text{if the policy action is to lose (expansionary);} \\
1 & \text{if the policy action is to tight (contractionary).} 
\end{cases}
\]

This categorization is simply defined by the sign of the policy shock - a positive shock to the quantity of money is considered as an expansionary policy, and thus the dummy will take on the value zero.
The size of the policy action is specified as the dummy variable

\[ size_t = \begin{cases} 
0 & \text{if the policy is within 1 standard deviation of historical mean;} \\
1 & \text{otherwise.} 
\end{cases} \]

Finally, the state variable related to the business cycle position is specified as the dummy variable

\[ rec_t = \begin{cases} 
0 & \text{if the economy is in expansion;} \\
1 & \text{if the economy is in recession.} 
\end{cases} \]

The definition of the economy being either in recession or expansion follows the work by Jorrat and Cerro (2000). They construct turning-point monthly probabilities of the Argentine economy according to the same methodology employed by the National Bureau of Economic Research (NBER) to characterize recessions in the U.S. economy.

III. The Data

The real output in Argentina, \( y_t \), is measured by two possible specifications. One specification will measure the real output by the log of quarterly gross domestic product, while the other will measure the real output by the log of quarterly industrial production. As discussed in Lo and Piger (2005), the latter is a narrow measure of output, yet it is supposed to be more tightly related to the effects of monetary policy shocks. Christiano et al. (1997) emphasize the important role of the manufacturing sector (being roughly the 80% of the industrial production in Argentina) in that it tends to respond to a greater extent to monetary shocks than wider measures of output. These quarterly output series for the period 1977:1-2006:4 are obtained from the Ministry of Economy of Argentina and from Martinez (1999).

Regarding the monetary policy variable, \( x_t \), M1 is considered as the instrument that is controlled by the Central Bank. The lack of trustable data makes it impossible to analyze monetary shocks through other types of policy. I construct monetary shocks from a recursively identified, four-variable VAR in which the log of M1 is ordered after both the log of real GDP and the log of the consumer price index (CPI), and before the nominal, deposit interest rate.²

It is clear from the previous statement the assumption that the monetary policy does not affect output or prices contemporaneously. According to both information criteria, Akaike (AIC) and Schwartz (SIC), the VAR is best estimated using two lags of each variable.

Given the structure of the econometric model at hand, it is not possible to find an unconditional expectation of the transition equation in the state-space representation of equations (1)-(5). This, indeed, is needed in order to initialize the Kalman filter used in performing the filtering method described by Kim (1994). Thus, the initialization of the filter is performed by high-variance guesses as discussed in Kim and Nelson (1999), followed by the computation of the likelihood function only after 20 quarters in order for the noise created by these initial guesses to vanish.³


IV. Estimation

After specifying the methodology followed for initializing the estimation process, I begin now by specifying the lag structure of the expression for movements of the output transitory component,

2. A GDP deflator and a funds rate like the Fed funds rate would be the appropriate series in the present study. However, given the lack of long historical series of both variables, I have used the CPI and the average deposit interest rate as proxy variables.

3. The source codes for the estimations in Gauss are available upon request.
described by equation (4). To do so, I used a set of specifications with different lag orders, setting a maximum of four lags for both $K$ and $J$, finding the best fit with a characterization of two lags on both. It is worth noting that for high lag order specifications, for instance $K=J=4$, the estimation procedure becomes unstable for a large set of initial values; results, then, are quite sensitive to the initialization method. This is relevant, for the sample is not as large as the one usually needed in frameworks of this kind. Regarding the measure for the type of output, I have chosen the real GDP; yet the industrial production index does not provide quite different results.

Let us compare now the results that we obtain from different specifications of the econometric model, depending on the number of asymmetries included and the way in which they enter the estimation. In particular, I am interested in the three specific structures of asymmetries discussed above, and their feasible, economically reasonable combinations. In this respect, I estimate the TVTP model given by expressions (1)-(6), studying the significance of the discrete-valued variables described in Section II as they appear in the vector $z_r$.

It may result interesting to compare the first results from this study, applied to Argentina, with its counterpart for the U.S. in Lo and Piger (2005). They find in all the versions of their model that the state $S_t$ is equal to one only in short periods, usually lasting a single quarter. In contrast, we find here that recession phases are more persistent and, indeed, the plots suggest that $S_t$ is equal to one for long periods, as I will show below formally.

As it was mentioned above, I am interested in identifying the effects of each asymmetry on further estimations of the transition probabilities $P(S_t = 1 | S_{t-1} = 1)$ and $P(S_t = 0 | S_{t-1} = 0)$. In respect, most specifications of the model described by equations (1)-(6) have brought very large coefficient estimates of the constant parameter, thus causing $P(S_t = 1 | S_{t-1} = 1)$ to be very close to one. On the other hand, any combination between the vectors $(a_{01}, a_{02}, \ldots, a_{0q})'$ and $(a_{11}, a_{12}, \ldots, a_{1q})'$ provided similar results as the estimations of the model having only one of this set of parameters. Equally important is the fact that, computationally, the system becomes continuously unstable when estimating the inverse of the information matrix, needed to obtain the significance of the estimates. For this reason, I followed the process of estimation emphasizing the effects of the three asymmetries on $z_r$ by applying models where, among other parameters, the vector $(a_{01}, a_{02}, \ldots, a_{0q})'$ is estimated.

Table 1 shows the global statistics for different specifications of $z_r$. The first row of this table shows the vector of dummies as empty, which means that the Markov process for the unobservable variable $S_t$ is constant (the fixed-transition probabilities model, or FTP). Results both on the likelihood and on the information criteria show that the FTP model is weak in explaining the effect of monetary policy. Moreover, the next two rows that show the model estimated including sign and size of the monetary policy – separately, one at a time in the vector - do not show stronger evidence compared to the FTP model. For instance, the dummy “size” of the policy explains better than the FTP considering the SIC, but it is not the case considering the AIC. Contrarily, the dummy “sign” of the shock does not explain better than the FTP considering both measures of information.

Different are the results for the “recession” dummy, provided it is included in the vector $z_r$ alone. The fourth row of Table 1 clearly shows that this variable improves the estimations compared to the model in which the Markov process for $S_t$ is constant. What this result shows is that periods of recession significantly change the values that determine the probability that the economy is indeed in a recession. Furthermore, this is especially proving that any shock to the monetary policy will affect the response of output, depending on whether the economy is in a recession.

I study now the robustness of the previous results through the exercise of analyzing how the dummies sign and size of the monetary shock behave when contemplated together with the phase of the cycle. That is, I investigate whether the direction and the size of the policy are, one at a time, jointly significant with the recession dummy. This is shown in the second part of Table 1. From the AIC and
the Log Likelihood value, we observe that these variables, jointly included with recession, explain better than the simpler FTP model.

Table 1

<table>
<thead>
<tr>
<th>Model Specification</th>
<th>Dummies in</th>
<th>SIC</th>
<th>AIC</th>
<th>Log Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (FTP model)</td>
<td></td>
<td>-2.58</td>
<td>-2.88</td>
<td>149.17</td>
</tr>
<tr>
<td>Sign</td>
<td></td>
<td>-2.50</td>
<td>-2.84</td>
<td>149.42</td>
</tr>
<tr>
<td>Size</td>
<td></td>
<td>-2.57</td>
<td>-2.92</td>
<td>153.11</td>
</tr>
<tr>
<td>Recession (Rec)</td>
<td></td>
<td>-2.61</td>
<td>-2.96</td>
<td>155.00</td>
</tr>
<tr>
<td>Rec and Sign</td>
<td></td>
<td>-2.59</td>
<td>-2.99</td>
<td>158.53</td>
</tr>
<tr>
<td>Rec and Size</td>
<td></td>
<td>-2.55</td>
<td>-2.95</td>
<td>156.56</td>
</tr>
<tr>
<td>Rec and Rec*Sign</td>
<td></td>
<td>-2.55</td>
<td>-2.95</td>
<td>156.83</td>
</tr>
<tr>
<td>Rec and Rec*Size</td>
<td></td>
<td>-2.56</td>
<td>-2.96</td>
<td>156.93</td>
</tr>
</tbody>
</table>

Finally, I introduce into the vector \( \mathbf{z}_t \) interaction terms between sign and size of the monetary policy, with the specific phase of the cycle. First, I investigate how significant is the asymmetry arising from the direction of the policy when this is performed during recession times. Second, I investigate to what extent is the size of the monetary shock strong in explaining switches in regime when it is controlled in a recession period. This is shown in third part of Table 1. As we observe, both experiments do not add much information compared to the last exercise, yet both are stronger candidates for explaining the effects of monetary policy than the FTP specification.

It is interesting to note how the response of the output transitory component, to past money shocks, varies between two regimes. In addition, the probability that a recession continues or switch through an expansion will depend on whether the economy is in a recession at the time the policy is taken, and on whether the policy shock is large or small, positive or negative.

Now, I provide detailed estimation results from a model in which the vector of dummies include only the “recession” variable. This model was primarily chosen based on the SIC (see Table 1), but also because it is simpler compared to those that are set up with two discrete-valued variables. In this respect, it is worth noting that the estimation procedure becomes quite unstable when adding more parameter estimates, and under most specifications the transition probabilities creates difficulties in inverting the information matrix.

Table 2 shows the maximum likelihood estimates of the parameters in equations (1)-(6) under the model specification in which \( \mathbf{z}_t = \text{rec}_{t-1}, \text{rec}_{t-2} \). As it was mentioned above, one caveat at this stage is the great difficulty in finding trustable estimates for the standard deviations of the parameters – remember the well-known computational limitations. Notice from Table 2, that the standard deviation estimates for the coefficients accompanying the dummy recession are quite misleading, and they do not give accurate information of the significance of these parameters. Indeed, one has to overcome this problem by restricting the estimation procedure to one or more assumptions. The assumption made here was to relax the starting point at the step of the parameter initialization from five to four years in order to recover more information from the sample. This of course has a cost in terms of accuracy of the estimates, which will be highly dependent on the sensitivity of the initial values. However, several computational exercises did not show much variability in this sense.
If we abstract from the scarce information given by the standard deviations for some estimates of Table 2, we can observe, first, that the permanent component of output, $y_t^p$, is fairly constant on the sample, as $\sigma_y$ and $\sigma_{\omega}$ are very close to zero. This suggests that the trend component of output is well characterized by low frequency shocks which, still, keep the growth rate unchanged along periods. Further, it is not only low frequency shocks to the trend that maintain the permanent component unchanged, but any other permanent shocks keep output at its long run path.

However, the estimate for $\sigma_z$ is significantly different from zero, suggesting that the transitory component of output, $y_t^T$, has large movements over time. In fact, in Figure 1 we observe that this component has large declines, somehow providing support to Friedman’s (1964, 1993) “plucking” hypothesis of economic fluctuations for the case of Argentina. Briefly speaking, this view states that output does not exceed a ceiling level but is occasionally plucked downward by recessions. In other words, negative deviations from trend are deeper than positive deviations.

**Table 2**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\sigma_y$</td>
<td>0.00 (0.00)</td>
</tr>
<tr>
<td>$\sigma_z$</td>
<td>0.04 (0.00)</td>
</tr>
<tr>
<td>$\sigma_{\omega}$</td>
<td>0.00 (0.00)</td>
</tr>
<tr>
<td>$\phi_1$</td>
<td>0.49 (0.07)</td>
</tr>
<tr>
<td>$\phi_2$</td>
<td>0.32 (0.07)</td>
</tr>
<tr>
<td>$\gamma_{10}$</td>
<td>-0.35 (0.05)</td>
</tr>
<tr>
<td>$\gamma_{11}$</td>
<td>0.40 (0.07)</td>
</tr>
<tr>
<td>$\gamma_{20}$</td>
<td>0.40 (0.05)</td>
</tr>
<tr>
<td>$\gamma_{21}$</td>
<td>-0.44 (0.07)</td>
</tr>
<tr>
<td>$\alpha_0$</td>
<td>-42.46 (484.20)</td>
</tr>
<tr>
<td>$\alpha_1$</td>
<td>-13.24 (399.92)</td>
</tr>
<tr>
<td>$\beta_0$</td>
<td>-0.20 (0.54)</td>
</tr>
<tr>
<td>$\beta_1$</td>
<td>42.52 (484.14)</td>
</tr>
</tbody>
</table>

Note: Results in parenthesis are standard deviations.

**Figure 1**

Transitory Component of Output
As for the regime-switching response coefficients (the $\gamma'_i$), they are all strongly significant. Results from Table 2, suggest that they affect the transitory movements of output at different levels, depending on both the properties of the policy shock and the state of the cycle. In order to have a more accurate view of this effect, I performed impulse-response analysis on the effect of monetary policy on output, setting money shocks at period $t-1$ equal to the standard deviation of the sample path of $x_{t-1}$ obtained from an identified VAR. In doing so, I simulate paths for $y'_{t+j}$ in equation (4), taking the coefficients estimated by maximum likelihood (see Table 2). Since the specification I estimate considers two lags for both the monetary policy variable and the transitory component, the impulse response functions will only depend on $S_t$ and $S_{t+1}$. According to this, I run the experiment for the four possible combinations on the dummy variable $S$:

1) $S_t = S_{t+1} = 1$,
2) $S_t = S_{t+1} = 0$,
3) $S_t = 1$, $S_{t+1} = 0$,
4) $S_t = 0$, $S_{t+1} = 1$.

Furthermore, as is standard in the computation of impulse-response functions, I have made the assumptions that $y'_{t-1} = y'_{t-2} = 0$, $\varepsilon_{t+1} = 0$, $\forall j$ and $x_{t-j} = 0$, $j \neq 1$. Figure 2 shows the response of the transitory component of output for as long as five years to a positive shock of size 0.12 (the standard deviation of the log of the quantity of money, $M1$). First, it is worth pointing out that bigger responses of the real economy - in absolute value - come from policies taken when at least one period involved (whether the current or the next one) is an expansion ($reci=0$). Notice that, when the economy is in a recession at both this period and the next one (case 1), the response of output to a policy shock is positive, yet almost unnoticed. It has an impact effect of size less than 1%, being also a maximum of the impulse-response function.

This is different for the remaining cases where in fact the response is greater. For instance, we observe the counter-intuitive case of a largely negative response of output to a loosening of the policy when the economy is in an expansion the current period, but in a recession the next one (case 4). There is no an economic explanation for this particular result, except for it is implicitly highlighting the caveats of those models that explicitly assume a constant response of output upon changes in the monetary policy. Nevertheless, note that when the economy is in a recession this period and in an expansion...
the next one, the response of output to a monetary shock reaches a maximum increase of about 5%. Finally, when the reverse happens, that is when the economy is in an expansion now and in a recession the next quarter, a lose to the monetary policy creates a fall of the transitory output of more than 4% at impact, but a recovery that reaches a maximum increase of almost 3% the next date.

Summarizing, we should be aware that these impulse-response functions cannot say much indeed about a clear effect of the dummy variable considered here - the “recession” dummy -, on the response of output to a monetary policy shock. One could say that a monetary policy shock will be effective, in the sense that it has large effects, whenever the economy is in an expansion. However, this experiment is not robust to all possible specifications of the model presented in this section, nor it is robust to the results found in Lo and Piger (2005) for the U.S. economy. In fact, they find that the reverse happens, i.e., monetary policy shocks are more effective when the economy involves at least one period of recession between both the current and the next quarter. An explanation to this difficulty may reasonably arise from the fact that we are comparing especially two different economies. On the one hand, the U.S. is a more stable economy than Argentina (considering all the variables being studied). On the other hand, the sample used for Argentina might not be as long as to dissipate the high variance of some estimates, which is not an issue for the study of the U.S. economy.

Let us analyze now the estimation results concerning the coefficients that explain the transition probabilities given by equation (6). In this sense, consider only the parameters $c_0$, the vector $(a_{01}, a_{02})'$, since, as was mentioned above, all specifications assume that $P(S_t = 1| S_{t-1} = 1)$ is constant. Indeed, looking at the estimate $c_{01}$ in Table 2, and even though it is not significant, a value of 42.52 is suggesting a high and constant value of $P(S_t = 1| S_{t-1} = 1)$, fairly close to one.

First, consider the specification in which $P(S_t = 0| S_{t-1} = 0)$ is constant; that is, the vector $(a_{01}, a_{02})'$ is $(0,0)'$. In this case, plugging the estimate $c_{00} = -0.20$ from Table 2, we obtain $P(S_t = 0| S_{t-1} = 0) = 0.45$. Compared to the same estimate of 0.99 found by Lo and Piger for the U.S., this is clearly showing that “normal” times in Argentina are nothing but short bursts, which results as expected if we look at Figure 3 below. Hence, if the economy has not been in a recession in the recent past, $S_{t-1} = 0$, the probability that it stays there at that “normal” stage, $S_t = 0$, is not as high as it is in the U.S.

When we consider the unrestricted case in which the vector $(a_{01}, a_{02})'$ can be different from zero, the transition probability $P(S_t = 0| S_{t-1} = 0)$ falls even more toward values very close to zero indeed. However, we might note that both values of $a$ are not significantly different from zero, as we observe in Table 2.

Let us focus now on the final objective of this work, which is the one related to the estimates of the timing of the regime switches. We can see this graphically using the estimated probability that $S_t = 1$ - often called a “filtered” probability -, denoted hereafter as $P(S_t = 1| t)$. Figure 3 shows these results (shaded areas indicate recession dates). As it can be observed, the model is identifying two clear regimes: one in which $P(S_t = 1| t)$ is close to zero, given more frequently, and the other in which the filtered probability is close to zero. Looking at Figure 4, which depicts the same exercise made for the U.S., we can easily note the difference between the two frequency shapes. In the U.S., regimes of recessions or “abnormal” periods are less frequent and sporadic. In particular, $P(S_t = 1| t)$ is generally close to zero, which gives the idea that monetary policy shocks have small effects in that economy. It was mentioned above that monetary policy in the U.S. was more effective during recessions. The reverse outcome occurs in Argentina: recession times are the basis for ineffective monetary shocks on output.

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4. Even though the fourth case shows results one might not expect to find.
5. I analyzed different specifications of the model. In particular, the linear VAR estimation procedure used in generating the monetary shock is quite sensitive to changes in the setting.
However, we find one similarity between the two economies. In both figures, we can see that recession times coincide with $P(S_t = 1 \mid t)$ as being fairly close to one. This is not surprising if we take into consideration that the dummy variables “recession” are significant in explaining variation in the transition probabilities of the two models: both for the U.S. and for Argentina. On this correspondence between recession times and $P(S_t = 1 \mid t)$, one should be aware, though, that the description for Argentina is not as accurate as it is for the U.S. This is, once again, a demonstration of the large volatility of the macroeconomic variables of Argentina. However, there still exists a strong correspondence between business cycle and filtered probability in that country, which seems to be robust along history. Notice that the time series corresponding to the sample used in this work includes a relatively large number of recessions.

**Figure 3**

Filtered Probability of Recession

**Figure 4**

Filtered Probability of Recession - U.S.
IV. Concluding Remarks

The primary goal of this work was to investigate the asymmetries that are claimed to arise in the real economy as a response to shocks to the monetary policy. In particular, the main purpose of this paper was to introduce ourselves into the empirical discussion of the asymmetries observed in the business cycles of Argentina.

It has been showed, for developed countries, that asymmetries may arise from the direction (positive or negative) and the size (small or big) of the monetary policy shocks - see for instance Ravn and Sola (2004). It has also been showed that, depending on whether the economy is in recession or expansion, monetary policy shocks may affect differently real output - see for example Garcia and Schaller (2002). Lo and Piger (2005) study these three asymmetries altogether, using a Markov regime-switching model, to investigate time variation in the response of the transitory component of output to monetary policy shocks.

I apply the specification aforementioned to investigate the response of the cyclical component of output to monetary policy shocks in Argentina, in a sample from 1977 to 2006. The model allows for time-varying transition probabilities in order to explain regime shifts from the three asymmetries mentioned above. The results strongly suggest time variation in the coefficients that describe the response of output to a monetary policy shock. This TVTP model, shows evidence that the time variation in the response of the cyclical component of output can be well explained by a discrete-valued variable indicating the phase of the cycle at the time the policy is applied. A suggestive finding from this setting provides support to Friedman’s “plucking” view of economic fluctuations.

The results seem to be robust, for that the evidence contains a relatively large number of changes in regime. Moreover, even though I have shown estimations using the dummy “recession” only, it is worth pointing out that including the other two asymmetries in combination with the recession variable, also show strong support to the model presented above. However, in contrast with the results found for the U.S. by Lo and Piger (2005), this paper’s findings show that output in Argentina responds mostly to policy actions taken during expansions.

Finally, I wish to call attention that it could be interesting to extend the analysis developed here for Argentina to study the asymmetric effects of monetary policy in a set of developing countries. This might be one, of many ways, to characterize the business cycle of this type of economies.
References


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