THE EFFECTS OF MONETARY POLICY ON THE FIFTEEN METROPOLITAN STATISTICAL AREAS IN TEXAS

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by
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THE EFFECTS OF MONETARY POLICY ON THE FIFTEEN METROPOLITAN
STATISTICAL AREAS IN TEXAS

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ABSTRACT

THE EFFECTS OF MONETARY POLICY ON THE FIFTEEN METROPOLITAN STATISTICAL AREAS IN TEXAS

by

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Texas State University-San Marcos

May 2012

SUPERVISING PROFESSOR: DR. DAVID BECKWORTH

As the Eurozone continues to deal with their crisis, the similarities of the causes of the crisis with the United States’ economy become more apparent. Monetary Policy is implemented by the Federal Reserve, a single central bank, by targeting the federal funds rate. Shocks in monetary policy implemented by the Fed causes responses in unemployment rates in MSAs across the country. Included in these MSAs are fifteen metropolitan areas in Texas. An analysis and correlation of the unemployment rates of these MSAs will be constructed in comparison to the United States using vector auto regression and impulse responses. Implications will then be presented to combat the disparities present between the economies.
INTRODUCTION: IDENTIFYING THE PROBLEM

Does it make sense to apply the same monetary policy to vastly different economies? This has become an important question over the past few years because of the Eurozone crisis. This crisis emerged, in part, because the European Central Bank (ECB) applied the same monetary policy to many diverse economies of the Eurozone. In 1999, the ECB lowered interest rates and eased monetary conditions which helped a sluggish German economy, but added too much stimulus for the fast-growing periphery of currency union. In 2011, the ECB refused to lower interest rates which kept the stable German economy from overheating, but further weakened the already depressed periphery. Many observers now question whether the European currency union ever made sense.

A similar question can be raised about the United States: does it make sense for the central bank of the United States, the Federal Reserve, to apply a uniform monetary policy for all 50 states? Does Texas really need the same monetary policy as Michigan? Research over the past decade has tackled this question and found that the Federal Reserve’s one-size-fits-all approach does create problems for some regions of the United States. Research by Carlino and Defina (1998, 2004), Kouparitsas (2001), Crone (2007), and Owyang and Wall (2004) all show that monetary policy shocks—sudden changes in the stance of monetary policy—do have a disparate impact on regions in the United States. Specially, they show that regions of the United States with a relatively largely share of their economy in manufacturing and construction industries tended to be more sensitive to monetary policy shocks. The rustbelt states, therefore, were found to suffer
more when the Federal Reserve tightened monetary policy. Regions, however, that had a lot of extractive industries actually did better in such circumstances. The main implication of these studies is that based on the different structure of the regional economies the impact of monetary policy shocks could vary.

Given the findings in this literature, a natural extension is to consider whether metropolitan areas are also affected differently by such monetary policy shocks. In this paper I examine this question. Specifically, I examine the effect of U.S. monetary policy shocks on the unemployment rate in the fifteen largest major metropolitan statistical areas (MSA) in Texas. I evaluate whether there are in fact different responses for each city to a common monetary policy shock and then consider what this means for policy.

The paper proceeds as follows. First, I will explain how monetary policy is typically conducted in the United States by the Federal Reserve. Second, for the period 1990:1 to 2011:12 I will examine historical trends for the unemployment rates of these fifteen largest Texas MSA's and compare them to the national average and each other. Third, I will then estimate a vector auto regression (VAR), where the relationship between the unemployment rates for each city and monetary policy shocks will be estimated. With this estimated relationship, I will then show impulse response functions which reveal how unemployment rates typically responded to monetary policy shocks over this period. Finally, I will conclude by discussing the policy implications of my findings.
Section II: HOW U.S. MONETARY POLICY IS CONDUCTED

Currently, U.S. monetary policy is conducted by adjusting a short term target interest rate. The reason for doing so is that by adjusting the current and expected path of short term interest rates, the Federal Reserve (Fed) can adjust the current and expected costs of borrowing. This, in turn, influences total aggregate spending. Currently, the Fed targets the federal funds rate, the interest rate at which banks lend excess reserves to each other. This interest rate serves as a benchmark for other interest rates and thus influences financial costs more broadly. The Fed does not have direct control over the federal funds rate, only indirect direct control. The Fed actually controls the monetary base, a measure of money that includes currency in circulation and bank reserves. The Fed manipulates the quantity of the monetary base, which given a certain demand for it, causes the federal funds rate to change and move toward its targeted value. In other words, the Fed indirectly controls the federal funds rate through its direct control over the monetary base.

Figure 1 illustrates this process. This figure shows how the demand for the monetary base ($M^D$) and the supply of it ($M^S$), which the Fed controls, interact to maintain the targeted federal funds rate (ffr). In the graph of Figure 1, the monetary base is such that it equals the demand for it at point “A”. At this point there is a 3% federal funds rates. If the Fed is targeting a 3% federal funds rate target then the target is being realized and all is well.

Now consider what happens if $M^D$ suddenly increases, shifting to the right in the second panel of Figure 1. Here, the interest rate rises from 3% to 4% at point “B”. This
is above the Fed’s 3% federal funds rate target. The Fed responds by increasing the monetary base such that the target federal funds rate value is restored. This occurs at point “C”, restoring the federal funds rate back to 3%. Note that the point “C” places the federal funds rate back where it was when point “A” prevailed. Thus, the Fed will adjust the monetary base in response to changes in $M^D$ to maintain a given target federal funds rate.
Figure 1: The Market for the Monetary Base and the Target Federal Funds Rate

1.

2.

3.

4.
But this process begs the question: how does the Fed sets its target federal funds rate in the first place? Why pick 3%? The answer to this question can be explained by the Taylor Rule. The Taylor Rule is an estimated equation that shows how the Fed in the past set the federal funds rate when it did a good job (i.e. maintained macroeconomic stability). The Taylor Rule, therefore, provides a benchmark on how to set an appropriate federal funds rate target. More formally, the Taylor Rule is as follows:

\[ \text{ffr}_T = \text{ffr}_N + .5(\pi^A - \pi^T) + .5 \frac{(Y^A - Y^P)}{Y^P}. \]

The \( \text{ffr}_T \) in the formula stands for the targeted federal funds rate. This is the target rate the Taylor Rule says indicates, given the parameters and values on the right-hand side of the equation. The \( \text{ffr}_N \) represents the neutral federal funds rate, the federal funds rate that would prevail if the economy were at full capacity and if inflation were stable. In short, it is the interest rate that would occur if there were no business cycles. The symbols \( \pi^A \) and \( \pi^T \) are the actual inflation rate and the targeted inflation rate, respectively. This part of the Taylor says that the federal funds rate should go up if actual inflation is above its targeted value and vice versa. The last term on the right-hand-side of the Taylor Rule is the output gap. The output gap measures the percentage difference between actual real gross domestic product, \( Y^A \), and potential real gross domestic product, \( Y^P \). It says that the federal funds rate should go up if actual real gross domestic product is greater than potential real gross domestic product and vice versa. In short, if the economy is overheating— either growing fast or experiencing too high inflation— then the Taylor Rule says the Fed should raise the federal funds rate. If the economy is underperforming, the Fed should lower the federal funds rate.
In this paper I will use the Taylor Rule as a way to measure the appropriate stance of monetary policy, given the state of the economy. Specifically, I take the difference between the actual federal funds rate and the benchmark Taylor Rule federal funds rate as a measure of the stance of monetary policy. This Taylor Gap will be used later in the paper to examine the effect of monetary policy shocks on the 15 largest MSAs in Texas.
Section III: UNEMPLOYMENT IN TEXAS

The state of Texas is located in the southern tip of the United States of America. It is a large state that consists of many different metropolitan statistical areas (MSA). Each of the fifteen largest MSAs contain unique economies that may be different enough from the national economy, which the Fed cares about, that a monetary policy shock may create different effects on them. For example, assume the U.S. economy is growing too fast and, as a consequence, the Fed raises its target federal funds rate. This move may stabilize the U.S. economy overall, but it might be destabilizing for some Texas cities if their economies were already experiencing slow growth. It is important for a one-size-fits-all monetary policy that the regional economies, including those of Texas MSAs, be in sync with the national rate.

In order to assess whether the Texas MSAs are in sync with the national economy, I look at their unemployment rates compared to the national one. There are other better measures of real economic activity, but few are available at the MSA level at a high enough frequency to be useful for the analysis of this paper. The unemployment rate, is available on monthly basis for the MSAs going back to 1990, and is in rate form, which makes it easy to compare across MSAs and the U.S. economy. For these reasons the unemployment rate is used in this study.

The unemployment rate is the ratio of unemployed individuals looking for work over the labor force. The labor force is equal to employed individuals plus unemployed individuals looking for work.

\[
\text{Unemployment Rate} = \frac{\text{Unemployed}}{\text{Labor Force}} = \frac{\text{Unemployed}}{\text{Unemployed} + \text{Employed}}
\]
The unemployment rate is determined each month by the U.S. Bureau of Labor Statistics via a monthly household survey. To be counted as part of the unemployed looking for work, one must not have a job but have actively looked for one in the prior four weeks and be currently available for work. The unemployment rate provides a measure of slack in the labor force and closely tracks the output gap used in the Taylor Rule.

Figure 2 below reports unemployment rates in Texas MSAs (black lines) in comparison to the U.S. unemployment rate (gray lines) for the period 1990:1 – 2011:12. This figure provides an indication of how in sync the Texas MSAs are with the national economy. The United States had an unemployment rate of over 6% for the first couple years of the 1990’s, up until around 1995 when the economy began to grow rapidly pushing down the unemployment rate to about 4% by 2000. The unemployment rate surges again with the 2001 recession. It then gradually falls during the housing boom period of the early-to-mid 2000s. With the onset of the Great Recession of 2007-2009 and the subsequent slow recovery, unemployment spikes once again hitting a high of about 10%. It has slowly and very gradually started to fall.
Figure 2: Unemployment Rate in Texas Cities

Texas City =  

USA =  
Given that the U.S. unemployment rate closely follows the output gap (a term in the Taylor Rule), the Fed effectively responds to swings in the unemployment rate. Therefore, the Fed in some sense is responding to the gray lines in Figure 2. That being the case, it is apparent from this figure that the Fed is often not responding appropriately to the swings in the Texas MSA unemployment rates. They are frequently very different than the swings in national unemployment. For example, Amarillo, Beaumont, Brownsville, El Paso, Laredo, and McAllen have both different levels of unemployment and often different turning points in the unemployment rate. Some cities, such as Dallas, Houston, Killeen, and San Antonio more closely follow the U.S. economy. Given this wide divergence in unemployment rates, it is not clear that a one-size-fits-all monetary policy makes sense for the MSAs in Texas.

As a way to summarize the information seen in Figure 2, Table 1 provides the average unemployment rate for each MSA over this 20-year period and the correlation of the MSA monthly unemployment rates with the U.S. monthly unemployment rate. For the correlation measure, the closer the number is to 1, the more correlated it is with U.S. unemployment rate. In other words, high correlation of an MSA with the U.S. economy means their economies are in sync to some degree. Ideally, the Fed would want a high correlation for all MSAs to make its job easier.

The data in Table 1 shows that there is a wide range in the average unemployment rates and in the correlations with the U.S. economy. Average unemployment rates vary from 4.23% in Amarillo to 13.67% for McAllen. Seven of the MSAs have a correlation of 0.80 or higher, indicating they are in sync with the U.S. economy. However, eight
MSAs have a correlation less than 0.80, meaning they are less in synch with the national economy.

For those these cities that are not in sync with the U.S. economy, it could be destabilizing to be in the dollar currency union. For them, what the Fed does with monetary policy could worsen their business cycle. Figure 3 sheds light on this issue. Using a scatter plot, it shows the relationship between the average unemployment rate and the correlation of the MSA with the U.S. economy. This scatter plot shows a remarkable negative relationship—the more in sync a MSA is with the national economy the lower is its average unemployment rate. This relationship has a R^2 of 0.7059. This means that approximately 70% of the variation in average MSA’s unemployment rates can be explained by being in sync with the national economy. In this case the relationship is strongly negative, implying that the less a Texas MSA is tied to the national economy, the higher is its average unemployment rate. One explanation is that the MSAs not in sync with the U.S. economy are getting buffeted with monetary policy shocks that are destabilizing for them. For example, McAllen which has a low 0.16 correlation with the U.S. economy is unlikely to benefit as much as Dallas, which has a high 0.91 correlation, when the Fed tightens monetary policy.

The analysis so far indicates that the Fed’s one-size-fits-all monetary policy does not seem to work for all of the large MSAs in Texas. In the next section we take a closer look at the impact of the monetary policy shocks on these MSAs.
Table 1: Summarizing the Relationships

<table>
<thead>
<tr>
<th>City</th>
<th>Average Unemployment Rate (%)</th>
<th>Correlation with the USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amarillo</td>
<td>4.23</td>
<td>0.85</td>
</tr>
<tr>
<td>Austin</td>
<td>4.38</td>
<td>0.77</td>
</tr>
<tr>
<td>Beaumont</td>
<td>8.41</td>
<td>0.66</td>
</tr>
<tr>
<td>Brownsville</td>
<td>10.42</td>
<td>0.40</td>
</tr>
<tr>
<td>College Station</td>
<td>4.01</td>
<td>0.73</td>
</tr>
<tr>
<td>Corpus</td>
<td>7.04</td>
<td>0.50</td>
</tr>
<tr>
<td>Dallas</td>
<td>5.45</td>
<td>0.91</td>
</tr>
<tr>
<td>El Paso</td>
<td>9.13</td>
<td>0.36</td>
</tr>
<tr>
<td>Houston</td>
<td>5.96</td>
<td>0.91</td>
</tr>
<tr>
<td>Laredo</td>
<td>8.61</td>
<td>0.22</td>
</tr>
<tr>
<td>Lubbock</td>
<td>4.47</td>
<td>0.91</td>
</tr>
<tr>
<td>Killeen</td>
<td>5.62</td>
<td>0.90</td>
</tr>
<tr>
<td>McAllen</td>
<td>13.67</td>
<td>0.16</td>
</tr>
<tr>
<td>SanAnt</td>
<td>5.17</td>
<td>0.89</td>
</tr>
<tr>
<td>Waco</td>
<td>5.33</td>
<td>0.88</td>
</tr>
<tr>
<td>US</td>
<td>6.00</td>
<td>1.00</td>
</tr>
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R² = 0.7059

Figure 3: Does Being in Sync with U.S. Economy Matter?
Section IV: EMPIRICAL METHODS

In this section I estimate a Vector Autoregression (VAR) to quantify the effect of a monetary policy shock on the 15 Texas MSAs. A VAR is a system of dynamic equations that attempts to describe the relationship among different variables. Formally, the VAR can be stated as follows:

\[ MP_t = \alpha + \sum_{i=1}^{p} \beta_{1,i} U_{t-i}^{MSA} + \sum_{i=1}^{p} \beta_{2,i} U_{t-i}^{Neigh} + \sum_{i=1}^{p} \beta_{3,i} MP_{t-i} + e_t \]

\[ U_{t}^{MSA} = \alpha + \sum_{i=1}^{p} \beta_{4,i} U_{t-i}^{MSA} + \sum_{i=1}^{p} \beta_{5,i} U_{t-i}^{Neigh} + \sum_{i=1}^{p} \beta_{6,i} MP_{t-i} + e_t \]

\[ U_{t}^{Neigh} = \alpha + \sum_{i=1}^{p} \beta_{7,i} U_{t-i}^{MSA} + \sum_{i=1}^{p} \beta_{8,i} U_{t-i}^{Neigh} + \sum_{i=1}^{p} \beta_{9,i} MP_{t-i} + e_t \]

where \( MP_t, U_{t}^{MSA}, U_{t}^{Neigh} \), are the stance of monetary policy, the unemployment rate for a particular MSA, and average unemployment rate of the particular MSAs two closest neighbor MSAs. Here the \( t \) subscript represents time periods and the \( e_t \) is a white noise, normally distributed error term. The \( \alpha \) and \( \beta \) parameters can be estimated using ordinary least squares. This model is estimated for each MSA. The objective here is to isolate non-forecasted changes in the stance of monetary policy, as measured by the Taylor Gap, and then determine the dynamic effect of such changes or shocks on the particular MSA. The average unemployment rate of the nearest two neighboring MSAs is included to account for spatial spillover effects.

As it stands this model can be estimated but is in reduced form. Some identifying restrictions, therefore, must be imposed on it to be able to pull out reasonably measured structural monetary policy shocks. The restriction I impose is that the MSAs can have no contemporaneous or lagged effect on the setting of U.S. monetary policy. The Fed does
not care about a particular MSA’s economy, rather it is concerned about the national economy. Consequently, I set all the $\beta_1$s and $\beta_2$s to zero and also impose a cholesky decomposition on the covariance matrix. This has the nice feature of ensuring that the same monetary policy shock is estimated for each MSA. If these parameters were not set equal to zero, then each MSA could affect monetary policy differently and lead to a different estimate of the monetary policy shock. I avoid this problem with these restrictions.

The MSA data for the VAR comes from Bureau of Labor Statistics website and is seasonally adjusted. The Taylor Rule gap is constructed according to the Taylor Rule equation spelled out above using macroeconomic data from the St. Louis Fed’s database. As noted above, the entire sample runs from 1990:1 through 2011:12.

I estimate the model and, as standard in this literature, use it to do innovation accounting. This exercise allows one to answer the following the question: on average, how did one variable in the VAR respond to a shock in another variable? In this case, I can use the impulse response function form of innovation accounting to show how the each Texas MSA responded on average to a typical (i.e. one standard deviation) shock to the Taylor Gap. These shocks are positive which means I am examining what happens after an unexpected tightening of monetary policy. One would expect the unemployment rate to go up given such a shock.

Figure 4 reports the impulse response functions for all 15 MSAs. The solid line in each panel represents the average or point estimate while the dashed lines show a standard error band. The standard error bands provide some sense of how precise the point estimates are. This figure reveals that there is wide variation in the response of
Texas MSAs to a monetary policy shock. Most MSAs see their unemployment rate increase somewhere between 0.07 percentage points to 0.15 percentage points.
Figure 4: Unemployment Impulse Response Function to a Typical Monetary Policy Shock

Quarters after shock
Some MSAs, however, vastly exceed that range. Brownsville sees a 0.24 percentage point increase while El Paso has 0.33 percentage point increase. The largest responses come from Laredo at 0.34 percentage points and McAllen at 0.35 percentage points. Interestingly, these MSAs with the largest responses tend to be the ones with the lowest correlation to the U.S. economy. This observation suggests that U.S. monetary policy may actually be disruptive to those MSAs not in sync with the national economy.

Figure 5 provides further evidence on this implication. It plots the size of the impulse response function 3 quarters after the shock against the correlation of the MSA economy to the U.S. economy. It shows there is in fact a strong, negative relationship: the less in sync a MSA is with the U.S. economy the more adverse the impact of a negative
monetary policy shock is upon it. The one-size-fits-all monetary policy of the Fed does seem to be creating problems for some of Texas MSAs.
Section V: POLICY RECOMMENDATIONS:

After the analysis in the previous sections, I conclude that U.S. monetary policy shocks do have a disparate impact on the regional economies in Texas. This further corroborates the findings of the earlier literature that showed similar results at the state level. These findings raise the question: what can be done to allow the Federal Reserve to conduct monetary policy without having to worry about its asymmetric effect on MSA’s? Below I consider three policy recommendations that could be used separately or together to increase effectiveness of the Monetary Policy.

The first option would be to find ways to improve labor mobility across the MSAs in the United States. The greater labor mobility, the easier it would be for a worker in an MSA hit hard by Fed policy to pack up and move to an MSA benefiting from Fed policy. This would reduce the unemployment rate in those adversely affected MSAs. Labor mobility already exists to some degree in the United States, but more can be done to increase it. Currently, one big constraint on labor mobility is the large number of underwater mortgages. Possible solutions to this might include more ambitious federal government debt reduction plans or a more aggressive monetary policy stimulus that would ease the real debt burden on households by raising nominal incomes. Other possible solutions might be to improve tax incentives for moving to a new job.

The second option that could affect how MSA’s respond to Taylor Gap shocks would be to increase price flexibility. Price flexibility gives the market the ability to restore equilibrium or full employment by cutting prices and wages. If price and wages cannot be cut easily, then the market will clear by adjusting quantity. That is, it will
adjust by producing less and firing workers. There are many institutional barriers that prevent increased price flexibility like unions and psychological bias against nominal wage cuts. New policies should be promoted that make it easier to get past these barriers to price flexibility.

The final option would be to provide more money for retooling and education for workers in the MSAs hit hardest by monetary policy shocks. A central premise of an optimal currency union is that those regions that benefit the most should be willing to help those that who benefit the least. Thus, we have fiscal transfers where if one state in the United States is doing relatively well, its higher income taxes end up providing a buffer via federally funded unemployment insurance through to those states not doing so well. The notion here is to do more along these lines, but in the form of retooling and schooling. This option would complement the first one by further improving labor mobility. Note this solution can only work at the level of the currency union. Thus, those MSAs benefiting anywhere in the United States from Fed policy should support the retooling of those in MSAs hit hard by Fed policy.

The end result of any of these implications could provide some assistance to the regional economies that are more negatively affected by the change in monetary policy. This thesis was based upon the MSA's in the state of Texas, but obviously is relevant to other MSAs of the United States as well. These finding suggest there are disparate changes from Fed policy shocks across all the United States. One size-fits-all monetary policy comes at a price. We should be willing to do more to minimize these asymmetric effects.
Bibliography


VITA

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