The Differential Impact of the Federal Reserve Rate Hikes on National and Regional Employment Figures: Evidence from San Joaquin County

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This study examines the relationship between Federal Reserve interest rate actions and the employment growth rate in one county within California's San Joaquin Valley, an economically distressed rural area. Since 2016, the Federal Reserve implemented a series of interest rate hikes and a "quantitative tightening" process to reduce the size of its balance sheet. Our data show that this tightening did slow the rate of employment growth nationally, but the rate slowed more in California and still more in San Joaquin County. This vulnerable region paid a high price for the desired contraction of monetary policy.

INTRODUCTION

This study examines the magnitude of response in California's San Joaquin Valley to recent Federal Reserve initiatives. Distinct geographically as the 250 mile long valley in the center of the Southern half of California, this region is usually seen as an economically distressed rural area in terms of measures like relative unemployment rates (Cowan, 2005).

While clear to its residents, it is not so clear what constitutes a region when data is to be collected. The 12 Federal Reserve Banks each report data for its district. Through historical accident and demographic change over time, the result has been districts that vary grossly in size. The San Francisco Fed reports on a district that comprised over 19% of the U.S. population in 1997 while the Minneapolis District comprised only 3% (Miller, 2002). This is the likely reason that regions were somewhat redefined for the Carlino and deFina (1996) study. Studies generally conclude that there are differences in the magnitude of response to Federal Reserve actions among regions.

It is unclear what constitutes a region, and impacts can be blurred if a region is defined too broadly. For example, after keeping rates at historically low levels from December, 2008, the Federal Reserve began implementing a series of rate hikes in December, 2015, which accelerated in 2017 and are

continuing (FOMC Statements). The intended nationwide effect is price stability in order to maintain a positive business environment. While such aggregate demand management policies may have this desired effect, it is not clear what the impact is on specific regions of the country, particularly the vulnerable ones with high unemployment rates and a workforce composition with a greater unskilled to skilled ratio. While the desired effect might be achieved at the national level, an unintended recessionary impact might occur on the individual county level. These regions may have a much stronger negative response.

An early study on this topic employed a vector autoregression model (VAR) to examine the effects among U.S. regions (Carlino and deFina, 1996). Their research considers regions separately but also recognizes that each region could be impacted by the others. Although the study's findings offer little empirical support, possible influences on the differential response include differences in the proportion of interest-rate sensitive industries, in the proportion of large and small firms and in the proportion of large and small banks. Interest sensitivity is deemed likely to be consistent with the proportion of the total gross product provided by construction and manufacturing.

A newer study by Potts and Yerger, (2010) finds differential impact across regions, noting that of three possible sources of differential impact of governmental interventions, empirical support is found for only one: the differences in percent of output from interest-rate sensitive sectors. The study also uses VAR, the methodology used here, with Canadian regions to identify possible responses to U.S. monetary policy.

The San Joaquin Valley is a much more distinct region than the "Far West" used in older studies, whether the full Federal Reserve District or the truncated one used by Carlino and deFina (1996), and its responses could easily be swamped with data from the more populous, coastal regions. San Joaquin County, which lent its name to the entire 8-county region, is representative. The county is characterized by a mix of urban and rural factors and constitutes a viable laboratory to further investigate this little examined research question. Further, San Joaquin County is an economically distressed rural area, which has more than twice the national rate of unemployment.

In analyzing the postulated regional vs. national effects of Federal Reserve rate hikes, this study contributes to the current literature in several distinct ways. First, the study examines the relationship between the Federal Reserve's rate hikes and employment growth in California's San Joaquin County. Second, the study examines the extent of the impact that may come from interest rate sensitive categories such as retail trade employment in responding to rate hikes. Third, it analyzes persistence effects. While the effects may be of intended duration and magnitude nationally, at the regional level effects may be delayed and much longer lasting.

Our findings reveal that rate hikes slow employment growth more at the regional than the national level. Thus, the examined region appears to have paid a higher than average price from the implementation of such policies by the Federal Reserve. Economic categories such as retail trade appear to be even more sensitive to interest rate increases than others. Although the economy in the San Joaquin Valley is dominated by agriculture, retail and hospitality employment are important and exhibit a much greater negative response than at the national level. This is due to the unskilled to skilled workforce ratio being much higher in the region. Further, due to the underdeveloped nature of labor markets, the response at the regional level is lagged by several months when compared with the response at the national level. Lastly, the effects of rate hikes display greater persistence at the regional level in that the effects last much longer at the regional than the national level.

After the literature review in section two, the remainder of this study is structured as follows: section three provides a simple Keynesian framework, section four describes the econometric methodology used in the study, section five summarizes descriptive statistics, section six reports the empirical findings and section seven concludes with a discussion of practical implications.

LITERATURE REVIEW

The work of Christopher Sims and Thomas Sargent, whose innovations in developing econometric models were recognized with a Nobel Prize for Economic Sciences in 2011, provide a basis for this study.

They developed analytical methods to understand the impact of governmental interventions on the economy by attempting to let the data speak. Using vector autoregression (VAR) their work made it possible to consider governmental policy, expectations and unexpected shocks. (Chaddock, 2011)

Modeling with VAR that "let the data speak" is a way to minimize theoretically based assumptions. Using such assumptions can make models too restrictive. Although ideally based on "theory," model assumptions can often be based more on intuition. In contrast, VAR models work by identifying characteristics of time series to find regularities in the data without predefining what characteristics might be expected. (Boumans and Sent, 2013).

This study focuses on a particular place, the San Joaquin county and surrounding regions. It is not a new understanding that regions respond differentially to economic interventions. Some regions have a stronger response to contractions in monetary policy, and interventions intended to dampen an overheated economy can hit more vulnerable regions.

It can be unclear what constitutes a region and impacts can be blurred if a region is defined too broadly. An early study employed VAR to look at impacts among U.S. regions (Carlino and deFina, 1996). The research considered each region separately but also recognized that each could be impacted by the others. Although there was little empirical support at the time, possible influences for the differential response were listed as differences in the proportion of interest-rate sensitive industries, differences in the proportion of large and small firms and differences in the proportion of large and small banks. Interest sensitivity was deemed likely to be consistent with the proportion of the total gross product provided by construction and manufacturing.

The study did conclude that there were differences in the magnitude of response among the defined regions. Regions considered "core" regions mirrored the national response and were listed as New England, Mideast, Plains, Southeast and Far West. These regions comprised nearly three quarters of gross state product and population. The remaining regions considered "noncore" regions showed quite a different response. These were Great Lakes, Southwest and Rocky Mountain (Carlino and deFina, 1996).

A newer study finding differential impact across regions noted that of the three possible sources of differential impact from governmental interventions, empirical support has been found for one: differences in percent of output from interest-rate sensitive sectors. The study used VAR to identify possible responses of Canadian regions to U.S. monetary policy. (Potts and Yerger, 2010).

San Joaquin County and its seven companion counties form a much more distinct region than the "Far West" used in older studies Responses from this component could easily be swamped when combined with data from more populous, coastal regions. The San Joaquin County region is characterized by a mix of urban and rural factors and may be more vulnerable to the impact of interventions such as rate changes or contraction in monetary policy. Similar vulnerable regions might include other quasi rural/urban pockets such as South Texas/ Rio Grande Valley, Kentucky coal country, Gary, Indiana.

A SIMPLE KEYNESIAN MODEL OF EMPLOYMENT AND INTEREST RATES

A simple Keynesian model of employment and interest rates can reasonably be constructed considering that the share of the U.S. external account constitutes a relatively smaller proportion of GDP even than in smaller economies such as Germany, Singapore and Mexico. Thus, in a simple closed economy Keynesian framework, the familiar income identity can be expressed as:

$$Yd = C + I + G - T \tag{1}$$

where Yd is disposable income, C is consumption expenditure, I is investment, G is government expenditures and T is taxes.

$$C = a + bYd \tag{2}$$

$$(1\text{-}b)Yd = I + G - T \tag{3}$$

$$m = (1\text{-}b) \tag{4}$$

$$I = nr \tag{5}$$

$$Yd = kE \tag{6}$$

where E is employment and k is the proportional factor of E that corresponds to Yd.

$$mkE = nr + G - T \tag{7}$$

$$E = (1/mk)[nr + G - T] \tag{8}$$

$$\delta E / \delta r = n/mk \text{ where } n \leq 0,\ m \geq 0,\ \text{and } k \geq 0 \tag{9}$$

After substituting and solving for the partial derivative of employment with respect to interest rate, the sensitivity of E to changes in r becomes *n/mk* with an expected overall sign of a negative coefficient.

ECONOMETRIC METHODOLOGY

In accordance with equation (9), two separate VAR models are estimated as expressed below (Sims, 1980, Boumans & Sent, 2013)):

$$Z(t) = C + \sum_{s=1}^{m} A(s)Z(t-m) + \varepsilon(t)$$

where, Z(t) is a column vector of the two variables for each estimated system, C is the deterministic component comprised of a constant, A(s) is a matrix of coefficients, m is the lag length and ε(t) is a vector of random error terms. To control for degrees of freedom and avoid parameterization and from equation (9), only two variables are included in each VAR specification.

Because, conventional t-values are void in the VAR system of equation, generalized impulse responses from the VAR model are employed for statistical inference and to trace the response of one variable to a one-standard-deviation shock in another variable. Monte Carlo methods are utilized to construct confidence bands around the mean response (Doan and Litterman, 1986). When the upper and lower bounds carry the same sign, the responses become statistically significant at the 95% confidence level. Generalized orthogonalization provides results that are robust to different variable orderings in the system of equations (Pesaran & Shin, 1997, 1998).

DESCRIPTIVE STATISTICS

Monthly data for interest rate, and employment production are obtained from DataStream, and the Bureau of Labor Statistics and cover a period from October 2009 to June 2017. The federal funds rate is the proxy for the short run interest rate. Time series properties are checked initially using the Augmented Dickey Fuller (ADF) test to avoid the possibility of finding spurious relationships. ADF tests reveal that the federal funds rate and logged first differences of employment levels are stationary and integrated of order one [I(1)]. Further, Johansen (1988) cointegration tests do not report any long-term links among the variables considered in the study. Optimal lag-length test point to three lags and the form of growth rate for employment variables.

Table 1 reports unemployment rates at five-year intervals for San Joaquin County and the nation. Consistently, unemployment rates for San Joaquin County have been much higher than at the national levels -- almost twice the rate observed nationwide. One can easily infer from these numbers the unfavorable economic position of San Joaquin County relative to the nation.

TABLE 1
FIRST QUARTER UNEMPLOYMENT RATES
SAN JOAQUIN COUNTY VS. NATIONAL AND FEDERAL FUNDS RATE

	San Joaquin County	National	Federal Funds Rate
2005	7.50%	4.60%	4.16%
2010	17.40%	9.10%	0.18%
2015	8.50%	4.80%	0.24%
2016	7.00%	1,75%	1.75%

EMPIRICAL FINDINGS

Figure 1 (See Appendix) reports impulse response functions from the VAR estimations involving the national employment rate growth and the federal funds rate. A one standard deviation positive and once-and-for-all shock to the federal funds rate reveals a one period lagged, statistically significant negative response of the national employment rate. Such a finding is consistent with the expected view that when the federal funds rate increase, growth in national employment rate decreases. When the upper and lower bands carry the same sign, the response is deemed statistically significant at the 95% confidence level. Thus, the response of the employment variable to a one standard deviation shock in the federal funds rate creates no persistence but a lagged response of one period. Further, the magnitude of the statistically significant mean response is -0.002.

Figure 2 (See Appendix) the reports the response of the log-difference of San Joaquin County employment to a one standard-deviation shock in the federal funds rate from the second VAR model. The response of the regional employment variable comes at a later lag than the national, at the second lag as postulated and the response is more persistent than at the national level as the statistically significant responses continue to exist beyond the fifth period. Further, the magnitude of the mean response in the first statistically significant period is greater than that of the national response.

Figure 3 (See Appendix) reports the impulse responses of national retail trade employment to the federal funds rate from the third set of VAR estimations. The magnitude of the statistically significant response in the second period is less than -0.004 in absolute value. When contrasted with Figure-4, reporting the response of the San Joaquin County retail trade employment to a change in the federal funds rate, the magnitude of the response in Figure-4 is greater than -0.005 in absolute value. Consistent with earlier findings, the region's reaction to rate hikes appears to be more sensitive than at the national level.

SUMMARY AND CONCLUDING REMARKS

The regional vs. national impact of the federal funds rate on the changes in employment has been little examined in the literature and less attention has been paid to determining meaningful regional compositions. An investigation of the extent of the impact reveals different results at the regional than at the national level. An economically disadvantaged region such as San Joaquin County is impacted to a much greater degree from changes in the federal funds rate in terms of magnitude and duration than at the national level. The region's reaction to rate hikes appears to be distinctly more sensitive than at the national level.

One of the first categories of employment to get hit by rate hikes has been retail trade employment relative to other categories such as construction and manufacturing employment (Stanislaus State, 2018). The federal funds rate has a greater impact on retail trade employment at the regional level. Leisure and hospitality services represent another category differentially affected between the national and local level.

Leisure and hospitality services were hit when interest rates last increased. The San Joaquin area is less a destination for hospitality than a marginal or stop-over locale.

It is important for policy makers to take into consideration this unfavorable effect on the regions when considering increasing rates. While at the national level the desired effect may be achieved, this may take place at the expense of individual counties such as the San Joaquin County, which may be driven into recession for many months to come. The effect of conventional aggregate demand management policies thus may be akin to killing a fly with a sledgehammer rather than a more fine-tuned approach. Perhaps, as a more modern approach, monetary policies at the micro level, on a bank by bank basis would be more suited. Such policies could introduce subsidized rates in extending local loans to be used specifically for investments in that particular region to even-out the disproportionate effect of rate hikes.

REFERENCES

Boumans, M., & Sent, E. (2013). A Nobel prize for empirical macroeconomics: Assessing the contributions of Thomas Sargent and Christopher Sims. *Review of Political Economy,* 25(1), 39-56.

Carlino G.A., & deFina, R.H. (1996). Does monetary policy have differential regional effects? *Business Review - Federal Reserve Bank of Philadelphia*, Mar/Apr, 17.

Chaddock, G.R. (2011, October 10). Can governments change the economy? American economists share Nobel. *The Christian Science Monitor*, p. 17.

Cowan, Tadlock, & Coord. (2005, December 12). California's San Joaquin Valley: A Region in transition, *Congressional Research Service Report for Congress*, Order Code RL33184, Library of Congress.

Doan, T., & Litterman, R. (1988). *User's manual RATS:Version 2.0,* Estima IL: VAR Econometrics.

Enders, W. (2008). *Applied econometric time series.* Hoboken, NJ: John Wiley & Sons.

Federal Open Market Committee Statements. (n.d.). Retrieved from https://www.federalreserve.gov/default.htm

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, 12(2-3), 231-254.

Litterman, R. B. (1986). Forecasting with Bayesian vector autoregressions—five years of experience. *Journal of Business & Economic Statistics*, 4(1), 25-38.

Litterman, R., & Supel, T. M. (1983). Using vector autoregressions to measure the uncertainty in Minnesota's revenue forecasts. *Quarterly Review*, 7(2), 10-22.

Miller, J.R., & Genc, I. (2002). A regional analysis of Federal Reserve districts. *The Annals of Regional Science,* 36(1), 123-138.

Pesaran, M. H., & Shin, Y. (1996). Cointegration and speed of convergence to equilibrium. *Journal of Econometrics*, 71(1-2), 117-143.

Pesaran, M. H., & Shin, Y. (1998). Generalized impulse response analysis in linear multivariate models. *Economics Letters*, 58, 17-29.

Potts, T. & Yerger, D. (2010). Variations across Canadian Regions in the sensitivity to U.S. monetary policy. *Atlantic Economic Journal*, 38(4), 443-454.

Stanislaus State (2018). *San Joaquin Valley Business Forecast,* 7(2).

Sims, C. A. (1980). Macroeconomics and reality. *Econometrica: Journal of the Econometric Society*, 48(1), 1-48.

APPENDIX

FIGURE 1
RESPONSE OF THE NATIONAL EMPLOYMENT TO A ONE STANDARD DEVIATION INCREASE IN THE FEDERAL FUNDS RATE

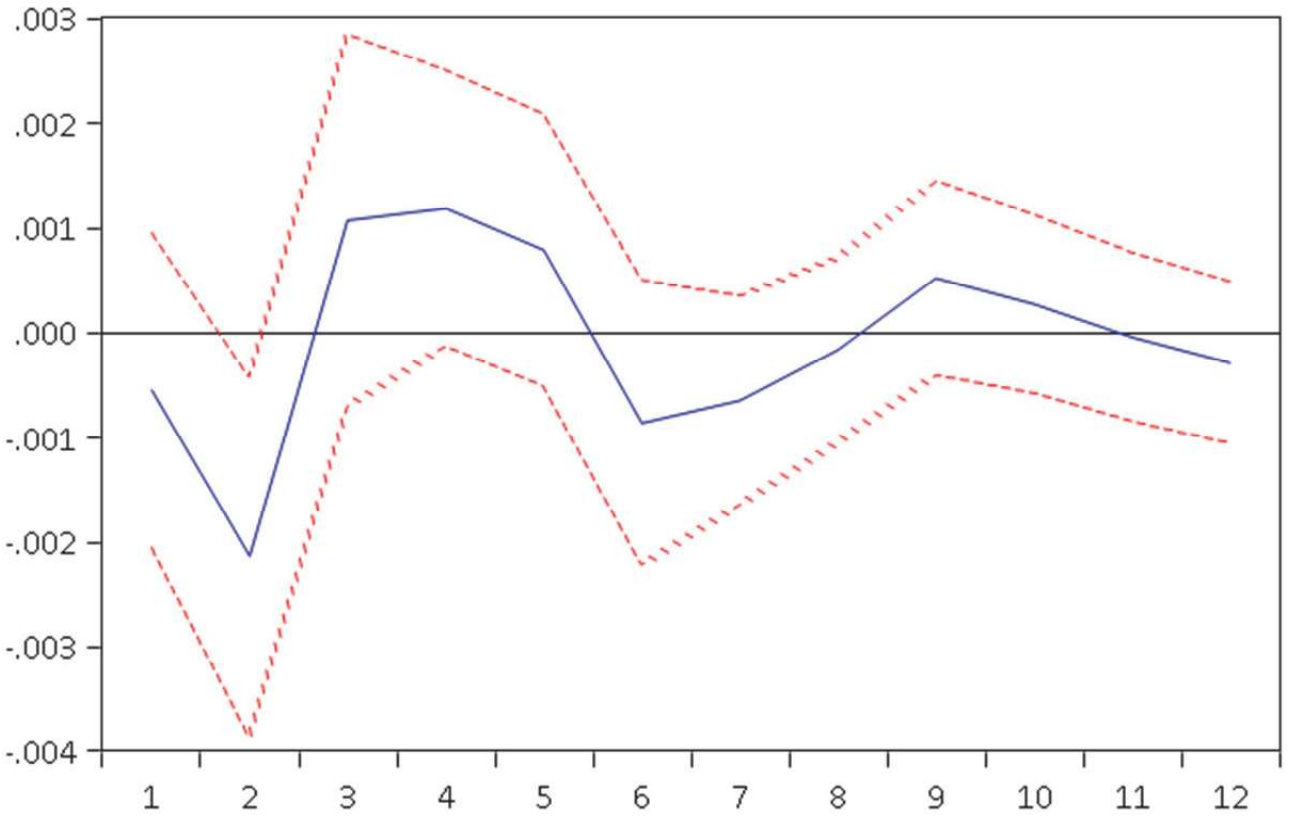

FIGURE 2
RESPONSE OF THE SAN JOAQUIN COUNTY EMPLOYMENT TO A ONE STANDARD DEVIATION INCREASE IN THE FEDERAL FUNDS RATE

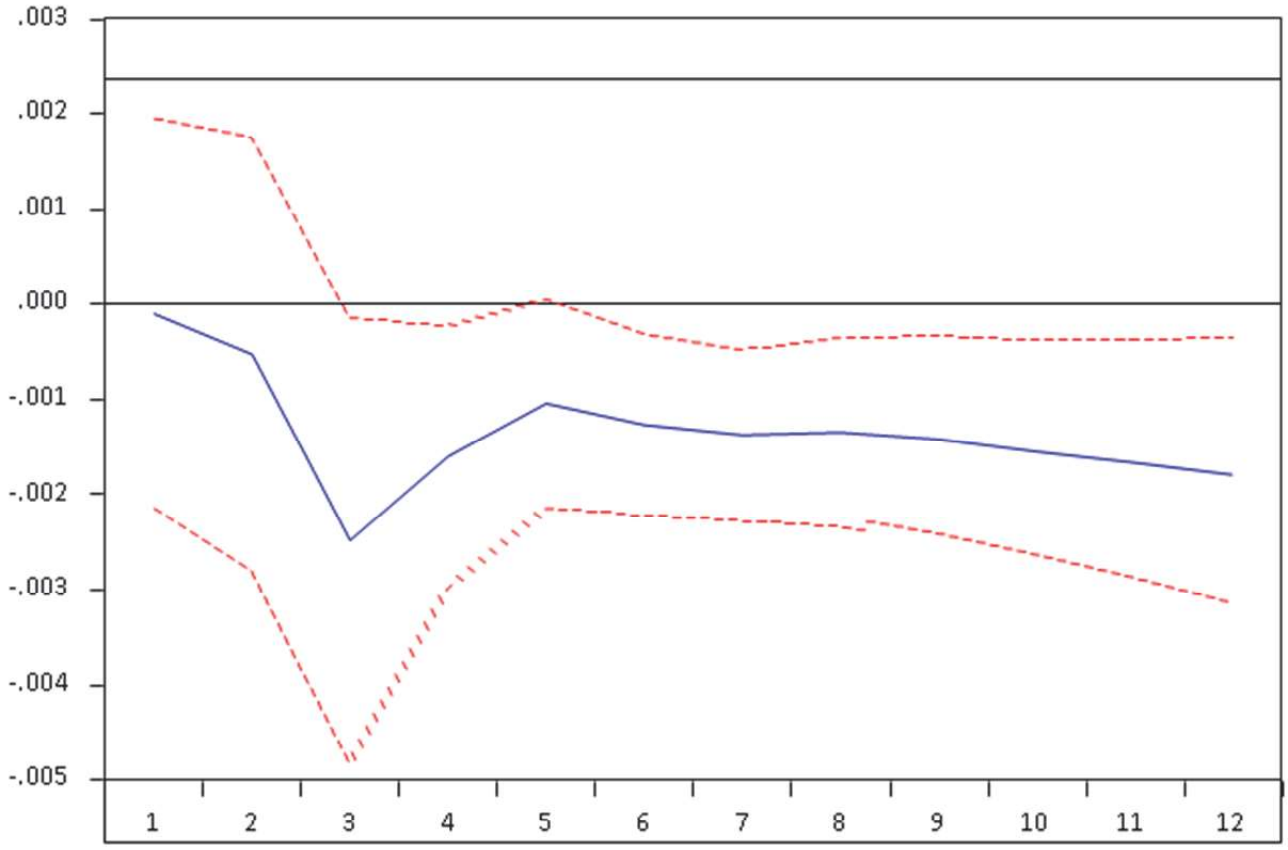

FIGURE 3
RESPONSE OF THE NATIONAL RETAIL EMPLOYMENT TO A ONE STANDARD DEVIATION INCREASE IN THE FEDERAL FUNDS RATE

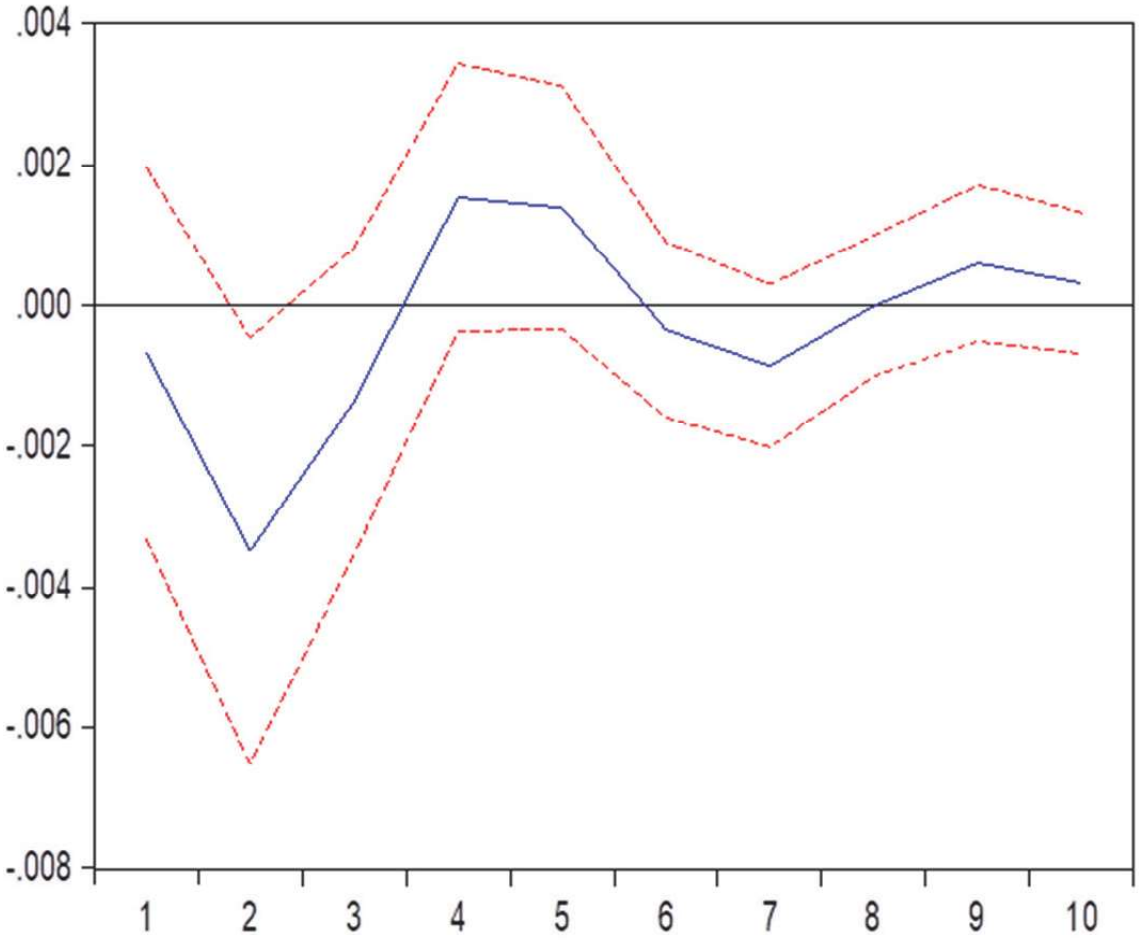

FIGURE 4
RESPONSE OF THE SAN JOAQUIN COUNTY RETAIL TRADE EMPLOYMENT TO A ONE STANDARD DEVIATION INCREASE IN THE FEDERAL FUNDS RATE