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A comparison of employment growth and stability before and after the Fort Worth tornado

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Abstract

This study examined the time series pattern of employment growth and stability in Fort Worth, Texas taking into account the March 28, 2000 tornado. The tornado is treated econometrically as an intervention and both the mean and conditional variance of employment growth were estimated. Overall, this regional labor market experienced a decline in the employment growth rate following the tornado. Among the sectors that exhibited differences in employment dynamics between the pre- and post-tornado periods, the mining sector experienced a significant increase in employment growth following the tornado while the service and wholesale, retail trade sectors experienced significant declines in employment growth in the post-tornado period. The manufacturing, service, and wholesale, retail trade sectors were characterized by greater stability (i.e., a lower level of employment growth volatility) in the post-tornado period than in the pre-tornado period. Interestingly, in several sectors, no differences in the time series dynamics of employment growth were detected between the pre- and post-tornado periods. These sectors included construction, finance, insurance, real estate, government, and transportation and public utilities.

Keywords: Fort Worth; Employment growth; Labor market risk; Tornadoes; Intervention analysis

1. Introduction

On March 28, 2000, a tornado outbreak hit the Texas cities of Fort Worth and Arlington. The tornado was rated as an F2 on the Fujita scale according to the National Weather Service. The trail of damage from the tornado started just north of White Settlement Road, near the West Fork of the Trinity River. The greatest damage from the Fort Worth tornado was to the Cash America International Building just west of downtown. In addition, the city of Arlington was hit by an F3 tornado. This tornado touched down south of I-20 near Cooper Street and continued toward the north side of the Arlington airport. The Fort Worth–Arlington tornadoes destroyed an estimated $500 million worth of property including homes and businesses. As a result, some businesses closed for weeks while others closed permanently.[1] Fig. 1 maps the tornado's path through both downtown Fort Worth and Arlington.

Physical damage from tornadoes can total millions of dollars. Additionally, the economic impact of natural hazards may be compounded by disruptions to commerce and business activity (Rose and Lim, 2002). In fact, when discussing the number of businesses that do not recover after a disaster, Armstrong (2000, p. 55) stated that this "should motivate business owners to investigate their risk and to invest in continuity planning

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[1]In addition to physical damage, the tornado killed five people and injured another 100 (USA Today, 2000).

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Fig. 1. Approximate damage paths for the March 28, 2000 tornado. *Source*: National Weather Service.

in conjunction with their community. Continuity planning is an integral part of economic survival". Consequently, studies of economic activity in the presence of tornadoes are of interest to policymakers concerned with regional economic development, growth, and sustainability (West and Lenze, 1994). It is commonly believed that a tornado will have an immediate (i.e., short run) impact on the local economy due to the extensive physical damage to commercial and residential property. However, communities and particular industries may respond to the destruction of physical capital and technology from tornadoes by reconstructing better facilities, installing improved infrastructure, and initiating mitigation devices. Through these enhancements, and the corresponding reorganization of activities, the local economy may show signs of economic improvement following the tornado. In fact, Guimaraes et al. (1993) concluded for the case of a hurricane that while the devastation often disrupts a city's or region's short-term economic activity, the disaster may actually be associated with some long-term economic benefit.[2] This may also be the case for a local economy after a tornado. Thus, it is of practical importance to understand how the local economy reacts to natural disasters. Knowledge of how various industries or sectors respond to tornado-induced destruction and business disruption can contribute to our understanding of regional economic development.

The aim of this research is to characterize the time series dynamics of greater Fort Worth's employment growth taking into account the 2000 tornado. Fort Worth and Arlington are both cities located in the north-central part of Texas approximately 20 miles from the Dallas/Fort Worth International Airport. These cities are popular destinations for vacationers with numerous museums and parks including the Stockyards, Botanical Gardens, Fort Worth City Zoo, and Six Flags over Texas. This area is also home to the Texas Rangers major league baseball team, as well as several other minor league professional sports franchises. In addition, both cities are home to several colleges and universities. The choice of an urban area to study employment growth dynamics in the presence of a tornado is particularly informative for a number of reasons. First, the urban area has a diverse set of industries that, due to their specific characteristics, are likely to exhibit different dynamics and to respond to the tornado in different ways. Second, there is a sufficiently large population base and labor force in which to examine the dynamics of labor market change. In the analysis, we focus on Fort Worth's total employment growth rate, controlling for state and national business cycles and trends. Additionally, we examine the growth rates for eight major industries' within the Fort Worth labor market. Of course, employment growth that corresponds directly to output growth is just one measure of economic performance. Economic stability is another common measure of performance. Thus, we also examine the conditional variance of employment growth before and after the tornado. This is a particularly interesting endeavor as the volatility of employment growth may be an important indicator of labor market stability.[3]

2. Employment growth and stability

The amount of output that an economy can potentially produce can be expressed in terms of employment, capital, and technology (Romer, 1996). Thus, for a given capital stock and for a given level of technology, potential output will increase with increases in employment. For this reason, employment growth is often used as an indicator of economic performance. In fact, a large body of economic research has emerged focusing on the importance of changes in employment in determining the direction of the business cycle (e.g., Caballero et al., 1997; Clark, 1998). However, like the national economy, a regional economy's growth is constrained by factors such as their existing capital stock, technology, and infrastructure.

An alternative way to describe the economic condition of a labor market is to characterize the volatility of that labor market's employment growth rate. A labor market that exhibits low volatility implies a more stable economic environment. One way the volatility of the labor market can be measured is by the variance of employment growth. The variance can be thought of as a measure of the risk inherent in successful labor market matches. Therefore, a lower variance in employment growth, all else equal, is preferred to an employment growth rate with higher variance. For example, with high variance it may be more difficult for firms to engage in accurate long-term planning and decision-making regarding their labor force. Firms are able to place greater confidence in activities such as employment projections of needs and staffing when there is a low variance in employment growth as opposed to a high variance. A riskier or more volatile labor market may make firms reluctant to locate in the area or to remain in the area because decisions relating to labor force needs are more difficult and more costly. Additionally, a less stable environment may make potential or existing employees reluctant to migrate to the area and cause these labor market participants to be less likely to remain in the area.

3. Employment data

In order to model the employment dynamics of the Fort Worth area labor market, we used monthly employment data from January 1980 to December

[2] In addition, Hewings and Mahidhara (1996) found evidence that the inflow of federal disaster relief dollars all but mitigated the effect of the Great Flood of 1993.

[3] See Ewing and Kruse (2002) for a discussion of how volatility may be used to gauge the state of the labor market.

Table 1
Descriptive statistics of Fort Worth employment growth by industry

	Mean	Standard Dev.
Total employment	2.985	2.281
CON	3.623	9.737
FIR	3.307	3.856
GOV	2.980	1.864
MFR	0.066	4.574
MIN	1.266	9.888
SRV	5.377	2.933
TPU	4.114	4.657
WRT	2.829	2.199

Note: Growth rates are for January 1980 to December 2002 for a total of 264 usable observations. Data are from the US Bureau of Labor Statistics' *Employment and Earnings*.

2002 for eight sector-specific industries for the Fort Worth–Arlington Metropolitan Statistical Area (MSA) as well as total employment for the MSA.[4] All data were obtained from the Bureau of Labor Statistics' *Employment and Earnings*. In addition, the respective state employment figures were also obtained. We seasonally adjusted the data and calculated the employment growth rates for Fort Worth and the different industries, as well as for the state-level data.[5] The eight specific industries used were: construction (CON); finance, insurance, and real estate (FIR); government (GOV); manufacturing (MFR); mining (MIN); services (SRV); transportation and public utilities (TPU); and wholesale, retail trade (WRT).

Descriptive statistics for the Fort Worth employment growth variables are shown in Table 1.[6] Interestingly, the total employment as well as the employment for all eight industries exhibited positive (mean) growth throughout the study period. The MFR industry had the lowest mean employment growth rate (0.07) and the SRV industry had the highest mean employment growth rate (5.38). Both the SRV and WRT sectors experienced their lowest employment growth rate in the post-tornado period. In addition, as measured by the standard deviation of employment growth, the MIN industry was the most volatile sector, while the GOV sector was the least volatile. The descriptive statistics illustrate that these industries differ from one another and, thus, we should not necessarily expect each sectors' employment growth rate to behave identically after a natural disaster.

Fig. 2 provides plots for each of the employment growth rates over the entire sample period. The shaded area in the figures depicts the post-tornado period. An examination of Fig. 2 reveals the relatively high variability in the MIN industry, as well as differences in variability among the different industries. To further analyze employment growth and stability after the tornado, we proceed with a more formal examination using modern statistical time series techniques. Our approach models both the conditional mean and variance of employment growth.[7]

4. Empirical methodology

The purpose of this research is to examine the employment dynamics of the Fort Worth labor market before and after the March 28, 2000 tornado. In order to accomplish this task, we estimate a time series econometric model commonly referred to as an intervention analysis.[8] The estimation procedure begins with the construction of the autoregressive moving average (ARMA) models of total employment growth for Fort Worth and the employment growth rates of the eight sector-specific industries. ARMA models allow for momentum in the employment growth rates through the autoregressive (AR) term. This is particularly important for our work as it is often found that immediate past values of economic time series variables are useful predictors of current and future values (Enders, 2004). In this sense, the models will account for periods of time in which employment growth is driven by past growth. For example, when demand is increasing, firms may expect future demand to remain strong, and thereby increase the size of their labor force.

The ARMA specification also takes into account the difference between past periods' expectations of employment growth and the actual or realized employment growth rate. The inclusion of a moving average (MA) term should capture much of the labor market response to past surprises in employment growth.

[4]The use of MSA-level employment data captures both the direct and indirect regional multiplier effects of the tornado on Fort Worth and surrounding areas. In what follows, we refer to the Fort Worth–Arlington MSA as Fort Worth.

[5]The ratio-to-moving-average (multiplicative) method is used to seasonally adjust the data series (Harvey, 1994). Growth rates were calculated as $[(e_t - e_{t-12})/e_{t-12}] \times 100$, where e represents employment. In addition to being easy to interpret, the use of the year-over-year calculation eliminates any remaining effects of seasonality.

[6]Appendix A provides a table of descriptive statistics on employment growth variables at the state level.

[7]The time series approach we are taking is extremely timely in light of the news that Robert Engle was awarded the 2003 Nobel Prize in economics for his work on modeling the time-varying nature of many economic time series and the development of the autoregressive conditional heteroscedasticity (ARCH) model. In Section 4, we describe Engle's ARCH model in some detail.

[8]Enders (2004) described the econometric theory underlying the intervention analysis. Basically, the intervention analysis may be used to estimate the immediate and long-term effects associated with an event of some kind. This approach has been used in economics research to examine the effects of policy, natural hazards, terrorism, etc.

It is also expected that Fort Worth's labor market would be affected by Texas' and United States' business cycles. In order to capture this effect on regional employment, we augment each of the ARMA models with the Texas employment growth rate corresponding to the eight industries and overall employment.[9]

A standard assumption in the conventional (linear) ARMA model is that the variance of the error process is constant. More formally, the assumption is that the unconditional variance and the conditional variance exist are greater than zero, and the current volatility is independent of past volatilities. The Lagrange multiplier test described in Engle (1982, p. 1000) can test for the presence of ARCH. The existence of these ARCH effects violates the assumption of constant variance and therefore estimation by classical ordinary least-squares is inappropriate. Specifically, if the employment growth series exhibits a non-constant variance (at least in the short run), then this means that estimates obtained from classical linear regression will be inefficient. However, Engle (1982) has shown that in the presence of ARCH effects, simultaneously modeling both the mean and the variance of the process under investigation improves the efficiency of the parameter estimates. Engle (1982) modeled the variance of the series as a function of past volatility, as well as (possibly) other exogenous variables. The ARCH model allows for non-linearity in the second moment in that the variance changes over time in a predictable way. Thus, a properly specified model of the (mean) employment growth rate should be tested for the presence of a time-varying variance, and if found, the ARCH model should be estimated.

The ARMA model includes an intervention variable designed to capture the time series behavior of employment growth both before and after the March 28, 2000 tornado. The intervention variable equaled one from April 2000 to December 2002 and zero otherwise:

$$\pi_t = \begin{cases} 1, & \text{April 2000} - \text{December 2002}, \\ 0, & \text{otherwise.} \end{cases} \tag{1}$$

Eq. (2) is the employment growth ARMA model augmented with the respective state employment growth rate and the tornado intervention variable:

$$\phi(L)\mu_t = \theta(L)\varepsilon_t + c_0 + \psi s_t + \lambda\pi_t + \tau T, \tag{2}$$

where ψ is the coefficient on the respective state employment growth rate variable (s), λ is the coefficient on the intervention variable (π), and τ is the coefficient on the trend variable (T).[10] $\phi(L)$ and $\theta(L)$ are polynomials in the lag operator. Eq. (2) is referred to as the mean equation and may be used to model the employment growth rate in the presence of the tornado.

We use standard Box–Jenkins time series techniques to identify the best-fitting specification of Eq. (2).[11] The AR model of order one, AR(1), was selected in each case[12] and augmented with the (contemporaneous) state employment growth rate and intervention variable.[13]

The conventional ARMA time series model assumes that the error process to have zero mean and constant variance, i.e., $\varepsilon_t \sim N(0, \sigma)$. In this case, ordinary least-squares estimation is appropriate. However, for the case in which the error process has a time-varying variance, i.e., $\varepsilon_t \sim N(0, h_t^2)$, alternative estimation methods are needed. We test each of the chosen specifications for Eq. (2) for ARCH effects using the test described by Engle (1982). If no ARCH effects were detected, Eq. (2) is treated as a conventional ARMA(1, 0) model and estimated accordingly using ordinary least-squares. When an employment growth rate series is determined to have time-varying volatility, Eq. (2) is estimated simultaneously with the (conditional) variance given in Eq. (3) using the method of maximum likelihood:

$$h_t^2 = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \gamma\pi_t, \tag{3}$$

where γ is the coefficient on the intervention variable (π), in the (conditional) variance equation. $V(\varepsilon_t|\Omega_{t-1}) = h_t^2$ is the conditional variance of ε_t with respect to the information set Ω_{t-1}.[14] Note that since the tornado may have had an effect on the stability of the labor market, we included the (exogenously determined)

[9]While the Fort Worth economy may be influenced by national business cycles, Payne et al. (1999) found that state and national labor markets are highly correlated in the long run. Thus, to avoid the multicollinearity problem, we include Texas growth rates in our analyses but do not include the corresponding US growth rates. Additionally, this specification is consistent with most regional economic models which assume the linkage is from national or state economic performance to MSA or regional performance and little or no "feedback" from regional or MSA to national indicators. Appendix B provides a plot of total employment growth rates for Fort Worth and Texas. Since there are several periods of time in which Fort Worth's employment growth rate does not mirror the movements of the Texas employment growth rate, it is unlikely that movements in Fort Worth's employment may be predicted solely on movements in the state employment growth rate. Similar conclusions are made at the industry level. These plots are available on request.

[10]Including a trend variable accounts for possible changes in potential output of the economy which are often attributed to such factors as productivity gains and changes in technology (Gordon, 2002).

[11]Mills (1999) provided a description of how to use the Box–Jenkins technique for choosing model specification based on goodness-of-fit.

[12]The only exception is in the WRT industry. This industry required an AR(2) term (i.e., estimated coefficient = 0.06, probability value <0.01).

[13]Note that the AR(1) model can be described as ARMA(1, 0). The absence of significant MA terms implies that immediate past surprises are not very important in determining an expectation of current employment growth. However, the immediate past value (i.e., momentum) of the employment growth rate appears to be an important factor and this is captured in the AR(1) nature of the model.

[14]Quasi-maximum likelihood covariances and standard errors are computed as in Bollerslev and Wooldridge (1992). It is assumed that the errors are conditionally normally distributed.

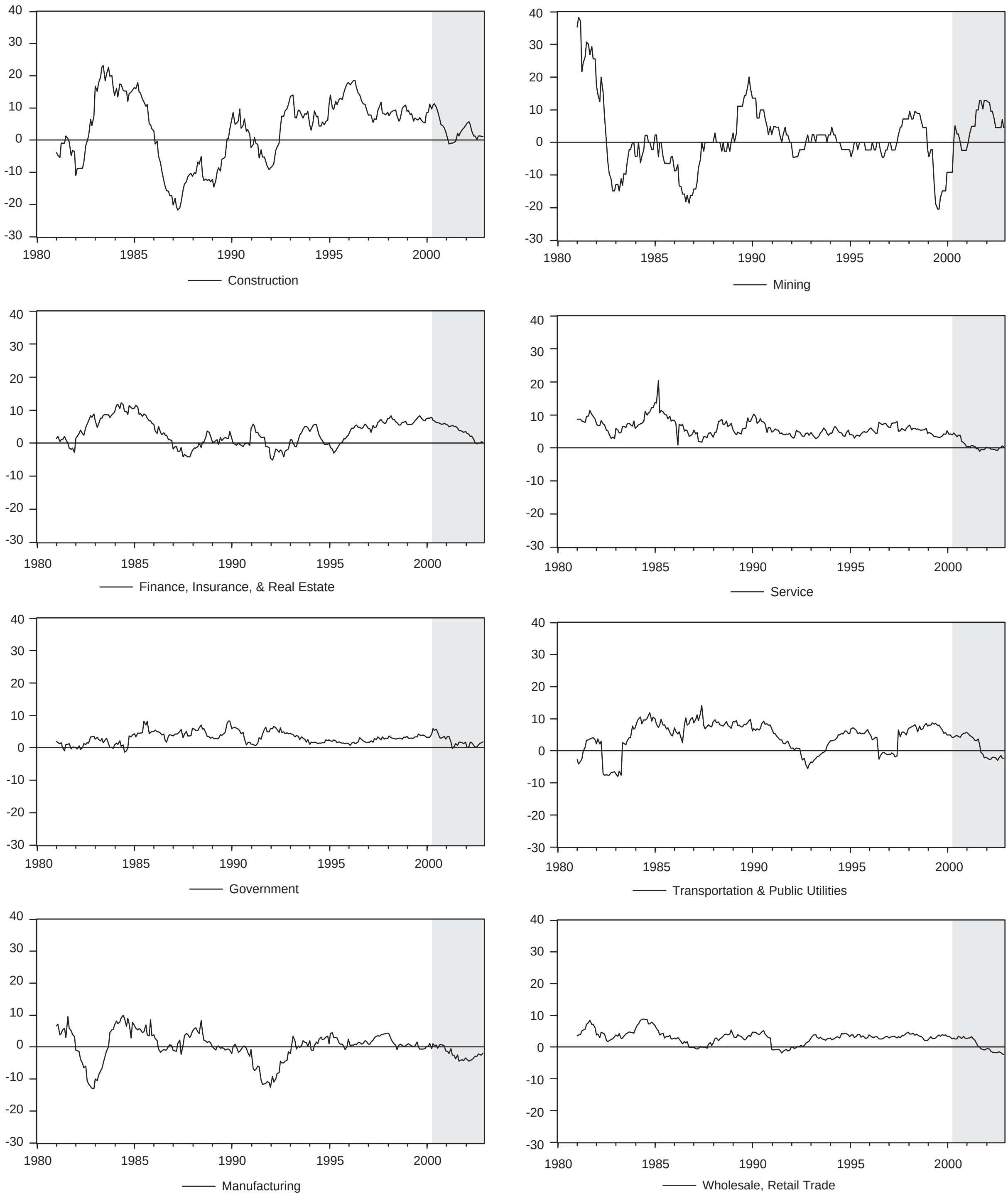

Fig. 2. Fort Worth employment growth by industry. *Note*: The shaded area represents the post-tornado period.

intervention variable in the variance equation. Eq. (3) contains an MA component known as the ARCH term.[15] The specification of the variance equation is determined based on goodness-of-fit and in each case that ARCH effects were detected, the ARCH(1) specification was deemed appropriate.

The (mean) employment growth model given by Eq. (2) exhibited evidence of ARCH for certain industries in Fort Worth. Thus, we concluded that estimation of the ARCH-class model was appropriate for MFR, MIN, SRV, and WRT industries. Section 5 discusses our empirical findings.

[15]While Eq. (3) may contain up to q ARCH terms, we found $q = 1$ to be sufficient to capture the dynamics of the conditional variance.

5. Empirical results and discussion

The empirical results are presented in Table 2. The first point worth noting is that the coefficient on the AR term in Eq. (2) is positive and significant in all industries as well as for total employment. This finding has several implications. Our evidence suggests there is significant momentum in employment growth rates. When employment growth was positive (negative) in the previous month, there was a tendency for growth to be positive (negative) in the current month, also. This momentum effect ranges from a low of 0.04 (WRT) to a high of 0.95 (TOT). However, the industry with the second lowest momentum effect is MIN (i.e., 0.78). Generally, this indicates that a one percent change in employment growth last period contributes from three-fourths to nearly one percentage point change in current growth.

Controlling for the Texas business cycle and the tornado, unanticipated changes in employment growth (i.e., shocks) are only temporary (or transitory), because the employment growth rate will return to its unconditional mean. When looking at individual industries, a shock appears to be most persistent in the CON sector (i.e., AR coefficient equals 0.94) and will therefore take the longest amount of time to return to its long run equilibrium employment growth rate. The results also indicate that the Texas business cycle, as measured by the respective industry or total state (contemporaneous) employment growth rate, is not a major factor in determining labor market activity in Fort Worth. Further, we find that only SRV and WRT employment growth equations have a statistically significant trend suggesting that these two industries are most likely to have experienced changes in their potential output over time.

Table 2 also indicates that the Fort Worth labor market as a whole changed following the March 2000 tornado. For instance, the coefficient on the tornado intervention variable in the total employment growth rate equation was negative and significant (note the estimated coefficient = −0.21 with associated probability value = 0.10). This finding indicates a change in the employment growth rate for Fort Worth in the post-tornado period. In this sense, it appears that, controlling for state business cycles and other factors, the tornado was associated with lower employment growth in the local economy.

In order to further our understanding of the employment dynamics surrounding the Fort Worth tornado, we examined how each of the eight industries that comprise the total labor market responded to the tornado. Generally, the results of the employment growth tornado intervention models varied by industry. Some of the industries experienced significant positive labor market outcomes after the tornado while others experienced negative or adverse labor market outcomes. Moreover, employment growth dynamics in some industries were virtually unaffected by the tornado.

The CON, FIR, GOV, and TPU industries appeared to have been largely unaffected by the tornado. That is, the coefficient on the tornado intervention variable in each of these industries' mean employment growth rate equation was statistically insignificant. This is not entirely surprising considering that these sectors (or the components of these sectors) were not hit by the tornado. Initial clean-up efforts notwithstanding, construction has been restricted in the post-tornado period as a result of the complex evaluation process the Fort Worth economic development team used in deciding how to rebuild the downtown area. In addition, the FIR

Table 2
Results of the employment growth models

	TOT	CON	FIR	GOV	MFR	MIN	SRV	TPU	WRT
Mean equation									
Constant	0.102	0.390	−0.099	0.266	−0.039	0.030	1.283[a]	0.396[c]	−14.460[a]
AR(1)	0.954[a]	0.939[a]	0.868[a]	0.876[a]	0.894[a]	0.782[a]	0.642[a]	0.928[a]	0.040[a]
State EG	0.020	0.094[b]	0.163[a]	0.041	0.070[b]	0.155[a]	0.212[a]	0.034	0.006[a]
Tornado	−0.208[c]	−0.083	−0.065	−0.160	−0.064	1.135[b]	−0.711[a]	0.254	−4.671[a]
Trend	−0.000	−0.002	0.001	0.000	0.000	−0.000	−0.002[b]	−0.001	−0.055[a]
Variance equation									
Constant	—	—	—	—	1.823[a]	4.727[a]	1.020[a]	—	0.306[a]
ARCH	—	—	—	—	0.379[a]	0.471[a]	0.371[a]	—	0.990[a]
Tornado	—	—	—	—	−1.411[a]	−2.081	−0.805[a]	—	−0.233[a]
Log likelihood	−204.1	−574.1	−376.1	−330.5	−469.4	−625.1	−386.8	−485.4	−428.9
F-statistic	1148.4[a]	1259.2[a]	872.4[a]	245.4[a]	279.9[a]	412.9[a]	175.8[a]	526.6[a]	8.733[a]

Note: Growth rates are for January 1980 to December 2002. Data are from the US Bureau of Labor Statistics' *Employment and Earnings*. AR(1) denotes the first-order autoregressive term; ARCH denotes the ARCH term in Eq. (3).

[a]Denotes p-value < 0.01.

[b]Denotes p-value < 0.05.

[c]Denotes p-value < 0.10.

industry is comprised of depository institutions, insurance carriers, and other investment offices that are skilled in pooling and managing risk, including downside risk. It is likely, of course, that insurance carriers settled claims and banks suffered losses as some businesses and homeowners may have defaulted on loans or become delinquent on payment. However, the devastation and rebuilding likely benefited these companies also, as new structures and equipment require financing and insurance. Furthermore, many new and rebuilt structures would presumably be of better quality than their predecessors resulting in higher property values. Consequently, though a strict interpretation of the results indicates the FIR industry was relatively isolated from the effects of the tornado, it may be the case that negative and positive outcomes simply offset each other. Both the GOV and TPU labor markets may have been completely unaffected by the Fort Worth tornado since the location and amount of damage from the tornado was minimal for these sectors.

Like the CON, FIR, and GOV sectors, the coefficient on the tornado intervention variable in the mean growth rate equation for the MFR industry was negative but insignificant (estimated coefficient = −0.06, probability value = 0.85). While the MFR industry mean employment growth rate may have been unaffected by the tornado, our results indicate there was a significant change in the stability of this sector as measured by labor market volatility. The variance of the employment growth rate for the MFR sector fell in the post-tornado period (estimated coefficient = −1.41, probability value = 0.00). In fact, of all the sectors examined, the model indicates that the largest drop in volatility in the post-tornado period occurred in the MFR sector. This result indicates the MFR sector's labor market became more stable following the tornado. One explanation for this improvement in stability is that this industry provides a variety of products including food, furnishings, plastics, equipment, and many other goods necessary in the rebuilding process.

Employment in the MIN industry was characterized by a significantly higher employment growth rate (estimated coefficient = 1.14, probability value = 0.03) in the post-tornado period. This finding is consistent with the idea that, to at least some extent, the mining of basic metals and fuels to run machinery and equipment is a necessary component in the rebuilding process, and this outcome is likely linked to increased demand for such resources.

The mean equations for employment growth in the SRV and WRT industries had negative and significant coefficients on the tornado intervention variable (estimated coefficients = −0.71 and −4.7, respectively, and probability values = 0.00 and 0.00, respectively). While these industries provide many of the goods and services following a tornado that are necessary for recovery, they tend to be highly volatile industries which may explain the higher (mean) employment growth rate in the pre-tornado period. The SRV industry provides hotel and lodging services, repairs, entertainment, health and legal services, and the WRT industry provides such products as durable goods, basic building materials, food, apparel, and home furnishings.

The coefficient on the tornado intervention variable in the variance equations of both SRV and WRT industries was negative and significant (estimated coefficients = −0.85 and −0.23, probability values = 0.00 and 0.03, respectively).[16] This change in volatility made these labor markets more stable. Perhaps the improvement in stability may be due to changes in infrastructure in which case this may help to explain the subsequent decrease in the mean employment growth rate for both these industries (i.e., the "financially stronger" firms survived the tornado whereas the "weaker" firms exited the market).

6. Concluding remarks

Employment growth patterns of the Fort Worth labor market were examined from January 1980 to December 2002, a period that included the March 28, 2000 tornado. The analysis utilized an intervention time series econometric technique that allowed for the possibility of ARCH effects to capture the dynamics of employment growth. Generally, the major industrial sectors of the Fort Worth economy exhibited a variety of outcomes over this sample period in terms of mean growth rates and stability. First, we found no evidence to suggest that the time series behavior of employment growth rates in the CON, FIR, GOV, and TPU sectors was affected by the tornado. Second, while MFR, SRV, and WRT exhibited a decline in employment growth following the tornado, the inherent risk in these same industries was also lower. Thus, labor market stability improved in these three sectors. Finally, no single industry's labor market experienced an increase in volatility following the tornado.

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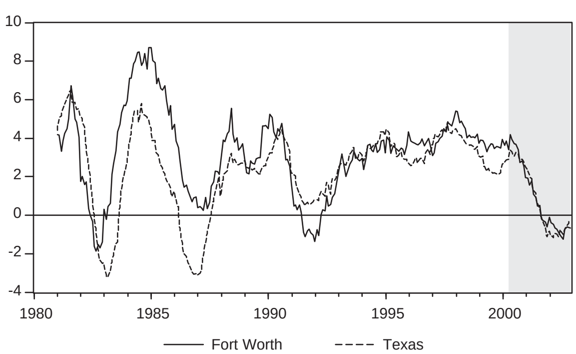
[16] In fact, the WRT sector had the largest coefficient on the ARCH term indicating that shocks to the variance of employment growth are the most persistent in this sector.

Appendix A. Descriptive statistics of Texas state employment growth by industry

	Mean	Standard Dev.
Total employment	2.219	2.161
CON	1.442	5.763
FIR	2.151	2.940
GOV	2.327	1.068
MFR	−0.142	3.983
MIN	−1.422	9.578
SRV	4.648	2.193
TPU	2.115	3.128
WRT	2.074	2.173

Note: Growth rates are for January 1980 to December 2002 for a total of 264 usable observations. Data are from the US Bureau of Labor Statistics' *Employment and Earnings*.

Appendix B. Total employment growth for Fort Worth and Texas



Note: The shaded area represents the post-tornado period.

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