EXAMINING THE RELATIONSHIP BETWEEN EMPLOYMENT AND ECONOMIC GROWTH IN THE TEN LARGEST STATES

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ABSTRACT

In this paper, we examine the relationship between economic growth, as measured by both real GDP and the output gap, and employment in the ten largest states from 1990 to 2003. Models are developed to estimate the employment intensity of economic growth as well as the timing of the relationship between employment and economic growth. Employment intensity is estimated to range from 0.31 to 0.61 in specific states with an estimate of 0.47 for the US as a whole. Also, results indicate that though economic growth has some immediate impact on employment, its effects continue for several quarters in most of the states considered.

INTRODUCTION

During the early stages of the most recent economic recovery, there has been much discussion regarding the relationship between economic growth and employment. Though the unemployment rate is considered by many to be a lagging indicator, there is some disagreement as to whether employment itself is a coincident or lagging economic indicator. For example, in the early 1990s, the unemployment rate increased for about a year following the end of the previous recession. Coming out of a recession, companies are thought to be reluctant to hire many more workers until they are convinced about the sustainability of a new economic recovery while people who had left the labor force during the recession return to seek to find jobs. According to the National Bureau of Economic Research, the US economy began its current economic recovery in December 2001. However, rather than experiencing employment growth, not only did the unemployment rate increase but the number of new jobs created in the economy actually declined significantly during the first year of the recovery. A variety of explanations are possible. Perhaps the recovery was uneven and the growing sectors of the economy increased labor utilization rather than increase the number of jobs. Another possibility is that companies employed new technologies, resulting in increased productivity instead of job creation.

In this paper, we examine the relationship between economic growth, as measured by both real GDP and the output gap, and employment in the ten largest states. A review of the existing literature on the topic is undertaken to provide both the underpinnings of the relationship as well as the context for the current research. Both the employment intensity of economic growth and the persistence of employment growth are estimated. Next, the timing of the relationship is assessed –

in other words, is there a lag between economic growth and employment growth and, if so, how long is the lag?

The period of this study begins at the start of the last recession in 1990 and ends in the second quarter of 2003. The statistical properties of each variable (employment and GDP growth) are examined. Next, empirical models are developed to estimate the employment intensity of economic growth as well as the timing of the relationship between employment and economic growth. Both models are estimated employing SUR[1] (for the state-specific models) and fixed-effects techniques (for the pooled regression). Employment intensity (the elasticity of employment with respect to real GDP) is estimated to range from 0.31 to 0.61 in specific states while the results from the pooled regression yielded an estimate of 0.47. Also, results indicate that though economic growth has some immediate impact on employment, there is a lag with the effects taking several quarters to be fully felt in most of the states considered.

REVIEW OF THE LITERATURE

Several authors have estimated employment elasticities (a measure of the relationship between employment and economic growth) for a variety of nations. Boltho and Glyn (1995) found elasticities of employment with respect to output growth in the order of 0.5 to 0.6 for a set of OECD countries. An International Labour Organization Report (1996) concluded that the responsiveness of employment growth to GDP growth has not declined in industrialized countries as a whole. However, a country-by-country analysis revealed mixed results with little relationship found in Germany, Italy and the UK in the 1990s, thus implying a jobless recovery. Padalino and Vivarelli (1997) found significant differences in employment elasticities between different countries, with an elasticity of approximately 0.5 for the United States and Canada while elasticities for Japan, France, Germany, Italy and the UK were close to zero. Pini (1997) estimated that the employment elasticities in Germany and Japan rose between the period 1979-95 compared to 1960-79 while it declined in France and Sweden and showed little change in Italy, UK and US. He also detected negative employment elasticities in Italy and Sweden for the period 1990-95. Pianta, Evangelista and Perani (1996) discovered evidence suggesting that restructuring of major economic sectors reduce the relationship between economic growth and employment. Among the G7 countries studied (Canada was excluded), a positive and significant relationship between growth in value added and employment was found only in Germany and the US. Walterskirchen (1999) found employment elasticities for the EU of 0.65 when employing a cross-country analysis of EU countries from 1988-98. Using data from 1970-98 for 7 countries plus the EU as a whole, employment elasticities ranged from 0.24 for Austria to 0.76 for Spain (the elasticitity for the US was 0.53).

Though some work has been conducted applying this technique to multinational studies, it has yet to be utilized in the examination of state-level data. Results of such an analysis should provide insight into the differences in the behavior of state labor markets as well as increased understanding as to why employment in diverse states may respond differently to changes in economic growth.

DESCRIPTIVE STATISTICS

Seasonally-adjusted, quarterly state employment data were obtained from the Bureau of Labor Statistics while data on quarterly real GDP were obtained from the Bureau of Economic Analysis. As can be seen in table 1, the nation and respective states exhibited different patterns of employment growth during the study period. The US had a mean quarterly employment growth rate of 0.33% with a median somewhat higher at 0.46%. States with average employment growth rates exceeding the nation include Florida, Georgia and Texas while the other states experienced sub par employment growth (NY's employment growth rate averaged close to zero). Most of the states had higher standard deviations of employment growth than that of the nation with the exception of Pennsylvania. This was likely due to the national economy being more diversified than that of the respective states. Georgia and Michigan had the highest standard deviations, in excess of 0.6% per quarter. Both the mean and median economic growth rates were 0.68% while the change in the output gap (percent difference between real GDP and potential real GDP) averaged out to be small and negative.

TABLE 1
DESCRIPTIVE STATISTICS

	Mean	Median	Standard Deviation
Economic growth	0.68	0.68	0.57
Change in output gap	-0.06	-0.10	0.51
Employment Growth:			
California	0.28	0.37	0.53
Florida	0.57	0.66	0.51
Georgia	0.51	0.68	0.62
Illinois	0.19	0.32	0.46
Michigan	0.22	0.38	0.65
New Jersey	0.16	0.25	0.56
New York	0.03	0.10	0.54
Ohio	0.20	0.32	0.49
Pennsylvania	0.16	0.18	0.37
Texas	0.56	0.65	0.44
USA	0.33	0.46	0.40

EMPLOYMENT INTENSITY AND PERSISTENCE

Methodology and Empirical Results

Similar to Boltho and Glynn (1995) and Padaline and Vivarelli (1997), the employment intensity of economic growth is estimated using the following model:

$$empgrowth = B_0 + B_1 \text{ economic growth} + \varepsilon \qquad (1)$$

where empgrowth is the quarterly percent change in employment for the respective state; economic growth is the quarterly growth rate of real GDP and B_1 is the estimated elasticity. The estimated elasticity provides a measure of the employment intensity of economic growth; i.e., the growth in employment resulting from growth

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in output. A high employment intensity indicates that growth in output leads to considerable job creation while low estimates of employment intensity suggest little correlation between economic growth and employment (a jobless recovery).

Some have suggested that higher productivity growth may limit the relationship between economic growth and employment. Thus, when productivity growth rises, economic growth must be higher in order to generate jobs. When GDP grows quicker than its potential, economic growth is high enough to generate jobs. Therefore, a similar model was used to estimate the elasticity of employment with respect to the output gap:

$$\text{empgrowth} = B_0 + B_1 \text{ growth in output gap} + \varepsilon \tag{2}$$

where growth in output gap is the change in the percent difference between real GDP and its potential, as estimated by a Hodrick-Prescott filter[2].

Empirical Results

All of the models specified were estimated using a fixed-effects estimation technique for the pooled regression and the SUR technique for state-specific models. Each was also tested for standard econometric properties. Results of the pooled regression are shown in table 2:

TABLE 2
EMPIRICAL RESULTS OF POOLED
MODELS: ELASTICITY

	Economic Growth	Change in Output Gap
Pooled model w/ economic growth	***0.47	---
Pooled model w/ output gap	---	***0.39

where *** indicates significance at the 1% level

In the model estimating the elasticity of employment with respect to economic growth (percent change in real GDP), the elasticity was found to be 0.47, significant at the 1% level. When considering the relationship to the output gap, the elasticity declined slightly to 0.39 (still significant at the 1% level).

Next, the state-specific models were estimated using a SUR technique to distinguish the employment elasticities of the respective states. The results are presented in the tables 3 and 4. As seen in table 3, employment growth was positively and significantly related to the growth rate of real GDP in every state. Elasticities ranged from a low of 0.31 in Texas to a high of 0.61 in Michigan and New Jersey. When the growth of the output gap was used instead (see table 4), significant and positive relationships were found in nine of the ten states (all but California, perhaps in part due to its government fiscal crisis) with employment elasticities ranging from 0.20 to 0.56.

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TABLE 3
EMPIRICAL RESULTS OF STATE-SPECIFIC
MODELS WITH ECONOMICS GROWTH

State	constant	Economic growth
CA	0.05	***0.35
FL	***0.23	***0.51
GA	0.10	***0.60
IL	-0.06	***0.37
MI	*-0.19	***0.61
NJ	***-0.25	***0.61
NY	***-0.32	***0.52
OH	-0.10	***0.45
PA	-0.10	***0.38
TX	***0.36	***0.31

where *** indicates significance at the 1% level;
** indicates significance at the 5% level and *
indicates significance at the 10% level

TABLE 4
EMPIRICAL RESULTS OF STATE-SPECIFIC
MODELS WITH OUTPUT GAP

State	constant	Change in Output Gap
CA	0.29	0.21
FL	***0.60	***0.45
GA	***0.54	***0.52
IL	***0.21	***0.29
MI	***0.25	***0.56
NJ	***0.19	***0.56
NY	0.05	***0.43
OH	***0.23	***0.39
PA	***0.18	***0.33
TX	***0.58	*0.20

where *** indicates significance at the 1% level;
** indicates significance at the 5% level and *
indicates significance at the 10% level

The above models estimated the simple relationship between employment growth and economic growth. However, one should consider the possibility of persistence in employment growth. That is, quarters with positive growth in employment are likely to be followed by further increases in employment and vice-versa. Thus, equations (1) and (2) were augmented by the inclusion of lagged employment growth, resulting in equations (3) and (4):

$$\text{empgrowth} = B_0 + B_1 \text{ economic growth} + B_2 \text{ lagged empgrowth} + \varepsilon \qquad (3)$$

$$\text{empgrowth} = B_0 + B_1 \text{ growth in output gap} + B_2 \text{ lagged empgrowth} + \varepsilon \qquad (4)$$

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In the augmented models, B_1 represents the *partial* elasticity of employment while B_2 is an estimate of the degree of persistence of employment growth. By persistence, we mean the correlation between past and current employment growth; in other words, does employment growth have momentum such that periods of positive growth are followed by further growth while declines tend to be followed by further declines? By ignoring the potential effect of lagged employment growth, the previous studies may have obtained misleading results. Equations (3) and (4) were estimated in a similar manner to the original models. The results for the pooled regressions can be found in table 5 while the state-specific models can be seen in tables 6 and 7.

TABLE 5
EMPIRICAL RESULTS OF POOLED MODELS
WITH LAGGED EMPLOYMENT GROWTH

	Economic Growth	Change in Output Gap
Pooled model w/ economics growth	***0.32	---
Pooled model w/ output gap	---	***0.31

where *** indicates significance at the 1% level; ** indicates significance
at the 5% level and * indicates significance at the 10% level

The elasticity with respect to real GDP was positive and significant, estimated to be 0.32, while the elasticity with respect to the output gap was also positive and significant, 0.31. Compared to the model without lagged employment growth, the elasticity with respect to real GDP declined considerably, from 0.47 to 0.32 (a statistically significant difference) while the elasticity with respect to the output gap also experienced a statistically significant decline from 0.39 to 0.31. Thus, the omission of lagged employment growth appears to have led to a positive bias on the estimated elasticity. That is, it resulted in too high an estimate of employment intensity than would be statistically appropriate.

In the state-specific models incorporating economic growth, coefficients on lagged employment growth were positive and significant at the 1% level in every state, with estimates ranging from a low of 0.27 in Michigan to a high of 0.80 in California (see table 6). Elasticities of employment with respect to real GDP were positive and significant in each case with a low of 0.15 in California to a high of 0.55 in Michigan. Augmenting the model to include lagged employment growth provides further insight into the relationship between employment growth and economic growth. Some states appear to exhibit higher degrees of persistence while others have relatively higher elasticities. However, similarities are evident in that most of the ten estimates of the elasticities are close to 0.33 (eight of the ten states are within 0.1 of it). When the growth of the output gap is used instead of economic growth, once again all ten states display persistence in employment growth, with estimates positive and significant at the 1% level. Estimates ranged from a low of 0.31 in Michigan to a high of 0.81 in California. Nine of the ten coefficients relating employment growth to the growth of the output gap were positive and significant (at the 1% level). Estimates ranged from a low of 0.26 in Illinois to a high of 0.51 in Michigan. As before, eight of the ten estimates were within a tenth of point to 0.33.

TABLE 6
EMPIRICAL RESULT WITH ECONOMIC GROWTH
AND LAGGED EMPLOYMENT GROWTH

State	constant	Economic growth	Lagged employment growth
CA	-0.05	**0.15	***0.80
FL	-0.01	***0.36	***0.58
GA	-0.01	***0.42	***0.45
IL	-0.10	***0.29	***0.44
MI	*-0.23	***0.55	***0.27
NJ	*-0.16	***0.40	***0.44
NY	*-0.21	***0.33	***0.65
OH	*-0.14	***0.37	***0.39
PA	*-0.10	***0.31	***0.30
TX	-0.005	***0.25	***0.68

where *** indicates significance at the 1% level; ** indicates
significance at the 5% level and * indicates significance at the 10% level

TABLE 7
EMPIRICAL RESULT WITH OUTPUT GAP AND
LAGGED EMPLOYMENT GROWTH

State	constant	Change in Output Gap	Lagged employment growth
CA	0.05	0.12	***0.81
FL	***0.23	***0.37	***0.64
GA	***0.27	***0.39	***0.51
IL	**0.11	***0.26	***0.49
MI	**0.16	***0.51	***0.31
NJ	**0.13	***0.37	***0.50
NY	0.03	***0.32	***0.69
OH	**0.12	***0.34	***0.44
PA	***0.13	***0.29	***0.35
TX	***0.16	***0.24	***0.72

where *** indicates significance at the 1% level; ** indicates significance at the
5% level and * indicates significance at the 10% level

EMPLOYMENT GROWTH AND ECONOMIC GROWTH: HOW LONG A LAG?

The first part of this study examined the employment intensity of economic growth in terms of the elasticity of employment with respect to real GDP and the output gap. However, another issue to consider is how quickly employment responds to changes in economic growth.

Methodology

As discussed earlier, there is some question as to how long it takes employment to respond to economic growth. In the early stages of a recovery, firms may be hesitant to hire more workers until they are convinced that the recovery will be sustained. Thus, though economic growth will have some immediate impact on employment, some of its effects may not be felt for a period of time. Thus, we

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estimate the following models (the specific lag structure was chosen based on Akaike's Information Criteria[3]):

$$empgrowth = B_0 + B_1 empgrowth_{-1} + B_2 rgdppc + B_3 rgdppc_{-1} + B_4 rgdppc_{-2} + B_5 rgdppc_{-3} \qquad (5)$$

$$empgrowth = B_0 + B_1 empgrowth_{-1} + B_2 gappc + B_3 gappc_{-1} + B_4 gappc_{-2} + B_5 gappc_{-3} \qquad (6)$$

Empirical Results

Equations (5) and (6) were estimated with pooled data using a fixed-effects estimation technique as well as by employing SUR for state-specific models. The results can be seen in tables 8-10.

TABLE 8
EMPIRICAL RESULTS OF POOLED MODELS: LAG STRUCTURE

	Pooled Model w/Econ. Growth	Pooled Model w/ Output Gap
Economic growth	***0.23	---
Economic growth$_{t-1}$	***0.18	---
Economic growth$_{t-2}$	***0.12	---
Economic growth$_{t-3}$	**0.07	---
Output gap	---	***0.23
Output gap$_{t-1}$	---	***0.16
Output gap$_{t-2}$	---	***0.10
Output gap$_{t-3}$	---	*0.05

where *** indicates significance at the 1% level; ** indicates significance at the
5% level and * indicates significance at the 10% level

TABLE 9
EMPIRICAL RESULTS WITH LAGGED ECONOMIC GROWTH

	constant	Emp. Lag	Econ Gr$_t$	Econ Gr$_{t-1}$	Econ Gr$_{t-2}$	Econ Gr$_{t-3}$
CA	**-0.20	***0.66	0.09	**0.17	0.08	0.08
FL	-0.09	***0.31	***0.24	***0.25	**0.19	0.04
GA	-0.17	***0.30	***0.32	*0.18	0.12	0.15
IL	***-0.29	**0.24	*0.20	0.13	**0.20	0.10
MI	***-0.41	0.15	***0.40	***0.35	0.13	-0.02
NJ	***-0.37	0.01	***0.23	*0.21	***0.26	**0.16
NY	***-0.50	***0.36	***0.20	***0.25	**0.26	0.07
OH	**-0.25	***0.34	***0.30	*0.16	0.01	0.07
PA	***-0.36	-0.11	***0.19	***0.23	***0.23	***0.16
TX	*-0.11	***0.54	***0.22	*0.12	0.06	*0.11

where *** indicates significance at the 1% level; ** indicates significance at the 5%
level and * indicates significance at the 10% level

TABLE 10
EMPIRICAL RESULTS WITH LAGGED
CHANGE IN OUTPUT GAP

	constant	Emp. Lag	Gap_t	Gap_{t-1}	Gap_{t-2}	Gap_{t-3}
CA	*0.08	***0.77	0.08	**0.17	0.06	0.04
FL	***0.37	***0.45	***0.28	***0.24	**0.17	0.04
GA	***0.36	***0.40	***0.30	0.16	0.12	0.17
IL	***0.16	***0.34	*0.18	0.11	**0.20	0.10
MI	***0.22	**0.22	***0.38	**0.33	0.13	0.02
NJ	***0.23	**0.21	**0.23	*0.17	**0.23	0.12
NY	*0.06	***0.57	***0.23	***0.23	***0.20	-0.00
OH	***0.14	***0.43	***0.27	0.14	0.00	0.09
PA	***0.20	0.08	***0.20	***0.21	***0.21	*0.14
TX	***0.22	***0.63	***0.23	*0.12	0.06	*0.11

where *** indicates significance at the 1% level; ** indicates significance
at the 5% level and * indicates significance at the 10% level

Similar results are found in the pooled regressions, whether one uses the percent change in real GDP or change in the output gap as the measure of economic growth. Though economic growth is found to have some immediate impact on employment, it continues to have positive and significant effects for up to three quarters.

In the state-specific models, persistence of employment growth is found in seven of the ten states in the model employing real GDP. Those with the highest persistence include California (0.66) and Texas (0.54) while persistence was not detected in Michigan, New Jersey or Pennsylvania. Nine of the ten states exhibited persistence in the output gap model. Once again, the highest persistence was found in California (0.77) and Texas (0.63) while persistence was not detected in Pennsylvania.

Economic growth was found to have its most noticeable impact immediately as nine of the states have positive and significant coefficients for the current period in both models. Employment was found to be the most sensitive to growth in current real GDP in Michigan (0.4) but not sensitive to the growth in current real GDP in California. Similarly, employment was most sensitive to changes in the output gap in Michigan (0.38) but a significant relationship was not found for California. Nine of the ten states showed a positive and significant relationship between employment growth and lagged growth in real GDP. Once again, Michigan had the strongest relationship (0.35) while no detectable relationship was found for Illinois. Seven states had positive and significant relationships between employment growth and a one-period lag in the change in the output gap. Georgia, Illinois and Ohio exhibited no relationship while Michigan had the strongest relationship. The effect of economic growth on employment appears to diminish over time as five states are found to have positive and significant coefficients with a two-period lag in both models. In both models, Illinois, New Jersey, New York and Pennsylvania had similar coefficients (between 0.20 and 0.26 in the GDP model and between 0.20 and 0.23 in the output gap model). Only three states had a positive and significant relationship with three lags in the GDP model, New Jersey, Pennsylvania and Texas, while two had significantly positive relationships in the output gap model, Pennsylvania and Texas.

SUMMARY AND CONCLUSIONS

In this study, we examined the nature of the relationship between employment and economic growth in the ten largest states. The elasticity of employment with respect to real GDP was estimated to be 0.47 using a pooled regression while ranging from 0.31 to 0.61 in state-specific regressions. This result is similar to those found by Padalino and Vivarelli (1997) who found the employment intensity of economic growth for the US to be approximately 0.5 as well as Boltho and Glyn (1995) who found elasticities of employment with respect to economic growth in the order of 0.5 to 0.6 for a set of OECD countries. A similar model relating employment to the output gap resulted in an elasticity of 0.39 with state-specific results ranging from 0.20 to 0.56. Once both models were augmented to include lagged employment growth, partial elasticities were found to be close to 0.33 for most states in both models, suggesting that previous studies may have overestimated employment elasticity. Persistence in employment growth was found in every state – ranging from a low degree of persistence in Michigan to a high in California. Next, the potential for lags in the relationship was considered. Results indicated that though economic growth has some immediate effect on employment, the effects continue for a few quarters.

The results help provide insight to the nature of the relationship between employment and economic growth. The difference between the original model and the one incorporating lagged employment growth suggest that though economic growth provides an impetus to employment, employment growth may take on a momentum of its own such that periods of poor employment growth are followed by further periods of poor employment growth. For example, at the beginning of economic recoveries when the economy starts to grow, thus providing an impetus to employment, employment growth may lag somewhat since preceding quarters (occurring at the end of the recession) experienced low employment growth. This could help explain, in part, the period of improving economic growth accompanied by lackluster employment growth that took place in 2003.

The model incorporating lags in economic growth provides further insight into the relationship. Economic growth has a positive and significant impact on employment growth, but some of the effects take a few quarters to be fully felt. As in the earlier model, persistence in employment growth plays a major role as well. Thus, economic growth may have to occur for a period of time before it can have a noticeable impact on the labor market. Once employment growth begins to accelerate, it takes on a momentum of its own. Once this occurs, the combination of economic growth and employment persistence should result in more substantial and sustained gains in employment.

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NOTES

[1] SUR – seemingly unrelated regression, estimates the parameters of a system of equations allowing for contemporaneous correlation of the error terms. For further information, see Kennedy, page 169.

[2] A Hodrick-Prescott Filter is commonly used to estimate a long-term trend component of a series. For further information, see Eviews, page 191-192.

[3] Akaike's information criteria (AIC) is a common selection criteria used to determine the appropriate number of lags in a model. For further information, see Kennedy, page 103.