

A Cross-Country Analysis of the Employment Intensity of Economic Growth

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Abstract

In this paper, we examine the relationship between economic growth and employment in six developed nations from 1990 to 2006. Models are developed to estimate the employment intensity of economic growth within each nation. Among those for whom a significant relationship was found, employment intensity is estimated to range from 0.14 to 0.33. Once the model is augmented to account for persistence in employment growth, employment intensity diminished in a majority of the nations, but remained significant in most, ranging from 0.16 to 0.33. The model was further modified to examine the dynamic nature of the relationship between employment and economic growth using impulse response analysis. As before, differences in the responsiveness of employment to economic growth are found between the nations studied. Reasons for the differences in the employment intensity of economic growth between nations are discussed. Evidence is found suggesting that nations with high labor force growth rates and/or relatively large service sectors tend to exhibit higher levels of employment intensity of economic growth.

Introduction

During the 1990s, several nations experienced moderate economic growth with little increase in employment while other nations with similar growth rates experienced higher levels of job creation. During the first year of the most recent economic recovery in the US (2002), employment actually fell. Several explanations have been suggested as to why this may occur. Perhaps the recovery was uneven and the growing sectors of the economy increased the utilization of labor rather than increase the number of jobs. Also, 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. Another possibility is that companies employed new technologies, resulting in increased productivity instead of more employment.

In this paper, we examine the relationship between economic growth, as measured by real GDP, and employment in the G7 nations for which comparable data were available¹. 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, some of the factors that help explain the differences between nations are explored.

The period of this study begins in 1990 and ends in the third quarter of 2006. The statistical properties of each variable (the growth rates of employment and real GDP) are examined. Empirical models are then developed to estimate the employment intensity of economic growth. Employment intensities (the elasticity of employment with respect to real GDP) are estimated to range from 0.14 to 0.33 in the nations considered for whom a significant relationship was found. Once the model is augmented to account for

¹ Comparable data were not available for Japan.

employment persistence, a smaller but still significant relationship is found for most of the countries considered. Next, the dynamic nature of the relationship between employment and economic growth is examined using impulse response analysis, providing further evidence of differences in the employment elasticities in the nations studied. Characteristics of the labor market help to explain some of the differences in the results.

Review of Literature

Several authors have estimated employment elasticities (a measure of the relationship between employment and economic growth) for a variety of nations. Significant differences in employment elasticities between different countries were detected by Padalino and Vivarelli (1997), 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. Elasticities in the order of 0.5 to 0.6 for a set of OECD countries were detected by Boltho and Glyn (1995). In a study of industrialized countries by the International Labour Organization Report (1996), 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. It also concluded that the responsiveness of employment growth to GDP growth has not declined in industrialized countries as a whole. Evidence suggesting that restructuring of major economic sectors reduced the relationship between economic growth and employment was discovered by Pianta, Evangelista and Perani (1996). 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 elasticity for the US was 0.53).

Though some work has been conducted applying this technique to multinational studies, it has yet to account for employment persistence. The absence of this key component of the model may have led to misleading and biased results. Results of such an analysis should provide insight into the differences in the behavior of national labor markets as well as increased understanding as to why employment in different nations may respond differently to changes in economic growth. Furthermore, the dynamic nature of the relationship has received scant attention in the literature. A time-series model is developed to capture the total response of employment to economic growth, not just the response for one period.

There has been little empirical work concerning the factors affecting the employment intensity of economic growth, but some previous studies help to provide some insight. Walterskirchen (1999) found that a higher growth of the labor supply tends to raise employment and reduce productivity, thus suggesting a higher level of employment intensity of economic growth. Mourre (2006) found that employment intensity tends to be highest in the service sector, suggesting that nations with large service sectors should exhibit higher employment intensities.

Descriptive Statistics

Quarterly data from 1990 to 2006 for both national employment and real GDP were obtained from *OECD Statistics*². As can be seen in table 1, the nations exhibited different patterns of economic growth during the study period. Italy had the slowest average quarterly growth in GDP of 1.38% (measured at an annualized rate) while the US had the highest rate, 2.89%. Canada, like the US, experienced relatively high economic growth while France and Germany experienced similar economic growth rates averaging about 1.8% and 1.9%, respectively. Germany experienced the least average growth in employment (just under 0.2% per quarter at an annualized rate) while the Canada and the US saw employment growth rates averaging in excess of 1%.

Table 1a
Descriptive Statistics: Economic Growth

| | Mean | Median | Standard Deviation |
|----------------|-------------|---------------|---------------------------|
| Canada | 2.61% | 2.63% | 2.42 |
| France | 1.81% | 2.01% | 1.72 |
| Germany | 1.92% | 1.52% | 3.06 |
| Italy | 1.38% | 1.45% | 2.01 |
| United Kingdom | 2.35% | 2.64% | 1.76 |
| USA | 2.89% | 2.93% | 2.07 |

Table 1b
Descriptive Statistics: Employment Growth

| | Mean | Median | Standard Deviation |
|----------------|-------------|---------------|---------------------------|
| Canada | 1.42% | 1.40% | 1.62 |
| France | 0.72% | 0.68% | 1.34 |
| Germany | 0.19% | -0.09% | 1.95 |
| Italy | 0.53% | 0.77% | 2.87 |
| United Kingdom | 0.42% | 0.93% | 2.16 |
| USA | 1.24% | 1.24% | 1.47 |

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:

² OECD Statistics can be found at <http://stats.oecd.org>

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

where empgrowth is the annual percent change in employment for the respective nation; economic growth is the annual 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. In other words, how much growth in employment results from a one-percent growth 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.

Empirical Results

All of the models specified were estimated using OLS³. Results of the regressions are shown in table 2:

Table 2
Model with Economic Growth

| Nation | constant | Economic growth |
|---------|----------|-----------------|
| Canada | *** 0.19 | *** 0.25 |
| France | 0.04 | *** 0.32 |
| Germany | -0.02 | ** 0.14 |
| Italy | *** 0.24 | -0.09 |
| UK | -0.03 | *** 0.33 |
| US | *** 0.17 | *** 0.17 |

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

As seen in table 2, employment growth was positively and significantly related to the growth rate of real GDP in every nation except Italy. Statistically significant elasticities ranged from a low of 0.14 in Germany to a high of 0.33 in the UK.

The above model 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, equation (1) was augmented by the inclusion of lagged employment growth, resulting in equations (2):

$$\text{empgrowth} = B_0 + B_1 \text{ economic growth} + B_2 \text{ lagged empgrowth} + \varepsilon \quad (2)$$

³ Results for all models in this study were tested for standard econometric problems including structural stability, ARCH effects, serial correlation, etc. Dummy variables were included when appropriate to account for changes in data methods. For example, beginning in January 2000, US data was adjusted for new population controls. Previous data did not incorporate this change. Thus, a one-period dummy for the first quarter 2000 was included for the US.

In the augmented model, 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 relationship 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 periods in which employment growth 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. Equation (2) was estimated in a similar manner to the original model.

Table 3
Model with Economic Growth and Lagged Employment Growth

| Nation | constant | Economic growth | Lagged employment growth |
|---------|----------|-----------------|--------------------------|
| Canada | 0.03 | *** 0.21 | *** 0.50 |
| France | -0.003 | *** 0.23 | *** 0.45 |
| Germany | -0.03 | 0.08 | 0.16 |
| Italy | ** 0.20 | -0.10 | * 0.18 |
| UK | -0.07 | *** 0.33 | ** 0.19 |
| US | 0.07 | *** 0.16 | *** 0.35 |

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

Coefficients on lagged employment growth were positive and significant in five nations, with estimates ranging from a low of 0.18 in Italy to a high of 0.50 in Canada (for those nations for which a significant result was found). Augmenting the model to include lagged employment growth provides further insight into the relationship between employment growth and economic growth. The degree of persistence seems to be a significant factor in explaining employment growth in virtually every nation.

Compared to the model without lagged employment growth, the elasticities of employment with respect to real GDP declined somewhat in several cases. Employment elasticity became noticeably smaller for France and insignificant for Germany. Thus, the omission of lagged employment growth appears to have led to a positive bias in some of the estimated elasticities.

Dynamic Model of Employment and Economic Growth

Building on the model specified in (2), the appropriate lag structure of both employment and economic growth are determined followed by an impulse analysis to identify the total response of employment to economic growth as opposed to just one period. The model takes the form:

$$\text{empgrowth} = B_0 + B_{1i} \text{ economic growth}(t-i) + B_{2j} \text{ empgrowth}(t-j) + \varepsilon \quad (3)$$

where $i = 0$ to n and $j = 1$ to n . Thus, current economic growth is an independent variable as well as its lagged value(s). Akaike's information criterion was used to determine the number of lags for both employment and economic growth. The model was estimated and the results are presented in table 4.

Table 4
Model including Appropriate Lag Structure (determined by AIC)

| Nation | constant | Economic growth | Economic Growth (t-1) | Employment growth (t-1) | Employment growth (t-2) |
|---------------|-----------------|------------------------|------------------------------|--------------------------------|--------------------------------|
| Canada | -0.04 | 0.08 | ***0.30 | ***0.38 | |
| France | -0.06 | **0.17 | *0.13 | 0.21* | ***0.36 |
| Germany | ***-0.12 | 0.04 | ***0.16 | 0.11 | *0.15 |
| Italy | 0.09 | 0.10 | -0.02 | -0.01 | ***0.40 |
| UK | ***-0.20 | 0.07 | ***0.48 | **0.16 | |
| US | -0.04 | *0.10 | ***0.28 | *0.15 | |

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

As before, a degree of persistence was found for each country. A positive and significant relationship between employment and economic growth was found in five of the six nations (the exception was Italy). In most cases, lagged economic growth tended to have a more noticeable impact than current economic growth. To assess the full effect of economic growth on employment, an impulse analysis was conducted with the results presented in figures 1 to 5 (Italy was excluded since a significant relationship was not detected).

Figure 1
Canada: Response of Employment to an Innovation in Economic Growth

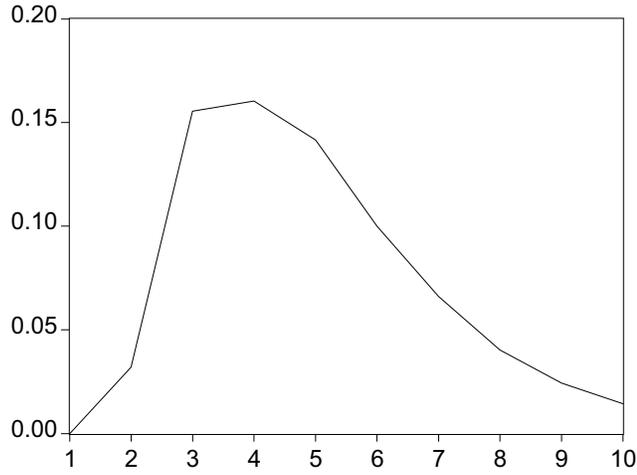


Figure 2
France: Response of Employment to an Innovation in Economic Growth

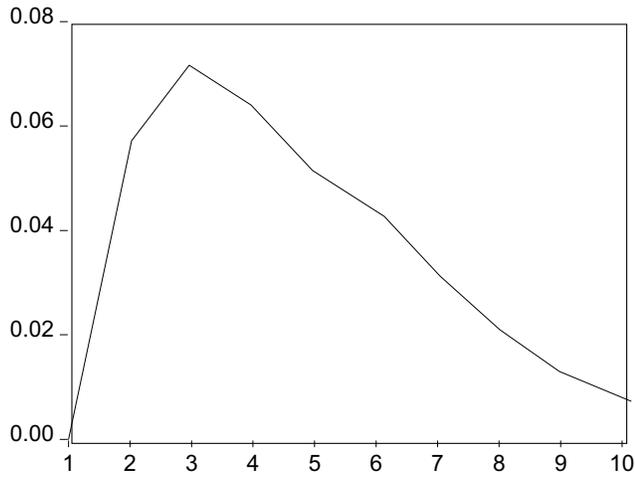


Figure 3
Germany: Response of Employment to an Innovation in Economic Growth

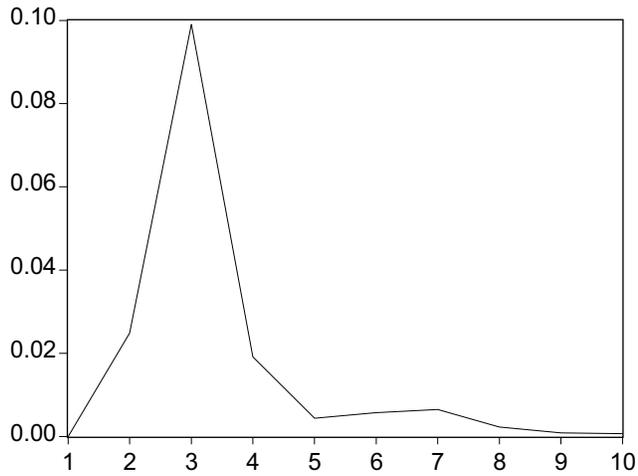


Figure 4
US: Response of Employment to an Innovation in Economic Growth

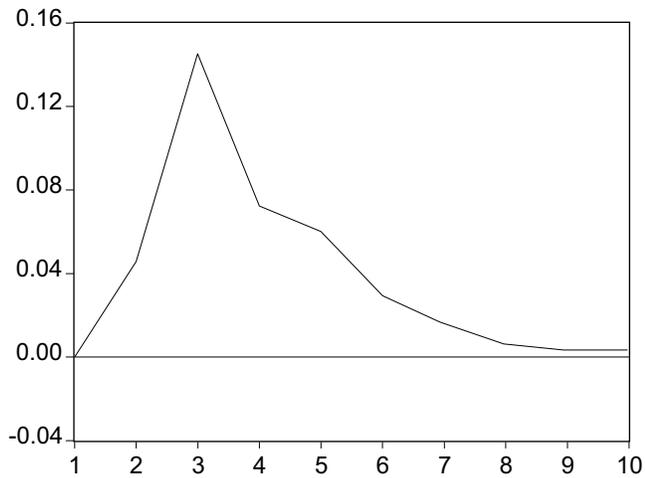
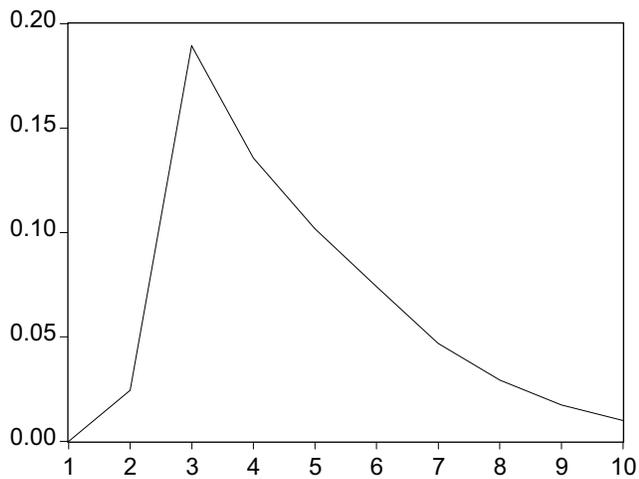


Figure 5
UK: Response of Employment to an Innovation in Economic Growth



As can be seen from the above figures, Canada, the UK and the US display the largest response of employment to economic growth while France and Germany show the smallest response (recall Italy had an insignificant relationship). This supports the earlier findings which indicated that Canada, the UK and the US displayed the largest responses of employment to economic growth while France, Germany and Italy showed the smallest response (or in the case of Italy, an insignificant response).

Reasons for the Differences in Estimated Employment Elasticities

Previous studies suggest several characteristics of the labor market that may influence the employment intensity of economic growth. In particular, the growth of the labor force and the relative size of the service sector help explain differences in employment elasticities. Walterskirchen (1999) found that increases in the labor supply tend to raise employment but reduce productivity. As a result, the employment intensity of economic growth increases. Mourre (2004) finds that the job intensity of growth is highest in the service sector – once again likely due to slower growth in productivity in services. Table 5 shows the growth of the labor force and size of the service sector in each of the countries for which comparable data were available.

Table 5
Characteristics of Labor Market

| Nation | Growth in Labor Force, 1990-2006 | Service Sector Employment as a Percent of Total Employment in 1990 |
|---------------|---|---|
| Canada | 23% | 72% |
| France | 11% | N/A |
| Germany | 1% | 55% |
| Italy | 0.6% | 58% |
| UK | 3.9% | 68% |
| US | 13.7% | 71% |

The two nations with the slowest growth in their labor force had either insignificant (Italy) or the lowest employment elasticity (Germany). Meanwhile, the nations with the highest labor force growth rates (Canada and the US) had two of the three highest employment elasticities. In addition, the nations with the three largest service sectors (Canada, UK and US) also had the highest employment intensity of economic growth while those with the smallest service sectors (Italy and Germany) had the lowest or insignificant levels of employment intensity⁴. Together, this lends support to earlier findings that provided evidence that the characteristics of the labor market helped explain differences in the employment intensity of economic growth.

⁴ Comparable data for service sector employment were not available for France.

Summary and Conclusions

In this study, we examined the nature of the relationship between employment and economic growth in the G7 nations. The elasticity of employment with respect to real GDP was estimated to be significantly different from zero in five of the six nations studied – ranging from 0.14 in Germany to 0.33 in the UK. Once the model was augmented to include lagged employment growth, partial elasticities were found to be smaller, but still statistically significant in most cases. Persistence in employment growth was found in almost every nation – ranging from a low degree of persistence in Italy and the UK (it was insignificant in Germany) to a high degree in Canada and France. The employment elasticity was found to be not statistically different from zero in Italy. Furthermore, the results of the dynamic model incorporating impulse analysis supported the earlier findings of a larger response of employment to economic growth in Canada, the UK and the US relative to France and Germany with no significant relationship found for Italy. This result is similar to the finding of the ILO report (1996) and Padalino and Vivarelli (1997) that also found no relationship for Italy. However, similar to Pianta, Evangelista and Perani (1996), a positive and significant relationship was found between employment and economic growth for the remaining nations in the study.

The results help provide insight as to the nature of the relationship between employment and economic growth. The difference between the original model and the one incorporating lagged employment growth suggests that though economic growth may provide an impetus to employment, employment growth tends to take on a momentum of its own such that periods of poor employment growth are likely to be followed by further periods of poor employment growth. Also, the impulse analysis indicates the total response of employment to economic growth in that the effect may be felt over several periods, not just one as suggested in previous models of employment intensity.

Potential reasons for differences in the estimated employment intensity of economic growth were explored. Evidence was presented suggesting that the characteristics of the labor market help to explain these differences. Similar to Walterskirchen (1999) and Mourre (2006), it was found that nations that are experiencing higher labor force growth rates and/or have sizeable service sectors are likely to exhibit relatively high levels of employment intensity of economic growth.

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