

Okun law unemployment



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Okun's Law; an Empirical Test across Countries

Abstract

Okun's Law postulates an inverse relationship between the change in the unemployment rate and the difference between actual and potential real output. The relation has proven to be an influential empirical framework in supply-side economics. This paper sets out to empirically test whether or not Okun's Law holds and how it varies across the UK, US and Japan during the time period 1976-2006. The quarterly data sets are analysed via both OLS Regression estimations over the whole sample period and Rolling Regression estimations over 18 separate subsamples, with the view to infer how stable the relationship has been over the last 30 years. The reasons for these changes and the implications these results can have for policymakers and labour markets are also briefly discussed. In addition, we find that the unemployment rate responds asymmetrically to expansions and contractions in output when the business cycle is considered. There is a considerable amount of evidence that supports Okun's Law usefulness as an empirical relationship.

Okun's Law is defined as the 'relationship between the change in the unemployment rate and the difference between actual and potential real output'. The relationship has had a substantial influence in macroeconomics in so far that the Law is widely used in macro-models as well as providing the theoretical building blocks to contribute to other empirical relationships such

as the Aggregate Supply curve and the Phillips Curve. For this reason, Okun's Law is an important feature of supply-side economics.

Okun's Law also gives policymakers and economists' an indication of how the economy is performing in regard to both the labour market and the goods market. Furthermore, central banks, primarily monetary policy, use Okun's Law as a forecasting tool to predict changes in the structure of the economy and aid in the decision-making process. Its effectiveness as a tool is somewhat contentious, since the relation is designed to be utilised as a benchmark or guideline to judge the performance of the economy against, rather than as a stringent policy rule. Additionally, the relationship is frequently used to achieve an optimal growth rate (without adverse effects on the unemployment rate) as well as more significantly - measuring the cost of high unemployment which is regarded as both socially undesirable and a waste of human capital.

This study specifically attempts to test, using the dynamic version of Okun's Law, whether or not the relationship holds in the UK, US and Japan and how the relationship varies across these countries over the period 1976-2006. This will be tested via OLS regression analysis. The central research question of this study is to infer from the results how stable the relation i. e. Okun's Law been over the last 30 years for the UK, US and Japan? This will effectively captured by the sensitivity of unemployment changes when output growth deviates from its equilibrium level, namely the Okun coefficient (The β term in the relation).

Most papers assume a symmetric relationship between output and unemployment. As a secondary objective of the study, an attempt will be made to test whether or not Okun's Law characterises an asymmetric relationship, in so far that expansions and contractions in output have a different absolute effect on changes in the unemployment rate, an issue pursued by many authors in the forthcoming literature. In addition, the results can be used to interpret to what extent policymakers can predict the performance of output and unemployment in an economy hence the usefulness of Okun's Law as a forecasting tool, once instability of the relation is taken into account.

Overview

The study proceeds as follows;

Section 1 presents a theoretical background to the Okun's Law and its significance as an empirical relationship.

Section 2 presents a review of the existing empirical literature on Okun's Law along with discussion of any relevant omissions and contradictions of the respective authors' findings.

Section 3 uses Blanchard (1998) methodology as a basis for the construction of Okun's Law as well as providing the necessary explanations of the variables used in the model, version of the relation used. The methods of data collection and the limitations of the methodology employed will also be stated.

Section 4 presents some preliminary data analysis including descriptive statistics, tests for Stationarity, Heteroskedasticity, Serial Correlation and Chow Test for structural stability.

Section 5 presents the empirical results and the subsequent analysis of the techniques used to interpret Okun's Law. Namely, OLS Regression Analysis over the whole period, Rolling Regressions, Stability Tests, and Dummy Variable analysis based on its use in the model and how the empirical results integrate with the subject matter raised in the literature. The implications of the empirical results for macroeconomic policymakers, the goods and the labour market are also briefly discussed.

Section 6 presents a judgement on the overall findings from the analysis of the data as well as providing a critical appraisal of Okun's Law and its usefulness as an empirical relation across countries. In addition, potential recommendations will be discussed in the context of how the study and/or the model can be improved for further research.

Background Theory

Okun's Law - the inverse relationship between unemployment and output is regarded as "one of the most reliable empirical regularities of macroeconomics". In recent times, there has been a considerable amount of research into the empirical significance of Okun's Law. Policymakers are interested in sustaining output growth and achieving a low unemployment rate and the relationship is seen as a fairly good indication of economic performance. The type of unemployment that will prevail depends on how labour supply and demand evolve over time and is the prime reason why <https://assignbuster.com/okun-law-unemployment/>

Okun's coefficient has reduced over time. The lack of empirical testing in this area is a major limitation of reliable Okun coefficients.

In 1962, Arthur Okun, an American economist, formulated and interpreted this relationship. He suggested a negative relationship between the change in the unemployment rate and the growth of real output. Many economists till this day, view Okun's Law to be a very useful relation in assessing macroeconomic performance. Okun estimated that in the US; output growth of 3% below equilibrium for one year, leads to an increase in the unemployment rate of one percentage point (reverse case also applies). However, more recent studies have shown that in fact, a 1% increase in output leads to a reduction in the unemployment rate by 2%.

The simplicity of Okun's Law, involving the use of fundamental economic variables (output and unemployment) makes it a striking empirical relationship to study. However, there are a number of forms or versions that Okun's Law can take. The predominant versions of Okun's Law are; the difference version, the dynamic version, the gap version and the production-function version. This study will use the dynamic version of Okun's Law since it is widely used by economists as well as taking into account deviation of output from some equilibrium level, which ultimately creates a more plausible investigation.

Although the magnitude of the decrease seems to be declining and with widespread acceptance of the relationship being pervasive, structural differences in an economy's product and labour markets coupled with the

difficulty that national governments face in managing the economy, highlights the need to rigorously investigate Okun's Law still further.

Literature Review

This section examines the existing empirical literature concerning Okun's Law and the most significant findings. The purpose of this section in particular is to evaluate the usefulness of Okun's Law as an empirical relation against a number of criteria. Additional focus will be placed on how the relationship varies across both differing time periods and different countries as well as the techniques used in the literature.

Using the original formulation of Okun's Law Equation (1) Blanchard (1998) estimated the relation across both countries and time. The time periods the author used were 1960-2003. (1960-1980 and 1981-2003). The author estimated the coefficient for the United States, the UK, Germany and Japan. According to the reports, as expected, the law does hold in all of these countries. The econometric techniques used by Blanchard in constructing these results involve the use of standard regression analysis. It was brought to our attention that the US had the highest response (-0.39), whilst Japan the lowest (-0.12). This is in part explained by the differences in structure within each country's respective labour markets. The study made 2 plausible yet restrictive assumptions. The first being that "Output moved one for one with employment". This is an important point to note since economic theory suggests that an expansion in an economy's output, *ceteris paribus* (an increase in productive capacity) will require an equal increase in the amount of labour (workers) needed to produce that additional output. The second

assumption is that of "A constant labour force". This assumption follows on from the first in that changes in employment are reflected in opposite changes in unemployment. A major critique of these assumptions is the fact that in absolute terms, the rise/fall in the unemployment rate may not be proportional to the rise/fall in the employment rate due to labour force participation. Blanchard also brought to our attention that in the Medium Run the relationship may differ due to both equilibrium values of output and unemployment returning to their natural levels. This adjustment of the variables means that certain macroeconomic policies cannot influence output growth or unemployment rates. However, earlier formulations assumed any increase or decrease in the unemployment rate relative to the rate of output growth to be in equal absolute proportions. The revised equation (below) rectifies this simplistic assumption by involving the actual deviation of output growth from its equilibrium, where the Beta coefficient measures the responsiveness of unemployment rate changes to deviations of output from equilibrium output.

$$U_t - U_{t-1} = -\beta (g_{yt} - \hat{g}_y) \quad (1)$$

Potential Rate of Output Growth

Unemployment rate at t-1 periods

Output Growth at t periods

Unemployment rate at t periods

Beta/Impact

Coefficient

Sogner, L and Stiasny, A, (2000) investigated Okun's Law for 15 OECD countries to deduce whether structural instability originates from the demand or supply-side of the economy. The Keynesian viewpoint was found to hold little empirical validity in contrast to that of the neoclassical one. This is in part down to the "assumption of fixed prices and wages." This is unrealistic to assume particularly in a world where inflation is everywhere a monetary phenomenon. Although firms do change their output plans according to changes in growth, both changes in wages and prices will determine the underlying unemployment rate and any estimates based on such assumptions will derive incorrect results. Economic agents expect certain activities to occur in the future based on either past or current activities. The most crucial finding of this paper is that the persistence in the unemployment is strongest in countries that have a highly protected labour market. Although this is inconclusive in contrast to other studies, it implies to a certain extent that variations in real output only have a small effect on employment levels which needs to be accounted for especially when revisions of the relation are considered.

Most Okun's Law stipulations tend to assume a symmetric relationship between unemployment and output growth. In other words, output growth for instance produces the same absolute effect on unemployment. Harris and Silverstone (2000) managed to test this assumption using hypothesis tests for New Zealand over the period 1979-1999. They discovered that Okun's Law does hold by means of regression analysis over this period. The most essential insight which can be extended across many countries if need be, is <https://assignbuster.com/okun-law-unemployment/>

the Okun coefficient which they estimated based on their regression results. In New Zealand, "a one percent change in output growth is associated with a 0.4% change in the unemployment rate." This is in fact due to changes in labour force participation, labour hours and capital utilization. The strength of this particular study was the use of labour supply analysis which contributed in supporting Okun's Law and its role on the supply side of the economy. The authors do however, wrongly assume a symmetric assumption throughout the paper and this is not plausible, especially in the long-run.

Productivity gains and the structure of the labour market play a vital contribution to the outcome of any relationship between unemployment and output. Walterskirchen (1999) proposed this argument to his study. This particular study generates differing perspectives to those posed by both Harris and Silverstone (2000) and thus varies greatly in terms of empirical results. The author does support Blanchard's view concerning the existence of a "strong positive correlation between GDP growth and change in the employment rate." However, the additional emphasis placed by Walterskirchen is that of productivity gains and labour supply and demand in the context of each country's individual labour market. The fact that the author cites demographic influences as well as economic is vital to the building blocks of empirical results and whether or not they are consistent with economic theory. The author carried out this particular focus of the study through two predominant methods; Time-series data analysis for each individual EU country and cross-country data analysis for the period 1988-1998. In both methods there appears to be a strong negative correlation between output growth and the resulting change in the unemployment rate.

Walterskirchen highlighted the difficulty in the calculation of potential output in order to estimate Okun's Law and thus disregarded this method in his empirical analysis, focusing instead on the change in the rate of output and unemployment.

He did however, attempt to correct another ambiguity in the fact that the relation overlooks the "influence of investment activity and technical progress on labour productivity." The results clearly show the rate of productivity to be approximately 2% in the EU, representing a constant figure. In times of high unemployment, Okun's coefficient will tend to also be high (1980's). In contrast, demographics explain the contribution of the rise in population growth on the employment rate. It was found that an increase in population growth puts considerable pressure on employment to increase and as a consequence labour productivity diminishes. This is relevant since "employment will only grow if economic growth rates are outstripping productivity". This adds further weight to the claims of productivity on the supply-side of the economy and the role it plays in determining the rate of unemployment. "The higher the Okun coefficient (usually 0.3 to 0.5), i. e., the elasticity of unemployment rates with respect to GDP growth, the better the chances for reducing unemployment through growth and demand policies". This aspect of the study is of great importance to policymakers. The author ensured that the significance of Okun's Law at the government level is not disregarded and hence plays a role in the effectiveness of policy at the macro level.

Schnabel (2002) investigated whether Okun's Law can be used to derive estimates of trend output growth but more importantly to focus on whether

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to use the trend rates derived in constructing measures of the output gap. It is a key concept in the construction of Okun's Law and the subsequent tests. The author pointed out the difficulties of estimating trend output, mostly in part to the numerous methods which can cause "biases and problems of interpretation". This is regarded as a major flaw of Okun's Law and Schnabel emphasizes this in his study. The interesting aspect of his econometric methods to test for the Okun coefficient was by use of Rolling Regressions for the G7 countries he intended to estimate. This technique aimed to test how the actual coefficients change or vary over time (many sample periods), in order to capture the dynamic changes which an economy undergoes over a shorter time horizon. The authors' estimates involve the G7 countries as well as the US, Japan and Canada, with each country's coefficients being significantly different than those of the next. Schnabel found out that the full sample had similar coefficients with that of the sub sample. This indicates that the relationship was relatively stable and accurate with the actual rates providing a sound benchmark to be compared against. A remarkable addition to the overall model was using business cycle stages as measures against the obtained trend values. This allowed the author to test the significance of the coefficients within different stages of growth, recovery or depressions. This is directly attributable to the case of UK, which had robust coefficients of 2.2 for growth an estimate taken from the period 1980-1990. During the 1990's labour market flexibility played vital a role in increasing participation rates within the labour market. This would suggest that as potential output grows, actual positive output growth exists. This is not a viable view since cyclical unemployment is not constant in all countries. The author, from the results, cited that sophisticated econometric techniques by <https://assignbuster.com/okun-law-unemployment/>

use of filters may produce more accurate results and less “shifting of parameters which are not deemed to be constant”. In addition, the trend rates obtained should “not be interpreted as the rates of growth compatible with stable inflation”. By introducing inflation into these estimates would complicate the estimations since such changes are reflected in the intensity of the business cycle, which the author correctly cites as a major limitation of his study.

Harris and Silverstone (2001) in their second study examine how upturns and downturns have a direct impact on Okun’s Law. A test which detects how unemployment and output growth react (proportionally) to changes in the business cycle is known as Asymmetry. Earlier, Blanchard made the view that Okun’s Law is symmetrical and many economists make this wrong assumption. The adjustment process in the real world follows different paths and involves many complex factors. Both Harris and Silverstone appreciate the need to test for asymmetry and ignoring this would see the hypothesis that there exists an inverse relationship between output and unemployment rejected, as well as numerous forecasting errors being made in the decision making process that policymakers go through. Output growth (y_t) was found to be weakly exogenous and this was true for all the OECD countries tested. Co integration Tests (were undertaken through Engle-Granger Two-Step method and Johansen Procedure) were calculated by Harris and Silverstone in an attempt to observe how the coefficients differed asymmetrically when the phase of the business cycle was considered. It was discovered that adjustments to disequilibrium are not prevalent in the downturn phase of the business cycle but in the upturn phase they are more volatile due to the

nature of both the goods and labour market which is consistent with economic theory. This is not the case for the UK and Japan since results indicated that they in fact move in opposite directions. Although, not explicitly stated the author manages to highlight the importance of this test as a benchmark for other relations such as the Philips Curve, AS curve and Taylor-Rule seemingly also strengthening the case for pursuing more in depth study of relationships and their responses in different countries.

Kosfeld and Dreger (1992-2000) investigated the German Labour Market and their study stressed the notion that "changes in production and employment are closely related". This gave rise to the Threshold concept, which in basic terms refers to there being a finite amount of capacity both in the economy and at firm-level. Any output growth above this specified capacity will tend to create new jobs and a fall in the unemployment rate over time. This serves as an important guideline to policymakers, albeit a different one to that specified by Walterskirchen. The thresholds in fact act as a determinant for both employment and unemployment. The authors' application of Okun's law is from both the demand and supply-side although Okun's law is usually approached from the supply-side due to the operation of labour markets. Instead of supporting Walterskirchen's view on demographics and other factors, the authors in this study believe that they in fact weaken the relationship. This arose due to the complexity of structural developments in the economy. The overall results followed on with the negative relationship between unemployment and output existing in Germany. However the unemployment benefit system in Germany led to employment and unemployment responding differently to changes in output. This response

was detected in the 1990's by a method known as spatial correlation equal to 0.2, which was regarded as relatively weak. This method is regarded as unsatisfactory since the results derived do not make a credible contribution to the study.

Huang and Chang (2005) proposed to evaluate the empirical validity of Okun's Law via structural change using the threshold approach in Canada. This supports Kosfeld's and Dreger's previous study. The empirical models used are far more accurate than previous standard linear equations. This highlights the difficulty in conducting accurate Okun's Law estimations. The study also takes into account the presence of serial correlation and this is embedded into the following autoregressive model;

$$U^c_t = \alpha_0 + \sum \alpha_i u^c_{t-i} + \beta y^c_t + \epsilon_t$$

In order to obtain both the unemployment rate and real output growth (GDP) the author has used the Hodrick-Prescott filter (HP) and the Band-Pass filter (BP). Both filters are widely used and results of the study show that Okun's Law strongly holds, with results supporting the Law with high negative correlations of -0.7967 and -0.8062.

However, the most crucial finding was that of a high Okun coefficient in the recession phase of the business cycle, this further supports Harris and Silverstone's notion that cyclical output's effect on cyclical unemployment is asymmetric. A high Beta coefficient acts as a signal to policymakers that unemployment is highly responsive to output gap deviations and thus provides a call for actions in the form of controlling the level of AD in the economy stimulating labour participation rates in the labour market.

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Weber, C. E (1995) study takes a similar direction to that of Huang and Chang however, the element is more specific and thus more precise. His purpose was to test Okun's Law post-war USA, to see if the relationship has been stable after this period. The interesting aspect of this particular study is that there was an apparent oil shock in the 1970's, which affects the supply-side of the economy. Weber focused on the periods both after and before the oil shock. The econometric method used for this test was predominantly OLS estimates via some form of Chow Test, using Dummy Variables (below);

$$U^c_t = \alpha_1 y^c_t + \alpha_2 D_t y^c_t + \varepsilon_{1t}$$

The empirical results for the OLS estimations were -0.314 which surprisingly turned out to be close to Okun's original estimate of -0.32. However, parameter constancy was rejected due to the high variation in the high t-statistic of -0.277 and -0.402. Weber did leave scope for further future developments with reference being made to the importance of the initial source of the shock (supply or demand) in the outcome of changes in cyclical unemployment/output.

On the basis of the existing literature, it is clear to see that Okun's Law does hold across a number of different countries and time periods. The ability to infer how stable the relationship is over both the long-run as well as the short-run proves vital in any empirical analysis undertaken. However, due to some of the components of the model being difficult to estimate as well as other factors such as productivity and inflation affecting output growth, doubts remain over the usefulness or reliability of Okun's Law as a benchmark for policymakers.

Research Methodology

Modelling Economic Theory

This sub section will provide the theoretical basis of Okun's Law as well as the major underlying assumptions of the model. In addition, brief explanations of the techniques employed and the justification for their use will be included.

Although, using almost the same methodology as Blanchard (1998) the estimates may vary considerably. Firstly, the most significant reason is that Blanchard (1998) tests Okun's Law across a number of different countries including the G7 countries. This study looks predominantly at the UK, US and Japan with the emphasis being placed on the former. Secondly, both studies look at different time periods and different frequency of data. Blanchard (1998) tested the relationship from 1960-2003 using monthly data, while this study will test the relationship with a technique called rolling regressions, using quarterly data from 1976-2006, giving us a more up to date inspection of Okun's Law. Another essential issue which could cause the results to differ is the estimation of potential output; needed to compute the output gap term in Okun's Law. Although both studies use this variable, the technique used to measure potential output is different.

(1)

$$\Delta U_t = -\beta (y_t - \hat{y})$$

(2)

Re-arranging

$$U_t = U_{t-1} - \beta (y_t - \hat{y}_t)$$

Pre-Analysis of the Data

Since specific data will be used to build an econometric model and test whether the model has theoretical validity, it is important to determine the properties of the variables in question.

Description of Data

To generate the model for Okun's Law as well as test it for each country (UK, US, Japan) this study uses the 124 quarterly data points for the Unemployment Rate (%), Real GDP and Potential GDP (GDP) for the period 1976-2006. The latter two are used to compute the Output Gap term in Okun's Law. To ensure reliability whilst contrasting and analysing time series data all the variables are logged.

Shortcomings of the Data

The estimation method of potential output is an approximate when generated from the Hodrick-Prescott Filter and thus the computation of the output gap term is not always accurate. Many authors use the Band-Pass Filter and this may lead to discrepancies of the estimations in this study. There may also be bias in the sample, since different countries use different measures to determine the unemployment rate. This study has used percentage unemployment as per the Claimant Count, Bureau of Labour Statistics and Statistics Bureau.

Trend Analysis

In Appendix A, a graphical account of each variable across the UK, US and Japan is given. It is apparent that over time Real GDP has an upward trend which indicates an expanding economy, at the general level.

This study makes three crucial assumptions building on from similar assumptions made by Blanchard (1998). Firstly, we assume that changes in output lead to changes of equal magnitude with changes in employment levels. Secondly, we assume that firms adjust their employment levels in response to labour-productivity growth and this has no bearing on the rate of unemployment. In other words, higher induced labour-force participation rates do not have a detrimental impact of the rate of unemployment, *ceteris paribus*. Thirdly, we assume that output in the long-run will grow at its underlying rate. In other words $y = \hat{y}$ (In equilibrium as the trend rate suggests in Appendix A).

The relationship being estimated is the one between the unemployment rate and real output. Equation (2) is essentially a dynamic version (short-run) version of Okun's Law. The dynamic element stems from the fact that the economy adjusts towards equilibrium over time, hence the use of the output gap term ($y_t - \hat{y}_t$). The β coefficient measures the responsiveness of unemployment changes to changes in output growth from equilibrium (which is denoted by a minus sign in Okun's Law due to the inverse relationship it implies). The equation (2) provides the framework model which will be utilised throughout this study. Economic modelling proposes that Equation (2) is not plausible under the conditions of assuming that last years'

unemployment rate and potential output (natural rate of output) don't change. I. e. are observed into the constant. To correct this we introduce lags into the model as well as assuming that potential output is absorbed into the constant. Under this new assumption the unemployment rate is derived from the unemployment rate in the previous period. The model thus becomes;

(3)

$$U_t = \beta_0 + \beta_1 U_{t-1} + \beta_2 y_t + \varepsilon_t$$

In an expanding economy, real output increases at a stable rate, therefore putting pressure on the economy's idle resources. Okun's Law thus predicts that any increases in real output above some underlying trend coincide with falling unemployment. Additionally, potential output (\hat{y}_t) is an unobservable variable. In order to derive Okun's Law; an empirical estimation of potential output is needed. Potential output (\hat{y}_t) is generated from the Hodrick-Prescott Filter function in EViews. (Appendix A).

Potential output is regarded as the underlying trend rate of output. This effectively is the level of output that the economy would produce if it utilised all of its resources. In order to allow for this in the model for Okun's Law we substitute the output gap term ($y_t - \hat{y}_t$) into y_t from Equation (3).

This yields the following;

(4)

$$U_t = \beta_0 + \beta_1 U_{t-1} + \beta_2 (y_t - \hat{y}_t) + \varepsilon_t$$

Policymakers are concerned with attaining explicit policy objectives and in order to achieve this they are interested in how the characteristics of a variable have changed over the course of time.

In this study, the key variable examined is unemployment, whereby achieving a low unemployment rate is desirable; many national governments pursue this policy objective. The fundamental basis for Okun's Law was discovering the cost of excessive unemployment to an economy when real output grows. In an ideal world, the rate of unemployment would be low and an economy's growth rate to be expanding at a sustained level. Typically, unemployment is considerably unstable in the short run which is clear to see in the graphical representation (Appendix B) of the unemployment rates of the respective countries; The UK, US and Japan.

The primary problem with running a regression over a whole sample period using time-series data is that the relationship does vary in the short-run sometimes more often than the variations in the long-