ARE DEEP RECESSIONS FOLLOWED BY STRONG RECOVERIES? RESULTS FOR THE G-7 COUNTRIES

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Are Deep Recessions Followed By Strong Recoveries? Results for the G-7 Countries[1]

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Abstract: We examine the hypothesis that the severity of a recession favorably affects the rate of growth of output during the period immediately after the recession. Our empirical analysis is based on the behavior of industrial output in the G-7 countries during the period 1960 to 1985. We show that the depth of a recession, defined as the cumulative output loss between the peak and trough dates, is negatively correlated with growth in the first twelve months of the subsequent expansion.

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1. Introduction

Is the course of an expansion influenced in any way by the character of the preceding recession? In particular, does the economy "recover" from a recession and does the strength of this recovery depend in any way on the severity of the prior recession? In a pair of earlier papers (Wynne and Balke (1992, 1993)) we investigated this issue using the chronology of business cycle peak and trough dates that the National Bureau of Economic Research (NBER) maintains for the United States. This chronology extends back through the mid-nineteenth century and dates peaks and troughs in economic activity on the basis of the cyclical behavior of a large number of series. These peak and trough dates, along with a measure of aggregate production, allowed us to investigate how certain characteristics of recessions in the United States may influence the course of subsequent expansions. We found that while neither the length nor the steepness of a recession was correlated with output growth in the first twelve months of a recovery, the cumulative output loss over the course of the recession was significantly negatively correlated with output growth over this horizon. We interpreted this finding as being consistent with the existence of a recovery or bounce-back effect.

The notion that there is a period of recovery that is distinct from the rest of an expansion is implicit in a variety of models of the business cycle. One of the earliest explicit statements of this idea in the academic literature is Friedman (1969), who asked whether "... the magnitude of an expansion [is] systematically related to the magnitude of the succeeding contraction? Does a boom tend on the average to be followed by a large contraction? A mild expansion, by a mild contraction?"(p.271). On the basis of simple rank correlation

coefficients, he found no systematic connection between the size of an expansion and that of the subsequent contraction, but did find that "a large contraction in output tends to be followed on the average by a large business expansion; a mild contraction, by a mild expansion." Friedman (1992) reiterated these findings and presented some additional evidence in support of his "plucking model" of business fluctuations. Moore (1965) also pointed out that "...rates of increase during the initial stages of recovery [are] generally larger following severe contractions than following mild ones...[and] that initial rates of increase (during, say, the first six to twelve months) usually exceed those at any subsequent time during the business expansion..." (p.503)

In a real business cycle model (see for example King, Plosser and Rebelo (1988) and Kydland and Prescott (1982)) a recession comes about as a result of some adverse real shock that knocks the economy away from its long run equilibrium growth path. Recovery from the recession then follows the course of a return to steady state equilibrium. The dynamics of the recovery are essentially the same as the transitional dynamics of the standard neoclassical Solovian growth model. The economy grows more rapidly the further the capital stock is from its long run equilibrium level. Consequently, large technology shocks that are absorbed in part by running down the capital stock should be followed by periods of rapid growth.

It is also common in both the academic and popular literature to see recessions referred to as "purgative" episodes where "excesses" of one sort or another are "cleansed" from the economy, and are followed by periods of rapid growth as a result of this cleansing.[1] Popular statements of this idea are Blinder (1984,1989,1991), who termed it the "Joe

Palooka" effect after a popular children's toy that bounced back with greater vigor the harder it was punched.

We investigate whether the strength of the recovery is influenced by the severity of the prior recession. Specifically, we consider the notion that the economy tends to bounce back from recessions - the more severe the recession, the more vigorous the recovery.[2] In this paper we look at evidence for a sample of OECD countries (the G-7 countries) for the postwar period. We show that growth in the early stages of an expansion tends to be greater the more severe the preceding recession, where severity is measured as the cumulative output loss over the course of the recession. One innovation in this paper is that we examine the recession-recovery relationship using data on growth cycles rather than business cycles. The distinction between the two concepts is simple: business cycles are fluctuations in the absolute level of activity, whereas growth cycles refer to fluctuations about trend.[3]

2. Dating business cycles

The empirical strategy followed in this paper to test for the existence of a bounce back effect considers individual recessions and recoveries as the basic unit of observation and employs a simple regression model that allows us to distinguish between various measures of the severity of a recession. The first requirement of this approach, then, is a chronology of peak and trough dates that mark the beginning and end of recessions. As already mentioned, the NBER developed, and the Center for International Business Cycle Research (CIBCR) at Columbia University maintains, a growth cycle chronology for the United States and a number of other developed countries. Moore and Zarnowitz (1986) describe the procedures

used to construct the NBER growth cycle chronology:

"1. Measures of aggregate economic activity such as industrial production, gross national product, personal income, employment, unemployment, and sales of goods and services are expressed in physical units or in constant prices, seasonally adjusted, with their long-run trend removed. The trend fitting procedure, called the phase average trend, provides a fairly flexible growth trend that is substantially free of the shorter-term cyclical movements in the series...

2. For each of the series above, computer selected peaks and troughs are derived from the deviations of the seasonally adjusted data from the growth trend...

3. These turning points are visually inspected and sometimes altered by shifting the date, omitting the turn, or adding another turn. These changes are relatively rare, affecting perhaps 5% of the turning points.

4. Median dates in the clusters of peaks and troughs formed by all the series mentioned above are computed.

5. A composite index based on the series above before their adjustment for trend is constructed, the growth trend is removed from the index, and turning points are selected in the deviations from trend.

6. The clusters of dates, the median dates, and the composite index dates are inspected, and a decision is made on which monthly date best represents the consensus. These dates are the growth cycle peaks and troughs."(Moore and Zarnowitz, 1986, pp.772-776)

The NBER/CIBCR growth cycle chronology for the G-7 countries is shown in Table 1. Some comments are in order. The chronology in Table 1 includes 67 growth recessions (peak-to-trough movements in economic activity). The chronology for Canada begins with a trough date, while those for Germany and Japan end with peak dates.[4] Three of the 67 expansions last less than 12 months, these being the 1952-53 expansion in the United States, and the 1950-51 and 1975-76 expansions in Canada, and are thus too short for our purposes.[5] Note that there are also three expansions that are exactly 12 months long (the 1961-62 and 1968-69 expansions in Canada, and the 1965-66 expansion in France).

An alternative growth cycle chronology for the G-7 countries has been published by the OECD (OECD 1987). The construction of the OECD chronology is similar in many respects to the NBER chronology, with only minor differences between the two. The OECD published two sets of growth cycle dates for member countries for the period from 1960 through the early 1980's, one corresponding to cycles in GDP and the other corresponding to cycles in industrial production. The first of these dates cycles by quarter, while the second dates cycles by month. The monthly chronology for industrial production is shown in panel A of Table 2. The OECD chronology distinguishes between major and minor cycles: the dates of the latter are shaded in the table. The distinction between the two is that only the major cycle dates are used in the trend elimination procedure. The OECD chronology for the G-7 countries consists of fifty growth recessions, including sixteen "minor" recessions. The dates correspond reasonably closely with those identified in the NBER chronology: the conformity is highest for the United Kingdom and Japan, and lowest for France.

Since the OECD dates only run through the early 1980's we decided to supplement

this chronology with dates of our own for the period since then. Our approach was to pick peak and trough dates using the Bry-Boschan business cycle dating algorithm applied to Hodrick-Prescott filtered (log) industrial production series for each country. These dates are reported in panel B of Table 2. The Bry-Boschan algorithm also formed the basis of the OECD dating procedure (OECD 1997, p. 27). The results reported below are robust to the exclusion of these dates form our analysis.

In the empirical work below we will report results for both the NBER and OECD growth cycle dates.

3. Is there a recovery?

The notion of a recovery, and indeed the name, suggests a response or adjustment to periods of recession. Not all conceptions of the business cycle necessarily imply a recovery. For example, if recessions and expansions are draws from a two-state Markov model as in Hamilton (1989), then the notion of a recovery is not empirically relevant. In this section, we present some evidence suggesting that output behaves differently immediately after a recession than during other periods of an expansion.

As we noted above, we decided to examine the bounce-back hypothesis for the G-7 countries using growth cycles rather than classical NBER business cycles for the simple reason that business cycle chronologies do not exist for countries other than the United States. For the United States, for which we have both a business cycle chronology and a growth cycle chronology it is interesting to compare the two. This comparison is shown in Table 3. A number of points are worth noting. First, and unsurprisingly, there are more

growth cycles than there are business cycles during the period covered by the two chronologies (twelve growth cycles versus nine business cycles). The 1980-81 business cycle recovery is included in the 1978-82 slowdown in the growth cycle chronology. Note that the trough dates in the business cycle chronology tend to match troughs in the growth cycle chronology, with only two exceptions: the 1954 growth cycle trough comes 3 months after the corresponding business cycle trough, and the 1982 growth cycle trough is 1 month after the business cycle trough. Growth cycle peaks, on the other hand, tend to consistently precede business cycle peaks, by an average of just under 5 months. *A priori* we would expect that growth cycle peaks would precede business cycle peaks, and that growth cycle troughs would come later than business cycle troughs. The fact that the growth cycle troughs tend to coincide with business cycle troughs tells us something about the "shape" of the business cycle. Specifically, growth in the early stages of an expansion must be relatively rapid compared to the rest of the expansion for the trough dates of business cycles and growth cycles to coincide. That is, expansions begin with periods of strong growth. If instead the growth rate tended to accelerate over the course of the expansion, we would be more likely to see the growth cycle trough coming a lot later than the business cycle trough. This phenomenon of rapid growth in the early stages of an expansion has bee noted by other authors, including Emery and Koenig(1992) and Sichel (1992). Elsewhere we have examined this phenomenon in more detail (see Balke and Wynne (1992)).

Figure 1 illustrates the average monthly growth rate over different phases of the growth cycle for each of the G-7 countries and all of them combined. For each country, the figure shows the average monthly growth rate of industrial production from peak to peak

(labeled r), the average monthly growth between the peak and trough dates (s), the average monthly growth rate in the first twelve months of the expansion (g), and the average monthly growth rate in the rest of the expansion (h). Note that in every case the average rate of growth in the first twelve months of expansion is consistently higher than the growth rate in the rest of the expansion. Furthermore, growth in the first twelve months of the expansion is also greater than the peak-to-peak growth rate, which can be considered an estimate of trend growth. The figure is certainly suggestive of the existence of a period of rapid growth in the immediate aftermath of a recession that might in some way be influenced by characteristics of the recession. We term this a bounce-back effect, and in the next section we investigate its nature.

4. The bounce-back effect

To test for the existence of a bounce-back effect, we consider a simple empirical model that expresses output growth in the early stages of an expansion as a function of three characteristics of the preceding recession. The variables we consider are measures of the depth, length and steepness of the recession. This builds on results reported in a pair of earlier papers (Wynne and Balke (1992,1993)) where we looked at growth during the first twelve months of an expansion as a function of the cumulative output decline over the course of the prior recession using U.S. industrial production data.

4.1 Empirical model

The model estimated in Wynne and Balke (1992) related (cumulative) growth during

the first k months of an expansion to the (cumulative) decline in output over the course of the prior recession. This can be written in log terms as

$$(y_{T_i+k} - y_{T_i}) = \alpha_0 + \alpha_1(T_i - P_i) + \alpha_2(y_{T_i} - y_{P_i}) + \epsilon_i \qquad (1)$$

where y_t denotes the log of output at date t, P_i is the date of the peak denoting the onset of the i'th recession, T_i is the date of the trough denoting the end of the i'th recession, T_i+k is k months after the trough date of the i'th recession, ϵ_i is an error term (assumed to have the usual properties) and α_0, α_1, α_2 are parameters to be estimated.

This equation can be rewritten as

$$k\, g_i(k) = \alpha_0 + \alpha_1(T_i - P_i) + \alpha_2 s_i(T_i - P_i) + \epsilon_i \qquad (2)$$

where $g_i(k)$ is the average monthly growth rate during the first k months of the expansion and s_i is the average monthly change in output over the course of the i'th recession. It is useful to think of s_i as a measure of the "steepness" of the decline in output over the course of a recession. The "depth" of the recession, as measured by the difference between output at the peak and trough dates, can be written as $d_i = s_i(T_i - P_i)$.

This model in turn suggests a more general model of the form

$$g_i(k) = \alpha_0 + \alpha_1 s_i + \alpha_2(T_i - P_i) + \alpha_3 s_i(T_i - P_i) + \epsilon_i \qquad (3)$$

This model relates growth in the first k months of an expansion to three characteristics of the prior recession, namely the steepness of the recession as measured by s_i, its length as measured by $(T_i - P_i)$, and its depth as measured by $d_i = s_i(T_i - P_i)$. Under the hypothesis that the severity of a recession favorably affects the rate of output growth immediately after the recession, we would expect some or all of the estimated coefficients α_1, α_2, α_3 to be significant. If the dimension of severity that matters is the steepness of the recession, we would expect $\alpha_1 < 0$. If instead it is the length that matters, we would expect that $\alpha_2 > 0$. If what matters is the cumulative output decline over the course of recession (so that the "cleansing effect" of a short sharp recession is identical to that of a long shallow recession) then we would expect $\alpha_3 < 0$.

4.2 Results for the G-7 countries

In our earlier studies of the bounce-back effect for the United States, we focused on the behavior of industrial production during and after recessions primarily because of the degrees of freedom problem that arises from taking individual recessions as the unit of observation. The Federal Reserve's Index of Industrial Production is available on a monthly basis back to 1919, and Miron and Romer (1990) have constructed a historical series for industrial production that covers the period from 1884-1940. Monthly measures of industrial and manufacturing output are available for a large number of OECD countries for the postwar period, and as we have already discussed, reference cycle chronologies have been published by Moore and Zarnowitz (1986) and OECD (1987).

To test for the bounce-back phenomenon across countries, we focused on the G-7

group of industrial nations. An immediate concern when pooling the observations from these countries for the postwar period is the potential effect of the radically different secular growth rates during this period. For this reason we decided to control for trend growth rates in all of the basic regressions, yielding the following empirical model specification:

$$g_i(k) = \alpha_0 + \alpha_1 s_i + \alpha_2(T_i - P_i) + \alpha_3 s_i(T_i - P_i) + \alpha_4 r_i + \epsilon_i$$

where r_i is the trend rate of growth during the i'th cycle, defined as the average rate of growth from peak to peak. Defining the trend rate of growth in this way allows for changes in the trend growth rate over time. A priori we expect that $\alpha_4 > 0$.

Table 4 presents the results of estimating the basic bounce back equation for industrial production in the G-7 countries using the NBER business cycle dates reported by Moore and Zarnowitz. The first row of the table shows the results of regressing growth in the first twelve months following a trough date on the depth variable alone (i.e. $k=12$). This was the specification that was found to be most satisfactory for the United States (see Wynne and Balke (1992)). The coefficient estimate is of the right sign and statistically significant, consistent with the presence of a bounce-back effect. However the low $\bar{R}^2$ raises the possibility of significant omitted variable bias. The second row of the table augments the basic specification with the trend growth rate. Doing so leads to an increase in the absolute magnitude of the coefficient estimate on the depth variable, but its sign and significance are unchanged. Not surprisingly, the coefficient estimate on the trend growth variable is positive and statistically significant, and the $\bar{R}^2$ increases dramatically, from 0.10 to 0.63. The last

three rows show the effects of augmenting the equation with the steepness and length variables, both individually and together. As was the case for the United States, neither of these variables add anything to the ability of the model to explain growth in the first twelve months of the expansion. It is perhaps not surprising that only two of the coefficients reported in the last row are significant in a statistical sense, given the potentially severe multicollinearity between the explanatory variables.[6] Note that the absence of any correlation between the length of a downturn and the strength of the subsequent recovery was also noted by OECD (1992) for a shorter sample than that considered here and using GDP as the measure of aggregate activity.

Table 5 reports the results obtained from estimating the same models using the OECD business cycle dates instead of the NBER dates. Note that now the depth variable on its own has absolutely no ability to explain growth in the first twelve months of an expansion. When the depth variable is augmented with the trend growth variable, it becomes significant at the five percent level. As with the NBER chronology, neither the steepness nor the length variables have any explanatory power. In general the results obtained using the OECD dates are somewhat weaker than those obtained using the NBER dates.[7]

5. Conclusions

In this paper we presented evidence supporting the notion that economies experience a bounce-back effect following recessions. We focused on the behavior of industrial production in the G-7 countries during the postwar period, and found that the depth of the recession bore a statistically significant (and negative) relationship to growth in the twelve

month period following the end of the recession. We also examined measures of "steepness" and of length of a recession, where the former is defined as the average monthly growth rate of output over the course of the recession, and the latter is simply the number of months between the peak and trough dates. Neither variable was found to be significant when considered in conjunction with the depth variable, confirming our earlier results for the United States.

The immediate policy implications of our results are not so obvious, as we have not examined how the strength of the bounce-back effect is influenced by policy variables such as interest rates, government spending or tax rates. It is arguable that the existence of a relationship between growth in the early stages of a recovery and the severity of the preceding recession may reflect some sort of self correction mechanism at work. It is equally arguable that rapid growth may reflect a vigorous policy response initiated as a result of the severity of the preceding recession. The results presented above do not allow us to discriminate between these competing views of recoveries, but hopefully may encourage further investigation of these competing hypotheses.[8]

However, the results in this paper, when considered in combination with the results in our earlier papers, suggest the existence of an interesting empirical phenomenon that may be useful in evaluating business cycle models. Elsewhere (Balke and Wynne (1995)), we have examined the ability of a prototypical real business cycle model to reproduce the bounce back phenomenon, and found that typically the relationship is stronger empirically than can be generated in reasonable parameterizations of real business cycle models.

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Table 1

NBER/CIBCR Growth Cycle Chronology for the G-7 Countries

	United States	Canada	Japan	Germany	France	Italy	United Kingdom
Peak	1948:7						
Trough	1949:10	1950:5					
Peak	1951:3	1951:4		1951:2			1951:3
Trough	1952:7	1951:12					1952:8
Peak	1953:3	1953:3	1953:12				
Trough	1954:8	1954:10	1955:6	1954:2			
Peak	1957:2	1956:11	1957:5	1955:10	1957:8	1956:10	1955:12
Trough	1958:4	1958:8	1959:1	1959:4	1959:8	1959:7	1958:11
Peak	1960:2	1959:10					
Trough	1961:2	1961:3					
Peak	1962:5	1962:3	1962:1	1961:2	1964:2	1963:9	1961:3
Trough	1964:10	1963:5	1963:1	1963:2	1965:6	1965:3	1963:2
Peak			1964:7				
Trough			1966:2				
Peak	1966:6	1966:3		1965:5	1966:6		1966:2
Trough	1967:10	1968:2		1967:8	1968:5		1967:8
Peak	1969:3	1969:2	1970:6	1970:5	1969:11	1969:8	1969:6
Trough	1970:11	1970:12	1972:1	1971:12	1971:11	1972:9	1972:2
Peak	1973:3	1974:2	1973:11	1973:8	1974:5	1974:4	1973:6
Trough	1975:3	1975:10	1975:3	1975:5	1975:6	1975:5	1975:8
Peak		1976:5				1976:12	
Trough		1977:12				1977:10	
Peak	1978:12	1979:10	1980:2	1980:2	1979:8	1980:2	1979:6
Trough		1980:5			1981:8		
Peak		1981:6			1982:12		
Trough	1982:12	1982:11	1983:6	1983:7		1983:5	1983:6

Table 1 (continued)

NBER/CIBCR Growth Cycle chronology for the G-7 Countries

	United States	Canada	Japan	Germany	France	Italy	United Kingdom
Peak	1984:6	1985:11	1985:5	1986:7		1985:6	1985:5
Trough	1987:1	1986:11	1987:5		1987:1	1987:8	1987:1
Peak	1989:3	1989:1					
Trough				1988:4			
Peak						1988:7	
Trough						1989:5	
Peak			1991:5	1991:4	1990:8		1990:2
Trough	1991:12						
Peak						1992:4	
Trough		1992:7			1993:10	1993:12	1992:12

Notes to Table 1. Source: Moore and Zarnowitz (1986) Table A.8; Center for International Business Cycle Research (1993), Appendix A; Anirvan Banerji (private communication).

Table 2

OECD Growth Cycle Chronology for the G-7 Countries

Industrial Production

	United States	Canada	Japan	Germany	France	Italy	United Kingdom
Panel A: official OECD dates							
Peak	1960:1	1959:10			1960:9	1960:6	1960:3
Trough	1961:2	1961:3				1960:12	
Peak	1961:12	1962:7	1962:1	1961:3		1962:1	
Trough	1962:12	1963:8	1962:12	1963:2	1963:3	1962:9	1963:1
Peak	1963:5		1964:2	1965:1	1964:1	1963:9	1965:5
Trough	1964:10		1966:2		1965:1	1965:3	
Peak	1966:10	1965:12	1967:11		1966:7	1967:2	
Trough	1967:7	1968:2	1968:9	1967:5	1967:10	1968:3	1967:8
Peak	1969:8	1969:3	1970:6	1970:5	1969:5	1969:1	1969:6
Trough	1970:11	1970:10	1972:1	1971:12	1971:5	1972:4	1972:2
Peak	1973:9	1974:1	1973:11	1973:8	1974:7	1974:1	1973:6
Trough	1975:3	1975:10	1975:3	1975:7	1975:5	1975:5	1975:8
Peak		1977:1	1977:1	1977:3	1977:1	1976:12	
Trough		1977:9	1977:7	1978:3	1977:12	1977:12	
Peak	1979:3	1979:9	1980:2	1979:12	1979:7	1980:4	1979:6
Trough	1980:7	1980:6	1981:5				1981:5
Peak	1981:7	1981:6	1981:10				
Trough	1982:11	1982:12	1983:2	1982:12	1982:8	1983:6	

Table 2 (continued)

OECD Growth Cycle Chronology for the G-7 Countries

Industrial Production

	United States	Canada	Japan	Germany	France	Italy	United Kingdom
Panel B: Supplemental Dates							
Peak	1984:7	1984:5	1984:10	1983:12	1984:5	1984:8	1984:1
Trough	1984:12	1984:12		1984:6	1985:1	1985:10	1984:8
Peak	1986:1	1986:1			1985:11	1986:4	1985:6
Trough	1986:6	1986:11	1987:5		1987:8		1985:12
Peak		1988:3	1988:2				1988:9
Trough		1989:10	1990:1			1989:5	1989:6
Peak	1990:9	1990:7	1991:5	1989:4		1989:12	1990:6
Trough	1991:3	1991:12	1992:8	1990:4		1991:4	1991:4
Peak	1993:2	1993:3		1992:2	1992:10	1992:5	1992:10
Trough	1993:10	1994:2		1993:2	1993:12	1994:1	1993:6

Notes to Table 2. OECD (1987) Table 13.3 and authors calculations. The shaded dates are designated as "minor cycles" in the OECD chronology.

Table 3

Comparison of Growth Cycle and Business Cycle Chronologies

for the United States

	Growth Cycles	Business Cycles
Peak	1948:7	1948:11
Trough	1949:10	1949:10
Peak	1951:3	
Trough	1952:7	
Peak	1953:3	1953:7
Trough	1954:8	1954:5
Peak	1957:2	1957:8
Trough	1958:4	1958:4
Peak	1960:2	1960:4
Trough	1961:2	1961:2
Peak	1962:5	
Trough	1964:10	
Peak	1966:6	
Trough	1967:10	
Peak	1969:3	1969:12
Trough	1970:11	1970:11
Peak	1973:3	1973:11
Trough	1975:3	1975:3
Peak	1978:12	1980:1
Trough		1980:7
Peak		1981:7
Trough	1982:12	1982:11
Peak	1984:6	
Trough	1987:1	
Peak	1989:3	1990:7
Trough	1991:12	1991:3

Notes to Table 3. Source: Moore and Zarnowitz (1986) Tables A.5 and A.8; Center for International Business Cycle Research (1993).

Table 4

Estimates of $g_t(12) = \alpha_0 + \alpha_1 s_t + \alpha_2(T_t - P_t) + \alpha_3 d_t + \alpha_4 r_t$

Industrial Production

G-7 countries; using NBER/CIBCR business cycle dates

α_0	α_1	α_2	α_3	α_4	$\bar{R}^2$	se
0.741***			-0.025**		0.10	0.586
(0.091)			(0.010)			
-0.023			-0.056***	2.297***	0.63	0.377
(0.110)			(0.008)	(0.280)		
-0.022	0.012		-0.056**	2.297***	0.62	0.381
(0.112)	(0.316)		(0.017)	(0.284)		
-0.147		0.004	-0.057***	2.360***	0.62	0.379
(0.191)		(0.005)	(0.008)	(0.292)		
-0.232	-0.246	0.007	-0.046**	2.407***	0.62	0.382
(0.238)	(0.408)	(0.007)	(0.020)	(0.304)		

Notes to Table 4. The sample consists of 49 observations. The industrial production data are from OECD Main Economic Indicators. Business cycle peak and trough dates are from Table 1. * denotes significance at the 10% level; ** denotes significance at the 5% level; *** denotes significance at the 1% level. Standard errors are in parentheses.

Table 5

Estimates of $g_t(12) = \alpha_0 + \alpha_1 s_t + \alpha_2 (T_t - P_t) + \alpha_3 d_t + \alpha_4 r_t$

Industrial Production

G-7 countries; using OECD business cycle dates

α_0	α_1	α_2	α_3	α_4	$\bar{R}^2$	se
0.799***			0.006		-0.01	0.459
(0.082)			(0.009)			
0.262*			-0.020**	1.467***	0.31	0.381
(0.135)			(0.009)	(0.319)		
0.256*	0.240		-0.033**	1.534***	0.32	0.379
(0.134)	(0.199)		(0.015)	(0.322)		
-0.343		0.019***	-0.033***	1.341***	0.45	0.339
(0.211)		(0.005)	(0.009)	(0.304)		
-0.451*	-0.198	0.022**	-0.024*	1.856***	0.45	0.340
(0.244)	(0.222)	(0.007)	(0.013)	(0.305)		

Notes to Table 5. The sample consists of 46 observations. The industrial production data are from OECD Main Economic Indicators. Business cycle peak and trough dates are from Table 2. * denotes significance at the 10% level; ** denotes significance at the 5% level; *** denotes significance at the 1% level. Standard errors are in parentheses.

1. See for example the recent papers by Caballero and Hammour (1991) and Aghion and Saint-Paul (1991).

2. An obvious corollary that we do not consider in this paper is that expansions contain the seeds of the subsequent recession.

3. The growth cycle concept was introduced by Mintz (1969) at a time when it appeared that the traditional business cycle was dead. Subsequent experience has shown that the traditional business cycle is very much alive.

4. Note that the dates for Germany refer to West Germany. The OECD industrial production series that we use in our empirical work refer to West Germany for the period prior to July 1990, and to all Germany from July 1990 on.

5. In our empirical model we define the recovery period to be the first twelve months of an expansion.

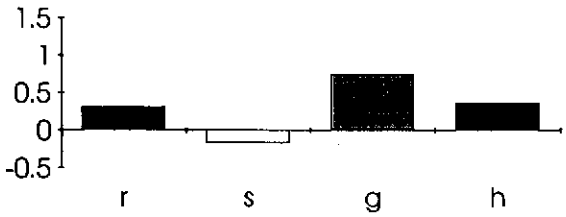
6. This point was noted by the referee.

7. We also examined the behavior of the model when manufacturing output is used instead of industrial output as the output measure. The pattern of the results was essentially the same as those reported in Tables 4 and 5.

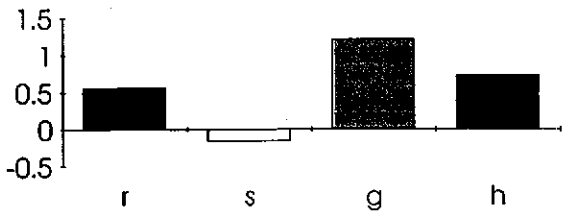
8. For some preliminary results on the possible role of policy in contributing to the bounce-back phenomenon see OECD (1992), where it is noted that strong recoveries are typically preceded by larger interest rate reductions than weak recoveries, and that strong recoveries are also typically those where the fiscal stance has eased the most.

Industrial Production
Growth Rates
(NBER Dates)

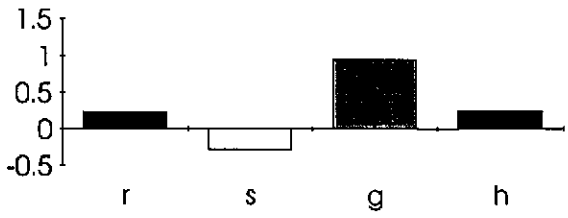
Canada



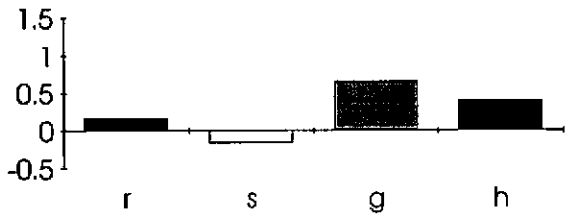
Japan



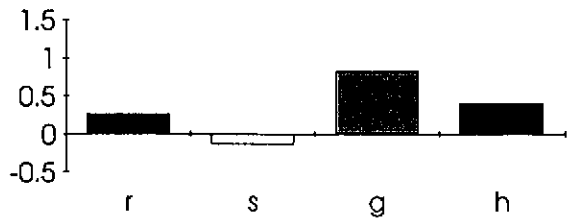
France



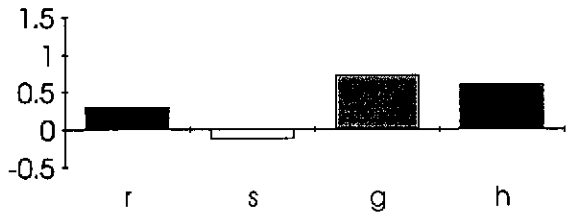
United Kingdom



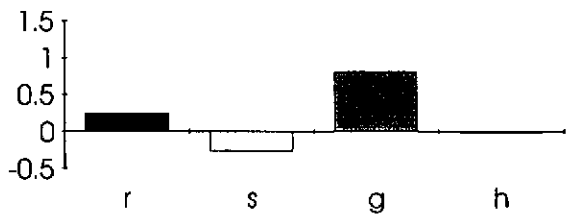
Germany



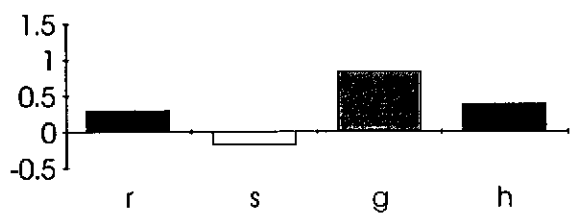
United States



Italy



G-7



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