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Abstract

A number of previous studies have looked at the effect of financial crises on actual output several years beyond the crisis. The purpose of this paper is to examine whether the growth of potential output also is affected by recessions, whether or not they include financial crises. Trend per capita output growth is calculated using HP filters, and average growth is compared for the two years preceding a recession, the two years immediately following a recession peak, and the two years after that. Panel regressions are run to determine whether characteristics of recessions, including depth, length, extent to which they are synchronized across countries, and whether or not they include a financial crisis, can explain the cumulative four-year loss in the level of potential output following an output peak preceding a recession. The main result is that the depth of a recession has a significant effect on the loss of potential for advanced countries, while the length is important for emerging markets. These results imply that the Great Recession might have resulted in declines in trend output growth averaging about 3 percent for the advanced economies, but appear to have had little effect on emerging market trend growth.

Keywords: growth, potential, cycles

JEL classifications: E32, O40

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Do Recessions Affect Potential Output?

1. Introduction

As the global economy struggles to recover from the Great Recession, a question that is likely to become increasingly relevant for policy purposes is the extent to which potential output may have been affected by the contraction in output. The lower potential output, the smaller the output gap for a given level of actual output and the sooner inflationary pressures may appear.

There are a number of reasons why growth rates of potential output, and possibly even the level, might fall during a recession. The most obvious is that investment generally contracts, resulting in a permanently lower level of the capital stock even if investment later recovers to its pre-recession level. If technical change is embodied, lower investment may also have a negative effect on the rate of technical progress.

Productivity could also be impacted in other ways. To the extent that necessity is the mother of invention, firms may be less likely to invest resources in innovation when demand is shrinking than when it is growing. Also, with fewer employees on payrolls, there is less learning-by-doing.

In addition, there may be implications for the equilibrium rates of employment and/or labor force participation. If workers are unemployed long enough, their job skills may atrophy, while new entrants may never obtain them. If the recession results in a major shift in the distribution of employment by occupation, the skills of the labor force may not be as good a fit for demand immediately after the recession as they were before. Some workers may become discouraged and drop out of the labor force altogether.

The permanent loss also may be greater the more synchronized the recession is across economies. If only one country is in recession while others remain at capacity, it might be possible for industries in that country to later catch up by importing technical innovation from the faster-growing economies. However, if all of the major economies are in recession at the same time, it may be more likely that the overall process of technical innovation will stall.

The purpose of this paper is to assess whether recessions tend to depress trend output over the four years following the onset of a recession, and whether these changes are related to the characteristics of the recession. The sample includes 40 countries, both advanced and emerging markets, for a total of 187 recessions. Unlike many previous studies, this paper does not focus exclusively on financial crises, but instead attempts to determine whether potential (or, more accurately, trend) output is affected by recessions, regardless of whether they qualify as financial crises.

In order to abstract from changes in trend output related to changes in working-age population growth, the variable used was GDP relative to persons aged 16 and over. Trend output per capita was estimated using HP filters, and growth rates were calculated for the two years preceding a recession, the two years immediately following the output peak, and the following two years. The difference between the first two periods measures the immediate effect of a recession on trend output growth, and the difference between the second and third periods measures to what extent any reduction in growth is later reversed. In order to avoid a loss in the level of trend output, the growth rebound would have to more than compensate for any reduction in the first two-year period. The cumulative loss of potential output is calculated as the difference between the estimated

level and what would have been attained if potential had continued to grow at its pre-recession rate.

Panel regressions were estimated to assess whether some of the important characteristics of recessions, such as length, depth, how synchronized they are with recessions in other countries, and whether or not they include financial crises, can explain the initial change in trend output, the degree of bounceback, and/or the size of the cumulative change in trend output. The equations for the cumulative change were used to project the size of the overall reduction in trend output per capita that might be expected four years after the beginning of the Great Recession.

The primary result is that recessions do appear to have a measurable impact on trend output over the four-year period following the beginning of the recession. Trend output growth rates fall by an average of about ½ percentage point in the two years following the peak, and only about half of that decline is reversed in the following two years. Thus, the cumulative loss is about 1½ percentage points. The output loss is on average larger for the advanced than for the emerging economies.

The panel regression results indicated that the depth of the recession is important for the advanced economies, but not the length; the opposite is true for the emerging markets. Synchronicity was not significant in any of the cumulative-change regressions, although it does appear to have some effect on the contour of the post-peak growth in trend output, reducing it in the first period and boosting it in the second period. Somewhat surprisingly, the financial crisis dummy is not significant in any of the regressions.

When applied to the most recent recession, the regression coefficients imply an average loss in trend output of a little more than 3 percentage points for advanced economies four years after the peak. For emerging markets, where the recessions were generally not as long as the past average, the equations in fact predicted an increase for 10 of the 16 countries that experienced recessions (China, India, and Indonesia did not).

Ten of the countries in the sample, all in the advanced group, have detailed data on the components of output, allowing for some analysis of how the different factors contribute to changes in the trend. The results differ widely across countries, making generalizations difficult. However, reductions in the growth of the capital-labor ratio, not surprisingly, have a substantial effect on the decline in the level of trend output for most of these countries.

The remainder of the paper is organized as follows: section 2 puts the paper in the context of previous work, section 3 details the data and methodology, section 4 presents the results, and section 5 concludes.

2. Previous Studies

Previous work on the effect of recessions on output has focused primarily on the effects of banking and financial crises on actual output, looking at the impact on levels, growth rate, and/or relation to trend. As summarized by Angkinand (2008), these studies either regress real GDP growth rates on crisis dummies, to obtain estimates of the effect of a crisis on annual GDP growth, and then extrapolate the total effect by multiplying by the length of the crisis, or derive the magnitude of total losses during a crisis by calculating the deviation between actual and potential output.

Only a few studies have attempted to estimate the effect of the crisis on potential output itself, a task made difficult by the fact that potential output is not directly observed. Furceri and Mourougane (2009) is one example. Using both production function and HP filter-based measures of potential output, they estimate an average loss in the level of potential output as a result of a crisis of 1.5-2 percentage points. For severe crises, the loss can be as high as 4 percent. Abiad et. al. (2009) look at medium-term output dynamics, which is closely related to changes in trend output, and find an average output loss of about 10 percent relative to trend after a 7-year period. Again, both of these studies focus on banking and/or other financial crises. Howard et. al (2011) look at a wider range of recessions and find that deep and long recessions lead to a sustained loss of output relative to pre-recession trend of about 8 to 10 percent after ten years.

As noted earlier, this paper looks at a wider range of recessions than most previous studies, similar to Howard et al. It also looks directly at potential output, proxied by HP filter trends. In addition, in order to abstract from changes in trend related to changes in population, the variable used was GDP relative to working-age population (persons aged 16 and over). Recessions were identified as two or more quarters of negative growth in output per capita (unless interrupted by a quarter that does not reverse the first quarter's growth) with a total decline of at least one percent. A total of 187 recessions are identified for 40 countries, 97 in advanced economies and 90 in emerging economies.

As noted above, trend output per capita is calculated using HP filters. There are obviously a number of drawbacks to this approach. As has been noted in previous

studies, because it is a two-sided filter, the estimate of trend output prior to the recession could be understated by including the post-peak observations in the filtered series. On the other hand, it has also been observed that output often appears to exceed its trend level in the run-up to a recession, implying that it would also not be desirable to only run the filter through the pre-recession peak. Some studies have attempted to circumvent this problem by measuring pre-recession trend output growth in a period that ends one or two years before the peak. However, because recessions occur fairly frequently in many of these countries, this approach risks either contaminating the results with data from previous recessions, or, if these observations are dropped, severely limiting the number of episodes.

The reality is that there is no perfect way to measure potential and/or trend output. This study uses HP filter estimates because, although production function-based estimates are available for some countries, they are not available for the range of countries used here due to lack of detailed data. The estimates obtained probably represent a lower bound on the effect of recessions on trend output, because the two-sided smoothing of the filter would, if anything, understate the size of the break that a recession might cause.

3. Data and Methodology

The analysis of trend output uses an unbalanced panel of GDP and working-age population for forty countries, 21 advanced and 19 emerging markets.[1] The GDP data

[1] The advanced countries are: The United States, Canada, Australia, Japan, the United Kingdom, Switzerland, Sweden, Norway, Denmark, France, Germany, Italy, the Netherlands, Austria, Belgium, Luxembourg, Finland, Ireland, Spain, Portugal, and Greece. The emerging market economies are: China, Hong Kong, Taiwan, South Korea, Singapore, Malaysia, the Philippines, Thailand, Indonesia, India, Argentina, Brazil, Chile, Colombia, Mexico, Venezuela, Turkey, Israel, and South Africa.

come from national sources, and the working-age population data are from the World Bank database.

After trend output per working age person was derived using HP filters, trend growth was then calculated for the two years prior to the beginning of each recession, the two years after the output peak, and the following two years. The object was to first determine whether trend growth does appear to fall as a result of a recession and secondly, to what extent any declines are later reversed. Although the HP filter is certainly not a perfect measure of trend (much less potential) output, it is still the case that if a decline in growth observed during the two-year period following the onset of a recession is temporary, these data should show a reversal.

The cumulative change in the level of trend output after the four-year period is calculated as the difference between the actual level of trend output and what the level would have been if output had continued to grow at its pre-recession rate, as illustrated in figure 1.

4. Empirical Results

A. Changes in Trend Output

Table 1 shows the average growth rates over the two years preceding each country's recessions, the average growth rates for the two years following the peak, the average growth rates for the next two years, the changes between the periods and the cumulative change in the level.

As shown in column 4, for 33 of the 40 countries, including all 21 of the advanced economies, average growth of trend output is lower in the two years after a cyclical peak than in the two years before, although the amounts vary considerably across countries.

Although growth also falls in most of the emerging market economies as well, there are five economies in emerging Asia, including China, where trend growth actually increases following a recession peak. For Turkey, there is no change in growth rates between the two periods. As shown in column 5, for nearly all of these countries there is some rebound in trend growth in the following two-year period. However, in most cases it is not enough to make up for the period of weak growth, and so there is a cumulative loss, shown in column 6.

Table 2 shows summary statistics for all economies, the advanced economies, and the emerging market economies. The average reduction in trend output growth between the two years before and after the peak is about ½ percentage point. On average, trend output growth retraces a little less than half of this decline in the next two years, leaving the rate still below its pre-recession rate. The average cumulative loss in the level of trend output is about 1½ percentage points.

The overall effect is larger for the advanced than for the emerging economies, which show a slightly smaller decline in the first two-year period and a slightly larger rebound in the second two-year period. The cumulative loss in the level of output is about 1¾ percentage points for the advanced economies and about 1 percentage point for the emerging economies. The standard deviations are sizable for all of these statistics, indicating that recessions are far from uniform across countries.

One problem with these calculations is that, if an economy was experiencing a recession during the two-year period over which the pre-crisis trend is calculated and/or has another recession within the 4-year period following the peak, the degree of rebound in trend output may be either over- or under-stated. To address this issue, the analysis

was repeated excluding such recessions, of which there are a total of 77. The majority of the excluded recessions are in the emerging economies, 51 compared with 26 for the advanced economies. The results of this analysis are shown in table 3.

The average cumulative loss for recessions not followed by another recession is again around 1½ percent, nearly 2 percentage points for the advanced economies and about 1¼ percentage points for the emerging markets. Both advanced and emerging economies show a decline in average trend growth of about ½ percentage point in the first two years of a recession, but the emerging market economies show a considerably stronger rebound in the next two years, with growth returning to its pre-recession rate. Nevertheless, the rebound is still not strong enough to make up for the period of slower growth, resulting in a cumulative loss in the level of trend output of about 1½ percent.

B. Effects of Characteristics of Recessions on Trend Output

This section looks at whether the initial change in trend growth, the rebound, and/or the cumulative loss in the level of trend output over the four-year period following a recession is related to the depth (total decline in per capita output) and length (number of quarters from peak to trough) of the recession. A variable that measures the degree to which the recessions are synchronized across countries also is included in the analysis. This variable is measured as the sum of all the quarters in which recessions in other countries overlap with each recession in the sample, divided by the number of quarters in that recession. A dummy variable for whether or not the recession included a financial crisis[2] also was included. There were 30 such crises in the sample, 6 in advanced and 24 in emerging economies.

[2] The financial crisis dates are taken from Laeven and Valencia (2008).

Summary data for length, depth, and synchronicity are shown in table 4. The average length of the recessions in the full sample is 6 quarters, for both advanced and emerging market economies. For the sample that excludes later recessions, the average is nearly 7 quarters for the total, with emerging market recessions about 1 quarter longer on average than advanced economy recessions. The average depth for all recessions is a little less than 6 percentage points both for recessions that are preceded and/or followed by another downturn and those that are not. Emerging economy recessions are about twice as severe on average as those in advanced economies. However, as indicated by the sizable standard deviations, there is considerable variation across recessions.

The synchronicity variable averages about 12 over the full sample, with recessions in advanced economies a little more synchronized on average than those in emerging markets. However, as indicated by the standard deviation of almost 6, synchronicity also varies widely across recessions.

The changes in growth rates between the first and second two-year periods and between the second and third two-year periods as well as the cumulative change in the level relative to what would have occurred if output growth had remained at its trend, were all regressed on length, depth, synchronicity, and the financial crisis dummy in panel regressions. These regressions also included dummy variables for whether or not there was another recession in either the two years preceding the peak or the four years following it.

For the cumulative change in trend output, the sign on length is expected to be negative, as a longer recession would be likely to result in a greater decline in trend output. The sign on depth should be positive, as a more negative change in actual output

would be expected to cause a bigger reduction in trend output. The sign on synchronicity is expected to be negative as well, as a more highly synchronized recession might be expected to have a bigger negative effect on the process of technical change. The financial crisis dummy also should have a negative sign. The sign on the pre-recession dummy is expected to be positive (if the previous growth rate is understated the cumulative change might be less negative), while the sign on the post-recession dummy is expected to be negative.

The results are shown in table 5. For all recessions for all countries, length has a significant effect on the loss of output. In the equation that does not include the recession dummies, the effect is about .3 per quarter; when the dummy is included the effect increases to .4. The coefficient on depth is smaller (about .1) and is not significant. The coefficients on the dummies for both earlier and later recessions are large (about 3) and highly significant. Neither the synchronicity variable nor the financial crisis dummy variable is significant.

The table also includes results from separate regressions for the advanced and emerging economies. The results differ substantially between the two categories. For the advanced economies, the depth coefficient is quite sizable at about .4 and it is also highly significant. However, length is not significant. The dummy variable for an earlier recession is significant, but that for a later recession is not. Again, neither the synchronicity nor the financial dummy variables are significant.

For the emerging economies, the results are quite different. The depth variable is small, incorrectly signed and insignificant, while the length variable is twice as large as in the aggregate recession (about .7) and highly significant. The coefficient on the pre-

recession dummy variable is about 3 and that on the post-recession dummy is nearly 5; both are significant. The synchronicity and financial crisis variables again are not significant.

Thus, the depth of the recession appears to matter for the advanced economies, while the length matters for emerging markets. Because the recession dummy variables were so important, the analysis was repeated using only the recessions that do not have either earlier or later recessions. Those results are shown in table 6.

For all countries, the coefficient on length is a little larger than in the regressions with all recessions (about .4) and the depth variable is still small and insignificant. The synchronicity and financial crisis variables also remain insignificant.

For the advanced economies, the length variable is still insignificant and the depth variable is still significant and about the same size as in the previous regressions. The length variable is again significant for the emerging market economies and the depth variable is still insignificant, as are the synchronicity and financial crisis variables.

Table 7 shows the estimated coefficients for similar regressions in which the dependent variable is the change in trend growth between the two years preceding the recession peak and the two years immediately following. The signs on the coefficients are all expected to be the same as the cumulative change regression.

For the sample that includes all recessions, both length and depth are significant and correctly signed. Each quarter of recession reduces trend output growth by about .06 percent per year and each percentage point of contraction reduces it by about .05 percent. Both of the recession dummies are highly significant, with the earlier recession dummy

adding .5-.6 percent per year and the later subtracting about .4 percent. The synchronicity and financial crisis variables are still not significant.

Depth is again more important for advanced economies than for emerging markets (.08 vs. .05), although it is significant for emerging markets. Length is again significant for emerging markets, but not for advanced economies, although it is correctly signed for both. The coefficient on the dummy variable for an earlier recession is significant and similar-sized at about .5 for both groups. However, the dummy for a later recession is about twice as large for emerging markets, .6 vs. .3. The synchronicity variable is significant for the advanced economies, suggesting that more widespread recessions do have some impact on the initial impact on trend growth for these economies even if the differences do not play a significant role in the cumulative loss.

The results for the stand-alone recessions, shown in table 8, are generally similar although the synchronicity dummy is not significant for this group.

Tables 9 and 10 show the results for the change in trend growth rates between the initial two year period and the two years after that. The change for the first two-year period is included as an explanatory variable, and is positive and highly significant. This suggests that larger reductions in trend output in the first period are generally followed by milder rebounds. The coefficient on length is generally negative, as was the case for both the initial and the cumulative change. The coefficient on depth also is negative, indicating that deeper recessions, all else equal, do result in a stronger bounceback in trend growth. The coefficient on synchronicity is positive and significant for both advanced and emerging market economies, suggesting that more widespread recessions also are associated with a stronger rebound in trend output growth. Thus, synchronicity

seems to affect the contour of the impact on trend growth—bigger initial decline, stronger bounceback—even though it did not have an effect on the cumulative reduction in the level of trend growth. The financial crisis dummy again is not significant.

C. Loss in Current Recession

The coefficients from the equations shown in the first line of each section of table 6 (the stand-alone recessions) were used to estimate the size of the trend loss they would predict for the most recent recession, given the length and depth. The equations used for the prediction exercise do not include the synchronicity and financial crisis variables, given that they were not significant. These results are shown in table 11 for each country using both the coefficients from the regression that included all countries as well as the separate ones for the advanced and emerging economies.

Using the coefficients from the aggregate equation, the cumulative loss is small for most countries. Not surprisingly, Greece and Portugal show the largest expected losses (near 3 percent), but the reductions are also more than 2 percent for the United Kingdom, Belgium, Finland, and Denmark. The average for the advanced economies is a little less than one percent. This is about twice as large as the average expected loss for the emerging economies. In fact, China, India, and Indonesia did not experience any recession in the most recent period.

The results, particularly for the advanced economies, are quite different using the equation that is specific to that group. For the advanced economies, the average projected cumulative loss in trend output is 3 percent, with reductions of 4 percent or more for a number of the European countries, and 2½ percent for the United States. In contrast, the emerging markets actually show a small increase, as their recent recessions

were generally shorter than the past average and length is more important than depth for these countries. For all of the countries, the average loss is .6 percent using the aggregate equation and just over 1 percent using the separate category equations.

D. Effect of recessions on components of trend output

Output per working-age person can be decomposed into a number of factors: output per hour, average hours per employee, employment as a fraction of the labor force, and labor force as a fraction of the working-age population. This section looks at the extent to which each of these factors has been affected by prior recessions.

Unfortunately, the detailed data required to do this analysis are available for only ten of the countries in the sample, all advanced economies: the United States, Canada, Australia, Japan, the United Kingdom, Sweden, France, Germany, Italy, and the Netherlands. Among this group, there are 43 recessions in the sample period, 35 if recessions that are closely preceded and/or followed by other recessions are excluded.

Tables 12 and 13 show the breakdown of the changes in trend output for these countries for all recessions and for stand-alone recessions, respectively. Output per hour is further decomposed into the contributions of the capital-labor ratio and total factor productivity. The former is calculated as the change in the ratio of capital to trend labor input weighted by capital's share of income and the latter is the residual between total output per hour and the capital-labor ratio contribution.

For both sets of recessions the average cumulative reduction in trend output is about 1¼ percentage point. There is substantial variation across countries, as trend output in the United States, Australia, and the Netherlands shows little or no reaction to recessions on average. There is also little effect for the stand-alone recessions for

Sweden. In contrast, trend output is reduced between 1 and 3 percentage points for the other six countries, with the largest reduction for Germany.

For both sets of recessions, slower growth of the capital-labor ratio is the largest contributor to the reduction in trend output. This is true both for the average as well as for most of the countries. Increases in total factor productivity in fact help to offset some of this decline for most countries. On average, the reduction in trend output for stand-alone recessions is split about evenly between output per hour and labor input (hours per employee, the employment rate, and the participation rate). A reduction in the employment rate (increase in the trend unemployment rate) reduces trend output by about .8 percentage point, and a fall in the participation rate reduces it by another .3 percent, so that a lower employment-population ratio reduces trend output by about a percentage point. Hours per employee rises by .4 percentage point on average for the stand-alone recessions.

There is again considerable variation across countries. Both employment and participation rates drop noticeably for Canada, Sweden, and the United Kingdom after recessions, and the employment rate also falls sharply for Germany. However, these rates show little change for the United States, Australia, and Japan.

5. Conclusion

This paper has attempted to assess whether recessions have a long-lasting effect on trend output. The results suggest that they do have a moderate impact on average, resulting in a cumulative loss of about 1½ percentage points in the level of trend output four years after a recession peak. However, panel regressions indicate that the depth of a recession contributes to the reduction in trend output for advanced economies, while the

length is important for emerging markets. As a result, recessions that are deeper and/or longer than the average may have a substantial effect on the level of trend output. The regressions in this paper suggest that the recent recession, which was more than twice as deep for advanced economies as the previous average (output per capita dropped about 7½ percent compared with a previous average of 3½ percent), could have resulted in an average loss of 3 percentage points in the level of trend output four years after the recession peak. In contrast, the recession does not appear to have resulted in a reduction in trend output for emerging markets, where the recent recessions were on average a little shorter than the previous average.

The paper also finds that whether or not a recession includes a financial crisis does not appear to have an effect on the cumulative loss in trend output. How synchronized one country's recession is with those in other countries also does not appear to have a significant effect on the cumulative loss, although it may affect the contour, as it seems to contribute to a reduction in trend output growth in the first two years following a recession peak and to an increase in the following two years.

For countries for which components of per capita output are available, the single most important contributor to the decline in trend output, not surprisingly, is a fall in the contribution of the capital-output ratio. Reductions in trend employment and/or participation rates also play an important role for Canada, Sweden, the United Kingdom, and Germany.

The main result of this analysis is that downturns in actual output, even if temporary, are likely to have a negative permanent impact on the level of potential output. The primary contributor to the reduction appears to be the reduction in the

capital-labor ratio as a result of lower investment. Declines in the rate of employment relative to the labor force and in labor force participation rate also appear to play some role.

This suggests that measuring output gaps by projecting potential using pre-recession trends is likely to overstate the gap and could thus lead to overly expansionary monetary policy. It also suggests that programs that attempt to minimize the effect of long spells of unemployment on both employability and attachment to the labor force may be worthwhile.

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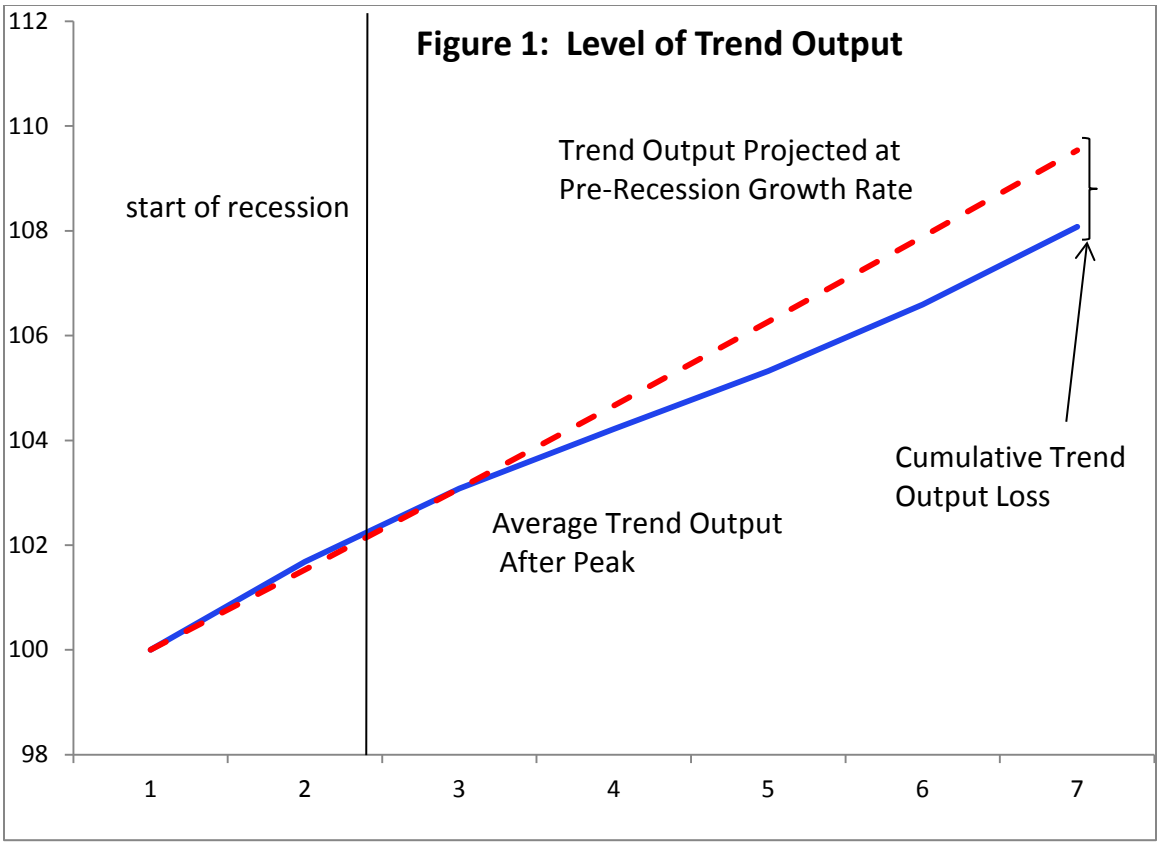
Figure 1: Level of Trend Output
112
110
108
106
104
102
100
98
1
2
3
4
5
6
7
start of recession
Trend Output Projected at
Pre-Recession Growth Rate
Average Trend Output
After Peak
Cumulative Trend
Output Loss

Table 1: Average Annual Trend Growth in Output Per Capita Around Recessions Average over all recessions for each country						
	(1) 2 years before peak	(2) 2 years after peak	(3) next 2 years	(4) change (2)-(1)	(5) change (3)-(2)	cumulative level change
U.S.	1.5	1.1	1.6	-.4	.5	-.4
Australia	1.3	1.2	1.3	-.1	.2	.0
Canada	1.4	.9	1.0	-.5	.1	-1.8
Japan	1.6	1.1	1.1	-.6	.1	-2.1
Sweden	1.2	.9	1.0	-.3	.2	-1.0
Switzerland	.6	.3	.6	-.4	.4	-.8
U.K.	1.6	.9	1.4	-.7	.5	-1.9
France	1.7	1.2	1.2	-.5	.0	-2.0
Germany	2.1	1.4	1.4	-.7	.1	-2.7
Italy	2.0	1.6	1.5	-.4	.0	-1.7
Spain	1.6	.3	-.2	-1.3	-.5	-6.2
Greece	1.4	.8	1.0	-.6	.2	-2.0
Ireland	3.3	2.8	2.8	-.5	.0	-2.0
Netherlands	1.5	1.1	1.2	-.4	.1	-1.4
Luxembourg	2.1	1.8	2.5	-.4	.8	.0
Belgium	2.0	1.3	1.2	-.6	-.1	-2.8
Austria	2.0	1.6	1.9	-.4	.2	-1.2
Finland	2.0	1.2	1.6	-.8	.4	-2.3
Norway	4.2	3.5	3.1	-.7	-.4	-3.5
Denmark	1.4	1.3	1.6	-.1	.3	.2
Portugal	2.3	1.3	1.6	-1.0	.3	-3.3
China	2.1	2.5	3.7	.4	1.2	4.1
Hong Kong	2.7	2.9	3.6	.2	.7	2.3
Korea	4.5	4.7	5.1	.2	.3	1.5
Malaysia	2.5	1.8	2.3	-.8	.6	-2.0
Philippines	.4	-.7	-.7	-1.1	.0	-4.4
Singapore	2.8	2.7	3.7	-.1	1.0	1.5
Taiwan	3.6	4.0	4.6	.4	.6	2.8
Thailand	2.7	-1.2	-.8	-3.9	.4	-14.7
Indonesia	1.8	.7	1.6	-1.1	.9	-2.6
India	1.7	2.0	2.1	.3	.1	1.5
Argentina	.6	-.1	-.5	-.7	-.4	-3.8
Brazil	.4	-.1	.2	-.5	.3	-1.4
Chile	1.3	.7	2.2	-.6	1.5	.7
Colombia	.9	.3	.4	-.6	.1	-2.3
Mexico	1.2	.0	-.1	-1.1	-.2	-4.8
Venezuela	-.9	-1.5	-1.4	-.6	.2	-2.0
South Africa	-.4	-.7	-.7	-.3	.0	-1.3
Turkey	1.2	1.2	1.5	.0	.3	.7
Israel	1.7	1.5	1.8	-.2	.4	-.2

Table 2: Average Annual Trend Output Growth Around All Recessions						
	(1) 2 years before peak	(2) 2 years after peak	(3) next 2 years	(4) change (2)-(1)	(5) change (3)-(2)	cumulative level change
All countries						
Mean	1.6	1.1	1.4	-.5	.2	-1.4
std. dev	1.6	1.7	1.9	1.0	1.0	5.3
Advanced						
Mean	1.8	1.3	1.5	-.5	.2	-1.7
std. dev	1.2	1.1	1.1	.8	.7	3.9
Emerging						
Mean	1.4	.9	1.3	-.4	.3	-1.0
std. dev	1.9	2.2	2.5	1.3	1.2	6.5

Table 3: Average Annual Trend Output Growth Around Stand-Alone Recessions						
	(1) 2 years before peak	(2) 2 years after peak	(3) next 2 years	(4) change (2)-(1)	(5) change (3)-(2)	cumulative level change
All countries						
Mean	1.9	1.4	1.6	-.6	.3	-1.6
std. dev	1.7	1.8	2.0	1.0	.9	5.1
Advanced						
Mean	1.8	1.3	1.5	-.6	.2	-1.9
std. dev	1.2	1.1	1.3	.8	.7	3.8
Emerging						
Mean	2.1	1.5	2.0	-.5	.5	-1.2
std. dev	2.4	2.7	2.9	1.4	1.2	6.8

Table 4: Characteristics of Recessions						
	Length quarters from peak to trough		Depth % change in output per capita		Synchronicity # of overlapping recession quarters	
	All	**Stand Alone**	**All**	**Stand Alone**	**All**	**Stand Alone**
All countries						
Mean	6.2	6.9	-5.7	-5.9	12.2	12.7
std. dev	4.8	5.2	5.8	6.4	5.6	5.5
Advanced						
Mean	6.1	6.4	-3.6	-3.7	13.3	13.3
std. dev	4.2	4.0	3.1	3.2	5.5	5.5
Emerging						
Mean	6.3	7.3	-7.9	-8.9	11.0	11.5
std. dev	5.3	6.4	7.1	8.3	5.6	5.3

Table 5: Estimated Coefficients for All Recessions Cumulative Change (P-values in parentheses)						
All countries (187 observations)						
Constant	Length	Depth	Recession Dummies		Synchronicity	Financial Crisis
			Earlier	Later		
1.09 (.13)	-.27^{+} (.02)	.14 (.19)				
2.05^{+} (.02)	-.35* (.00)	.14 (.15)	2.84* (.00)	-3.40* (.00)		
1.11 (.38)	-.34* (.00)	.15 (.13)	2.96* (.00)	-3.41* (.00)	.07 (.31)	
2.06^{+} (.02)	-.36* (.00)	.15 (.13)	2.87* (.00)	-3.38* (.01)		.62 (.66)
1.12 (.38)	-.34* (.00)	.16 (.12)	2.99* (.01)	-3.39* (.00)	.07 (.32)	.61 (.67)
Advanced Economies (97 observations)						
-.08 (.93)	-.01 (.94)	.45* (.01)				
-.15 (.88)	-.02 (.90)	.42* (.01)	2.71@ (.06)	-1.31 (.26)		
-.19 (.90)	-.02 (.90)	.42* (.01)	2.71@ (.07)	-1.31 (.27)	.00 (.97)	
.05 (.96)	-.05 (.71)	.45* (.01)	2.72@ (.06)	-1.30 (.27)		1.68 (.40)
.02 (.99)	-.05 (.71)	.45* (.01)	2.73@ (.07)	-1.30 (.27)	.00 (.97)	1.68 (.40)
Emerging Economies (90 observations)						
2.10$^{@}$ (.07)	-.57* (.01)	-.06 (.68)				
4.01* (.01)	-.68* (.00)	-.04 (.77)	2.90$^{@}$ (.06)	-4.64* (.00)		
1.99 (.32)	-.65* (.00)	-.03 (.80)	3.11^{+} (.04)	-4.82* (.00)	.17 (.13)	
4.06* (.01)	-.68* (.00)	-.06 (.71)	2.86$^{@}$ (.06)	-4.67* (.00)		-.57 (.77)
2.04 (.31)	-.65* (.00)	-.05 (.73)	3.07^{+} (.04)	-4.85* (.00)	.18 (.13)	-.60 (.76)

* Significant at 1% level. +Significant at 5% level @Significant at 10% level

Table 6: Estimated Coefficients for Stand Alone Recessions Cumulative Change (P-values in parentheses)				
All countries (110 observations)				
Constant	Length	Depth	Synchronicity	Financial Crisis
1.78[+] (.02)	-.40[*] (.00)	.10 (.20)		
2.44[@] (.07)	-.40[*] (.00)	.11 (.18)	-.05 (.56)	
1.72[+] (.02)	-.39[*] (.00)	.08 (.35)		-.64 (.66)
2.36[@] (.09)	-.40[*] (.00)	.09 (.31)	-.04 (.58)	-.58 (.69)
Advanced Economies (71 observations)				
.42 (.62)	-.12 (.28)	.39[*] (.01)		
1.67 (.27)	-.14 (.21)	.40[*] (.01)	-.08 (.32)	
.48 (.57)	-.13 (.25)	.41[*] (.01)		.97 (.57)
1.80 (.24)	-.15 (.18)	.42[*] (.01)	-.08 (.30)	1.12 (.52)
Emerging Economies (39 observations)				
3.74[*] (.01)	-.59[*] (.00)	.05 (.72)		
2.34 (.36)	-.60[*] (.00)	.03 (.82)	.11 (.51)	
3.72[*] (.01)	-.55[*] (.00)	-.02 (.92)		-2.52 (.31)
2.01 (.44)	-.56[*] (.00)	-.04 (.80)	.13 (.46)	-2.68 (.28)

* Significant at 1% level. +Significant at 5% level @Significant at 10% level

Table 7: Estimated Coefficients for All Recessions for Change in Growth from Pre-Recession Period to Next Two Years (P-values in parentheses)						
All countries (187 observations)						
Constant	Length	Depth	Recession Dummies		Synchronicity	Financial Crisis
			Earlier	Later		
.15 (.20)	-.06* (.01)	.05* (.00)				
.21@ (.10)	-.06* (.00)	.05* (.00)	.56* (.00)	-.43* (.00)		
.45+ (.03)	-.07* (.00)	.05* (.00)	.52 (.00)	-.43* (.00)	-.02 (.14)	
.20 (.13)	-.06* (.00)	.04* (.00)	.56 (.00)	-.42* (.00)		-.14 (.52)
.44+ (.03)	-.06* (.00)	.04* (.00)	.52 (.00)	-.43* (.00)	-.02 (.13)	-.16 (.47)
Advanced Economies (97 observations)						
-.05 (.71)	-.03 (.16)	.08* (.00)				
-.05 (.71)	-.03 (.17)	.08* (.00)	.47+ (.04)	-.28 (.11)		
.30 (.18)	-.03 (.11)	.08* (.00)	.43@ (.06)	-.30@ (.09)	-.03+ (.04)	
-.06 (.69)	-.02 (.21)	.08* (.00)	.47+ (.05)	-.28 (.11)		-.05 (.88)
.30 (.19)	-.03 (.14)	.08* (.00)	.43@ (.06)	-.30@ (.09)	-.03+ (.04)	-.05 (.87)
Emerging Economies (90 observations)						
.40+ (.03)	-.07+ (.02)	.05+ (.02)				
.65* (.01)	-.09* (.00)	.05+ (.02)	.48+ (.05)	-.69* (.00)		
.63@ (.07)	-.09* (.00)	.05+ (.02)	.48+ (.05)	-.69* (.00)	.00 (.94)	
.63* (.01)	-.08* (.00)	.04@ (.08)	.48+ (.05)	-.68* (.00)		-.31 (.30)
.62@ (.07)	-.08* (.00)	.04@ (.08)	.48@ (.06)	-.68* (.00)	.00 (.97)	-.31 (.31)

* Significant at 1% level. +Significant at 5% level @Significant at 10% level

Table 8: Estimated Coefficients for Stand Alone Recessions for Change in Growth from Pre-Recession to Next Two Years (P-values in parentheses)				
All countries (110 observations)				
Constant	Length	Depth	Synchronicity	Financial Crisis
.18 (.19)	-.06* (.00)	.05* (.00)		
.19 (.45)	-.06* (.00)	.05* (.00)	-.00 (.94)	
.16 (.24)	-.06* (.00)	.04* (.01)		-.16 (.57)
.17 (.51)	-.06* (.00)	.04+ (.02)	-.00 (.98)	-.16 (.57)
Advanced Economies (71 observations)				
.05 (.74)	-.03@ (.09)	.10* (.00)		
.28 (.30)	-.04@ (.06)	.10* (.00)	-.01 (.31)	
.05 (.73)	-.03@ (.09)	.10* (.00)		.03 (.92)
.29 (.30)	-.04@ (.06)	.10* (.00)	-.02 (.30)	.06 (.86)
Emerging Economies (39 observations)				
.53@ (.07)	-.08+ (.03)	.05@ (.07)		
.07 (.89)	-.08+ (.02)	.04 (.11)	.04 (.28)	
.50@ (.08)	-.07+ (.05)	.04 (.22)		-.48 (.33)
.00 (.99)	-.07+ (.04)	.03 (.32)	.04 (.24)	-.53 (.28)

* Significant at 1% level. +Significant at 5% level @Significant at 10% level.

Table 9: Estimated Coefficients for All Recessions for Change in Growth from First Two Years After Recession Peak to Next Two Years (P-values in parentheses)							
All countries (187 observations)							
Constant	Change between prev. periods	Length	Depth	Recession Dummies		Sync.	Financial Crisis
				Earlier	Later		
-.20^{+} (.04)	.59* (.00)	-.02 (.28)	.07* (.00)				
.36* (.00)	.56* (.00)	-.03$^{@}$ (.08)	-.08* (.00)	.03 (.83)	-.36* (.01)		
-.21 (.25)	.58* (.00)	-.02 (.13)	-.08* (.00)	.10 (.52)	-.33* (.01)	.04* (.00)	
.37* (.00)	.56* (.00)	-.03$^{@}$ (.07)	-.07* (.00)	.03 (.84)	-.36* (.01)		.12 (.54)
-.20 (.28)	.59* (.00)	-.02 (.13)	-.07* (.00)	.10 (.53)	-.34* (.01)	.04* (.00)	.16 (.39)
Advanced Economies (97 observations)							
-.01 (.92)	.66* (.00)	.03^{+} (.04)	-.09* (.00)				
.04 (.73)	.64* (.00)	.03$^{@}$ (.09)	-.09* (.00)	-.02 (.92)	-.16 (.28)		
-.40^{+} (.03)	.70* (.00)	.03^{+} (.03)	-.08* (.00)	-.00 (.99)	-.13 (.37)	.03* (.00)	
.07 (.58)	.64* (.00)	.02 (.18)	-.08* (.00)	-.02 (.92)	-.17 (.25)		.29 (.27)
.30 (.19)	.70* (.00)	.03$^{@}$ (.08)	-.08* (.00)	-.00 (.99)	-.14 (.34)	.03* (.00)	.29 (.24)
Emerging Economies (90 observations)							
.25 (.14)	.57* (.00)	-.08* (.01)	-.10* (.00)				
.50^{+} (.02)	.48* (.00)	-.09* (.00)	-.10* (.00)	.21 (.37)	-.49^{+} (.03)		
-.09 (.76)	.48* (.00)	-.09* (.00)	-.10* (.00)	.27 (.22)	-.51^{+} (.02)	.05* (.01)	
.50^{+} (.03)	.49* (.00)	-.10* (.00)	-.10* (.00)	.21 (.38)	-.49^{+} (.03)		.09 (.74)
-.09 (.76)	.49* (.00)	-.09* (.00)	-.10* (.00)	.27 (.23)	-.51^{+} (.02)	.05* (.01)	.12 (.66)

* Significant at 1% level. +Significant at 5% level @Significant at 10% level

Table 10: Estimated Coefficients for Stand Alone Recessions for Change in Growth from First Two Years After Recession Peak to Next Two Years (P-values in parentheses)					
All countries (110 observations)					
Constant	Change between prev. periods	Length	Depth	Synchronicity	Financial Crisis
.44* (.00)	.51* (.00)	-.04+ (.03)	-.06* (.03)		
.74* (.00)	.50* (.00)	-.04+ (.02)	-.06* (.00)	-.02 (.12)	
.45* (.00)	.51* (.00)	-.04+ (.03)	-.06* (.00)		.07 (.76)
.75* (.00)	.51* (.00)	-.04+ (.02)	-.06* (.00)	-.02 (.12)	.11 (.67)
Advanced Economies (71 observations)					
.08 (.57)	.64* (.00)	.03@ (.10)	-.08* (.00)		
.10 (.45)	.64* (.00)	.03 (.15)	-.07* (.01)	-.00 (.96)	
.09 (.72)	.64* (.00)	.03 (.11)	-.07* (.00)		.41 (.13)
.14 (.57)	.64* (.00)	.03 (.18)	-.07* (.01)	-.00 (.86)	.41 (.13)
Emerging Economies (39 observations)					
.61+ (.02)	.39* (.01)	-.11* (.00)	-.09* (.00)		
1.01+ (.02)	.42* (.00)	-.11* (.00)	-.09* (.00)	-.03 (.25)	
.61+ (.02)	.39* (.01)	-.11* (.00)	-.09* (.00)		-.11 (.79)
1.00+ (.02)	.42* (.01)	-.11* (.00)	-.09* (.00)	-.03 (.27)	-.06 (.90)

* Significant at 1% level. +Significant at 5% level @Significant at 10% level.

Table 11: Predicted Cumulative Effect of Recent Recession on Trend Output (%)					
Advanced Economies	**Aggregate Equation**	**Adv. Econ. Equation**	**Emerging Economies**	**Aggregate Equation**	**Em. Econ. Equation**
U.S.	-.5	-2.5	China	n.a.*	n.a.*
Australia	.3	-.6	Hong Kong	.2	2.1
Canada	-.5	-2.2	Korea	-1.4	-.1
Japan	.1	-3.3	Malaysia	.3	2.2
Sweden	.3	-2.3	Philippines	1.6	3.8
Switzerland	.1	-1.6	Singapore	1.3	3.4
U.K.	-2.4	-3.6	Taiwan	.4	2.2
France	.0	-2.1	Thailand	.1	1.9
Germany	-.7	-3.2	Indonesia	n.a.	n.a.
Italy	-.6	-1.1	India	n.a.	n.a.
Spain	.4	-2.2	Argentina	-1.8	-.6
Greece	-2.7	-4.7	Brazil	-.1	1.6
Ireland	-.1	-2.2	Chile	-1.3	.0
Netherlands	.5	-1.6	Colombia	-2.4	-1.3
Luxembourg	-.5	-3.9	Mexico	.7	2.7
Belgium	-2.1	-4.0	Venezuela	-3.3	-2.6
Austria	-.9	-4.1	South Africa	1.2	3.4
Finland	-2.8	-3.6	Turkey	-.9	.6
Norway	1.2	-.5	Israel	-1.6	-.3
Denmark	-2.3	-5.1			
Portugal	-3.5	-6.4			
Average	-.8	-3.0		-.4	1.2
Average all countries in sample		**Aggregate Equation**		**Category Equation**	
		-.6		-1.1	

* no recession in the recent period.

Table 12: Behavior of Components of Trend Output Per Capita During All Recessions							
	Total	**Output Per Hour**	**Contribution to Output per Hour**		**Hours Per Emp.**	**Emp. Rate**	**Part. Rate**
			K/L Ratio	**TFP**			
Total	-1.3	-.8	-1.3	.5	.6	-.8	-.3
U.S.	-.4	-.3	-1.4	1.1	.7	.0	-.7
Australia	.0	-.2	-.3	.1	.1	-.2	.2
Canada	-1.8	.3	-.1	.3	.1	-1.0	-1.3
Japan	-2.1	-2.7	-2.9	.1	1.0	.1	-.4
Sweden	-1.0	-.5	-1.6	1.1	1.9	-1.4	-1.0
U.K.	-1.9	.8	-.8	1.6	-.3	-1.7	-.8
France	-2.0	-.7	-2.0	1.2	-.6	-.5	-.1
Germany	-2.7	-1.5	-.7	-.7	.4	-2.0	.4
Italy	-1.7	-1.9	-2.5	.6	1.1	-.8	-.1
Netherlands	-.1	-.8	-1.1	.1	.9	-.6	.4

Table 13: Behavior of Components of Trend Output Per Capita During Stand-Alone Recessions							
	Total	**Output Per Hour**	**Contribution to Output per Hour**		**Hours Per Emp.**	**Emp. Rate**	**Part. Rate**
			K/L Ratio	**TFP**			
Total	-1.2	-.6	-1.5	.9	.4	-.8	-.3
U.S.	.0	-.4	-2.2	1.8	.6	.3	-.6
Australia	-.2	-.4	.1	-.5	.1	-.1	.2
Canada	-1.4	.3	-2.2	2.5	.2	-1.0	-.9
Japan	-2.1	-2.7	-2.9	.1	1.0	.1	-.4
Sweden	.2	3.9	-1.3	5.3	.8	-2.6	-1.9
U.K.	-1.9	.8	-.8	1.6	-.3	-1.7	-.8
France	-2.0	-.7	-2.0	1.2	-.6	-.5	-.1
Germany	-2.7	-1.5	-.7	-.7	.4	-2.0	.4
Italy	-1.8	-1.5	-2.2	.8	1.0	-.9	-.4
Netherlands	-.1	-.8	-1.1	.4	.9	-.6	.4