Preliminary
April 22, 2005

Why Have Business Cycle Fluctuations Become Less Volatile?

Andres Arias
Ministerio de Hacienda y Crédito Publico, Republic of Colombia

Gary D. Hansen
UCLA

Lee E. Ohanian
UCLA and Federal Reserve Bank of Minneapolis

Abstract

This paper shows that a standard RBC model driven by productivity shocks can successfully account for the 50 percent decline in cyclical volatility of output and its components, and labor supply that has occurred since 1983. The model is successful because the volatility of productivity shocks has also declined significantly over the same time period. We then investigate whether the decline in the volatility of the Solow Residual is due to changes in the volatility of some other shock operating through a channel that is absent in the standard model. We therefore develop a model with variable capacity and labor utilization. We find that the two most commonly used business cycle shocks - government spending shocks and preference shocks ("labor wedges") – cannot account for the change in the volatility of the Solow Residual. We do find some potential that it can be accounted for by changes in the volatility of shocks to the intertemporal first order condition.

1. Introduction

Business cycle volatility has decreased substantially in the last 20 years. Kim and Nelson (1999), McConnell and Perez-Quiros (2000) and Stock and Watson (2002) all identify a large and statistically significant permanent decline in U.S. GDP volatility beginning in the first quarter of 1984.

This paper examines this decreased volatility through the lens of neoclassical business cycle theory. We focus our analysis on changes in the variance of the Hodrick-Prescott cyclical component of real GDP, its components, in the variance of the HP detrended labor input, and in the variance of HP detrended total factor productivity (TFP). All of these variances are about 30-50 percent smaller in the post-1983 period compared to the 1955-83 period.

Within the neoclassical framework, changes in cyclical volatility are the result of either changes in the volatility of the exogenous shocks that are fed into the model, and/or changes in the structure of the model that maps the exogenous shocks into the endogenous variables.
We focus our analysis on changes in the exogenous shock volatility. We organize the analysis using the accounting framework of Chari, Kehoe, and McGrattan (2004), This framework uses the first-order and feasibility conditions from a standard business cycle model to identify four empirical shocks: a productivity shock, a shock to the household's static first order condition, a shock to the household's dynamic first order condition, and a shock to the resource constraint.

We calculate the volatility of these four shocks during the high GDP volatility period (1953:1-1983:4) and during the low GDP volatility period (1984:1 –2004:x). We then conduct two sets of simulations. The first set simulates the model with the shock volatilities set to their values from the first period. The second set is with the shock volatilities set to their values from the second period. To assess the relative contributions of each of the 4 shocks, each set of simulations includes simulations with each of the four shocks individually and with multiple shocks. We then compare the differences in the volatilities of the endogenous variables in the model over the two periods.

We find that a reduction in the volatility of the productivity shocks is by far the dominant source of the reduction in the volatility of the endogenous variables. The variability of the TFP shock falls about 50 percent between the two periods, which individually reduces the volatility of all the endogenous variables by about 50 percent. The contribution of the three other shocks is very small, either because the volatilities do not change much between the two periods, and/or because the quantitative impact of the shock is not very large within the model.

Given the size and importance of the TFP volatility reduction, we next investigate potential explanations for the change in this factor. Perhaps the most likely candidate explanation is that lower TFP variability is due to changes in the volatilities of other shocks operating through mis-measured capital and labor services. This view follows from the perspective that cyclical TFP fluctuations are artifacts of capital and labor mis-measurement responding to other shocks (see Basu (1996) and Burnside, Eichenbaum and Rebelo (1995)).

We therefore assess whether lower output volatility, labor input volatility and TFP volatility can be jointly accounted for in our model, augmented with variable capital utilization and labor hoarding, operating through the three remaining shocks. Our augmented model is quite similar to the Burnside and Eichenbaum (1996) model. We find that the two most commonly used business cycle shocks – government spending shocks (Christiano and Eichenbaum (1992), McGrattan (1994), Braun (1994)) and preference shocks (Hall, Parkin, Mulligan, Chari, Kehoe, and McGrattan, Bencivengna, Ingram, Kocherlakota, and Savin,) cannot do this. We do find some evidence that changes in the volatility of shocks to the consumer's intertemporal first order condition, which previously have been a shock that has not been considered to be important in business cycles (see Chari, Kehoe, and McGrattan), may be able to jointly account for the volatility change in both the Solow Residaul and in output, its components, and labor supply.

2. **Connection with the Literature**

The existing literature offers several explanations for the fall in business cycle volatility. Kahn, McConnell and Perez-Quiros (2002) argue that the “information revolution” has changed the way shocks are propagated. In particular, they make a case for the volatility reduction resulting largely from improvements in inventory management techniques, using a model that differs from the standard neoclassical model**.** Their approach thus focuses on changes in a specific model’s impact propogation mechanism. Other authors, for example Clarida, Galí and Gertler (2000), maintain that improved monetary policy since the early 1980’s has stabilized the U.S. economy. Stock and Watson (2002) conduct a comprehensive statistical examination and find that the volatility reduction is primarily due to “good luck.” That is, there has been a fall in the variance of the structural shocks that impact the economy.

Our paper complements Stock and Watson’s work by providing a fully articulated assessment of the contribution of lower shock volatility to the business cycle. Our DSGE analysis allows us to make progress on understanding which shocks are important for the change in cyclical volatility, and on understanding the structural mechanisms through which these shocks operate.

We therefore develop a simple RBC model, hold the propagation mechanism in our model economy constant across the two subperiods and then consider how changes in the volatility of different shocks would affect business cycle volatility. While our approach appears to put us exclusively in the “good luck” camp, policy explanations may be consistent with our approach. In particular, the shocks we consider can have a variety of structural interpretations, as argued in Chari, Kehoe and McGrattan (2004). That is, we consider changes in shock variances without trying to interpret what might have led to the change. Improved monetary policy is one of the possibilities.

Our findings point us to one possible conclusion and to a direction for future research. A conclusion consistent with our findings is that the decreased volatility of U.S. business cycles is due to a fall in the variance of aggregate technology shocks—or shocks that are propagated in a manner observationally equivalent to technology shocks. Another possibility, of course, is that the mechanism through which non-technology shocks affect TFP is not sufficiently captured by the Burnside and Eichenbaum (1996) model that we use in this paper.

2. Volatility in a Basic Real Business Cycle Model

In Table 1, we present a measure of business cycle volatility for a variety of U.S. aggregate time series. [1] Here, the business cycle is defined by deviations from a Hodrick-Prescott trend. We report the percent standard deviation of quarterly data from 1955:3 to 2003:2 in the first column of the table. In the second and third columns, the same statistic is reported for the pre-1984 and post-1984 subperiods. In the last column, the ratio of the volatility measure for the late subperiod to the early subperiod is given.

This table shows that volatility of all series in the later subperiod are significantly less volatile than in the earlier subperiod. Output and TFP are about half as volatile, while the labor

[1] We use quarterly data from 1955:3 – 2003:2. The beginning date is the first for which hours based on the household survey are available. Data has been logged before applying the Hodrick-Prescott filter. All National Income and Product Account data is in 1996 dollars. Hours (HS) is total hours worked based on data from the Current Population Survey and available on the Bureau of Labor Statistics website. The BLS data has been seasonally adjusted prior to computing our volatility statistics. Hours (ES) is based on data from establishment payrolls and is also available on the BLS website. Measured total factor productivity (TFP) is computed as $\log(TFP_t) = \log(GNP_t) - .6\log(Hours_t)$.

input is 70 percent as volatile. This fall in volatility of the labor input is essentially identical in both hours worked measured using the household survey as well as hours from the establishment survey. A component of GNP on which we focus particular attention is consumption of services and nondurables, since this corresponds conceptually to consumption in a stochastic growth model. Similarly, consumer durables plus fixed investment corresponds to investment in our theoretical model. We find that investment is 58 percent as volatile, and consumption 65 percent, in the later subperiod as compared with the early subperiod. Government spending is 55 percent as volatile. Overall, these statistics show that volatility declined 30-50 percent in these variables after 1983.

Table 1—Volatility of U.S. Data

Series	1955:3-2003:2	1955:3-1983:4	1984:1-2003:2	Late/Early
	Percent Standard Deviation			
GNP	1.59	1.78	0.93	0.53
Hours (HS)	1.51	1.58	1.12	0.71
Employment	1.02	1.08	0.73	0.68
Hours per worker	0.69	0.74	0.58	0.79
Hours (ES)	1.72	1.82	1.29	0.71
Labor Productivity (HS)	1.01	1.15	0.75	0.65
Labor Productivity (ES)	0.79	0.86	0.67	0.78
TFP (HS) $(= GNP / Hours^{0.6})$	1.04	1.21	0.62	0.51
TFP (ES)	0.83	0.95	0.46	0.49
Consumption Expenditures	1.23	1.38	0.80	0.57
Nondurables	1.10	1.23	0.79	0.64
Services	0.71	0.74	0.54	0.74
Durables	4.54	5.08	3.07	0.60
Nondurables + Services	0.80	0.88	0.57	0.65
Investment Expenditures	7.06	7.66	4.41	0.58
Fixed Investment	4.87	5.29	3.20	0.61
Fixed Investment + Consumer Durables	4.53	4.97	2.88	0.58
Government Expenditures	1.50	1.73	0.96	0.55

We now use the accounting procedure discussed by Chari, Kehoe, and McGrattan (2004) and Cole and Ohanian (2001) to assess how much of the volatility reduction in output and its components, and labor can be accounted for by changes in the volatilities of four shocks: (1) a productivity shock, (2), a shock to the household's static first order condition governing their time allocation decision, (3) a shock to the housheold's intertemporal first order condition governing the allocation of income between consumption and savings, and (4) a shock to the resource constraint.

We do this using the following real business cycle model. The equilibrium of this model economy is characterized by the solution to a social planner's problem (where the initial capital stock, k_0, is given):

$$\max_{k_{t+1}, h_t} E \sum_{t=0}^{\infty} \beta^t \left[\log c_t + \theta h_t \frac{\log(1-\bar{h})}{\bar{h}} \right]$$

subject to

$$c_t + k_{t+1} = e^{z_t} k_t^{1-\alpha} h_t^{\alpha} + (1-\delta) k_t$$

$$z_{t+1} = \rho_1 z_t + \varepsilon_{1,t+1}, \ \varepsilon_1 \sim N(0, \sigma_1^2)$$

In this economy, labor is indivisible (individuals work $\bar{h}$ or not at all), and the labor market allows trade in employment lotteries—contracts that specify a probability of working $\bar{h}$ hours (see Hansen (1985) for details). In this problem, z_t is the log of TFP, c_t is consumption, and h_t is aggregate hours worked. The log of TFP follows a first order autoregressive process.

The model is calibrated in way that is standard in the real business cycle literature (see Cooley and Prescott (1995)). In particular, the value of the discount factor, β, is determined so that the average quarterly *k/y* ratio for the model is the same as in U.S. data. The depreciation rate is calibrated to the average investment to output ratio and the reduced form preference parameter, $\frac{\theta \log(1-\bar{h})}{\bar{h}}$, is chosen so that individuals spend on average 31 percent of their substitutable time working. The parameter α is set equal to average labor's share in the U.S. national income accounts, and ρ_1 is set close to one in order to match the autocorrelation of measured TFP. These criteria lead us to assign the following parameter values: β = .988, δ = 0.018, $\frac{\theta \log(1-\bar{h})}{\bar{h}}$ = 2.547, α = 0.6, and $\rho_1 = .95$.

Table x shows the volatilities of these shocks…

Suppose there was a one-time decrease in the variance of technology shocks in 1984. We explore the implications of this change by simulating the model using 3 different values of σ_1: one that matches measured volatility of TFP for entire 1955-2003 period, one that matches TFP volatility for the 1955-1983 subperiod, and one that matches TFP volatility for the 1984-2003 subperiod. The results of this experiment are shown in Table 2.

Table 2—Volatility in a Standard Real Business Cycle Economy

Percent Standard Deviations

Series	*Entire Period*	*Early Subperiod*	*Late Subperiod*	*Late/Early*
Output	1.57	1.80	0.87	0.49
Hours	1.25	1.43	0.69	0.49
Capital	0.36	0.40	0.19	0.49
Investment	5.61	6.45	3.07	0.49
Consumption	0.40	0.46	0.22	0.49
Labor Productivity	0.40	0.45	0.22	0.49
TFP	0.83	0.95	0.46	0.49
Calibrated σ_1	0.0065	0.0075	0.0037	

Although this quantitative exercise displays a larger decrease in volatility than found in actual data, the fall in the volatility of GNP and other aggregate variables is not a puzzle from perspective of "pure" real business cycle theory. In addition, because there is only one shock in this model and the propagation mechanism is close to linear, the volatility of all variables falls by the same amount. This would not be the case if we introduced additional shocks to the model.

Several researchers, however, [Basu (1996) and Burnside, Eichenbaum and Rebelo (1995)] have argued that aggregate procyclical TFP fluctuations are due primarily to unmeasured changes in factor utilization. According to these studies, once unmeasured utilization is taken into account, there is little in the way of TFP volatility to be accounted for by exogenous shocks. Hence, in the next section, we consider the impact of changes in the volatility of shocks other than technology shocks in a model with endogenous movements in TFP due to labor hording and capital utilization.

In particular, we consider the importance of an additive shock to the resource constraint (government spending shock) and a shock that affects the labor-leisure tradeoff (preference or labor income tax shock). Chari, Kehoe, and McGrattan (2004) show that a large number of structural shocks (monetary shocks, etc.) are equivalent to these.

2. Volatility in Model with Endogenous Factor Utilization

In this section, we use the model of Burnside and Eichenbaum (1996) to study the impact of changes in the size of alternative shocks on business cycle volatility in a model with unmeasured factor utilization. This model incorporates two sources of factor utilization to a real business cycle model similar to the one studied in the previous section. These include labor hording as modeled in Burnside, Eichenbaum and Rebelo (1993) and capital utilization as modeled in Greenwood, Hercowitz and Huffman (1988) and Taubman and Wilkinson (1970).

The equilibrium of this model is characterized by the solution to a social planner's problem like the one in the previous section except with two additional choice variables: labor effort, *e*, and the rate of capital utilization, *u*. Labor hording is introduced by assuming that employment (n_t) is chosen before period *t* shocks are observed. The remaining choices (k_{t+1}, u_t, and e_t) are made after the shocks are observed. The planner's problem is the following subject to this timing restriction:

$$\max_{k_{t+1}, n_t, e_t, u_t} E\sum_{t=0}^{\infty} \beta_t \left[\log c_t + \theta_t n_t \log(1-\omega-\overline{h}\, e_t)\right]$$

subject to

$$c_t + k_{t+1} + g_t = e^{z_{1t}} \left(u_t k_t\right)^{1-\alpha} \left(e_t n_t \overline{h}\right)^{\alpha} + (1-\delta(u_t))k_t$$

$$\delta(u_t) = \gamma u_t^{\phi}, \ \phi > 1$$

$$g_t = \overline{g} e^{z_{2t}}$$

$$\theta_t = \overline{\theta} e^{z_{3t}}$$

$$\beta_{t+1} = \beta_t \overline{\beta} e^{z_{4t}} \ , \ \beta_0 = 1$$

$$\log z_{i,t+1} = \rho_i \log z_{i,t} + \varepsilon_{i,t+1}, \ \varepsilon_i \sim N(0, \sigma_i^2) \ \text{ for } i = 1-4$$

k_0 given.

This model economy is subjected to four types of uncorrelated stochastic shocks (z_1 to z_4). The first is the same technology shock as in the previous section. The second can be interpreted as a government spending shock, assuming that government expenditures are financed with lump sum taxes [see Christiano and Eichenbaum (1992)]. The third is a preference shock that distorts the labor-leisure decision. The importance of this class of shocks for business cycles has been argued by Hall (1997). The last is a shock to the subjective discount factor and introduces a stochastic wedge in the intertemporal Euler equation.

Capital utilization, u_t, affects both production and the rate of depreciation. The higher capital is utilized in production, the larger is the rate of depreciation. As discussed in Burnside and Eichenbaum (1996), both this feature and labor hording have important implication for the way shocks are propagated.

The model is calibrated in a similar manner as in the previous section. In particular, the value of $\bar{\beta}$ is chosen to target the *k/y* ratio, ϕ chosen to target the *i/y* ratio, and $\bar{g}$ chosen to target the *g/y* ratio. The parameter $\bar{\theta}$ is chosen so that the average time devoted to market activities, $n_t(\omega+\bar{h})$, is equal to 0.31 and γ is chosen so that the average utilization rate is 0.9.[2] The length of a work shift, $\bar{h}$, is set so that effort (*e*) is 1 in steady state. Labor's share is set equal to 0.6 and the fraction of time spent commuting (ω) is set equal to 6/98. The autoregressive coefficients for the shock processes are $\rho_1 = .95$; $\rho_2 = .98$; $\rho_3 = .99$, and $\rho_4 = .99$.

The volatility of government spending in the data falls by almost half in the later subperiod. To measure the impact of reducing the volatility of government spending, we simulate the model as follows, setting $\sigma_3 = \sigma_4 = 0$:

1. Set σ_1 and σ_2 to match the volatility of TFP and government spending for the entire 1955-2003 period shown in Table 1.
2. Keep σ_1 at the same value, but choose σ_2 to match the volatility of *g* during the early subperiod.

---

[2] The cyclical properties of the model do not depend on the value of the parameter γ.

3. Keep σ_1 at the same value, but choose σ_2 to match the volatility of g during the late subperiod.

The percent standard deviations associated with each of these parameterizations are given in the first three columns of Table 3.

Table 3—Volatility in a Model with Variable Factor Utilization
The Role of Government Spending Shocks ($\sigma_3 = \sigma_4 = 0$)

	Percent Standard Deviations			
Series	*Entire Period*	*Early Subperiod*	*Late Subperiod*	*Late/Early*
Output	1.40	1.40	1.32	0.94
Hours	1.26	1.29	1.15	0.89
Capital	0.25	0.25	0.24	0.98
Investment	5.17	5.11	4.94	0.97
Consumption	0.31	0.31	0.28	0.90
Labor Productivity	0.65	0.66	0.62	0.94
TFP	0.83	0.82	0.80	0.97
Government Expenditure	1.50	1.73	0.96	0.55
Calibrated σ_1	0.00311	0.00311	0.00311	
Calibrated σ_2	0.01173	0.01378	0.00773	

The key finding to be drawn from Table 3 is that, although government spending is 55 percent as volatile in the second subperiod as the first, this has relatively little effect on the volatility of any of the endogenous variables.

Perhaps a reduction in the variance of the preference shock will have a more important quantitative effect on business cycle volatility. In order to conduct an empirically relevant experiment, we need to calibrate σ_3. To do so, we use the first order condition for choosing e_t, which can be written as follows:

$$\frac{y_t}{c_t\, n_t\, \overline{h}} = \frac{\theta_t\, e_t}{\alpha(1-\omega-\overline{h}e_t)}$$

The volatility of the left hand side can be computed from data, but the right hand side is a function of unobservable effort. We choose σ_3 so that simulations of the model imply volatility of the left hand side of this equation (our "theta target") that is the same as that measured in U.S. data.

More precisely, Table 4 gives results from the following experiment (assume $\sigma_2 = \sigma_4 = 0$):

1. Set σ_1 and σ_3 to match the volatility of TFP and the "theta target" for the entire 1955-2003 period shown in Table 1.
2. Keep σ_1 at the same value, but choose σ_3 to match the volatility of the target during the early subperiod.
3. Keep σ_1 at the same value, but choose σ_3 to match the volatility of the target during the late subperiod.

Table 4—Volatility in a Model with Variable Factor Utilization
The Role of Taste Shocks ($\sigma_2 = \sigma_4 = 0$)

Percent Standard Deviations

Series	*Entire Period*	*Early Subperiod*	*Late Subperiod*	*Late/Early*
Output	1.78	1.77	1.67	0.94
Hours	2.10	2.10	1.96	0.94
Capital	0.30	0.30	0.28	0.94
Investment	6.34	6.25	5.94	0.95
Consumption	0.68	0.68	0.63	0.93
Labor Productivity	0.85	0.85	0.81	0.95
TFP	0.83	0.82	0.79	0.96
Theta target	1.10	1.10	1.03	0.93
Calibrated σ_1	0.00258	0.00258	0.00258	
Calibrated σ_3	0.00822	0.00834	0.00784	

Table 4 shows very little change in business cycle volatility from the calibrated change in the variance of the taste shock. The reason this change is small is quite different than for the case in Table 3. Here, the volatility of our "theta target" falls by only 7 percent from the early to the late subperiod. This implies relatively little change in the value of σ_3. If the variance of the theta target had fallen more substantially, we would find a bigger change in business cycle volatility between the early and late subperiods.

In this case, the volatility of all endogenous variables is reduced substantially. However, the volatility of consumption (nondurables and services) falls by more that the volatility of investment. The opposite is true in the data. Similarly, the volatility of hours worked falls by more than the volatility of output. Again, the opposite is seen in U.S. data. Finally, a large fall in the volatility of θ cannot account for the substantial fall in TFP volatility reported Table 1.

Our next experiment considers the potential of the intertemporal shock to account for the change in volatility. This shock enters the intertemporal first order condition, which can be written as follows:

$$\frac{1}{c_t} = \overline{\beta}\, e^{z_{4t}} E\left[\frac{(1-\alpha)(y_{t+1}/k_{t+1}) + 1 - \gamma\, u_{t+1}^{\phi}}{c_{t+1}} \right].$$

A natural way to calibrate the standard deviation of this shock is to target the volatility of consumption. If we employ this criterion, the value of σ_4 we obtain using data for the entire period, turns out to be 0.000403. While this is a considerably smaller value than our estimates of the other shock volatilities, it turns out to imply considerable volatility in the endogenous variables. In particular, the percent volatility of TFP implied by our model turns out to be 0.85. This is actually *larger* than TFP volatility computed from U.S. data for this same period (0.83).

Because of the considerable volatility generated by this shock, we report results for an experiment where the other shock volatilities are set equal to zero. That is, Table 6 gives results from the following experiment (assume $\sigma_1 = \sigma_2 = \sigma_3 = 0$):

1. Set σ_4 to match the volatility of consumption for the entire 1955-2003 period shown in Table 1.
2. Choose σ_4 to match the volatility of consumption during the early subperiod.
3. Choose σ_4 to match the volatility of consumption during the late subperiod.

Table 6—Volatility in a Model with Variable Factor Utilization
The Role of Intertemporal Shocks ($\sigma_1 = \sigma_2 = \sigma_3 = 0$)

Percent Standard Deviations

Series	*Entire Period*	*Early Subperiod*	*Late Subperiod*	*Late/Early*
Output	2.49	2.73	1.77	0.65
Hours	3.34	3.67	2.38	0.65
Capital	0.67	0.73	0.47	0.64
Investment	16.58	17.90	9.04	0.50
Consumption	0.80	0.88	0.57	0.65
Labor Productivity	1.15	1.29	0.84	0.65
TFP	0.85	0.94	0.61	0.65
Calibrated σ_4	0.000403	0.000453	0.000296	

We find that considerable volatility reduction can be accounted for by the intertemporal shock. In particular, unlike the government spending or preference shock, this shock appears to be able to account for the reduction in volatility of TFP and other endogenous variables once endogenous factor utilization is taken into account.

3. Conclusion (Preliminary)

- A decline in the variance of technology shocks can account for the change in U.S. business cycle volatility since 1984.
- If not technology shocks, need to consider shocks that operates through the "efficiency wedge" as defined in Chari, Kehoe and McGrattan (2004). Examples are given in Chari, Kehoe and McGrattan (2004), Comin and Gertler (2003), and Philippon (2002). Neither government spending shocks nor preference shocks are successful in a model rigged to generate large endogenous changes in the Solow Residual. Shocks to the consumer's intertemporal first order condition, however, may be successful.

References

Ahmed, S., A. Levin and B. A. Wilson. 2002. "Recent U.S. macroeconomic stability: good policies, good practices, or good luck?" International Financial Discussion Paper No. 730. Board of Governors of the Federal Reserve System.

Basu, S. 1996. "Procyclical Productivity: Increasing Returns or Cyclical Utilization?" *The Quarterly Journal of Economics* Vol. 111, No. 3, 719-751.

Blanchard, O. and J. Simon. 2001. "The long and large decline in U.S. output volatility." *Brookings Papers on Economic Activity*, 1, 135-164.

Burnside C. and M. Eichenbaum. 1996. "Factor-hoarding and the propagation of business-cycle shocks." *American Economic Review* 86, 1154-1174.

Burnside, Craig, Martin Eichenbaum and Sergio Rebelo. 1993. "Labor Hoarding and the Business Cycle." *Journal of Political Economy*, Vol. 101, No. 2. 245-273.

Burnside, Craig, Martin Eichenbaum, and Sergio Rebelo, "Capital Utilization and Returns to Scale," in *NBER Macroeconomics Annual 1995*, pages 67-110.

Chari, V.V., P.J. Kehoe and E.R. McGrattan. 2004. "Business Cycle Accounting." Federal Reserve Bank of Minneapolis Staff Report 328.

Christiano, L.J. and M. Eichenbaum. 1992, 'Current Real Business Cycle Theories and Aggregate Labor Market Fluctuations,' *American Economic Review*.

Clarida, R., J. Galí and M. Gertler. 2000. "Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory." *Quarterly Journal of Economics*, February, 147-180.

Cooley, T. F. and E. C. Prescott. 1995. "Economic growth and business cycles." In T. F. Cooley, ed., *Frontiers of Business Cycle Research*. Princeton University Press, 1-38.

Greenwood, Jeremy, Zvi Hercowitz and Gregory W. Huffman. 1988. "Investment, Capacity Utilization, and the Real Business Cycle" *American Economic Review*, Vol. 78, No. 3, 402-417.

Hansen, G. D. 1985. "Indivisible labor and the business cycle." *Journal of Monetary Economics* 16, 309-327.

Hall, R.E. 1997. "Macroeconomic Fluctuations and the Allocation of Time." *Journal of Labor Economics* 15 No. 1 Pt. 2, S223-S250.

Kahn, J. A., M. M. McConnell and G. Perez-Quiros. 2002. "On the causes of the increased stability of the U.S. economy." *Federal Reserve Bank of New York Economic Policy Review*, May, 183-202.

Kim, C.-J. and C. Nelson. 1999. "Has the US Economy Become More Stable? A Bayesian Approach Based on a Markov Switching Model of the Business Cycle." *Review of Economics and Statistics* 81, 608-616.

McConnell, M. M. and G. Perez-Quiros. 2000. "Output fluctuations in the United States: what has changed since the early 1980's?" *American Economic Review* 90, No. 5, 1464-1476.

Philippon, T. 2002. "Corporate Governance and Aggregate Volatility." MIT Working Paper.

Rogerson, R. 1988. "Indivisible labor, lotteries and equilibrium." *Journal of Monetary Economics* 21, 3-16.

Stock, J.H. and M.W. Watson. 2002. "Has the Business Cycle Changed and Why?" *NBER Macroeconomics Annual 2002*.

Taubman, Paul and Maurice Wilkinson. 1970. "User Cost, Capital Utilization and Investment Theory." *International Economic Review*, Vol. 11, No. 2. 209-215.