The cyclical component of US asset returns

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Preliminary and incomplete

Abstract
We show that excess returns on a broad range of assets are positively correlated with future economic growth. This common tendency for excess returns to lead the business cycle suggests a role for aggregate risk in the cyclical behavior of asset returns. We construct an exchange economy that illustrates how this might work. Its important ingredients are recursive preferences, stochastic volatility, and dynamic interaction between volatility and growth.

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Keywords: leading indicators, term spread, excess returns, business cycles, recursive preferences, stochastic volatility.

*Preliminary and incomplete: no guarantees of accuracy or sense. We welcome comments, including references to related papers we inadvertently overlooked. The latest version of the paper is available at: http://pages.stern.nyu.edu/~dbackus/GE_asset_pricing/ms/BRZreturnslatest.pdf.

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1 Introduction

We look at asset prices from the perspective of macroeconomists and ask: what do they tell us about the structure of the economy that generated them? We document two sets of facts that we think are worth exploring further. The first is the tendency for equity prices (or their growth rates) and term spreads (differences between long- and short-term interest rates) to lead the business cycle. In US data, and to some extent in data for other countries, fluctuations in these variables are positively correlated with future economic growth. Yet in virtually all business cycle models, everything — including equity prices and term spreads — moves up and down together. Indeed, this phrase is often treated as the defining feature of the business cycle. The second set of facts concerns excess returns. We show that excess returns on equity and bonds also lead the cycle. Moreover, they display similar cyclical patterns. This property is less widely known. It suggests that the cyclical component of excess returns is common across asset classes and has a macroeconomic origin.

If these are the facts, what do they tell us about the structure of the macroeconomy? To keep things simple, consider a traditional exchange economy in which the only inputs are preferences and a stochastic process for consumption growth. The evidence on equity prices and the term spread is telling us something about the dynamics of the economy, which suggests we look at consumption growth. What we need, it seems, is a process in which predictable changes in future consumption growth show up now in equity prices and the term spread. Preferences play a role, too, since they affect the value given to expected future growth. We'd have to work out the details to see whether this approach delivers the goods, but it strikes us as a plan worth pursuing.

The evidence on excess returns poses more of a challenge. If we have constant variances in the consumption growth process and use loglinear approximation methods, expected excess returns are constant by construction. We need variation in either aversion to risk or in risk itself. This point was made forcefully by Atkeson and Kehoe (2008) and we think it’s a good one: you can’t talk sensibly about the cyclical behavior of asset returns without cyclical variation in risk and/or risk aversion. Both paths have been taken in the literature. Without making any claim to superiority, we consider changes in risk generated by stochastic volatility in the consumption growth process. Recursive preferences allow us to assign volatility a positive price. Cyclical variation requires, in addition, some interaction between consumption growth and volatility. The net result is a modest generalization of the environment of Bansal and Yaron (2004).

Here’s the plan of attack. We document the facts in the next two sections using cross-correlation functions, useful visual representations of the dynamic relations between asset prices and economic growth. In Sections 4 and 5 we describe an exchange economy and
outline how it can be tuned to deliver something like the facts documented earlier. The last two sections connect our work to the literature, clean up some loose ends, and point to issues that remain unresolved.

2 Financial indicators of business cycles

In the US and elsewhere, financial variables are commonly used as indicators of economic growth in the near-term future. Two of the most popular are equity prices (typically the growth rate or return of a broad-based index) and the term spread (the difference between a long-maturity interest rate and a short rate). We describe the dynamic relations between these variables and aggregate economic growth with cross-correlation functions.

Data

Our data are monthly, and cover the period from 1960 to the present. Financial variables are (primarily) from CRSP. Bond yields refer to the end of the month — the last trading day — so the yield associated with October 2008 is that for October 31. Returns $r_t$ cover the whole month; the return for October 2008, for example, refers to the period September 30 to October 31. We use logarithms of gross returns because they line up more neatly with our theory.

Real variables come from FRED, the data repository of the Federal Reserve Bank of St. Louis. They are typically time averages. Industrial production for October 2008 is an estimate of the average for that month. The same holds for our other two measures of economic growth, consumption (real, total) and employment (nonfarm employment from the establishment survey). We compute growth rates as log-differences $(\log x_t - \log x_{t-1})$ over the previous month, so that the October growth rate is the growth rate of October over September. We also use centered year-on-year growth rates $(\log x_{t+6} - \log x_{t-6})$ on occasion to smooth out the high-frequency variation in these series without disturbing the timing. We think of these year-on-year growth rates as crude approximations to the Hodrick-Prescott filtered series often used in business cycle analysis.

Cross-correlation functions

The dynamic interrelations between financial indicators and economic growth are conveniently summarized with cross-correlation functions. If $x$ is a financial indicator and $y$ is a measure of economic growth, their cross-correlation function is

$$r_{xy}(k) = \text{corr}(x_t, y_{t-k}),$$
plotted as a function of the “lag” $k$. For negative values of $k$, $r_{xy}(k)$ reflects correlations of the indicator with future economic growth. If the correlations are nonzero, we say the indicator leads the business cycle. Similarly, positive values of $k$ correspond to correlations of $x$ with past economic growth; nonzero values suggest a lagging indicator. Our interest, obviously, is in the former: financial variables that lead economic growth and thus serve as a source of information about the future.

Consider equity returns. In Figure 1 we report the cross-correlation function for the (nominal) return on an aggregate portfolio of publicly-traded equity and the monthly growth rate of industrial production. The correlations on the left show that equity returns are positively correlated with growth in industrial production 3 to 11 months in the future. The correlations are small individually (the largest are between 0.1 and 0.2) but there’s a clear pattern. The correlations on the right are smaller, on average.

Figure 2 shows that this pattern is robust to a number of obvious variations. If we subtract inflation, to produce a real return, the picture is virtually the same (upper right panel). The correlations to the left are slightly larger, but it’s hard to see this in the figure. If we use year-on-year growth in industrial production to smooth out the month-to-month variation (lower left panel), the figure is considerably less bumpy, but the same pattern emerges: high equity returns are associated with high economic growth several months later. Finally, if we use only data from 1990 on, we see a similar tendency, but the cross-correlation function is much choppier with the shorter sample period.

In Figure 3 we turn to interest rates. The figure shows the cross-correlation function between the term spread (in this case the difference between yields on 5-year and 1-month treasuries) and the monthly growth rate in industrial production. Both yields are continuously compounded and nominal. A high value for the spread indicates a steep yield curve, a small or negative value a flat or declining yield curve. Decades of research has found repeatedly that steep yield curves (and large term spreads) are associated with above-average future economic growth.
this relation in our theoretical work, since it incorporates the lead of interest rates over GDP growth in a particularly simple form.

Quantities exhibit both higher correlations and more modest leads and lags. Consumption (Figure 3) is more highly correlated with GDP than equity prices or interest rates (the contemporaneous correlation is 0.63), but the correlations fall quickly with both leads and lags. Both are different from familiar correlations constructed from Hodrick-Prescott filtered data, where the contemporaneous correlations are larger and the decay rate smaller. See, for example, Christiano and Eichenbaum (1992) and Kydland and Prescott (1982). Evidently growth rates include more high-frequency noise than HP-filtered data. There’s also a slight tendency for consumption to lead GDP. In three of the four panels, the maximum correlation is contemporaneous \( (k = 0) \), but consumption growth leads GDP growth in the sense that the correlation of consumption with future GDP is larger than that of consumption with past GDP. The exception is consumption of services, which accounts for more than half of total personal consumption. Its growth rate leads GDP’s by about a quarter. Investment (Figure 4) is roughly contemporaneous, although equipment and software leads GDP a little and non-residential structures lags. Employment (Figure 5) exhibits a slight tendency to lag GDP. Although the maximum correlation is again contemporaneous, employment growth is more strongly correlated with past GDP growth than future GDP growth.

Similar features of US data have been reported in dozens, perhaps hundreds, of other papers. Prominent recent examples include Ang, Piazzesi, and Wei (2006), Estrella and Hardouvelis (1991), King and Watson (1996), Rouwenhorst (1995), and Stock and Watson (1989, 2003). We think they are interesting from a theoretical perspective, since they suggest more complex dynamics than most existing models possess.

3 Cyclical behavior of excess returns

4 A theoretical environment

5 Cyclical behavior of theoretical excess returns

6 Discussion

Including related work.


Computations. Collard...
Other interpretation: robust: more ambiguity in recessions? varying risk aversion?

Endogenous consumption. Naïk, BRZ, Lars, Max....

Cross-section of returns. Lustig, Koijen, and Van Nieuwerburgh (2008)
References


Croce, Massimiliano, 2005 “Welfare Costs and Long-Run Consumption Risk in a Production Economy,” manuscript, August.


Gallmeyer, Michael F., Burton Hollifield, and Stanley E. Zin, 2005??


Figure 1
Cross correlations for equity returns

Notes. The figure depicts the cross-correlation function for the return on an aggregate equity portfolio and the monthly growth rate of industrial production. On the left side of the figure, returns lead growth, on the right side they lag. The sample period is 1960-present.
Figure 2
Cross correlations for equity returns: variations
Figure 3
Cross correlations for the term spread
Figure 4
Cross correlations for the term spread: variations