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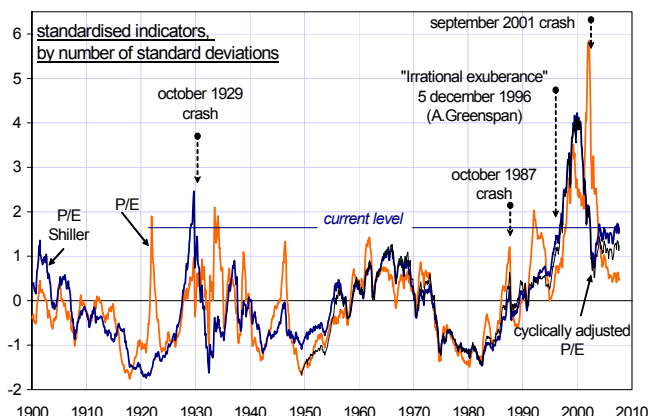
TRÉSOR-ECONOMICS

Are stockmarkets overvalued?

- The very sharp rise in equity prices until summer 2007, at a time when the US economy was showing signs of running out of steam, suggested that the markets were being unduly optimistic over earnings growth, especially since the latter already appeared to be very high at the beginning of the year. We consider this question here using the different types of "multiples" used in financial analysis, such as the price earnings ratio (P/E).
- In the United States, ratios are above their long-term average but by no more than one standard deviation. Historically, the "one standard" deviation distance can be identified as the threshold beyond which a correction on financial market has generally been observed. However, at least two factors show that one cannot rule out the risk of over-valuation in the US market.
- Cyclically adjusted P/E ratios turn out higher than non-adjusted ratios and thus, further away from the long term average. Indeed, the adjusted ratios appear to be better predictors of future price movements in the direction of a return to historical average P/Es.
- Moreover, there may be an upward bias in the calculation of average P/Es in the United States, due to the steep over-valuations seen in the late-1990s. Allowing for this distortion would move P/Es a little further away from their long-term average. This would appear to be confirmed by the use of a very long series based on the S&P Composite going back to 1870, especially when cyclically adjusted.
- In the eurozone, the stock market bull run appears to be consistent with fundamentals, in terms of both cyclically unadjusted and adjusted ratios. In other words, future market movements ought to take place in line with earnings trends. In Japan as well, regardless of the metric used, the multiples remain close to their long-term average, sometimes below, sometimes above, and thus cannot serve as early warning signals of an over-valued market.

This study was prepared under the authority of the Treasury and Economic Policy General Directorate and does not necessarily reflect the position of the Ministry of the Economy, Finance and Employment.

P/E indicators for the S&P Composite index over the long period



Sources: Shiller (<http://www.econ.yale.edu/~shiller/>), Datastream

1. Ratios are frequently used in financial analysis as a yardstick to assess valuations

Financial analysis regularly uses multiples, or ratios, as a yardstick to assess whether assets are correctly valued. These ratios serve to express a firm's market valuation relative to its fundamental variables (e.g. profit, cash flow, capital value, etc.). Despite their resemblance and the fact that they often move very closely in line, they nevertheless express different concepts.

1.1 The price earnings ratio is probably the one most commonly used

The Price Earnings Ratio (P/E) is defined as the ratio between the price of a company's¹ share and the net earnings per share². The P/E may be interpreted in a number of ways:

- P/E reflects the cost of a share of capital expressed per unit of earnings, which comes down to valuing a company on the basis of its present profitability;
- P/E is the theoretical number of years required for the sum of annual earnings to equal the price of a share. This is a theoretical number only, since even if the investor acquires an interest in the capital of a company and thus becomes the owner of a share in its future profits, the company does not pay out its entire annual profits to shareholders;
- P/E reflects expected future earnings growth relative to contemporaneous earnings. This is because a high P/E may suggest that investors expect strong future earnings growth, thereby pushing up the price of shares today.

Whatever the case, these interpretations explicitly refer to the analysis of companies' fundamentals. However, and because of the "asset price" nature of shares, a high P/E may also reflect exogenous factors, unrelated to companies' fundamentals, such as:

- a bubble or excess liquidity in the market, leading to a rational or irrational inflation in asset prices;
- an excess of demand and / or a preference shock for this type of asset; this too can push up prices;
- a temporary negative shock to earnings (due to an exceptional charge, etc.).

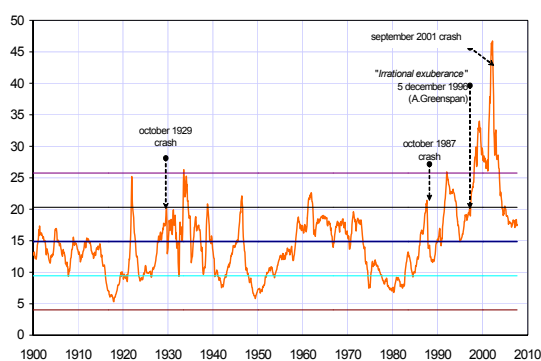
Consequently P/Es can vary widely depending on the sector, the business cycle, the stock exchange on which the share is quoted, the liquidity of the share, the quality of earnings estimates, etc. **However, it is not affected by company share buybacks (see box 1).**

For an index, the P/E primarily allows one to assess the average valuation of the companies comprising

the index relative to the past average valuation. For example, since 1871, the price earnings ratio of the S&P Composite has fluctuated around an average of 15, moving above 20 or below 10 (i.e. +/- the standard deviation) on rare occasions only. In the late-1990s, on the other hand, it moved durably above 25 and underwent a sharp correction with the bursting of the bubble in technology stocks (see Chart 1). The reversion of P/Es to the mean can thus be seen as an historical regularity.

A priori, P/E has no predictive value regarding share prices, and a high P/E does not necessarily point to an impending correction. However, as we have just seen, the propensity of the series to revert to its mean is an historical regularity: yet a high ratio can be followed by either a price drop (where earnings growth expectations are unreasonable), or by a rise in earnings (if the expected growth in earnings materialises).

Chart 1: Chart 1: S&P composite P/E



Source : Shiller (<http://www.econ.yale.edu/~shiller/>).

Comparing P/Es for different sector indexes is a tricky exercise due to their different long-term growth prospects: P/Es for different sectors may be structurally different and desynchronised. For example some sectors have high growth potential, such as technology firms, start ups, etc., which have high P/Es; others may be slow growing, or inherently weak, for example heavy industry.

It is interesting in theory to compare P/Es between different countries, since this would illustrate differences between cyclical outlooks and would bring the other macroeconomic variables (interest rates, exchange rates, etc.) into play. This kind of exercise is not very robust, however, since accounting rules for determining earnings are not necessarily harmonised from one country to the next. In addition, the indexes represent only

(1) For an index, the P/E is calculated as the sum of the market value of the constituent companies, divided by the sum of the same companies' earnings

(2) The earnings used here correspond in theory to the earnings contemporaneous with the share price. In practice, earnings refer either to the last published annual earnings, or to estimated future earnings for the current year, or to an average of the two, or again to a mix of the two (expected earnings for certain firms, and published earnings for others). The use of past and estimated future earnings allows analysts to work from more frequently updated data.

a sample of the real economy, and indeed embracing different perimeters, which can lead to distortions.

Sometimes the reverse of P/E, namely the earnings yield, is used. This ratio can be interpreted directly as the return on an asset, i.e. the potential earnings of a share relative to its price. The equity risk premium (ERP) refers to the difference between the earnings yield and the real interest rate (see Chart 2). Historically this premium has only very rarely been negative, and when it has been, this occurred systematically during times of financial turmoil, i.e. in the early-1930s, following a rise in real interest rates (to around 8.5% in November 1933); in 1987, just before the October crash; and between 1999 and 2001, just before the bursting of the internet bubble (see Chart 3).

1.2 The other ratios considered in financial analysis are price-to-book value, price-to-cash and dividend yield

The *price-to-book ratio* (P/B or P/Book) represents the market price of a unit of the firm's physical capital (see Box 1). The higher this price, the more profitable the firm's capital. For example, technology sector firms have very high P/B ratios because their capital is relatively small in relation to expected earnings. By construction (taking fixed capital,

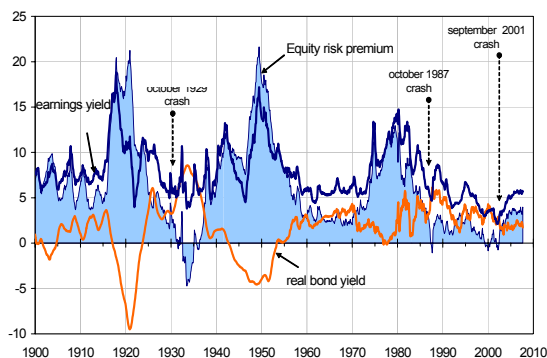
etc. into account), P/B is much lower than P/E (<10) and reflects share price variations more than P/E (see Chart 3).

The *price-to-cash ratio* (P/C or P/Cash) values the share in relation to the firm's cash flow (see Chart 4).

The *dividend yield* is equivalent to the earnings yield but considers dividends paid and not earnings. It therefore reflects the real income accruing from ownership of a share in the firm's market capitalisation and not its potential income. Although dividend ratios have the reputation of being the most reliable reflection of fundamentals, they are subject to short-term fluctuations caused by discretionary decisions. That is because the *dividend yield* will behave differently depending on whether shareholders are remunerated through dividends or capital gain, stemming from share buyback programs for instance.

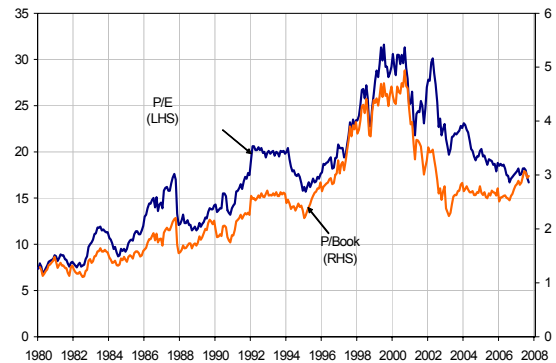
Some observers have advanced these kind of technical factors (share buybacks for instance) to account for the low dividend yield in the late-1990s (see Chart 5). It is possible to adjust for the bias induced by share sales. Campbell and Shiller³, however, show that the P/E is a far better indicator of future share price movements than the *dividend yield*.

Chart 2: long rates and the S&P Composite earnings yield



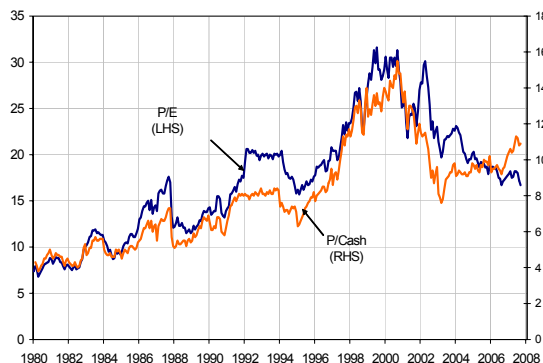
Source : Shiller, Datastream.

Chart 3: P/E and P/Book in the United States



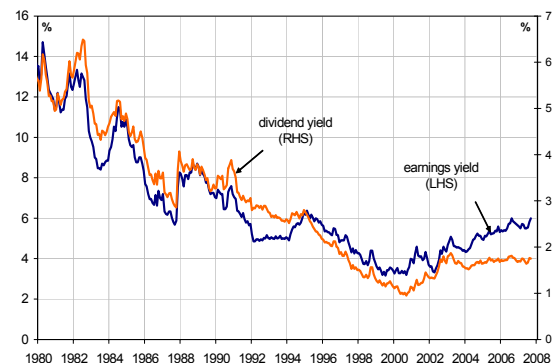
Source : Datastream Global Indices.

Chart 4: P/E and P/Cash in the United States



Source : Datastream Global Indices.

Chart 5: yield and dividend yield in the United States



Source : Datastream Global Indices.

(3) Campbell and Shiller (1988): "Valuation Ratios and the Long-run Stock Market Outlook", *The Journal of Portfolio Management*.

Box 1: Glossary

Dividend yield: ratio of a firm's dividend to its market value: $DY_t = \frac{DPS_t}{P_t} = \frac{D_t}{MV_t}$ (1)

where P is the price of a share, MV the firm's market value, DPS dividend per share, and D the total dividend paid by the firm.

Dividends generally represent a distribution of current year profits (or else they can be drawn from prior year profits, deferred, or transferred to reserves). Dividend ratios can be manipulated financially, for example when a firm uses its profits not to pay dividends to shareholders but to buy back its shares. In so doing it reduces the number of shares outstanding and hence the volume of dividends paid, which reduces the dividend yield independently of any fundamental consideration. This bias can be corrected by taking into account net buybacks of shares.

Table 1: Share of earnings paid out in dividends for selected stock market indexes

Period	1973-1995	1995-2007	1973-2007
DAX 30	41%	29%	37%
CAC 40	35%*	43%	40%**
S&P Comp	47%	35%	43%

*period 1988-1995 and **period 1988-2007. Source : Datastream and DGTPE calculations

Earning yield: the ratio is defined as the reverse of P/E (see definition of P/E).

Price-to-Book Value ratio: ratio of market value to the company's book value (in other words total assets less total liabilities, in the first place). P/Book thus represents the market cost of a unit of the company's capital.

$$P/Book_t = \frac{P_t}{BPS_t} = \frac{MV_t}{BookValue_t}$$

where BPS is the Book Value per share and $BookValue$ is the book value.

Price-to-cash ratio: ratio of market value to operating cash flow. It values the share in terms of the company's income-generating capacity. Cash flow is defined as the sum of net profit, depreciation and amortisation, and provisions for fixed assets, and capital gains or losses on asset disposals.

$$P/Cash_t = \frac{P_t}{CPS_t} = \frac{MV_t}{CashFlow_t}$$

where CPS is the Cash Flow per share and $CashFlow$ the cash flow of the company.

Price Earning ratio (PER): at the company level, ratio of the share price to earnings per share (net profit divided by the number of shares). It can also be defined as the ratio of the company's market value to its total net profit. The P/E is neutral relative to share buybacks by companies since the market capitalisation is neutral too.

$$PER_t = \frac{P_t}{EPS_t} = \frac{MV_t}{E_t}$$

Where EPS is earnings per share, MV the Market Value of the company, and E earnings of the company

For the index as a whole, P/E is the sum of the market capitalisations of all of the companies comprising the index, divided by the sum of their earnings. Consequently, this is not an average P/E of the companies in the index. That is because the average P/E of these companies is liable to be biased when the earnings of certain companies in the index are close to zero or negative: In such cases, P/Es diverge (when the denominator nears zero). Calculating the P/E based on the total capitalisation and the sum of earnings thus avoids these distortions.

$$\text{for a stock: } PER_t = \frac{P_t}{EPS_t} = \frac{MV_t}{E_t}, \text{ for an index: } PER_{index, t} = \frac{\sum_{i \in \text{Index}} P_{i, t} \cdot N_{i, t}}{\sum_{i \in \text{Index}} E_{i, t}}$$

Where EPS is earnings per share, MV Market Value, and E earnings, P_i the price of a share i and N_i the number of shares and E_i the earnings of company i .

Equity risk premium (ERP): difference between a risk-free real interest rate and earnings yield. In that sense it refers to the risk premium attached to the holding of shares rather than risk-free bonds.

$$ERP_t = \frac{E_t}{MV_t} - R_t, R \text{ is the risk-free real interest rate.}$$

Shiller ratio: (Campbell and Shiller [1988]) ratio between the real market capitalisation and 10-year moving average real earnings. Some authors, e.g. Smithers, recommend calculating a geometrical mean of earnings to ensure that the reverse of the adjusted P/E is equal to the adjusted earnings yield. Shiller's choice of a 10-year moving average corresponds to Graham and Dodd's [1934]^a recommendation to use moving averages of more than 5 years in order to eliminate short-term volatility.

One can also discount earnings not on the basis of price movements but by using a reference discount rate (the nominal long-term interest rate) in the same way as one could discount future profits, for example. However, the results of these different calculations are very close to those obtained with the Shiller method.

a. Graham & Dodd [1934], Security Analysis, McGraw-Hill Companies edition.

2. Cyclically adjusted P/Es reduce excess short-term earnings volatility and improve forecast performance

2.1 The Shiller method is based on the use of 10-year moving average earnings

According to Campbell and Shiller⁴ the "technical" volatility of earnings distorts and diminishes their informative content: due to the existence of sometimes complex accounting rules, together with non-permanent measures, cyclical trends, etc., short-term earnings variations would impair the predictive capacity of the P/E ratio. The authors thus suggest to smooth profits. They show that the ratios price/smoothed earnings are indeed better predictors of future dividend and price movements.

Historically (since 1871, see Chart 10), Shiller P/Es calculated on the basis of the Standard & Poors Composite index have been more volatile than P/Es (with a standard deviation of 6.4 versus 5.5) and higher on average (16 versus 15). This behaviour can notably be accounted for by Shiller's method of calculation: on the one hand the use of a moving average for earnings underestimates their upward trend during a growth phase; on the other, profits and share prices are correlated, which stabilises the ratio. Smoothing the denominator (earnings) hence increases its correlation with share prices and its volatility.

This greater volatility more explicitly reveals misalignments, if any, between earnings expectations (contained in the share price) and smoothed earnings. The most recent example is provided by the bursting of the technology stocks bubble in 2001: as early as 1995, and more markedly so than P/Es, the Shiller P/E had risen to historical highs, indicating possible over-valuation.

P/E ratios have no predictive value as to share prices, *a priori*. **Nevertheless, Campbell and Shiller show that, over the long term, P/E ratios are better indicators of future share price movements than they are of future earnings growth.** The authors thus show a positive correlation between share price variations and Shiller P/Es over the next ten years, whereas the correlation between future earnings growth and Shiller P/Es is only weakly negative. Over the short run, correlations between future variations in prices and earnings and P/E ratios are very weak, on the other hand.

2.2 The earnings cycle-trend breakdown splits P/Es into a structural and a cyclical component

The Shiller method may appear satisfactory insofar as it correctly smoothes earnings variations. However, it presents two major drawbacks.

(1) Due to the tendency for real earnings to rise, the moving average systematically underestimates them. Moving averages are commonly used to smooth series that are a little too volatile. When not centred but calculated only past values, it systematically lags behind variations in the crude series. Consequently, due to the tendency for real earnings to rise, the Shiller method will tend to underestimate them (and hence to overestimate P/E ratios) and to adjust only belatedly for any structural acceleration in earnings. Throughout the entire period during which the moving average lags the acceleration of earnings, the Shiller ratio will consider the assets to be overvalued.

(2) **This method has no theoretical foundation.** The choice of 10 years is *ad hoc*, based on the work of Graham & Dodd [1934], which recommends using moving averages for periods above 5 years for the purposes of financial analysis. Subsequently Campbell and Shiller [1988 and then 1998] sought to show that ratios built on the basis of a 10-year moving average were "quite suited" to analysis of multiples, inasmuch as they provide more information than unadjusted ratios with respect to future asset price movements.

To remedy these two points, we propose a cycle-trend breakdown of real earnings using a space-state model (see box 2). This method has the advantage of being intuitive and based on structural notions. Moreover, it takes into account additional information from exogenous indicators (leading indicators of the cycle) in order to estimate the cyclical signal. However, like most frequency filtering techniques, the last points in the filtered series generally depend on future movements and will be revised over time. Finally, the parameters defining the degree of smoothing are often *ad hoc*, their sole purpose being to yield properly smoothed series.

The breakdown directly generates the cyclically adjusted earnings and their cyclical component. Contrary to the moving average, the cyclically adjusted earnings series follows that of earnings and shows no misalignment in terms of level. The P/Es obtained using this method will thus be directly comparable with the unadjusted P/Es (with an identical average but different standard deviations), whereas this comparison was not possible using the Shiller ratios. The results of the estimates are presented in the following section.

(4) Campbell & Shiller (1988), "Stock prices, earnings and expected dividends", *Cowles Foundation Discussion Paper* n°858.

3. In the United States, P/E levels are currently being contained by the cyclical vigour of earnings. In the eurozone, they are in line with their historical trends

In the United States, the cyclical component of earnings has been positive since the beginning of 2005, reflecting the US economy's recovery since the 2001-2002 slowdown. Put another way, the recent vigour of earnings is partly cyclical and thus not sustainable. Hence cyclically adjusted P/Es are higher than unadjusted P/Es (since trend earnings are lower) and apart from a brief excursion to the mean and back in April 2003, valuation levels have remained above their historical mean, more so when cyclically adjusted (see Chart 6 and Table 1).

In the eurozone, the cyclical component of earnings has been negative since 2000, and is close to zero at present: earnings growth expectations are hence undisturbed by a temporary earnings acceleration and rather reflect a shift in the earnings trend (see Chart 9).

Moreover, these expectations and implied valuation levels do not seem unreasonable, insofar as ratios are currently at levels close to their historical mean (see Chart 7 and Table 2).

To a degree even more pronounced than in the United States, Japanese P/Es are currently being contained by a sharp spurt in earnings: indeed the cyclical component is at its highest since the early-1990s (see Chart 9). However, at that time, and contrary to today, Japanese market valuations were extremely high, to the point of being unreasonable, and P/Es were far above their historical mean (see Chart 8). Today, valuation levels have not soared, and given the recent earnings acceleration P/Es are still well in check. **As measured by cyclically adjusted P/Es, earnings growth expectations are indeed barely in line with their historical mean.** Owing to the sharp earnings surge since 2005, the Shiller P/Es, meanwhile, are pointing to market over-valuation (see Table 2).

Analysis in terms of level, and notably comparison of ratios with their historical mean, suffers from one important weakness : series are surely too short (1970- 2007) to avoid an upward bias in the calculation of the average due to the exceptionally high valuations observed in the United States and the eurozone between 1999 and 2001, and in Japan in the early-1990s.

The trend in P/E ratios suggests that the correction in the US and European markets in summer 2007 was justified. Nevertheless, the question as to whether this correction was sufficient to bring the markets back into line with fundamentals remains an open one. In the case of the United States, it is clear that this correction may not have been sufficient in scale since P/Es have not fallen below their historical mean, even though this is what has always

been observed for those indexes for which a longer history is available. It is thus possible that the Fed's strong response in the wake of the bursting of the Internet bubble, and the fact that it kept rates extremely low over an extended period, may have helped preserve a latent over-valuation of American assets.

Taking a longer period (since 1900), which is available in the case of the S&P Comp in the US, we find that since 2001, the P/E for this index has never fallen beneath its long-term mean. On the contrary, cyclically adjusted, it has even stabilised at more than one standard deviation above, which from an historical point of view has never happened over so long a period. On the few occasions on which P/Es have diverged by more than one standard deviation from their mean (1901; 1929-1930; 1965-1966), the markets have experienced a sharp correction in the following years.

Based on the Shiller P/Es, some economists had flagged a few month ago the possibility of over-valuation (see Martin Wolf, Financial Times, 08/03/2007 and forum for a discussion), especially since the business outlook for 2007 had been downgraded. Our analysis underpins this idea in showing that the relatively high valuation is sustained by a cyclical-and hence non-durable-acceleration of earnings, which means that valuation levels should be revised downwards⁵.

Where the eurozone is concerned, the measurement bias on the historical mean is probably less pronounced, even though there is no long series (dating beyond 1970) available on a European index. Indeed, contrary to the United States, P/E levels observed in the late-1990s were not that high compared to levels reached in the 1980s. Consequently there appears to be less of a risk that valuation levels may need to be revised downward as in the case of the United States.

Fabrice MONTAGNÉ

Table 2: Standard deviation distance relative to the mean of different P/E ratios in September 2007

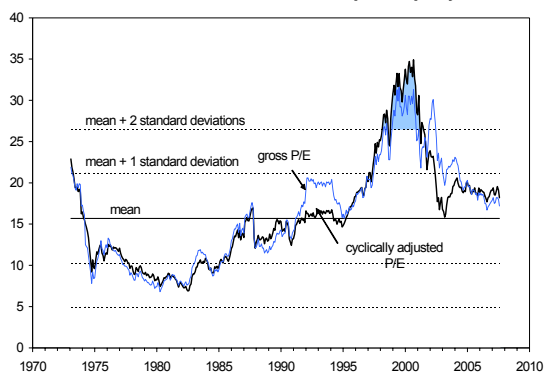
Indicator	US	EZ	JP	US (long time series)
P/E	0,2	0,4	-0,7	0,5
P/E Shiller	0,1	0,5	0,1	1,6
P/E trend component	0,5	0,3	-0,1	1,2

NB: the standard deviations and means have been calculated for the period 1972-present day, except in the last column, where a long time series dating back to 1870 has been used. The values calculated from short time series have been adjusted to account for the distortion introduced by periods of sharp over or under-valuation, as identified by a deviation from the mean greater than two standard deviations.

Source : datastream, Global Indices, calculs DGTPE

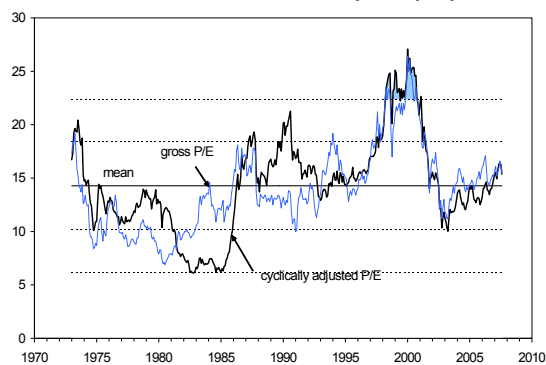
(5) Campbell and Shiller [1998] show that an excessive P/E is generally absorbed by a fall in prices relative to earnings, and not the contrary.

Chart 6: US P/E (thin line) and cyclically adjusted P/E



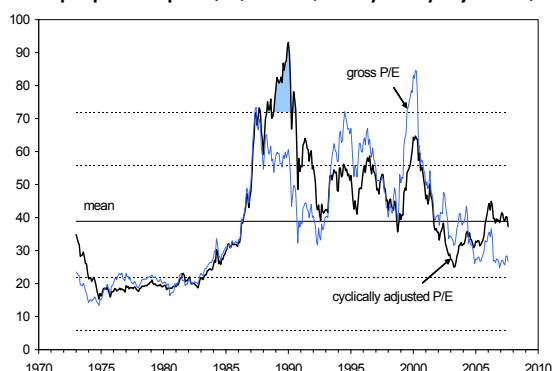
Source : Datastream Global Indices.

Chart 7: eurozone P/E (thin line) and cyclically adjusted P/E



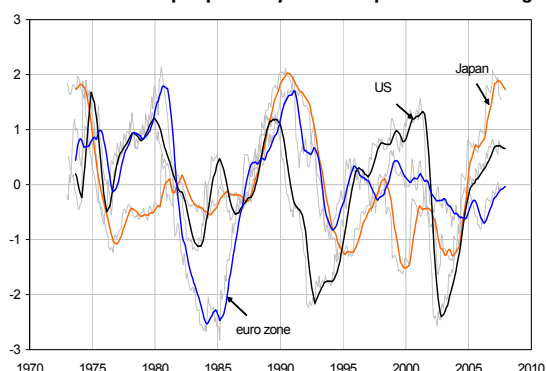
Source : Datastream Global Indices.

Graphique 8 : Japan P/E (thin line) and cyclically adjusted P/E



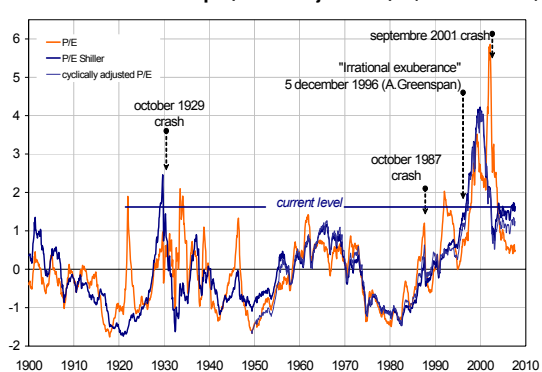
Source : Datastream Global Indices.

Graphique 9 : Cyclical component of earnings



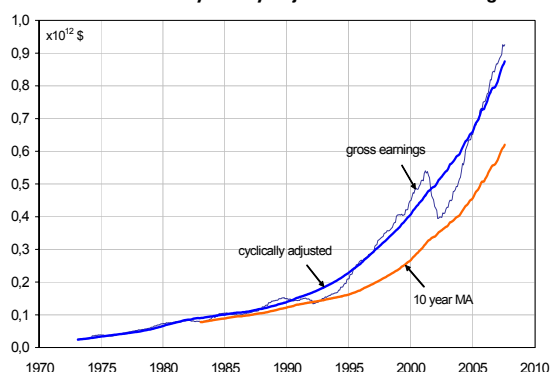
Source : Datastream and DGTPE calculations.

Chart 10: S&P Comp P/E and adjusted P/E (standardized)



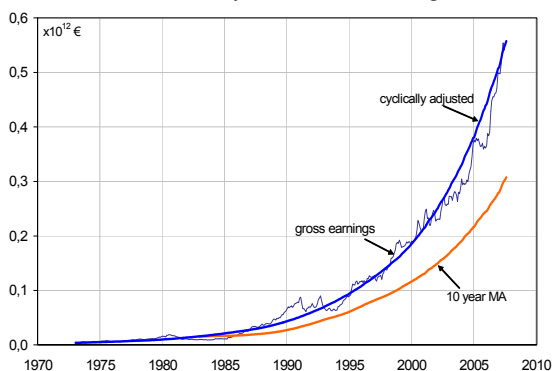
Because the trend component series of the P/E (Kalman) does not start until 1949, the cyclically adjusted series have been standardized using the mean and standard deviation for the P/E series since 1900. Source: Shiller, Datastream and DGTPE calculations.

Chart 11: Cyclically adjusted nominal earnings - US



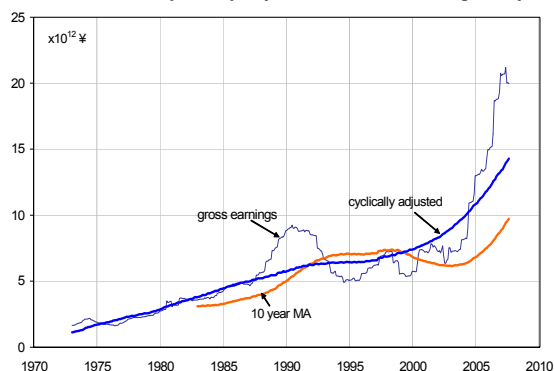
Source : Datastream Global Indices. and DGTPE calculations

Chart 12: adjusted nominal earnings - eurozone



Source : Datastream Global Indices. and DGTPE calculations

Chart 13: Cyclically adjusted nominal earnings - Japan



Source : Datastream Global Indices. and DGTPE calculations

Box 2: Presentation of the cycle-trend breakdown method

In building the following space-state model, we assume that log real earnings (deflated by consumer prices) can be broken down additively into a cycle, a trend and an noise component. The trend component is a process with a stochastic tendency, allowing us to account for a variety of types of permanent and temporary shocks. The cycle is possibly autoregressive, and assumed to be correlated with a cycle indicator (of the industrial output survey-type) and subject to shocks.

$$\begin{aligned} \text{Measurement equation} & \left\{ \begin{aligned} \text{earnings}_t &= \text{trend}_t + \text{cycle}_t + \varepsilon_t \end{aligned} \right. \\ \text{State equation no.1} & \left\{ \begin{aligned} \text{trend} &= \text{trend}_{t-1} + \beta_{t-1} + \mu_t \end{aligned} \right. \\ \text{State equation no.2} & \left\{ \begin{aligned} \beta_t &= \beta_t + \eta_t \end{aligned} \right. \\ \text{State equation no.3} & \left\{ \begin{aligned} \text{Cycle}_t &= \rho \cdot \text{Cycle}_{t-1} + \sum_k \alpha_k \cdot \text{Indic}_{t-k} + \kappa_t \end{aligned} \right. \end{aligned}$$

The variance parameters σ_ε and σ_μ are set to 0 (the state equation no. 2 and the measurement equation are therefore certain). The parameter σ_η is set such as to obtain a "satisfactory" degree of smoothing of the trend^a (the smaller σ_η the less volatile the trend). A certain degree of smoothing is authorised in state equation no. 2. ($\rho = 0, 5$). The remaining parameters α_k and σ_κ are estimated.

Table 3 presents the results of the estimation, when the indicator of the cyclical position is that of the OECD (*OECD Leading Indicator*) with different lags. The estimations of this equation for the United States, taking different cyclical indicators into account (ISM, output gap) give very similar results indicating that this type of analysis is quiet robust regarding the different indicators.

Table 3: results of estimations (Jan1970-Sept2007)

US		Euro zone		Japan	
α_3	$1,4 \cdot 10^{-2}$	α_1	$6,1 \cdot 10^{-2}$	α_1	$4,6 \cdot 10^{-2}$
α_{13}	$2,3 \cdot 10^{-2}$	α_{15}	$8,1 \cdot 10^{-2}$	α_{15}	$4,5 \cdot 10^{-2}$
$\text{var}(k)$	$1,9 \cdot 10^{-3}$	$\text{var}(k)$	$8,4 \cdot 10^{-3}$	$\text{var}(k)$	$6,7 \cdot 10^{-3}$
Log likelihood	612	Log likelihood	328	Log likelihood	337
Akaike info criterion	-2,932	Akaike info criterion	-1,559	Akaike info criterion	-1,602
Schwarz criterion	-2,903	Schwarz criterion	-1,530	Schwarz criterion	-1,573
Hannan-Quinn criter	-2,920	Hannan-Quinn criter	-1,548	Hannan-Quinn criter	-1,591

a. See Gordon, R.J., 1997. "The Time-Varying NAIRU and its Implications for Economic Policy", *Journal of Economic Perspectives*, vol. 11 (1).

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