The Difficulty of Pricing "New Economy" Stocks

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Executive Summary

With the emergence around 1997 of a distinction between "new economy" stocks and the so-called "old economy" stocks, it has become necessary to take an additional dimension into account when monitoring stock markets. Specifically, pricing new economy stocks raises three types of problems :

- Definitions and measures are not straightforward;
- The usual analytical frameworks show limits;
- The behaviour of investors and issuers is new.

1. Definitions and measures

The definition of "new economy stocks" can be based on official statistical nomenclature (i.e., aggregation of selected sub-sectors) or on multi-criteria approaches including qualitative assessment of the innovative capacity and potential growth rate of firms. Regarding the "nomenclature" approach, the concept "New information and communication technologies" – NICT – provides a valuable starting point. A broader definition of "technologically innovative sectors" can be obtained by adding to the NICT other technological activities.

Stock market index approaches are basically relying on these concepts, adding also some qualitative criteria. Due to the flourishing of new indices designed to capture new economy stocks, market participants can now use three types of indices, i.e. *indices specific to certain segments or markets*, *sectoral sub-indices* of general indices, and *specialised indices* that group technologically innovative sectors.

Specialised indices and specific indices, which were both created recently, were intended to capture "emerging" segments of stock markets. However, specialised markets are neither restricted to technologically innovative stocks, nor do they have a monopoly on these stocks, since a number of them are still listed on traditional stock markets. Moreover, the new indices suffer from their lack of historical track-record. Conversely, sectoral sub-indices of general indices, which are certainly less homogeneous, can be used over a longer period. Against this background, we decided to combine the various indices instead of sticking to a particular kind of index.

Evaluating the specificity of technology stocks requires a wide range of indicators. In addition to the trends in the stock indices (rate of growth, volatility), additional key indicators are price earning ratios, developments in the different sectors' relative weight in stock market capitalisation, and "supply/demand" ratios on the primary market for IPOs.

No simple conclusion can be drawn from the combination of these indicators. However, new economy stocks differ from the so-called old economy stocks in the high levels of historical price volatility. Furthermore, new economy stocks display high expected PER compared with other sectors of activity. The relative weight of new technologically innovative sectors in stock market capitalisation has increased sharply since the beginning of the 1990s. Finally, we suggest that the demand for new listed securities does not differ significantly from what is observed for other sectors.

2. The usual analytical frameworks show limits

The findings of macroeconomic and historical valuations of "new economy" stocks give rise to divergent interpretations. As a matter of fact, the discussion on stock valuations has centred on the discrepancy between the long-run returns on risky financial assets as valued according to historical series (estimated at 6-7% per year) and the strong growth in new economy asset prices over the recent period: with the exception of Japan, the main stock markets have posted average annual growth of over 20% since 1996.

This divergence between long-term returns and actual returns leads us to examine the "supply shock" of the new economy and its impact on stock markets. In its more restrictive interpretation, the new economy can be said to be the product of a new technological revolution, similar to the advent of railroads or electricity. In theory, this definition should induce investors to be more circumspect, since in the past the introduction of technical changes sparked off speculative waves without generating strong long-term growth cycles on stock markets. In its broader interpretation, the new economy can be considered to be the result of three phenomena : a technological revolution, the diffusion of the free market economy model, and the sustained integration of financial markets. This unprecedented combination would therefore support the assertion that there has been a break in the long-term trend of equity returns, which may lead to an alternative model of long-term equilibrium.

Like macro-economic and historical approaches, "micro-economic" or "practitioners" approaches raise also difficulties. Firstly, stock pricing methods are invariably based on two pillars. The first pillar is the use of "historical track-record", that is, the ability to make projections based on past earnings and financial structure according to typical corporate trajectories (or profiles). The second pillar is the ability to position a firm within a homogenous group of comparable firms. In the case of technology stocks, these two pillars—historical track-record and positioning benchmarks—are either partially or completely lacking. Secondly, financial approaches relying on the risk premium concept (Capital Asset Pricing Model, options theory) assume that the company which has been selected will, in a few years time, win out over the competition. In fact, there are two pitfalls with this approach when applied to new economy stocks. First, when forecasting the anticipated future earnings of technology stocks, investors may not fully factor in the consequences of the transition from a growth market to a mature market: all stocks have a positive value while, in the end, not all firms will survive. Second, instability arises when the various players in a sector compete for added value. The uncertainty regarding future earnings resulting from these power games within given sectors may lead to excessive valuations for certain companies and undervaluations for others.

3. The behaviour of investors and issuers is new

Changes in the behaviour of market participants and financing circuits influence the pricing of new economy stocks.

The behaviour of technology stocks can be explained in part by theoretical analyses of stock markets. The theory of asset bubble provides a relevant framework for analysing the development of bubbles on market for technology stocks, notably in the United States and in Europe. The rational bubble approach helps to explain why the price of a stock may diverge increasingly from its fundamental value and over a fairly long period of time, under the assumption that the agents' expectations are rational. However, the correction observed in technology stocks both in France and the United States, as from the spring of 2000, cannot be easily explained by the existence of a bubble developed by a market made up of rational investors. The "mimetic" bubble approach, which is based on the assumption of a certain "mimetic confidence" between agents on fundamentals, appears more convincing. It can account for the emergence – or bursting - of speculative bubble at a macroeconomic level, since, under growing uncertainties about the value of the fundamentals, investors tend to "copy" other investors' strategies. Finally, the "irrational and noise" bubbles theory, that questions the assumption of homogenous rational expectations, may provide an explanation for the chronic instability of stock prices.

Against this theoretical background, it is worth investigating changes in the market functioning. As a matter of fact, stock-market dealing mechanisms may affect the pricing of technology stocks and contribute to the emergence or persistence of bubbles on equity markets. First, in order to deal with offerings and investor demand, intermediaries on equity market may, among other solutions, increase the issue price. They also tend to step up the number of IPOs, at the risk of listing very young companies for which valuation is rather uncertain. Index-linked management can amplify the spread of herd behaviour and lead to self-sustaining

price increases, since benchmarking implies the allocation of capital according to relative value of expected performance. Furthermore, the advent of electronic trading platforms and on-line broking can hasten the spread of market trends.

Changes in the financing of new economy companies also makes it more difficult to price their shares. The distinction between seed capital, venture capital and development capital has blurred. Until the end of the 1990s, the first stages of the creation of a company were handled by specialists such as venture companies. IPOs took place once the company had reached a further stage of development. Two major changes have affected new economy companies: the initial phase may be launched resorting to public savings; it is difficult to position listed companies at a given phase of their development, since there is no stable industrial model. This makes determining the initial listing price very complicated.

While start-ups can call on two effective sources of financing – Nouveau marché ("new market") in France or venture capital financing on the one hand, banks lending on the other hand, a third source – a bond market for small issuers or issuers with a high risk profile – has not yet come to maturity in Europe. As a result, investors cannot resort to an important reference, the interest rate charged on debt markets. While equity investors base their decisions on growth potential, bond investors base theirs on default risk. Combining both approaches is the best means of forming a reasoned opinion of the "value" of new economy companies. In this context, a market for private risk bonds would provide investors with a useful reference for assessing developments in equity markets.

All in all, the debate on the fair pricing of new economy stocks appears to be open and inconclusive. Furthermore it cannot be dissociated from other issues such as the rational allocation of financial resources between the different sectors of activity on the one hand, and the appropriate financing channels on the other hand. Failures in both areas can fuel financial bubbles, making it even harder to reach an agreement on the fair price of assets.

1. Defining and measuring the new economy and technology stocks

1.1. Definitions

Financial market operators consider "new economy" stocks to be "TMT stocks"—Technology, Media, Telecommunications — or "technology stocks".

This terminology, widely used by stock market analysts, is not clearly defined. Of course, it is not the first time that the financial community is using a concept which is not clear-cut. In the 1970s and in the early 1980s, stocks referred to as *blue chip* stocks came to the fore; at the end of the 1980s, the concept of *growth stocks* appeared (in France, the Second Marché -"Second Market"-, and subsequently the Nouveau Marché -"New market"- were set up to list these stocks). However, statisticians on the one hand and designers of stock market indices on the other have sought to clarify these terms.

1.1.1. A sectoral nomenclature approach

In France, the report *Technologies et Société de l'Information*[1] adopted in 1999 the concept of new information and communication technologies (NICT), which provides a useful starting-point. However, as the new economy is not restricted to new information technologies, a wider concept, known as "technologically innovative sectors", has also been adopted for the main innovation indicators published periodically by the Ministry for the Economy, Finance and Industry. In addition to the NICT, it also covers the sectors concerned with biotechnology, pharmaceuticals and new materials (see box 1).

Box 1: Definition of technologically innovative sectors

According to the main innovation indicators drawn up by the General Directorate for Industry, Information Technologies and Postal Services (DigitiP) the technologically innovative sectors are the following:

1) Sectors linked to information and communication technologies (NICT):
– manufacturing of computers and other IT equipment;
– manufacturing of isolated wires and cables;
– manufacturing of navigational aids;
– manufacturing of scientific and technical instruments;
– manufacturing of equipment for controlling industrial processes;
– wholesale trade of office equipment and computer hardware;
– telecommunications;
– renting of office machines and computer hardware;
– EDP;
– cinema and video;
– radio;
– production of television programmes;
– broadcasting of television programmes.

2) Other technological activities:
Sub-groups of chemistry, industrial pharmacy, biotechnology and new materials.

The activities of these technologically innovative sectors are very diversified, both in terms of the type of customers (final consumer, other businesses), the degree of capital intensity, the time horizon of the return on

[1] *Technologies et société de l'information*, French Secretary of State for Industry, 1999

investment (from heavy industry to engineering), and the international exposure (domestic, European, world markets). This diversity should be reflected in the corresponding stock price trends.

1.1.2. A stock market index approach

Market participants have three types of indices at their disposal: indices specific to certain segments or markets, sectoral sub-indices of general indices, and specialised indices.

As far as the *indices specific to certain segments of the stock market* are concerned, the rules of the so-called new stock markets are particularly well adapted to start-ups or companies in high-growth segments. These new market indices should therefore constitute a homogeneous benchmark. However, specialised markets are neither restricted to technologically innovative stocks, nor do they have a monopoly on these stocks, since a number of them are still listed on traditional stock markets. Referring to the Nasdaq, which is a significant indicator of the trends in technology stocks, 35% of companies listed on the Nasdaq in 1999 carried out activities linked to the Internet. *By contrast, 65% did not*. Therefore, equating the Nasdaq index with Internet stocks would be certainly excessive.

The *sectoral sub-indices of general indices* may also be used to represent new economy stocks. An example is the SBF 250[2], which comprises two sub-indices, SBF capital goods and SBF other services.

Finally, the cross-segment *specialised indices* group the stocks of technologically innovative sectors within a homogeneous index. However, the new indices suffer from their lack of historical track-record.

Specialised indices and specific indices, which were both created recently, were intended to capture "emerging" segments of stock markets. However, although they are less homogeneous, sectoral sub-indices may be used over a longer period. In order to describe the stock price trends of technologically innovative sectors, one can refer to the specialised and specific indices on the one hand, and the sectoral sub-indices on the other (see box 2 next page). Both approaches have been used in a complementary manner in the following discussion.

1.2. Measuring the phenomenon

Four types of indicators can be used to evaluate the specificity[3] of technology stocks on financial markets: trends in the aforementioned stock indices, price earning ratios, developments in the different sectors' relative weight in stock market capitalisation, "supply/demand" ratios on the primary market for IPOs.

1.2.1. Analysing stock market indices: growth rate and volatility

Three lessons can be drawn from the graphs and tables on the average annual growth rates and the volatility of the different French stock market indices (cf. appendix).

– Companies in technologically innovative sectors differ in terms of valuation trends (graph 1): the average annual growth rate of their stock prices has risen over the recent period, whereas that of the broad SBF 250 index peaked during the 1996-1998 period before slowing over the most recent period. This observation should not lead us to equate all high-growth stocks with technology stocks. Certain companies outside the aforementioned sectors have also registered significant increases in their stock prices. For example, the LVMH group ranked third in the CAC stock index in terms of annual stock price progression in 1999 (+190%). We should therefore qualify our judgement on the instrumental role played by the new economy in the rise in stock prices and also take into consideration the fact that a significant share of the increase can be attributed to the so-called old-economy stocks.

[2] SBF stands for « Société des Bourses Françaises »

[3] The objective of this section is to highlight the distinctions between listed technology stocks and other stocks. It is not to measure the weight of the new economy in market capitalisation, as this objective is beyond the scope of this article.

Box 2: ***French stock market indices measuring the performance of technologically innovative sectors***

There are three types of stock market indices:

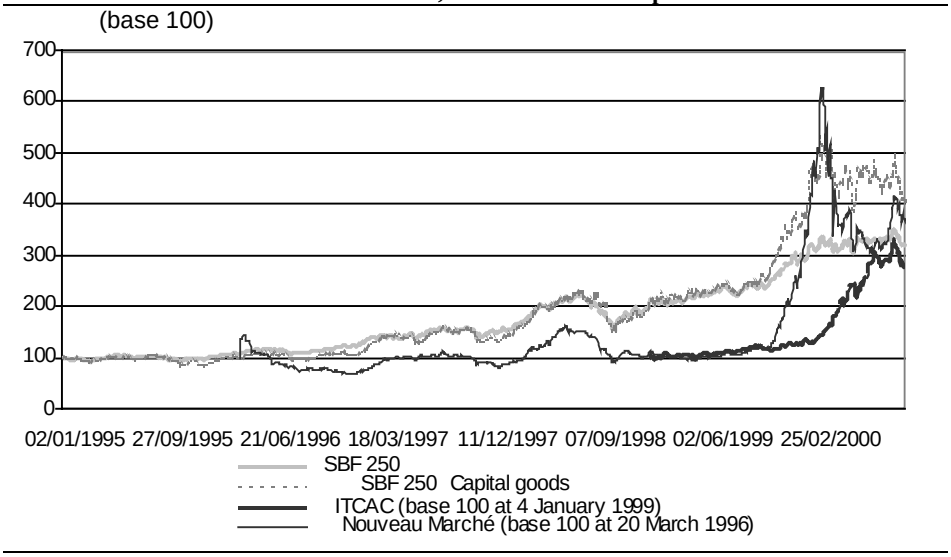
- *The index specific to the Nouveau Marché tracks the stock market prices of all the companies listed on the Nouveau Marché. The sectoral breakdown of companies forming this index shows that a majority of them are active in new economy sectors ("information technology", "electronics", "telecommunications") which account for more than 50% in the index. The other sectors represented are "engineering", "life sciences", "services" and "other". Setting aside the last two sectors, which are more diverse, over two thirds of the stocks are from technologically innovative sectors.*

- *Two sectoral indices drawn from the general SBF 250 index: the SBF 250 index (base 1000 at 31 December 1990) reflects the general market trend as well as that of its main economic components. Two sectoral sub-indices of this broad index can be considered to be representative of new economy stocks: the SBF capital goods index and the SBF other services index. The main activities of a large number of companies listed under these sectoral indices are linked to technologically innovative sectors. These indices are useful because they can be calculated over a longer period of time than the specialised Nouveau Marché indices and the ITCAC 50, with which they partially overlap.*

- *Two specialised indices: the ITCAC 50 index (base 1000 at 31 December 1998) and the broad ITCAC index. The former comprises the companies in the technologically innovative sectors, while the latter also includes retail trade in computer hardware and software, as well as on-line financial services, which are not included in the definition of the DigitiP (see box 1). The designers of the ITCAC 50 and ITCAC indices indicate, in their methodology, that companies which have Internet-related activities (for example e-commerce) can join this index: "it is not possible to define any purely deterministic criteria for this group of companies (…) The fact that these stocks are included in the target population is a result of the company's firm strategic decision to position itself on new technologies. Despite these subtle differences, there nevertheless appears to be some agreement on the boundaries of the technologically innovative sector".*

Graph 1

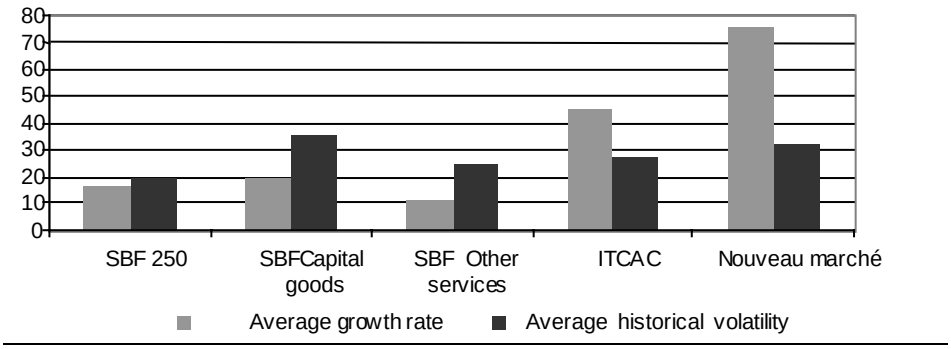
French stock market indices : broad index, sectoral index and specialised indices



– Technology stocks differ even more from the so-called "old economy" stocks in the high levels of historical price volatility (graph 2). Maximum volatility levels were reached in 2000 (over 50%, and even more than 100% for the "Nouveau Marché" (New Market), largely reflecting the uncertainty about the value of the securities concerned. The maximum level of volatility of the broad SBF 250 index was reached in 1998, corresponding to a more unstable macroeconomic environment (slump of world economic growth at the time of the South-East Asian stock market and foreign exchange crises).

Graph 2

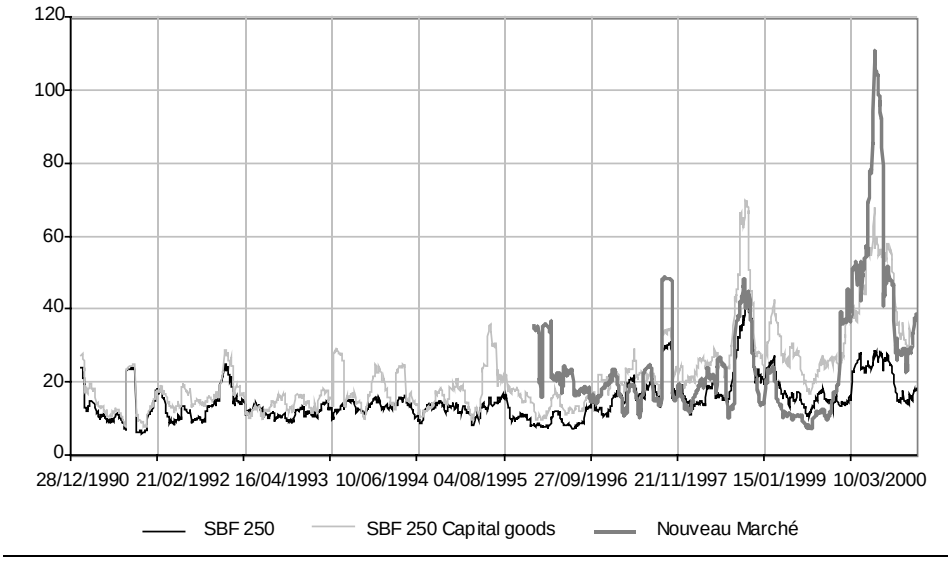
Average growth rates and average historical volatility
from 1 January 1999 to 30 September 2000



– All sectors are experiencing greater volatility, although the levels differ (graph 3). This has been a general trend over the past ten years, which has been driven by three mechanisms. Firstly, the rapid development of certain technologies is disturbing the competition structure, including in the so-called traditional sectors. Secondly, the traditional sectors are finding new sources of growth, especially in the emerging economies, whose economic cycles are less predictable, if not more abrupt. Such geographical diversification reinforces the growth potential of multinationals which invest there, but can also alter their risk profile. Thirdly, after a period when the priority was given to financial consolidation, companies have endeavoured to benefit from interest rate levels which enabled them to achieve positive leverage, thereby increasing their debt ratios. This is also a factor which could affect the volatility of expected profits.

Graph 3

Historical volatility since 28 December 1990



The trends observed on the French markets appear in other countries too (table 2): the strong rise in technology stocks is illustrated for example in France by a 237% rise in the Nouveau Marché index over the last eighteen months, while the CAC 40 index climbed by 51%. In the United States, the surge in Nasdaq and Nasdaq Telecom indices has exceeded that of the Standard & Poor's 500 and Dow Jones indices.

Table 2: Growth rate of technology and traditional indices between 4 January 1999 and 30 September 2000

Traditional indices		**Technology indices**	
United States		**United States**	
DJ industrial	16	Nasdaq	66
S&P 500	17	Nasdaq Telecom	46
France		**France**	
CAC 40	51	Nouveau Marché	237
SBF 250	53	ITCAC	175
Germany		**Germany**	
DAX	29	Euro Neuer Markt	64
United Kingdom		**United Kingdom**	
FTSE 100	7	FTSE Techmark (a)	55
Japan		**Japan**	
Nikkei	17	Nasdaq	225
Topix	38		

(a) Period: 5 November 1999 to 30 September 2000
Source: Bloomberg

1.2.2. Results drawn from Price Earning Ratios (PER)

The PER analysis highlights a special feature of the new economy stock market, i.e. high expected price earning ratios compared with the other sectors of activity. The PERs of the specialised indices also rose, in particular in the first half of 2000 (tables 3 and 4).

Table 3: Average PERs of a few stock market indices

	29 Dec. 1990 to 31 Dec. 1995	1 Jan. 1996 to 31 Dec.1998	1 Jan. 1999 to 30 June 2000
Dow Jones	20.46	20.13	25.24
S&P 500	20.60	22.78	31.64
CAC 40	27.62	25.34	30.08
SBF 250	–	38.06	30.30
ITCAC	–	–	37.22
Nasdaq	–	47.38	107.12

Table 4: Average PERs of the sectoral components of the S&P 500 index

	29 Dec. 990 to 31 Dec.1995	1 Jan.1996 to 31 Dec.1998	1 Jan.1999 to 30 June 2000
S&P 500	20.60	22.78	31.64
S&P 500 telecommunications	65.75	67.00	70.44
S&P 500 industry	23.04	25.53	37.69
S&P 500 finance	13.11	16.30	18.52
Source: Bloomberg			

The difference between sectors is partly attributable to the heterogeneity of the business structures, or even to the impact of accounting methods, which in fact make international comparisons difficult:

– In absolute terms, the earnings of numerous companies in the technologically innovative sectors are low. As the returns on investment are not yet certain, the value of the PERs is driven upwards.

– A relatively larger proportion of these companies' investments is devoted to intangible expenses recorded as costs, weighing on the earnings more than if the expenses had been capitalised and amortised over several years. For this reason, the PERs of companies with considerable intangible expenses are structurally higher than average.

1.2.3. Changes in the different sectors' relative weight in stock market capitalisation

Considering that the indices devoted to technology stocks were created recently, it is necessary to resort to the sectoral breakdown of broad indices to measure the relative changes in the weight of technologically innovative sectors (or technology stocks) in market capitalisation in the medium term. In table 5, we use the two sectors of the SBF 250 index that tally the best with the components of the ITCAC index: "capital goods" and "other services"[4].

[4] – the sub-sector "other services" includes 15 out of 60 stocks that cannot be included in the technologically innovative sectors (principally Adecco, Accor, Air France).
– 43 stocks, weighted at 50%, can be included.
– Suez Lyonnaise and Vivendi, classified in this sub-sector and partly linked to the new economy, represent the remaining third.

Table 5: Weight of the technology stocks as reflected by the sectoral sub-indices of SBF 250

	31 Dec.1990	31 Dec. 1995	31 Dec.1999	30 June 2000
SBF 250 index	1,000	1,233	3,811	4,069
SBF sub-indices :				
– capital goods	1,000	929	4,124	4,744
– other services	1,000	911	3,197	3,366
Weight (%) of the sub-indices in the index	22.0	19.0	38.8	40.2
Source: EuroNext Paris				

After decreasing in the mid-1990s, in line with changes in business conditions and corporate restructuring affecting certain players in these rapidly-changing sectors, the relative weight of the technologically innovative sectors showed a significant increase at 30 June 2000 compared with the early 1990s. This fact is not totally surprising considering that the phenomenon is relatively recent in France. The smaller weight observed at the end of 1995 (19%) seems to correspond to a transition period for many players in these sectors, with the restructuring of traditional sectors and uncertainty about the development and growth of future technologies. Between 1995 and 2000, two factors contributed to the 40% increase in the relative weight of the technologically innovative sectors : introduction of previously non-listed large market players and the development of companies already listed in 1990. Therefore, in addition to investors' interest in technology stocks, the growing role of stock markets in financial intermediation (increase in the listing) contributed to the growth in the relative weight of these stocks in total market capitalisation.

1.2.4. Supply/demand ratios on the primary market

Although demand for new listed securities has so far exceeded offerings in a majority of cases, the demand for such securities does not differ significantly from what is observed in other sectors. This point can be illustrated by examining the most recent period in France, which was characterised both by a sustained flow of IPOs and an "experience effect", which is likely to have influenced the behaviour of issuers and investors, following the strong fluctuations in the first four months of 2000 (table 6).

Table 6 : Supply/demand ratios for IPOs in the Paris Bourse

	May 2000		June 2000		July 2000		Individuals (a)		Institutional (a)	
	Indivi-duals	Institu-tional	Indivi-duals	Institu-tional	Indivi-duals	Institu-tional	Mini-mum	Maxi-mum	Mini-mum	Maxi-mum
Premier and Second Marchés	70	27	33	9	68	44	0.79	100.0	1.41	73.61
Nouveau Marché	54	23	70	36	67	40	7.76	100.0	3.28	92.36
(a) The minimum and maximum columns indicate, for each category of investors, the highest and the lowest ratios observed on the basis of the new listings drawn up during the three-month period under review.										

This result can be explained by the three parameters which determine investors' interest on the primary market, and which have a similar impact on companies in the technological sectors and in other sectors:

- the sector of activity: the IPO of a company in a traditional sector, on a market with low growth but likely to produce regular profits, can generate as much demand as that of a company holding a patent or a concept with promising outlets;
- the number of securities actually floated;
- the investor's assessment of the relative cost of the listing price.

2. Difficulties in analysing results

2.1. The findings of the macroeconomic and historical valuations give rise to divergent interpretations

The debate on stock valuations has centred on the discrepancy between the long-run returns on risky financial assets as valued according to historical series and the strong growth in new economy assets in the past three years. Based on work by J. Siegel (1998)[5], the return on equities has been estimated at 6%-7% in the past two hundred years. A study published by CSFB Gilt Studies in 1999 [6] gives a return of 6.5%. R. Mehra and E. Prescott (1985) consider that American equities yield an average real return of 7% per year after inflation, compared with only 1% for US Treasury bonds.

According to these estimates, *after recording annual growth of 50%, a stock market would be expected to stagnate for six to eight years, thus converging towards very long-term equity returns*.

With the exception of Japan, the main stock markets have posted average annual growth of over 20% since 1996 (see annex), in comparison with long-term equity returns of 6% to 7%.

In this context, a study by Wadhani (1999) examined the assertion by Siegel that equities were historically undervalued in the past. The author concludes that, given these circumstances, the recent stock price surge is more a reflection of a downward revision of the risk premium, measured *ex post*. However, the author underscores the paradox of low risk premia co-existing with expectations of returns that are much higher for equities than for bonds.

This divergence leads us to examine briefly the "supply shock" of the new economy and its impact on stock markets.

In its narrow ("technological") interpretation, the new economy can be said to be the product of a new technological revolution, similar to the advent of railroads or electricity. In theory, this definition should induce investors to be more circumspect, since in the past the introduction of technical changes sparked off speculative waves without generating strong long-term growth cycles on stock markets.

In a broader interpretation, the new economy can be considered to be the result of three phenomena: a technological revolution, the spread of the liberal development model and the sustained integration of financial markets. This unprecedented combination has made it possible to invest massively in research and development: Not only have a wide range of sources of financing become accessible, but the R&D efforts can now be amortised in the markets of emerging economies as well as in those of developed countries. This broad approach would support the assertion that there has been a break in the long-term trend of equity returns, which may lead to an alternative model of long-term equilibrium.

2.2. The "microeconomic" or "practitioners" approaches are not yet stable

2.2.1. "Trajectory analyses" and "sector positioning"

Stock pricing methods are invariably based on two pillars, both for the valuation of tangible and intangible assets and the capitalisation of discounted cash flows. The first pillar is the use of "historical track-record", that is, the ability to make projections based on past earnings and financial structure according to typical corporate trajectories (or profiles). The second pillar is the ability to position a firm within a homogenous

[5] J. Siegel, "Stocks for the Long Run", 1994, *Irving Professional Publishing*, and "Risk and Return", *FT finance series*, 1998

[6] Quoted in the *Financial Times*, Plender, 3 January 1999

group of comparable firms. In the case of technology stocks, these two pillars—historical track-record and positioning benchmarks—are either partially or completely lacking. In other words:

– The initial public offering of certain start-ups is relying more on the promotion of a new "business model" rather than on a more traditional development plan with detailed financing forecasts.

– It is hard to determine the life cycle of new products in the new economy sector because rapid innovation can lead to the obsolescence of a new product or service more quickly than expected.

– A static analysis of holdings of intangible assets (measured in terms of market share, patents and brands) is hindered by the lack of a proven sectoral benchmark. Many recently-created companies do not have well-established brands or patents, and their market share is difficult to assess or tends to fluctuate.

2.2.2. The financial approaches

The approaches relying on the risk premium concept (Capital Asset Pricing Model, options theory) highlight the substantial risks associated with any stock market investment for which the expectations of future returns are very high. This is borne out by the fact that the activity of most technological companies is based on a single product. A company with more diversified activities is less risk-prone: its *beta*[7] converges to 1 and its return approximates the market average.

From this point of view, investing in technology stock means taking a gamble: the investor is assuming that the company chosen will, in a few years time, win out over the competition and establish a sound competitive position. True, the actual valuations of individual companies are based on a rational approach, but if the capital of these companies were held by a listed holding company, the value of the holding company itself would be lower, because the market would implicitly apply a "failure rate" to the valuation of the group. In fact, there are two pitfalls to the approaches incorporating a modelised risk premium:

- The first is the difficulty of anticipating the overall consequences of the consolidation phase that will ensue when the new markets mature. When forecasting the anticipated future earnings of technology stocks, investors may not take into account accurately the consequences of the transition from a growth market to a mature market. According to this approach, all the companies that will be competing directly with each other at the end of the growth phase have similar valuations, although not all will survive. Moreover, the "losers" will not necessarily be bought out at their current market price, since restructuring costs will be discounted. Indeed, during the consolidation phase, some of the investments made today, in particular intangible assets, will be partly eliminated. This can happen, for example, if a technological standard is abandoned when standards are harmonised, or if one brand is removed to reinforce the name-recognition of another brand.

- The second pitfall is the instability arising when the various players in a sector compete for added value. Each company will endeavour to increase its margins to the detriment of the others in order to capture the additional value generated by technological progress. The uncertainty regarding future earnings resulting from these power games within given sectors may lead to excessive valuations for certain companies and perhaps undervaluations for others. For example, who will be the main beneficiaries of the emergence of e-commerce: the on-line sellers themselves, the logistic companies on which they depend to deliver their products properly, or the designers of secure means of payment?

[7] The beta measures the specific risk, i.e. that which arises on the company's business. This risk is added to the market risk, which is the justification for the premium earned by equities over bonds.

3. The impact of the changes in the behaviour of market participants and financing circuits on the pricing of new economy stocks

3.1. The behaviour of technology stocks can be explained in part by theoretical analyses of stock markets

The theory of asset prices bubbles, which takes into account specific aspects of the behaviour of economic agents, provides a relevant framework for analysing the emergence of bubbles on markets for technology stocks, in particular in the United States and Europe. We give below a brief overview of certain approaches, gleaned from the abundant literature available on the subject.

3.1.1. The rational bubble approach

A speculative bubble appears when there is a discrepancy between the actual value of a security and its fundamental value[8].

The "rational" bubble theory helps to explain why the price of a stock may diverge increasingly from its fundamental value and over a fairly long period of time. The bubble is deemed "rational" because the model assumes that agents' expectations are rational.

In this type of model, the expectations of economic agents are perfectly self-fulfilling. The bubble appears because, at a given time, agents expect prices to increase rapidly, i.e. that the bubble will be significant (Bourguinat, 1989)[9].

Certain observers believe that such a bubble has emerged on the equity markets of the new economy. This would explain why the prices of technology stocks are increasingly diverging from their fundamental values. F.Modigliani[10] pointed out in April 2000 that the financial bubble seen in the new economy stocks was "rational" insofar as the expectations of corporate growth in this sector have, in fact, boosted growth, which in turn validates the expectations.

However, the recent corrections observed in technology stocks both in France and the United States since the spring of 2000 cannot be easily explained by the existence of a bubble triggered by rational investors. In fact, this type of model cannot explain how agents' expectations develop, and accordingly why a financial bubble disappears. It therefore becomes necessary to introduce the concept of herd behaviour into this approach.

3.1.2. The mimetic bubble approach

The emergence of herd behaviour on the part of investors can create situations of "unanimity" on financial markets, and in particular on stock markets. If a large number of investors adopt identical expectations, for example that a stock price will rise, this theory claims that the market will increasingly tend to reflect the mean opinion. As a result, a bubble will form at the macroeconomic level.

Bubble models based on the mimetic confidence that agents have in the fundamentals appear to be particularly appropriate to account for the valuations of new economy stocks.

Certain economic theories (Orléan, 1991[11]) have shown that at times of growing uncertainty about the value of the fundamentals—an uncertainty which characterises new economy shares for which analysts have little reliable data—herd behaviour spreads rapidly to a large number of investors, thus helping to widen the gap

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[8] This fundamental value results from the model.

[9] Bourguinat, "Les structures de la finance globale", 1989

[10] *International Herald Tribune*, 1-2 April 2000

[11] Orléan, "Les désordres boursiers", *La Recherche*, 1991, vol. 22

between stock prices and their fundamental values. Consequently, the likelihood of a mimetic bubble increases in step with growing doubts or uncertainty about the value of the fundamentals, since investors will tend to "copy" other investors when faced with a lack of reliable stock market information. From the investor's point of view, such herd behaviour is rational, but at the macroeconomic level, it gives rise to the risk of a mimetic, speculative bubble.

Moreover, according to this approach, changes in average investor opinion may cause the bubble to burst or deflate. A reversal of expectations for a variety of reasons, such as profit warnings or macroeconomic data, which may be amplified by herd behaviour, can set off sharp share price corrections in a process of self-fulfilling expectations.

Market analysts frequently interpret the instability of financial markets as reflecting a lack of diversity in agents' individual opinions. Keynes[12] himself already considered "unanimous" situations to be a source of instability.

3.1.3. The irrational bubble approach

The approach using "irrational and noise" bubbles refers to the idea of an imperfect, competitive financial market. In particular, it questions the assumption of homogenous, rational expectations and provides an explanation for the chronic instability of stock prices.

The models evaluating the noise created by certain investors contribute to extending the analysis of asset bubbles. The model by De Long, Shleifer, Summers and Waldmann (1990)[13,] for example, highlights the fashions and fads affecting investor beliefs[14]. This model postulates that there are two types of investors: "sophisticated" investors who have rational expectations, and noise traders whose expectations are based on erroneous beliefs. Thus, rational investors may decide to buy when noise traders sell, and vice versa.

The asset bubbles models based on the coexistence of rational investors and noise traders are particularly useful in understanding how bubbles appear in new economy stocks, for which investor expectations appear to be very diverse.

One of the model's main findings relates to the excessive volatility of certain stock prices with respect to their fundamental values, even though the model assumes that there is no uncertainty regarding these values. The opinions of non-rational investors (noise traders) are partially factored into stock prices and into the expectations of rational investors. As a result, the latter incorporate such noises or incorrect opinions into their expectations, just as they would for any other relevant information. Disrupted by the noise, the prices of these stocks no longer converge to their equilibrium level (fundamental values). On the contrary, they may diverge, sometimes widely and for fairly long periods, thus leading to the development of asset bubbles. The presence of rational agents on stock markets[15] therefore no longer suffices to stabilise the equilibrium price at its fundamental value: the stock price may fluctuate according to changes in the beliefs of non-rational investors. This generates structural instability in the market prices of these shares, and the more unpredictable the expectations of non-rational investors, the stronger the instability.

Similarly, other models such as that of Shiller (1984)[16]—which also postulates the existence of two types of investors[17]—conclude that stock market prices may be shaped by fashion trends[18] among ordinary investors.

[12] J. M. Keynes, "The General Theory"

[13] « Noise Traders Risk in Financial Markets », *Journal of Political Economy*, vol. 98

[14] A fashion or fad is defined as a discrepancy between the actual value (market price) and the fundamental value caused by psychological factors.

[15] But this can also apply to financial markets.

[16] Shiller, « Stock prices and social dynamics », *Brookings Papers on Economic Activity*, 1984, n° 2

[17] Intelligent investors whose expectations are rational, and ordinary investors who overreact to market information and follow fashions.

[18] The price depends on the one hand on the discounted value (at the rate of future expected dividends) and on the other hand on the expected future demand of ordinary investors, according to a coefficient of proportionality equal to the risk premium which would incite all intelligent agents to hold all shares on the market.

3.2. Stock market dealing mechanisms may affect the pricing of technology stocks

Given the current working of financial markets, certain factors may encourage the emergence or persistence of bubbles on equity markets.

3.2.1. The imbalance between IPOs and investment demand

Intermediaries on primary equity markets have two means of managing the imbalance between offerings and investor demand. They can reduce the offering, which means that small shareholders and even institutional investors may not always be able to subscribe to significant amounts of stocks, thus preventing the newly-listed company from having a diversified stockholder base. Or, they can raise the issue price. In that case, the issue price, which aims at finding an "instantaneous" balance between offering and investor demand, no longer reflects the company's realistic growth prospects. Beyond that, when faced with strong investor demand, intermediaries tend to step up the number of IPOs, at the risk of listing very young companies for which valuation is even more uncertain.

3.2.2. The greater role of index-linked management

Benchmarking management leads to the allocation of capital according to the relative value of the expected performance, rather than according to an autonomous target for maximising expected portfolio value at the accepted risk level. This financial management technique can amplify the spread of herd behaviour and lead to self-sustaining price increases: when the prices of certain stocks rise, their relative weight in the index increases, thus prompting managers to buy more of these shares to build up their benchmark portfolios again. In addition, the generalisation of such techniques has induced a relative scarcity of the shares included in these indices, as well as speculation on the securities that can potentially be included or excluded from the indices. Although this problem is not unique to listed companies in the technologically innovative sectors, it compounds the other factors of instability and speculation.

3.2.3. The emergence of electronic trading platforms (*Electronic Communication Networks*) and on-line broking

By making the pricing process more transparent, the development of electronic trading has fostered the contagion of market trends. It can also amplify fluctuations in liquidity when financial markets are under stress, since these electronic communication networks reduce the role of market makers, who normally maintain the market by making transactions on their own accounts when there are too few counterparties.

In addition, these electronic platforms appear to be conducive to intraday trading, since they offer permanent access and reduced transaction costs. The intensity of intraday trading depends on the volatility of share prices, but such transactions which can enhance market liquidity can also exacerbate price volatility.

Electronic trading platforms enable smaller amounts to be processed and reduce transaction costs, thus giving a wider customer base access to financial markets. Combined with on-line broking, this encourages individual investors to enter the market alongside institutional investors, although they do not use market information in the same way. Individual investors have less technical expertise and react differently to market rumours, which can increase stock price deviations, with ambiguous effects on volatility and valuations. Just like the development of index-linked management, the emergence of these platforms affects all types of stocks. However, the features specific to technology stocks—small float, high volatility and speculative nature—appear well-suited to investors who prefer these new channels of communication and stock market trading.

3.3. The financing of new economy companies makes it more difficult to price their shares

There are two reasons why it is difficult to distinguish clearly between the various sources of financing, although such a distinction is necessary if they are to play their respective roles properly.

3.3.1. The distinction between seed capital, venture capital and development capital has blurred

Until the end of the 1990s, the first stages of the creation of a company were handled by specialists, such as venture capital companies which provided the equity. Once the company reached the capital development stage, its IPO marked the withdrawal of the initial partners of the project. Given the buoyant market, it appears to be in the interests of venture capitalists to shorten the incubation or holding period in order to maximise their initial investment when withdrawing. There are thus two major changes affecting new economy companies. On the one hand, the initial phase may be launched by resorting to public savings, which was previously the case only for very specific projects. On the other hand, it is difficult to position listed companies at a given phase of their development, since there is no stable industrial model. This makes determining the initial listing price very complicated.

3.3.2. A lack of reference points for a rational distinction between equity and debt

In France, start-ups can call on two effective sources of financing: the Nouveau Marché or venture capital funds for equity financing, and banks for borrowings. However, in Europe a third source—a bond market for small issuers or issuers with a high risk profile—has not yet come to maturity. As a result, investors cannot resort to an important reference, the interest rate charged on debt markets, which is frequently used to stabilise stock price fluctuations. While equity investors base their decisions on growth potential, bond investors base theirs on default risk. Combining both approaches is the best means of forming a reasoned opinion of the "value" of new economy companies. In this context, a market for private risk bonds, in which issuers of all sizes would be classified by counterparty risk, would provide investors with a useful reference for evaluating fluctuations in equity markets.

Appendix: French stock indices – growth rate and volatility

Index	Starting value (date)	28 Dec. 1990 to 31 Dec. 1995	1 January 1996 to 31 Dec. 1998	1 January 1999 to 30 June 2000	Closing value (30 June 2000)
SBF 250	**1 000 (28 Dec. 1990)**				**4 069**
Average annual growth rate		5.39	26.53	19.30	
Volatility		12.90	16.10	19.24	
Maximum volatility		24.68	43.80	28.49	
(date)		(9 Oct. 1992)	(20 Oct.1998)	(April 2000)	
SBF - capital equipment	**1 000 (28 Dec. 1990)**				**4 743**
Average annual growth rate		0,86	30,48	38,32	
Volatility		16,57	22,78	35,30	
Maximum volatility		35,62	69,83	68,03	
(date)		(1 Nov. 1995)	(12 Oct. 1998)	(11 April 2000)	
SBF - other services	**1 000 (28 Dec. 1990)**				**3 366**
Growth rate		0,86	30,48	38,32	
Volatility		16,57	22,78	35,30	
Maximum volatility		35,62	69,83	68,03	
(date)		(1 Nov. 1995)	(12 Oct. 1998)	(11 April 2000)	
Second market index					**2 795**
Growth rate			13.56	16.16	
Volatility			8.51	10.32	
Maximum volatility			26.37	30.39	
(date)			(2 Dec. 1997)	(20 April 2000)	
Nouveau Marché index	**1 063 (21 March 1996)**				**4 805**
Average annual growth rate			5.80	52.61	
Volatility			22.20	32.44	
Maximum volatility			48.88	110.92	
(date)			(5 Nov. 1997)	(11 April 2000)	
ITCAC index	**1 036 (4 January 1999)**				**2 797**
Average annual growth rate				49.52	
Volatility				28.32	
Maximum volatility				70.18	
(date)				(7 April 2000)	

NB: Average historical 30-days moving volatility
(a) Date of first compilation of the indices