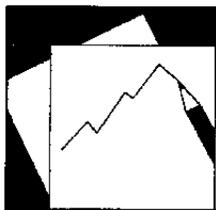


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Wealth Effects and the New Economy

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IMF Working Paper

Research Department

Wealth Effects and the New Economy

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Abstract

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This paper investigates if there is a different impact from changes in “new” and “old” economy stock valuations on private consumption. Estimating a reduced-form VAR for seven OECD countries for the 1990s, it is found that the impact from changes in old economy stock valuations on consumption is in general larger in the United States, Canada, and the United Kingdom than in continental Europe. Furthermore, the impact from changes in new economy valuations to consumption is roughly the same in the United States, Canada, the United Kingdom, and in continental Europe. Finally, the results suggest that in continental Europe the impact on consumption from changes in the valuation of new economy stocks is bigger than from the old economy stocks, whereas for the United States, Canada, and the United Kingdom, the impact is more or less the same between the two sectors.

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	Contents	Page
I.	Introduction.....	<u>3</u>
II.	Analytical Framework and Related Literature.....	<u>5</u>
III.	Developments in the 1990s affecting the Wealth Effect	<u>6</u>
IV.	Empirical Analysis.....	<u>10</u>
V.	Robustness Tests.....	<u>17</u>
VI.	Conclusions.....	<u>19</u>
 Tables		
1.	Total market capitalization as a share of GDP.....	<u>7</u>
2.	TMT market capitalization as a share of GDP.....	<u>7</u>
3.	Households' equity holdings as a percent of disposable income.....	<u>8</u>
4.	United States: Percent of adult population owning stocks in various forms	<u>9</u>
5.	The use of incentive pay in Europe and the United States	<u>9</u>
6.	Effect on retail sales after two years of a 10 percent change in TMT and non-TMT stock market capitalizations	<u>14</u>
7.	Impact of a one dollar increase in TMT and non-TMT stock market valuations on aggregate consumption	<u>16</u>
8.	The effect after two years of a 10 percent change in different wealth components	<u>17</u>
9.	Effect after two years on retail sales of a 10 percent change in major stock market index, selected countries	<u>18</u>
10.	The impact after two years on consumption of fall in stock prices from March 2000 to March 2001.....	<u>19</u>
 Figures		
1.	Stock Price Indices for Technology, Media, and Telecommunications (TMT) vs. non-TMT Sector.....	<u>4</u>
2.	Percent of adult population that owns stocks.....	<u>8</u>
3.	Funds raised by IPOs	<u>10</u>
4.	Impulse-response reactions for retail sales	<u>12</u>
 Appendix I		
	Data Appendix	<u>21</u>
	Bibliography	<u>22</u>

I. INTRODUCTION

Stock markets throughout the world have experienced quite dramatic movements in the 1990s.² A striking feature of this development has been the very different behavior of the technology (Telecommunication, Media, and Information Technology (hereafter TMT)) and non-technology (hereafter non-TMT) segments of stock markets (Figure 1). While valuations of non-TMT stocks have increased steadily in most countries through the 1990s, valuations of TMT stocks have been much more volatile.

The rise and fall in technology stock prices seen in Figure 1 begs the question whether there is a difference between the effect from changes in TMT and non-TMT stock valuations to consumption. Thus, the focus of this paper is to examine the co-variation between stock market valuations and future consumption with an emphasis on comparing the results for technology sector stocks to the results for the non-technology sector stocks for different groups of countries. The implications of the recent relative weakness in technology stock prices are assessed for seven major OECD countries focusing on whether one would expect the historical empirical estimates between stock prices and consumption to be changed.

There are at least two reasons to expect a difference between the effect from changes in new and old economy stocks on consumption.³ First, TMT stock valuations are much more volatile than non-TMT stock valuations, which implies that there is a greater risk involved in investing in new economy stocks. Consequently, households might have a smaller propensity to consume out of new economy wealth increases, since households would know that gains and losses are less permanent. A second reason to expect a different impact is that the use of stock options as part of compensation has been more widespread in the TMT sectors worldwide. This means that more households have been dependent on developments in valuations of new economy stocks. Consequently, the increasing use of stock options implies that changes in stock prices have a significantly bigger impact on consumption than before. The net impact of these two effects is unclear and hence it becomes an empirical issue if the wealth effect has become stronger or weaker as a consequence of the boom in new economy stocks in the 1990s.

This paper contributes to the existing literature in two ways. First, it investigates if there is a different impact on consumption from changes in valuations in TMT and non-TMT stocks. Second, the same methodology is applied to seven major OECD countries, testing how the wealth effect differs amongst the sample of countries. The conclusion is that changes in technology stock valuation can have quite different impacts on consumption compared with the effect from the rest of the stock market, particularly in continental Europe.

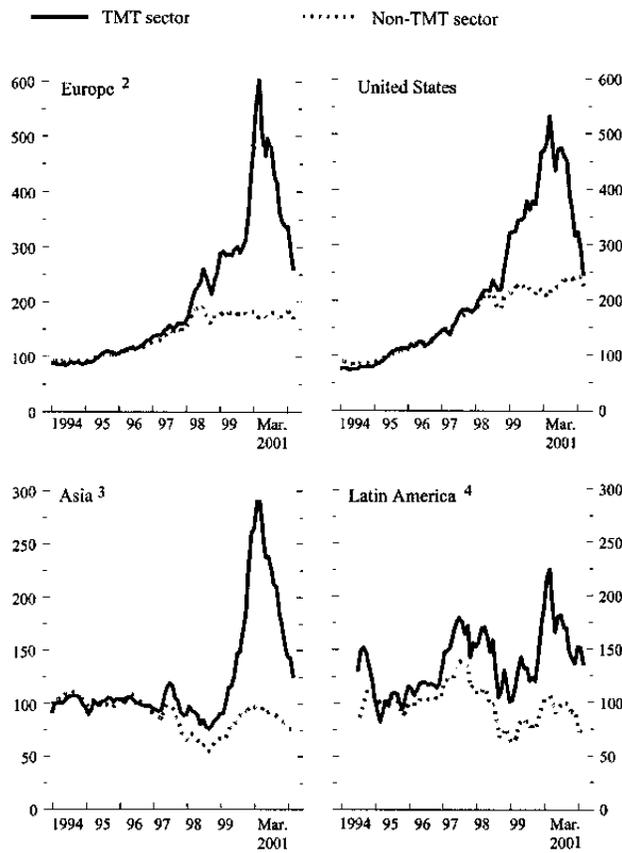
² See IMF (2001) for a detailed discussion of recent developments.

³ In Edison and Sløk (2001) we analyze the impact from changes in new and old economy stock valuations on private investment.

The paper is organized as follows. Section 2 provides a brief description of the analytical framework and related literature. Section 3 examines developments in factors affecting how strong the wealth effect is in different countries. Section 4 presents the empirical results and Section 5 augments the results with a series of robustness tests. Finally, Section 6 presents the conclusion.

Figure 1. Stock Price Indices for Technology, Media, and Telecommunications (TMT) vs. Non-TMT Sector¹
(1995=100)

A global phenomenon is the rise and fall in technology stock valuation.



Source: Primark

¹ Weighted by market

² Includes Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Switzerland, and the United

³ Includes China, Hong Kong SAR, India, Indonesia, Japan, Korea, Philippines, Singapore, Taiwan Province of China, and

⁴ Includes Argentina, Brazil, Chile, Colombia, Mexico, Peru, and

II. ANALYTICAL FRAMEWORK AND RELATED LITERATURE

Wealth is a key determining factor in explaining consumption. As Poterba (2000) points out, budget constraints require that when an individual's wealth increases, the individual must either spend that wealth or leave the money to someone else to spend sometime in the future. Thus, a central idea in analyzing wealth effects is in part a matter of timing. If the lag between a shock to wealth and consumption takes many years to develop, then there will be a limited impact on aggregate spending. However, if the link between wealth and consumption is immediate, then sharp changes in equity prices may translate into large changes in consumer spending.

Tests of the relationship between consumption and wealth vary. Traditionally, the wealth effect has been measured by estimating aggregate time-series regressions, which take the form,

$$C_t = \alpha + \beta W_t + \delta YP_t + \varepsilon_t \quad (1)$$

where C_t is consumer spending, W_t is consumer net worth, YP_t is a measure of income, and ε_t is an error term capturing other factors that might influence consumption.⁴ Equation (1) can be derived from underlying theory of consumer behavior as found in Deaton (1992). The coefficient β describes the marginal propensity to consume out of wealth and is interpreted as the increase in consumer spending associated with an increase in wealth. In the empirical work below we focus on the effect stock market wealth has on consumption because its value is more volatile than other forms of wealth. In order to investigate the role of different types of wealth we split stock market based wealth into two categories: TMT and non-TMT equities.

There is a large growing literature analyzing the impact of total stock market changes on consumption (Campbell, 1998 and 2000, Davis and Palumbo, 2001, Dynan and Maki, 2000, Gourinchas and Parker, 1999, and Kiley, 2000). Most empirical studies analyze the wealth effect for the United States while the literature covering the continental European countries is rather limited. Partly for data reasons, there is almost no literature covering wealth effects in emerging markets and likewise we will in the following focus only on advanced economies.

In a recent survey of the literature, Poterba (2000) calibrates a simple model of consumption responses to stock market wealth shocks and shows that the amount, by which a household could increase its consumption in all remaining years of life, when it receives a favorable wealth shock, depends on its life expectancy and the after-tax real interest rate. The calibrations suggest that a household with a 30-year planning horizon that faces a 3 percent real

⁴ The interest rate is not included in this specification since the substitution effect between current and future consumption is expected to be relatively small (which is also confirmed by the data for the countries analyzed here).

after-tax return can raise consumption outlays by 5 cents for each \$1 increase in wealth. Depending on the after-tax rate and the household-planning horizon Poterba finds that the calibrated cents-to-the-dollar impact is in the range of 3 to 10 cents.

Starr-MacCluer (1998) finds for the United States wealth effect estimates in the range 3 to 7 cents for a one-dollar increase in stock market wealth, which seem consistent with the findings of Poterba. Davis and Palumbo (2001) suggest a two-step procedure and find that the wealth effect for the United States is in the range between 3 and 6 cents per dollar stock market increase. Applying the methodology in Davis and Palumbo, Goldman Sachs (2001) finds the wealth effect to be 4.4 cents to the dollar. Kiley (2000) simulates and estimates a traditional life cycle model and finds a wealth effect of 3.3 cents of additional consumption for each additional dollar of wealth. In sum, using significantly different methods, a number of recent studies arrive at an aggregate wealth effect from total stock market wealth to consumption in the United States in the range between 3 to 7 cents per dollar wealth increase.

In a study covering several countries Boone, Giorno, and Richardson (1998) find that the impact on consumption is similar in Canada, the United Kingdom, and the United States while in continental Europe the effect is about a third of that in the Anglo-Saxon countries. Japan lies in between continental Europe and the Anglo-Saxon countries. Finally, a study for the Netherlands [van Els and Vlaar, 1996] finds a propensity to consume out of stock market wealth of 0.025, which is somewhat lower than the estimates for the United Kingdom and the United States and consistent with the findings of Boone, Giorno, and Richardson (1998).

III. DEVELOPMENTS IN THE 1990s AFFECTING THE WEALTH EFFECT

Equation (1) shown above presents the consumption function for a representative household in an economy. But at the macro level the impact on economy-wide consumption depends not only on changes in the size of income and wealth, but also on the size of stock markets relative to GDP, the share of households owning stocks, and the use of stock options as payment to employees. These three factors directly or indirectly determine wealth and income in the economy, and during the 1990s they have increasingly pointed in the direction of a stronger wealth effect in many countries. These developments will be examined in turn.

First, if stock markets are small, it is expected that the impact on consumption will also tend to be small. Similarly, if stock markets are large it is anticipated that the effect will tend to be large. In the 1990s, the dramatic increases in stock market wealth have increased the wealth of households both in absolute terms and relative to income. Table 1 shows total market capitalization as a percent of GDP for various countries. For all countries examined stock markets in December 1994 were less than 100 percent of GDP with Germany having the lowest ratio at 18 percent, and the United Kingdom with the highest ratio at 85 percent. With the exception of Japan, stock market capitalization as a share of income doubled in most countries from December 1994 to December 1997, and at the peak in March 2000 the ratio was on average three times higher than in 1994. Since then, total market capitalization has fallen throughout 2000 and into 2001. For Japan, total market capitalization as a share of income first

fell and then increased, ending with a capitalization to GDP ratio close to the December 1994 level.

Country	December 1994	December 1997	March 2000	March 2001
Canada	0.38	0.70	1.03	0.82
France	0.25	0.42	1.03	0.88
Germany	0.18	0.35	0.65	0.48
Japan	0.69	0.53	0.92	0.67
Netherlands	0.65	1.30	1.90	1.50
United Kingdom	0.86	1.40	1.89	1.62
USA	0.48	0.98	1.40	1.17

Source: Market capitalization is from Primark Datastream and GDP is from the WEO database.

Table 2 shows that the same pattern has been evident in the TMT sector, except that the cycle in TMT valuations has been magnified considerably compared with the cycle observed for the total market. For the United States, TMT stock market capitalization relative to GDP stood in March 2001 at a level three times higher than in December 1994 and this tendency is also found for several European countries. For example, in March 2001 both France and Germany had a TMT market capitalization that was about ten times higher than in December 1994. For Canada and the United Kingdom the ratio was about three, whereas for Japan TMT market capitalization relative to GDP had increased only by a factor of two. For all countries, the increase in TMT market capitalization in general reflects that the TMT sector became bigger in terms of number of companies and that these companies in general gained higher valuations.

Country	December 1994	December 1997	March 2000	March 2001
Canada	0.07	0.14	0.48	0.20
France	0.02	0.07	0.34	0.24
Germany	0.01	0.05	0.20	0.08
Japan	0.08	0.09	0.33	0.16
Netherlands	0.09	0.17	0.47	0.18
United Kingdom	0.11	0.16	0.68	0.35
USA	0.10	0.22	0.62	0.33

Source: Market capitalization is from Primark Datastream and GDP is from the WEO database.

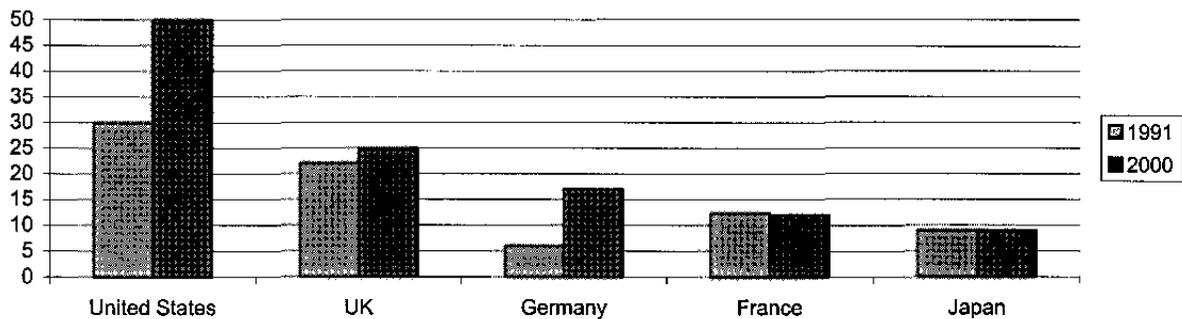
A second development in the 1990s that might have strengthened the wealth effect is the developments in stock ownership of households. Table 3 and Figure 2 illustrate the increased share of household stock ownership. Table 3 shows that for the United States, households' equity holdings increased by a factor of seven from 1990 to 1999, and for Germany it went from about 11 percent of income in 1990 to around 77 percent of income in 1999. Canada, France, and the United Kingdom also experienced increases in households' equity ownership, whereas Japan experienced a fall. In other words, the numbers indicate that for most countries households' stock ownership has gone up dramatically in the 1990s.

	1990	1995	1999
Canada	53.8	72.4	94.3
France	87.2	84.8	183.2
Germany	11.6	42.5	77.6
Japan	48.7	39.9	33.4
United Kingdom	56.9	76.2	110.6
United States	52.4	96.8	174.1

Source: OECD (2000)

Figure 2 shows that during the 1990s there has been a large increase in the share of households who are direct owners of stocks in Germany and the United States. The change was less dramatic in France, Japan, and the United Kingdom. The Figure also illustrates that in 2000 stock market ownership in the United States was about double that in the United Kingdom and about four times higher than in France and Germany. Note that the numbers in Figure 2 do not say anything about the composition of shares (new/old economy) owned by households. In particular, there is an abundance of anecdotal evidence that "newcomers" to the stock market in the late 1990s primarily bought new economy stocks.

Figure 2. Percent of adult population that owns stocks



Source: Adapted from The Economist, May 5 2001.

Table 4 focuses on the data for the United States and shows that the share of households that hold stock in any form has increased from 40 percent of the population in 1992 to about 52 percent of the population in 1998. The composition of this increase reveals that the increases in stock ownership have been broadly based, with a significant share of the population owning some form of retirement account or pension plan.

	1992	1995	1998
Ownership of equity mutual funds in taxable accounts	9.1	12.4	16.5
Ownership in taxable accounts	22.5	24.0	29.9
Ownership of stock or equity mutual fund through retirement saving accounts: 401(k), 403(b), or SRA	9.4	17.4	24.0
Ownership through IRA, 401(k), 403(b), or SRA	22.2	27.3	27.4
Ownership of equity or equity mutual funds through any defined contribution pension plan	18.0	25.2	29.8
Any form of stock ownership	40.0	43.9	51.8

Source: Poterba (2001).

A third development in the 1990s affecting the strength of the wealth effect is the increasing use of incentive pay (such as stock options and other performance pay instruments). The increase in stock market valuations increased firms' access to capital and many firms have subsequently decided to pay employees with stock options, in addition to cash. As a result, a change in stock prices not only changes the wealth of households but also the income of households. Table 5 illustrates the increasing use of incentive pay in Europe and the United States in the late 1990s.

	Incentive as percent of base salary	
	1996	1998
France	8.8	13.7
Spain	11.8	13.9
United States	15.3	19.3

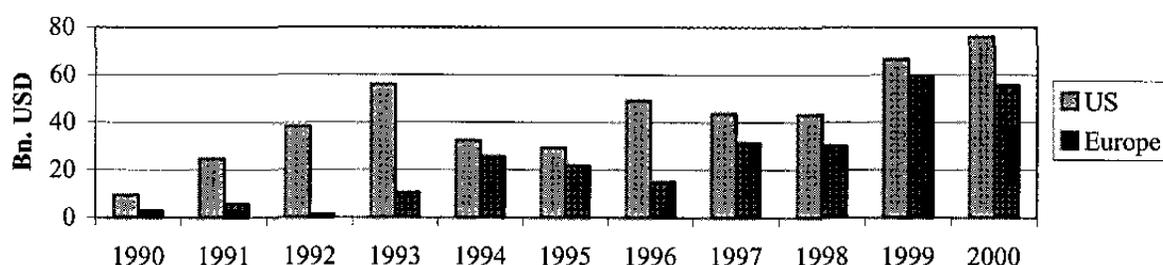
Source: Thompson and Yurkuat (1999)

The United States has the highest level of incentive as percent of base salary, and the use of incentive pay has increased significantly in all three countries. Thompson and Yurkuat (1999) also include other European countries in their analysis, and their main conclusion is that incentives are becoming a measurable and expected part of the total compensation package in the major European economies.

Furthermore, there is considerable evidence that stock options tend to be used extensively in firms in the TMT sector (Schuster and Zingheim (2000)). Figure 3 shows the total funds raised by IPOs in Europe and the United States in the 1990s. The numbers indicate that total funds raised in Europe (including the United Kingdom) do not appear significantly different from those raised in the United States. In other words, the amount of cash raised by

new firms and their owners is relatively similar in the United States and Europe. Consequently, since new economy firms tend to compensate employees partly in stock options, Figure 3 suggests that in both the United States and Europe there were large resources available for households who wanted to sell or exercise their stock options in new economy firms.

Figure 3. Funds raised by IPOs



In sum, developments in stock market sizes, households' stock ownership and the use of stock options clearly suggest that the wealth effect has become stronger throughout the 1990s. In particular the impact from changes in TMT stock valuations seem to have played an increasing role globally. In order to quantify the impact of changes in TMT and non-TMT stock valuations on consumption we will now turn to an empirical analysis of this question.

IV. EMPIRICAL ANALYSIS

To test the wealth effect on consumption for different countries, a vector autoregression (VAR) model was estimated for each country. The main advantage of the VAR methodology is that it maps the dynamic interaction between the variables in the model. The variables included in the VAR are retail sales, TMT stock market capitalization, non-TMT stock market capitalization, and industrial production.⁵ Data for retail sales and industrial production were seasonally adjusted. The VAR can be seen as an approximation of equation (1) above, where retail sales is a proxy for consumption, TMT and non-TMT capitalizations are proxies for developments in wealth, and industrial production is a proxy for income.

Data were collected for the sample period January 1990 to October 2000. Monthly data were used in order to best capture the co-variation between stock valuations and consumption and to increase the degrees of freedom in the analysis. Unfortunately, there are no monthly time series for consumption; consequently data for retail sales were used.⁶ Stock market

⁵ The data sources are described in the data appendix.

⁶ The downside of using retail sales for consumption is that we exclude consumption of services. The upside of using retail sales is that we can reasonably estimate the model using monthly data starting in 1990 when TMT may have started to play a different role in the economy.

capitalization figures were used as wealth variables instead of simple stock price indices as stock market capitalization is a more correct measure of households' wealth than a stock price index. A stock price index is a weighted average of stock price developments and hence it does not measure exactly the changes in the wealth of consumers in the same way that market capitalization does. Furthermore, the definitions of stock price indices often change over time, which introduces some variance, which cannot be expected to be related to households' consumption decisions. Thus, to capture the "true" variation in households' wealth over time we use stock market capitalization data. Finally, industrial production was used as a proxy for income, as monthly data on income is difficult to obtain across a wide range of countries

Since the focus of this paper is to investigate the different impact TMT/non-TMT has on consumption and to compare this difference across countries we use a common VAR specification for each country. More specifically, the four variable specification of the VAR outlined above was estimated using data from January 1990 to October 2000 for seven countries: Canada, France, Germany, Japan, the Netherlands, the United Kingdom, and the United States. All the variables in the VARs are in logs. All the VARs have three lags and experimenting with longer lag lengths did not significantly change the results reported below. The estimation period is relatively short, therefore no restrictions, such as underlying long run relationships between the variables, are imposed. Rather it is assumed that there is super-consistency and hence the VARs can be estimated in logged levels.⁷

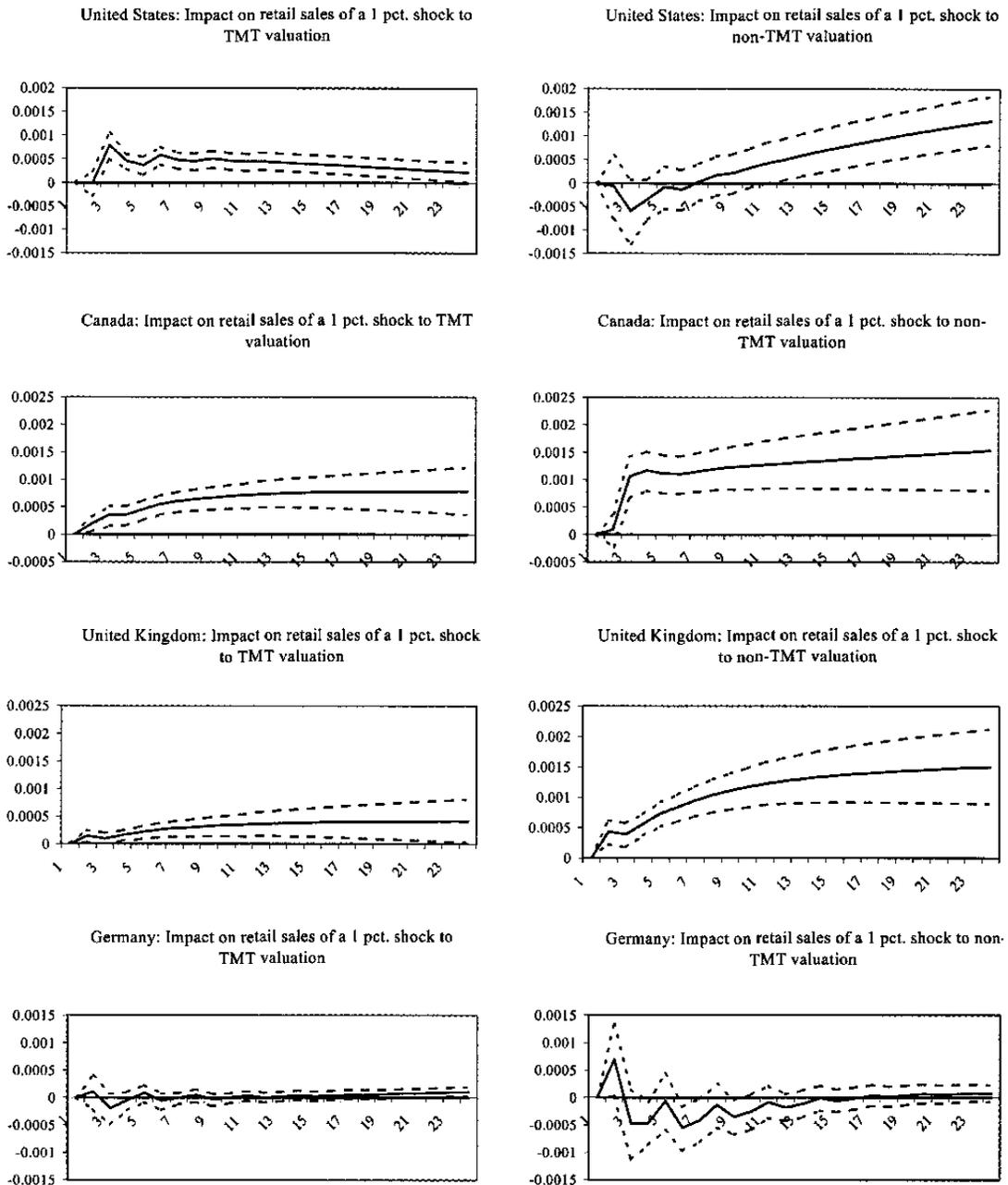
The reduced-form VARs are used to assess the difference in the response of private consumption to changes in real TMT and non-TMT stock market capitalization. In order to investigate this, impulse-response analyses were carried out, analyzing how changes in TMT and non-TMT stock market valuations change private consumption over time. The VARs were identified using the choleski recursive scheme. In the ordering, retail sales—the variable of main interest—was placed first, then the stock market variables (TMT stock market capitalization and non-TMT stock market capitalization), and finally industrial production. Using this ordering, a change in wealth and income will have no contemporaneous impact on consumption, which seems a plausible assumption. The results reported below were, however, in general not sensitive to the ordering of the variables.

Figure 4 shows the impulse-response functions for the seven different countries and the reaction of retail sales of a one percent increase in TMT and non-TMT stock market capitalizations over a 24-month horizon. A notable feature of this experiment is that the error bands associated with the TMT results are narrower than those for the non-TMT results, plausibly due to the much higher variation in TMT capitalization than in the non-TMT

⁷ Trace-tests for cointegration suggest that for all countries one cointegration vector exists, which can be interpreted as a consumption function. The reduced form VAR was chosen since it does not impose potentially faulty restrictions on the system (due to the short period analyzed), and in addition, calculating confidence intervals for impulse-response functions when cointegration is imposed, requires additional restrictive assumptions.

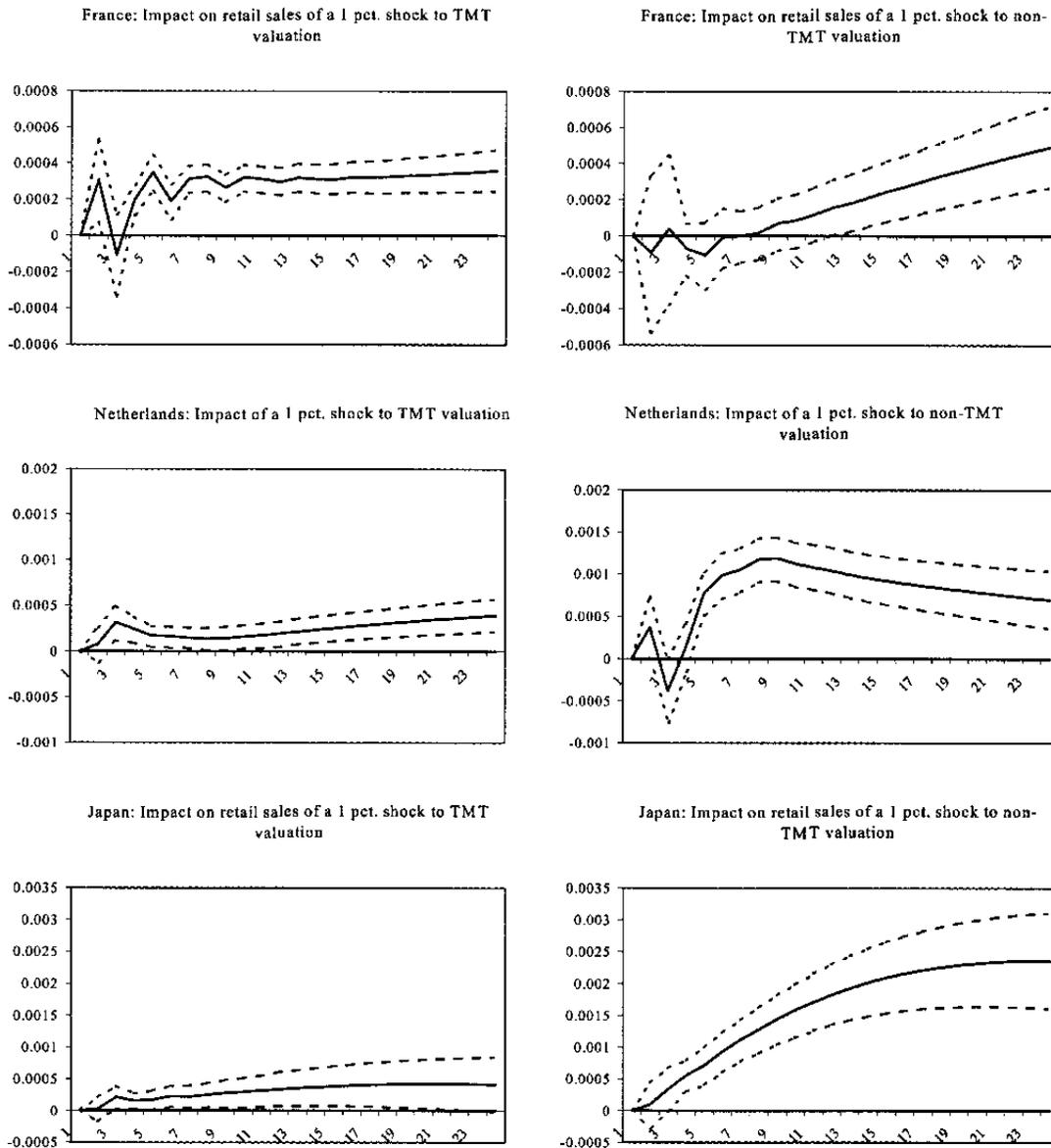
capitalization. For the United States, a shock to TMT valuations has an instantly positive effect on retail sales, whereas the effect of a shock to non-TMT stocks has a steadily rising effect on retail sales over time. For Canada and the United Kingdom the effect is significantly positive and relatively large for both types of stocks, whereas in the continental European countries the effect is much more muted.

Figure 4. Impulse-response reactions for retail sales



Note: Authors' calculations. One standard error confidence intervals shown.

Figure 4 contd. Impulse-response reactions for retail sales



Note: Authors' calculations. One standard error confidence intervals shown.

In particular in Germany there appears to be no wealth effect from either the TMT or the non-TMT stocks.

Table 6 illustrates the impact of a ten percent increase in TMT and non-TMT market capitalizations on retail sales after two years. Given the similarity of the financial systems in

Canada and the United States (hereafter North America) and the United Kingdom on the one hand and the continental European countries on the other, it is useful to differentiate between these two groups. Indeed, the coefficients within these two groups are insignificantly different from each other.⁸

For non-TMT there are significant differences between North America and the United Kingdom and the continental European countries. In particular, for Canada, the United Kingdom, and the United States, a ten percent increase in non-TMT stock market capitalizations after two years leads to an increase in retail sales of around 1.4 percent. This is significantly higher than the corresponding number on average for the continental European countries in the sample, which is 0.4 percent.

For TMT, a ten percent increase in TMT market capitalization in North America and the United Kingdom has a 0.5 percent impact on consumption after two years, compared to a 0.4 percent impact in continental Europe, insignificantly different from each other. Finally, for Japan, the effect on consumption is very high and too high to be plausible as a pure wealth effect. The high number probably reflects the impact of the fragile banking system on the real economy, which has been a dominant feature in the 1990s (see also Bayoumi, 2000). The robustness tests carried out below for Japan indicate that these high estimates are indeed not robust, in particular not when including house prices in the Japanese VAR. Overall, the average estimate of a ten percent increase in TMT market valuations has more or less the same impact in North America and the United Kingdom and in continental Europe and also Japan.

Table 6. Effect on retail sales after two years of a 10 pct. change in TMT and non-TMT stock market capitalizations (in percent)		
	TMT	Non-TMT
Canada	0.8	1.5
France	0.4	0.5
Germany	0.1	0.1
Japan	0.4	2.4
Netherlands	0.4	0.7
United Kingdom	0.4	1.5
USA	0.2	1.3
North America and United Kingdom average	0.5	1.4
Continental Europe average	0.4	0.4

Note: Bold estimates denote that they are statistically significant from zero in the impulse-response functions. The significance of the averages is based on a $X^2(3)$ -distributed Wald test.

⁸ Such aggregation and tests are easy to do as the individual coefficient estimates can be assumed to be independent.

As discussed above, markets in these countries are significantly different in size. Hence, a ten percent increase in market valuation in the United States must be expected to have a larger impact on consumption than in, for example, Germany where stock markets are a much smaller share of income. Or put differently, the ratio of consumption to market capitalization varies between countries. Not only are stock markets of different sizes but consumption as a share of GDP also differs. Consequently, it is of interest to compare the impact of a one-dollar increase in wealth on aggregate consumption in these seven economies.⁹

To calculate the increase in consumption when stock market capitalization increases by one dollar we calculated how much a one percent increase in stock market valuation corresponds to in dollars. This amount was then put in relation to how big the impact on retail sales was, measured in dollars. Next, since the correlation between retail sales and total economy-wide consumption is approximately about a half for all countries in the sample, the cents-per-dollar amounts were adjusted with this figure in order to get the impact on consumption and hence make the results comparable with other studies.¹⁰ The resulting cents-per-dollar estimates can be seen in Table 7.

⁹ Note, that there is no exchange rate conversion taking place and hence the numbers do not change if we instead write for example “cents per euro”. Cents-per-dollar was used for all countries to keep the description of the results as simple as possible.

¹⁰ To be precise, the estimated two-year elasticity from the impulse-response functions was multiplied by aggregate consumption in 2000 in order to calculate the wealth effect measured in dollars. Since the estimated elasticity is on retail sales (and not aggregate consumption, which is not available on monthly data) the figure was corrected for the elasticity from consumption to retail sales which about 0.5, and this figure was then multiplied on the estimated dollar amounts in order to get the dollar wealth effect for aggregate consumption. This assumption implies that the wealth effect applies more to durable goods than to services. The aggregate consumption dollar wealth effect was then divided by the dollar change in market value using TMT and non-TMT market values in December 2000 to arrive at the cents-per-dollar figures shown in the table. Applying instead the level of consumption in the mid-1990s and the average market caps in the mid-1990s increases the cents-per-dollar impacts, since the ratio of consumption to market capitalization in most countries was higher than it was in 2000. For example, using consumption and market capitalization data for the United States for 1995 yields approximately a 6 cents-per-dollar impact for both TMT and non-TMT.

Table 7. Impact of a one dollar increase in TMT and non-TMT stock market valuations on aggregate consumption		
	TMT	Non-TMT
Canada	7.3 cents	7.2 cents
France	4.1 cents	1.9 cents
Germany	2.8 cents	0.1 cents
Japan	6.4 cents*	13.1 cents
Netherlands	4.5 cents	1.1 cents
United Kingdom	2.9 cents*	3.4 cents
USA	1.7 cents*	5.1 cents
North America and United Kingdom average	4.0 cents	5.2 cents
Continental Europe average	3.8 cents	1.0 cent

Note: See notes to Table 6. A * denotes if the TMT estimate for a country is significantly different from the non-TMT estimate for the same country.

The results in Table 7 suggest that for the United States a one dollar increase in TMT market capitalization leads, after two years, to a 1.7 cents increase in aggregate consumption, and for non-TMT the impact of a one dollar increase is 5.1 cents. The estimate for non-TMT seems in line with the 3 to 7 cents per dollar after two years found in previous studies for the United States (as discussed above). The lower estimate for TMT on the other hand, suggests that consumers have indeed viewed changes in TMT stock valuations as a more temporary shock to wealth. Or put differently, the increase in TMT stock valuations through the 1990s has been so dramatic that consumer spending has “not been” able to increase with the same speed. For Canada, the impact from a one dollar change in TMT and non-TMT on private consumption is identical and just above the 3 to 7 cents range, but not statistically different from the average estimate for North America and the United Kingdom. Also, for the United Kingdom the estimate is more or less identical between the TMT and non-TMT segments.

For France, Germany, and the Netherlands the cents-per-dollar effects are universally higher in the TMT sector compared with the non-TMT sector. Within each country between the two sectors the estimates are, however, not statistically significant from each other which is partly due to the high standard errors around the non-TMT estimates. For the TMT sector the average impact of a dollar increase in TMT stock market capitalization in continental Europe leads to an increase in consumption of around 4 cents. For non-TMT the effect is much smaller and around 1 cent per one-dollar increase in capitalization. The large impact from a change in the value of TMT stocks on consumption in continental Europe could be an indication that the TMT sector is in many aspects functioning in the same way globally. First, in the TMT sector many employees are partly paid in stock options, and this tendency is on the rise globally (as discussed above). Second, the TMT sectors are in general smaller in continental Europe compared with the United States, and consequently a one dollar increase in continental Europe constitutes a bigger percent of the TMT market cap than in the United States. Third, the funds

raised from IPOs in United States and Europe (including the United Kingdom) were more or less identical, which suggests that the funds given to owners of new economy companies both in the United States and Europe were quite substantial.

Again, the results suggest that for Japan the estimated impacts are substantial and seem too big to be plausible as a wealth effect. The results probably illustrate the fragility of the Japanese banking system and the negative impact it has had on the real economy and consequently also consumption in the 1990s. This seems consistent with a view that changes in equity valuations are translated to activity through their impact on bank capital and lending.

V. ROBUSTNESS TESTS

This section presents additional tests to shed light on the robustness of the VARs that have been presented in the previous section. Three additional tests are considered: the inclusion of house prices, the substitution of stock prices for stock market capitalization as a measure of wealth, and the substitution of aggregate stock prices for the TMT and non-TMT variables.

First, we consider the impact of adding house prices to the current VAR system. Even though stock prices are the most volatile component of households' wealth, there may be reason to expect that property prices may have a significant effect on consumption. In the existing literature, the impact on consumption of an increase in house prices is, however, ambiguous. An increase in house prices implies an increase in the wealth of households who are house owners, which may lead to an increase in consumption, especially in countries that allow borrowing against the increased value. However, at the same time, households who are renters do not experience the same increase in wealth. Rather, an increase in house prices will tend to lead to a fall in consumption, as these renting households must allocate a larger share of their total income to pay the rent. To investigate the net impact of a change in this wealth component a real house price index was introduced into the VAR regressions above. Table 8 reports these results.

	TMT	Non-TMT	Real house prices
Canada	0.3	1.2	-19.4
France	0.1	0.5	11.6
Germany	0.1	0.1	0.3
Japan	0.3	1.8	- 7.3
Netherlands	0.4	0.5	2.5
United Kingdom	0.6	1.2	- 3.1
USA	0.3	1.1	- 14.1

Note: Bold estimates denote that they are statistically significant from zero in the impulse-response functions. For France and Netherlands house prices were only available on a monthly basis starting in 1995.

A number of conclusions emerge from Table 8. First, the TMT and non-TMT elasticities for the individual countries are relatively similar to the estimates reported in Table 6. This result should not be surprising since the variance of stock prices is much higher than the variance of house prices. Second, the house price effect differs across country groupings. A positive shock to house prices in general has a negative effect in Canada, Japan, the United Kingdom, and the United States, whereas the increase in house prices leads to an increase in consumption in continental Europe. This finding seems consistent with the fact that large shares of households in continental Europe are house owners (European Mortgage Federation, 1999). Finally, following from the first two points, the effects of housing and stock market wealth on consumption seem to differ, suggesting that the marginal propensities to consume between the two types of wealth probably differ.

In studies focusing on the United States, stock prices are used rather than market capitalization as a measure of stock market wealth. Therefore our second robustness check was to replace market capitalizations with stock price indices. Specifically, we use the related stock price index for TMT and non-TMT and reran the VARs. It turns out that none of the estimates are significantly different from the elasticities obtained in Table 6 and hence they are not reported. This is not surprising, since much of the variation in market capitalization is the same as the variation in prices.

Our third robustness test uses the total stock market wealth, proxied by total stock market prices. Using aggregate price indices allows comparison with other studies as well as helps to identify any results specific to the time period selected. For Germany the DAX100, for Japan the Nikkei 225, for the United Kingdom the FTSE100, and for the United States, the Wilshire 5000 was used. Table 9 reports the two-year impact effects derived from the VAR using the total stock market indices. Overall, the results are consistent with our earlier results, namely that Canada, the United Kingdom, and the United States have a larger wealth effect than the other countries in the sample.

Table 9. Effect after two years on retail sales of a 10 pct. change in major stock market index, selected countries (in percent)	
Germany (DAX100)	0.1
Japan (Nikkei225)	0.6
United Kingdom (FTSE100)	1.1
USA (Wilshire 5000)	1.2

Note: Bold figures denote that the estimates are significantly different from zero.

Finally, we use this VAR formulation to conduct the following experiment: how much would consumption change after two years following a permanent drop in stock prices equivalent to the decline in prices experienced between March 2000 and March 2001? The experiment was carried out the following way: First, the level of stock prices was exogenized for a two-year forecast period and the stock price equation was removed from the VAR. The resulting model consisting of two equations (consumption and industrial production) was then simulated assuming stock prices would stay at the March 2000 level to derive the implied

forecasted consumption level. Second, the same procedure was applied keeping stock prices fixed at the lower March 2001 level and the model was simulated to compute the new consumption level. Finally, the results of the two simulations were compared over the forecast period in order to get an estimate of the impact on consumption of the fall in stock prices over this period. Table 10 shows the effect of this experiment.

Germany (DAX100)	-1.6
Japan (Nikkei225)	-1.1
United Kingdom (FTSE100)	-2.3
USA (Wilshire 5000)	-3.0

Note: Over this period Wilshire 5000 fell 26%, FTSE 100 fell 14%, DAX 100 fell 23%, and Nikkei 225 fell 36%.

A permanent fall in stock prices in the United States leads to a 3 percent lower level of consumption after two years. For the United Kingdom the estimated impact on consumption is 2.3 percent and for Germany and Japan the number is somewhat lower at 1.6 percent and 1.1 percent, respectively. It should be noted that this experiment is highly stylized, in particular since it just focuses on the peak and the March 2001 level of stock prices. Specifically, it may be that consumers take a moving average of stock prices when making consumption decisions instead of looking at the peaks and troughs as assumed here. In other words, the impacts shown here should be viewed as being as the high end of the scale.

Overall, the results from the estimation using aggregate price indices seem consistent with the findings in Section IV, and they confirm that the wealth effect is bigger in North America and the United Kingdom than in continental Europe. For Japan the impact of a 10 percent change in the Nikkei index is now 0.6 percent, which is somewhat more moderate than the higher elasticity found for non-TMT above.

VI. CONCLUSION

The empirical analysis reported in this essay suggests that stock market developments may have a significant impact on consumption in Canada, the United Kingdom, and the United States. For Canada and the United Kingdom the differences between the TMT and non-TMT sectors are small whereas for the United States the consumption impact of a change in non-TMT market capitalization was larger than for the TMT sector. Furthermore, changes in non-TMT valuations do not appear to have a large impact on activity in continental Europe. Changes in TMT valuations in continental Europe, on the other hand, seem to have a similar impact in Canada, the United Kingdom, and the United States but the overall effect on GDP in continental Europe is smaller as valuations are a lesser ratio of GDP. The results for Japan are relatively imprecise, but are consistent with a view that changes in equity valuations are translated to activity through their impact on bank capital and lending.

The links from stock markets to the real economy found in this essay raise a number of issues for policymakers. If stocks have become a more important transmission mechanism of business cycle movements, it strengthens the arguments for policymakers to follow TMT equity market developments closely. In addition, the analysis suggests a strong link from equity markets to consumption in countries with widespread stock ownership, large stock markets, and in countries where stock options are used as payment to employees. Together with the close correlation of TMT valuations across the world¹¹, this could imply that the TMT sector is capable of providing significant generalized disturbances to global activity.

¹¹ For example discussed in IMF (2001).

Data Appendix

Retail sales

For all countries retail sales comes from Datastream. The code in Datastream is XXOCSRALG, where XX is the country code.

Stock market variables

For all countries the TMT/non-TMT stock market variables come from Datastream. The codes are as follows: TMT market capitalization: TLMITXX(MV), TMT price index: TLMITXX(PI), non-TMT market capitalization: TOTXTXX(MV), non-TMT price index: TOTXTXX(PI), where XX is the country code. Data for Wilshire5000, Nikkei225, DAX100, and FTSE100 were taken from Bloomberg.

Industrial production

For all countries industrial production comes from International Financial Statistics, IMF. Code: Code: XXX66..CZF, where XXX is the country code.

Consumer price index

For all countries the data comes from International Financial Statistics, IMF. Code: XXX64...ZF, where XXX is the country code.

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