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Innovation and Dynamism

Interaction between Systems and Technical Progress

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Abstract

Literature on post-socialist transformation usually deals with the political, economic and social sides of it, although there have also been important changes in the field of technical advance in the last 20 years. One of capitalism's main virtues is the strong incentive it gives to dynamism, enterprise and the innovation process. Every revolutionary new product (for civilian use) has been brought about by the capitalist system. The socialist system was capable, at most, of developing new military products. The article analyzes how far the radical difference can be explained by the innate tendencies and basic attributes of the two systems. Our daily lives have been transformed by these new products (for instance, the sphere of information and communications by the computer, the mobile phone and the internet). While many people see all these as favorable changes, fewer discern the causal relation between the capitalist system and rapid technical progress. Yet the usual syllabus of microeconomics does not enlighten students on this important virtue of capitalism, which is not adequately emphasized in the statements of leading politicians either.

Keywords: systems, capitalist system, socialist system, innovation, technical progress, Schumpeterian entrepreneurship
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1 Introduction

The essence of post-socialist transformation can be easily summarized in a few words: a large set of countries moved from socialism to capitalism. This shift itself is the strongest historical evidence of the superiority of capitalism over socialism. Nevertheless, it is our obligation to continue the impartial and unbiased comparison of the two systems. All the more so since we are living in difficult times, and nostalgia for the failed old regime can be felt by a significant portion of the population. We must convince our fellow citizens that we are heading in the right direction. There are several arguments to support this optimistic belief. I would like to spell out only one virtue of capitalism: its innovative and dynamic nature. In the first part of the study I argue that rapid innovation and dynamism are not a random phenomenon which may or may not occur, but a deeply rooted *system-specific property* of capitalism. The same can be said about its opposite, the socialist system. Its inability to create great revolutionary new products and delay in other dimensions of technical progress are not due to some errors in policy, but are a deeply rooted system-specific property of socialism. Unfortunately, this highly visible great virtue of capitalism does not get the appreciation it would deserve. It is completely ignored by most people and even by most professional students of alternative systems, and I feel angry and frustrated watching that neglect, motivating me to choose the theme of this study.

Entering the world of capitalism creates the conditions of innovative processes and faster technical progress, and also increases the chances that the country will take this opportunity. But it does not guarantee full success immediately. The second and third part of my study will discuss problems of the transition period.

The ‘Great Transformation’ is an ensemble of several processes. Firstly, there were changes in the *political* domain: the transition from a single-party dictatorship to a multi-party democracy. This transformation put an end to the state-protected privileges of the Marxist-Leninist ideology, and gave the green light to the competition of various schools of thought. Then there were changes in the *economic* domain: the predominance of state-ownership was replaced by the predominance of private ownership. Associated with the transformation of ownership forms, the relative influence of various co-ordination mechanisms also went through radical changes. The impact of centralized bureaucratic control became much smaller, and the influence of market co-ordination and other decentralized procedures increased dramatically. These profound political and economic changes associated with several other changes jointly mean the change of the *system,* i.e., the transition from socialism to capitalism.

The post-socialist region has experienced another class of changes in the domain of technical progress as well. Although, due to its familiarity, I apply the term ‘technical progress’, in my interpretation it is a much wider phenomenon. Based on the stream of new products and new technologies its effects go far beyond the technical aspects. It is a part of modernization, generating profound changes in our lives. This meaning of the term ‘technical progress’ will unfold in the context of my study. Technical progress went on, of course, all the time, also before 1989, but following 1989 it has accelerated spectacularly.

In our profession, or sub-profession, all the experts on post-socialist transition have been concentrating their attention on the study of political, economic and social changes as part of the Great Transformation. Let us confess frankly, we perhaps briefly mention technical progress once in a while, but we have not studied thoroughly the interaction between changing the system on the one hand, and changing our profile in generating and using new products and new technologies, on the other. I myself have certainly missed this point before. I have written two studies summarizing the main consequences of the changes after 1989, but discussing only political and economic changes and their interaction (Kornai 2001, 2006). I start today to make up what I missed before. Thus, the subject of the second and third part of my study is the interaction between the post-1989 change of the system and the acceleration of technical progress.

2 Capitalism, socialism, and technical progress

2.1 Revolutionary new products

The complex process of technical progress is composed of several sub-processes. Let us begin with the great, break-through, revolutionary innovations, illustrated by 87 examples in Table 1.[1] As we take a look at the role of socialist countries in creating revolutionary new products, we have to go back in time to the birth of the Soviet Union, the first socialist state. Therefore the period covered by the list starts in 1917.

Since 1917 many innovations of great significance have been born. It is debatable why exactly these 87 are included in the table, as we could perhaps find twenty or fifty additional ones of no less significance. The selection is arbitrary, yet the list seems to be apt to demonstrate that all the innovations mentioned here in a narrower or wider scope fundamentally change the everyday practice of people's lives, work, consumption, recreation, and the relationships to others.[2] The office and the factory, transportation, shopping, housework, education have all changed. The tie between the home and the workplace differs, travel has changed as well, and we could continue listing, at great lengths, the effects of innovation causing permanent upheaval and the reorganization of life. The modern world is made dynamic by the perpetual flow of innovations. We consider our times more dynamic compared to earlier periods, because many more innovations are being introduced, which are generating much deeper changes in our everyday life.

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[1] The literature on technical progress and innovation distinguishes new *products* and new *technologies*, although the appearance of these two categories is often intertwined. For example, while the Xerox machine is a new product, it has also introduced a new technology of printing. Table 1 lists new products, because of their salience in everyday life.

[2] Certain classes of innovation were excluded at the selection. Criteria of exclusion are explained partly in the footnote at the bottom of the table, and partly in later sections of the study.

Table 1: Revolutionary innovations

INNOVATION	YEAR	COUNTRY	COMPANY
Computer, information, communication			
Integrated circuit	1961	USA	Fairchild
Touch-tone telephone	1963	USA	AT&T
Fax	1966	USA	Xerox
Optical fiber cable	1970	USA	Corning
Pocket electronic calculator	1971	USA	Bowmar
Word processing	1972	USA	Wang
Microprocessor	1974	USA	Intel
Laser printer	1976	USA	IBM
Modem	1978	USA	Hayes
MS-DOS operating system	1980	USA	Microsoft
Hard disk drive	1980	USA	Hard disk drive
Graphical user interface	1981	USA	Xerox
Laptop	1981	USA	Epson
Touch screen	1983	USA	Hewlett-Packard
Mobil telephone	1983	USA	Motorola
Mouse	1984	USA	Apple
Web search engine	1994,	USA	WebCrawler
Pendrive	2000	USA	IBM
Skype (peer-to-peer phone)	2003	Estonia	Skype
YouTube video sharing website	2005	USA	YouTube
Household, food, clothing			
Tea bag	1920	USA	Joseph Krieger
Hair dryer, hand held, electric	1920	USA	Hamilton Beach
Wall plug	1920	UK	Rawlplug Co.
Spin-dryer	1924	USA	Savage
Automatic pop-up toaster	1925	USA	Waters Genter Co.
Steam electric iron	1926	USA	Eldec
Electric refrigerator	1927	USA	General Electric
Air conditioning	1928	USA	Carrier Engineering Co.
Neon light	1938	USA	General Electric

Instant coffee	1938	Switzerland	Nestle
Electric clothes dryer	1938	USA	Hamilton Manufacturing Co
Nylon	1939	USA	DuPont
Espresso machine (high pressure)	1946	Italy	Gaggia
Microwave oven	1947	USA	Raytheon
Drive-through restaurant	1948,	USA	In-n-Out Burger,
Saran plastic wrap	1949	USA	Dow Chemical
Polyester	1953	USA	DuPont
Tefal kitchenware	1956	France	Tefal
Hook-and-loop fastener (Velcro)	1957	USA	Velcro
Athletic shoe	1958	UK	Reebok
Halogen lamp	1959	USA	GE
Food processor	1960	USA	Roboot-Coupe
Tetra Pak	1961	Sweden	Tetra Pak
Beverage can	1963	USA	Pittsburgh Brewing Co
Health, cosmetics			
Adhesive bandage (Band-aid)	1921	USA	Johnson & Johnson
Facial tissue (Kleenex)	1924	USA	Kimberley-Clark
Paper towel	1931	USA	Scott Paper Co.
Electric shaver	1931	USA	Schick
Aerosol container	1947	USA	Airosol Co.
Disposable diaper	1949	USA	Johnson & Johnson
Transistor hearing aid	1952	USA	Sonotone
Roll-on deodorant	1955	USA	Mum
Disposable razor	1975	USA	BIC
Liquid detergent	1982	USA	Procter & Gamble
Office			
Adhesive tape (pressure sensitive Scotch tape)	1930	USA	3M
Ball point pen	1943	Argentina	Biro Pens
Correction fluid	1951	USA	Mistake Out
Copy-machine	1959	USA	Haloid Xerox
‘Post-it’	1980	USA	3M
Transport			
Escalator	1921	USA	Otis
Parking meter	1935	UK	Dual Parking Meter Co.
Scooter	1946	Italy	Piaggio

Jet-propelled passenger aeroplane	1952	USA	Comet
Black box (for aeroplanes).	1958	UK	S. Davall & Son
Leisure			
Drive-in cinema	1933	USA	Hollingshead
Instant camera	1948	USA	Polaroid
TV remote control	1956	USA	Zenith
Plastic construction toy	1958	Denmark	Lego
Barbie doll	1959	USA	Mattel
Quartz wristwatch	1969	Japan	Seiko
Video cassette recorder (VCR)	1971	Netherlands,	Philips
Walkman	1979	Japan	Sony
Rubik's cube	1980	USA	Ideal Toys
CD	1982	Netherlands, Japan	Sony, Philips
Portable video-game	1989	Japan	Nintendo
Digital camera	1991	USA	Kodak
Book trade on the internet	1995	USA	Amazon
DVD	1996	Japan	Philips, Sony, Toshiba
Commerce, banking			
Supermarket	1930	USA	King Kullen
Shopping cart	1937	USA	Humpty Dumpty Supermarket
Shopping mall	1950	USA	Northgate Mall
Charge card	1950	USA	Diners Club,
Credit card	1958	USA	Bank of America
Automated Teller Machine (ATM)	1967	UK	Barclays Bank
Express shipping	1973	USA	Federal Express
Bar code	1974	USA	IBM
e-commerce	1998	USA	eBay

Note: Entries are selected out of a larger set of innovations surveyed in various collections and lists of relevant inventions and innovations. The main inclusion criterion was the relevance for large groups of users, well-known to the majority of people, and not only to small groups of experts. Some of the criteria of exclusion are discussed in the text: (1) The list contains only Schumpeterian-type innovations. Accordingly, innovations initiated and financed mainly by the military are excluded. (2) New products and services used for medical care, i.e. medicines, diagnostic equipments etc. are not included, simply because of the difficulty of selection of the greatest innovations out of hundreds or thousands of new drugs and new medical instruments. (Perhaps at a later stage of research this sector might be included.)

Source: The source of several entries were Ceruzzi (2000) and Harrison (2003, 2004.) The source of each entry is on record, and is available from the author at request.

Out of the 87 innovations about 25-30 are related to computers, digital equipment and information. This subset attracts the most intensive attention from the public and the academic world. A large and fast-growing literature is studying the social effects of the

information society.[3] My study cannot penetrate deeply into this exciting subject, because I would like to cover a wider set of innovations. Around 60 out of 87 in the list are innovations unrelated or not closely related to the revolution in the information–communication sphere. Admitting wholeheartedly the extraordinary importance of information and communication, there have been and there will be innovations in many areas outside this area. For the poorest inhabitants of a poor Albanian or Siberian village the introduction of the refrigerator or the appearance of a supermarket might contribute to relevant changes in life-style—the use of the computer might come later. I would like to discuss certain issues of technical progress as a whole, i.e., the technical change related and unrelated to the revolution of information and communication.

Innovation is preceded by invention. The first step is made by the inventor: the professional or amateur researcher, the academic scholar, or the company engineer, is the one to whom the new idea occurs. However, the originality of the idea, its novelty, and its ingenuity are not at all enough. In the second step the invention becomes an innovation; the practical introduction begins, i.e. the organization of production and the diffusion of the new product, or the application of a new organizational form. If we turn our attention towards this second phase, to the practical execution of the change (Table 1 indicates the country in which the innovator company is operating), we will, without exception, read the names of capitalist countries here. As the time period captured in the table includes the entire era during which the socialist system existed, it is clear that in no instance did the innovation pioneer in a socialist country.[4]

2.2 Following the pioneers, the diffusion of innovation

While revolutionary innovation is the most important component of technical progress, there are other components as well. The pioneer has followers. Beside the first innovator, after some time-lag, various other organizations participate in minor quality improvements, implementation of small but not negligible inventions, and in the process of *diffusion*. The innovation appears first in a certain country, but then followers show up in other countries as well.

The socialist system in numerous spheres followed the pioneering inventions born in a capitalist country, taking place in diverse forms. Sometimes it was just imitation. The mere reproduction of the model, perhaps its makeshift copying, was simple. Breaking up the secret was a relatively more difficult task. The reinvention of the innovations protected by patents and business privacy virtually developed into an art in socialist economies. Industrial espionage, the stealing of intellectual property, was a further possibility.[5] However, despite the diverse attempts, regarding these processes the socialist economy sluggishly trudged behind the capitalist economy.

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[3] Perhaps the most influential work in this area is Castells (1996-98). See also Fuchs (2008).

[4] Table 1 excludes innovations initiated in the military sector of the economy. The military sector produced innovations appearing first in a socialist country. I will return to that point further down.

[5] Stealing Western intellectual property in the high-tech sphere was hindered by various barriers, e.g. by strictly enforced prohibition of exporting certain products to communist countries (the so-called COCOM list of products used for military purposes). In spite of strict prohibitions, the co-operation of smart spies and technical experts succeeded in slipping through the holes of the barriers.

Let me draw your attention to two details. First, in the socialist countries this delay, the followers' lag behind the pioneers, was significantly larger in magnitude than in the capitalist countries; see for example the data on Tables 2 and 3. Examining a longer time period, the lag measured in years was mostly growing instead of shrinking.

Table 2: Time-lag in following the leaders of innovation: plastic materials

Product	Innovator		First follower		Second follower		Soviet Union	Years behind innovator
Cellophane	France	1917	USA	1924	Germany	1925	1936	19
Polystyrene	Germany	1930	USA	1933	Italy	1943	1955–59	25–29
PVC	Germany	1931	USA	1933	Japan	1939	1940	9
Silicon polymers	USA	1941	Germany	1950	Japan	1951	1947	6*
Epoxy resins	Switzerland	1936	USA	1947	Germany UK	1955 1955	1957–59	21–23
Polypropylene	USA Germany Italy	1957 1957 1957	UK	1959	France	1960	1970	13

Note: *In this case the Soviet Union followed the pioneering country faster than the capitalist economies.
Source. Amann et al. (1977: 272–85).

Table 3: Time-lag in following the leaders of innovation: controlled machine tools

	Reached by	USSR (+ in advance; – behind) in relation to			
	USSR in	USA	UK	Japan	FRG
Start of research	1949	–2	–1	+4	+6
First prototype	1958	–6	–2	–	–
Start of industrial production*	1965	–8	–2	+1	–1
First machining center	1971	–12	(–10)	–5	–10
First third generation control system	1973	–7	(–5)	(–5)	(–5)
First use of computer for control	1973	–6	(–4)	–5	(–4)

Note: ( ) estimate. *50 units or more per annum.
Source: Amann et al. (1977: 41).

And second, the diffusion of new products and new technologies was much faster in the capitalist economies than in the socialist ones; for example see Table 4 and Figure 1.

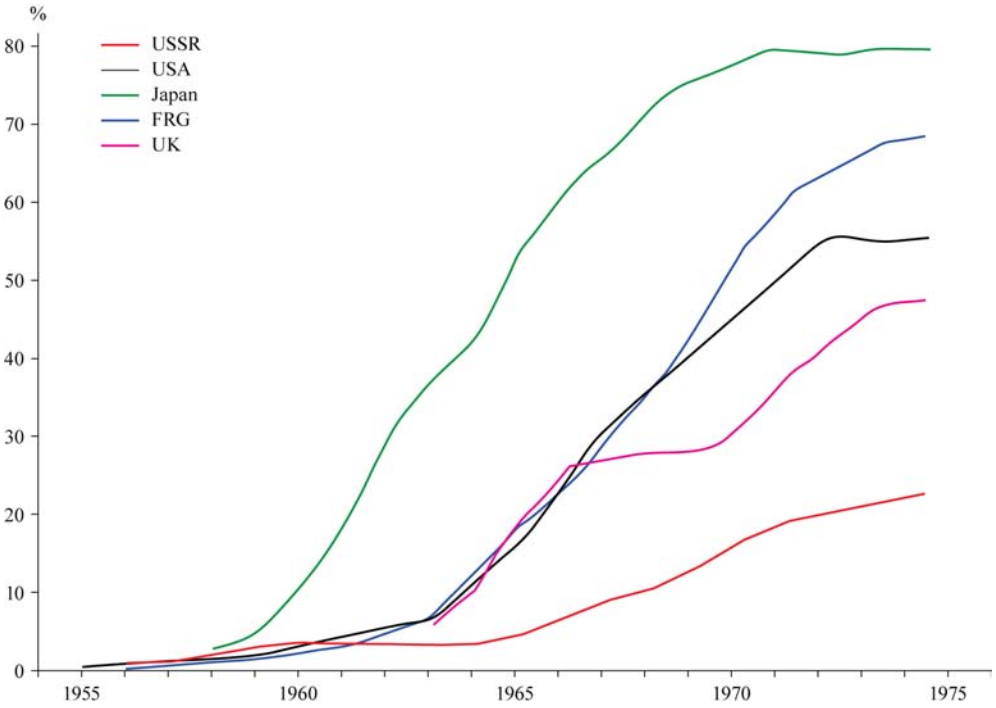
Table 4: Penetration of modern technology: steel industry, continuous casting (%)

Country	Continuous casting per total production		
	1970	1980	1987
Socialist countries			
Bulgaria	0	0	10
Czechoslovakia	0	2	8
East Germany	0	14	38
Hungary	0	36	56
Poland	0	4	11
Romania	0	18	32*
Soviet Union	4	11	16
Capitalist countries			
France	1	41	93
Italy	4	50	90
Japan	6	59	93
Spain	12	49	67
UK	2	27	65
USA	4	20	58
West Germany	8	46	88

Note: *1986.

Source: Finansy i Statistika (1988: 109).

Figure 1: Penetration of modern technology: steel industry, oxygen steel (oxygen steel as a proportion of total steel output, % of total)



Source: Amann et al. (1977: 97).

The tables and figures shown here are only illustrations. The large amount of empirical evidence in the comparative economic literature also supports the proposition that the socialist system was sluggish in following the pioneering innovations.[6]

2.3 Innovative entrepreneurship under capitalism

Thus, capitalism produced all the break-through innovations and was much faster in other aspects of technical progress—historical experience grants irrefutable evidence. Nevertheless, let us add the causal explanation of that crucial systemic difference. In capitalism the entrepreneur plays a distinguished role.[7] My study adopts this term in the sense used by Joseph Schumpeter (1912/1934). Beyond terminology, Schumpeter's theories about development and the nature of capitalism leave their mark on the message of this study.[8]

Innovative entrepreneurship is a *function*, a role, which can be fulfilled by an individual alone or by teaming up with one or more partners, or with the support of a small firm. Or even a large firm can function as an entrepreneur. The main point is that the entrepreneur is the one who brings together the necessary financial and personal conditions that the innovation calls for, in other words, the human resources, the physical instruments and financial resources essential to the activity. S/he is the one finding the place of application; s/he directs the execution of the change. Often a long time passes before a promising invention is taken up by a true entrepreneur.[9] Probably it happens many times that an invention or discovery and an entrepreneur do not find each other. Fortunately, it is quite frequent that the match is made.

From Table 1 it emerges how many different types of innovation are possible—not only new products, or new production technologies, but new organizational forms as well.

In most cases the Schumpeterian entrepreneur drives the innovation process during the first realization of the revolutionary innovation. Diffusion, i.e. the process following the pioneering innovation, is also mostly driven by entrepreneurs. The initiative appears at the beginning of the sequence. For example, in 1996 Larry Page, a PhD student at Stanford, is searching for a dissertation topic. Some specific issues about browsing the internet attract his attention. He teams up with another student, Sergey Brin. They develop a 'search engine'. On the Stanford homepage it receives the name 'google.stanford.edu'. In this story these two men unite the two usually separated roles: they are the inventors and at the same time they are the innovators. Skipping over all the intermediate stages, let us jump to where we are right now. Google is one of the world's largest and wealthiest companies.[10] Its worldwide network is using about 450,000

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6 The most important empirical works on the subject are the books by Amann et al. (1977, 1982). See also Berliner (1976), Hanson (1981), Hanson and Pavitt (1987).

7 Not all entrepreneurs are innovators (Baumol and Schilling 2008). This study is focusing on one extremely important class, the entrepreneurs engaged in the process of innovation.

8 On Schumpeter's contributions to social science see Heertje (2006) and McCraw (2007). See also Baumol (2002). Already the title of his book catches the real essence of the phenomenon I am going to discuss: *The Free-Market Innovation Machine: Analyzing the Growth Miracle of Capitalism.*

9 One can find numerous examples for this delay in the 1995 book of Rogers. See also Freeman (1982: 111-12).

10 For a concise introduction to the Google story, see the company's own brief summary (Google 2009) and the entry on Google in Wikipedia (2009a).

servers. I would not like to play lightly with words, but the influence of Google has proved to be of revolutionary significance.[11] I will return to the Google story, but only to illustrate the general characteristics of the innovation process taking place in the capitalist environment.

Let me summarize the specific characteristics of the capitalist economy not only making the innovation process possible, but also inducing, constantly developing and propelling it:

Decentralized initiative. Larry Page and Sergey Brin did not receive any orders from their superiors to solve a specific innovational task. They did not have to ask for permission from their superiors to work on a special direction of an innovative action. The individuals and the decision makers of small firms, or the chief executives of large companies – in other words, the separate entities functioning inside the entire system – determine for themselves what they want to do.[12]

Gigantic reward. Today Page and Brin are among the richest men of the world.[13] It is not the task of this study to analyze the difficult ethical dilemmas of income distribution. How large is the reward that is 'proportional' to performance? One point is certain: the most successful innovations usually (not always, but very often, with a high probability) result in enormously large rewards.[14] The range of the reward spreads rather unevenly. At the end of the scale one can find the owners of gigantic wealth: people like Bill Gates, or in the older generations the Fords or the Duponts. The entrepreneur leading the technical progress is able to gain a huge monopolistic rent. It is worth being the first, even temporarily, because it creates a monopolist position. The enormous financial reward is usually accompanied by prestige, fame and reputation.

Competition. This is inseparable from the previous point. Strong, often ruthless competition is taking place to attract the customers. The faster and more successful innovation is not the exclusive instrument for that purpose, yet a highly important one to gain advantage over one's competitors.

Extensive experimenting. There must have been hundreds, perhaps thousands of entrepreneurs wanting to find suitable tools to search the internet. Only a few achieved almost as great a break-through as the founders of Google, however, others have been also able to realize innovations with fairly large, medium or small success. And there must have been many, quite many, who have tried but failed. Moving beyond the example, so far no one has assessed the volume of innovational attempts constantly occurring in all spheres under capitalism and the distribution of their success and failure. Those gaining an impression about this highly important activity can only

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[11] Based on my personal experience, I admit that it has changed my research habits as well. It is different to be a researcher in the Google age than it was earlier, in the Gutenberg era.

[12] Acemoglu, Aghion and their co-authors argue in a recent paper (Acemoglu et al. 2007) both theoretically and empirically that pioneering innovation requires decentralization.

[13] According to the well-known ranking of *Forbes* magazine, they tie for rank No. 5 in the USA.

[14] The Google story can rather be considered a unique case, where the pioneering inventor and the role of the innovator are played by the same people. In the more frequent instance of these roles being separated, the inventor in some cases does, in others s/he does not, attain benefits from the invention or the discovery. The latter was the fate of the computer mouse. The inventor Douglas Engelbart has received no financial reward for his ingenious invention. Apple, the innovator company pioneering the mass introduction, has produced an enormous profit on this innovation.

intuitively sense the huge number of the attempts, and compared to that the rare spectacular successes like the story of Google, Microsoft, Tetrapack, Nokia or Nintendo. Many highly talented people are motivated exactly for innovation, because—although with quite a small probability—a phenomenal success is promised, and even with a larger probability a more moderate yet still substantial success materializes, and that is why it is worth taking up the risk of failure.[15]

Reserve capital waiting to be invested: the flexibility of financing. The two founders of Google gained access to financial resources enabling them to launch the innovative activity, the distribution. Successful researcher and innovator Andy Bechtolsheim (who happened to be also a wealthy businessman) at the very beginning of the process reached into his pocket for his chequebook and signed a US$100,000 cheque.

An innovative enterprise rarely happens to be realized solely from one's own resources. Although there are examples of this as well, resorting to outside resources is much more common.[16] The diverse forms to open up resources include a bank loan, investors willing to take part in the business, or 'venture capital' institutions specialized in particularly high risk and, in case of success, high reward projects (Bygrave and Timmons 1992). Basically, flexible disposable capital is needed in order to realize the pioneering introduction and quick diffusion of innovations, including wide range experimenting, and within this, eventually unsuccessful attempts.

I do not claim that the Schumpeterian-type entrepreneurship is the only way to generate innovative processes in a capitalist system. Let me mention only three of the several other non-Schumpeterian frameworks:

(i) In several instances an important innovation is initiated, financed and implemented by the military. For example, in the 1960s there was a strong demand expressed by the Pentagon to find ways of a completely decentralized mailing service to assure that the destruction of the centre of the postal system would not lead to a breakdown of written communication. This requirement of the military and the generous financial support of research in that direction led to a revolutionary innovation, the creation of email, a completely decentralized 'invisible hand' device for communication. Though at a later stage the free-of-charge, non-profit email system intertwined with more commercial profit-oriented activities, email is still a classical example of a non-Schumpeterian innovation.

While under socialism competition was eliminated in the centralized, bureaucratically managed civilian economy, the Soviet Union and its allies were fatally involved in the military race with the West, first of all with the USA. This life-and-death competition put the innovative process under sufficient pressure for generating great innovation. The first satellite, the Sputnik, was created by the Soviet Union. The sluggishness of

15 On the importance of experimentation see Thomke (2003).

16 Undoubtedly, there is a connection between the economic booms of the great innovative periods and the increase in the available amount of credit. Easily accessible money helps technical progress, but also entails the danger of a bubble formation. It is timely to re-read Schumpeter when analyzing the history preceding the current crisis (Schumpeter 1939, especially Chapter IV.) The great temptation to discuss this aspect is regrettably limited by the available space.

technical progress in the civilian sector was overruled by the overall objectives of the leadership, to keep pace with, or even jump ahead of, the development of the Western military forces. But when it came to the civilian utilization of a military innovation, the inferiority of the socialist system did show up again. In the USA the pioneering military applications were followed by the use of satellites for civilian use, leading to rapid quality and efficiency improvements in all areas of telecommunication. In the Soviet block the civilian application followed only after a long delay. The example of the satellites demonstrates that focused action in a highly centralized bureaucratic system might produce spectacular results—but without the same strong spillover effect as great innovations appearing in a decentralized, entrepreneurial capitalism:

(ii) In certain instances important research and later, the diffusion of the invention, is initiated and financed by civilian, non-military sectors of the government, e.g. the agencies in charge of medical care. There are good examples when intelligent, competition-.friendly government policy is promoting targeted innovation (.e.g. in order to protect the environment).

(iii) In several instances important innovations are initiated, and also executed, by an ad hoc ensemble of researchers, or by an association, or by a non-governmental and non-profit organization. That is how, for example, one of the most significant, truly revolutionary innovations, the World Wide Web started; see the memoirs of the pioneer Berners-Lee (1999.) Many other important innovations in the sphere of computers, digital applications, information and communication started in this civilian, non-profit, associative way of the non-Schumpeterian innovation.

Admitting the relevance of non-Schumpeterian processes, most breakthrough innovations follow the Schumpeterian path. That is certainly true for the innovations targeted at the market of consumer goods and services for practical use in everyday life. And even the non-Schumpeterian starts are followed typically by many profit-oriented applications, and innovators with a commercial orientation execute the larger share of wide diffusion.

2.4 The impossibility of innovative entrepreneurship under socialism

Moving on to socialism, let us begin by stepping back to the preceding phase of innovation, namely *invention*. Creative minds lived in the socialist countries as well. Excellent scientists and engineers worked there, who made important discoveries and inventions that were revolutionarily significant, with a potential to be applied in industry and commerce. The first example is the Soviet physicist Abram Joffe, who is regarded in the history of science as one of the pioneers of the semi-conductors, today playing a fundamentally important role in the electronics industry. He had already come forward with his discoveries during the 1930s but the economic environment simply did not allow for the introduction of their industrial applications. Much later the manufacturing of semi-conductors became dominated by the USA, Japan, Taiwan, South Korea; the Soviet Union trailed behind among the slow followers of the leaders.[17]

[17] Joffe was first showered with the highest state awards, and received high academic honors, but during the last years of Stalin's terror he was removed from his high positions as a 'Zionist'. Whether up or down, his discoveries never turned into a revolutionary innovation.

Jacek Karpinski, a Polish engineer and scientist invented the first mini-computer between 1971-73. His name is recognized among the great pioneers of computer technology. However, his invention did not become a widely dispersed innovation while he lived on Polish soil. Karpinski later emigrated, and his invention, in competition with similar discoveries, became a widespread innovation in the capitalist world.

The most famous Hungarian example is the story of Rubik's cube. I listed this ingenious toy among the breakthrough innovations, and it certainly has a legitimate place there. The inventor, Ernő Rubik, tried to initiate the worldwide distribution, after seeing the enthusiastic reaction of everyone familiar with this intellectual masterpiece, but with a rather moderate effect. Later it became a fantastic success when a well-known, truly entrepreneurial American toy company bought it and started worldwide marketing.

Even in Hungary only a few know that the floppy disk, the plastic covered simple data storage device for personal computers used by millions, was invented by a Hungarian engineer, Marcell Jánosi. After inventing it in 1974, Jánosi offered the well functioning prototype to the Hungarian industry and exporters in vain; the leaders of the socialist industry did not see the great business opportunity in the invention. They felt reluctant to risk mass production and worldwide distribution, and did not even support the extension of its patent protection. The inventor was not allowed to take the marketing of his intellectual product in his own hands. At the end, a Japanese firm 'reinvented' it, and it was first there that the innovative process of mass introduction developed.[18]

After these sad stories of frustrated inventors, we turn to the *innovation* phase. Surely, even in the socialist system many individuals had entrepreneurial talent, but it was dormant. Perhaps a large project's leader could to a certain extent unfold his talent, provided that he was picked for his position because of his abilities and not his party connections. Still, the inherent characteristics of the system did not allow the development of a Schumpeterian-type entrepreneurship.[19] Let us return, one by one, to the conditions reviewed earlier when discussing capitalism, and study the situation under the socialist system.

Centralization, bureaucratic commands and permissions. The plan of technical innovation is one chapter in the state plan. The central planners set key changes to be carried out regarding the composition and the quality, together with the production technology, of the products. What follows is the disaggregation of the central plan numbers into plans for sectors, sub-sectors, and in the end to companies. The 'command economy' among others means that firms receive detailed orders about when they should replace one product with a new one, and which old machinery or technology should be replaced with a new one. Before the final approval of the plan, company managers are allowed to make suggestions, so among other things they can initiate the adaptation of a new product or a new technology, that is to say, they can join in the process of innovation diffusion. However, they must ask for permission to realize all significant initiatives. If an action happens to be of large scale, even their immediate superiors cannot decide by themselves, but turn to the higher levels of the hierarchy for

[18] The Hungarian inventor is still alive. Since his retirement he has been living on a very modest pension. See the story of the floppy in Kovács (1999) and Drávucz (2004).

[19] For empirical studies see the references in Footnote 6. For a theoretical explanation, see Berliner (1976); Gomulka (1983); Kornai (1980, 1992).

approval. The more extensive an initiative is, the higher one has to go for the final decision, and the longer the bureaucratic process preceding the actual action is.[20]

As opposed to the above, if in capitalism a very promising innovation is rejected by the first company, another one may be willing to embrace it – made possible by decentralization, private property and the market. In the centralized socialist economies the innovative idea follows the official pathways, and in case of a declared negative decision no appeal can be made.

No or only insignificant reward. If the higher authority deems a technical innovation in a factory unit successful, the manager and perhaps his immediate colleagues receive a bonus, an amount equal to one or two months of salary at best.

There is no competition between producers and sellers.[21] Production is strongly concentrated. Quite many companies enjoy monopolist positions, or at least a (regional) monopoly in producing an entire group of products. The chronic shortage of products creates a monopolist behaviour even where many producers operate in parallel. The shortage economy, one of the strongest system-specific properties of socialism, paralyzes the forceful engine of innovation, the incentive to fight for the favours of the customer (Kornai 1970, 1980, 1992: Chapters 11-12.) The producer/seller is not compelled to attract the buyer by offering him a new and better product, since the latter is happy to get anything in the shop, even an obsolete and poor-quality product. There are examples of inventions activities motivated by chronic shortages: ingeniously created substitutes for missing materials or machinery parts (Laki 1984-1985.) These results of the inventors' creative mind, however, do not become widespread, commercially successful innovations in the Schumpeterian sense.[22]

The tight limits of experimenting. Capitalism allows for hundreds or thousands of barren or barely fruitful attempts so that, eventually, one will succeed. In the socialist planned economy actors are inclined to avoid risks. As a result, the application of revolutionarily significant innovations are more or less excluded, since those always mean a leap into the dark, as success is necessarily unpredictable. As far as followers are concerned, some economies follow up quickly, others slowly. The socialist economies belong to the group characterized by the slowest pace. They rather maintain the already known, old production procedures, and produce the old well-tried products—new technologies and new products have too many uncertain characteristics making the planning of the directives difficult.

There is no capital waiting to be utilized, investment allocation is rigid. Central planning is not dealing miserly with the resources devoted to capital formation. The share of investment carved out from the total output is typically higher than in the capitalist economies. However, this enormous volume is appropriated ahead of time to the last penny. Moreover, most of the time, over-allocation takes place. In other words,

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[20] For a powerful theoretical analysis of the relationship between centralization and innovation, see Qian and Xu (1998).

[21] As mentioned before, the defense industry was an exception, because in this area the Soviet empire was in a truly fierce competition with the West.

[22] Not only did the socialist system suffer from chronic shortages. During wars shortages occur in capitalist economies as well. During the Second World War the shortage of raw materials spurred innovating activities to develop 'Ersatz' (substitute) raw materials.

the ensemble of all project plans prescribes the requisition of more resources than the required amount to execute the plan. It never happens that unallocated capital is waiting for someone with a good idea. The allocators do not search for an entrepreneur waiting to step forward with a proposal for innovation. Flexible capital markets are unknown. Instead, the rigid and bureaucratic regulation of project activities takes place. And to devote capital resources to activities with possibly uncertain outcomes is inconceivable. No foolish minister of industry or factory manager will be found who would demand money for ventures admitting in advance that the money may be wasted and the innovation may not succeed.[23]

At this point, it is worth running through points A to E again about the description of the mechanisms of innovation in these points are actually the consequences of the basic characteristics of the capitalist and the socialist systems. The reviewed phenomena are direct results of private property and market co-ordination in one system and of public property and bureaucratic co-ordination in the other.

I do not claim that a country's pace of technical progress solely depends on its being governed by a capitalist or a socialist system. Numerous other factors play significant roles: the country's state of economic development, the level of education, including the training of researchers, the level and the institutional framework of financing academic research and industrial R&D activity, research financed by the military and so on. Luck undeniably also plays a role. It was a matter of luck why it was in Finland, and not in Denmark or Norway, where a company like Nokia has appeared and reached unparalleled success in the diffusion of mobile phones. Following the pioneering work by Zwi Griliches (1957) there is rich recent literature discussing the problems of diffusion, leaders and followers in the innovation process (see, e.g. Davila et al. 2006; Freeman 1982; Rogers 1995).[24] Admitting the relevance of all other explanatory factors, I maintain the proposition: the *system-specific effect* is quite strong.[25]

2.5 Political factors and technical progress

The decisive factor explaining the nature of the innovative process is the influence of the system-specific features of the economy, which is, of course, ultimately determined by the political structure of the system. There are, however, several direct linkages between the political structure and technical progress. I will briefly touch upon a few linkages.

Communist dictatorship aggressively promoted innovations in the information-communication sphere when it provided efficient technology for political propaganda

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23 For the analysis of the relationship between flexibility of financing, centralization and innovation see Huang and Xu (1998).

24 Rogers (1995) is perhaps the most quoted work in the literature written for businessmen and managers interested in the practical issues of innovation. In this otherwise excellent and very carefully written book the name Schumpeter is not even mentioned, nor is any other *economic* theory of innovation.

25 The experience of the divided Germany is especially instructive. East Germany, beside Czechoslovakia, was the most developed country in the socialist region. It started with an excellent research infrastructure and devoted resources generously to higher education, academic and industrial research. Yet it was not able to step forward with even one break-through revolutionary innovation. In spite of having first-rate, highly skilled experts at disposal, the rate of following the pioneering innovations was in most sectors slower than in West Germany (Bauer 1999; Stokes 2000).

and more generally, the spreading of the official ideology. Lenin was among the first political leaders to understand the relevance of the cinema for propaganda purposes. Also, the USSR was among the first countries to introduce television broadcasting, since it was a highly centralized medium in the first period, concentrated in a single or only a few studios, and subject to the tough political control of the Party. Also, the program of the radio stations could be easily controlled, and transmitted through loudspeakers even to remote villages.

Radio and television were supported by the communist regime as long as tough central control was feasible. Luckily, as the IC technology developed further, complete centralization and censorship became technically impossible. The Berlin Wall stopped people from crossing between the two worlds, but no wall could stop radio and TV waves transmitting through the Iron Curtain from West Germany to East Germany, from Munich to the whole Eastern Europe, no matter how much they tried to jam transmissions to try to stop the destabilizing impact of Western broadcasts. Among the certainly numerous factors leading to the collapse of the socialist system one was the technical impossibility of airtight isolation of the Soviet Union and other socialist countries from the voice coming from the rest of the world.

The last turmoil in the socialist block occurred in the period when Xerox machines, email and the internet became available even in this area. Gorbachev called for ‘glaznosty’, (openness), and through the open doors of the internet, email, radio and TV waves information flowed from abroad, and later also from open-minded awaking domestic citizens in ever larger volume. It had a devastating effect on old dogmas, frozen beliefs, misleading party propaganda, liberating the minds of more and more people (Shane 1994; Kedzie 1997a, 1997b; Stolyarov 2008). Let me come back to the relationship between political structure and technical progress at a later point.

2.6 First summary: systems and technical progress

Assume for a moment that the vision of Marx, Lenin and Trotsky had materialized, the world-revolution was victorious all over the globe, without a spot of capitalism left. In such a case we would never get the computer and the transistor radio, the refrigerator and the supermarket, the internet and the escalator, CD and DVD, digital photography, the mobile phone and all the other revolutionary technical changes. Our way of life, at least with respect to the use of various devices and equipment, would more or less stagnate at the standard taken over from the last spots of capitalism before its final defeat.

We arrive here at fundamental issues of understanding and explaining the long-lasting trends of human history. The technologies (instruments, devices, equipments etc.) utilized in all activities (not only in production of goods, but in all other individual and social activities) are developed in a complex social process. That complex process is what we call concisely ‘technical progress’. The speed and other properties of technical progress are determined by several factors. The general philosophy underlying this study (and my other writings) is the following: one of the strongest explanatory factors is the system. A strong causal relationship is working between the type of system (capitalism or socialism) as one of the *causes*, and the speed and other properties of technical progress as the *effect*.

I am using the concept ‘technical progress’ generally accepted by the whole economic profession. We must be aware that the second word, ‘progress’ has an appreciative or even laudatory sound, as it reflects a value judgment: it is better to live in a world with automatic dishwashers, mobile phones and CDs than in a world without those products. But is it really better? Nobody, even the most enthusiastic fans of modern technology would reply with a simple ‘yes’ without qualifications and reservations. Since the invention of the fire and the knife all new instruments and technologies have been used for both good and evil purposes. It is a trivial, but still extremely important, fact of life that the latest great wave of technical progress, namely the stormy development in the sphere of computers, electronics, digital instruments, modern technologies of information and communication can serve criminals, sex offenders, terrorists, and extremist political movements, also opening the new technology for tricky advertisement misleading or at least bothering people. The substitution of the work of human beings by robots can lead to the ‘dehumanization’ of various activities and contacts. Sitting in front of the screen of the computer or TV day and night can distract children and adults from more worthy studies and entertainment. Technical progress has been and will be used not only for peaceful, but also for military activities, and not only for the defence of the homeland but for aggression as well. Yet, the majority of people, myself included, call the direction of technical changes *progress*, because it brings more, many more benefits than drawbacks or dangers (find survey results to prove this to be the majority’s opinion below).

Based on this value judgment I regard the promoting impact of capitalism on technical progress as one of the greatest virtues of that system, and the retarding impact of socialism on technical progress as one of the greatest vices of that other system. This observation alone could be a good reason to celebrate the fall of the socialist system.

3 Transformation and the acceleration of technical progress

Entering the world of capitalism, all post-socialist countries opened the door for entrepreneurship, path-breaking innovations, the fast diffusion of new products and new technologies. The change in basic features of the economy has created the conditions for the acceleration of technical progress in this part of the world.

When formulating the above sentences I tried to be cautious. Capitalism has a built-in tendency for entrepreneurship, innovation and dynamism. However, this is just a tendency, an inclination, a disposition—and not more than that. It is not like a law of physics, which *must* materialize. The earlier section discussing innovation under capitalism underlines that beside the decisive impact of system-specific factors, other circumstances also exert a significant influence. The diversity of these other, non-system-specific factors explains the differences in the speed of the innovative process between various transition economies. As entrepreneurship, innovation and dynamism come to life through human action, it is the social, political and legal environment created by human beings that influences how far and how quickly the tendency breaks through. It depends on the business climate. And it depends to a large extent on the courage, inspiration and competence of individuals who might become entrepreneurs.

3.1 New innovative entrepreneurs

Let us start with innovations introducing revolutionary new products. The first example is Skype, listed among the great revolutionary innovations in Table 1. Its two inventors are Scandinavian, Niklas Zennström is Swedish and Janus Friis is Danish, but the company launching the worldwide distribution was founded and is registered in Estonia. Therefore, following the criteria applied in this study, it is an Estonian innovation. It was so successful that the USA-based e-Bay paid almost €2 billion for the pioneering company when it took over and continued the innovative process.

The second, less spectacular, but still remarkable example is the story of the Hungarian high-tech company Graphisoft. The inventor-innovator, Gábor Bojár, a former senior fellow in an academic research institute, created a programme for three-dimensional design targeted for utilization mainly by architects (Bojár 2007). While not unique in the field, compared to other products his software is elegant, efficient and therefore commercially successful in several countries. Bojár's company is marketing the product worldwide. This is a classical example of a Schumpeterian entrepreneurial career. What a difference there is between the stories of the two Hungarians: floppy disk inventor Jánosi not succeeding in the pre-1989 era, remaining poor and virtually unknown, and Graphisoft creator Bojár reaching fame, reputation and a big fortune.

The third story about data-recovery from damaged computer hard disks starts also in Kádár-era Hungary, characterized by half-way market reforms. At the time there were quite a few computers around, but were rather expensive for the Hungarian environment. If a computer breaks down, the most valuable part, the hard drive, should not be dumped as it worthwhile restoring it for use in another computer. Two brothers, János and Sándor Kürti acquired special skills for the restoration of hard drives. And then came the creative idea: restoring data from damaged hard disks. Mostly everybody these days knows the traumatic feeling of losing important information and files on our computers. The Kürtis learnt the technique, or more precisely the art, of conjuring data believed to be lost forever from damaged disks. As after 1989 this very special knowledge became a marketable service, the Kürti brothers founded a company, and trained several experts in their technique. They have now customers all over the world (Kürti and Fabiányi 2008; Laki 2009), making theirs another story of the highly successful Schumpeterian innovators.

Though two out of the three examples come from Hungary, due to my personal connections to people familiar with those cases, I am convinced that there are similar stories in many other post-socialist countries.

3.2 The acceleration of follow-up and diffusion

As post-socialist economies were moving forward in enlarging the private sector and creating the institutions of market co-ordination, technical progress accelerated in many ways, including the faster follow-up of innovations introduced elsewhere.

Table 5: Telephone lines: comparative data (number of lines per 1000 people)

Year	Bulgaria	Hungary	Poland	Romania	Soviet Union	Germany	Greece	Italy
1979	91	53	53	67	67	308	226	216
1980	102	58	55	73	70	332	235	231
1985	167	70	67	88	103	416	314	305
1990	242	96	86	102	140	441	384	387
1995	305	210	148	131	169	514	494	434
2000	353	372	283	174	218	610	536	474
2005	323	332	307	203	280	661	567	431

Source: United Nations Statistics Division (2009).

Table 6: Penetration of modern communication technology in EU countries:
15 old EU member states (EU15) versus 10 new post-socialist member states (EU10)

Indicator	Unit of measurement	Group	1995	2001	2007
GDP	per capita constant 2000 US$	EU15	19,706	23,747	26,781
		EU10	3,469	4,425	6,295
GDP	per capita, PPP constant 2005 US$	EU15	25,831	31,134	35,058
		EU10	9,758	12,286	17,570
Personal computers	Per 100 people	EU15	16	35	37
		EU10	3	12	33
Internet users	Per 100 people	EU15	3	32	64
		EU10	1	14	48
Broadband subscribers	Per 100 people	EU15	NA	2	24
		EU10	NA	0	12
Mobile phone subscriptions	Per 100 people	EU15	7	77	116
		EU10	1	40	118

Notes: Figures are simple means for each country group. For missing data (NA); see source for details.
Source: World Bank (2008).

Access to a telephone line has been regarded self-evident to everyone in the West in the last decades. But not in the least so for citizens of socialist countries, where it was a service in very short supply, reserved for the privileged and provided for others only after a waiting period of several years. There were not enough lines, because planners assigned them a low priority, and allocated resources to other sectors. As long as socialism prevailed it seemed to be hopeless to change the relationship of supply and demand in telephone service. Then followed the change of the system and together with it the situation completely reversed in the telephone sector. Table 5 shows that in a relatively short time old-style cable phone service became accessible to everyone. In addition, a revolutionary new product, the mobile phone appeared and conquered the phone market[26] (see Tables 6, 7, and 8). The penetration of these services occurred in stormy speed (Cooper 2009). As the use of the phone has become unconstrained on the supply side, nowadays only the demand constraint is effective.

[26] In some countries, e.g. in Hungary, it has not only stopped the further increase of cable-connected phone service, but has actually started to replace it in many households.

Table 7: Penetration of modern communication technology in EU countries (five Visegrád countries versus three South European countries)

Indicator	Unit of measurement	Group	1995	1997	1999	2001	2003	2005	2007
GDP	per capita, constant 2000 US$	S3	10,406	11,020	11,847	12,642	13,054	13,623	14,289
		V5	3,865	4,194	4,435	4,756	5,108	5,635	6,338
GDP	per capita, PPP, constant 2005 US$	S3	18,620	19,721	21,200	22,618	23,345	24,357	25,545
		V5	11,550	12,535	13,228	14,176	15,237	16,821	18,956
Personal computers	per 100 people	S3	5	7	9	14	15	17	28
		V5	4	6	9	12	18	23	39
Internet users	per 100 people	S3	1	3	10	16	26	33	41
		V5	1	2	6	13	29	39	50
Broadband subscribers	per 100 people	S3	NA	NA	0	1	3	8	14
		V5	NA	NA	0	0	1	5	11
Mobile phone subscriptions	per 100 people	S3	3	12	40	74	88	100	115
		V5	1	4	14	46	72	92	113

Notes: Figures are simple averages for each country group. V5 = Visegrád countries: the Czech Republic, Hungary, Poland, Slovakia, Slovenia; S3 = South European countries: Greece, Portugal and Spain.
Source: World Bank (2008).

The clear causal relationship between capitalism and the abundant supply of the phone service is present on several levels. The transition to private ownership based on the liberalized market economy put an end to the shortage economy. Phone service is supplied because domestic or foreign entrepreneurs profit from this business. Because of the close substitutability of the cable-connected telephone by mobile phones the first one cannot remain a monopoly. On the contrary, we witness a fierce rivalry between phone companies. Thirty years ago in the Soviet Union or in Eastern Europe the would-be-customer begged the bureaucracy for the great favour of getting a phone line. Nowadays phone companies are bidding for the favour of the customer.

I, for one, remember well my own troubles due to the lack of a phone line in my home, and am grateful that due to post-socialist transition and capitalism I now have a phone at home, as do all members of my family. I am grateful for the improved chances of technical progress due to the change of the system. I know that 'gratitude' is a word missing from the vocabulary of economics and political science. Yet, I want to use exactly that term because it clearly reflects not only my rational understanding of a positive causal relationship between capitalism and innovation in general, and the shift toward capitalism and the availability of phone services in particular, but also a strong emotion toward the post-1989 changes. In spite of all shortcomings and lost battles, I genuinely celebrate the anniversary and it is one of the important reasons to celebrate the advent of capitalism that all the products of technical progress are finally available also for us, the citizens of the post-socialist region.

Table 8: Penetration of modern communication technology in Russia and some other countries

Indicator	Unit of measurement	Country	1995	2001	2007
GDP	per capita, US$	Russia	1,618	1,870	2,858
		Brazil	3,611	3,696	4,222
		Mexico	4,892	5,864	6,543
GDP	per capita, PPP	Russia	7,853	9,076	13,873
		Brazil	7,727	7,910	9,034
		Mexico	9,949	11,927	13,307
Personal computers	per 100 people	Russia	2	8	NA
		Brazil	2	6	NA
		Mexico	3	7	NA
Internet users	per 100 people	Russia	0	3	21
		Brazil	0	5	35
		Mexico	0	7	23
Broadband subscribers	per 100 people	Russia	NA	0	3
		Brazil	NA	0	4
		Mexico	NA	0	4
Mobile phone subscriptions	per 100 people	Russia	0	5	115
		Brazil	1	16	63
		Mexico	1	22	63

Source: World Bank (2008).

Tables 6, 7, and 8 show similar results for quite a few other, not less important, diffusion processes: the use of computers, access to the internet and so on. The speed of following the pioneering countries has accelerated quite spectacularly.

Numerous entrepreneurs take the example of a pioneer, adapt the idea to the actual local circumstances and achieve great successes. One of these Schumpeterian great innovators is the Chinese businessman Ma Yun, the founder and leader of the Alibaba Group. The main activity of the companies belonging to his group is the business-to-business trade over the internet, especially trading between small companies. The Alibaba Group is now the largest company of that sector in China, and one of the largest in the world. Ma Yun started as a high school teacher, and became a multi-billionaire.[27] (The story of Alibaba is a spectacular success story, but hundreds of other impressive innovation stories have evolved in the post-socialist world. To sum up, the gap between the most developed countries and the post-socialist countries has not disappeared, but is narrower now, in contrast to the socialist era when the gap was typically increasing over time.[28]

[27] See www.alibaba.com (company information).

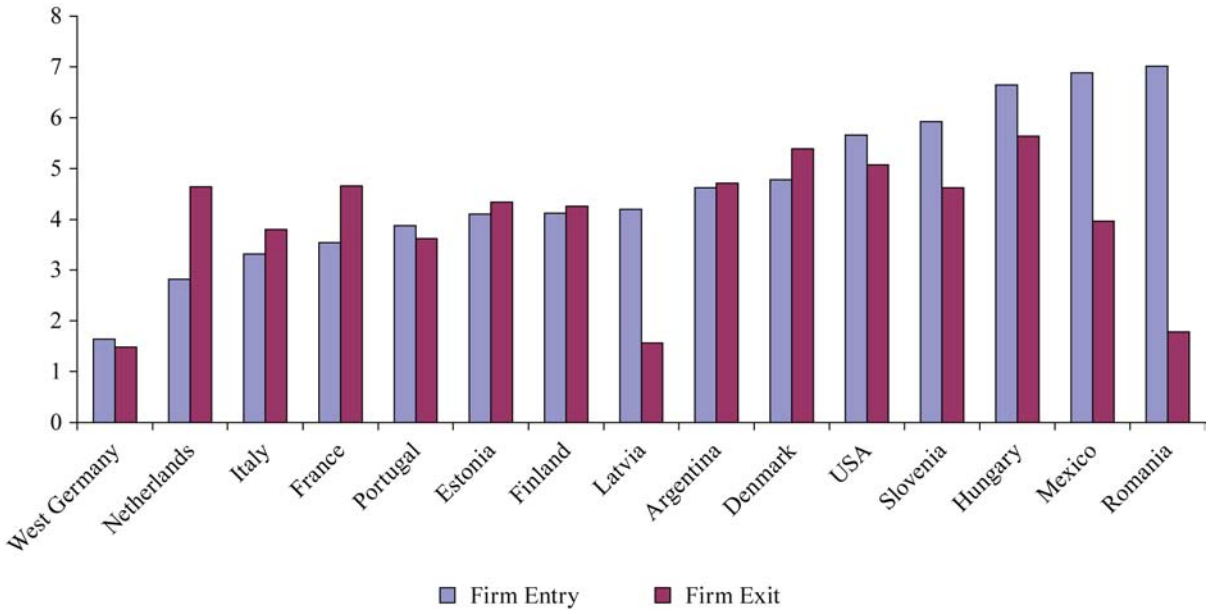
[28] According to the Information Society Index, reflecting the development of various aspects of 'information society' in a synthetic way, several post-socialist countries, e.g. the Czech Republic, Hungary, and Slovenia, have achieved a decent position in the ranking (Karvalics 2009). The whole group of countries observed is moving ahead, and is getting higher values each year, though it takes strong efforts just to hold the rank achieved today.

3.3 Creative destruction

The process of innovation and the dynamics of firms' entry and exit are closely associated. Schumpeter coined the name 'creative destruction' for the latter, describing concisely and precisely the two inseparable sides of fast technical progress. It is easy to appreciate happy arrivals to the business world, especially if they appear in the form of successful innovators. But there is no fast progress without the sad events of bankruptcies, business failure, exits, and the accompanying bitter phenomena of lay-offs and unemployment.

Transition economies have had the bad fortune of experiencing two big waves of creative destruction. I called the first one 'transformational recession' in an earlier paper (Kornai 1993). It caused trauma in all post-socialist countries, leading to a huge number of exits and creating the first shock of mass unemployment after decades of over-employment and job security. The present recession is not yet over, but—looking with some degree of optimism into the near future—it will probably lead to a smaller fall of production than the decline of output under the transformational recession. That was probably one of the deepest recessions in economic history, but the world paid less attention to it than to the present crisis because only we, the citizens of the former communist region, were the victims of the transformational recession, and the rest of the world did not share the painful experience.

Figure 2: Firms' entry and exit rates in the 1990s



Note: Columns in blue show the entry rates, defined as the number of new firms divided by the total number of incumbent and entrant firms in a given year. Columns in purple show the exit rates, defined as the number of firms exiting the market in a given year divided by the population of origin, i.e. the incumbents in the previous year.

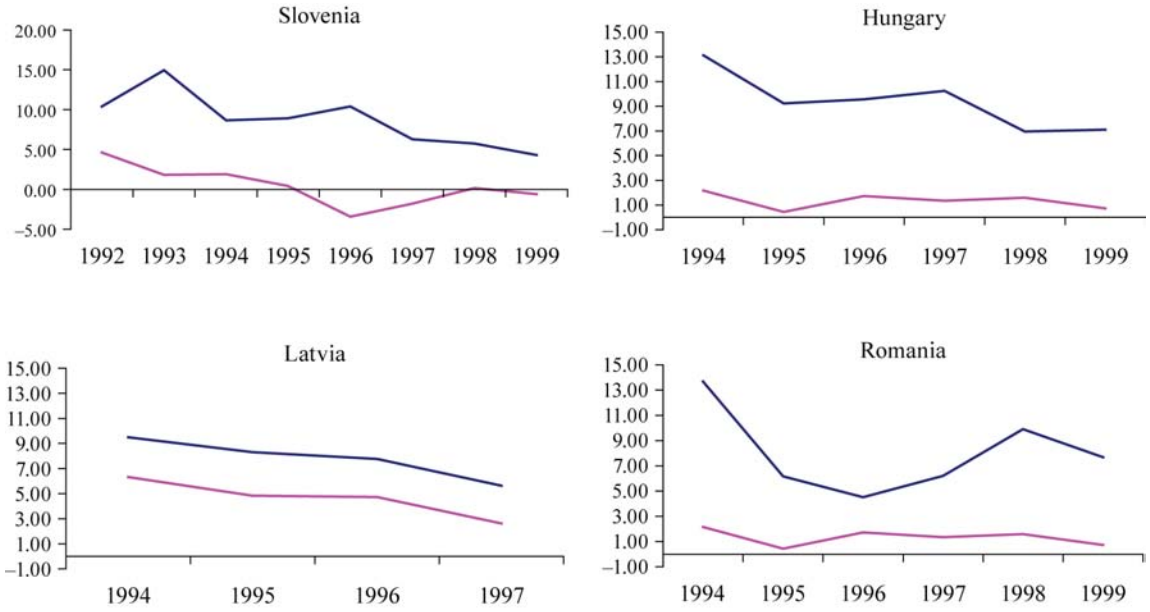
Source: Bartelsman et al. (2004: 16, panel C).

The transformational recession carried a dreadfully high price tag of suffering, but it created benefits as well. It compelled quick adjustments to a radical shift in the composition of the internal and external market, and also cleared the way to more dynamism, more innovation and higher productivity. Many obsolete production lines, smoky and rusty factories, and poorly supplied shops disappeared and brand new production units located in modern buildings equipped with the latest technology, and

new supermarkets and shopping centres appeared. Well-organized data are available on entry and exit in the post-socialist area. The paper by Bartelsman et al. (2004) provides a careful report and analysis, based on firm-level data, of the process of creative destruction across 24 countries, including several transition countries: Estonia, Hungary, Latvia, Romania and Slovenia. We present here only one diagram for the sake of illustration (see Figure 2), covering firms with at least 20 employees in the 1990s.

In the first years of transition the number of entries was much larger than the number of exits, which was different from more mature market economies where the difference of these two flows is usually smaller, or is negative. Many large (formerly state-owned) companies went out of business, and small business entered in huge numbers. Total firm turnover (exit + entry rate) was between 3 and 8 per cent in most industrial countries, and more than 10 per cent in some of the transition economies in the 1990s.

Figure 3: The evolution of gross and net firm flows in transition economies



Note: The calculations cover the whole business sector. The black line shows the total turnover (entry rate plus exit rate), the red line the net flow (entry rate minus exit rate.)

Source: Bartelsman et al. (2004: 17, Figure 2, panel B).

The turbulence caused by the fast turnover and short life-span of newly created firms later calmed down. By the end of the 1990s the characteristic demographic data of the firm-population came fairly close to those observed in other countries. Figure 3 shows the trend towards a more balanced ratio between entry and exit. The red line is approaching the zero position, where the numbers of employee-weighted entry and exit rates cancel each other out. It took several years to get over the worst phase of the destructive side of the Schumpeterian process. Post-socialist economies started to grow with increased efficiency, producing a much more up-to-date output-mix, when suddenly a new external shock, the impact of the global recession shook the economy. The people of our region are going through the second painful recession. It is quite understandable that nowadays the word ‘capitalism’ does not resonate nicely in the ears of the citizens of post-socialist countries.

It is too early to ask the question whether the present recession—beside causing disturbance and suffering—has a cleansing effect in the Schumpeterian sense. Does the

destruction clear the way for more construction in the post-socialist region? Ten or more years from now will provide sufficient evidence to answer that question. It would require a separate long study to discuss the policy implications of the positive description provided above. What I can do here is just offer a few hints at policy options and the dilemmas associated with the choice between the options.

1. Accepting the basic Schumpeterian idea of creative destruction does not imply an automatic approval of all specific manifestations of destruction. If the blind market forces lead to the exit of a firm, some organizations (the central or local government, the financial sector or some other entities) might consider a bail-out. Here we are in the middle of a huge area of theoretical and practical problems discussed in the literature on the soft budget constraint and moral hazard. I have discussed this issue in several papers (Kornai et al. 2003; Kornai 2009). At this point I want to add only one remark: the Schumpeterian process of innovation is accompanied by the spectacularly rapid growth of exactly the sectors and sub-sectors which are the most promising and most 'fashionable' (remember the mass entry and stormy growth of 'dot-com' firms). This process inevitably has two sides: many projects are needed for the few great successes, and at the same time we get too many of them. But then 'natural selection' follows, and we must not fight for the survival of each species destined for extinction. Policymakers might rally strong arguments in favour of certain bail-outs, e.g. to protect the economy as a whole from far-reaching serious macroeconomic damage caused by excessive numbers of exits. However, the counter-arguments must be also carefully considered.

2. The debate about the causes of the recent recession is going on. A well-known train of thought refers to the easy-going lending policy of the financial sector and is calling for much more rigorous, more conservative lending rules in the future. I do not refuse this line of thinking, but I must add a warning. The Schumpeterian process of innovation requires relatively easy access to capital for risky projects which might fail, or might lead to the fantastic achievements of technical progress (see conditions D and E in the above survey of circumstances necessary for enfolding the Schumpeterian process of innovation). The general mood calls for caution and stronger risk-aversion than before the recession. I agree, more caution is needed than before but it would be a fatal mistake to apply a very conservative attitude blindly. Lending criteria should be carefully differentiated so as to leave the chances for financing risky but promising innovative projects open.

3. We hear loud calls for regulation and warnings against the unfettered rule of market forces. These calls and warnings are legitimate, up to a certain limit. Beyond that we might enter the area of over-regulation, the bureaucratic obstacles to starting businesses, which can dampen the vigour of the entrepreneurial spirit. Moreover, in quite a few post-socialist countries it is still a difficult obstacle race to start a business (see the report of the World Bank and the International Finance Corporation (2009) *Doing Business*). Policymakers should avoid both types of mistake; going too far in deregulation, or introducing too much (and/or ill-targeted) regulation.

4. The public mood is upset because of sky-rocketing earnings of many business people and top managers. We hear calls for practical measures against this phenomenon. Though the anger is morally justified and psychologically understandable, nevertheless an (unpopular) caveat is needed. One of the conditions of the Schumpeterian process (condition B in the above listing) is the gigantic reward in the case of success. Not simply a large, but a huge reward. That does encourage the would-be innovators to take the large risk of failure. Let us remember that in this context not only the first pioneers of introducing the great break-through inventions deserve the name 'innovators', but also the entrepreneurs quick in following the (domestic or foreign) pioneers. On the other hand, how difficult it is to imagine the work of an honest and competent jury able to draw the line between a well-deserved and an undeserved high reward. I am not prepared to propose a feasible procedure, just want to draw the attention to the two (mutually contradictory) aspects of very high business income.

4. Reflection of historical reality in people's minds

4.1 The basic phenomenon: lack of understanding

In the previous parts of the study I described the historical reality of the interaction between the Great Transformation, i.e. the change of the system, and technical progress. Allowing for errors in the description, I am convinced about its basic accuracy, supported by sufficient evidence. We have to separate the description of historical reality and the reflection of that reality in people's minds. The reflexive process works differently in different people. The reality described in the earlier sections is perceived, understood and evaluated differently by each individual, depending on his/her social status, education, personal history and character.

Table 9: Evaluation of technical progress

	Scientific and technological progress will help to cure diseases such as AIDS, cancer, etc.	Thanks to science and technology, there will be greater opportunities for future generations	Science and technology make our lives healthier, easier and more comfortable	Science and technology will help eliminate poverty and hunger around the world	The benefits of science are greater than the harmful effects it could have
AT	82	71	71	33	48
FIN	89	77	77	21	50
IT	82	73	76	50	57
SP	79	66	73	37	57
PL	89	93	83	45	65
HU	94	81	79	34	63
CZ	85	74	70	35	44

Note: The following question was asked, 'do you agree with the following statements?'. The table shows the proportions of positive answers in % of the total number of respondents.

Source: Eurobarometer (2005).

The first question we must raise is about the evaluation of technical progress. Do people regard the past and future appearance of inventions and innovations, new products and new technologies as advancement or are they afraid of the process and regard it as harmful or dangerous? The question has been asked in some international surveys; Tables 9 and 10 give us interesting insights. Considering benefits and harms caused by technical progress, two thirds of Polish and Hungarian respondents find the positive effect stronger than the negative. In that respect a larger proportion of citizens of these two post-socialist countries are in favour of technical progress than in Austria, Finland, Italy and Spain, and in the post-socialist Czech Republic. The proportion of respondents approving technical progress is much higher when the question is about the future impact (see the fifth column of Table 9 and the first column of Table 10).

Table 10: Expectations concerning the impact of new technologies (%)

Country	The next generation will enjoy a better quality of life	Solar energy	Computers and information technology	Biotechnology and genetic engineering	The internet	Mobile phones	New energy sources to power cars	Air transport
EU15	47	90	85	63	77	67	90	79
EU10	72	84	87	64	81	70	86	79
Germany	75	95	89	65	75	57	92	72
UK	82	91	92	65	81	61	90	80
Hungary	82	87	87	74	78	67	81	75
Poland	91	89	92	63	86	80	88	88
Romania	83	78	86	65	82	75	84	85

Note: The following question was asked, 'do you think the following new technologies will have positive negative or neutral effects?'. Only the proportions of positive answers are shown.

Source: Eurobarometer (2005).

The second question aims not at the evaluation but causality. I take the risk and start with a bold general conjecture. The large majority of citizens in the post-socialist region do not understand the basic causal relationship between capitalism and technological progress. Although the innovations of the last 50-100 years, and in particular the revolutionary change of information and communication technology, has dramatically changed everyone's life, and most people enjoy the advantages of fast technological change, they do not attribute this great change to capitalism.[29] On the contrary. A large part of the population has moderate or even vehement anti-capitalist feelings—while taking advantage of the mobile phone, the internet, the bar code in the supermarket, the plastic materials and synthetic fibres, the modern household appliances, the Xerox copier and so on and so on, without acknowledging that all of them, without exception, are creations of the despised or hated capitalist system. That is a conjecture. And to my regret I cannot refer to one single survey, public opinion pool or value survey supporting, correcting or refusing that conjecture.[30] Among the hundreds of more or

[29] In an earlier section, talking about the shortage of telephone lines under socialism and the abundant supply after 1989, I made a subjective remark: I am *grateful* to capitalism for this change in my life. Perhaps I am not the only one who has this feeling, but I am afraid, we are a small minority.

[30] With the help of my assistant Dániel Róna, we tried to check the most respected surveys carefully. We checked the four best-known transnational surveys looking for the question formulated above in the text

less relevant questions asked from the informants, nobody ever asked in any form the question formulated here: what do you think and how do you feel about the interaction between the overall system (capitalism, socialism, transition from socialism to capitalism) on the one hand, and technical progress, on the other?

Let me maintain the conjecture until we get the first survey data providing a reliable insight in people's minds concerning these questions and the results call for the modification of the conjecture. The lack of surveys seems, in some strange way, an indirect support of my conjecture. If professional researchers studying the understanding of social change and people's sentiments vis-á-vis the changes completely ignore this set of questions then what can we expect from the average citizen? The complete lack of surveys related to these vital issues is a clear indication of intellectual indifference toward the understanding of the relationship between the political and economic sphere and the acceleration of technical progress. Public opinion is shaped by a complex social process. Everyone is taking part, the parents and the teachers in the kindergarten and the primary school, our neighbour at home and our colleague at the workplace. I would make a few remarks about professional groups carrying special responsibility for shaping public opinion.

4.2 The responsibility of the economic profession

What do we teach to students? The exciting and important new current of growth theory, inspired to a large extent by Schumpeter (Aghion 1998; Grossman and Helpman 1991), is acknowledged by the rest of the profession, and usually respect is expressed in a polite footnote but without profoundly penetrating the way of thinking in mainstream economics. Highly distinguished economists (Baumol et al. 2007; Phelps 2008: 77-98) put a heavy emphasis on entrepreneurship in explaining the virtues of capitalism. The recent representatives of the Austrian school (see e.g. Kirzner 1985: 119-49) never get tired of drawing attention to the innovative nature of spontaneous market forces. Economists specializing in comparative economics and the study of socialist and post-socialist economies draw the attention to the strong causal relationship between the specific properties of a system and the characteristics of technical progress; an excellent example is in Balcerowicz (1995: Chapter 6). Nevertheless, these valuable ideas do not penetrate, via a large number of courses on microeconomics, serving the routine education of young economists.

There is a simple, but decisive test: let us check the most influential introductory textbooks. Take Gregory Mankiw's (2009) textbook, which is one of the most widely used texts in the USA, and is also translated into several languages. It is used as a textbook in my country, Hungary, as well. It is a masterpiece in didactics, well-written, full of interesting illustrations of the main propositions. Yet not a single sentence on the Schumpeterian innovative process can be found! There are several dozen names in the index, but Schumpeter's name does not appear. There are a few pallid paragraphs about the increase of factor productivity and technical progress, but that does not compensate

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and did not find anything resembling the content of that question. The results of these surveys are on record and available from the author.

for the lack of the vivid description of the innovative process and the profound explanation of the dynamism of capitalism.[31]

Let me add a few reservations. I focus here only on *introductory texts*, because they play a crucial role in the formation of the thinking of students, they do the 'imprinting' of the conditional reflexes and automatisms of the thought process.

Above appear the names of distinguished economists who are perfectly aware of the role of entrepreneurship and the Schumpeterian approach. If these scholars (and quite a few others accepting a similar view of the capitalist economy) are teaching microeconomics, they certainly do not ignore the explanation of the innovative process and the role of the capitalist system in generating break-through innovations.[32] Our small sample is, of course, not representative. It is beyond the limits of my present research and this study to analyze a large and representative sample of textbooks and draw the appropriate conclusions. But until I do not meet well-substantiated refusal, I maintain the hypothesis claiming that a large (probably dominant) part of the higher education introducing the students to the principles of economics does not explain this highly important system-specific property of capitalism sufficiently.

Mainstream economics is often accused of advertising the favourable properties of capitalism. If so, it is doing a rather poor job in teaching, lacking the mention of one of the main virtues of the system, its inclination toward unstoppable stormy innovation.

The GDP has become the dominant indicator when it comes to the measurement of growth—it is a great achievement of economists and statisticians to have an operational definition and methodology for measuring the GDP, uniformly accepted all over the world. But this important success has generated some kind of laziness in evaluating the successes and failures of the development process. Attention is focused on GDP growth rates to an exaggerated extent. Perhaps a few other indicators also get attention: inflation, fiscal balance, the current account, measures of inequality, and a few more. But there are no widely accepted and regularly observed indicators of measuring success or failure, acceleration or slow-down of technical progress—understanding this term in the spirit of the present study. Post-socialist economies in Eastern Central Europe reached the pre-1990 level of GDP around 1994-2000, and the successor states of the Soviet Union even later or are still below that level. Yes, but in the meantime the way of life has completely changed for a large part of the population. Here, in the context of the present study, I do not refer to the changes in the political environment, income distribution and social mobility. Beside all these very important changes, I refer to the accelerated use of new products and new technologies in the everyday life of people created by the capitalist innovative process. We lament about troubles with the level of the GDP, but a large part of the population is now connected to the rest of the society by phone and the internet, a much larger number of people have cars and

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[31] With the help of my research assistant, Judit Hürkecz, we checked seven more popular introductory textbooks, widely used in teaching in the USA and Europe, including Hungary and other posts-socialist countries. Every remark made on Mankiw's book applies exactly to six books as well. Out of the small sample of eight books , there is only one exception. (I come back to that exception in the next footnote.) The list of these textbooks is on record, and available at request from the author.

[32] Small wonder that the exception in our sample is the work of Baumol and Blinder (2009). William Baumol is one of the intellectual leaders advocating a Schumpeterian approach in understanding capitalism.

modern household appliances and use several other new products formerly available for people in the West only. We should elaborate appropriate indicators and measurement methods in order for the correct observation and demonstration of the effects of technical progress on everyday life.

The need to complement the measurement of GDP with other indicators to reflect other aspects of welfare and development is well-known to every economist and economic statistician. Important new initiatives are enfolding to improve the measurement of growth, and are complementing the data on aggregate output with various indicators reporting on health, education, income distribution and so on. [33] I am worried that the aspect highlighted in this study—the impact of technical progress on the way of life—may be left out again from the efforts of reforming statistics, and does not get the attention it deserves.

4.3 The responsibility of politicians

Politicians are, self-evidently, in charge of governmental policy. Everything mentioned above with respect to the policy implications of the analysis belongs to the competence of political decision makers. Right now, however, I would make a few remarks about another aspect of political activity. Political leaders are also educators of their nation.

With the help of a few colleagues, we read some public speeches of political leaders of the following countries: Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Serbia, Slovakia and Slovenia. In each country we chose the speeches or writings of the head of state and/or the prime minister, furthermore, the leader(s) of the most influential opposition party (or parties). We tried to select speeches or written statements offering a general overview of the country's successes and failures (like the State of the Union address in the USA) mostly delivered at the occasions of national holidays and events. Most of the texts we analyzed were delivered during the first eight months of 2009. In some cases we were able to find a speech celebrating the twentieth anniversary of the 1989 events, and providing an overall evaluation of the post-socialist transition.[34]

The general finding is easy to summarize. Out of 53 speeches and political statements there was not a single one explaining the *causal linkage* between capitalism and technical progress and the impact of this progress on people's life. This virtue of capitalism was not spelled out in order to convince the people that moving from socialism to capitalism meant a shift to the world of innovation, modernization and dynamism. Some political leaders say a few words about technical progress. The same politicians or some others speak favourably about the capitalist system. But we did not find the argument just explained in their speeches. The sample of 53 statements is large enough to speak out loudly—that is a shocking and disappointing observation. We observe here not the conduct of radical anti-capitalist political figures from the extreme right or the extreme left, but of leaders of the political 'establishment' in Eastern Europe. They alternately are in governmental or oppositional position, but they are

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33 The President of the French Republic has invited a group of economists and statisticians, chaired by Joseph Stiglitz, Amartya Sen and Jean-Paul Fitoussi, to work on new proposals for improving the measurement of growth and development. At the moment the group is circulating the first drafts of the report (Stiglitz et al. 2009).

34 The list of documents studied is on record and available from the author.

certainly friends and not enemies of capitalism, and yet, they miss one of the best arguments in favour of the system. Let us add immediately, very few are ready to take a stand for capitalism. It is becoming quite common among politicians (both on the left and on the right) to emphasize the dark side of the system, and speak out against it.

Certainly, more political speeches and written statements should be checked. I would welcome any additional information, including counter-examples, i.e. speeches underlining the role of capitalism in generating innovation, and adding the acceleration of technical progress to the list of successes achieved in the era of transition. However, as long as it is not refuted, I maintain the proposition: politicians at all points of the political spectrum carry heavy responsibility for neglecting the explanation of the causal relationship between 'capitalism→innovation→changes in the way of life'. Understanding this crucial linkage would be an effective antidote against anti-capitalist sentiments—and our political leaders do not provide that antidote.

Neglect is, of course, the milder sin. What I find most irritating is populist demagoguery against capitalism, while making practical use of all the discoveries and innovations generated by capitalism. It is morally repulsive to see political activists mobilizing people for an extremist anti-capitalist meeting or protest demonstration using a personal computer, mobile phones and communication channels provided by satellites and optical fibre. That is happening in the post-socialist region. Political activists, denying even the simple fact that the change of system has already happened, put their populist anti-capitalist slogans on a blog or an internet site, give inflammatory speeches to a mob through electronic loudspeakers and communicate with each others via mobile phones, thus exploiting the technique generated by capitalism.

4.4 Interconnectivity and democracy

While we know practically nothing about the comprehension and evaluation of the 'capitalism→innovation→changes in the way of life' causal linkage in people's minds, we have some insights into the opposite direction of interaction, namely, the effect of technical progress (or more precisely, of progress in the information–communication sector) on the political views of people in post-socialist countries. Tables 11, 12, and 13 summarize survey-data on post-socialist area respondents' attitudes toward democracy, capitalism and the former socialist system. In the tabulations presented here the population was divided into two classes; people using and not using the internet frequently. The difference is quite impressive.[35] Those connected to the world of modern information technology (IT) hold more favourable views on democracy and capitalism, and are more critical of the past regime, which is an encouraging sign. The users of the internet are more immune to the sentiments of nostalgia for the old socialist order—a feeling strengthened in many, especially since the recent economic crisis.

[35] We touch here upon a highly relevant question whether the appearance of high-tech communication expand social inequality. The search for an answer reaches beyond the limits of the present study.

Table 11: Satisfaction with democracy: population divided into users and non-users of the internet

Country	Internet users		Non-users	
	mean	%	mean	%
Central Eastern Europe	2.6	30	2.8	70
Czech Republic	2.5	42	2.8	57
Hungary*	2.2	23	2.4	77
Poland	2.7	34	2.9	66
Russia	3.0	14	3.1	86
Slovenia	2.2	57	2.1	43

Note: In the second (resp. fourth) column the share of users (resp. non-users) of internet. The following question was asked, 'how satisfied are you with the way democracy works'. Answers were expected at a 4-degree scale: 1 = completely satisfied; 2 = somewhat satisfied; 3 = not very satisfied; 4 = completely dissatisfied. The table shows the mean (not weighted). *I have reservations concerning the Hungarian data on internet users. The figure seems to be too low compared with other statistics. (JK)

Source: Rose (2004).

Table 12: Evaluation of the capitalist economic system: population divided into users and non-users of the internet

Country	Internet users		Non-users	
	mean	%	mean	%
Central Eastern Europe	1.9	30	0.4	70
Czech Republic	2.5	42	0.7	58
Hungary*	0.7	23	–0.5	77
Poland	1.1	34	–0.9	66
Russia	0.9	14	–0.8	86
Slovenia	1.6	57	0.7	43

Note: In the second (resp. fourth) column the share of users (resp. non-users) of internet. The following question was asked, 'how satisfied are you with the capitalist system'. Answers were expected at a 21-degree scale: -10 = worst, 0 = neutral, +10 = best. The table shows the mean (not weighted.) *I have reservations concerning the Hungarian data on internet users. The figure seems to be too low compared with other statistics. (JK)

Source: Rose (2004).

Table 13: Evaluation of the socialist economic system: population divided into users and non-users of the internet

Country	Internet users		Non-users	
	mean	%	mean	%
Central Eastern Europe	1.1	30	3.7	70
Czech Republic	–2.6	42	0.6	58
Hungary*	0.2	23	3.0	77
Poland	–0.4	34	3.4	66
Russia	1.6	14	4.4	86
Slovenia	3.0	57	4.0	43

Note: In the second (resp. fourth) column the share of users (resp. non-users) of internet. The following question was asked, 'how satisfied were you with the former socialist system'. Answers were expected at a 21-degree scale: -10 = worst, 0 = neutral, +10 = best. The table shows the mean (not weighted.) *I have reservations concerning the Hungarian data on internet users. The figure seems to be too low compared with other statistics. (JK)

Source: Rose (2004).

The empirical results reported above fit well into the findings of another line of studies: the research on *interconnectivity*. The intuitive meaning of the term is clearly indicated by the name: individuals are connected to each other by various technical instruments and procedures. Email plays a particularly important role in this respect. The more people are technically able to send email to others, the tighter the network of connections becomes. That phenomenon is certainly observable and measurable.

I rely here on an exciting study by Christopher R. Kedzie (1997a), who refers to a metric measuring 'interconnectivity'. Not being an expert of that field, I cannot judge whether the metric used in Kedzie's study is the best available for the purpose for which he is using it. Conditionally accepting his choice, the basic results of his study are certainly worth mentioning. He looked, beside other calculations, on the correlation between 'democracy' (measured by various indicators) and 'interconnectivity'. This correlation turns out to be 0.73, stronger than the correlation of democracy with per capita GDP (0.57). I report the proposition with some reservation, due to my lack of knowledge in the area utilized by the interconnectivity index. A more recent study by Frisch (2003), however, supports Kedzie's findings. Hopefully, research in that direction will continue.

At this point let me recall my earlier remark on the role of modern information-communication technology in dismantling the monolithic power of the communist party and the official Marxist-Leninist ideology. There I looked at events which happened 20 years ago in the former Soviet Union and in the socialist countries in East Central Europe. The problem is, however, not outdated at all. There are two small countries, Cuba and North Korea, where not much has changed in the economy, and heavy-handed communist dictatorship still prevails. And then there are two large countries, where far-reaching reforms have been introduced and have moved the economy close to capitalism while the political structure has changed very little, remaining a single-party dictatorship. How will modern information–communication technology influence those countries? China and Vietnam eagerly utilize all advantages provided by the revolutionary achievements of technical progress, and at the same time they are scared of the consequences. These two objectives of the leadership—maximum gain from technical progress and maximum protection of the monopoly of power—diametrically contradict each other, resulting in hesitation, steps forward and backward, ambivalence.

Another major problem to analyze is the prospects: what is the future of the interaction between the forthcoming waves of innovation and the way of life? On my pessimistic days I foresee various evil scenarios. Even without a special talent for prophecy we can easily predict the misuse of technical achievements. I read several reports about efforts of the Chinese government to apply political censorship of the internet, block the transmission of certain TV channels or shut down outspoken blogs.[36] Since an ever-growing share of all computers used in China is produced domestically, it is easy to enforce the incorporation of a centrally-controlled censorship software into the operation system. Sadly, large Western corporations, scared of losing the huge Chinese market, are willing to co-operate with the officials in their efforts to introduce political censorship.

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[36] See Chao (2009) and Timmer (2009) on Chinese efforts to apply political censorship. For a general overview see the entry on internet censorship in Wikipedia (2009b).

When Orwell wrote his book *Nineteen Eighty-Four* sixty years ago (Orwell 1949/1950), Big Brother did not have the equipment envisaged in the novel. But nowadays there is no technical difficulty in installing cameras and listening devices in every flat and office. Imagine a future Stalin with the latest gadgets of observation and telecommunication, resolved to use it to watch all citizens. But then, on my more optimistic days I escape the nightmarish visions and hope that modern technology gives birth time and again to decentralization, whatever efforts dictatorships devote to assure or even further strengthen centralization. If the centralizator invents a new way of blocking information, there will be hundreds and thousands of decentralizators, inventive computer users who break through the blockades and barriers.[37]

5 Concluding remarks

My study has covered a vast array of topics. I did not intend to limit the study to one or two issues. We are looking at a huge white area on the otherwise colourful map of research in comparative economics and post-socialist 'transitology'. The purpose of my study was to give a general overview of the area.

Among the great number of valuable studies on several topics, some are mentioned in my study. Unfortunately, each topic has its own large body of literature but sharply separated from each other, lacking cross-references. The emphasis of my study was not the detailed description and analysis of one or the other linkage, but to give you an impression of the totality of interactions. And there are also dozens of themes deserving penetrating research, empirical observation and theoretical analysis, barely touched upon or not even mentioned in my study. The study of technical progress and its relationship to society is going on in a multi-dimensional space. The points discussed in my study are located in a sub-space, and I am aware that there are relevant dimensions outside my sub-space.[38]

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[37] In the last footnote I referred to an article by Timmer (2009) published on the internet. The editor asked for comments. Here is the first comment: 'So what is there to keep Chinese citizens from reformatting their hard drives and installing pirated copies of Windows?'.

[38] Let me mention a few dimensions which do not appear in my study:

- What is the effect of the new technology of information and communication on the relationship between individuals, social groups, settlements, countries, and states? What can be expected concerning the relationship between high-tech information and communication, on the one hand, and the nation-state and globalization, on the other? (Castells 1996-1998; Nyíri 2004: 5-34; Webster 2004).
- The future of capitalism. Does the new age of information lead to a radical change of the basic properties of capitalism? Or does it create a new system which cannot be called capitalism any more? (two Hungarian economists, Katalin Szabó and Balázs Hámori (2006) wrote an interesting book with the following subtitle *Digital capitalism or a new economic system*. See Haug (2003.)
- How does the revolutionary change of information and communication technology affect the practical mode of running a business, especially in the financial sector?
- What are the implications of the new Information Age concerning property rights, especially with respect to intellectual property?
- A quite different direction of thought is to reconsider at a more abstract philosophical level our general understanding of human history. What is the role of the changes in the technology of production and human interaction on the institutions of society, and on the functions of the government?

I wish I were younger, with all the energy needed for the careful exploration of the white area as a whole. What an exciting and intellectually challenging subject for research! I hope that my study will encourage others to enter this largely under-researched field. In any case, I would like to continue the study of the interaction between the change of the political and economic spheres of the system and the properties of technical progress.

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