THE "NEW ECONOMY" AND CATCHING-UP POTENTIAL OF TRANSITION ECONOMIES

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Abstract:
The contribution of the "new economy" to economic growth in developing countries has so far been minimal. The "old economy" will for long be the fundamental force behind economic growth in transition economies. Nonetheless, in the longer run the "new economy" offers great potential for faster economic growth in post-socialist economies. Realizing this potential is, however, not automatic. It can be left unharnessed if there is no suitable institutional infrastructure, which would allow for adoption, diffusion, and productive use of information and communication technologies (ICT). The paper introduces a New Economy Indicator (NEI) measuring the level of preparedness of transition economies for harnessing the potential of ICT to accelerate the long-term economic growth and catching-up with developed countries. In the NEI ranking Slovenia scored the highest, followed by the Czech Republic and Hungary, Albania, Bosnia and Herzegovina, while Yugoslavia occupy the bottom of the table.

Keywords: post-communist transition, new economy, information and communication technologies, economic growth

JEL Classification: O1, O2, O3, O5

1. Introduction

The "new economy" hype is over. The bursting of the stockmarket bubble instilled much needed realism into debates on the economic impact of the on-going technological revolution spurred mostly by information and communication technologies, and most visibly embodied in the Internet. The business cycle is alive and kicking, unemployment is up, and shares prices are down. The economic nirvana of the "new economy" did not materialize. Neither did the "new economics". The "new economy" thus still needs to be taken in quotes.

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**) This paper is based on "The 'New Economy' and Economic Growth in Transition Economies: The Relevance of Institutional Infrastructure". Helsinki, United Nations University World Institute for Development Economics Research, UNU/WIDER Discussion Paper 2002/62.

Nonetheless, the underlying forces of the "new economy", that is globalization and the ICT revolution, have not been arrested: they are and will be proceeding at a fast rate now and in the future.[1)] Despite the hype (one has to admit though that it was mostly concentrated in the business press rather than in economics), the impact of the "new economy" on the world-wide economy has so far been quite limited, particularly in terms of its geographical reach. The "new economy" has been mostly felt in developed countries, some examples to the contrary notwithstanding (Bangalore in India is a fitting and often-cited example). However, the contribution of new technologies to growth in developing and transition economies has been minimal, particularly when viewed from a macroeconomic perspective (although countries like Malaysia, Philippines, Thailand, South Korea, and Taiwan benefited from the production of ICT).

Despite a somewhat ambivalent start, in the longer run the "new economy" offers great potential for faster economic growth and an increase in standards of living in less developed countries, twenty seven transition countries included. The acceleration in productivity and output growth could allow transition economies to shorten the process of their catching-up with developed countries. The relative low level of economic development together with technological backwardness offers them a handicap in development: thanks to absorption, imitation and application of knowledge, blueprints, ideas, technological and organizational advances, and superior technologies already developed in rich countries, post-socialist economies should now grow faster than developed economies. The Central and Eastern Europe and Central Asia countries may be thus able to "leapfrog" stages of technological development and subsequently considerably increase rates of economic growth. The "knowledge-like", weightless nature of the "new economy", which provides for easier and faster diffusion, can further accelerate the absorption process.

Realizing the benefits of the "new economy" is, however, not automatic. Its potential can be left unharnessed if there is no suitable institutional infrastructure, which would allow for adoption, diffusion, and profitable use of innovative technologies.

After more than a decade of transformation from a command economy to a market economy, the process of institution building is still far from being concluded. Like the technological revolution, the post-socialist institutional revolution is not over. The results of the latter revolution will bear upon the future prospects for development. Countries with insufficiently developed institutions are likely to find themselves in a "technological trap", risking to be marginalized in a global economic community. Various speeds of adoption of the "new economy" are also likely to add to the increasing polarization of growth rates among the post-socialist countries. Ultimately, the "new economy" can have both its winners and losers. The existence of appropriate institutions will be one of the deciding factors.

Hence, what are the institutional preconditions for transition economies to benefit from the potential of the "new economy"? What is the current level of institutional readiness for adoption of the "new economy" among transition countries? Can it prosper in spite of the old problems of the poor "hard" infrastructure, lack of regulations and mature institutions, scarce capital, and finally lack of English language skills? What does the future hold?

This paper constructs a New Economy Indicator (NEI) measuring the capacity of transition economies to exploit the potential of the innovation and technology diffusion stemming from the "new economy" to accelerate the long-term economic

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1) As said by the IMF: "The longer term benefits (of IT) for the global economy are likely to continue, or even accelerate, in the years to come" (IMF, 2001, p. 103).

growth and catching-up with developed countries. The NEI is comprised of ten variables believed to be the most pertinent for development of the "new economy" and its profitable use.

The structure of the paper is as follows: section 2 succinctly discusses the phenomenon of the "new economy" in developed countries and analyze current and prospective impacts of the ICT revolution on growth in transition countries. In section 3 the NEI is developed, section 4 then describes the variables and section 5 concludes the paper.

2. The Impact of the "New Economy" on Transition Countries

The existence of the "new economy", the term itself so often put in quotes, is still open to debate. The "new economy" is most often presented as a superior economic structure perpetuated by innovations mostly in ICT, which – while impacting all sectors of the economy – accelerates productivity and economic growth. Other definitions of the "new economy" underscore the contribution of globalization (see Pohjola, 2001), spillover effects of communication networks (see Stiroh, 1999), and permanently higher growth rate in productivity stemming from the production, adoption, and continued diffusion of ICT (see De Masi et al., 2001).

The emergence of the concept of the "new economy" largely rests on the extraordinary performance of the US economy in the second half of the 1990's, where annual labour productivity in the non-farm business sector increased roughly 2.5 per cent between 1996 – 2000 from 1.5 per cent between 1973 – 1995 (see IMF, 2001). It seems that also Finland, Ireland, Sweden, Singapore, Canada, and Australia were able to benefit from the ICT to increase their rates of output and productivity growth in the late 1990's.

Notwithstanding the US "miracle", the impact of the "new economy" on the global economy has so far been negligible. The "new economy" in developing and transition countries, aside from small-scale microeconomic improvements, did not seem to contribute to economic growth.[2)] Software industry development in Bangalore in India, fish markets in Bangladesh, eastern European information portals, or Internet coffee markets in Brazil have added much to the "new economy" hype. Alas, these much-cited developments did not seem to have equally added to the economic growth of their countries.

The lack of macroeconomic impact of the use of ICT on developing countries was confirmed by the results of a comprehensive cross-country empirical study on the returns of IT investment in developed and developing countries (see Dewan, Kraemer, 2000). The study shows that returns on IT investment are "positive and significant for developed countries, but not statistically significant for developing countries" (as quoted in Kraemer, Dedrick, 2001, p. 262). The estimate of IT output elasticity is 0.057 (positive and significant) for developed countries,[3)] but statistically indistinguishable from 0 for developing countries. Pohjola shows that the relative contribution of IT to GDP growth in developing countries, to which transition countries be-

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2) Although developing countries like Malaysia, Thailand, Philippines, Taiwan, and South Korea benefited from the production of ICT in the late 1990's (see IMF, 2001). However, in the aftermath of the current economic slowdown, the benefits from production of ICT are now much smaller. In some countries, the collapse of ICT production resulted in even negative GDP growth rates. Nonetheless, there is no conclusive evidence that these countries were able to benefit from the use of ICT rather than production only.

3) A 10 per cent increase in IT investment should result in 0.57 per cent increase in output.

long, was less than 2 per cent (China, India, Argentina, Chile, Brazil, Thailand, Venezuela) compared to more than 10 per cent in the US, Finland, Canada, Sweden, and UK. No other studies have found any sizable contribution of ICT to growth in developing countries. It seems that more research in this area is needed, however, lack of relevant data is a usual constraint.

One reason for the apparent lack of benefits from the diffusion and adoption of the "new economy" in transition countries is still the relatively small value of IT investments – the most advanced transition countries (the Czech Republic, Estonia, Hungary, Poland, Slovakia, Slovenia) in 1999 invested in IT between 1.9 per cent (Poland) to 4.2 per cent (the Czech Republic) of their GDPs, which compares to Sweden's 6.5 per cent, 5.3 per cent in the US and the overall OECD average of 4.3 per cent (see OECD, 2001b).[4] Also in absolute numbers the value of IT investments in Central and Eastern European countries were much smaller than in rich countries.[5] IT investments in less developed transition countries of Central Asia are not likely to exceed 1 per cent of GDP. Thus it seems that investments are too small to bear upon growth.

Yet, why do not even small investments yield positive returns? Kraemer and Dedrick (2001) suggest that developing countries, as opposed to developed countries, have not been able to profitably use ICT products and services due to the lack of complementary investments in infrastructure, human capital, and R&D. This seems to be right. Returns on many various high-value added investments depend on complementarities. To put it into colloquial terms, a brand new high-tech factory in the middle of an underdeveloped country (or "developing" as euphemistically we all have learned to say) will not be efficient when faced with lack of local suitable labour skills, infrastructure, regulations, taxation and so on (which together equates to institutional infrastructure as we discuss more forcefully later). In this environment, returns on investments in basic infrastructure (drinking water, primary schools, hospitals) are very likely to be more productive than high-technology investments. As a result, some transition countries could rightly decide to invest in basic infrastructure while compromising ICT investments.[6] Consequently, at least during the process of building basic infrastructure, a technological chasm between underdeveloped and developed countries could further widen.

The technological gap could also widen between more and less developed transition economies. The "new economy" may thus contribute to rising growth disparities in transition economies. Different qualities of institutional infrastructure and the various speeds at which these economies espouse the Internet revolution will most likely lead to further polarization of patterns of economic growth in those countries. The least developed countries, like Tajikistan or Albania, can even find themselves in the technological trap. Initial development conditions therefore matter for the adop-

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4) According to other data available from the European Information Technology Observatory (see EITO, 2002 as quoted by Deiss, p. 5), IT expenditures in 2000 in the EU candidate countries ranged from 0.9 per cent of GDP in Romania to 3.1 per cent of GDP in the Czech Republic against the EU average of 3.4 per cent.

5) According to IDC (2000), all transition economies spent a little more than USD 10 billion on IT in 1999. This is roughly equal to the IT investments of Sweden alone.

6) The technological trap is analogous to the poverty trap, which is very interestingly discussed in Easterly (2001). He explains the idea of a poverty trap by taking an example of the returns on education in an underdeveloped country, where it is more profitable for parents not to spend money on education of their children since benefits from being educated in a poor country are likely to be lower than a value of children's lifelong work on the farm.

tion of the "new economy". It is because when one country is better developed than another, it has higher chances for taking advantage of the "new economy".

Despite negligible macroeconomic impact, the IT revolution seems to have contributed to productivity and output growth on a microeconomic level in certain industries (retail, financial services, transport) and specific enterprises. According to one of the recent studies on the transport industry in Poland (see Brdulak, 2002), the market share of transport companies in Poland using sophisticated software increased from 45 per cent in 2000 to 60 per cent in 2001, thus evidencing benefits of IT use. Other anecdotal evidence claims that management information systems together with the use of e-mail seem to have been the most important for their contribution to better productivity (as discussed with several CEO's in Poland). Yet, these effects are seemingly too small to reflect on the macro picture.

The "new economy" has contributed to a few success stories. Rapid development of e-banking, e-commerce,[7)] and Internet portals bears proof of the potential of new technologies. Yet again, far from being euphoric, the macro impact of e-business in transition countries is still insignificant. Growing penetration of the Internet (more than 15 per cent of Poles used the Internet regularly at the end of 2002; there are more users in Estonia, Slovenia, Hungary, the Czech Republic, but much fewer in other post-socialist countries), promulgation of e-signatures (the Czech Republic, Slovenia, Poland, Hungary, Bulgaria), or attempts to introduce e-government (like in Slovenia, see *Economist,* 2001a) do not much contribute to economic growth, either.[8)]

Microeconomic rapid progress in adoption of ICT innovations evidences the potential of the technological revolution for transition countries, though it seems that much more time is needed for microeconomic progress to make a tangible impact on people's well-being. Productivity improvements at the firm and industry level driven by ICT are, however, likely in medium and long-term to contribute to acceleration in aggregate growth. Additionally, in the long run, as argued by the conditional convergence hypothesis, transition countries should also grow faster than developed countries owing to absorption of knowledge other than technology, organizational and managerial blueprints, and financial resources from rich countries. Benefits of convergence and IT will depend on the quality of national policies and the level of development of institutional infrastructure.

The "new economy" and the times of "punctured equilibrium" (see Thurow, 1997) that it induces, presents quite a few opportunities for transition economies to achieve faster development. At the same time, however, it poses substantial threats. Generally speaking, transition countries stand a chance to grow faster thanks to the low opportunity costs of switching from old to new technologies (these are higher for developed countries – no "sunk costs" for transition economies), younger populations which generally tend to espouse innovations faster, and a relatively high level of educational attainment, the value of which is much higher in the "new economy" environment. Additionally, the potential of the Internet revolution also stems from

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7) E-commerce is rapidly developing. International Data Corporation estimated that in 2001 the e-commerce market in four Central European countries (the Czech Republic, Hungary, Poland, Slovakia) increased six-fold to USD 650 million (see *Rzeczpospolita,* 2001). In Poland www.ce-market.com, a successful B2B platform for transactions in non-ferrous metals, attracted more than 450 customers in less than six months from inception. In the same period, the total value of transactions amounted to some USD 6 million (see http://www.ce-market.com/aboutus_what_press.asp).

8) Although growing Internet penetration contributes to better access to information, convenience, customer choice, and satisfacton. These factors might be captured by some kind of a Human Convenience Index (HCI), the value of which surely skyrocketed after the emergence of the Internet.

the weightless, knowledge-like and non-rival nature of the "new economy" (see Quah, 2001), which allows for its faster diffusion and adaptability of innovations, and thus higher value of international R&D spillovers. These opportunities are mitigated by threats of digital divide and technological trap.

Despite challenges, the economic potential of the technological innovations underlying the "new economy" is significant. That is because in the long-run technical progress is everything – in his famous article Solow (1957) found that capital accumulation accounted for only 13 per cent of economic growth in the US in the first part of the twentieth century. The rest, almost 90 per cent, was attributed to technological progress (as expressed by TFP – total factor productivity).

In the shorter run, though, it appears that traditional accumulation of physical and human capital matters more than technological progress. This is also because of the pace of technological progress itself, still mostly embodied in equipment and machinery, largely depends on investment in physical capital as it expands and renews the existing capital stock and enables new technologies to enter the production process. Welfe et al. (2001) found, based on growth accounting calculations, that between 1974 – 1990 Poland's annual TFP growth amounted to 0.73 per cent, which represented only 26 per cent of the period's potential annual growth rates. Physical and human capital accumulation was responsible for the remaining 74 per cent of the potential GDP growth. The same calculations based on data for the 1990's revealed that investments in physical capital were responsible for almost half of the growth in potential GDP (1990 – 1995) and between 1980 – 1990 per cent of growth between 1996 – 2000. The effects of technical progress, driven by the increase in the quality of human capital and the absorption of foreign technical progress, were thus quite limited.

Coe and Helpman (1995) show that between 1991 – 1995 TFP in the most developed countries of Western Europe was responsible for approximately 60 per cent of the annual GDP growth rates,[9] that is substantially more than in Poland. This suggests that for Poland, and – per proxy – other transition economies, accumulation of traditional factors of production, that is investments in physical, and – to a lesser extent – human capital, matters much more than for developed countries. ICT may help to drive investment thanks to the substitution effect spurred by rapidly declining prices, yet its small share in total investments[10] coupled with non-extraordinary returns on ICT investments (see again Dewan, Kraemer, 2000) mean that investments in non-ICT capital are likely to remain the mainstay of economic growth in transition countries.[11]

This may also stem from the fact, as also argued by Kreamer and Dedrick (2001), that in order for developing countries to benefit from technological innovations they need to develop physical infrastructure, invest in human capital and labour skills, and establish appropriate institutions, which all strengthen the impact of the technological progress on economic growth.

One can conclude that the process of catching-up of transition economies will mostly depend on the "old" economy, that is investment in non-ICT and human capital. Nonetheless, the importance of the "new economy" for economic growth is li-

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9) Potential TFP for Poland and actual TFP for Western European countries (see Welfe et al., 2001, for methodological details).

10) Which does not exceed 4.2 per cent of GDP (see OECD, 2001b) versus annual total investment rates in fixed capital, which are generally higher than 20 per cent of GDP in transition economies (see EBRD, 2001).

11) Although one must remember that a large part of non-ICT investments carry an embedded ICT technology. Thus the true ICT share in investments may be much larger.

kely to gradually increase – diminishing returns to investment in physical and human capital imply that with time and rising incomes the growth of TFP driven by technological progress will have to accelerate in order to sustain high growth rates.[12] In the long run, then, the ultimate success of catching-up will also depend on the "new economy".

Similarly, Kolodko (2001, p. 71) argues that "the post-socialist countries – unlike developed market economies – need not aptly utilize the potential of e-business, but first raise efficiency of the 'old economy', since these two 'economies' are destined for a lengthy coexistence". One may add that the "old economy" and capital and human accumulation, as prescribed by traditional development economies, also seem to be binding for developed economies. One of the paradoxes of the American productivity miracle in the 1990s driven by ICT is the fact that the European Union, seemingly quite slow in adopting the Internet revolution, has nonetheless recorded productivity growth in 1995 – 2000 of 1.5 per cent annually, only slightly below the 1.8 per cent recorded in the US.[13] The EU experience suggests, examples of Finland, Sweden, and Ireland notwithstanding, that improvements in the "old" economy must have mostly contributed to this significant productivity growth. Therefore, even in developed countries the "new economy" is not the only solution to faster economic growth – the "old" economy, that is non-ICT industries and services, still has a great role to play. Old-style efficiency improvements in structural, organizational, and institutional frameworks of economies still matter, although globalization and absorption of ICT has certainly proved to greatly enhance the speed and urgency of these changes.

3. The New Economy Indicator

Neither the "old" or the "new economy" will develop without appropriate institutions. These, while creating particular economic incentives, decide on the allocative efficiency of an economy. The quality of institutions largely explains differences across countries in productivity and economic growth (see North, 1990; Hall, Jones, 1996; World Bank, 2002; Clague, 1997). Likewise, technological progress also contributes to divergence in growth rates.

The paper develops an institutional indicator – the New Economy Indicator – with an objective to provide a best estimate of readiness of 27 transition countries, based on the level of development of the NE institutional and economic infrastructure, for harnessing the NE in order to achieve faster long-term economic growth and catching-up.[14] Motivation for the use of indicators, as argued by Zinnes et al. (2001,

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12) Welfe et al. (2001) argue, based on their econometric model for Poland's economy, that in order for Poland to reach 6 – 7 per cent annual growth of potential GDP during the next decade, and assuming that investments to GDP would equal 30 per cent annually and the contribution of labour force would not change, the TFP would have to be responsible for at least 50 per cent of the increase in potential GDP. Without acceleration in TFP growth, the potential GDP would only increase by 3 to 3.5 per cent annually.

13) Calculated as net domestic product (NDP) per man-hour (see *Economist,* 2001b). If one takes into account GDP per hour worked in the ten years to 2000, American productivity in that period rose by an annual average of 1.6 per cent in the ten years to 2000, but euro area productivity rose by 1.9 per cent. Total factor productivity, which takes into account the efficiency with which capital and labour are used, also grew slightly faster in the euro zone than in America (see *Economist,* 2001c).

14) As a word of caution, the NEI, since it could not be tested due to lack of reliable data, does not present a hard scientific proof. Nonetheless, the implications of the indicator seem to indeed add to the current stock of knowledge on the determinants of adoption of new technologies. The lack of hard data should then not limit our quest for knowledge. In a telling story, Krugman (1997, pp. 1–3) cites a paper on "the evolution of ignorance" about Africa. The paper describes the evolution of European maps of the Afri-

p. 321) is two-fold: first, ... indicators provide an easy way to capture a concept when a single, quantitatively measured variable cannot. ... Second, the indicator approach helps to overcome problems of scarcity and quality of data, which are major obstacles to any work on transition economies.

In other words, indicators come in handy when relevant hard data is missing. This paper's indicator, while building on the foundations of theoretical and empirical macroeconomics as well as institutional economics (see North, 1994, 1997), combines ten variables, which are believed to be the most relevant for the adoption and profitable use of technological progress.[15] The ten variables are listed in Table 1.

4. Description of the Variables

First of all, a relevance of each variable for general economic growth will be established based on a selection of research results. Second, the relevance of each of the variables for harnessing the potential of the "new economy" will be discussed. Third, the level of development of transition countries will be commented with regard to particular variables.

Table 1
Variables

Factor	Proxy	Source
1. Quality of regulations and contract enforcement	Legal system effectiveness & extensiveness	EBRD 2001[1]
2. Infrastructure	Total number of telephone lines (main and cellular) plus Internet hosts per 100 persons	ITU 2002
3. Trade openness	Exports plus imports to GDP	EBRD
4. Development of financial markets	Broad money (M3) to GDP	EBRD
5. R&D spending	Annual R&D spending to GDP	Eurostat 2000[2]
6. Quality of human capital	Education Index 1999	HDI (UNDP) 2001
7. Labour market flexibility	Unemployment rate	EBRD
8. Product market flexibility	Competition policy index	EBRD
9. Entrepreneurship	Private sector share in GDP	EBRD
10. Macroeconomic stability	Inflation	EBRD

1) All EBRD data from EBRD (2001).
2) Quoted from Laafia (2000).

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can continent between the fifteenth and the nineteenth century. In the fifteenth century, maps of Africa were relatively inaccurate. Yet, they described the interior of Africa often based on indications like "six days to the south, two days east from there." In later centuries, cartography and the quality of information improved. The development of cartography, however, enhanced the standard of what would be considered valid data. Thus, six days to the south did not qualify anymore. As a result, maps developed in later centuries showed a sparser area for the African interior than on maps from the fifteenth century! As Krugman says "there was an extended period of time in which improved technique actually led to some loss in knowledge." He further concludes that "doing economics ... is a kind of mapmaking." This paper's indicator is yet another kind of a map.

15) These are also based on various research projects (see OECD, 2001a; IMF, 2001; World Bank, 1998).

The measure of the level of development of the NE institutional infrastructure will be reflected by a weighted sum of values of all ten variables for each country. It has been assumed that the variables of quality of regulations and law enforcement, financial development, trade openness, infrastructure, R&D spending, and human capital will be given twice as large relative weight compared to other variables (which have been multiplied by 0.5) as they are believed to be the most important for adoption of the "new economy". Due to either lack or limited availability of relevant data, variables are proxied only by observations available for the whole sample of countries. The construction of the indicators is based on the competitiveness indicator developed by Zinnes et al. (2001, p. 322) and is performed in the following way:

– variables are selected, ensuring that each of them is either entirely positively or negatively related to the main concept;

– if variables are negatively correlated (like inflation), they are multiplied by –1 to insure that always "more is better";

– variables are standardized.[16)]

4. 1 *Regulations and Contract Enforcement*

As argued by Clague et al. (1997) the quality of regulations and contract enforcement mechanisms largely explain why some countries prosper while others do not. He shows that the high level of contract enforcement and respect for property rights lowers the cost of market exchanges. The lower costs of transactions are especially important for transition countries, where because of the low level of development of market exchange mechanisms the transaction costs are much higher. Higher transaction costs stifle economic growth. Quite evidently then, the quality of regulations and contract enforcement is vital for long-term economic growth.

The rule of law is equally important for adoption of ICT, particularly in less developed post-socialist countries, where contract enforcement has been traditionally lacking. New enterprises utilizing innovations will not prosper if the legal environment is not conducive to their development. When faced with inadequate law enforcement, entrepreneurial effort tends to shift to less transparent gray and black markets. The law extensiveness and quality of contract enforcement is then prerequisite to emergence of the "new economy".[17)]

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16) The sample mean is subtracted from each number and then the result is divided by sample standard deviation. This implies a mean of zero and a standard deviation of one across countries in the sample. Hence, all results are comparable and can be aggregated.

17) However, quite interestingly, software piracy, due to lack of contract/copyright enforcement, is beneficial to adoption of the "new economy" in transition economies. Billions of dollars' worth of software has been pirated and then widely distributed. As reported by Business Software Alliance (2001), in 1999 alone USD 12 billion worth of software was pirated globally. A couple of years ago, the majority of software used by local enterprises in Poland were not licensed. In less developed countries, like Kazakhstan or Albania, almost all software is still illegal. Piracy pays: in the short run it definitely adds to faster diffusion of information technologies. Without piracy, technological catching-up would be considerably slower as local economies could not afford to pay the full price of software products. This Machiavellian idea does not, however, hold in the long-run. In the longer perspective, the low quality of contract enforcement and regulations is inimical to growth. This is true also because countries known for piracy risk to be isolated by the international trade community and thus lose access to knowledge spillovers.

4. 2 *Infrastructure*

This is quite a self-evident category for the adoption of the "new economy" – there will not be any "new economy" without telephone and computer networks.[18] It seems probable that in order to benefit from the so-called network effects one needs to exceed a critical point in development of the network. While the exact position of the critical point is not known, it seems reasonable to assume that it is close to universal penetration. Network effects may then be non-linear – after exceeding the critical point, the economic value of the network increases more than proportionately.

It is well known that communication and computer/Internet infrastructures in transition economies significantly lag behind developed countries. According to Eurostat statistics (see Deiss, 2002) on the EU-candidate countries for 2001, the number of PCs and Internet hosts in a covered sample of transition economies are relatively low compared to EU countries. Diversity in results is interesting – PC penetration in Slovenia almost equals the EU average of 31 PCs per 100 inhabitants; in Bulgaria though, the PC penetration amounts to only 4.9 PCs per 100 inhabitants. Similarly with Internet hosts: Slovenia boasts of 1.5 hosts per 100 inhabitants compared to Bulgarian 0.3 and the EU average of 3.5. Indeed, there is much to be done to improve the "new economy" infrastructure.

Persisting underdevelopment of infrastructure does not, however, change the fact that in recent years most transition economies have made big steps in up-grading their networks. Mobile telecommunications, one of the wonders of the "new economy", allowed most countries to start rapid catch-up with developed countries. Mobile telephony is a perfect example illustrating potential of technological "leapfrogging" – from year-long waiting lists for main line telephones to plentiful access to mobile telephones at affordable prices.

4. 3 *Trade Openness*

There is a broad consensus among economists that liberalized exports and imports are positively correlated with productivity and output growth. Trade openness is particularly important for diffusion of knowledge and innovations – imports are their main carrier. Open borders allow for international R&D spillover effects, which may represent a very potent contribution to economic growth in developing countries (according to Mohnen, 2001, a 0.5 per cent increase in R&D spending in terms of GDP in developed countries may result in a 14 per cent increase in output in the long-run in developing countries). Coe and Helpman (1995) find a significant relationship between import propensities and the ability to benefit from R&D spillovers: i.e. for a given level of R&D performed abroad, countries with a higher import propensity have higher productivity growth.

4. 4 *Financial Markets*

Schumpeter (1912) already asserted that a developed financial sector is important to economic growth. This assertion was confirmed by King and Levine (1993), Levine (1997), and Greenwood and Smith (1997). Financial markets play an impor-

18) Other types of hard infrastructure are almost as important – the NE will not develop in a country with dilapitated transportation networks (proverbial "pot holes"), low quality logistics system, etc.

tant role in collecting and aggregating savings and then redistributing it for productive purposes. A developed financial market is evidently critical for the "new economy". In particular, the value of venture capital (VC) investments is especially important as it finances start-up companies, which tend to predominantly utilize new technologies and ideas (as the experience of dot.coms suggests). Equity markets represent the second important channel for financing the "new economy".

Unfortunately, neither of the two "new economy" financial channels is sufficiently developed in transition economies. The total value of VC investments is negligible. According to available data (see Global Entrepreneurship Monitor, 2001) domestic VC capital investment to GDP in Poland, one of the most developed countries in Central and Eastern Europe, amounted to less than 0.1 per cent in 2000 compared to 1.2 per cent in Israel and 1.0 per cent in the US. According to Dresdner Kleinwort Capital (2001), in the whole of Central and Eastern Europe the average ratio of private equity funds raised (raised does not mean invested, though) to GDP as of the end of 2000, amounted to 1.3 per cent compared to the UK with more than 5.1 per cent, Sweden with 3.3 per cent and France at 2.0 per cent of GDP. In Poland alone the aggregate amount of VC capital invested was about EUR 200 million in 2000 – that is only 0.1 per cent of GDP!

The allocative role of equity markets is equally small – the total value of equity sold through (IPOs) on the Warsaw Stock Exchange in 2000 amounted to some 0.6 per cent of total annual initial public offerings investments in fixed capital. Hence, the financial infrastructure of the "new economy" in transition countries is underdeveloped and undoubtedly limits prospects for realizing the economic potential of the ICT.

4. 5 *R&D Spending*

Thanks to the findings of inter alia the endogenous growth theory, the importance of R&D for economic growth is by now quite obvious. Stiglitz (1998, pp. 26-27) states that "studies covering returns to R&D in industrial countries have found individual returns of 20 – 30 per cent and social returns of 50 per cent and higher". He further argues that "for most countries not at the technological frontier, the returns associated with facilitating the transfer of technology are much higher than the returns from undertaking original R&D". Hence, it seems that an ability to absorb the technology is key to fast development.

In transition countries R&D spending is at a very low level. It generally does not exceed 1.0 per cent of GDP compared to more than 2.0 per cent on average spent by the OECD countries (see Laafia, 2000). Low R&D spending puts post-socialist countries in a disadvantaged position since local R&D is extremely important for understanding and absorbing knowledge developed internationally, up-grading their own R&D skills, and active participation in international R&D networks. The OECD (2001a, p. 41) argues that "domestic R&D ... is key in tapping into foreign knowledge; countries that invest in their own R&D appear to benefit most from foreign R&D". Domestic R&D seems to be essential for absorption of international R&D spillovers.[19)]

19) It has been argued that the rapid development of Japan since 1950s and later of Korea has been mostly based on successful adoption, imitation, and up-grading of innovations developed abroad. The same path can be taken by transition economies. Yet, domestic R&D is needed in order to successfully follow this route.

R&D spending is nevertheless not everything – what matters is a profitable application of the newly created knowledge. This is where the post-socialist countries seem to lag the most: the flow of knowledge between science and industry is very weak. Most R&D institutes in post-socialist countries, often quite sophisticated in the quality of their research, nonetheless are very incompetent in terms of diffusing the results of their research for business use. This is mostly due to the legacy of socialist times when all applications of R&D were controlled by the state. The state relinquished this role in the early 1990s and left it entirely to R&D institutes. However, they proved unable to disseminate this knowledge because of the lack of clear incentives, managerial competence, and often insufficient financial support.

The ability of enterprises in transition economies to adopt R&D created both locally and internationally, is equally low. It is because the level of business R&D is particularly small. According to the OECD (2001b) main science and technology indicators, business enterprise sector R&D expenditure as a percentage of the domestic product of industry in 1999 amounted to 0.42 per cent in Poland, 0.33 per cent in Hungary, 0.69 per cent in Slovakia, and 0.95 per cent in the Czech Republic. This compares to Sweden's 4.74 per cent and the OECD average of 1.89 per cent.

Foreign direct investment (FDI) can play a substantial role in domestic absorption of international R&D. Its role should be growing. Yet, FDI inflows depend on the attractiveness of particular countries. Here transition countries lose in the global battle for FDI: they attract less than USD 30 billion annually, which is less than Brazil alone. Transition countries then have a lot to do to promote FDI and its R&D component.

4. 6 *Human Capital*

The role of human capital in economic growth is widely acknowledged. Various empirical studies have found that human capital is positively correlated with GDP growth rates (see Barro, Sala-i-Martin, 1995; Bassanini, Scarpetta, 2001). Benefiting from the ICT requires the right skills and competencies. That involves building on the foundations of solid education and lifelong learning. Tertiary education is particularly important for the "new economy" since this level of education prepares people for absorption of high-technology knowledge from abroad. In this context, it is also important to note that in order to benefit from ICT, tertiary education in math, computer science and engineering rather than liberal arts should be emphasized.[20)]

The quality of human capital in transition economies is relatively high despite their low national incomes. Ukrainian human capital is better developed than Venezuelan and Tajikistani better than Nigerian is.[21)] Human capital is one of the few positive legacies of the communist era. Yet, formal education is not all – especially because ICT appropriate skills matter more than broad knowledge. ICT skills are lacking in transition countries. This is due to the relatively low numbers of math,

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20) For instance, according to Stiglitz (1998) the high ratio of engineers in tertiary education in Korea and Taiwan (almost triple the US level) contributed to narrowing their productivity gap with developed countries.

21) According to the Human Development Index (see UNDP, 2001), the Education Index 1999 for Ukraine amounted to 0.92, while its GDP index was only 0.59. This compares to, for instance, Venezuelan GDP index of 0.67, and Education Index of only 0.83. Post-socialist countries on the whole, thanks to a high value of the Education Index, score much higher in the HDI ranking than in the GDP ranking. For Armenia, the difference amounts to 44 places in the ranking; for Tajikistan it is 36 places.

physics, and engineering graduates. More importantly though it seems that inadequate ICT skills are due to the lack of the culture of lifelong learning – it is very rare to see middle-aged people take courses in local universities. Yet, without lifelong learning people will not be able to keep abreast of ever-changing technology, whose progress – thanks to the "new economy" – has recently even quickened.

Education also contributes to the driving demand for technological products. As argued by Quah (2001), the "new economy" will not develop without demand for its products. Here again a lot can be done in post-socialist countries in terms of changing attitudes towards adoption of innovations. Better education surely will help. Nonetheless, current attitudes will not be changed overnight – cultural and societal changes take decades to come about. This risk is, however, largely mitigated by an apparent strength – since youth tend to adopt innovations faster, the relatively young populations of Eastern Europe and Central Asia should espouse technology much quicker than older and established societies in developed countries.

4. 7 *Labour Market*

The relevance of labour market flexibility for economic growth has been known for a long time. The OECD Jobs Study launched in 1994 was the first to find evidence that flexible labour markets result in reduction in unemployment (see OECD, 1999). Higher employment translates into higher output. Di Tella and MacCulloch (see *Economist,* 1999) found additional powerful evidence based on a survey of 21 countries over seven years to 1990.

Flexible labour markets are particularly important for the development of the "new economy": adoption of e-business and emergence of new organizational and management structures predominantly require flexibility in re-allocating people from old to new tasks and new ways of doing business. Since innovation introduces new products and industries that replace existing ones, it leads to labour re-allocation between firms and sectors. Rigid labour markets, while stifling necessary changes in employment, inhibit the adoption of the "new economy". Flexible labour markets are thus necessary for adoption and diffusion of the technological revolution (see Johnston, 2001).

4. 8 *Flexible Product Markets and Competition*

Competition, through lowering of the barriers of entry, improves incentives and thus leads to more productive use of resources. The importance of flexible product markets for economic growth has so far been plainly evidenced (see Bassanini et al., 2001). Competitive markets are very important for the growth of the "new economy" and its contribution to increasing productivity. New, more productive enterprises using new technologies have to have a chance to compete with incumbent companies. Market regulatory framework has to push down the barriers of entry as low as possible. Telecoms companies are a case in point – in countries where the telecommunication market has been liberalized (the US, most of the EU, developed countries of the South-East Asia), the quality has risen while costs of telecommunication services have considerably dropped in a short period of time (see OECD, 2001a). This is mostly not the case with telecom companies in transition economies, which retain their monopolistic positions. Market liberalization, which generally induces a decrease in prices and reduction in barriers to entry, is thus extremely important for the emergence of the "new economy".

4. 9 *Entrepreneurship*

It is not enough to know. It is equally important to be able to put the knowledge into profitable use. That is where entrepreneurial spirit and thus entrepreneurs come into place. There would be no commercially utilized innovations without entrepreneurs. They transform somebody else's ideas into economic reality.

J. Schumpeter (1912) had already discovered the links between entrepreneurship and economic growth. He was the first one to assert that entrepreneurship is, next to innovations and credit, an important factor spurring economic growth (see Blaug, 1994). As forces of "creative destruction" replace old inefficient firms with new and innovative firms, the growth rate of productivity accelerates. To state the obvious, entrepreneurship is at the core of the "new economy". There would not be Amazon, Yahoo, eBay, and other paragons of the Internet era without the risk-takers.[22)]

4. 10 *Macroeconomic Stability*

A high level and high variability of inflation increases uncertainty and decreases the efficiency of price mechanisms in allocating resources. As a result, inflation tends to lower the value and productivity of investments. However, specific evidence on the relationship between inflation and growth is ambivalent: while the relationship is robust in cases of high inflation, it is less so in cases of moderate or low inflation (see Bruno, Easterly, 1996). Nonetheless, it is generally accepted that inflation, particularly high and variable inflation, is inimical to growth.

Macroeconomic stability is equally relevant for the adoption and development of the "new economy". In an unstable inflation-prone economy, no investments will flourish (not even ICT investments). Low and stable inflation rates are thus necessary for benefiting from the technological progress.

4. 11 *Other Factors*

The New Economy Indicator could be complimented with additional variables of such harder-to-quantify factors like political freedom and stability (democracy, civil liberties, state support for the Internet), culture (openness to adoption of innovations), corruption, religion, ethnicity, or even command of English. Yet, due to the very qualitative nature of these variables and for the sake of the NEI's simplicity, these variables are not included. Nonetheless, the impact of political, social, and cultural factors on economic growth, and – in the paper's context – on the adoption of new technologies, remains a rich field for further research.

Let us finally turn to the New Economy Indicator scores, in Table 2.

Slovenia scored the highest in the ranking, followed by the Czech Republic, Hungary, Estonia, the Slovakia and Poland. Uzbekistan, Albania, Bosnia and Herzegovina, and Yugoslavia occupied the bottom of the Table. The results seem to agree with a common knowledge: most advanced transition countries are ranked in

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22) Private sector share in GDP based on EBRD data is used as a variable in covering a full sample of countries. It surely is a flawed measure since it reflects both entrepreneurial activity and progress in economy-wide privatization. Nonetheless, a large share of the private sector in the GDP of transition countries means that, first of all, the structural reforms that promote entrepreneurship are advanced. Secondly, grass-roots private business has been expanding, too (in most transition countries start-up private businesses rather than privatized companies now contribute a large part of the private economy's contribution to GDP).

Table 2
Rankings of Transition Countries According to New Economy Indicator

Country	NEI rank	NEI score	Regulations and law enforcement	Infra-structure	Trade openess	Financial system	R&D spending	Human capital	Labour market flexibility	Product market flexibility	Entrepreneur-ship	Macroecono-mic stability
Slovenia	1	10,8012	1,0846	2,3856	0,4393	1,2911	3,2527	1,1878	0,5269	1,0033	0,4107	0,3792
Czech Republic	2	10,1259	0,4310	2,0060	1,0642	2,4531	2,6677	-0,2700	0,3573	1,4730	1,3349	0,3826
Hungary	3	7,2732	1,0846	1,4889	0,8087	0,8867	0,3669	0,8963	0,3361	1,4730	1,3349	0,3381
Estonia	4	7,3827	0,8232	1,3457	1,7600	0,9481	0,1329	1,1878	-0,1728	1,0033	1,0268	0,5126
Slovakia	5	6,7511	-0,0266	0,8940	1,2058	1,9975	1,0688	0,3132	-0,6074	1,4730	1,3349	0,3963
Poland	6	3,7422	1,0846	0,4842	-1,3954	0,6768	0,5618	1,1878	-0,3000	1,4730	0,7188	0,3929
Bulgaria	7	2,3397	1,0846	0,4403	0,0268	0,3595	0,0159	0,0216	-0,6074	0,3769	0,7188	0,2937
Latvia	8	2,1582	1,0846	0,5791	-0,5181	-0,0040	-0,5301	0,8963	-0,1092	0,3769	0,4107	0,6221
Lithuania	9	1,2747	0,8232	0,5081	-0,2410	-0,3265	-0,0621	0,8963	-0,3424	-1,6586	0,7188	0,6357
Croatia	10	1,1471	0,8232	1,0444	-0,7521	0,8765	-0,5301	-0,5615	-0,4166	0,3769	0,1027	0,4305
Russia	11	0,6573	-0,0266	-0,4061	-0,8690	-0,6643	1,3418	0,6047	0,2619	0,3769	0,7188	-0,0039
Kazakhstan	12	0,1328	1,0846	-0,8403	0,0299	-0,7258	-0,5301	0,6047	0,6541	-0,0928	0,1027	0,3552
Ukraine	13	-0,6724	-0,4842	-0,4875	0,2238	-0,5620	-0,5301	0,6047	0,8449	0,3769	0,1027	-0,1989
Moldova	14	-0,9426	0,4310	-0,6606	0,0145	-0,4698	-0,5301	0,0216	1,0570	-0,0928	-0,5134	0,0508
Kyrgyz Republic	15	-1,5160	0,1695	-1,0359	-0,3519	-0,9049	-0,5301	0,6047	0,6965	-0,0928	0,1027	0,3587
Romania	16	-1,6560	0,6271	-0,1752	-0,8690	-0,3162	-0,3351	-0,5615	0,1771	0,3769	0,1027	-0,7086
Armenia	17	-3,1266	-0,2227	-0,8337	-1,0076	-0,7616	-0,5301	0,6047	0,1347	-1,6586	0,1027	0,6699
FYR Macedonia	18	-3,1322	-0,2881	-0,1231	0,2977	-0,3316	-0,5301	-1,1447	-2,1127	-0,0928	-0,2054	0,3860
Turkmenistan	19	-3,3963	-2,6414	-1,0408	1,6768	-0,4698	-0,5301	0,6047	1,2902	-1,6586	-2,0536	0,4305
Belarus	20	-4,4567	-1,7916	-0,3776	0,8303	-1,0022	-0,5301	0,6047	1,0676	-0,0928	-2,3617	-2,9936
Tajikistan	21	-3,5857	-1,5301	-1,1789	2,3048	-1,0585	-0,5301	-0,5615	1,0252	-0,5625	-1,1295	-1,3961
Georgia	22	-3,9427	-0,6803	-0,6272	-1,0414	-1,1199	-0,5301	-0,2700	0,1983	-0,0928	0,1027	0,4442
Azebaijan	23	-4,3465	-0,6803	-0,6954	-0,7459	-0,9152	-0,5301	-0,5615	-0,1304	-0,0928	-0,8214	0,6084
Uzbekistan	24	-4,5651	-0,2227	-1,0797	-0,1241	-0,8998	-0,5301	-1,7278	1,2266	-0,0928	-0,8214	-0,2742
Albania	25	-4,7612	-0,6803	-0,8618	-1,6602	1,6085	-0,5301	-2,8940	-0,4908	-0,5625	1,0268	0,5400
Bosnia & Herzegovina	26	-7,1586	-1,3340	-0,7652	-0,5335	-0,0961	-0,5301	-1,1447	-2,9608	-1,6586	-1,4375	0,5468
FR Yugoslavia	27	-6,5273	-0,0266	0,0127	-0,5735	-0,4698	-0,5301	-1,1447	-1,6039	-1,6586	-1,1295	-3,1988

the leading positions. Countries where the transition process has made the least progress (Georgia, Azerbaijan, Uzbekistan, Albania) or where war wreaked havoc on the economy, as in Bosnia and Herzegovina and Yugoslavia, rank at the very bottom.

The NEI results also largely square with the results of the Global Competitiveness Report published by the World Economic Forum (2001). As one might expect, the NEI of readiness for harnessing the "new economy" seems to be correlated with countries' competitiveness (see Table 3). This suggests that fundamental forces responsible for the development of both the "new" and the "old" economy are largely the same. Hence, since both "economies" rely on the same foundations, then there is no "new" or "old" economy: there is only one economy where old recipes for development still apply.

Table 3
Rankings of Transition Countries in Global Competitiveness Report and New Economy Indicator

	GCR [1)]	NEI
1.	Hungary	Slovenia
2.	Estonia	Czech Republic
3.	Slovenia	Hungary
4.	Czech Republic	Estonia
5.	Slovakia	Slovakia
6.	Poland	Poland
7.	Lithuania	Bulgaria
8.	Latvia	Latvia
9.	Romania	Lithuania
10.	Bulgaria	Croatia
11.	Russia	Russia
12.	Ukraine	Kazakhstan

1) GCR lists only twelve transition economies.

We have also calculated the NEI for an unweighted sum of values of all variables. Table 4 shows that the NEI based on the unweighted and weighted sum are largely

Table 4
Rankings for Weighted and Unweighted New Economy Indicator[1)]

	Weighted NEI	Unweighted NEI
1.	Slovenia	Slovenia
2.	Czech Republic	Czech Republic
3.	Hungary	Hungary
4.	Estonia	Estonia
5.	Slovakia	Slovakia
6.	Poland	Poland
22.	Georgia	Tajikistan
23.	Azerbaijan	Uzbekistan
24.	Uzbekistan	Azerbaijan
25.	Albania	Macedonia
26.	Bosnia	Bosnia
27.	Yugoslavia	Yugoslavia

1) First six and bottom six countries.

similar. Similarity of the results bears proof to the robustness of the ranking: if changes in weights of variables were to result in big corrections to the NEI, than it might imply that the rankings are arbitrary. As shown, this is not the case here.

5. Conclusion

The information technology revolution, like all previous industrial revolutions, is poised to change the ways of doing business on a global scale and thus contribute to faster productivity and output growth. The "new economy" has already made its impact on growth rates in developed countries. Despite the current slowdown coupled with some pessimism, the information revolution is here to stay. More time is, however, needed for the benefits of "new economy" to fully feed through to the whole economy.

The "new economy" has not yet, however, had any major impact on less developed countries. Nonetheless, it represents a significant potential for less developed and transition economies to attain long-term growth, sustained and fast socio-economic development, and catch-up with developed countries. However, benefitting from this potential is not automatic: it seems that sufficient institutional infrastructure must exist before these countries can tap into the benefits of the "new economy".

The New Economy Indicator developed in this paper has been thus designed to illustrate the level of institutional readiness of transition economies for adoption of the "new economy". As could be expected, countries most advanced in the transition process have received the highest rankings. Those countries where the process of transformation from planned economy to a market economy has progressed the least, rank at the bottom of the Table. These countries risk finding themselves in the "technological trap" where, due to the insufficient quality of institutional infrastructure, investments in new technologies may yield lower returns than investments in older technologies. Hence, older technologies can prevail over new ones.

Different speeds of adoption of technological innovations resulting from the different quality of institutional infrastructure are likely to contribute – along with the traditional "old" economy – to diverging rates of economic growth and thus add to the growing income polarization among the post-socialist economies. The most advanced countries (front-runners like Estonia, the Czech Republic, Hungary, Poland, and Slovenia) thanks to ICT are likely to speed ahead much faster, while economic growth in lagging countries (Azerbaijan, Bosnia and Herzegovina, Yugoslavia, and Tajikistan) may further languish.

Income polarization among transition countries is likely to grow also because of the impact of the impending accession of ten transition countries to the EU. In the long-term, the accession to the EU is set to gradually increase the value of all variables in the NEI index of all new EU Members. Financial assistance from the EU to new member countries worth some EUR 40 billion between 2004 – 2006, will improve the institutional infrastructure of the "new economy".[23)]

The potential for harnessing the "new economy" for faster and sustained long-term economic growth and catching-up of post-socialist countries will depend on the level of development of the institutional infrastructure. This is mostly influenced by national economic policies and strategies. The NEI index shows where much more emphasis should be placed to promote diffusion, absorption, and the productive use

23) For instance, Poland is to receive EUR 1 billion in 2002 and 2003 and EUR 6.5 billion annually afterwards for infrastructure investments only (see Morgan, 2002).

of innovations. All variables count for the "new economy". Yet not only for the "new" economy – they equally count for the "old" one, too. It is because in reality there is only one economy, which – as has been the case throughout history – combines the old with the new.

Traditional recipes for development still hold: investment in physical and human capital will for long to come be the most important ingredient of fast growth. Yet, long-term growth will also depend on the speed of replacement of the old with the new. The ICT revolution is likely to accelerate the replacement process. This is particularly true for transition economies. The technological leapfrogging will not, however, materialize without appropriate institutions. Their fast build-up is the recipe for ultimate catching-up with the developed world.

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