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Information and Communication Technologies, Globalisation and Competitiveness: A Selective Survey

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"Idle talk about the promise of computers and information technology infuriates economists. They find that those overly taken with the new technology often display a breathless naivete inconsistent with what economists consider to be proper hardheaded analysis."

Quah, D.T. (1997: 1), "The Weightless Economy: Nintendo and Heavy Metal"

"New economy types have a tendency to tell great stories, both about the economy and about themselves. Alas, the fact that a story is entertaining doesn't mean that it is true."

Krugman, P. (2000: 2), "Networks and Increasing Returns to Scale: A Cautionary Tale"

"*The adjustments and dislocations that millions of people are experiencing in the current epoch of the information revolution are not historical anomalies; the technical progress has been disturbing people's lives ever since the industrial revolution.*"

Aghion P., P. Howitt (1998: 3), "Endogenous Growth Theory"

Summary

This paper gives a selective survey of different economic theories in order to discuss the role which IT plays for globalisation and how globalisation and technological progress in the IT-sector influences structural change, economic growth and national competitiveness. The decline in trade costs induced by IT will further enhance the existing trend of increasing trade in goods and services, especially those where reduction in trade costs due to IT are going to be most substantial. One hypothesis is that the rise in services trade will be greater than the rise in goods trade. Furthermore, modern IT does not just influence if, but also how foreign trade is to be carried out. Globalisation initiates structural change. In the long-run, however, conclusions with respect to convergence or divergence of factor endowments, production patterns and income levels seem to depend on the choice of the theoretical model. In discussing the role of IT for growth of the aggregate economy we have to distinguish between capital deepening and spillover effects. Since capital deepening means purchases of IT-investment goods we expect that firms are able to judge the growth prospects offered by IT. Thus there is no need for a special policy approach for firms involved in the manufacturing and supply of IT-products. If on the other hand the IT-sector generates technological spillovers, then a special economic policy treatment is justified.

1. Introduction

In today's economic and political discussion, globalisation plays a major, and simultaneously, controversial role. An intensification of world trade and stronger competition of national economies on internationally mobile production factors that put new challenges to economic policy are closely associated with globalisation. Some commentators in today's discussion fear an increasing disparity in both the national distribution of income and the international income development, and thus warn us of a "globalisation trap" (e. g. Martin and Schumann, 1996).

In this regard, it is very often argued that new information and communication technologies (henceforth IT) are

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largely responsible for the recent trend in globalisation. The upgrading of IT has led to an improvement in the coordination of various economic activities among suppliers, clients and partners abroad, at the same time making the procedure more cost-effective. IT enable, for instance, a splitting of the production process by which locational advantages and scale benefits can be exploited; furthermore this technology boosts the exportability in the service sector. Cairncross (1995, 1997) in the British Magazine *The Economist* has already predicted a "Death of Distance" and a "A Connected World" for the future.

Taken together, there seems to be a widespread consensus that globalisation and technological advances in IT represent a fundamental transformation of the economy, which will make familiar relationships between structural change, economic growth and a nation's competitiveness obsolete. The aim of this paper is to provide a theory-based discussion of this issue. Based on a survey of different fields of economic theory, we attempt to clarify the role which IT plays in globalisation on the one hand, and the role which globalisation and technological progress in the IT sector play in structural change, economic growth and national competitiveness on the other hand. In doing this, we will search for clear-cut predictions for future developments and policy implications that the various theories provide.

In general, it is often overlooked that globalisation is by no means a recent development, as claimed by certain contemporary observers and experts.[1] From the very beginning, the process of industrialisation in the now developed economies was accompanied by the opening of the market to foreign trade to an extent, as far as capital and trade flows are concerned, that is comparable with current figures.[2] Even transport and communication possibilities were much better in the previous century, as is commonly assumed.[3] For instance, owing to the expansion of overseas trade after 1870 there was a regular "grain invasion" in Europe, which in turn had a dramatic influence on price trends. Between 1870 and 1913, the price of wheat in Liverpool, originally around 70 percent above the price in Chicago, slumped to just about 5 percent above — an almost ideal example of international price convergence caused by foreign trade.

Our general understanding of globalisation follows from a definition given by Tilly (1999: 9, authors' translation):

"Globalisation refers to an increasing international integration of goods, capital and labour markets the immediate causes of which lie in the rise in international mobility of products and production factors, indirectly aided by technological development and changes in the respective governmental economic policies."

The above definition pinpoints the two indirect causes of globalisation which could be distinguished as the political and market-based factors. Accordingly, the reduction in trade costs caused by technological progress (for instance, owing to the use of modern IT) represents a market-based factor, and the reduction of trade restrictions offers a political factor for globalisation.[4] The question then is: which of these indirect causes is responsible for the phenomenon of globalisation? Henning Klodt (1998) of the Institute of World Economy in Kiel claims that modern IT is the first and most important driving force in globalisation. Paul Krugman (1995) from MIT, however, finds that globalisation is borne by changes in international trade and exchange rate policies. Section two will deal more closely with this debate by discussing the influence of IT on trade costs and, thus, on globalisation.[5]

In addition, the above definition also distinguishes between the direct and indirect causes of globalisation. This distinction is important because economies are not engaged in trade with one another simply because there are no tariffs or trade costs. The direct causes of foreign trade are, however, found in price differences and product differentiations of certain goods, services and factors of pro-

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[1] Studies in the field of economic history have resulted in numerous articles on this subject, see Irwin (1996), Bairoch, Kozu-Wright (1996), Bordo, Krajnyak (1997), O'Rourke, Williamson (1998), Bordo et al. (1999), Tilly (1999). In a recent study, Baldwin, Martin (1999) compare the 19th and 20th century levels of industrialisation and globalisation.

[2] Migration of the workforce had a much greater significance before World War I than it has today, see Hatton, Williamson (1998).

[3] To give a few examples, in 1858 — completion of the first Transatlantic telegraph line, in 1869 — construction of the Suez Canal and the Union Pacific Railroad, in 1876 — invention of the telephone. By 1860, Europe already had an extensive and efficient railway network. Woodruff (1985: 455) elaborates on this point: "Of all economic fields developed by Europeans in the century prior to 1914, no one field had as dramatic and lasting an effect on the creation of a world economy as the innovations in transport and communications". Borchardt too (1985: 187) speaks of the 19th century as the "century of a communications revolution".

[4] Other market-based factors are the increasing per-capita income, the increasing vertical integration of manufacturing production ("outsourcing") and a decreasing relative price ratio of tradable and non-tradable goods. Krugman (1995), however, points to the growing share of services in value added as a counterbalance to globalisation because services are by and large non-tradables — despite some progress in services trade due to IT.

[5] The importance of this seemingly terminological distinction for the discussion on globalisation is at once noticeable when we keep in mind that the integration of the global economy effected by market-based factors represents an irreversible process. On the other hand, the growing integration prompted by political decisions is principally reversible. In this paper, however, we do not go deeper into the discussion about political versus market-based causes of globalisation, see Rose (1991), Krugman (1995), Sachs, Warner (1995), Bergstrand (1996), Baldwin, Martin (1999). It should be noted that political and market-based factors are not mutually exclusive. While efficient monetary systems and the abolishment of trade restrictions happen to be the cause for pushes to globalisation, technological progress is capable of explaining why globalisation between these phases has a steady upward trend. For empirical evidence supporting this view, see Ben-David, Papell (1997).

duction. Section three will deal more closely with the causes and effects of foreign trade. Apart from taking a closer look at the neoclassical theories of trade and growth, we will also deal with theoretical approaches that enable an analysis of those stylised facts which can not be discussed using the neoclassical theory, including technological progress, persisting and diverging trade patterns, intra-industrial trade, international agglomerations and multinational firms. In the last section, we will summarise the results.

2. Globalisation, Trade Costs, and IT

2.1 Trade Costs, Transaction Costs and IT

This section looks at the role of IT in declining trade costs. By trade costs, we mean in a broader sense the consumption of resources required for the movement of goods, services, production factors or information between nations. Trade costs include figures such as freight charges, capital transfer costs, insurance costs, communication and information costs, tariffs and the cost of non-tariff trade barriers. At a more general level, trade costs can be divided into transport and transaction costs, although this distinction is not always clear-cut.

Transaction costs may be defined as expenditure for information and communications necessary for the preparation, execution and surveillance of the exchange of goods and the division of labour, the level of which is in turn determined by the various factors that influence the transaction itself (Picot et al., 1996: 22, authors' translation). In the light of this definition, it is obvious to expect that IT influences the transaction costs of foreign trade. The reduction of costs in the IT sector should boost the international integration of markets for goods, services and production factors.

For IT to play a central role in globalisation, at least two requirements must be fulfilled. First, the prices of products related to IT must decrease conspicuously. Second, the share of the resulting cost savings in the total trade costs should show a significant magnitude. Whereas there are no great difficulties in showing that information and communication costs have dropped drastically over the past few decades,[6] it is no easy task to examine the second precondition. The reason is that the share of information and communications costs involved in trade costs is a magnitude, which is difficult to judge and quantify. In comparison to various criteria such as size and weight that determine the physical transport costs for a particular commodity, transaction costs depend on a wide range of factors that strongly vary, depending on the goods and services in question.[7]

The significance of transaction costs can be derived indirectly from numerous empirical studies undertaken to explain patterns of trade on the basis of gravity regressions in which the distance variable, measuring the distance between trading nations, often exerts a greater influence than what is theoretically expected from pure physical transport costs. The usual explanation for this finding is that the distance variable takes into account more than simply overcoming geographical distance, in addition, it also approximates the costs of information and communications among the trading partners.[8]

All in all, we can expect that the decline in trade costs due to new ITs should lead to an increased international exchange of goods and services. In fact, we can even assume that the services trade will grow at a stronger rate than the goods trade because trade costs usually play a more important role in services. For the same reason, trade with countries that are farther away should also increase more strongly. The decline in trade costs should also lead to an increase in trade along the value chain. This means the disintegration of the production process, in which a good is produced in a number of production stages in at least two countries. This increase in "intramediate trade" can be attributed to two main causes. First, trade with intermediate products can rise because firms are finding it profitable to outsource increasing amounts of the production process abroad. Second, it is quite possible that manufacturing of final goods requires a greater number of intermediate goods, for the simple reason that final goods become increasingly "more complicated". In the event of these intermediate goods being imported, trade, too, will increase, of course without causing a break-up in existing value chains.[9]

2.2 IT and the Nature of Trade

Given that IT reduces transaction costs in foreign trade, modern IT does not just influence it, but also how goods and services are exchanged (i. e. via markets, hybrid

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[6] See Junius (1999) for empirical evidence on trade costs and the literature therein.

[7] It could be expected that trade will become more "weightless", because goods and services will become more knowledge intensive and their economic value will no longer be manifested in material form. In an extreme case, trade costs can go to zero when moving knowledge in the form of a digital code across the internet. In addition, IT will enhance the tradability of services because the physical presence of the service provider is no longer necessary (e. g. Amazon) or could be replaced by video and telephone conferences. And last but not least IT will make it easier to get information on supply and demand conditions around the world.

[8] See Krugman (1995), Junius (1999) and Portes, Rey (1999).

[9] The exact extent of trade along the value chain is statistically difficult to record. Recent studies, however, suggest that trade along the value chain comprises a substantial share of the total increase in world trade and is a modern characteristic of globalisation, see Krugman (1995), Feenstra (1998), Hummels et al. (1998).

organisations or firms). Since IT influences the decision of the firm regarding the co-ordination of purchases, production and sales abroad, does this imply a rise in inter-industrial or intra-industrial trade, or a rise in intra-firm trade?

If one shared the opinion of Picot et al. (1996: 56) that transaction costs "chiefly represent costs of procuring and processing information", the introduction of new ITs should lead to a reduction of fixed and variable transaction costs. Business development costs (for example, due to databanks and data networks), communication costs (for example, by taking advantage of e-mail and video conferences), and monitoring costs (for example, due to computer-aided quality control systems) would be reduced. As a result, IT would be conducive to market-related and hybrid co-ordination solutions, so that markets and hybrid organisations are then in a position "to realise tasks hitherto considered to have too high transaction costs, i. e., to realise key tasks so far characterised as too specific and uncertain. Importance of the hierarchy would gradually diminish and that of market-related and hybrid solutions would gain more importance. IT thus facilitates a market-based and hybrid orientation of the organisation of the firm" (Picot et al.,1996: 270, authors' translation).

This argumentation, however, raises some questions regarding the stylised facts of globalisation. In the first place, it is obvious that this line of argument cannot explain the rise in foreign direct investment, i. e. the hierarchical solution. Either factors other than reductions in transaction costs attributable to IT are of importance, or one must assume a clearly stronger decline in costs for transactions undertaken within the firm. The effects of IT on internal transaction costs should therefore be significantly greater than the effects on external transaction costs for market-based or hybrid forms of organisation. This view is put forward by Broll and Gilroy (1994: 133, authors' translation): "Modern information and communications technology is of growing assistance in this form of internalisation [i. e., foreign direct investments — the authors]. This technology facilitates the co-ordination of internal international production and marketing of goods and services" (underlined as in the original document).

A second point concerns the assumption that IT does indeed have a substantial influence on transaction costs. In general, institutional economics highlights transaction costs arising on the basis of incomplete information on the side of market participants. The term information in institutional economics implies more than the simple transportation of news and data; instead it is linked to concepts such as uncertainty and asymmetrical information. Uncertainty refers to future developments that cannot be predicted with certainty in spite of great efforts made in attempting this. It is questionable, however, whether IT will be able to significantly reduce transaction costs by reducing the inherent uncertainty of the future.

The case of foreign direct investment between firms active in different production stages makes this point clearer. If one firm produces a good that is used as an input for another firm, problems of co-ordination may arise because future demand and supply conditions are uncertain. A fluctuating price may impose excessive risk for both sides of the market. On the other hand, negotiating a contract may be disadvantageous because no contract, no matter how long and detailed, can account for every conceivable (or inconceivable) event that might occur. If both firms are merged into one single vertically integrated firm, these problems could be at least partly solved because giving new instructions is cheaper than negotiating a new contract.[10]

A third aspect is that a large share of currently observed foreign direct investment takes place between firms in the same production stage. In order to make not only the vertical, but also the horizontal internalisation decisions of firms more transparent, institutional economics resorts to the concept of asymmetrical information. This means that one side of the market has incomplete information, but that essentially it is possible to cover this information gap. In this case, transaction costs do not arise merely because the communication and processing of information is not possible or too costly, but because one side of the market deliberately tends to block the flow of information, either prior to or after closing a deal.

The international transfer of technology offers a suitable example for information asymmetries whereby technology could be broadly defined as any kind of economically useful knowledge. If a firm is confronted with the decision of profitably transferring its knowledge abroad, then market-based or hybrid solutions are often ruled out on grounds of the so-called information paradox. After all, the foreign buyer or licensee cannot precisely estimate the economic value of the information (that is, the knowledge about the technology) before closing the contract. However, it is no longer attractive for him to buy this information once he possesses it. For this reason, a transfer of technology usually takes place by establishing a foreign affiliate. Further reasons can be found in the difficulty of establishing property rights in the field of knowledge, because knowledge often has a tacit character and cannot always be

[10] Evidence for the view that transaction costs are not necessarily reduced by IT is given by the so-called international diversification puzzle. Although modern IT has succeeded in creating a world wide network with nearly unlimited flows of news and data on financial markets, portfolio investments display a clear national bias: at the end of the 1980s, 94 percent of US capital assets were invested in the United States, 98 percent of the Japanese assets were invested in Japan. Canada, France and Germany respectively invested only one percent of their capital in America or Japan, see French, Poterba (1991).

transferred in the form of words, numbers or blueprints. Why IT should play a special role in reducing transaction costs under such circumstances, still remains unclear.[11]

2.3 Conclusion

There are substantial arguments supporting the opinion that technological progress in form of modern IT reduces trade costs and, thus, is one vehicle of globalisation. On the other hand, the role of IT should not be overstated because IT will not be able to reduce transaction costs arising from uncertainty and asymmetric information; or to quote Krugman (1995: 341): "It is clear that the volume of trade is not completely determined by technology: transportation and communication technology were considerably better in 1950 than they were in 1913, but the world economy was substantially less integrated. Correspondingly, since much of the growth of trade since then represents only a return to 1913 levels of integration, it is hard to argue that technology has been the dominant factor in that growth".

3. Globalisation and IT: Theoretical Aspects on Structural Change, Growth and Competitiveness

3.1 The Neoclassical Trade and Growth Theories

3.1.1 Foreign Trade, Trade Costs, and Structural Change

The classical and neoclassical trade theory claims that when two countries are engaged in trade, the outcome will be that each one will specialise in the production and export of those goods in which they have comparative advantages. In turn, the existence of such comparative advantages is attributable to exogenous differences in the relative labour productivities (Ricardo) or the relative factor endowments (Heckscher-Ohlin).[12] The establishment of foreign trade is always associated with structural change. Since this structural change is also accompanied by a shift in the national distribution of income, there will be winners and losers within an economy. But for the economy as a whole, foreign trade is associated with an improvement in general welfare.

In the neoclassical trade theory, trade costs account for the existence of non-tradable goods. Many goods are not traded on international markets, either because the ratio of trade to production costs is too high or because the comparative cost advantage between the prospective trading partners is too low. Decreasing trade costs due to IT would then mean that goods that were previously only locally tradable can now be traded on international markets, thus setting up a structural change among the non-tradable goods.

One disadvantage of the neoclassical trade theory is that it offers only a comparative-static analysis. The situation prior to the establishment of foreign trade is compared with the situation arising later. This seriously limits the possibilities of discussing various effects of globalisation on structural change. Indeed, the present discussion on international competitiveness is by and large quite static. The achievements of the new industrialised countries (NICs) are compared with the problems of industrialised nations without taking into account the differences in income levels. The relative backwardness of these countries gives rise to a potential for economic growth and catching-up, which in turn has important implications for structural change.

3.1.2 Foreign Trade and Economic Growth

In order to make a statement on competitiveness and dynamic comparative advantages in the future, it is worthwhile to combine the static neoclassical trade theory with the dynamic neoclassical growth theory. Growth and catching-up processes in that case can be driven by two forces, namely factor growth on the one hand, and technological progress on the other. The sectoral pattern of foreign trade and growth can then be outlined as follows (Gries et al., 1996): since higher growth of income also implies higher growth of savings, accumulation of physical and human capital in the less-developed countries will rise faster than in the industrialised nations. Thus, the comparative advantages of the industrialised nations in the capital-intensive sectors will be "rolled up from behind". Those sectors having comparative advantages only

[11] On being asked what effects the enormous distances between the two headquarters might have, Daimler-Chrysler president Stallkamp gave the following answer, throwing light on the tacit nature of knowledge which is only transferable by way of "face-to-face" communication: "We have to travel a lot to be able to meet our counterparts personally. This costs a lot of energy but there is also the advantage of getting to know one another. In this regard, even video and telephone conferences are not very helpful. Every second week, we must sit facing one another. You see, our business is very complicated. We sell cars and not toothpaste. Synthesising and co-ordinating our organisation is an extremely complex issue"; excerpt in: Süddeutsche Zeitung, 9th/10th January 1999 (authors' translation).

[12] The simple Ricardian model of comparative advantage is well suited to clarify two important issues that are often overloooked in current discussions on globalisation (Krugman (1996), Gries (1998: 36)). First, it is not admissible to compare the wage level of a German worker with that of his counterpart from a low-wage country, as long as we ignore productivity differences between these countries. Actually, not wages but (real) unit labour costs ought to be compared. Second, comparisons for the total economy, i. e. average comparisons with regard to unit labour costs, do not make much sense. Instead, sectoral comparisons of unit labour costs determine the international competitiveness of the individual sectors. Comparative advantages in some sectors are imperatively linked with comparative disadvantages in other sectors. No country can have comparative advantages in all of its sectors.

on the basis of a "medium" capital-intensive production will first incur the pressure to adjust.

Owing to their faster increase in human capital relative to more highly developed countries, less-developed countries will become capable of imitating existing technology. Therefore, the initial attack will be on the comparative advantages of those sectors whose technological lead can easily be reduced by imitating their products. But even sectors with cutting-edge technology will be under pressure to adapt because the process of imitation in the less-developed countries will proceed at a faster pace than the process of innovation in the industrialised nations. In the long run, however, the convergence of the income level will also lead to a convergence of factor endowments and technology levels, which in turn implies a convergence of production patterns and comparative advantages. Eventually, the process of growth and catching-up removes the fundamental causes of the international division of labour.

3.1.3 IT, Economic Growth, and International Competitiveness

In the recent debate we often encounter the viewpoint that IT is significant for international competitiveness because, being a cross-sectional technology, it affects all the other sectors of an economy. Accordingly, IT leads to productivity gains and cost savings in the investment and consumer goods sectors. As a result, the entire price level of an economy will decrease, accompanied by a positive impact, either directly or indirectly, on overall economic growth. This happens directly because the decreasing price level leads to an increased international competitiveness, and indirectly because the released production factors can be applied elsewhere.[13]

In the long run, however, this argument is only partly valid because increases in productivity in one sector usually lead to a change in relative prices without generally influencing the price *level*. A change in the price level for a given supply of money can only occur when IT also contributes to a significant increase in productivity in the entire economy.[14] Under flexible exchange rates, however, changes in the price level will lead only to an adjustment of the nominal exchange rate, without influencing the overall economic competitiveness. By contrast, IT does have an influence on the comparative advantages of various sectors to the extent that IT leads to different increases in sectoral productivity.

On the basis of the neoclassical theory, one should expect the price mechanism to ensure that the contributions of new technologies towards an increase in productivity among various sectors of the economy will be correspondingly rewarded. Markets and firms alone will make provisions for the exploitation of the vast range of possibilities of modern IT. There is also no need for the domestic economy to have an IT sector which is internationally competitive. As long as IT enjoys free competition on the international market and as long as all countries have equal access to the best and most competitively priced IT products, it is quite immaterial which country has the comparative advantage in the production of this technology.[15] One would otherwise have to defend the opinion that in view of the importance of modern transportation technology, each and every country ought to start its own automobile production.[16]

3.1.4 Conclusion

From the neoclassical model, the following conclusions can be derived: First, insofar as IT contributes to the reduction of trade costs, it will boost the trade of goods and services where trade costs previously exceeded comparative advantages. This will lead to further structural change. Second, in the long run factor growth and technological imitation lead to a convergence of production patterns and comparative advantages. Third, government intervention and aid for the domestic IT sector only make sense if IT causes external effects ("spillovers") which cannot be internalised. In this case, private marginal returns are lower than social marginal returns and, therefore, investment in IT is too low. Correspondingly, the main question is, what the connection between globalisation and IT, and structural change, growth and competitiveness is, if IT entails external (technological) effects. This question is pursued by theoretical approaches which we will present in the following sections under the headings "Evolutionary Theory" and "The New Theory of Trade, Economic Geography and Growth".

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[13] See for example Cronin et. al. (1992: 557).

[14] On this issue, see the next section. In discussing the role of IT in growth of the aggregate economy, we have to distinguish between the direct effect and the spillover effect, see Gordon (2000). Productivity growth can be divided into growth in total factor productivity (TFP) and growth due to capital deepening. Rapid technological progress in the IT-sector will lead to declining prices of IT investment goods and, thus, to larger purchases of IT, -investment goods by firms. This will give us the direct effect: growth due to capital deepening. In addition, growth in overall TFP will rise by one-for-one, however weighted by the share of the IT sector. Because this is currently not a large figure, TFP growth in the IT sector will be a small part of overall TFP growth. However, some advocates of the IT revolution maintain that TFP growth in the IT sector will also stimulate TFP growth in other sectors. This will give us the spillover effect. In neoclassical theory, spillover effects are assumed to be zero.

[15] Krugman (1996) points out that productivity gains in the economy of the trading partner do not necessarily burden the domestic economy. The effects on the domestic economy will depend on the sectors in which the trading partner experiences productivity gains. If, for instance, productivity rises in the export goods sector of the trading partner, then the import goods will become relatively cheaper from the perspective of the domestic economy, and the terms of trade as well as the domestic real wage will improve.

[16] It is however important that each country develops the infrastructure in order to utilise IT.

3.2 Evolutionary Theory

3.2.1 Technology and Foreign Trade

Evolutionary theory criticises neoclassical theory for neglecting the question of the determinants of technological progress.[17] In the neoclassical growth model, the contribution of a new technology to economic growth cannot be discussed for two reasons. First, we usually are referring to a one-sector model in which a homogenous product is consumed and invested simultaneously. Second, technological progress is assumed to be exogenous.[18] In contrast to this, evolutionary theory understands technological change to be a complex, interacting process of invention, innovation and diffusion.[19]

With reference to the nature of technology, the evolutionary theory highlights four central points (Archibugi and Michie, 1998: 4): first, technology is not considered a public good but rather one principally endowed with and entitled to property rights. Second, intangible technology in the form of knowledge is regarded to be only partly transferable: the major part can be acquired only after a costly process of learning. Third, technology is path-dependent; or in other words, the more technology was accumulated in the past, the easier it is to acquire newer, more specialised technology. Fourth, the impact of the above-mentioned points varies in different industries.

In evolutionary theory, these four characteristics lead to a very distinct specialisation in technology for each country.[20] Every country possesses a particular technological advantage in the production of certain goods and on the basis of the above-mentioned properties of technology, an international diffusion of technology is not ensured, even by way of foreign trade. Consequently, economic growth and foreign trade "cement" the sectoral structure of a country. Contrary to the neoclassical trade theory, the degree of technological specialisation is also considered to be a function of the size of a country. Larger countries show a more extensive "portfolio" of sectors in which they have technical advantages for the simple reason that larger markets have to be supplied with a greater quantity of products. Correspondingly, we can expect a higher degree of specialisation for the smaller countries (Münt and Grupp, 1996: 15).

3.2.2 Economic Structure, High-Tech, and IT

From evolutionary theory, we can conclude that not only the extent of resources required for generating technological change, but equally their sectoral distribution, is vital (Freeman, 1998). The sectoral structure of an economy determines whether a country will find itself in a virtuous circle composed of international competitiveness, high economic growth and technological progress; or whether it will fall into a vicious circle of loss of international competitiveness, decline in economic growth and a general technological setback (Grupp and Münt, 1998: 175). Therefore, the critical question is: in which sector, or sectors should an economy possess technological advantages? There are two opinions on this. The first one argues that IT should be considered as a basic innovation; the other one sees the key to future economic growth in the so-called high-tech industry (to which IT certainly belongs).

Proponents of the latter opinion assume that international trade in high-tech products will strongly increase (Archibugi and Michie, 1998: 10). Therefore, it seems advisable for a country to intensify its efforts in the field of high-tech industry in order to safeguard its international competitiveness. This immediately brings us to the next question, namely, what actually is the high-tech industry? If we understand those goods to be high-tech in whose production a large amount of knowledge has been invested, then we could define the high-tech industry as that industry in which the share of R&D costs in value added is relatively high. Although the exact classification of the various kinds of industry with regard to their technological intensity is controversial, there is no doubt that IT belongs to the technology intensive or the so-called high-tech sector.[21] As a consequence evolutionary theorists should find the IT sector to be a promising area and therefore recommend that governments promote this sector. The authors of evolutionary theory, however, avoid making this policy suggestion.[22]

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[17] Connected with this criticism is a break with methodological tools — the evolutionary theory deviates from general equilibrium theory. See for a comparison on theoretical and methodological issues Diederen (1993) and Sarkar (1998).

[18] As early as the 1960s, British economist Joan Robinson criticised the fact "that economists still treated technology as if it was provided by God and the engineers" (quoted in Archibugi, Michie (1998: 1)). In the neoclassical growth theory, if we consider the integration of two separate economies having different levels of technology, then a catching-up process is simply assumed on the basis that the technology of the more advanced economy will equally be at the disposal of the relatively less-advanced economy as well. If this process runs without friction, there will be a convergence of the two countries, as discussed in the previous section. This characterisation of technology as a public good implies that the less-developed economy can indeed adopt and make use of the advanced technology. Empirical studies, however, have shown that it is a very lengthy process, see Barro, Sala-i-Martin (1995), Schalk, Untiedt, (1996).

[19] Innovation here refers to the first commercial application of a product or process invention, and diffusion means spreading the innovation.

[20] See the contributions in Archibugi, Michie (1998).

[21] See Grupp, Gehrke (1994: 35).

[22] Archibugi and Michie (1998: 10) have formulated it in this way: "Despite some pioneering studies, however, we know little about the role played by crucial bandwagon sectors in industrial development. Economic historians have shown the importance of emerging industries for development; we generally associate the industrial revolution with steam engines, textile machinery and railways, and the public opinion of our age *(Continuation on p. 551)*

3.2.3 Basic Innovations and IT

Schumpeter's theory of long-term economic development is characterised by the idea that technological progress is encouraged by basic innovations, which in different stages of economic development, have influenced and will influence the rate of growth. According to this view, economic growth is not steady but rather cyclical in nature. The empirical expression of basic innovations is found in Juglar and Kondratieff cycles.[23]

The special significance of IT on economic growth, according to some proponents of the evolutionary theory, lies in the fact that IT must be regarded as the basic innovation of the fifth Kondratieff-cyle.[24] Since information may be regarded as the "raw material of the future" (Klodt, 1998: 62) or as the "central production factor" (Federal Ministry for Economy, 1996: 15), many countries including Germany will inevitably find themselves as part of a modern "information society". The traditional three-way classification of an economy should be given up in favour of a four-way classification introducing an IT sector. According to the Institute for Employment Research, around 50 percent of the working population in Germany are already currently employed in the IT sector and by the year 2010, the figure of "information workers" is expected to rise to 55 percent.

From our point of view, this emphasis on the importance of information in the production process seems to be exaggerated and the result of a linguistic misunderstanding. For example, Nefiodow (1996: 12) describes the various forms of information as data, texts and news, in addition, he uses the terms knowledge and ideas. And in the literature on business management, Wittmann's definition (1959: 14) — "Information is knowledge with a purpose" is often quoted (Krcmar, 1997: 19ff.). But what is knowledge? Can information be put in the same category as knowledge (or ideas)? From our point of view, putting these two concepts on a par with each other is not justified. Recent articles on business management similarly stress the differences. Krcmar, for instance, writes (1997: 19, authors' translation): "Since the uses and applications of information and communications technology are also termed as information processing, data processing, and even as the processing of knowledge, we are tempted to think that data, information and knowledge are the same entity. But it certainly is not so, even though the content of the term information is controversial to this day".

Knowledge can be incorporated in physical or human capital. If we intend to show the importance of human capital with the help of the number of "information workers", then it is not new that the advanced economies have had an increasing human capital stock ever since. The importance of IT as a significant cross-sectional technology and an unavoidable technology endowment for many future jobs should not, however, be underestimated. But has every employee whose workplace requires electricity therefore been an "energy worker" in the past?

3.2.4 Summary

Summarising, we can say that evolutionary theory has clarified the "naive" concept of technology as presented by neoclassical growth theory. Evolutionary theory gives more attention to the sectoral pattern of technological progress ("technological fields"). It also forecasts that globalisation increases the speed of structural change, since countries will specialise in their respective fields with technological advantages. In the long run, however, divergence of sectoral structures is predicted due to the lack of technology diffusion between countries.

The concept of IT being a basic innovation is not convincing because knowledge is not created by IT but by R&D. New ideas lead to product and process innovations which in turn lead to an improvement of existing technology or to the creation of new technologies like, for example, transport technology, biotechnology, environmental technology and IT. But there is no *a priori* theoretical reason to credit IT with greater achievements in technological progress than other fields of technology.[25]

3.3 The New Theory of Trade, Economic Geography and Growth

3.3.1 Technology and Increasing Returns to Scale

The realisation that it seems to be an inadmissible simplification to regard technological progress as exogenous, of course, was not reserved only for the authors of the evolutionary theory. The assumption of decreasing marginal returns and constant returns to scale in the neoclas-

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(Continuation from p. 550) rightly associates the contemporary economic transformations with computers, software, and telecommunications. But economic theory is still lagging behind: while interesting industry case-studies are available, and sophisticated multi-sectoral growth models have been developed, a systematic exploration of the role played by rising sectors in economic growth is still lacking. It is to be hoped that research on innovation and development will fill this gap over the next few years".

[23] Borchardt (1977), Maddison (1991)

[24] See Nefiodow (1996) and the Federal Ministry for Economy (1996). For a critical discussion of the view that IT is a basic innovation, see Gordon (2000).

[25] In this connection, "Solow's paradox" has been mentioned, see David (1990). Contrary to the widespread reception of rapid technological progress in the form of modern IC-technology, there are hardly any indications for the same in productivity statistics at both the microeconomic level and the macroeconomic level. Concerning the macro-data, see Jones (1998: 41) and Gordon (2000), and for micro-data, see the bibliographical reference in Picot et al. (1996: 187) and Krcmar (1997: 1).

sical production function, however, is problematic when one attempts to model endogenous technological progress. According to Euler's theorem, the revenue produced is wholly distributed among the production factors labour and capital. Under these assumptions, there is no scope for the compensation of the "production factor" technology. Furthermore, technology can not be regarded as a private good, as the application of one particular kind of technology in one particular firm does not necessarily imply the exclusion of that same technology in another firm. Thus, technology must be regarded as a non-rival good.

However, if exclusiveness can not be guaranteed (for example, by patents), private business will have no incentive to carry out product or process innovations. Technological progress can then only come about as a positive externality in the process of factor accumulation. If, on the contrary, it is assumed that at least a partial exclusiveness can be established, then the paradigm of perfect competition appears unsuitable. This is because innovative work is usually accompanied by very extensive R&D activities which the markets should later reward with extra profits. Accordingly, we can expect that, after the successful implementation of an innovation, high fixed costs of a given firm spent on R&D subsequently lead to decreasing average costs and increasing returns to scale.[26]

Thus, two concepts might be of use in order to examine increasing returns to scale and endogenous technological progress. The first case leads to economies of scale external to the firm as emphasised by Marshall (1920); and the second, to economies of scale internal to the firm and to models of monopolistic competition (Dixit and Stiglitz, 1977). Both cases should be outlined with regard to foreign trade, structural change and growth.[27]

3.3.2 Economies of Scale and the New Trade Theory

External economies of scale could be seen as the result of a concentration of firms in one region (agglomeration), establishing a number of benefits for all the local firms — benefits in the form of "better" infrastructure facilities, a "better" qualified work force, a "better" exchange and flow of information, and "better" access to the supply and labour markets. Another possibility is the existence of dynamic increasing returns to scale based on learning effects which lead to declining unit costs subject to the cumulative production level of an industry. One explanation is the cumulative character of knowledge which does not depreciate in production (learning by doing). In any case, each firm considers the increasing returns to scale within an entire industry as given. As far as the overall economy is concerned, external economies of scale within one or more sectors determine a transformation curve having either a partially convex or wholly convex course. In the case of foreign trade, this would lead to specialisation; however, it is not clear from the onset which country is going to specialise in the production of which commodity. The structural change caused by foreign trade is not determined by comparative cost advantages, it is instead directed by random events and sheer coincidence.

Krugman (1979) has shown that internal economies of scale could, if combined with the assumption of monopolistic competition, give us a simple explanation for intra-industrial trade even though there might be no traditional causes for foreign trade. The main component is the assumption of heterogeneous goods and horizontal product differentiation desired by consumers. In autarky the level and variety of production are determined by a "trade-off" between additional diversification and the accompanying fixed costs for each new product line. If the borders between two countries are opened, then product variety could increase without the two countries having to deal with additional fixed costs due to the expansion of the market. The increase in the variety of products will be the only consequence of foreign trade: there will be no terms of trade and real income effects. Krugman's model, however, does not provide any answer on the pattern of intra-industrial trade. This trade is determined by the course of history and by accident (Obstfeld and Krugman, 1997: 139).

In recent years, Krugman's original contribution has initiated further models under the general heading "new trade theory" (Helpman and Krugman, 1990). These models show that two similar economies with no comparative advantages will become increasingly engaged in intra-industrial trade.[28] Distinguishing between intra-industrial trade caused by horizontal product differentiation (that is, the supply of different varieties of a product belonging to the same quality grade) and vertical product differentia-

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[26] In an interview with American Secretary of Finance, Larry Summers, we can see the importance of using models dealing with increasing returns to scale for the discussion about the consequences of IT. On being asked what might be new about the "New Economy", the former Harvard economist replied, "It is the rise in the number of products that are manufactured at high fixed costs and low variable costs. ... This changes the structure of competition. Under the conditions of the New Economy, I find it difficult to maintain the paradigm of perfect competition".; excerpt in: Süddeutsche Zeitung, 26th July 2000 (authors' translation).

[27] See Junius (1999: 63 ff.) for a detailed typology on economies of scale and a review of the literature on its empirical relevance.

[28] Apart from examining an industrial sector in which heterogeneous products are manufactured under conditions of monopolistic competition, Helpman (1981) also takes into account a traditional sector producing homogenous primary goods. His model can explain the parallel emergence of inter-industrial trade based on comparative advantages and intra-industrial trade based on product differentiation. As in the Heckscher-Ohlin model, comparative advantages are established with the help of diverging factor endowments. In the event of the differentiated product being more capital-intensive, the country relatively richer in endowment with capital will have a comparative advantage in the industrial sector.

tion (that is, the supply of various quality grades of the same product), it is possible to show that not only the level of income but also the distribution of income influences the structure of foreign trade. It follows from this that a similar distribution of income within the trading countries will be conducive for intra-industrial trade (Broll and Gilroy, 1994).

3.3.3 Economies of Scale, Transport Costs, and New Economic Geography

The interaction between increasing returns to scale and trade costs is the subject of the so-called new economic geography (Ottaviano, Puga (1998), Fujita et al. (1999), Schmutzler (1999)). A special feature found in the new economic geography is the emergence of the "home market" effect. According to this, the size of the domestic product markets plays a decisive part in the determination of which products will be exported. Krugman (1980) shows that under increasing returns to scale, manufacturers of a differentiated product would locate their production near a larger market. The reason is that economies of scale offer the incentive to concentrate production in one place, whereas the choice of the larger market as the production site would mean that trade costs for the majority of sales would lapse. Krugman's primary model originates from the assumptions that two countries are identical in relation to their size (number of workers), and the size of a market is the consequence of diverging consumer preferences. This leads to a result which at first appears to be quite paradoxical, namely that a huge domestic demand for a particular product will also make this product an export commodity. An elaboration of the "home market" effect is presented in the works of Krugman and Venables (1995), Krugman and Venables (1996), and Venables (1996), in which they consider "forward-backward-linkages" between vertical production stages. In effect, given the existence of trade costs, increasing returns to scale and imperfect competition, these models establish tendencies towards international agglomeration after the opening of borders. Thus, the fears of experts who see trade between a larger and a smaller country as disadvantageous for the smaller country could be theoretically justified.[29]

Trade costs play a decisive role in these models:[30] if trade costs are too high, the need to supply domestic markets proves to be an obstacle to the concentration of firms in one single place. In the case of medium trade costs, there are advantages of an agglomeration, accompanied by stronger competition of scarce or limited production factors and commodities. Rising factor and goods prices, however, induce yet further agglomeration owing to the immigration of mobile factors of production. Should the trade costs decline further, national characteristics such as immobile factors and non-tradable goods would regain their significance of counteracting the advantages of agglomeration.

3.3.4 Economies of Scale and the New Growth Theory

The new growth theory maintains the distinction between internal and external economies of scale. In the so-called AK-models of Romer (1986) and Lucas (1988), technological externalities in the process of (human-)capital accumulation are responsible for increasing returns to scale. Hence, upon the opening of borders to foreign trade, it seems quite natural to ask: To which economic area could external effects be confined? Lucas (1988: 37), for instance, holds that limiting external effects to the political unit "nation" is arbitrary. Some models, however, assume that external economies of scale could be restricted to a single country and determine dynamic comparative advantages, trade structures and technological progress simultaneously (Krugman (1987), Young (1991)). One major implication of these models is, as repeatedly emphasised by supporters of the evolutionary theory, that a particular specialisation tends to reinforce itself. A country experiencing increasing returns to scale in one of its industrial sectors will be able to manufacture that particular product with declining average costs upon acquiring new markets by way of foreign trade. Thus, the convergence of trade structures and growth rates, as predicted by the neoclassical theory, will not take place.

Another possibility to model the relation between endogenous technological progress and dynamic comparative advantages can be found in the assumption of internal economies of scale and the introduction of a research and development sector into the models (Romer (1990), Grossman and Helpman (1991), and Aghion and Howitt (1998)). The connection to the neoclassical trade theory is established by taking into consideration two or three sectors (the traditional sector of manufacturing consumer goods, the manufacture of intermediate products, and the R&D sector), diverging factor intensities in the production processes (qualified and unqualified labour), and diverging factor endowments between two countries. The connection to the new trade theory is established by taking into consideration imperfect competition in the production of horizontally or vertically differentiated intermediate products. Rivera-Batiz and Romer (1991), for instance, demonstrate that intra-industrial trade of intermediate products that incorporate the technological achievements of both countries will boost economic growth. This, however, is true only as long as the level of technology in both countries is considered to be equally advanced. Integration between two countries having different technology

[29] One Example for such an international agglomeration is the European "Hot Banana" (the area between Milan and London, containing Northern Italy, Southern Germany, South East France, the Ruhr area, the Ile de France, Belgium, the Netherlands, and South East England), see Ottaviano, Puga (1998).

[30] Davis (1998), in addition, shows that not only the magnitude but also the structure of the trade costs is important.

levels would cause the more-advanced country to specialise in R&D, and the less advanced country to specialise in the traditional sector. As a consequence, the growth rates would diverge, subsequently also leading to a divergence in the intra-industrial trade structure.

Even if we include the possibility of inter-industrial trade, the impact of foreign trade on trade structures and growth depends on whether technological externalities can be confined to the borders of the respective countries (and also on whether factor price equalisation is possible). If there is no complete international technology transfer initial conditions such as the size of a country and its technology level determine the course of dynamic comparative advantages. One country would then produce in a steady state without possessing a high-tech sector, and would therefore show even lower growth than it would have under autarky. In this case, the government's attempt to avoid losing industrial activities with economies of scale (that is, the high-tech sector) to foreign countries is theoretically justified (Grossman and Helpman 1991: 258).

3.3.5 Conclusion

On the basis of the new theory of trade, economic geography and growth, the fundamentals of which have been presented only roughly in the above sections, the following conclusions can be made: first, intra-industrial trade, spatial concentration of economic activities, and endogenous technological progress which cannot be explained by neoclassical theory, can be well-founded at a microeconomic level and elucidated within the framework of general equilibrium models. Second, these models come closer to reality than neoclassical theory, but at the expense of clear-cut statements concerning the relations between foreign trade, structural change and technological progress. Processes of convergence at an aggregate and a disaggregate level, as projected by neoclassical theory, are not inevitable even if there is complete price and wage flexibility. In this manner, the models formalise those concepts which have been already emphasised by the evolutionary theory. Third, it is possible to infer a positive role of industrial policies. The effects on economic welfare, however, depend on the choice of the model, and the assumptions on international technology diffusion, and factor price equalisation. Recommendations with regard to economic policies are thus very limited, or as stated by Aghion and Howitt (1998: 268): "In the end, we are left with a lot of possibilities".

3.4 The Theory of the Multinational Firm

3.4.1 Exports, Licensing, Direct Investments

The above discussion focussed mainly on the trade of goods (and services). However, a distinct feature of globalisation is an increasing exchange of capital between the countries involved in international trade (Obstfeld (1998)). A topic of great interest is the transfer of capital in the form of foreign direct investments. Besides the transfer of capital, foreign direct investments also include the acquisition of information-, control- and property rights. Thus, it might be misleading to regard foreign direct investments as only one way of transferring capital.[31]

A widely cited theory on foreign direct investment is the so-called OLI-Theory by Dunning (1980, 1988). According to this theory, exports, foreign direct investments and awarding of licenses represent alternative means of supplying a foreign market. Which particular alternative a firm will then choose depends on the existence of firm-specific (ownership), location-specific (location) and internalisation-specific (internalisation) advantages. The existence of firm-specific advantages is a necessary but not sufficient reason for foreign direct investments. A firm could also exploit these advantages by the export of goods or by awarding the respective license to a foreign company. However, exports would probably face hindrances in the form of trade restrictions or high trade costs. On account of the intangible nature of firm-specific advantages like know-how or management skills, the awarding of licenses might be omitted because the enforcement of property rights can only be achieved at extremely high costs (see section 2.2 on the so-called information paradox). Only when location-specific advantages arise in addition to firm-specific and internalisation-specific advantages will a firm decide to venture a foreign direct investment. The OLI-Theory, however, has the shortcoming that it does not allow any deliberations on the precise determinants of firm-specific, location-specific and internalisation-specific advantages.

3.4.2 Direct Investments and Structural Change

It is necessary to switch over to general-equilibrium models if we are required to deal with the effects of foreign direct investments on the sectoral structure of the economy (Ethier (1986), Markusen (1995), Markusen and Venables (1995)). In general, these models are based on neoclassical or new trade theory, however, they also integrate the horizontal and vertical internalisation decisions of multinational firms. Without going into details, these models show that the existence of multinationals has an impact on the structure of international trade patterns. Besides trading on an inter- and intra-industrial level, multinational companies also establish intra-firm trade. With Ethier's (1986) and Markusen and Venables's (1995) models we can even derive a "convergence-hypothesis" which maintains that intra-firm trade steadily gains significance

[31] This aspect of foreign direct investments was already recognised by Hymer (1960). See Jungmittag (1996:, 44 ff.) for a comprehensive survey of the literature.

over inter- and intra-industrial trade with rising equalisation of the parameters country size, factor endowment and technology level of the trading partners. According to UNCTAD figures, at present around one-third of the world's trade occurs within multinational firms.

4. Summary

This paper has provided a selective survey of different economic theories in order to discuss the relationship between globalisation and modern IT and structural change, economic growth and a nation's competitiveness. In section two, we attempted to clarify the role which IT plays for globalisation. In section three, we discussed how globalisation and technological progress in the IT sector influences structural change, economic growth and national competitiveness according to various theories.

The decline brought about by IT in trade costs will further enhance the existing trend of increasing trade in goods and services. However, it cannot be determined exactly which goods and services will be involved in this process, as it is not known which sectors will face the most substantial reductions in trade costs due to IT. One hypothesis is that the rise in services trade will be greater than the rise in goods trade. Furthermore, modern IT does not just influence *if*, but also *how* foreign trade is carried out. Once again, it is not possible to determine exactly whether IT has a positive impact on foreign direct investment, or whether not the export of a commodity or the awarding of licenses represents a more cost-effective option. The role of IT in the reduction of transaction costs, however, should not be overrated because even IT will not be able to overcome the problems of uncertainty and asymmetric information which are the subject matter of institutional economics.

Globalisation initiates structural change. In the long run, however, conclusions with respect to convergence or divergence of factor endowments, production patterns and income levels seem to depend on the choice of the theoretical model. Based on neoclassical theory, clear-cut predictions could be made with regard to comparative advantages and the convergence of income levels. In addition, according to this theory, globalisation is always welfare-enhancing. If, on the contrary, one invokes the evolutionary theory or one of the models from new trade and growth theory in which external economies of scale play a role, globalisation entails the risk that countries get "locked in" to undesirable patterns of specialisation and can even lose from foreign trade. The new economic geography shows that there may be a U-shaped relation between globalisation and economic development. Models of new trade and growth theory with internal economies of scale point to the fact that the gains of globalisation lie not only in the international division of labour according to comparative advantages but also in the variety of final and intermediate goods available.

Finally, in discussing the role of IT for growth of the aggregate economy we have to distinguish between the direct effect due to capital deepening and the spillover effect. Since capital deepening means purchases of IT investment goods by firms, we should expect that these firms are able to judge the growth prospects offered by IT. Thus, there is no need for a special policy approach for firms involved in the manufacture and supply of IT products. If, on the other hand, the IT sector generates technological spillovers, then a special economic policy treatment is justified. Nonetheless, one has to keep in mind that as long as the external economies of scale of IT are not confined to national boundaries, there is no reason to see the lack of a domestic IT sector as a competitive disadvantage. The same is largely true if IT products are tradable and produced under internal economies of scale.

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Zusammenfassung

Informations- und Kommunikationstechnologien, Globalisierung und Wettbewerbsfähigkeit: Ein selektiver Überblick

In diesem Beitrag werden aus der Sicht verschiedener ökonomischer Theorien die Rolle von IuK-Technologien für die Globalisierung und die Frage diskutiert, wie Globalisierung und IuK-Technologien den Strukturwandel, das Wirtschaftswachstum und die nationale Wettbewerbsfähigkeit beeinflussen. IuK-Technologien führen zu einer Reduktion der Distanzkosten (Transport- und Transaktionskosten) und verstärken damit den langfristigen Trend eines stark wachsenden internationalen Handels mit Gütern und Dienstleistungen. Das Aufbrechen der Wertschöpfungskette wird in Zukunft an Bedeutung gewinnen, so dass weltweit der für jede Produktionsstufe günstigste Standort gewählt werden kann. IuK-Technologien beeinflussen aber nicht nur die Frage ob, sondern auch wie der internationale Handel zunehmen wird. Globalisierung und technischer Fortschritt beschleunigen den Strukturwandel. Prognosen darüber, ob es langfristig zu einer Konvergenz oder Divergenz in den Faktorausstattungen, den Produktionsstrukturen oder dem Einkommensniveau kommen wird, hängen jedoch vom zu Grunde gelegten theoretischen Modell ab. Eindeutige Aussagen über die Richtung des Strukturwandels und die Konvergenz von Technologie- und Einkommensniveaus sind lediglich auf Basis der neoklassische Theorie möglich. Bei der Diskussion um den Beitrag der IuK-Technologien für das gesamtwirtschaftliche Wachstum sind Kapitalintensivierung und Spillovereffekte zu unterscheiden. Da Kapitalintensivierung den Kauf von IuK-Gütern für die Produktion umfasst, kann davon ausgegangen werden, dass Unternehmen um die Wachstumsperspektiven wissen, welche die IuK-Technologien offerieren. Es besteht dann keine Notwendigkeit, den IuK-Technologien produzierenden Unternehmen eine besondere wirtschaftspolitische Stellung zu geben. Erzeugen diese Unternehmen jedoch technologische Spillovereffekte, ist eine gesonderte wirtschaftspolitische Behandlung gerechtfertigt.