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The product-cycle revisited: Some extensions and clarifications

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The standard version of the product-cycle hypothesis is widely used but suffers from several shortcomings: It never worked out in detail the relative importance of demand and supply factors, the elements which make a product a "new" one, the way mature products are transferred to the periphery and the characterization of the types of goods following the cycle. This paper investigates these questions and proposes a probabilistic version of the product-cycle.

The regionalized version of the product-cycle is widely used: in International Economics[1], in Regional Economics[2] or in Economic Geography[3]. According to that hypothesis new products are born in agglomerations, and their production filters down to the less developed regions in lockstep with the aging of the product. It has never been an undisputed theory, however: *Vernon* (1979) believes that the product-cycle hypothesis has lost much of its earlier explanatory power: multinational corporations have become more important, the transfer of knowledge has accelerated, and national markets are increasingly growing together to one worldwide market. Other commentators are less critical but they consider the product-cycle hypothesis as a proposition rather than a hypothesis or even a theory: Things may or may not follow that course. This lack of persuasive power of the product-cycle hypothesis may be due to four shortcomings: It has never been worked out in detail

- how demand, supply and information play together in generating the product-cycle;
- what characterizes a "new" product;
- why and how aging products are transferred to less advanced regions and what are the preconditions of this transfer – especially in the receiving region;
- which goods follow a product-cycle.

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[1] *Lall* (1980), 147 - 74.
[2] *Palme / Jeglitsch / Schneider* (1984), 54 - 177.
[3] *Auty* (1984).

This paper attempts to alleviate these shortcomings: The first point by surveying the literature and combining the different proposals, the other three by some further research.

1. Demand and supply factors constituting the product-cycle hypothesis

The idea central to the product-cycle hypothesis is the introduction of new-product technology as a third factor of production, in addition to labor and capital. The different elements have been developed over a long period of time: *Schumpeter* (1911) put heavy emphasis on new products arising from a process of endogenous innovation[4]. But his economy had neither a structural nor a spatial dimension and therefore no product-cycle. *Kusnets* (1930) and *Burns* (1934) added the structural dimension: The industry (product)-cycle as the law of industrial growth. A first idea of the spatial dimension – new-product technology as an immobile factor of production – can be found in *Vernon* as an explanation of the intra-U.S. division of labor: "Producing the unpredictable" is New York's comparative advantage, given its pool of specialists, of skills, of suppliers, of freight services, the speed with which solutions of problems can be achieved and the good chances of face-to-face contacts.[5] Much more important than the spatial dimension is *Vernon's* discovery of the role of information. *Posner* developed this idea further towards an information-lag product-cycle to explain the trade in manufactured goods among advanced countries: Comparative cost differences induce trade during the lapse of time needed by the rest of the world to imitate the leading countries' innovation.[6] Similar to Schumpeter *Posner* ((1961), 324) did not restrict himself to new products but treated new processes similarly.

Heuss (1965) neglected the spatial aspects, but was the first to describe the product-cycle phases (without using the term product-cycle) and to emphasize the importance of entrepreneurial behavior. He assumed inventions as frequent and stochastic, having a very low chance of realization; only ideas invented within an enterprise are better off.[7] It is the task of the initiative entrepreneur to realize innovations and to create markets for new goods.[8] This is done by the initiative pioneer. Other types of entrepreneurs are initiative imitators, conservative entrepreneurs reacting defensively,

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[4] *Tichy* (1984), 83.

[5] *Vernon* (1969), 68 - 73.

[6] *Posner* (1961), 324.

[7] 15 years later *Vernon* (1979), 256, emphasized that "innovations which do not arise out of a market stimulus – innovations, for instance, that are dreamed up by the laboratory as a clever application of some new scientific capability – have a relatively low chance of industrial success. See for instance *Nyers / Marquis* (1969), 31".

[8] "Nachfrageproduktion"; *Heuss* (1965), 30.

and conservative immobile ones.[9] These attributes are partly inborn, partly a function of age. Older persons are less initiative and less mobile.[10]

Hirsch (1967) added technical and skill elements in his Harvard-doctoral dissertation finished in 1965 but published later. As a student of Vernon – he reintroduced spatial aspects. Influenced by his work at the Ministry of Commerce and Industry at Jerusalem Hirsch started with the observation that small leading countries which lack a broad array of resources (D-countries) have the greatest comparative advantage in certain types of new products: These are characterized by intensive use of scientific and technical know-how which is relatively cheap in these countries and the relative insignificance of the contribution of managerial talents and capital. A-countries, the industrial leaders, have a competitive edge in products whose development and manufacture involve extensive utilization of external economies, capital and managerial inputs, and which need a large domestic market. C-countries, which are in the initial stage of industrialization, have a comparative advantage in mature products.[11] Hirsch, resident of a small industrialized but leading country (D-country) put some emphasis on supply elements: the availability of (relatively) cheap scientists and researchers for the creation of new products. *Vernon,* the resident of a large leading country (A-country in Hirsch's terminology) put more weight on demand factors:[12] Innovation occurs where the demand for new products is highest,[13] resulting from high income as a source to satisfy new desires (luxury goods) and as a cost factor (need for labor saving devices), where entrepreneurs are first aware of new opportunities to satisfy new wants and where more effective communication exists between potential market demand and potential suppliers.[14] So, in their early stage, new products are produced in high-income agglomerations as the price elasticity of demand is low and swift and efficient communication with customers, suppliers and competitors is necessary. When the product gets standardized and price elasticity increases, labor unit costs become of prime importance and production moves to low income countries.[15]

The standard version of the product-cycle hypothesis combines the supply and demand factors developed over three decades: Goods are born in high-income countries and transferred to less and less developed ones the more they themselves and the production processes get standardized. The countries with the highest income produce a continuous flow of new products,

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[9] *Heuss* (1965), 10.
[10] *Heuss* (1965), 11.
[11] *Hirsch* (1967), 32 - 41.
[12] *Vernon* (1966).
[13] See footnote 7.
[14] *Vernon* (1966), 192 - 93.
[15] *Wells* (1969).

lower-income countries receive mature goods almost automatically in an endless, deterministic process. This textbook version pretends an idyllic world of growth and peaceful division of labor! Necessarily several facts do not fit into this nice picture: *Krugman* (1979) emphasized that pull factors are responsible for the transfer process: Standardized goods are not given away by the high-income countries deliberately but they are pulled away by low-income countries. If high-income countries are not able to find and to introduce enough new goods they may fall back in income and wealth. *Nelson / Winter* ((1982 b), 131 f.) found some likelihood that successful imitators may overspeed inventors. *Auty* ((1975), 1984, 327) emphasized a polarization effect: Growth of demand and production increase productivity and cut costs while slackening demand decreases productivity and investment (Verdoorn law). So the transfer of standardized goods to the periphery may not happen at all, and for core regions the danger of factory fossilization rises if they fall back in growth for a while. *Stobaugh* (1977) added a technical factor, a form of a technological production cycle:[16] Scale economies rather than technical complexity hinder the diffusion of new-product technology to low-income countries; foreign plants are feasible not till the foreign market is large enough to keep busy a plant of (minimal) optimum scale. *Vernon* (1979), *Awerbuch* (1984) and *Auty* (1984) emphasize a similar factor on the demand side: Low income countries take over the production of standardized goods more because home demand for that good has risen rather than because of low wages.

While the "classical" product-cycle comprised three stages: pioneer, growth and maturity, the recent experience of stagnating growth, structural problems and emigration of traditional production processes to the third world made several authors conscious of a fourth phase: eclipse.[17] So the product-cycle was regarded as a full cycle for the first time.[18] But the same facts made it obvious as well that the market structure changes considerably in the maturity phase: Industries concentrate, quite often they turn into state-controlled enterprises or are subsidized or sheltered by the government. Barriers to exit arise which in several ways may work themselves out.

In its most advanced form the product-cycle hypothesis may be condensed to the following table (adapted from Auty 1984, 328):

These characteristics are not highly disputed, even if the eclipse phase and its consequences, however, have not yet been integrated into the textbook version of the product-cycle hypothesis. Still unresolved, however, are the

[16] The same idea has proven extremely useful in international trade theory. See for instance *Krugman* (1980).

[17] *Auty* (1984), 328.

[18] *Heuss* (1965), 85 - 104, was the only earlier author who mentioned a phase of decline ("Rückbildungsphase").

Product-cycle stage

	Pioneer	Growth	Maturity	Eclipse
Growth	high, erratic	high	moderating	slow, contracting
Risk	high	declining	low	increasing
Market structure	oligopoly	declining oligopoly	competition	concentration state monopoly
Product strategy	single product	single product	dominant product	diversification, subsidized single product
Spatial strategy	home	home + export	home + foreign subsidiary	import substitution, protection
Dominant factor of production	information	skilled labor	capital	unskilled labor
Income elasticity	high	high, declining	declining	low
Price elasticity	low	low, rising	declining	low

conditions necessary for the birth of new products ("seedbed") as well as the likelyhood of a transfer of standardized goods to the periphery and the conditions improving or complicating this process.

Collecting the several demand and supply elements proposed by different authors to explain the first phase of the product-cycle the following pattern emerges:

Demand elements: Demand for new products is said to arise primarily in the most advanced (high-income) market. Several reasons are given:

- Life style and fashion are considered more important in high income agglomerations and only there people can afford to live according to these preoccupations (Vernon).
- New products become necessary in agglomerations for technical reasons as a consequence of congestion, pollution, the need for quick communication, information etc. (Vernon).
- High and rising labor cost bring about increasing demand for labor-saving and do-it-yourself devices (Vernon).
- New products have a very limited market initially: they can only survive in agglomerations where home demand is higher and out-of-region demand is attracted by high accessibility (Auty, Awerbuch).

Supply elements: New goods are developed and produced in agglomerations because:

- Information is necessary to detect new demand and to develop new products. Most of the necessary information results out of face-to-face contacts.[20] It can not be transferred by standard means of communication before the new product has found a standardized form (Heuss, Vernon).
- The market stimulus to develop new products is strongest for those producers close to the market and the investor is most likely to respond to demand for goods with which he is familiar (Heuss, Vernon).
- The means to develop and supply a new product are to be found predominantly in high-income agglomerations. They are most likely to provide the services of different specialists for R &D, construction, design, maintenance, service and marketing (Hirsch, Posner).
- Even if high-income agglomerations should provide every simple activity at higher cost than other regions, their comparative advantage can be found in creating, developing and producing products in their pioneer phase.

It is important to be aware that the informational advantages of agglomerations concern demand and supply. Inhabitants of agglomerations are in a better position to detect new needs and new demand and they are in a better position to develop goods and processes to satisfy the new demand.

For the gradual filtering down of more and more developed products to the periphery again both, demand and supply factors are responsible:

Demand elements:

- Demand for developed products increases steeply in most cases as their price falls (Vernon); so additional large plants are necessary.
- Plants in other countries are built when home demand is large enough to justify a plant (Auty, Awerbuch, Krugmann).

Supply elements:

- The increasing standardization of the product requires less skilled labor and less information.
- The growing demand requires more production facilities which are lacking or expensive in agglomerations.
- The factors of production needed in later phases of the product-cycle are available and cheaper in the periphery.

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[19] Omitted.

[20] Concerning the importance of face-to-face contacts see *Westaway* (1973), 147.

Several questions concerning the smoothless functioning of the product-cycle, however, remain unresolved by the standard form of the hypothesis:

- Not every agglomeration innovates at the same rate, not every firm in an agglomeration innovates, and some firms innovate which do not reside in agglomerations.
- If the pioneer and the growth phase of the product-cycle are sustained by the most initiative entrepreneurs, the maturity and eclipse phase by conservative ones: by what mechanisms do the initiative ones concentrate in the agglomeration, the conservative ones in the periphery?
- Can agglomerations continue to produce new products in an endless process, or can they loose their innovative power and, as a result, their leading income position? And if they loose it and fall back to a later stage of the cycle, is this aging of agglomerations a normal or a pathological process?
- To what extent and under which conditions can industrial countries innovate, which are second or third in income, and/or small? Has Hirsch (1967) offered a useful explanation in arguing that these (D-)countries have a relatively cheap supply of researchers, a hypothesis not followed by the standard version of the product-cycle hypothesis?
- To what extent can economies of scale (Stobaugh), Verdoorn's law (Auty) or reverse engineering hinder the filtering down of the products?

These unresolved questions reveal that the standard hypothesis emphasizes some important conditions but the set is surely not sufficient. Some of the conditions may not even be necessary. Therefore: What are the specific conditions necessary for successful development and production of a new product and its later transfer to the periphery?

2. What is a new product?

Fundamental for an answer to this question is the definition of "new". *Hirsch* ((1967), 17) following *Kuznets* ((1953), 254) defines "new" as involving a revolutionary invention or a discovery which changes the industrial process fundamentally. This definition is too technical and too rigid:

- It is too technical as a product, technologically similar to a previously existing one, may be "new", nevertheless, if it is designed for different needs and/or sold on different markets: The typical motor-cycle of the fifties was a very similar product to the one of the eighties – technologically. But in design and marketing it is a completely different product: the motor-cycle has changed from the old product "poor-man's means-of-transportation" to the new product "rich-man's sport-kit". It is sold for different needs. The same happened when Asian watches pressed into the

Swiss-dominated market: It was a different – a cheaper and non-exclusive – product which sold on a very different market.

– It is too rigid as the newness of a product need not exist in product characteristics. The product may have already existed but it had not been offered on markets: *Stigler* ((1951), 188) observed that "new" products may arise out of the growth of markets: Products and services (e.g. maintenance) a firm had to provide by itself as long as they were firm specific needs with no market, can be offered as separate (and therefore "new" in the sense that they had never been supplied before) products when the aggregate demand of several firms is large enough to afford production by "specialists". A new market for a good – existing before but not marketable – may arise for other reasons as well: A new technology e.g. may offer economies of scale, so that specialists can work cheaper. Or the new good saves time for the user (prefabricated food, ready-mix concrete) or makes organization easier.

Therefore it would be appropriate to use a wider and more flexible definition: "New" goods are goods which either have not existed before or which were newly designed to suit a new group of purchasers or which are technologically different from previous goods in a way relevant for the purchaser. It is important to note that this implies a hierarchy of novelty from completely new (e.g. electric current or electronic chips) to major innovations (e.g. electronic pocket calculators) to moderately new products (e.g. gas lighter relative to the old gasoline lighter). This hierarchy is important insofar as one can assume that an innovation is the more likely to happen outside of an agglomeration the less important it is, the less skill and interdisciplinary information – especially the less face-to-face communication – it needs, and the more production-oriented its character is. On the other hand: Even small modifications which are too small to justify the name "new product" (e.g. a new car model) may need the agglomeration as its birth place if they are heavily market-oriented.

Concluding we have to make a first addition to the traditional product-cycle hypothesis: *"New" and "old" are not alternatives but extremes* on a spectrum of possibilities. Innovations can be large or small, they can be process or product innovations and if they are the latter they can have more technical or more marketing character; they may address themselves towards producers or consumers.

3. Elements of a theory of product creation

The traditional product-cycle hypothesis proposes that the creation of new products and new processes is restricted to agglomerations. The conclusion of section 2 reveals that reality is much more manifold and complex:

The information relevant for process-innovations is most likely to exist where the production is located, for marketing-innovations where the market is. For a third group of innovations the availability of research skill appears to be crucial. Typical examples for those innovations are goods to substitute scarce materials (synthetic rubber, liquefaction of coal) or the differentiated products developed by the specialized industries in Hirsch's D-countries. It is remarkable, however, that these products, even if developed in D-countries, are produced there only when demand is limited (pulver metallurgy). If large scale production and marketing is required (video-recorder, compact-disk), the production is transferred to low income countries, most likely to dependent plants.

The different degrees of newness, the varying information requirements and information levels propose a second modification of the standard product-cycle hypothesis: Firms can innovate and actually do innovate *everywhere,* but the conditions for successful innovations are *better* in agglomerations if the innovation is primarily market-oriented and addresses itself toward consumers or non-differentiated large groups of producers. Only certain types of innovations are restricted to high-income agglomerations. But even in agglomerations only a part of the firms actually innovates (successfully), others don't. They apparently do not use or cannot use the information supply of the agglomeration. *Nelson / Winter* ((1982 a), 135) argue that "highly flexible adaptation to change is not likely to characterize the behavior of individual firms. ... As a second approximation firms may be expected to behave in the future in ways that resemble the behavior that would be produced if they simply followed their routines of the past". So the average firm does not appear as highly innovative, not even in agglomerations. What are the conditions that make a firm most likely to innovate and where do these conditions prevail? In addition to the information and skill requirements extolled by traditional product-cycle explanations, four groups of arguments may be relevant: challenge, information, organization, and skill to transform needs into products or processes.

3.1 Challenge (CH)

As innovations are costly and risky and entrepreneurs normally tend to follow routines the innovative process needs a challenge to start. Innovations therefore occur most likely when the pressure to innovate is highest and therefore most new products are born as the result of a challenge. When this occurs, is an open question for economic theory. Three challenges may be relevant:

CH 1 Lack of profit: According to Schumpeter pressure to innovate results from the fact that only new products can earn a positive rate of profit. The

risks involved in the creation of new products result from the fact that prices and costs are very difficult to predict. So innovations concentrate in equilibrium phases of the business cycle,[21] the phases in which the system of relative prices is reasonably stable and therefore predictable. In this case no geographical preferences for innovations exist.

CH2 Competition from low-cost producers: The challenge implicit in traditional product-cycle theory is the risk of loosing a product to a cheap imitator. So entrepreneurs innovate when the risk of an innovation is equal to or smaller than the risks inherent in their existing products. If entrepreneurs try to maintain a portfolio of old and new products with a constant risk-profit ratio, they have to innovate when old products get more risky and less profitable. It is more likely that this happens in periods of fast change than in equilibrium.[22] This challenge is more likely to occur in agglomerations where costs are higher and competition is more fierce. But a pressure to innovate may be felt equally well in regions lacking natural resources,[23] in D-countries under competition of both A- and C-countries (Hirsch) or in traditional industrial areas where rising wages enforce process-innovations to cut cost to remain competitive.

CH3 Reasonableness of the challenge: Not every challenge, however, is likely to accelerate the creation of new products. It does so only if it makes the disconcerted more receptive for new ideas and if it increases mobility. If the challenge is regarded as a threat, it creates uncertainty which is subjectively insurmountable.[24] *Heiner* ((1983), 562) has analyzed this situation as C-D gap, the gap between the agents' competence (C) and the difficulty (D) of the decision problem to be solved. If the problem is too big for the firms' competence, the managers try to reduce risk by centralization, by reducing the middle-managements' leeway and by more strictly limiting the risks they may take. The managers choose a mechanistic instead of an organic organization structure.[25] So the flexibility of the firm decreases in a period where more flexibility is needed, the creation of new products gets less likely. If the firm can survive at all, then by firing the top management.

3.2 Informational prerequisites (IP)

A challenge is necessary to increase the firms' willingness to innovate, information is necessary for the firms to respond to the challenge in a useful

[21] *Schumpeter* (1961), 144ff.

[22] *Tichy* (1985).

[23] It is not by chance that Switzerland or Baden-Württemberg belong to the richest regions with highly innovative production.

[24] *Roepke* (1980), 137, emphasizes that challenges which are either too small or too big have no stimulating effect.

[25] *Bourgeois / McAllister / Mitchell* (1978).

and creative way. According to *Magee* ((1977), 317f.) five types of information are necessary: Information concerning (a) product creation, (b) product development, (c) production functions, (d) product markets, and (e) appropiability of the results. For the questions dealt with in this paragraph information according to (c) and (d) is less relevant. What are the conditions making it most likely to collect the relevant information (a), (b), and (e)?

IP1 Type of entrepreneur: *Casson* ((1982), 2) observed that the function of the entrepreneur is to coordinate under the condition of uncertainty, and to make markets. In both cases the entrepreneur collects information from very different sources, evaluates it, and uses it in a way other persons consider strange or even silly.[26] The personal characteristics of a person who is able to collect information from very different sources and to evaluate it in a very subjective way usually not shared by others are probably young,[27] unconventional, communicative, open minded, broadly interested and self-conscious but not too industrious. Idle time is of prime importance, at least ability and preparedness to forget every day's business to recline and meditate. Such a person should live at the place where the new needs originate, but this need not always be the agglomeration (see above).

IP2 Age of the firm: The second group of conditions making it more likely that useful information from very different sources comes together and is gainfully combined in unconventional ways concerns the age of the firm. A young firm having not yet established a hierarchical organization makes it more likely that people with very different tasks communicate with each other. *Nelson* (1962) observed that patents for a given industry follow a S-curve over firms and *Magee* ((1977), 322) found a negative correlation between R & D-expenditure (relative to sales) and the average age of the industry.

IP3 Location of the firm: As it has been proposed above, the informational prerequisites for consumer-market oriented innovations most likely exist in agglomerations, for process innovations in smaller firms under heavy competitive pressure, for research-intensive products where the facilities for research happen to be and where research is supported (or otherwise not too expensive).

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[26] The last point is very important as otherwise other persons would use the same information in the same way, create the same goods, make the same markets and so suppress any entrepreneurial gains right from the beginning. For the pioneer phase of the product cycle, the phase in which new products are created, a divergent or even deviating valuation of a certain information by the innovating entrepreneur is extremely important, much more than in the later phases: It prevents imitation and gives the innovator a lead, which in some cases may be considerable. But even if it is short, it is of crucial importance for survival.

[27] See *Heuss* (1965), 11.

IP4 Growth of the firm: Information from unconventional sources is more likely to come together in a fast growing firm. The organization must change continually in this case and so confronts the personnel with ever changing tasks. Additional personnel necessarily enters which has gained different experience in other firms, sometimes even in other branches. The technological processes also have to change in fast growing firms because of scale effects.

IP5 Product-cycle stage: The informational prerequisites for the creation of new products are better if the firm produces products in the first phase of the product-cycle. As new and unconventional problems have to be solved in this stage, people have to cooperate in a non-routine way and they frequently have to search for unconventional problem solvers and trouble shooters from outside and to cooperate with them.

IP6 New-product multiplier: It is important to note that a multiplier is built into argument IP5: Firms in an early stage of the product-cycle are most likely to get information from different sources and in this way are best equipped to create new products. This probably is the main argument underlying the standard product-cycle hypothesis: Firms which have started to create new products can – with some likelihood – continue to do so in a never ending sequence, they never age. The argument has at least some plausibility but it must not be overdone: Firstly, it is possible or even likely under these circumstances that information from very different sources is available but cannot be appraised and used because of lack of time and the pressure to concentrate on the problems having to be solved primarily. It may be easier to get an unconventional information under these conditions but more difficult to perceive, and even more difficult to evaluate it (see IP2). Secondly, with the passage of time the entrepreneur and the firm get older, both facts reducing the likelihood of innovations (see IP1). If they do change their organization, firms may later on come into the part of the firm cycle where administration kills innovativeness (see 3.3). If they manage, however, to find a perfect organization, successful firms' innovative period may last very long. This may happen with greater likelihood in an agglomeration where organizational skill is a more abundant factor of production and more specialists are available. But the chance that this happens is of course limited even in agglomerations.

IP7 Organization of the firm: Last but not least good conditions to collect and use information from very different sources may exist in a well organized older firm which rotates its management, has a very good organized information system and actively encourages a horizontal flow of information and horizontal cooperation among its departments.

3.3 Organizational requirements (OR)

The organization of the firm influences its ability to innovate much more thoroughly than its ability to collect information. The theories of organizational life cycles[28] state that "in general the pattern of (firms) development moves from emphasis on innovation and 'niche generation' to stability and institutionalization"[29] or from orientation on innovation and profit towards growth and preservation of existence.[30] *Adizes* (1979) has proposed a ten phased firm cycle characterized by variing importance of the firms' tasks: To produce results, to administer, to integrate, and to play the entrepreneurial role (creativity, risk taking). As the cycle proceeds, producing and entrepreneuring loose importance relative to administration. The step from one stage to the next can be done successfully only if the firm is able to solve the organizational problem inherent in the new stage.[31] Firms therefore can grow old only if they overcome all these passages.[32] The older they grow, however, the greater the likelihood that administrative functions dominate[33] and that entrepreneurial ones diminish.[34] An old firm may innovate but this is not very likely and needs an extremely good organization for several reasons. Firstly successful firms grow and therefore old successful firms are large. For large firms, however, it is difficult to collect and evaluate information in an unconventional way as it has been proposed above (IP2). Secondly the comparative advantages of large firms are in handling of information which can be better transmitted intrafirm. This is not the information concerning creation of goods but their improvement, production, and marketing.[35] Large firms therefore concentrate their R & D-expenditures more on development of existing and less on creation of new products.[36] The optimal firm size is smaller in young industries than in older ones.[37] Successful older and therefore larger firms almost necessarily concentrate their activity on products in later phases of the product-cycle. *Adizes* ((1979) 8), however, emphasizes that the more the product-cycle advances the less likely become dynamic entrepreneurs: The later stages of the cycle are domi-

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[28] For a survey see e.g. *Quinn / Cameron* (1983).

[29] *Lyden* (1975).

[30] *Mueller* (1972).

[31] *Greiner* (1972) demonstrates how organizations develop by way of crises.

[32] One can seize the size of the problems if one regards that half of the firms die within 1 1/2 years and the firms' mediums age is 7 years only *(Kimberly / Miles* (1980)).

[33] This behavior is the more likely to be tolerated by the markets as old firms – mainly because they grow slowly – do not need outside capital. So the firm can become more and more introverted, looking for and reaching more to its own needs than to market challenges.

[34] *Adizes* (1978), 8.

[35] *Magee* (1977), 323.

[36] *Mansfield* (1974), 150.

[37] *Nelson* (1962), 5; *Magee* (1977), 323.

nated by conservative entrepreneurs[38] which are in most cases neither willing nor able to search for new products. The chances for the firm to find new products are reduced further as old firms grow slower – as *Fizaine* (1968) has impressively demonstrated – and slow growing firms are less likely to innovate (see IP4).

Summarizing this discussion – which up to now has inadequately been integrated in the traditional version of the product-cycle – the following organizational requirements for innovations can be formulated:

OR1 Decentralized decision process: A firm is more likely to innovate the more able it is to collect and evaluate information and transform it into marketable products and processes. In most cases a decentralized process of decision making and a close continuous cooperation of the departments for research, production, marketing and sales may help toward this goal.[39]

OR2 Decision making where the information is: Much information is lost on its way through the organization. A decentralized system of decision making which simulates the structure of a small firm can avoid these problems. Empirical investigations suggest that large firms with a dezentralized production structure show up better than those with a centralised,[40] indicating that organizational slack may be more important in most cases than economies of scale.

OR3 Separation of the product-cycle stages: If a firm with aging products attempts to add never ones, it may be better to assign this task to a subsidiary with a younger staff and a more flexible organization.

OR4 Removal of barriers to entry: A firm is likely to loose its innovative capacity when aging but it can hinder this process by a very good organization. Regions loose this innovative capacity, with the firms operating in the region. Even if the firms age and loose their innovative capacity the region can retain it, if economic policy avoids monostructure, continuously removes barriers to entry and promotes the founding of new firms.[41]

3.4 Skill to transform information into products (ST)

In addition to a challenge that makes a firm willing to innovate, to information about market needs and technological possibilities, and in addition to organizational requirements for starting the process of innovation, skill is required to transform information about market needs and technological

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[38] The same observation can be found in *Heuss* (1965).
[39] *Rothwell / Zegfeld* (1985), 75.
[40] *Aiginger / Tichy* (1984), 145.
[41] *Tichy* (1987).

possibilities into marketable products and superior processes. The skill requirements are a complex mixture of technical and marketing factors. In Europe at least, most observers consider that marketing skills are a more serious bottleneck than technical and scientific ones.[42]

ST1 Continuity of innovative activity: Firms can learn how to organize finding new ideas and transforming them into marketable products, as can be seen in firms producing short-living goods, leisure goods (magic cube, skate board) or fashion goods. They must find a new idea and must produce new goods year after year. In industries which need not change their production program that frequently the absence of the ability to organize the process of innovation becomes evident only when these firms have lost their potential to develop completely new products. Several recent cases show how difficult it is to get this ability back again once it has been lost.[43]

ST2 New-product multiplier: If firms can manage to innovate continuously, the new-product multiplier described in IP6 sets in, the process feeds upon itself.

ST3 Innovation projects of appropriate size: It is very important for a firm to search for projects of a size matching its production and marketing capacity. If the project is too big, the firm will not be able to satisfy market demand. Either larger firms will step in and overspeed the small innovator because of their superior capacity to improve the product; or the innovator is forced to expand production extremely fast, straining its finance and even more its organization, becoming extraordinarily exposed to risk.

ST4 Innovation projects based on existing strength and know-how: The skillful firm better starts to ask which market needs it can satisfy, given its technological and marketing knowledge rather than to search in a general way for the "mankind's great needs" of tomorrow.

Industrial history suggests that the skill of a firm concerns the knowledge of markets and in the best cases a knowledge how to organize the firm to be able to follow changes of the market quickly. The knowledge of a firm almost never comprises the needs of the customers (as distinct from their demand). Established firms are better equipped in most cases to react to changes in demand than to react to changed needs. Drastically changed needs are normally satisfied not by the industry serving these needs before they changed but rather by an industry which is nearer to the production

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[42] See for instance J. Marcum: Technology and Economic Growth. Lecture delivered to the Economic Committee of the North-Atlantic Parlamentarian Assembly. See Handelsblatt 2. 5. 1985.

[43] Good examples are the German car manufacturers BMW und Volkswagen: Both had lost their ability to develop new models. In both cases the learning processes were successful but both needed outside managers and development personnel, a broad reorganization, large sums of money, and learning period of several years.

process necessary to satisfy the new needs. If there exists no such industry, completely new firms arise. Therefore pocket calculators and electronic watches were introduced by the microchip industry and not by the calculating-machines and watch industry, paper handkerchiefs by the paper and not by the textile industry, heating oil for households is distributed by the fuel and not to the coal distribution system, railways, automobiles and mimeografers are produced by completely new industries.[44]

The spatial consequences of the orientation of most industries to technical (supply) factors (described in ST 3) rather than to customers' desires are that new products may be born not in agglomerations but at the location of the industry which can serve the new desire from a technological point of view, or where research has been undertaken. In this way existing agglomerations may loose importance, and agglomerations of minor importance may gain importance. The shift of the center of gravity in the U.S. westwards and in Europe southwards may result therefrom. The old investment goods industry was less prepared to adjust to the electronic revolution than the precision tool and instrument makers. But even the existing precision tool firms were not able to adapt themselves easily. Rather the specialized skills of the region enabled new entrepreneurs to succeed in these new branches.

3.5 Conclusions regarding the origin of new products

Regarding all these considerations a third conclusion emerges which modifies the standard product-cycle hypothesis: Even for innovations of market-oriented and consumer goods the seedbed function of agglomerations is not obligatory. It depends on several characteristics, the most important of which is the existence of innovative entrepreneurs. Agglomerations tend to have a higher share of innovative entrepreneurs

- the more intensively the innovative potential of residents is challenged,
- the more innovative people imigrate,
- the more innovative entrepreneurs tend to found an enterprise there,
- the more likely difficulties to realize an idea and to expand the firm are solved there (low mortality rate of new products and new firms).

Given innovative entrepreneurs, agglomerations are the more likely to produce new goods

- the more different information is available,

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[44] One exception, cited by *Redlich* (1955), 64, is the Augsburg steam-engine producer Buz who promoted the Diesel engine, correctly anticipating its superiority over the steam engine.

- the more communicative the society,[45]
- the younger the firms, not so much in years, but in terms of the firm-cycle stage,
- the greater the number of firms in the early stages of the firm-cycle,
- the less hierarchical the firms' organization,
- the more goods are produced in an early stage of their production cycle,
- the more manifold the production processes,
- the more the environment changes perpetually but not too seriously so and in not too big jumps.

Even agglomerations fulfilling all these criteria may fall back and have to give the lead position to another area if a technological revolution or a major change in consumer preferences favors industries not resident in the area, as normally industries are caught in their prevailing technology.[46] Monostructured agglomerations[47] are likely to have great difficulties to create new products. The chances of diversified agglomerations of a lower order to do so are not too bad, however, especially if they try to create products which do not sell to people in the highest income strata. The comparative advantages of lower-order agglomerations can be found in inventing new investment goods or in diversifying already existing goods. Even pure industrial areas without the diversified supply typical for high income agglomerations may innovate: The innovations most likely in these areas are process innovations.

4. Elements of a theory of the transfer of standardized products to the periphery

The third unresolved question of the standard product-cycle hypothesis concerns the transfer of standardized products from the agglomeration to the periphery. The textbook version says: The more a product is fully developed and standardized the less it needs the conditions and the factors of production prevailing in the agglomeration and the more the comparative advantages of low-income regions become relevant. In the standard version

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[45] The pronounced specialization of persons and firms in agglomerations enforces communication even for tasks which the less specialized but more broadly skilled inhabitants of the periphery can solve alone.

[46] In addition to the technological reasons given above this immobility is caused by bounded rationality which makes it difficult for the management to recognize even the causes of the problems facing the firm (*Simon* (1959); *Cyert / March* (1963)).

[47] Monostructured agglomerations are not unlikely. As young industries tend to concentrate geographically (*Magee* (1977), 332) a monostructured area develops if the industry is very successful so that it leaves no room for other branches to develop (*Tichy* (1985)).

of the hypothesis the transfer to the periphery apparently happens automatically and without any noticeable friction. *Vernon* ((1979), 257) mentioned in his latest paper that usually a triggering event has to occur to induce the producer to shift production from the agglomeration to a place where the factors of production are less expensive, to a place where new demand has emerged which can be served cheaper by local production or where other advantages can be gained. The triggering event is necessary as the shift of production contains risks and costs: The producer looses economies of scale and accumulated learning effects, he has difficulties to calculate the foreign costs and the like.[48]

With or without the necessity of triggering events the standard theory of the product cycle assumes implicitly that the producer deliberately shifts his own production to a foreign country or at least to another region. Insofar *push-factors* are responsible for the transfer. However, even with triggering events this case may not happen frequently. It is restricted either to multiproduct firms developing new products successfully and that fast that they can found branch plants, or to firms producing goods the market for which expands that fast that founding local plants to serve the local market makes sense even allowing the loss of scale economies and learning effects. In both cases multinational corporations will be involved most frequently. According to *Magee* ((1977), 318) they are specialists in the production of information that is less efficiently transmitted through markets than within firms (as they produce sophisticated techniques which are not easy to appropriate). Smaller firms may transfer their innovations by granting licences but in general licences apparently are more frequently given to regions of the same stage of development than to less developed regions. So the push-transfer of technology is almost exclusively restricted to multinational corporations. In contradiction to *Vernon* ((1979), 264) the multis therefore promote the existence of the product cycle rather than abolishing it.

The product-cycle hypothesis' standard case of a transfer of standardized products to less developed regions is therefore restricted almost exclusively to multinational corporations - in contrast to *Vernon* (1979) –, and even in these cases it is *not* the firm which deliberately pushes out products which can be produced more cheaply elsewhere: Rather the more profitable conditions abroad pull the products away and make production in the agglomeration less competitive. This *pull-transfer* may take place between plants of one corporation in different countries or different regions or between separate firms, the new competing against the old one. This case affords some further consideration as it is more complicated than the text-book model and it cannot occur without entrepreneurs and innovations in the less developed acquiring region.

[48] *Magee* (1977), 333.

At least some researchers have long been aware of the fact that it is almost impossible to distinguish innovation from imitation and routine.[49] Even if the imitator buys or steals blueprints and studies a product already existing, he has to adapt the production process to the local conditions of cheaper but less skilled labor, he has to solve the problems resulting from the lack of infrastructure in his area (lack of specialists for repair and maintenance and to solve unforeseen problems) and he has to find or make a market.[50] But this relatively easy situation seldom occurs. In most cases the imitator cannot buy or steal the blueprints and settle down in an established market. In the normal case the imitator has to offer a "new" product of lower quality at a cheaper price to new customers. *Redlich* ((1955), 64) coined the term "first derivative innovator". So the imitator first pulls away the lower price segment of the innovator's market. Then, learning by doing, the imitator improves the quality of his copy and slowly proceeds to the higher priced segments. This was the way the Japanese camera and car industry pushed into the markets of the industrialized countries and it is the same way on which today South-Korean and Taiwanese computers and South-Korean cars roll up the markets dominated by Japanese firms. If the innovators in the agglomerations cannot find new products or at least sophisticatedly differentiated versions, they will quickly be pushed out of the market. *Auty* ((1975), 150) is correct in critisizing regional theory which only investigates into the foundation of new plants but not into the processes of adjustment of established factories to changing operating conditions (expansion, take-over, closure et cetera).

This suggests a fourth conclusion, modifying the standard product-cycle hypothesis. In most cases – multinationals probably excluded – the transfer of standardized products to non-agglomerations is not the simple mechanical decision the standard product-cycle hypothesis assumes: It affords entrepreneuers and innovations – even if of lower hierarchy – in the region (country) taking-over the product.

The most typical case of a transfer appears to be even more offensive than described above. It has to be accomplished against the active resistance of producing firms and politicians in the agglomeration. The firms try to protect their innovations by patents, by sophisticated product- and process-characteristics which impede imitation, they try to hinder the set-up of distribution systems for the imitated product or to kill it by underselling, they try to find new production technologies more appropriate to their cost struc-

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[49] *Redlich* (1965), 62 - 64.

[50] This is a difficult task even if – in many cases – there exists a world market for standardized goods where the price is the most important marketing instrument. *Stobaugh* ((1970), 45) refers to investigations according to which the marketing costs of old products are one tenth of those of the new products.

ture (reverse engineering).[51] Economic policy in the agglomeration tries to impede the transfer of goods to the periphery by subsidies, duties, protection, "voluntary market agreements" (restraint of delivery) a.s.o. to avoid the loss of jobs.[52] Therefore the alleged faster distribution of knowledge in our days or even the faster diffusion of innovation – if existing at all[53] – need not accelerate the product cycle that much that it disappears as *Vernon* (1979) believes. Quite to the contrary the product cycle may be blocked as goods are not transferred away from the agglomeration, so that the challenge to develop new products is weakened. In addition to the factors already mentioned a further blockade of the product cycle showed up recently: In the sixties goods were transferred to the periphery because of a shortage of workers in the agglomerations. The absence of this tranfer-trigging event since almost two decades has given rise to reverse engineering and to structural problems in both agglomerations and periphery. It is difficult to evaluate whether this situation will prevail. If the product cycle will become obsolete, however, it may be a result of the blockade of the transfer by politicians and firms rather than of the technical factors suggested by *Vernon* (1979).

This implies the fifth conclusion dissenting from the standard product-cycle hypothesis: The more firms and politicians become aware of the existence and the consequences of a product cycle the more they try to prevent the transfer. Therefore forceful barriers to exit arise. The less firms in agglomerations, however, are threatened by the transfer of products the less pressure is exerted on them to develop new ones. This may impede product cycle from both sides.

5. Which products may follow a product cycle

Traditional product-cycle hypotheses do not explicitly restrict the basket of goods to which they apply. *Hirsch* ((1974), 70ff) did it and excluded Ricardo goods. Within the product-cycle goods he distinguished new products (N), mature labor-intensive (LM) and mature capital-intensive goods

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[51] The change of technology, however, is very costly in most cases. The fact a transfer of production is cheaper than a change of technology is the very basis of the product-cycle hypothesis.

[52] In this way the European attempts to shelter large firms and prevent their exit are surely one explanation of the fact that the European backwardness in high-tech production is larger than the science and technology gap between Europe and the U.S. and Japan in general.

[53] The diffusion of innovations is sometimes extremely long (e.g. for oxygen steel or continuous casting; see *Ray* (1969); *Nasbeth / Ray* (1974)), sometimes rather short (e.g. semiconductors, see *Tilton* (1971), 22). The differences may be explained, at least partly, by technical factors and barriers to entry. No evidence exists whether the process of diffusion accelerates or not.

(KM). According to the modifications of the product-cycle hypothesis proposed above even Hirsch's list appears too long: Several goods cannot leave the agglomeration for reasons of demand or supply, and so cannot follow a (regional) product cycle. Taking account of these facts one should distinguish[54]

- Ricardo-goods (R) as usually defined (raw material-oriented),
- agglomeration-oriented goods (A), i.e. Loesch-goods (AL) which are demand (market)-oriented and Thuenen-goods (AT) which are supply (high skill)-oriented, and
- product-cycle goods (P) which may be subdivided – following Hirsch – in new product-cycle goods (PN), labor-intensive (PL) and capital-intensive (PK) goods, if one wishes to do so.

Product-cycle goods (P) normally need the agglomeration for their birth and their pioneer stage – see, however, the restrictions formulated in section 3 of this article. In the later stages of their cycle they may emigrate to the periphery if the barriers are not too high. New process technology, however, may bring them back again. New product-cycle goods (PN) can stay in their pioneer phase for a very long or a rather short time depending on technology. If this phase is long, the goods may be called *Posner*-goods:[55] In this case a new-product multiplier may work, technology may be in constant change, or the market may be too small to afford standardization of the good. But skill advantages, learning effects or scale economies may contribute as well.[56]

Agglomeration-oriented products (A) in contrast to new product-cycle goods (PN) cannot leave the agglomeration in normal cases. Demand-oriented (Loesch) goods (AL) are normally characterized by simple production processes, but continuous contact with customers is necessary. As the product has to be adapted to market wants rather quickly and the value added is moderate, the firms settle in commuting distance from the agglomerations' centre. They serve the local market[57] and only export as an overspill to those markets,[58] which are too small so far to allow local production. If these industries expand to foreign markets, it is by way of subsidiaries.

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[54] The names have been proposed by *Palme* (1984a), (1984b). I borrow his names even if I give them a slightly different meaning and the groups therefore have a different coverage.

[55] *Posner* (1961); *Kramer* (1984), 45 - 57.

[56] *Lall* (1980).

[57] Observe that even a "local" market does exist only in agglomerations for this type of goods.

[58] This corresponds to export-trade hypothesis of *Linder* (1961), so that those goods are sometimes referred to as Linder-goods.

Supply-oriented (Thuenen) goods (AT) need the agglomeration not for demand reasons – their market is the world – but because only agglomerations can provide the specialists and the services they employ. Custom-tailored machines and instruments, goods including a dominating service component, products for small market niches may serve as examples. In several cases the firms producing these goods limit themselves to design and assembling and employ several subcontractors for production of the parts. If one of their products actually finds a broad market, they sell licences rather than expand production.

If one accepts this line of reasoning, the usual product-cycle hypothesis has to be revised considerably in this point: Not only Ricardo-goods but Loesch- and Thuenen-goods as well do not follow a regional product cycle. On the other hand not only new product-cycle goods but also Loesch- and Thuenen-goods are produced in agglomerations. This gives some stability to agglomerations which would have been extremely vulnerable in the textbook product-cycle model in which they have to rely on the likelihood to create enough new goods to prevent their aging.

So the sixth modification of the product-cycle hypothesis says that a group of goods follows the product cycle which does not comprise Ricardo-, Loesch- and Thuenen-goods. The production in agglomerations comprises Loesch- and Thuenen-goods in addition to new product-cycle goods.

6. Conclusion: Elements of a probabilistic theory of the product cycle

Vernon collected arguments supporting the hypothesis that the product cycle "no longer can be relied on to provide as powerful an explanation of the behavior of U.S. firms as in decades past".[59] This argument is correct for

[59] *Vernon* (1979), 267. Vernon finds three arguments supporting his hypothesis: (1) The *greater similarity of markets* and the broader availability of technological knowledge, (2) the multinationalization of firms and their wider geographical reach and (3) the quicker diffusion of innovations. The first argument is correct and makes clear why the explanation of American exports has to draw on additional arguments but it does not damage the product-cycle hypothesis in general. The second argument, *multinationalization of firms and markets,* has eased rather than impeded the transfer of standardized goods to the periphery. As has been argued in section 4 the barriers to transfer are small for multinationals while they are large in all other cases. With research centers and therefore innovations more heavily concentrated in agglomerations in a world of multinationals, and with the easier transfer of developed products within multinational firms this argument does not leave the product-cycle hypothesis weaker but quite to the contrary much more powerful. The third argument, *quicker diffusion of technical progress,* is questionable from an empirical point of view and not necessarily harmful to the product-cycle hypothesis in general: Blueprints can be transferred easily, turn-key plants with the latest technology can be set up in the desert, but the know-how for marketing, for product development and product relaunch, for maintenance and repair of the equipment are not easier to transfer nowadays than earlier.

the very simple fact that the U.S. nowadays have to compete with other high income agglomerations and the product-cycle hypothesis has never been destined to explain specialization among agglomerations. But a correctly formulated product-cycle hypothesis can be more than "a guide to the motivations and response of some enterprises in all countries of the world".[60] However, what is the "correct formulation"? This paper has tried to search for an explanation of those facts which the standard product-cycle hypothesis neglects. It could demonstrate that the product cycle gives the tendencies of evolution for an important group of goods (and indirectly for firms and regions), which are characterized by very specific information requirements (concerning technology, design and marketing) in the course of their creation and which are characterized by a very high income elasticity and a very low price elasticity in the early years of their existence. These goods are developed in high-income agglomerations and produced there at least in the early years of their existence. This is true, however, for this group of goods only and it is true only if the agglomeration can provide a special combination of a large number of entrepreneurial and informational requirements (see conclusion 3). As the necessary combination of these requirements changes from product to product and the supply from region to region and from time to time it is useful to frame the theory in probabilistic terms.

According to this revised product-cycle hypotheses it would be wrong to say that new goods are born in high income agglomerations in general. Some goods do not follow a product cycle at all (Ricard-, Loesch-, Thuenen-goods; see conclusion 6). Some product-cycle goods for which the information requirements are less heavy or more specialized may be born in lower-level agglomerations or in production areas (conclusion 2). In some cases the necessary combination of information may exist elsewhere even for typical product-cycle goods of the highest order of novelty. But the probability is highest that they are born in high-income agglomerations. And it is equally wrong to state that agglomerations produce new product-cycle goods only: In addition they produce Thuenen- and probably Loesch-goods (conclusion 6), and due to the existence of barriers to exit even product-cycle goods in a later stage of their cycle (conclusions 4 and 5).

Agglomerations can loose their ability to innovate and age if the pressure to develop new products is lessened or if they loose their ability to provide information from very different sources. This happens with great likelihood in an agglomeration which is very successful with one type of product and so specializes.[61] But an agglomeration may age as well when technological jumps or major shifts of demand favor a type of technical and marketing innovation concentrated elsewhere (see conclusion 3).

[60] *Vernon* (1979), 267 (my emphasis G. T.).
[61] *Tichy* (1985).

So the aging of agglomerations and the birth of new ones is very well compatible with the hypotheses submitted in this paper. But these processes evolve over decades for several seasons:

- First the transfer of fully developed products – apart from the fact that a product is never fully developed (see conclusion 1) – is no mechanical shift but a process which affords entrepreneurs and innovation in the country taking it over (conclusion 4).
- Secondly heavy resistance of firms and politicians against the transfer creates powerful barriers to exit (conclusion 5).
- and thirdly because the agglomeration continues to produce Thuenen-, Loesch- and later-stage product-cycle goods even after having lost its innovative capacities (conclusion 6).

The reformulation of the product-cycle hypothesis can help to improve our understanding of the process of development, of the rise and fall of regions. It can help us to realize that the aging of regions is no pathological process but a normal development, given some preconditions.[62] And the reformulation can warn us that a region's concentration on a few industries comprises the danger of the loss of informational diversification and therefore the loss of innovative capacity. Diversification therefore should be a goal of economic policy. The reformulation helps us, furthermore, to understand that "normal" industrial countries could be more endangered to become "old" and immobile than highest-income agglomerations: The standard product-cycle hypothesis sees the greatest danger for agglomerations unable to develop new products.[63] It neglects the barriers to exit, necessarily resulting from the awareness of product-cycle consequences. If – as it looks like – barriers to exit are easier to errect (and maintain) in an earlier product-cycle phase, high-income agglomerations and low-income countries may have better chances to employ their resources than countries inbetween.

Summary

The following revisions of standard product-cycle theory are proposed:

(1) "New" and "old" are not alternatives but points within a broad spectrum.

(2) Firms can innovate everywhere.

(3) Innovative entrepreneurs are more likely to exist and to become stimulated in agglomerations.

(4) The transfer of mature goods to the periphery is no mechanical process but needs innovative entrepreneurs as well.

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[62] *Tichy* (1985).

[63] *Nelson / Winter* (1982b), 131; *Auty* (1984), 327.

(5) Firms and politicians try to prevent the transfer of goods away from the agglomeration, so lowering the pressure to innovate and impeding the regional product cycle from both sides.

(6) Ricardo-, Loesch- and Thuenen goods do not follow a product cycle.

Zusammenfassung

Folgende Adaptionen der Produktzyklus-Hypothese werden vorgeschlagen:

(1) „Neu" und „alt" sind relative Begriffe, Punkte innerhalb eines breiten Spektrums.

(2) Innovationen sind nicht auf Agglomerationen beschränkt, doch finden sich dort bessere Bedingungen, vor allem für marktorientierte Innovationen und

(3) bessere Stimulantien für innovative Unternehmer.

(4) Die Abwanderung reifer Produkte in die Peripherie erfolgt nicht mechanisch, sondern erfordert ihrerseits innovative Unternehmer.

(5) Firmen und Politiker in der Agglomeration versuchen meist die Abwanderung reifer Produkte zu verhindern; dadurch sinkt der Innovationsdruck und der Produktzyklus wird von zwei Seiten behindert.

(6) Keineswegs alle Güter unterliegen einem Produktzyklus: Ausgenommen sind insbesondere Ricardo-, Loesch- und Thünen Güter.

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